Energy & Sustainability Report

194 Goldhurst Terrace, NW6 3HN

Client: 194 Goldhurst Terrace (Cowell) Limited

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Revision History

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About Environmental Economics

Our team of experienced consultants specialise in construction and building energy. We have qualifications in sustainability, energy, engineering, building physics and construction as well as environmental, quality management and auditing.

Over the last decade, we have provided assessments and consultancy for some of the largest UK house builders, including Barratt Developments, David Wilson Homes, Bellway Homes, Abbey New Homes and Davidsons. We develop flexible, practical, cost-effective specifications for our clients through identifying solutions and delivering design advice. This includes the following disciplines:

- *Energy Reports*
- *Compliance assessments and advice covering*
    - *Part L (SAP)*
    - *Part F (ventilation)*
    - *Part G (water)*
- *BREEAM*
- *SBEM (existing and new build)*
- *Minimum Energy Efficiency Standards (MEES)*
- *Thermal Bridging (Psi value calculations)*

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Contents

1. Executive Summary

1.1.1. 194 Goldhurst Terrace (Cowell) Limited has proposed a development comprising of the conversion of an existing building, and its extension, into 8 flats and the construction of 1 new build house (through the conversion and extension of the existing garage). This application should refer to the Camden Local Plan, London Plan 2021 Minor Development and Approved Document L 2021 regulations.

1.1.2. The proposed development at 194 Goldhurst Terrace is designed to achieve low carbon emissions through the adoption of good fabric performance and the use of ground source heat pumps.

1.1.3. The use of smart meters will provide occupiers with real time data which will allow occupiers to manage their energy consumption, save money and reduce carbon emissions. This is particularly important as the UK migrates towards half-hourly pricing levels and the proposed smart grid system.

1.1.4. Potential overheating risk will be assessed in accordance with the newly released Approved Document O.

1.1.5. Water efficiency has been reviewed as part of the design process and a Part G compliant specification will be adopted, resulting in the higher standard (lower water use) of 105 litres/person/day internal potable water and 5 litres/person/day external potable water.

1.1.6. There will be a 97% decrease in surface water discharge (for a 1 in 100-year plus 45% climate change rainfall event) from the proposal.

1.1.7. As a ground source heat pump heat network is currently proposed for this development, there are no direct NOx or PM emissions.

1.1.8. All plots built to Part L 2021 automatically achieve a minimum 31% uplift over Part L 2013. Therefore, all dwellings achieve the 19% carbon reduction improvement required by the policy, although this is only required for newbuilds, as conversions are not required to meet Part L 2021 regulations.

1.1.9. The development also achieves an approx. 75% reduction in carbon emissions, well above the 20% requirement, through the use of the following Low and Zero Carbon Technologies (LZCT):

- Ground Source Heat Pumps (GSHPs)
- Waste Water Heat Recovery Systems (WWHRs)

1.1.10. The proposed development therefore complies with Policy CC1 as set out in the Camden Local Plan along with The London Plan by delivering a significant reduction in Carbon emissions.

1.1.11. Before each plot can be signed off, it will have the following tests/appraisals to ensure design intent is followed, in order to deliver an energy efficient property:

- Every plot air tested on completion.
- Every plot to have thermal junctions photographed during construction to ensure continuity of insulation.
- Every plot to be checked for potential overheating risk using dynamic thermal modelling (TM59).
- As-bult specification to be checked and confirmed by technical team.

2. Introduction

2.1. Description of Site

2.1.1. In brief, the proposed development consists of the conversion of an existing building, and its extension, into 8 flats, as well as the construction of 1 new house (involving the re-siting, conversion and extension of the existing garage).

2.1.2. The site sits within a predominantly residential area and is conveniently located roughly 5 minutes' walk from the nearest bus stop.

2.1.3. The location and proposed site plans are shown in Appendix A, whilst the immediate vicinity is shown in Figure 1 below, with the red dot indicating the proposed development area:

Figure 1: The immediate vicinity of the development, with the proposed development marked in red.

2.1.4. The proposed development will provide a high quality, energy efficient building, allowing a dedicated layout to ensure efficient operation of the residential apartments.

2.1.5. The overall appearance of the site has been sympathetically designed, to both fit within the context of the local area and to provide a distinct improvement in appearance and performance when compared to the existing site.

3. Planning Policy

3.1.1. Policies relating to this development are contained within the Camden Local Plan, the CPG 2021: Energy Efficiency and the CPG 2021: Design, the London Plan 2021 (minor development) and the South Hampstead Conservation Area Statement.

3.2. Planning Policy – Camden Local Plan

3.2.1. Policy CC1 - Climate Change Mitigation of the Camden Local Plan confirms:

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

a) Promote zero carbon development and require all development to reduce carbon dioxide emissions through following the steps in the energy hierarchy;
b) Require all major development to demonstrate how London Plan targets for carbon dioxide emissions have been met;
c) Ensure that the location of development and mix of land uses minimise the need to travel by car and help to support decentralised energy networks;
d) Support and encourage sensitive energy efficiency improvements to existing buildings;
e) Require all proposals that involve substantial demolition to demonstrate that it is not possible to retain and improve the existing building; and
f) Expect all developments to optimise resource efficiency.

Further supporting text reads:

All new residential development will also be required to demonstrate a 19% CO2 reduction below Part L 2013 Building Regulations. The Council will expect developments of five or more dwellings and/or more than 500 sqm of any gross internal floorspace to achieve a 20% reduction in carbon dioxide emissions from on-site renewable energy generation, unless it can be demonstrated that such provision is not feasible."

3.2.2. Policy CC2 – Adapting to Climate Change of the Camden Local Plan confirms:

"The Council will require development to be resilient to climate change. All development should adopt appropriate climate change adaptation measures such as:

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

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

Policy D1 Design of the Camden Local Plan confirms:

"The Council will seek to secure high quality design in development. The Council will require that development:

a) Respects local context and character;
b) Preserves or enhances the historic environment and heritage assets in accordance with Policy D2 Heritage
c) Is sustainable in design and construction, incorporating best practice in resource management and climate change mitigation and adaptation;
d) Is of sustainable and durable construction and adaptable to different activities and land uses;
e) Comprises details and materials that are of high quality and complement the local character;
f) Integrates well with the surrounding streets and open spaces, improving movement through the site and wider area with direct, accessible and easily recognisable routes and contributes positively to the street frontage;
g) Is inclusive and accessible for all;
h) Promotes health;
i) Is secure and designed to minimise crime and anti-social behaviour;
j) Responds to natural features and preserves gardens and other open space;
k) Incorporates high quality landscape design (including public art, where appropriate) and maximises opportunities for greening for example through planting of trees and other soft landscaping;
l) Incorporates outdoor amenity space;
m) Preserves strategic and local views;
n) For housing, provides a high standard of accommodation; and
o) Carefully integrates building services equipment."

The Energy efficiency and adaptation CPG 2021 confirms:

Key Messages:

- *"All development in Camden is expected to reduce carbon dioxide emissions by following the energy hierarchy in accordance with Local Plan policy CC1.*
- *Energy strategies are to be designed following the steps set out in the energy hierarchy.*
- *Natural 'passive' measures should be prioritised over active measures to reduce energy.*
- *All new major developments in Camden are expected to assess the feasibility of decentralised energy network growth.*
- *Developments are to target a 20% reduction in carbon dioxide emissions from on-site renewable energy technologies."*

- *All new build residential development (of 1 – 9 dwellings) must meet 19% carbon dioxide reduction*
- *All developments should demonstrate how sustainable design principles have been considered and incorporated.*

The Design CPG 2021 confirms:

Key Messages:

- *"Camden is committed to excellence in design and schemes should consider:*
  - *The context of a development and its surrounding area;*
  - *The design of the building itself;*
  - *The use and function of buildings;*
  - *Using good quality sustainable materials;*
  - *Creating well connected public spaces and good quality public realm*
  - *Opportunities for promoting health and well-being*
  - *Opportunities for improving the character and quality of an area*

3.2.3. Residential development within the proposed site is required to address energy efficiency and carbon emissions by consideration of London Plan 2021 Minor Development along with the requirements of the Camden Local Plan.

3.2.4. Part L 2021 represents a 31% uplift over Part L 2013. As the newbuild dwelling on site is being built to Part L 2021, it therefore automatically meets the 19% uplift required in the local policy. This will be discussed in more detail in Section 5.

3.2.5. As highlighted in paragraph 3.2.1 the Camden Local Plan is in general conformity with the London Plan. Therefore the proposed development responds to applicable sustainability issues via the London Plan reporting matrix, as set out in paragraph 3.3.4.

3.3. Planning Policy - The London Plan 2021

3.3.1. As stated in 2.1.1, the proposed development consists of 9 dwellings; 8 flat conversions and 1 newbuild house. Therefore, this development is categorised as a "Minor Development" under The London Plan 2021. A minor development is defined as a proposed development of 10 dwellings or fewer and has <1,000m^2 of floor space.

3.3.2. In relation to sustainable development, The London Plan 2021 states:

9.2.12 The Mayor may publish further planning guidance on sustainable design and construction[157] and will continue to regularly update the guidance on preparing energy strategies for major development.

3.3.3. Provision for detailed energy reports for MAJOR development remains a separate process, set out in the GLA publication "Energy Assessment Guidance" June 2022.

3.3.4. Minor developments are not required to prepare detailed energy statements. However, the proposed development will need to comply with building regulations.

3.4. Building regulations

3.4.1. The 1 new house for this development will fall under Part L1A 2021 of the building regulations, and therefore will be required to follow SAP 10 methodology. Part L1A 2021 regulations will have a higher standard in carbon requirements than Part L1A 2013. Specifically, any plots on site which are to be built to the Part L 2021 (using SAP 10) will exceed current Part L1A 2013 regulations by 31%.

3.4.2. In addition to the higher standards, some of the carbon content for different types of fuel has changed, meaning that the resultant carbon emissions will be calculated differently. For reference, see the tables in Appendix B for the SAP 2012 and SAP 10 carbon factors.

3.4.3. However, any plots within a development that will need to achieve the new standard of carbon and energy efficiency will exceed the 19% target set out in the Camden Local Plan as they will be built to comply with Part L1A 2021, which represents a 31% uplift against Part L1A 2013 requirements.

4. Design Response

4.1. Assessment Methodology

4.1.1. Environmental Economics have modelled a sample of the proposed dwellings using the software Design SAP 10 by Elmhurst and approved by BRE. The software provides several outputs, and based of the provided specification for this proposed development, we can assess the following areas for our calculations:

- *Building regulations compliance, including:*
  - *Carbon emissions (kg CO2/m2/year)*
  - *Primary Energy Demand (kWh/m2/annum)*
  - *Fabric Energy Efficiency (kWh/m2/annum)*
- *Energy usage per year (kWh/annum)*
- *Energy costs per year (£/annum)*
- *More detailed breakdowns by end use (space heating, water heating, cooking, lighting, appliances)*

4.1.2. Each of these outputs can be used in different ways to analyse the performance of the dwelling. The total regulated carbon emissions for each property are based upon:

- *Space heating*
- *Water heating*
- *Electricity for pumps and fans*
- *Electricity for lighting*

4.1.3. SAP software is issued by independent software suppliers and checked and approved on behalf of government by the Building Research Establishment (BRE). As of 22nd November 2022, SAP 10 has now been fully approved as shown in Appendix C.

4.1.4. The specifications and calculation results enclosed are provided in order to illustrate good design intent, and indicate resultant performance. Data should therefore be taken as draft, and will be updated and revised once fully compliant software is released.

4.1.5. The draft SAP reports used in this energy report are shown in Appendix H.

4.2. Design Philosophy

4.2.1. In order to improve the dwelling performance to achieve ADL 2021, various upgrades have been made to almost all physical elements of a typical ADL 2013 specification.

4.2.2. The proposed development adopts the good design principles endorsed and promoted by The Zero Carbon Hub, the construction industries' key advisors and partners with the Governments Department for Levelling Up, Housing and Communities. This guidance follows the general good principles of energy efficiency as the industry moves towards zero carbon. The principles are illustrated in Figure 2 below.

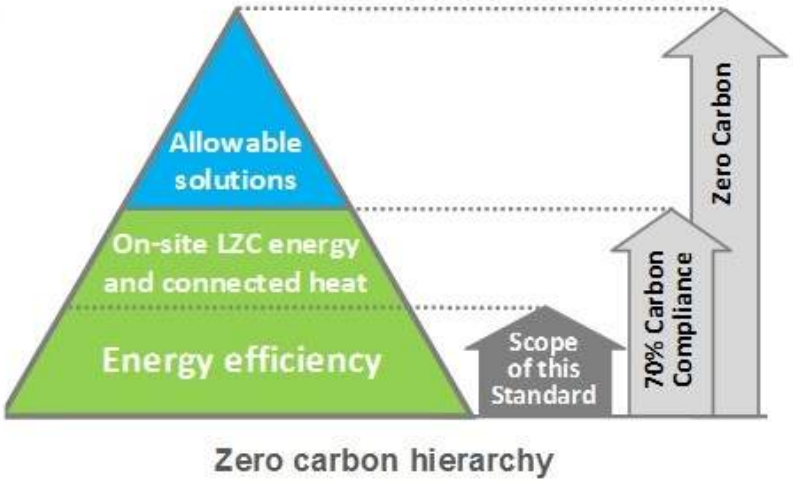


Figure 2

4.2.3. To reduce the residual carbon emissions, a number of improvements were made to the standard material and product specification. These improvements include:

- *Improved insulation levels;*
- *Upgraded heating and hot water controls;*
- *Design air permeability of 4m^3/hr/m^2 ;*
- *Bespoke, low heat loss thermal bridging designs.*

4.3. Building Fabric - Newbuild

4.3.1. As this development is not yet at detail design stage, the exact building materials have not yet been confirmed. Therefore, an outline set of U-Values for each element of the building is proposed.

4.3.2. The building fabric for all dwellings within the proposed development will be improved in comparison to ADL 2013 specifications, and in relation to the ADL 2021 backstop notional specification. These fabric improvements reduce the space heating requirement upon a property. The improvements will be made through a combination of upgraded materials and increased insulation thicknesses. Enhanced glazing with a larger transmittance factor allowing for increased solar gains will also be used.

4.3.3. Proposed fabric designs and U-Values can be found in Table 1 below.

Element	***Minimum Standard***	***Improved Specification***	
-	***W/m²k***	***Description***	***W/m²k***
Walls	0.26	Cavity wall insulated to achieve:	0.18 - 0.19
Roof	0.16	Roof insulated to achieve:	0.11
Floor	0.13	Heat-loss floor insulated to achieve:	0.11 – 0.12
Doors	1.60	To achieve:	1.20
Glazing	1.60	Double glazed to achieve:	1.20

Table 1 – Fabric Design and U-Values

4.3.4. Please note that this specification is not finalised and is subject to change up until detailed design stage.

4.3.5. As the project is not yet at detail design, the specific construction details for junctions of thermal elements are not designed. This is typical for planning stage reporting.

4.3.6. As a result of following these junction details and focusing on build quality air permeability will also decrease. A target air pressure rating of 4.0m^3/hr.m^2 has been set for all flats on site which is a significant improvement on the maximum allowable rating in the 2021 Building Regulations.

4.4. Building Fabric - Conversion

4.4.1. As an existing building is being converted into flats, the 8 flat conversions in this development must meet the requirements relating to Material Change of Use Approved Document L 2021.

4.4.2. Existing fabric elements that will become thermal elements should meet the limiting improved U-values in Table 2 below:

Element	*Threshold U-value*	*Improved U-value*
-	***W/m²k***	
Walls	0.70	0.3/0.55
Roof	0.35	0.16
Floor	0.7	0.25

Table 2 – Limiting U-values for existing elements in existing dwellings

4.4.3. Table 3 gives an overview of the performance of the 8 flats:

	Duplex	*Second floor flat*
SAP 10 rating	**88B**	**87B**
CO2 emissions	**0.31 t/yr**	**0.26 t/yr**
TER kgCO2/yr/m2	6.16	8.82
DER kgCO2/yr/m2	2.05	2.19
Pass by %	**66.72%**	**75.17%**
TPER kWh/m2/yr	32.78	45.95
DPER kWh/m2/yr	21.31	22.8
Pass by %	**34.98%**	**50.37%**
TFEE kWh/m2/yr	34.26	32.2
DFEE kWh/m2/yr	31.08	30.82
Pass by %	**9.29%**	**4.3%**

Table 3 – Limiting U-values for existing elements in existing dwellings

4.5. Building Services & Renewable Energy (LZCT)

4.5.1. The systems used in a property to supply hot water and heating, as well as to control it, are important to the overall energy demand of a property. Part L 2021 includes requirements for efficiency and controls of such equipment, including space heating, water heating, ventilation, and lighting.

4.5.2. The design of building services which provide space heating and domestic hot water, ventilation, and lighting, must be considered in a holistic way to avoid unintended consequences and to maximise the benefits from such systems.

4.5.3. After due consideration of the potential LZCT available, the design team propose to adopt the following technology which provide benefits / compliance with national and local policies as listed:

- ***Ground Source Heat Pumps (GSHPs)***
  - No connection to the gas grid;
  - Uses grid electricity as the fuel;
  - Provides 100% space heating and domestic hot water;
  - Minimum co-efficient of performance over 2.5 (250% efficient);
  - Delivers very good performance within Building Regulations assessments;
  - Significant reduction in primary energy demand due to the Coefficient of Performance (COP).
- ***Waste Water Heat Recovery (WWHR)***
  - Passive technology, no maintenance required;
  - Recovers waste heat from shower, pre-heats incoming cold. This mitigates the amount of hot water required from the hot water cylinder;
  - Typical systems recover ~60% waste heat.

4.5.4. Where installed, hot water cylinders can lose a significant amount of energy. To minimise this energy loss and corresponding carbon emissions, cylinders which have higher levels of insulation in comparison to typical hot water cylinders will be used. Hot water distribution pipework will be fully insulated.

4.5.5. Lighting provision will be from LED low energy fittings achieving a minimum efficacy of 100 lamp lumens per circuit watt, an improvement of over 50% from ADL 2013 performance levels.

4.5.6. Smart meters will be installed on all properties, providing:

- Real time information on energy use both in terms of consumption and cost
- Occupier can manage their energy, save money, and reduce carbon emissions
- Smart meters will also allow for easier switching between suppliers
- Facilitate a more reactive, price driven, demand-response
- End estimated billing and eliminate the need for meter readers to visit premises

4.5.7. A full breakdown of the LZC technologies considered for the proposed development is shown in Appendix D.

5. Results (Energy & Carbon)

5.1. Carbon emissions

5.1.1. Alongside the adoption of good fabric performance, each dwelling employs the use of renewables, specifically ground source heat pumps via a heat network, and waste water heat recovery.

5.1.2. Policy CC1 of the Camden Local Plan requires that minor new build developments achieve a 19% reduction in emissions beyond Part L 2013, which is equivalent to Level 4 of the Code for Sustainable Homes.

5.1.3. However, as the requirements for Part L 2021 are more stringent than Part L 2013, the new regulations represent a reduction in emissions of 31% over Part L 2013.

5.1.4. Therefore, as all 9 dwellings are being built to comply with Part L 2021, they demonstrate an improvement of at least 31% compared to Part L 2013, thereby easily surpassing the 19% over Part L 2013 requirement.

5.1.5. Policy CC1 of the Local Plan also requires that a 20% reduction in carbon emissions is achieved from on-site renewable energy generation.

5.1.6. Table 4 below shows the reduction in carbon emissions achieved through LZCT:

	GSHP	*GSHP & WWHR*
Second floor flat	61%	79%
Duplex	63%	77%
House	66%	69%

Table 4 – Reduction in carbon emissions from LZCT

5.1.1. As shown from the table above, the proposed LZC technologies allow dwellings to achieve well over the 20% energy from LZCT requirement set out in Policy CC1 of the Camden Local Plan. A breakdown of this calculation can be found in Appendix G.

6. Sustainability Appraisal

This Sustainability Statement considers the individual sustainability aspects of the London Plan as follows:

RESOURCE MANAGEMENT	
Land	
Optimising the use of land	Design Team Response
Through both their Local Plans and planning decisions, boroughs should ensure development patterns reflect the strategic spatial vision for London.	Not relevant to individual developments.
Through both their Local Plans and planning decisions, boroughs should aim for 100% of development to be delivered on previously developed land.	The proposed site is on previously developed land and will make better use of the space than at current.
Developers should optimise the scale and density of their development, considering the local context, to make efficient use of London's limited land.	The new development is an optimised size, designed to fit within the existing setting.
Basements and lightwells	
Where there is pressure for basement developments, boroughs should consider whether there are any particular local geological or hydrological issues that could particularly effect their construction, and adopt appropriate policies to address any local conditions.	Geological and hydrological issues from basement sections of this development have been considered within the Basement Impact Assessment, submitted with this planning application.
When planning a basement development, developers should consider the geological and hydrological conditions of the site and surrounding area, proportionate to the local conditions, the size of the basement and light well and the sensitivity of adjoining buildings and uses, including green infrastructure.	Geological and hydrological issues from basement sections of this development have been considered within the Basement Impact Assessment, submitted with this planning application.
When planning and constructing a basement development, developers should consider the amenity of neighbours.	The amenity of neighbouring dwellings will not be impacted by this development.
Local food growing	
To protect existing established food growing spaces.	Not applicable.
To provide space for individual or communal food growing, where possible and appropriate.	Not applicable.
To take advantage of existing spaces to grow food, including adapting temporary spaces for food growing.	Not applicable.

Site layout and building design	
Any existing buildings that can be practically refurbished, retrofitted, altered, or extended should be retained and reused.	The existing building will be improved by the development, with the addition of the new dwelling making better use of space than current.
A mix of uses, where suitable should be included to provide a range of services commensurate to the public transport accessibility.	The development is in a residential area and will fit with its surroundings.
The design of the site and building layout, footprint, scale and height of buildings as well as the location of land uses should consider: Existing features • the possible retention and reuse of existing buildings and structures; and • the retention of existing green infrastructure, including trees and other ecological features, and potential for its improvement and extension; • access routes to public transport and other facilities that minimise the use of private transport ; New design of development • the existing landform; • the potential to take advantage of natural systems such as wind, sun and shading; • the principles sets out London Plan policies 7.1 and 7.6; • the potential for adaption and reuse in the future; • potential for incorporating green infrastructure, including enhancing biodiversity; • potential for incorporating open space, recreation space, child play space; • energy demands and the ability to take advantage of natural systems and low and zero carbon energy sources; • site wide infrastructure; • access to low carbon transport modes; • the promotion of low carbon transport modes, including walking and cycling ; • potential to address any local air quality, noise disturbance, flooding and land contamination issues; and • the potential effect on the micro-climate.	The proposed structure is designed to fit within the existing context in terms of height, scale, massing and aesthetically to be in keeping with the surrounding area. The building will be designed to comply with the requirements of the Building Regulations and the specific criteria set out in the energy assessment included above, thereby including assessment and consideration of high efficiency heating and cooling, low carbon energy sources and renewable technologies. Transport requirements have been considered with the provision of secure cycle storage spaces and close proximity to multiple overground/underground stations and bus stops. An energy assessment has been undertaken above. Bicycle storage is being provided within the proposed development to promote sustainable travel. The remaining items are addressed in subsequent sections in the following pages.

Energy and carbon dioxide emissions	
The overall carbon dioxide emissions from a development should be minimised through the implementation of the energy hierarchy set out in London Plan policy 5.2.	Please refer to sections 4&5, which show that the units tested exceed policy targets and the development overall will meet policy requirements.
Non-domestic buildings Year — Improvements beyond 2013 Building Regulations 2016 – 2019 — As per the Building Regulation requirements 2019 - 2031 — Zero carbon	Not applicable
Developments should contribute to ensuring resilient energy infrastructure and a reliable energy supply, including from local low and zero carbon sources.	Please refer to sections 4&5.
Developers are encouraged to include innovative low and zero carbon technologies to minimise carbon dioxide emissions within developments and keep up to date with rapidly improving technologies.	Please refer to sections 4&5, which sets out that Ground Source Heat Pumps and Waste Water Heat Recovery are proposed as part of the development to meet policy requirements.
Energy demand assessment	
Development applications are to be accompanied by an energy demand assessment	Please refer to sections 4&5.
Use less energy	
The design of developments should prioritise passive measures.	Please refer to sections 4&5.
Efficient energy supply	
Where borough heat maps have identified district heating opportunities, boroughs should prepare more detailed Energy Master Plans (EMPs) to establish the extent of market competitive district heating networks.	Please refer to sections 4&5.
Developers should assess the potential for their development to: • connect to an existing district heating or cooling network; • expand an existing district heating or cooling network, and connect to it; or • establish a site wide network, and enable the connection of existing buildings in the vicinity of the development.	Please refer to sections 4&5.
Renewable energy	
Boroughs and neighbourhoods should identify opportunities for the installation of renewable energy technologies in their boroughs and neighbourhoods	Please refer to sections 4&5.
Major developments should incorporate renewable energy technologies to minimise overall carbon dioxide emissions, where feasible.	This is not a major development. However the scheme incorporates Ground Source Heat Pumps and Waste Water Heat Recovery.

Carbon dioxide off-setting	
Boroughs should establish a carbon off-set fund and identify suitable projects to be funded.	Camden Council has an established carbon offset fund.
Where developments do not achieve the Mayor's carbon dioxide reduction targets set out in London Plan policy 5.2, the developer should make a contribution to the local borough's carbon dioxide off-setting fund.	Carbon dioxide emissions calculated in section 5. Proposed development is policy compliant and no off-set payments are required.
Retrofitting	
Boroughs should set out policies to encourage the retrofitting of carbon dioxide and water saving measures in their borough.	Not relevant to individual developments.
Monitoring energy use	
Developers are encouraged to incorporate monitoring equipment, and systems where appropriate to enable occupiers to monitor and reduce their energy use.	Specifications are likely to include suitable energy meters, sub-metered where appropriate to allow occupier to monitor energy use.
Supporting a resilient energy supply	
Developers are encouraged to incorporate equipment that would enable their schemes to participate in demand side response opportunities.	Energy storage is unlikely to be possible.
Water efficiency	
Developers should maximise the opportunities for water saving measures and appliances in all developments, including the reuse and using alternative sources of water.	Water saving measures will be adopted. WC's will be dual flush and all taps will be fitted with flow restrictors in order to reduce potable water use.
Developers should design residential schemes to meet a water consumption rate of 105 litres or less per person per day.	Compliant water consumption of 105 litres/person/day internal potable water and 5 litres/person/day external potable water is to be targeted. Example water calculation shown in Appendix E.
New non-residential developments, including refurbishments, should aim to achieve the maximum number of water credits in a BREEAM assessment or the 'best practice' level of the AECB (Association of Environment Conscious Building) water standards.	Not applicable.
Where a building is to be retained, water efficiency measures should be retrofitted.	Water efficiency measures will be considered at the detailed design stage of the development.
All developments should be designed to incorporate rainwater harvesting.	The potential for rainwater harvesting has been assessed in the SuDS strategy for this development.
All residential units, including individual flats / apartments and commercial units, and where practical, individual leases in large commercial properties should be metered.	Water meters will likely be used where applicable for the development.

Materials and waste	
The design of development should prioritise materials that: • have a low embodied energy, including those that can be re-used intact or recycled; • at least three of the key elements of the building envelope (external walls, windows roof, upper floor slabs, internal walls, floor finishes / coverings) are to achieve a rating of A+ to D in the BRE's The Green Guide of specification; can be sustainably sourced; • at least 50% of timber and timber products should be sourced from accredited Forest Stewardship Council (FSC) or Programme for the Endorsement of forestry Certification (PEFC) source; • are durable to cater for their level of use and exposure; and will not release toxins into the internal and external environment, including those that deplete stratospheric ozone.	The design process will consider, where possible, the merits of suitable materials. Once detailed design is commenced the specifications will include a requirement to source FSC or PEFC certificated timber products.
The design of developments should maximise the potential to use pre-fabrication elements.	The design team will review the specifications accordingly.
Developers should maximise the use of existing resources and materials and minimise waste generated during the demolition and construction process through the implementation of the waste hierarchy.	Use of existing resources and waste minimisation have been reviewed as part of the Method Statement produced for this development.
Developers should provide sufficient internal space for the storage of recyclable and compostable materials and waste in their schemes.	Suitable waste facilities are provided in each unit. The house is provided with its own bin storage area, and the flats will be provided with a communal bin storage area. The proposals therefore provide sufficient space for refuse and recyclable waste.
The design of development should meet borough requirements for the size and location of recycling, composting and refuse storage and its removal.	The plans include provision of bin enclosures at ground level. Refuse collection will be designed to be in line with the operation of other residential units on the street.

Nature conservation and biodiversity	
There is no net loss in the quality and quantity of biodiversity.	The proposed development will develop any existing green infrastructure with the addition of a large communal garden for the apartment building and a private garden for the house. There will also be the addition of two green roofs to further increase green cover. A full Ecological Report has been produced for this development which considers contributions to biodiversity in line with Policies D1 and D2 of the Camden Local Plan as the development lays within a conservation area.
Developers make a contribution to biodiversity on their development site.	

CLIMATE CHANGE ADAPTATION	
Tackling increased temperature and drought	
Overheating	
Developers should include measures, in the design of their schemes, in line with the cooling hierarchy set out in London Plan policy 5.9 to prevent overheating over the scheme's life-time	Potential overheating risk will be assessed in accordance with Approved Document O.
Heat and drought resistant planting	
The design of developments should prioritise landscape planting that is drought resistant and has a low water demand for supplementary watering.	The proposed development will serve to implement greenery where possible for ecological, aesthetic and sustainability benefits.
Resilient foundations	
Developers should consider any long term potential for extreme weather events to affect a building's foundations and to ensure they are robust	Foundation designs will be appropriate to the long term viability of the structure and an allowance for extreme weather events will be included within that process.
Increasing green cover	
Urban greening	
Developers should integrate green infrastructure into development schemes, including by creating links with wider green infrastructure network.	Green infrastructure will not be reduced by the development. There will be the addition of gardens and green roofs.
Major developments in the Central London Activity Area (CAZ) should be designed to contribute to the Mayor's target to increase green cover by 5% in this zone by 2030.	The development is not within the Central London Activity Area (CAZ).
Trees	
Developments should contribute to the Mayor's target to in-crease tree cover across London by 5% by 2025.	Existing trees within the site are to be predominantly retained. New tree planting is to be assessed within the landscape proposals for the development.
Any loss of a tree/s resulting from development should be replaced with an appropriate tree or group of trees for the location, with the aim of	5 tree groups are proposed to be removed for this development. Please refer to the Tree Report produced for this development for further information.

providing the same canopy cover as that provided by the original tree/s.	
Flooding	
Surface water flooding and sustainable drainage	
Through their Local Flood Risk Management Strategies boroughs should identify areas where there are particular surface water management issues and develop policies and actions to address these risks	Full Flood Risk Assessment and SuDS Strategy Reports have been produced for this development.
Developers should maximise all opportunities to achieve greenfield runoff rates in their developments	A full SuDS Strategy Report has been prepared for this development.
When designing their schemes developers should follow the drainage hierarchy set out in London Plan policy 5.13	The drainage hierarchy is to be considered. A full SuDS Strategy Report has been prepared for this development.
Developers should design Sustainable Drainage Systems (SuDS) into their schemes that incorporate attenuation for surface water runoff as well as habitat, water quality and amenity benefits.	
Flood resilience and resistance of buildings in flood risk areas	
Developments are designed to be flexible and capable of being adapted to and mitigating the potential increase in flood risk as a result of climate change.	The site is within Flood Zone 1 (lowest risk of flooding). See Appendix F. Please refer to the Flood Risk Assessment and SuDS Strategy Report for further details.
Developments incorporate the recommendation of the TE2100 plan for the future tidal flood risk management in the Thames estuary.	Not applicable – not within the TE2100 zone.
All sources of flooding need to be considered when designing and constructing developments.	A full Flood Risk Assessment has been carried out for this development.
POLLUTION MANAGEMENT	
Land contamination	
Developers should set out how existing land contamination will be addressed prior to the commencement of their development.	A separate Land Contamination Assessment Report is recommended pursuant to a planning condition, which will put forth suitable findings and recommendations.
Potentially polluting uses are to incorporate suitable mitigation measures.	It is understood that the development is not likely to result in any land pollutants.

Air quality	
Developers are to design their schemes so that they are at least 'air quality neutral'.	The proposed building will employ building services equipment meeting current high standards in terms of low CO2 and NOx emissions. Emissions in line with Part L 2021 and Policy CC1 of the Camden Local Plan are shown in the above Energy Assessment in sections 4&5.
Developments should be designed to minimise the generation of air pollution.	
Developments should be designed to minimise and mitigate against increased exposure to poor air quality.	
Developers should select plant that meets the standards for emissions from combined heat and power and biomass plants set out in Appendix 7.	Ground Source Heat Pumps are to be used for this development which exceed Part L 2021 emissions standards.
Developers and contractors should follow the guidance set out in the emerging The Control of Dust and Emissions during Construction and Demolition SPG when constructing their development.	This will be considered and taken into account during the construction phase.
Noise	
Areas identified as having positive sound features or as being tranquil should be protected from noise.	There is to be no noise pollution generated by this development as the proposed use of the development is in line with surrounding context.
Noise should be reduced at source, and then designed out of a scheme to reduce the need for mitigation measures.	
Light pollution	
Developments and lighting schemes should be designed to minimise light pollution.	Potential external space lighting likely to be controlled via a timer and security lighting aims to be activated via movement sensors. A sensitive lighting scheme will be produced to minimise light spill.
Water pollution	
Surface water runoff	
In their aim to achieve a greenfield runoff rate developers should incorporate sustainable urban drainage systems (SuDS) into their schemes which also provide benefits for water quality.	Full Flood Risk Assessment and SuDS Strategy Reports have been produced for this development.
Encourage good environmental practice to help reduce the risk from business activities on the London water environment.	The development is residential in nature, not business. The development does not directly introduce any adverse impact on the London water environment.
Encourage those working on demolition and construction sites to prevent pollution by incorporating prevention measures and following best practice.	The development/construction team will incorporate the relevant best practice processes into the demolition and construction activities.

Wastewater treatment	
Residential developments discharging domestic sewage should connect to the public foul sewer or combined sewer network where it is reasonable to do so.	The development site will discharge foul water into the existing foul network.
Commercial developments discharging trade effluent should connect to the public foul sewer or combined sewer network where it is reasonable to do so subject to a trade effluent consent from the relevant sewerage undertaker.	Not applicable.
Developments should be properly connected and post-construction checks should be made by developers to ensure that misconnections do not occur.	This process will likely be validated in consultation with the sewerage / utility providers.

7. Conclusion

7.1.1. This Energy & Sustainability Report has been produced to accompany the planning application for the proposed development of 1 newbuild house and an 8 flat conversion at 194 Goldhurst Terrace.

7.1.2. The proposals set forth are in line with the sustainability policy requirements by utilising good design practice whereby each relevant criterion has been appropriately addressed.

7.1.3. While the development is still at an early stage of the design process, an assessment of the sustainability attributes as laid out in the London Plan and the Camden Local Plan has shown that the proposed development achieves the recommended levels set out therein.

7.1.4. It is therefore considered that the proposal achieves the required levels of sustainability.

7.1.5. It is anticipated that the newbuild house on site will be, at the very least, constructed to comply with the higher standards set by Part L1A 2021, which is a 31% reduction in carbon emissions in relation to current Part L1A 2013 regulations.

7.1.6. Therefore, this development will comply with Policy CC1 of the Camden Local Plan to achieve a 19% carbon reduction in relation to Part L1A 2013 regulations, which is required for the new build on site.

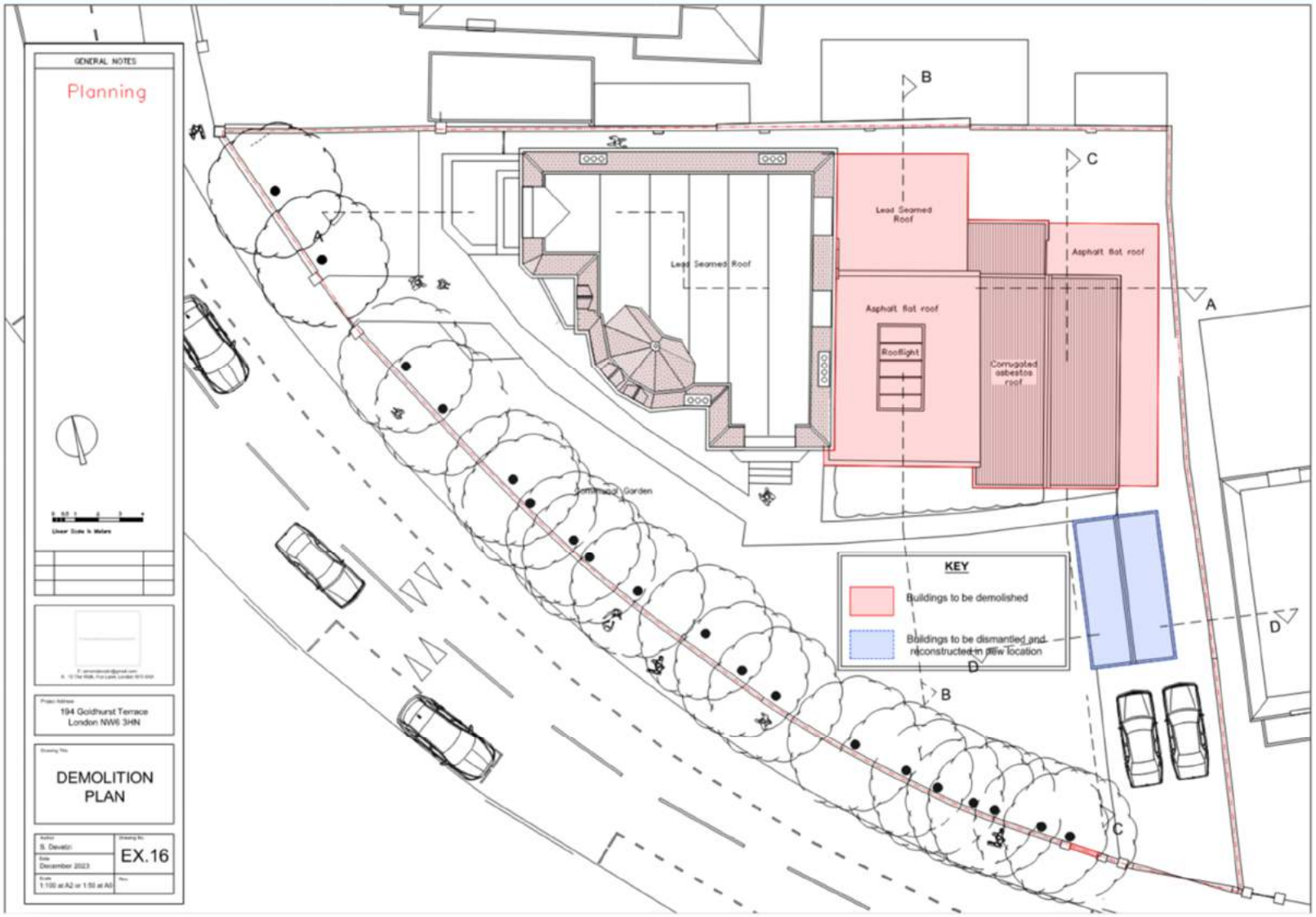
7.1.7. The proposed LZC Technologies for this development are:

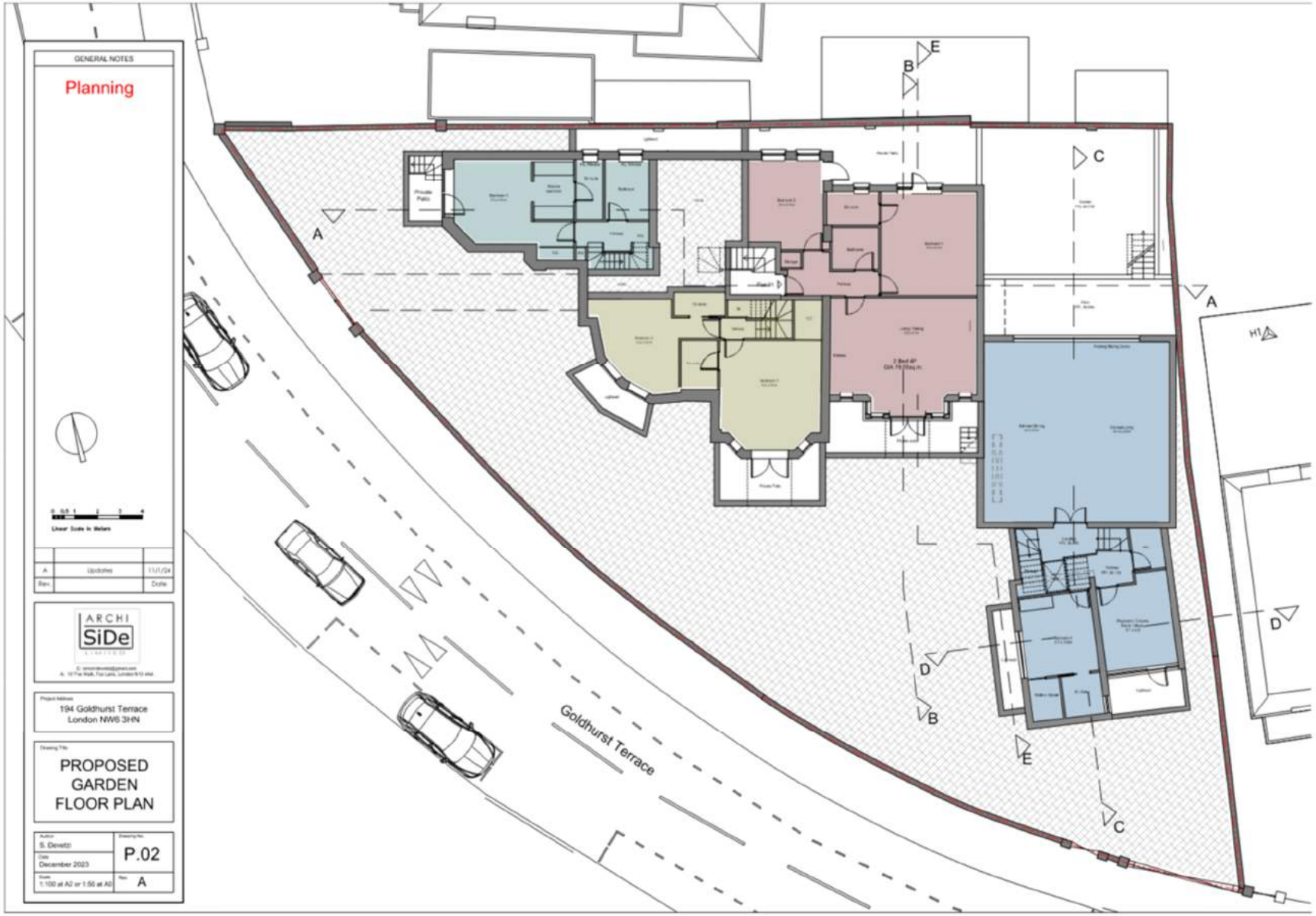
- Ground Source Heat Pumps (GSHPs)
- Waste Water Heat Recovery (WWHR)

7.1.8. A reduction in carbon emissions of approximately 75% is achieved through the use of GSHP and WWHR on site. Therefore, the development easily meets the 20% target required by the policy.

7.1.9. It should be noted that future policies and building regulations may require an update to the sustainability measures within this report.

Appendix A – Location and Site Plan

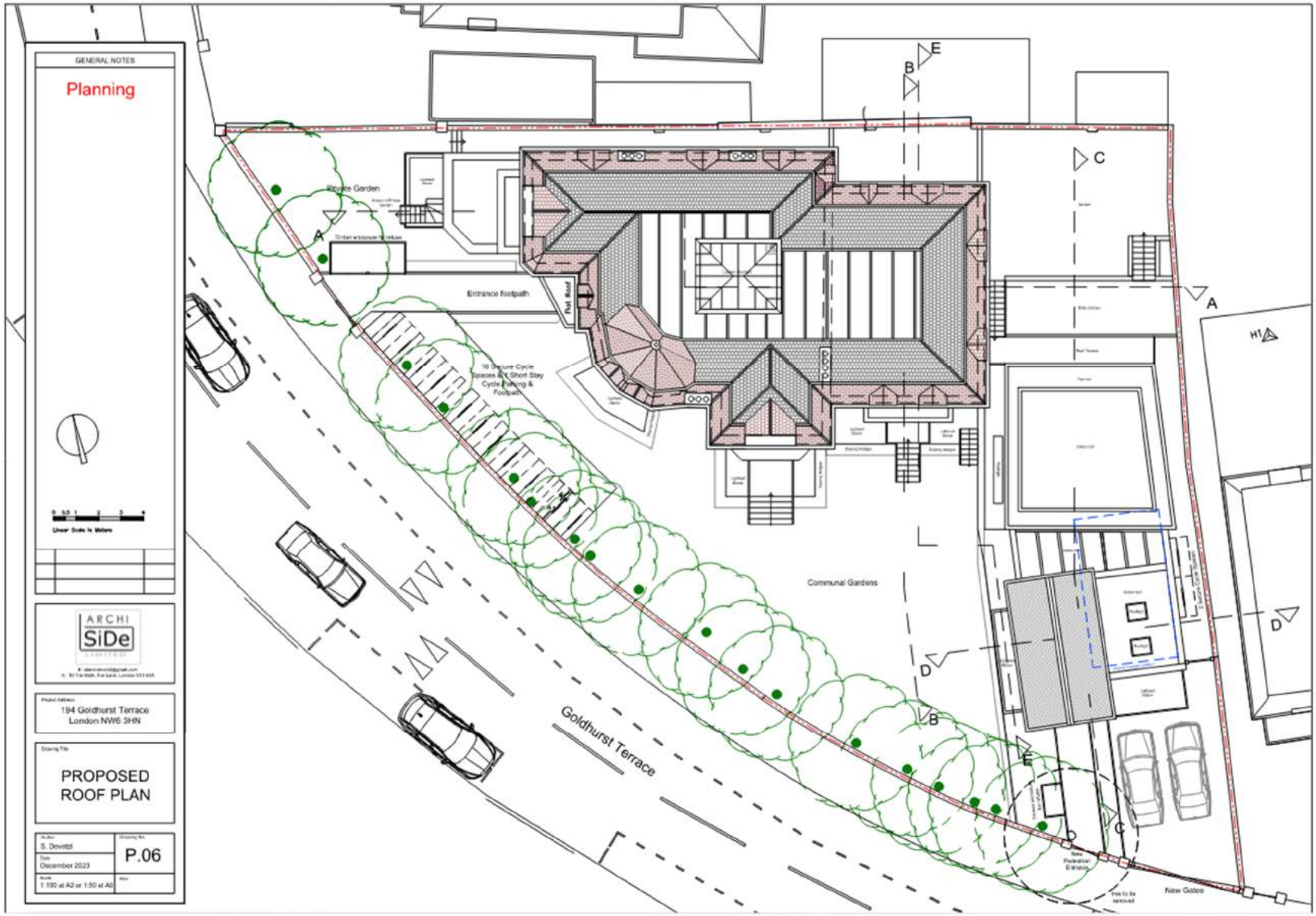



GENERAL NOTES
Planning
ARCHI SiDe
194 Goldhurst Terrace
London NW6 3HN
PROPOSED GARDEN FLOOR PLAN
P.02
A
December 2023
Goldhurst Terrace
A
B
C
D
E
H1


GENERAL NOTES
Planning
ARCHI SiDe
194 Goldhurst Terrace
London NW6 3HN
PROPOSED GROUND FLOOR PLAN
S. Devetzi
P.03
December 2023
1:100 at A2 or 1:50 at A0
Entrance footpath
Communal Gardens
Goldhurst Terrace
A
B
C
D
E
H1


GENERAL NOTES
Planning
ARCHI SiDe
194 Goldhurst Terrace
London NW6 3HN
PROPOSED FIRST FLOOR PLAN
S. Devetzi
December 2023
1:100 at A2 or 1:50 at A0
P.04
Private Garden
Terrace
Entrance footpath
Flat Roof
Communal Gardens
Goldhurst Terrace
New Gates
A
B
C
D
E
H1


GENERAL NOTES
Planning
ARCHI SiDe
194 Goldhurst Terrace
London NW6 3HN
PROPOSED SECOND FLOOR PLAN
S. Dewtot
December 2023
P.05
1:100 at A2 or 1:50 at A0
Private Garden
Entrance footpath
Flat Roof
Communal Gardens
Goldhurst Terrace
New Gates
A
B
C
D
E
H1


GENERAL NOTES
Planning
ARCHI SiDe LIMITED
194 Goldhurst Terrace
London NW6 3HN
PROPOSED ROOF PLAN
S. Devrtd
December 2023
P.06
Private Garden
Entrance footpath
Flat Roof
Communal Gardens
Goldhurst Terrace
New Gates
A
B
C
D
E
H1

Appendix B – Carbon Factors

Table A

SAP 2012 version 9.92 (October 2013)

Table 12: Fuel prices, emission factors and primary energy factors

Fuel	Standing charge, £ [a]	Unit price p/kWh	Emissions kg CO_2 per kWh [b]	Primary energy factor	Fuel code
Gas:					
mains gas	120	3.48	0.216	1.22	1
bulk LPG	70	7.60	0.241	1.09	2
bottled LPG		9.87	0.242	1.07	3
LPG subject to Special Condition 18 [c]	120	3.37	0.242	1.07	9
biogas (including anaerobic digestion)	70	7.60	0.098	1.10	7
Oil:					
heating oil		5.44	0.298	1.10	4
biodiesel from any biomass source [d]		7.64	0.123	1.06	71
biodiesel from vegetable oil only [e]		7.64	0.083	1.01	73
appliances able to use mineral oil or biodiesel		5.44	0.298	1.10	74
B30K [f]		6.10	0.245	1.09	75
bioethanol from any biomass source		47.0	0.140	1.08	76
Solid fuel: [g]					
house coal		3.67	0.394	1.00	11
anthracite		3.64	0.394	1.01	15
manufactured smokeless fuel		4.61	0.433	1.21	12
wood logs		4.23	0.019	1.04	20
wood pellets (in bags for secondary heating)		5.81	0.039	1.26	22
wood pellets (bulk supply for main heating)		5.26	0.039	1.26	23
wood chips		3.07	0.016	1.12	21
dual fuel appliance (mineral and wood)		3.99	0.226	1.02	10
Electricity:					
standard tariff [a]	54	13.19	0.519	3.07	30
7-hour tariff (high rate) [h]	24	15.29	0.519	3.07	32
7-hour tariff (low rate) [h]		5.50	0.519	3.07	31
10-hour tariff (high rate) [h]	23	14.68	0.519	3.07	34
10-hour tariff (low rate) [h]		7.50	0.519	3.07	33
18-hour tariff (high rate) [h]	40	13.67	0.519	3.07	38
18-hour tariff (low rate) [h]		7.41	0.519	3.07	40
24-hour heating tariff	70	6.61	0.519	3.07	35
electricity sold to grid		13.19 [i]	0.519	3.07	36
electricity displaced from grid			0.519 [i]	3.07 [i]	37
electricity, any tariff [j]					39
Community heating schemes: [k]	120 [l]				
heat from boilers – mains gas		4.24	0.216	1.22	51
heat from boilers – LPG		4.24	0.241	1.09	52
heat from boilers – oil		4.24	0.331 [m]	1.10	53
heat from boilers that can use mineral oil or biodiesel		4.24	0.331	1.10	56
heat from boilers using biodiesel from any biomass source		4.24	0.123	1.06	57
heat from boilers using biodiesel from vegetable oil only		4.24	0.083	1.01	58
heat from boilers – B30D [f]		4.24	0.269	1.09	55
heat from boilers – coal		4.24	0.380 [n]	1.00	54
heat from electric heat pump		4.24	0.519	3.07	41
heat from boilers – waste combustion		4.24	0.047	1.23	42
heat from boilers – biomass		4.24	0.031 [o]	1.01	43
heat from boilers – biogas (landfill or sewage gas)		4.24	0.098	1.10	44
waste heat from power station		2.97	0.058 [p]	1.34	45
geothermal heat source		2.97	0.041	1.24	46
heat from CHP		2.97	as above [q]	as above [q]	48
electricity generated by CHP			0.519 [i]	3.07 [i]	49
electricity for pumping in distribution network			0.519	3.07	50

Energy Cost Deflator [r] = 0.42

164

Table B

SAP version 10.2 (20-08-2021)

Table 12: Fuel prices, emission factors and primary energy factors

Fuel	Standing charge, £ [a]	Unit price p/kWh	Emissions kg CO_{2e} per kWh [b] [s]	Primary energy factor [t]	Fuel code
Gas fuels:					
mains gas	92	3.64	0.210	1.130	1
bulk LPG	62	6.74	0.241	1.141	2
bottled LPG (for main heating system)		9.46	0.241	1.141	3
bottled LPG (for secondary heating)		11.20	0.241	1.133	5
LPG subject to Special Condition 11F [c]	92	3.64	0.241	1.163	9
biogas (including anaerobic digestion)	62	6.74	0.024	1.286	7
Liquid fuels:					
heating oil		4.94	0.298	1.180	4
bio-liquid HVO from used cooking oil [d]		6.79	0.036	1.180	71
bio-liquid FAME from animal/vegetable oils [e]		6.79	0.018	1.180	73
B30K [f]		5.49	0.214	1.136	75
bioethanol from any biomass source		47	0.105	1.472	76
Solid fuels: [g]					
house coal		5.58	0.395	1.064	11
anthracite		4.19	0.395	1.064	15
manufactured smokeless fuel		5.91	0.366	1.261	12
wood logs		5.12	0.028	1.046	20
wood pellets (in bags for secondary heating)		6.91	0.053	1.325	22
wood pellets (bulk supply for main heating)		6.25	0.053	1.325	23
wood chips		3.72	0.023	1.046	21
dual fuel appliance (mineral and wood)		4.77	0.087	1.049	10
Electricity: [a]					
standard tariff	81	16.49	0.136	1.501	30
7-hour tariff (high rate) [h]	7	19.60	0.136	1.501	32
7-hour tariff (low rate) [h]		9.40	0.136	1.501	31
10-hour tariff (high rate) [h]	21	20.54	0.136	1.501	34
10-hour tariff (low rate) [h]		12.27	0.136	1.501	33
18-hour tariff (high rate) [h]	26	17.41	0.136	1.501	38
18-hour tariff (low rate) [h]		14.17	0.136	1.501	40
24-hour heating tariff	26	14.04	0.136	1.501	35
electricity sold to grid, PV		5.59 [i]	0.136	0.501	60
electricity sold to grid, other		5.59 [i]	0.136	0.501	36
electricity, any tariff [j]		N/A	0.136	1.501	39
Heat networks: [k]	92 [l]				
heat from boilers – mains gas		4.44	0.210	1.130	51
heat from boilers – LPG		4.44	0.241	1.141	52
heat from boilers – oil (assumes 'gas oil')		4.44	0.335	1.180	53
heat from boilers that can use mineral oil or biodiesel		4.44	0.335	1.180	56
heat from boilers using HVO from used cooking oil		4.44	0.036	1.180	57
heat from boilers FAME from animal/vegetable oils [e]		4.44	0.018	1.180	58
heat from boilers – B30D [f]		4.44	0.269	1.090	55
heat from boilers – coal		4.44	0.375	1.064	54
heat from electric heat pump		4.44	0.136	1.501	41
heat from boilers – waste combustion		4.44	Under review	Under review	42
heat from boilers – biomass		4.44	Under review	Under review	43
heat from boilers – biogas (landfill or sewage gas)		4.44	Under review	Under review	44
waste heat from power station		3.77	Under review	Under review	45
geothermal heat source		3.77	Under review	Under review	46
heat from CHP		3.77	as above [q]	as above [q]	48
electricity generated by CHP			Under review	Under review	49
electricity for pumping in distribution network			0.136	1.501	50
Fuel from PCDB [u]	Data for each field comes from PCDB table				99

Energy Cost Deflator [r] = 0.36

Appendix C – Software Approval (SAP 10)

Approved software for SAP 10.2* Updated: 22nd November 2022

SAP 10.2 – applicable for building regulations from 15th June 2022 in England, and from 15th June 2022 for EPC lodgements in England.

List of SAP programs tested by BRE* for use in connection with building regulations and Energy Performance Certificates for new dwellings

Phased approval: The following software packages have been granted approval specific to dwellings with the following features:

Phase 1	Building fabric (walls, roofs, floors, windows etc.), Boilers (mains gas, LPG, electric, oil), FGHRS, Secondary room heaters, Instantaneous WWHRS, Solar heating (hot water only), Natural ventilation with intermittent extract fans, Centralised MEV, Decentralised MEV, Balanced ventilation with heat recovery (MVHR), PV (without battery or diverter), and Air conditioning.
Phase 2	All Phase 1, plus Electric heat pumps, Electric immersion, PV with battery, PV with diverter, and Wind turbines.
Phase 3	All Phase 2 plus Heat Networks (not from PCDB), Balanced ventilation without heat recovery.

Full Approval: The following software packages have been tested for full approval covering:

Phase 4	All Phase 3 plus all other systems including Storage WWHRS, Solar heating (space and water heating), and Heat Networks from PCDB
Phase 5	All Phase 4 plus production of EPCs including improvement recommendations, element star ratings and element descriptions

See also notes on last page.

* The SAP programs listed have been checked by BRE on behalf of BEIS, DLUHC, BSD and the Welsh Government. Whilst BRE has taken due care and precaution in testing the programs, it will not be held liable for any failure or consequence thereof that may occur in their use or application.

SAP 10.2 Page 1 of 3

Approved software for SAP 10.2* Updated: 22nd November 2022

Organisation	Contact name	Address, telephone, e-mail, website	Calculation Software / User Interface	Phase	Version	Building Regulations E	W	S	NI	EPC E	W	S	NI	Date of approval
Stroma Certification Limited	The SAP Team	6 Silkwood Park, Fryers Way, Wakefield, WF5 9TJ 0345 621 1111 www.stroma.com/certification SAP@stroma.com	FSAP 10.2	1	1.x	Yes	-	-	-	-	-	-	-	08/06/2022
				2	1.x	Yes	-	-	-	-	-	-	-	04/07/2022
				3	1.x	Yes	-	-	-	-	-	-	-	17/07/2022
				4	1.x	Yes	-	-	-	-	-	-	-	28/07/2022
				5	1.x	Yes	Yes	-	-	Yes	Yes	-	-	31/10/2022
			FSAP 10.2 UI	1	1.x	Yes	-	-	-	-	-	-	-	14/06/2022
				2	1.x	Yes	-	-	-	-	-	-	-	06/07/2022
				3	1.x	Yes	-	-	-	-	-	-	-	29/07/2022
				4	1.x	Yes	-	-	-	-	-	-	-	29/07/2022
				5	1.x	Yes	-	-	-	Yes	-	-	-	19/08/2022
Elmhurst Energy Systems LTD	New Build Dwelling Support Team	16 St Johns Business Park Lutterworth Leicestershire LE17 4HB Tel: 01455 883250 www.elmhurstenergy.co.uk onconstruction-support@elmhurstenergy.co.uk	Design SAP 10	1	1.x	Yes	-	-	-	-	-	-	-	09/06/2022
				2	1.x	Yes	-	-	-	-	-	-	-	28/06/2022
				3	1.x	Yes	-	-	-	-	-	-	-	27/07/2022
				4	1.x	Yes	-	-	-	-	-	-	-	29/07/2022
				5	2.x	Yes	Yes	-	-	Yes	Yes	-	-	22/11/2022
			Design SAP 10	1	1.x	Yes	-	-	-	-	-	-	-	10/06/2022
				2	1.x	Yes	-	-	-	-	-	-	-	07/07/2022
				3	1.x	Yes	-	-	-	-	-	-	-	29/07/2022
				4	1.x	Yes	-	-	-	-	-	-	-	29/07/2022
				5	2.x	Yes	Yes	-	-	Yes	Yes	-	-	22/11/2022

* The SAP programs listed have been checked by BRE on behalf of BEIS, DLUHC, BSD and the Welsh Government. Whilst BRE has taken due care and precaution in testing the programs, it will not be held liable for any failure or consequence thereof that may occur in their use or application.

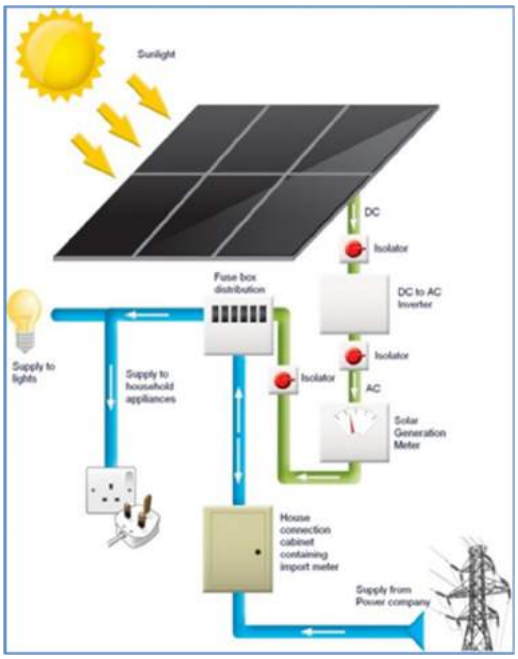
SAP 10.2 Page 2 of 3

Appendix D – LZC Technologies

Photovoltaic (PV) Cells

The efficiency of PV cells has improved rapidly over the last 15 years. This has made a previously uneconomical technology an increasingly viable solution to rising energy costs and demand. The cells can be produced in a variety of formats but are typically manufactured as a panel or a roof tile for domestic housing applications.

The PV system typically produces direct current (DC) which is then sent through an inverter to supply the house with electricity. If a greater amount of electricity is produced than used by the household, this extra can be exported to the national grid.



A PV cell is assessed on its peak power rating. This is tested by exposing the cell to the equivalent of full solar radiation and measuring the power output. The peak power is input into the Design SAP software as well as the physical attributes of the installation such as pitch, orientation and over-shading. A total energy saving per year can then be calculated through SAP for the PV installation. This is then offset against the electricity energy demand for the house.

Solar Hot Water (SHW)

SHW systems generate energy which is used to heat stored water (in a special solar hot water cylinder) which offsets the energy required for the boiler, thereby reducing fuel use and reducing carbon emissions. Therefore, SHW systems are ideally utilised when the design of a dwelling already calls for a hot water cylinder, and not when a combination boiler is specified.

There are two main SHW systems: evacuated tubes and flat plate collectors. Evacuated tubes are more efficient at transferring solar irradiation to the fluid although flat plate collectors are considered to be better aesthetically and to install.

The final energy contribution to the household, calculated through SAP, is based on several factors:

- *Pitch, orientation, and over-shading*
- *Heat absorption efficiency for the collector*
- *Average hot water usage of the dwelling*

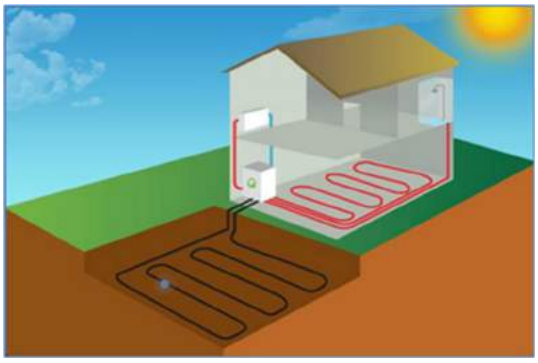
Most of the energy savings will be made in the hot water demand for the dwelling however, adding a SHW system will impact upon other energy demands.

Air Source Heat Pumps (ASHP)

ASHP provide heating and hot water to a home through thermal energy gathered from air outside the dwelling. Systems can be designed to work in conjunction with a boiler system but in the case of energy efficient new builds it is possible for an ASHP unit to provide 100% of the heating and hot water demand.

The thermal performance of the unit depends on the outside temperature as well as the unit's Coefficient of Performance. This is the ratio of thermal energy produced to energy used. A typical value for this would be around 3.5, meaning that for every 1kW of electricity consumed the unit would provide 3.5kW of thermal energy to the household. This efficiency leads to large carbon and energy savings for both space and water heating.

Ground Source Heat Pumps (GSHP)



GSHP provide heating and hot water to a dwelling through geothermal effects. A GSHP system would offset the energy demand from the main space heating. There is, however, an additional electricity demand for the pump and control system. This would reduce energy savings from the installation.

GSHP are expensive to install and rely on having appropriate ground conditions and suitable space around the dwelling for the pipe looping. Energy savings are dependent upon the type of system being replaced and the way the system is operated by the homeowner.

Biomass Heating Systems

Biomass heating systems burn fuels, considered carbon neutral, to heat the water required for a dwelling. There are a large variety of systems available, and choice depends on the type of fuel to be burned and the level of automation.

The system would offset the energy demand from the hot water and main space heating. However, biomass systems typically require a large amount of maintenance and monitoring.

The savings from such a system, in terms of CO2 and money, depends upon what it is replacing. The savings are greatest when replacing an electrical hot water system but are considerably less for replacing mains gas.

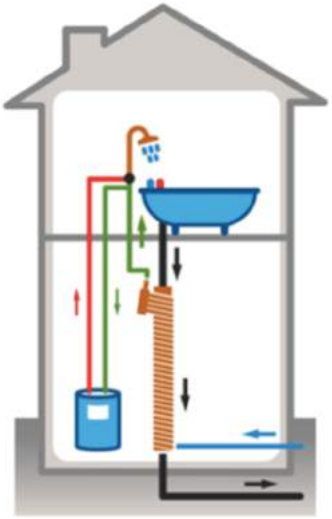
Wind Turbines

Wind turbines provide electricity directly to a dwelling. They can be added to a property in two ways: pole mounted or building mounted. The pole mounted systems are free standing and therefore require enough space around them to allow for the construction and maintenance of the structure, as well as to allow for efficient operation. The building mounted systems have a lower power output but do not require additional structures, as can be seen in figure

The energy produced from a wind turbine is heavily dependent upon the surrounding landscape. The energy saved will be offset against the electricity usage of the dwelling.

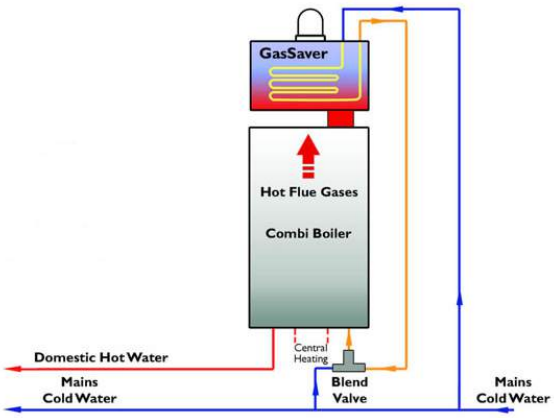
WWHRS

Waste water heat recovery system (WWHRS) recovers the energy that is lost from the waste water that is generated from showers. It uses a heat exchange system which recovers a portion of the energy that would normally be wasted. The waste heat is partially transferred to the incoming mains water inlet, which reduces the change in temperature required for the boiler to make. It therefore has the ability to reduce the amount energy required for the boiler to operate at specific points in the day.



FGHRS

Flue gas heat recovery system (FGHRS) works by recovering waste heat from the flue of a boiler. This waste heat is partially transferred to the main water inlet which raises the temperature of the water which is fed into the boiler. This reduces the amount of energy required to heat the boiler, as it reduces the temperature increase required for the boiler to operate, and therefore reduces the energy demand to heat the dwelling.



Appendix E – Water Efficiency Calculator

WATER EFFICIENCY CALCULATOR FOR NEW DWELLINGS - (BASIC CALCULATOR)

	House Type:	Type 1		Type 2		Type 3		Type 4	
	Description:	Bath and Shower		Shower only					
Installation Type	Unit of measure	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day
Is a dual or single flush WC specified?		Dual		Dual		Select option:		Select option:	
WC	Full flush volume	4	5.84	4	5.84		0.00		0.00
	Part flush volume	2.6	7.70	2.5	7.40		0.00		0.00
Taps (excluding kitchen and external taps)	Flow rate (litres / minute)	4	7.90	4	7.90		0.00		0.00
Are both a Bath & Shower Present?		Bath & Shower		Shower only					
Bath	Capacity to overflow	195	21.45		0.00		0.00		0.00
Shower	Flow rate (litres / minute)	8	34.96	8	44.80		0.00		0.00
Kitchen sink taps	Flow rate (litres / minute)	4	12.12	4	12.12		0.00		0.00
Has a washing machine been specified?		No		Yes					
Washing Machine	Litres / kg		17.16	8.1	17.01		0.00		0.00
Has a dishwasher been specified?		No		No					
Dishwasher	Litres / place setting		4.50		4.50		0.00		0.00
Has a waste disposal unit been specified?		No	0.00	No	0.00		0.00		0.00
Water Softener	Litres / person / day		0.00		0.00		0.00		0.00
	Calculated Use		111.6		99.6		0.0		0.0
	Normalisation factor		0.91		0.91		0.91		0.91
Code for Sustainable Homes	Total Consumption		101.6		90.6		0.0		0.0
	Mandatory level		Level 3/4		Level 3/4		-		-
Building Regulations 17.K	External use		5.0		5.0		5.0		5.0
	Total Consumption		106.6		95.6		0.0		0.0
	17.K Compliance?		Yes		Yes		-		-

Appendix F – Flood Map for Planning

Environment Agency

Flood map for planning

Your reference	Location (easting/northing)	Created
Goldhurst TR	**525769/184079**	**19 Dec 2023 12:42**

Your selected location is in flood zone 1, an area with a low probability of flooding.

You will need to do a flood risk assessment if your site is **any of the following:**

- bigger that 1 hectare (ha)
- In an area with critical drainage problems as notified by the Environment Agency
- identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

Notes

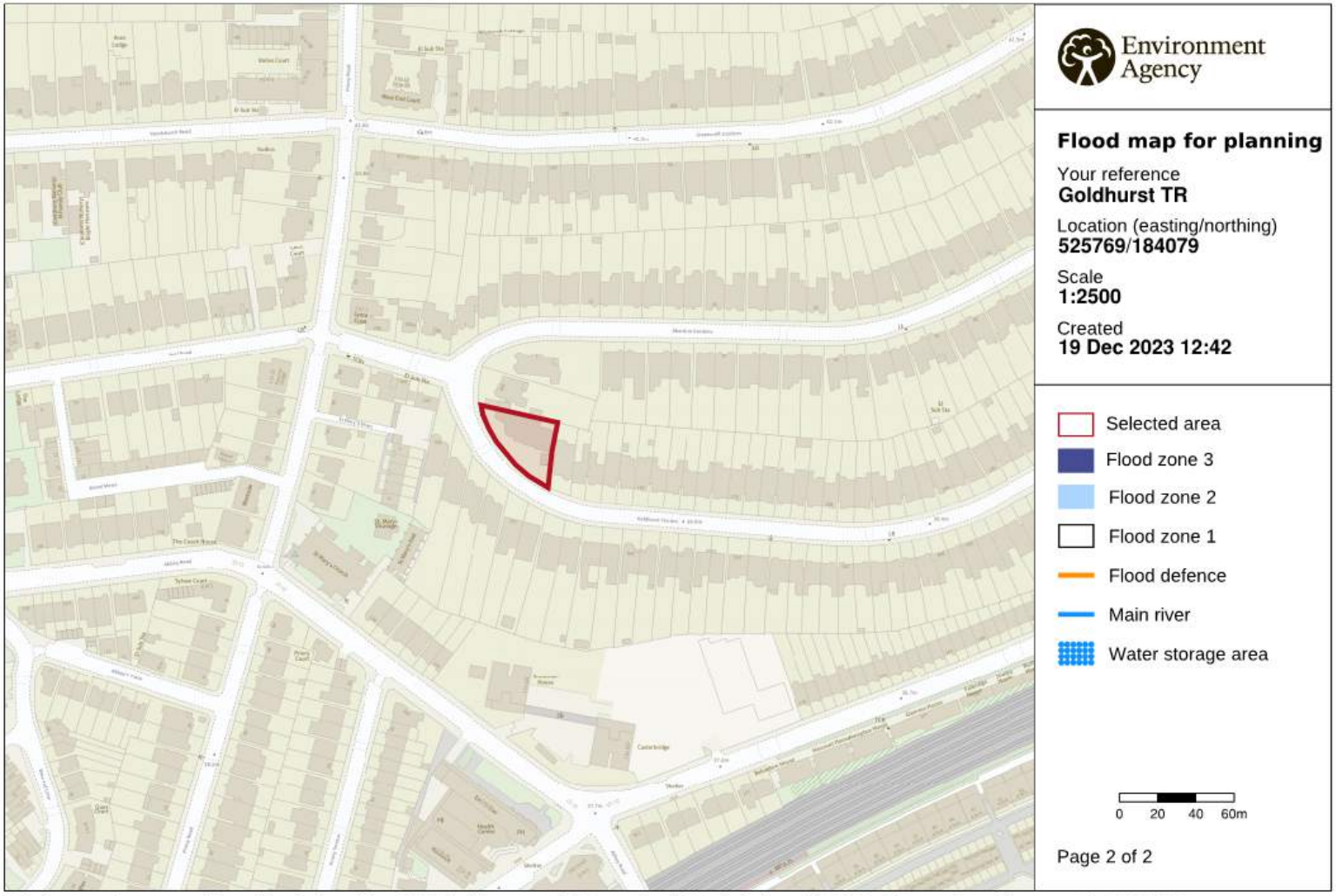
The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

Flood risk data is covered by the Open Government Licence **which** sets out the terms and conditions for using government data. https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/

Use of the address and mapping data is subject to Ordnance Survey public viewing terms under Crown copyright and database rights 2022 OS 100024198. https://flood-map-for-planning.service.gov.uk/os-terms

Page 1 of 2



Appendix G – Energy from Renewables

Housetype	Version	Change	Space Heating Demand (kWh/yr) (box 98c)	Domestic Hot Water Demand (kWh/yr) (box 64)	Total Space heating & DHW Energy Demand (kWh/yr)	Space Heating Efficiency (box 210)	Domestic Hot Water Heating Efficiency (box 217)	Renewable energy from heat pumps used for space heating (kWh/yr)	Renewable energy from heat pumps used for DHW heating (kWh/yr)	Energy from WWHR (kWh/yr) (box 63a)	Total LZC Energy provision (kWh/yr)	Energy from LZCT (%)
2B4P Second floor flat	1	Base (GSHP)	3101.3	2644.0	5745.3	3.5	1.98	2215.24	1308.65	0	3523.88	**61.33%**
	2	WWHR	3101.3	1869.0	4970.3	3.5	1.98	2215.24	925.06	774.29	3914.59	**78.76%**
3B4P Duplex	1	Base (GSHP)	4252.2	2675.0	6927.2	3.5	1.98	3037.29	1323.99	0	4361.28	**62.96%**
	2	WWHR	4252.2	1889.0	6141.2	3.5	1.98	3037.29	934.96	785.91	4758.16	**77.48%**
House	1	Base (GSHP)	9150.5	3052.0	12202.5	3.5	1.98	6536.10	1510.59	0	8046.68	**65.94%**
	2	WWHR	9150.5	2742.0	11892.5	3.5	1.98	6536.10	1357.15	309.56	8202.81	**68.97%**

Appendix H – SAP Calculations

SAP calculations can be found on the following pages:

Full SAP Calculation Printout

Property Reference	3B4P Duplex	**Issued on Date**	21/12/2023
Assessment Reference	GSHP Heat Network_ WWHR	**Prop Type Ref**	
Property			

SAP Rating	88 B	**DER**	2.05	**TER**	6.16
Environmental	98 A	**% DER < TER**			66.72
CO_2 Emissions (t/year)	0.31	**DFEE**	31.08	**TFEE**	34.26
Compliance Check	See BREL	**% DFEE < TFEE**			9.29
% DPER < TPER	34.98	**DPER**	21.31	**TPER**	32.78

Assessor Details	Ms. Ruth Ferguson	**Assessor ID**	AE69-0001
Client	194 Goldhurst Terrace, 194 Goldhurst Terrace		

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)	
Ground floor	116.6500 (1b)	x	2.6800 (2b)	=	312.6220	(1b) - (3b)
First floor	54.6000 (1c)	x	2.6100 (2c)	=	142.5060	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	171.2500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	455.1280	(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	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		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700	(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	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Mechanical extract ventilation - centralised		
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)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(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	
Doors			4.5200	1.2000	5.4240			(26)
Windows (Uw = 1.20)			24.6700	1.1450	28.2481			(27)
Heatloss Floor 1			37.1200	0.1100	4.0832			(28a)
External Wall 1	129.4400	29.1900	100.2500	0.1900	19.0475			(29a)
Wall to common	21.1900		21.1900	0.1700	3.6023			(29a)
Total net area of external elements Aum(A, m2)			187.7500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		60.4051			(33)
Party Wall 1			6.7100	0.0000	0.0000			(32)
Party Ceiling 1			54.6000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	217.7500	(35)
Thermal bridges (User defined value 0.045 * total exposed area)	8.4488	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	68.8538	(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	75.0961	75.0961	75.0961	75.0961	75.0961	75.0961	75.0961	75.0961	75.0961	75.0961	75.0961	75.0961	(38)
Heat transfer coeff	143.9500	143.9500	143.9500	143.9500	143.9500	143.9500	143.9500	143.9500	143.9500	143.9500	143.9500	143.9500	(39)
Average = Sum(39)m / 12 =												143.9500	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8406	0.8406	0.8406	0.8406	0.8406	0.8406	0.8406	0.8406	0.8406	0.8406	0.8406	0.8406	(40)
HLP (average)												0.8406	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9642	(42)
Hot water usage for mixer showers	94.9855	93.5580	91.4780	87.4981	84.5611	81.2858	79.4241	81.4884	83.7513	87.2680	91.3333	94.6216	(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses	44.9868	43.3509	41.7151	40.0792	38.4433	36.8074	36.8074	38.4433	40.0792	41.7151	43.3509	44.9868	(42c)
Average daily hot water use (litres/day)												128.4705	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	139.9723	136.9090	133.1930	127.5773	123.0044	118.0932	116.2315	119.9317	123.8304	128.9830	134.6843	139.6084	(44)
Energy conte	221.6819	194.9566	204.7127	174.6469	165.5876	145.2093	140.5719	148.5005	152.6953	175.0288	191.8824	218.5930	(45)
Energy content (annual)											Total = Sum(45)m =	2134.0668	
Distribution loss (46)m = 0.15 x (45)m	33.2523	29.2435	30.7069	26.1970	24.8381	21.7814	21.0858	22.2751	22.9043	26.2543	28.7824	32.7889	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2200	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.7320	(55)
Total storage loss	22.6920	20.4960	22.6920	21.9600	22.6920	21.9600	22.6920	22.6920	21.9600	22.6920	21.9600	22.6920	(56)
If cylinder contains dedicated solar storage	22.6920	20.4960	22.6920	21.9600	22.6920	21.9600	22.6920	22.6920	21.9600	22.6920	21.9600	22.6920	(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	267.6363	236.4638	250.6671	219.1189	211.5420	189.6813	186.5263	194.4549	197.1673	220.9832	236.3544	264.5474	(62)
WWHRS	-84.5826	-74.8055	-78.3320	-64.8620	-60.4491	-51.7267	-48.4855	-51.5595	-53.5184	-63.0923	-71.4760	-83.0162	(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	183.0537	161.6582	172.3351	154.2569	151.0929	137.9546	138.0407	142.8954	143.6489	157.8908	164.8785	181.5312	(64)
										Total per year (kWh/year) = Sum(64)m =		1889.2369	(64)
12Total per year (kWh/year)												1889	(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	110.4728	98.0288	104.8305	93.6477	91.8214	83.8597	83.5037	86.1399	86.3488	94.9606	99.3785	109.4457	(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	148.2122	148.2122	148.2122	148.2122	148.2122	148.2122	148.2122	148.2122	148.2122	148.2122	148.2122	148.2122	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	184.3627	204.1158	184.3627	190.5081	184.3627	190.5081	184.3627	184.3627	190.5081	184.3627	190.5081	184.3627	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	342.8224	346.3798	337.4152	318.3307	294.2398	271.5978	256.4716	252.9142	261.8788	280.9633	305.0542	327.6961	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8212	37.8212	37.8212	37.8212	37.8212	37.8212	37.8212	37.8212	37.8212	37.8212	37.8212	37.8212	(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)	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	(71)
Water heating gains (Table 5)	148.4849	145.8762	140.9012	130.0663	123.4158	116.4718	112.2361	115.7795	119.9289	127.6352	138.0257	147.1044	(72)
Total internal gains	743.1336	763.8355	730.1427	706.3686	669.4820	646.0414	620.5340	620.5200	639.7794	660.4249	701.0516	726.6269	(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	12.0000	10.6334	0.7600	0.7000	0.7700	47.0433	(74)
South	2.0200	46.7521	0.7600	0.7000	0.7700	34.8175	(78)
Southwest	1.8700	36.7938	0.7600	0.7000	0.7700	25.3666	(79)
West	8.7800	19.6403	0.7600	0.7000	0.7700	63.5750	(80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	170.8024	314.4991	489.3352	699.4362	864.2253	892.3939	846.1224	718.6628	561.7718	363.8462	208.9584	143.2926	(83)
Total gains	913.9360	1078.3346	1219.4779	1405.8049	1533.7073	1538.4353	1466.6564	1339.1827	1201.5512	1024.2711	910.0100	869.9195	(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	71.9573	71.9573	71.9573	71.9573	71.9573	71.9573	71.9573	71.9573	71.9573	71.9573	71.9573	71.9573	
alpha	5.7972	5.7972	5.7972	5.7972	5.7972	5.7972	5.7972	5.7972	5.7972	5.7972	5.7972	5.7972	

util living area													
	0.9977	0.9936	0.9811	0.9274	0.7892	0.5862	0.4300	0.4902	0.7612	0.9621	0.9943	0.9983	(86)
MIT	19.8903	20.0732	20.3374	20.6742	20.9046	20.9855	20.9979	20.9958	20.9415	20.6195	20.1848	19.8473	(87)
Th 2	20.2183	20.2183	20.2183	20.2183	20.2183	20.2183	20.2183	20.2183	20.2183	20.2183	20.2183	20.2183	(88)
util rest of house													
	0.9971	0.9919	0.9757	0.9079	0.7434	0.5196	0.3546	0.4090	0.6962	0.9479	0.9924	0.9978	(89)
MIT 2	18.9011	19.1346	19.4692	19.8815	20.1362	20.2094	20.2175	20.2165	20.1761	19.8236	19.2780	18.8461	(90)
Living area fraction										fLA = Living area / (4) =		0.1491	(91)
MIT	19.0487	19.2746	19.5987	19.9997	20.2508	20.3251	20.3339	20.3327	20.2903	19.9423	19.4133	18.9954	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0487	19.2746	19.5987	19.9997	20.2508	20.3251	20.3339	20.3327	20.2903	19.9423	19.4133	18.9954	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9957	0.9889	0.9702	0.9016	0.7455	0.5289	0.3658	0.4211	0.7026	0.9417	0.9897	0.9967	(94)
Useful gains	909.9932	1066.3873	1183.1606	1267.4081	1143.3595	813.7191	536.4819	563.8902	844.2481	964.5167	900.6255	867.0476	(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	2123.0692	2069.2246	1885.5582	1597.7995	1230.8924	824.1322	537.4943	566.1175	891.0886	1344.8220	1772.4933	2129.8027	(97)
Space heating kWh	902.5285	673.9066	522.5838	237.8818	65.1245	0.0000	0.0000	0.0000	0.0000	282.9472	627.7448	939.4899	(98a)
Space heating requirement - total per year (kWh/year)												4252.2071	
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	902.5285	673.9066	522.5838	237.8818	65.1245	0.0000	0.0000	0.0000	0.0000	282.9472	627.7448	939.4899	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4252.2071	
Space heating per m2											(98c) / (4) =	24.8304	(99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(301)
Fraction of space heat from community system												1.0000	(302)
Fraction of heat from community Heat pump-Space and Water												1.0000	(303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000	(305)
Factor for charging method (Table 4c(3)) for water heating												1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system												1.0000	(306)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating:													
Space heating requirement													
	902.5285	673.9066	522.5838	237.8818	65.1245	0.0000	0.0000	0.0000	0.0000	282.9472	627.7448	939.4899	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00													
307a	902.5285	673.9066	522.5838	237.8818	65.1245	0.0000	0.0000	0.0000	0.0000	282.9472	627.7448	939.4899	
Space heating requirement													
	902.5285	673.9066	522.5838	237.8818	65.1245	0.0000	0.0000	0.0000	0.0000	282.9472	627.7448	939.4899	(307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000	(308)
Space heating fuel for secondary/supplementary system													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(309)
Water heating													
Annual water heating requirement													
	183.0537	161.6582	172.3351	154.2569	151.0929	137.9546	138.0407	142.8954	143.6489	157.8908	164.8785	181.5312	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00													
310a	183.0537	161.6582	172.3351	154.2569	151.0929	137.9546	138.0407	142.8954	143.6489	157.8908	164.8785	181.5312	
Water heating fuel													
	183.0537	161.6582	172.3351	154.2569	151.0929	137.9546	138.0407	142.8954	143.6489	157.8908	164.8785	181.5312	(310)
Cooling System Energy Efficiency Ratio												0.0000	(314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(315)
Pumps and Fa	13.5817	12.2674	13.5817	13.1436	13.5817	13.1436	13.5817	13.5817	13.1436	13.5817	13.1436	13.5817	(331)
Lighting	46.4452	37.2600	33.5485	24.5791	18.9856	15.5114	17.3193	22.5123	29.2412	38.3661	43.3344	47.7360	(332)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333a)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	(333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334a)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	(334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335a)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	(335a)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333b)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	(333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334b)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	(334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335b)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	(335b)
Annual totals kWh/year													
Space heating fuel - community heating												4252.2071	(307)
Space heating fuel - secondary												0.0000	(309)
Water heating fuel - community heating												1889.2369	(310)
Efficiency of water heater												0.0000	(311)
Electricity used for heat distribution												42.5221	(313)
Space cooling fuel												0.0000	(321)
Electricity for pumps and fans:													
(MEVCentralised, Database: in-use factor = 1.6000, SFP = 0.2880)													
mechanical ventilation fans (SFP = 0.2880)												159.9138	(330a)
Total electricity for the above, kWh/year												159.9138	(331)
Electricity for lighting (calculated in Appendix L)												374.8391	(332)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(333)
Wind generation												0.0000	(334)
Hydro-electric generation (Appendix N)												0.0000	(335a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(335)
Appendix Q - special features													
Energy saved or generated												-0.0000	(336)
Energy used												0.0000	(337)
Total delivered energy for all uses												6676.1970	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy	Emission factor	Emissions	

	kWh/year	kg CO2/kWh	kg CO2/year	
Efficiency of heat source Heat pump			350.0000	(367)
Space and Water heating from Heat pump	1754.6983	0.1561	189.6895	(367)
Electrical energy for heat distribution (space & water)	42.5221	0.0000	9.2935	(372)
Overall CO2 factor for heat network			0.0447	(386)
Total CO2 associated with community systems			274.8228	(373)
Space and water heating			274.8228	(376)
Pumps, fans and electric keep-hot	159.9138	0.1387	22.1820	(378)
Energy for lighting	374.8391	0.1443	54.1009	(379)
Total CO2, kg/year			351.1057	(383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.0500	(384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Heat pump			350.0000	(467a)
Space and Water heating from Heat pump	1754.6983	1.5780	1917.1758	(467)
Electrical energy for heat distribution (space & water)	42.5221	0.0000	95.8081	(472)
Overall CO2 factor for heat network			0.4613	(486)
Total CO2 associated with community systems			2833.1828	(473)
Space and water heating			2833.1828	(476)
Pumps, fans and electric keep-hot	159.9138	1.5128	241.9176	(478)
Energy for lighting	374.8391	1.5338	574.9408	(479)
Total Primary energy kWh/year			3650.0412	(483)
Dwelling Primary energy Rate (DPER)			21.3100	(484)

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)	
Ground floor	116.6500	(1b) x	2.6800	(2b) =	312.6220	(1b) - (3b)
First floor	54.6000	(1c) x	2.6100	(2c) =	142.5060	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	171.2500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		455.1280	(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) =	0.0879 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3379 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2872 (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	0.3662	0.3590	0.3518	0.3159	0.3087	0.2728	0.2728	0.2657	0.2872	0.3087	0.3231	0.3375	(22b)
Effective ac	0.5670	0.5644	0.5619	0.5499	0.5477	0.5372	0.5372	0.5353	0.5412	0.5477	0.5522	0.5569	(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	
TER Opaque door			4.5200	1.0000	4.5200			(26)
TER Opening Type (Uw = 1.20)			24.6700	1.1450	28.2481			(27)
Heatloss Floor 1			37.1200	0.1300	4.8256			(28a)
External Wall 1	129.4400	29.1900	100.2500	0.1800	18.0450			(29a)
Wall to common	21.1900		21.1900	0.1800	3.8142			(29a)
Total net area of external elements Aum(A, m2)			187.7500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		59.4529			(33)
Party Wall 1			6.7100	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							217.7500	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.4300	0.0500	0.7215

E3 Sill	12.2800	0.0500	0.6140	
E4 Jamb	48.4200	0.0500	2.4210	
E5 Ground floor (normal)	47.8300	0.1600	7.6528	
E6 Intermediate floor within a dwelling	44.6200	0.0000	0.0000	
E16 Corner (normal)	15.8700	0.0900	1.4283	
E18 Party wall between dwellings	5.2900	0.0600	0.3174	
P1 Party wall - Ground floor	1.0000	0.0800	0.0800	
P2 Party wall - Intermediate floor within a dwelling	3.7000	0.0000	0.0000	
E8 Balcony within a dwelling, wall insulation continuous	2.1700	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.2350 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 72.6879 (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	85.1659	84.7749	84.3916	82.5913	82.2545	80.6866	80.6866	80.3962	81.2905	82.2545	82.9359	83.6483	(38)
Heat transfer coeff	157.8538	157.4628	157.0795	155.2792	154.9424	153.3745	153.3745	153.0841	153.9784	154.9424	155.6238	156.3362	(39)

Average = Sum(39)m / 12 = 155.2776

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9218	0.9195	0.9173	0.9067	0.9048	0.8956	0.8956	0.8939	0.8991	0.9048	0.9088	0.9129	(40)
HLP (average)												0.9067	
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 2.9642 (42)

Hot water usage for mixer showers

94.9855	93.5580	91.4780	87.4981	84.5611	81.2858	79.4241	81.4884	83.7513	87.2680	91.3333	94.6216	(42a)

Hot water usage for baths

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

44.9868	43.3509	41.7151	40.0792	38.4433	36.8074	36.8074	38.4433	40.0792	41.7151	43.3509	44.9868	(42c)

Average daily hot water use (litres/day) 128.4705 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	139.9723	136.9090	133.1930	127.5773	123.0044	118.0932	116.2315	119.9317	123.8304	128.9830	134.6843	139.6084	(44)
Energy conte	221.6819	194.9566	204.7127	174.6469	165.5876	145.2093	140.5719	148.5005	152.6953	175.0288	191.8824	218.5930	(45)
Energy content (annual)										Total = Sum(45)m =		2134.0668	
Distribution loss (46)m = 0.15 x (45)m	33.2523	29.2435	30.7069	26.1970	24.8381	21.7814	21.0858	22.2751	22.9043	26.2543	28.7824	32.7889	(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

268.2768	237.0423	251.3076	219.7388	212.1825	190.3012	187.1668	195.0954	197.7872	221.6237	236.9743	265.1879	(62)

WWHRS	-43.4234	-38.4040	-40.2145	-33.2992	-31.0336	-26.5557	-24.8917	-26.4699	-27.4755	-32.3906	-36.6947	-42.6193	(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

224.8534	198.6383	211.0931	186.4396	181.1488	163.7455	162.2751	168.6255	170.3116	189.2330	200.2796	222.5686	(64)

Total per year (kWh/year) = Sum(64)m = 2279.2122 (64)
12Total per year (kWh/year) 2279 (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

110.9852	98.4916	105.3429	94.1436	92.3338	84.3556	84.0161	86.6523	86.8447	95.4730	99.8744	109.9581	(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	148.2122	148.2122	148.2122	148.2122	148.2122	148.2122	148.2122	148.2122	148.2122	148.2122	148.2122	148.2122	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	184.3627	204.1158	184.3627	190.5081	184.3627	190.5081	184.3627	184.3627	190.5081	184.3627	190.5081	184.3627	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	342.8224	346.3798	337.4152	318.3307	294.2398	271.5978	256.4716	252.9142	261.8788	280.9633	305.0542	327.6961	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8212	37.8212	37.8212	37.8212	37.8212	37.8212	37.8212	37.8212	37.8212	37.8212	37.8212	37.8212	(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)	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	(71)
Water heating gains (Table 5)	149.1736	146.5649	141.5899	130.7550	124.1045	117.1605	112.9248	116.4682	120.6176	128.3239	138.7144	147.7931	(72)
Total internal gains	746.8223	767.5242	733.8314	710.0574	673.1707	646.7301	621.2228	621.2087	640.4681	664.1136	704.7403	730.3156	(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	12.0000	10.6334	0.6300	0.7000	0.7700	38.9964	(74)
South	2.0200	46.7521	0.6300	0.7000	0.7700	28.8618	(78)
Southwest	1.8700	36.7938	0.6300	0.7000	0.7700	21.0275	(79)
West	8.7800	19.6403	0.6300	0.7000	0.7700	52.7004	(80)

Solar gains	141.5862	260.7032	405.6331	579.7958	716.3973	739.7476	701.3909	595.7336	465.6793	301.6094	173.2156	118.7820	(83)
Total gains	888.4085	1028.2274	1139.4646	1289.8532	1389.5680	1386.4777	1322.6137	1216.9423	1106.1474	965.7229	877.9559	849.0976	(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	65.6192	65.7822	65.9427	66.7072	66.8522	67.5357	67.5357	67.6638	67.2708	66.8522	66.5595	66.2562	
alpha	5.3746	5.3855	5.3962	5.4471	5.4568	5.5024	5.5024	5.5109	5.4847	5.4568	5.4373	5.4171	
util living area	0.9981	0.9954	0.9880	0.9557	0.8600	0.6734	0.5040	0.5663	0.8282	0.9745	0.9956	0.9985	(86)
MIT	19.7213	19.8946	20.1573	20.5262	20.8196	20.9648	20.9939	20.9890	20.8926	20.5083	20.0552	19.6976	(87)
Th 2	20.1490	20.1510	20.1529	20.1618	20.1634	20.1712	20.1712	20.1727	20.1682	20.1634	20.1601	20.1565	(88)
util rest of house	0.9975	0.9940	0.9843	0.9418	0.8196	0.5991	0.4122	0.4704	0.7666	0.9641	0.9941	0.9981	(89)
MIT 2	18.6338	18.8567	19.1925	19.6594	20.0012	20.1487	20.1689	20.1679	20.0868	19.6450	19.0694	18.6088	(90)
Living area fraction										fLA = Living area / (4) =		0.1491	(91)
MIT	18.7960	19.0115	19.3364	19.7887	20.1232	20.2704	20.2919	20.2904	20.2069	19.7738	19.2164	18.7712	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7960	19.0115	19.3364	19.7887	20.1232	20.2704	20.2919	20.2904	20.2069	19.7738	19.2164	18.7712	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9962	0.9915	0.9795	0.9342	0.8174	0.6084	0.4258	0.4845	0.7698	0.9576	0.9916	0.9970	(94)
Useful gains	885.0367	1019.4545	1116.0760	1205.0184	1135.8985	843.5301	563.1900	589.5722	851.5062	924.7829	870.5522	846.5541	(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	2288.2481	2222.0325	2016.3287	1690.7899	1305.1147	869.6957	566.2437	595.5546	940.3377	1421.4074	1885.6018	2278.0087	(97)
Space heating kWh	1043.9893	808.1324	669.7881	349.7555	125.8968	0.0000	0.0000	0.0000	0.0000	369.4886	730.8357	1065.0022	(98a)
Space heating requirement - total per year (kWh/year)												5162.8886	
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	1043.9893	808.1324	669.7881	349.7555	125.8968	0.0000	0.0000	0.0000	0.0000	369.4886	730.8357	1065.0022	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5162.8886	
Space heating per m2										(98c) / (4) =		30.1483	(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	1043.9893	808.1324	669.7881	349.7555	125.8968	0.0000	0.0000	0.0000	0.0000	369.4886	730.8357	1065.0022	(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)	1131.0827	875.5497	725.6642	378.9333	136.3996	0.0000	0.0000	0.0000	0.0000	400.3127	791.8047	1153.8485	(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	224.8534	198.6383	211.0931	186.4396	181.1488	163.7455	162.2751	168.6255	170.3116	189.2330	200.2796	222.5686	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.0600	86.8670	86.4632	85.4491	83.2600	79.8000	79.8000	79.8000	79.8000	85.5328	86.6968	87.1019	(217)
Fuel for water heating, kWh/month	258.2741	228.6694	244.1423	218.1879	217.5700	205.1948	203.3522	211.3102	213.4231	221.2403	231.0115	255.5267	(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	38.3069	30.7312	27.6701	20.2723	15.6589	12.7934	14.2846	18.5676	24.1175	31.6435	35.7412	39.3716	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-90.9973	-120.0301	-161.4596	-169.3895	-172.8652	-157.7659	-155.5738	-151.3503	-142.9386	-130.9412	-96.9456	-79.6564	(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	-79.8012	-163.5513	-317.5508	-466.5898	-607.4469	-607.1469	-600.1885	-512.5960	-381.5880	-230.5194	-105.3671	-63.4591	(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 5593.5954 (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 2707.9024 (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) 309.1588 (232)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-5765.7185	(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	2930.9381	(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	5593.5954	0.2100	1174.6550	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2707.9024	0.2100	568.6595	(264)
Space and water heating			1743.3145	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	309.1588	0.1443	44.6212	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1629.9135	0.1361	-221.8027	
PV Unit electricity exported	-4135.8050	0.1265	-523.3772	
Total			-745.1800	(269)
Total CO2, kg/year			1054.6850	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			6.1600	(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	5593.5954	1.1300	6320.7628	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2707.9024	1.1300	3059.9297	(278)
Space and water heating			9380.6926	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	309.1588	1.5338	474.1980	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1629.9135	1.5030	-2449.7922	
PV Unit electricity exported	-4135.8050	0.4645	-1921.2710	
Total			-4371.0632	(283)
Total Primary energy kWh/year			5613.9282	(286)
Target Primary Energy Rate (TPER)			32.7800	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	116.6500 (1b)	x	2.6800 (2b)	=	312.6220	(1b) - (3b)
First floor	54.6000 (1c)	x	2.6100 (2c)	=	142.5060	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	171.2500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	455.1280	(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) =	0.0879 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.2879 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2447 (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	0.3120	0.3059	0.2998	0.2692	0.2631	0.2325	0.2325	0.2264	0.2447	0.2631	0.2753	0.2875	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0.0000 (23c)

Effective ac	0.5487	0.5468	0.5449	0.5362	0.5346	0.5270	0.5270	0.5256	0.5299	0.5346	0.5379	0.5413 (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	
Doors			4.5200	1.2000	5.4240			(26)
Windows (Uw = 1.20)			24.6700	1.1450	28.2481			(27)
Heatloss Floor 1			37.1200	0.1100	4.0832			(28a)
External Wall 1	129.4400	29.1900	100.2500	0.1900	19.0475			(29a)
Wall to common	21.1900		21.1900	0.1700	3.6023			(29a)
Total net area of external elements Aum(A, m2)			187.7500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	60.4051			(33)
Party Wall 1			6.7100	0.0000	0.0000			(32)
Party Ceiling 1			54.6000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 217.7500 (35)
Thermal bridges (User defined value 0.045 * total exposed area) 8.4488 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 68.8538 (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	82.4062	82.1223	81.8441	80.5372	80.2927	79.1545	79.1545	78.9437	79.5929	80.2927	80.7873	81.3045	(38)
Heat transfer coeff	151.2600	150.9762	150.6979	149.3911	149.1465	148.0083	148.0083	147.7975	148.4467	149.1465	149.6412	150.1583	(39)
Average = Sum(39)m / 12 =												149.3899	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8833	0.8816	0.8800	0.8724	0.8709	0.8643	0.8643	0.8631	0.8668	0.8709	0.8738	0.8768	(40)
HLP (average)												0.8723	
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 2.9642 (42)
Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

31.9114	31.4375	30.7701	29.5396	28.6181	27.5964	27.0446	27.7073	28.4289	29.5221	30.7780	31.8036	(42b)

Hot water usage for other uses

44.9868	43.3509	41.7151	40.0792	38.4433	36.8074	36.8074	38.4433	40.0792	41.7151	43.3509	44.9868	(42c)

Average daily hot water use (litres/day) 70.4840 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	76.8983	74.7885	72.4852	69.6187	67.0614	64.4038	63.8520	66.1506	68.5080	71.2372	74.1290	76.7904	(44)
Energy conte	121.7881	106.4978	111.4070	95.3046	90.2776	79.1920	77.2234	81.9082	84.4773	96.6682	105.6103	120.2352	(45)
Energy content (annual)										Total = Sum(45)m =		1170.5896	
Distribution loss (46)m = 0.15 x (45)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	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
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	103.5198	90.5231	94.6960	81.0089	76.7359	67.3132	65.6399	69.6220	71.8057	82.1680	89.7688	102.1999	(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	103.5198	90.5231	94.6960	81.0089	76.7359	67.3132	65.6399	69.6220	71.8057	82.1680	89.7688	102.1999	(64)
									Total per year (kWh/year) = Sum(64)m =			995.0012	(64)
12Total per year (kWh/year)												995	(64)
Electric shower(s)	59.1980	52.7459	57.5965	54.9636	55.9950	53.4138	55.1943	55.9950	54.9636	57.5965	56.5135	59.1980	(64a)
					Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =							673.3736	(64a)
Heat gains from water heating, kWh/month	40.6795	35.8172	38.0731	33.9931	33.1827	30.1818	30.2085	31.4042	31.6923	34.9411	36.5706	40.3495	(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	148.2122	148.2122	148.2122	148.2122	148.2122	148.2122	148.2122	148.2122	148.2122	148.2122	148.2122	148.2122	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	184.3627	204.1158	184.3627	190.5081	184.3627	190.5081	184.3627	184.3627	190.5081	184.3627	190.5081	184.3627	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	342.8224	346.3798	337.4152	318.3307	294.2398	271.5978	256.4716	252.9142	261.8788	280.9633	305.0542	327.6961	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8212	37.8212	37.8212	37.8212	37.8212	37.8212	37.8212	37.8212	37.8212	37.8212	37.8212	37.8212	(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)	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	(71)
Water heating gains (Table 5)	54.6767	53.2995	51.1735	47.2127	44.6005	41.9191	40.6029	42.2100	44.0171	46.9639	50.7924	54.2332	(72)
Total internal gains	649.3254	671.2587	640.4151	623.5151	590.6666	571.4887	548.9008	546.9505	563.8676	579.7535	613.8183	633.7556	(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	12.0000	10.6334	0.7600	0.7000	0.7700	47.0433	(74)
South	2.0200	46.7521	0.7600	0.7000	0.7700	34.8175	(78)
Southwest	1.8700	36.7938	0.7600	0.7000	0.7700	25.3666	(79)
West	8.7800	19.6403	0.7600	0.7000	0.7700	63.5750	(80)

Solar gains	170.8024	314.4991	489.3352	699.4362	864.2253	892.3939	846.1224	718.6628	561.7718	363.8462	208.9584	143.2926 (83)
Total gains	820.1278	985.7578	1129.7503	1322.9513	1454.8919	1463.8826	1395.0232	1265.6133	1125.6395	943.5997	822.7768	777.0482 (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	68.4797	68.6085	68.7352	69.3365	69.4501	69.9842	69.9842	70.0840	69.7775	69.4501	69.2206	68.9822	
alpha	5.5653	5.5739	5.5823	5.6224	5.6300	5.6656	5.6656	5.6723	5.6518	5.6300	5.6147	5.5988	
util living area	0.9987	0.9961	0.9877	0.9469	0.8282	0.6266	0.4635	0.5297	0.8068	0.9752	0.9967	0.9991	(86)
MIT	19.7421	19.9320	20.2115	20.5901	20.8654	20.9778	20.9965	20.9930	20.9142	20.5338	20.0696	19.7113	(87)
Th 2	20.1817	20.1832	20.1845	20.1911	20.1923	20.1980	20.1980	20.1990	20.1958	20.1923	20.1898	20.1872	(88)
util rest of house	0.9983	0.9950	0.9840	0.9312	0.7847	0.5560	0.3807	0.4412	0.7440	0.9651	0.9955	0.9988	(89)
MIT 2	19.0148	19.2052	19.4835	19.8551	20.0999	20.1871	20.1969	20.1967	20.1459	19.8081	19.3483	18.9884	(90)
Living area fraction										fLA = Living area / (4) =		0.1491	(91)
MIT	19.1233	19.3136	19.5921	19.9647	20.2141	20.3051	20.3162	20.3155	20.2605	19.9163	19.4558	19.0962	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1233	19.3136	19.5921	19.9647	20.2141	20.3051	20.3162	20.3155	20.2605	19.9163	19.4558	19.0962	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9976	0.9933	0.9805	0.9260	0.7860	0.5657	0.3930	0.4543	0.7495	0.9607	0.9941	0.9982	(94)
Useful gains	818.1964	979.1929	1107.7043	1225.0366	1143.4780	828.1607	548.3134	574.9671	843.6950	906.4750	817.9097	775.6848	(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	2242.1708	2176.1114	1972.9537	1652.9692	1269.8479	844.3956	550.0254	578.6969	914.5001	1389.4960	1848.9429	2236.7952	(97)
Space heating kWh	1059.4369	804.3292	643.7456	308.1115	94.0192	0.0000	0.0000	0.0000	0.0000	359.3676	742.3439	1087.0661	(98a)
Space heating requirement - total per year (kWh/year)												5098.4200	
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	1059.4369	804.3292	643.7456	308.1115	94.0192	0.0000	0.0000	0.0000	0.0000	359.3676	742.3439	1087.0661	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5098.4200	
Space heating per m2											(98c) / (4) =	29.7718	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1391.2780	1095.2614	1123.2611	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9068	0.9539	0.9259	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1261.5885	1044.7436	1040.0172	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1621.5124	1544.8352	1397.3802	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	259.1453	372.0681	265.8781	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	64.7863	93.0170	66.4695	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												224.2729	(107)
Energy for space heating												29.7718	(99)
Energy for space cooling												1.3096	(108)
Total												31.0814	(109)
Fabric Energy Efficiency (DFEE)												31.1	(109)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	116.6500	(1b)	x 2.6800	(2b) =	312.6220	(1b) - (3b)
First floor	54.6000	(1c)	x 2.6100	(2c) =	142.5060	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	171.2500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		455.1280	(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) =	0.0879	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3379	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2872	(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	0.3662	0.3590	0.3518	0.3159	0.3087	0.2728	0.2728	0.2657	0.2872	0.3087	0.3231	0.3375	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5670	0.5644	0.5619	0.5499	0.5477	0.5372	0.5372	0.5353	0.5412	0.5477	0.5522	0.5569	(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	
TER Opaque door			4.5200	1.0000	4.5200			(26)
TER Opening Type (Uw = 1.20)			24.6700	1.1450	28.2481			(27)
Heatloss Floor 1			37.1200	0.1300	4.8256			(28a)
External Wall 1	129.4400	29.1900	100.2500	0.1800	18.0450			(29a)
Wall to common	21.1900		21.1900	0.1800	3.8142			(29a)
Total net area of external elements Aum(A, m2)			187.7500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		59.4529			(33)
Party Wall 1			6.7100	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							217.7500	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.4300	0.0500	0.7215
E3 Sill	12.2800	0.0500	0.6140
E4 Jamb	48.4200	0.0500	2.4210
E5 Ground floor (normal)	47.8300	0.1600	7.6528
E6 Intermediate floor within a dwelling	44.6200	0.0000	0.0000
E16 Corner (normal)	15.8700	0.0900	1.4283
E18 Party wall between dwellings	5.2900	0.0600	0.3174
P1 Party wall - Ground floor	1.0000	0.0800	0.0800
P2 Party wall - Intermediate floor within a dwelling	3.7000	0.0000	0.0000
E8 Balcony within a dwelling, wall insulation continuous	2.1700	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		13.2350	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	72.6879	(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	85.1659	84.7749	84.3916	82.5913	82.2545	80.6866	80.6866	80.3962	81.2905	82.2545	82.9359	83.6483	(38)
Heat transfer coeff	157.8538	157.4628	157.0795	155.2792	154.9424	153.3745	153.3745	153.0841	153.9784	154.9424	155.6238	156.3362	(39)
Average = Sum(39)m / 12 =												155.2776	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9218	0.9195	0.9173	0.9067	0.9048	0.8956	0.8956	0.8939	0.8991	0.9048	0.9088	0.9129	(40)
HLP (average)												0.9067	
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												2.9642	(42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	31.9114	31.4375	30.7701	29.5396	28.6181	27.5964	27.0446	27.7073	28.4289	29.5221	30.7780	31.8036	(42b)
Hot water usage for other uses	44.9868	43.3509	41.7151	40.0792	38.4433	36.8074	36.8074	38.4433	40.0792	41.7151	43.3509	44.9868	(42c)
Average daily hot water use (litres/day)												70.4840	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	76.8983	74.7885	72.4852	69.6187	67.0614	64.4038	63.8520	66.1506	68.5080	71.2372	74.1290	76.7904	(44)
Energy conte	121.7881	106.4978	111.4070	95.3046	90.2776	79.1920	77.2234	81.9082	84.4773	96.6682	105.6103	120.2352	(45)
Energy content (annual)										Total = Sum(45)m =		1170.5896	
Distribution loss (46)m = 0.15 x (45)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	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
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													

	103.5198	90.5231	94.6960	81.0089	76.7359	67.3132	65.6399	69.6220	71.8057	82.1680	89.7688	102.1999	(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													
	103.5198	90.5231	94.6960	81.0089	76.7359	67.3132	65.6399	69.6220	71.8057	82.1680	89.7688	102.1999	(64)
										Total per year (kWh/year) = Sum(64)m =		995.0012	(64)
12Total per year (kWh/year)												995	(64)
Electric shower(s)													
	59.1980	52.7459	57.5965	54.9636	55.9950	53.4138	55.1943	55.9950	54.9636	57.5965	56.5135	59.1980	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						673.3736	(64a)
Heat gains from water heating, kWh/month													
	40.6795	35.8172	38.0731	33.9931	33.1827	30.1818	30.2085	31.4042	31.6923	34.9411	36.5706	40.3495	(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	148.2122	148.2122	148.2122	148.2122	148.2122	148.2122	148.2122	148.2122	148.2122	148.2122	148.2122	148.2122	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	184.3627	204.1158	184.3627	190.5081	184.3627	190.5081	184.3627	184.3627	190.5081	184.3627	190.5081	184.3627	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	342.8224	346.3798	337.4152	318.3307	294.2398	271.5978	256.4716	252.9142	261.8788	280.9633	305.0542	327.6961	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.8212	37.8212	37.8212	37.8212	37.8212	37.8212	37.8212	37.8212	37.8212	37.8212	37.8212	37.8212	(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)													
	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	(71)
Water heating gains (Table 5)													
	54.6767	53.2995	51.1735	47.2127	44.6005	41.9191	40.6029	42.2100	44.0171	46.9639	50.7924	54.2332	(72)
Total internal gains													
	649.3254	671.2587	640.4151	623.5151	590.6666	571.4887	548.9008	546.9505	563.8676	579.7535	613.8183	633.7556	(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	12.0000	10.6334	0.6300	0.7000	0.7700	38.9964	(74)
South	2.0200	46.7521	0.6300	0.7000	0.7700	28.8618	(78)
Southwest	1.8700	36.7938	0.6300	0.7000	0.7700	21.0275	(79)
West	8.7800	19.6403	0.6300	0.7000	0.7700	52.7004	(80)

Solar gains	141.5862	260.7032	405.6331	579.7958	716.3973	739.7476	701.3909	595.7336	465.6793	301.6094	173.2156	118.7820	(83)
Total gains	790.9116	931.9619	1046.0482	1203.3109	1307.0639	1311.2363	1250.2917	1142.6841	1029.5469	881.3629	787.0339	752.5377	(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	65.6192	65.7822	65.9427	66.7072	66.8522	67.5357	67.5357	67.6638	67.2708	66.8522	66.5595	66.2562	
alpha	5.3746	5.3855	5.3962	5.4471	5.4568	5.5024	5.5024	5.5109	5.4847	5.4568	5.4373	5.4171	
util living area													
	0.9989	0.9971	0.9918	0.9664	0.8832	0.7035	0.5312	0.5991	0.8588	0.9828	0.9974	0.9992	(86)
MIT	19.6507	19.8257	20.0927	20.4750	20.7898	20.9565	20.9922	20.9856	20.8691	20.4534	19.9899	19.6273	(87)
Th 2	20.1490	20.1510	20.1529	20.1618	20.1634	20.1712	20.1712	20.1727	20.1682	20.1634	20.1601	20.1565	(88)
util rest of house													
	0.9986	0.9963	0.9892	0.9553	0.8465	0.6287	0.4354	0.4995	0.8020	0.9753	0.9965	0.9989	(89)
MIT 2	18.8977	19.0739	19.3410	19.7224	20.0131	20.1491	20.1688	20.1677	20.0884	19.7071	19.2452	18.8803	(90)
Living area fraction										fLA = Living area / (4) =		0.1491	(91)
MIT	19.0100	19.1860	19.4531	19.8346	20.1290	20.2695	20.2916	20.2897	20.2048	19.8184	19.3563	18.9917	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0100	19.1860	19.4531	19.8346	20.1290	20.2695	20.2916	20.2897	20.2048	19.8184	19.3563	18.9917	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9980	0.9949	0.9864	0.9499	0.8448	0.6381	0.4497	0.5141	0.8049	0.9712	0.9952	0.9985	(94)
Useful gains	789.3128	927.2012	1031.8211	1143.0420	1104.1839	836.7268	562.2115	587.4834	828.6463	856.0221	783.2665	751.3768	(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													
	2322.0342	2249.5106	2034.6619	1697.9223	1306.0041	869.5629	566.1975	595.4512	940.0129	1428.3176	1907.3716	2312.4815	(97)
Space heating kWh													
	1140.3447	888.5919	746.1136	399.5138	150.1542	0.0000	0.0000	0.0000	0.0000	425.7879	809.3557	1161.4619	(98a)
Space heating requirement - total per year (kWh/year)												5721.3237	
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													
	1140.3447	888.5919	746.1136	399.5138	150.1542	0.0000	0.0000	0.0000	0.0000	425.7879	809.3557	1161.4619	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5721.3237	
Space heating per m2											(98c) / (4) =	33.4092	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1441.7199	1134.9710	1163.4391	0.0000	0.0000	0.0000	0.0000	(100)

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8466	0.9149	0.8762	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1220.5789	1038.4026	1019.3879	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1443.0946	1375.6686	1253.6968	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	160.2113	250.9259	174.3258	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	40.0528	62.7315	43.5815	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												146.3658	(107)
Energy for space heating												33.4092	(99)
Energy for space cooling												0.8547	(108)
Total												34.2639	(109)
Fabric Energy Efficiency (TFEE)												34.3	(109)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	116.6500 (1b)	x	2.6800 (2b)	=	312.6220	(1b) - (3b)
First floor	54.6000 (1c)	x	2.6100 (2c)	=	142.5060	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	171.2500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	455.1280	(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		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700	(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													
	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)
Mechanical extract ventilation - centralised													
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)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(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	
Doors			4.5200	1.2000	5.4240			(26)
Windows (Uw = 1.20)			24.6700	1.1450	28.2481			(27)
Heatloss Floor 1			37.1200	0.1100	4.0832			(28a)
External Wall 1	129.4400	29.1900	100.2500	0.1900	19.0475			(29a)
Wall to common	21.1900		21.1900	0.1700	3.6023			(29a)
Total net area of external elements Aum(A, m2)			187.7500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		60.4051			(33)
Party Wall 1			6.7100	0.0000	0.0000			(32)
Party Ceiling 1			54.6000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	217.7500	(35)
Thermal bridges (User defined value 0.045 * total exposed area)	8.4488	(36)
Point Thermal bridges	(36a) = 0.0000	
Total fabric heat loss	(33) + (36) + (36a) = 68.8538	(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	75.0961	75.0961	75.0961	75.0961	75.0961	75.0961	75.0961	75.0961	75.0961	75.0961	75.0961	75.0961	(38)
Heat transfer coeff	143.9500	143.9500	143.9500	143.9500	143.9500	143.9500	143.9500	143.9500	143.9500	143.9500	143.9500	143.9500	(39)
Average = Sum(39)m / 12 =												143.9500	

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

HLP	0.8406	0.8406	0.8406	0.8406	0.8406	0.8406	0.8406	0.8406	0.8406	0.8406	0.8406	0.8406	(40)
HLP (average)												0.8406	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9642	(42)
Hot water usage for mixer showers													
	94.9855	93.5580	91.4780	87.4981	84.5611	81.2858	79.4241	81.4884	83.7513	87.2680	91.3333	94.6216	(42a)
Hot water usage for baths													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses													
	44.9868	43.3509	41.7151	40.0792	38.4433	36.8074	36.8074	38.4433	40.0792	41.7151	43.3509	44.9868	(42c)
Average daily hot water use (litres/day)												128.4705	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	139.9723	136.9090	133.1930	127.5773	123.0044	118.0932	116.2315	119.9317	123.8304	128.9830	134.6843	139.6084	(44)
Energy conte	221.6819	194.9566	204.7127	174.6469	165.5876	145.2093	140.5719	148.5005	152.6953	175.0288	191.8824	218.5930	(45)
Energy content (annual)										Total = Sum(45)m =		2134.0668	
Distribution loss (46)m = 0.15 x (45)m													
	33.2523	29.2435	30.7069	26.1970	24.8381	21.7814	21.0858	22.2751	22.9043	26.2543	28.7824	32.7889	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2200	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.7320	(55)
Total storage loss													
	22.6920	20.4960	22.6920	21.9600	22.6920	21.9600	22.6920	22.6920	21.9600	22.6920	21.9600	22.6920	(56)
If cylinder contains dedicated solar storage													
	22.6920	20.4960	22.6920	21.9600	22.6920	21.9600	22.6920	22.6920	21.9600	22.6920	21.9600	22.6920	(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													
	267.6363	236.4638	250.6671	219.1189	211.5420	189.6813	186.5263	194.4549	197.1673	220.9832	236.3544	264.5474	(62)
WWHRS	-84.5826	-74.8055	-78.3320	-64.8620	-60.4491	-51.7267	-48.4855	-51.5595	-53.5184	-63.0923	-71.4760	-83.0162	(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													
	183.0537	161.6582	172.3351	154.2569	151.0929	137.9546	138.0407	142.8954	143.6489	157.8908	164.8785	181.5312	(64)
										Total per year (kWh/year) = Sum(64)m =		1889.2369	(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													
	110.4728	98.0288	104.8305	93.6477	91.8214	83.8597	83.5037	86.1399	86.3488	94.9606	99.3785	109.4457	(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	177.8546	177.8546	177.8546	177.8546	177.8546	177.8546	177.8546	177.8546	177.8546	177.8546	177.8546	177.8546	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	53.0624	47.1295	38.3283	29.0170	21.6905	18.3121	19.7868	25.7197	34.5209	43.8322	51.1587	54.5371	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	511.6752	516.9848	503.6048	475.1204	439.1639	405.3699	382.7935	377.4839	390.8639	419.3483	455.3047	489.0987	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.7497	55.7497	55.7497	55.7497	55.7497	55.7497	55.7497	55.7497	55.7497	55.7497	55.7497	55.7497	(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)													
	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	(71)
Water heating gains (Table 5)													
	148.4849	145.8762	140.9012	130.0663	123.4158	116.4718	112.2361	115.7795	119.9289	127.6352	138.0257	147.1044	(72)
Total internal gains													
	828.2570	825.0251	797.8689	749.2382	699.3049	655.1884	629.8510	634.0176	660.3482	705.8503	759.5237	805.7749	(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	12.0000	10.6334	0.7600	0.7000	0.7700	47.0433	(74)
South	2.0200	46.7521	0.7600	0.7000	0.7700	34.8175	(78)
Southwest	1.8700	36.7938	0.7600	0.7000	0.7700	25.3666	(79)
West	8.7800	19.6403	0.7600	0.7000	0.7700	63.5750	(80)

Solar gains	170.8024	314.4991	489.3352	699.4362	864.2253	892.3939	846.1224	718.6628	561.7718	363.8462	208.9584	143.2926	(83)
Total gains	999.0594	1139.5242	1287.2041	1448.6744	1563.5302	1547.5823	1475.9734	1352.6804	1222.1200	1069.6965	968.4821	949.0675	(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	71.9573	71.9573	71.9573	71.9573	71.9573	71.9573	71.9573	71.9573	71.9573	71.9573	71.9573	71.9573	
alpha	5.7972	5.7972	5.7972	5.7972	5.7972	5.7972	5.7972	5.7972	5.7972	5.7972	5.7972	5.7972	
util living area													
	0.9964	0.9916	0.9758	0.9190	0.7794	0.5830	0.4273	0.4855	0.7522	0.9547	0.9923	0.9973	(86)
MIT	19.9525	20.1168	20.3818	20.6948	20.9107	20.9859	20.9980	20.9960	20.9450	20.6461	20.2266	19.9053	(87)
Th 2	20.2183	20.2183	20.2183	20.2183	20.2183	20.2183	20.2183	20.2183	20.2183	20.2183	20.2183	20.2183	(88)
util rest of house													
	0.9954	0.9894	0.9692	0.8980	0.7331	0.5167	0.3523	0.4050	0.6869	0.9384	0.9897	0.9966	(89)
MIT 2	18.9805	19.1898	19.5243	19.9049	20.1420	20.2096	20.2175	20.2166	20.1789	19.8549	19.3309	18.9204	(90)
Living area fraction										fLA = Living area / (4) =		0.1491	(91)

MIT	19.1255	19.3281	19.6522	20.0227	20.2566	20.3254	20.3339	20.3328	20.2932	19.9729	19.4645	19.0673	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1255	19.3281	19.6522	20.0227	20.2566	20.3254	20.3339	20.3328	20.2932	19.9729	19.4645	19.0673	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9934	0.9859	0.9631	0.8920	0.7355	0.5260	0.3635	0.4170	0.6936	0.9320	0.9864	0.9950	(94)
Useful gains	992.4982	1123.4053	1239.7464	1292.1662	1149.9940	814.0441	536.5194	564.0159	847.6198	997.0025	955.3068	944.3110	(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													
	2134.1289	2076.9204	1893.2577	1601.1179	1231.7224	824.1710	537.4988	566.1328	891.5038	1349.2289	1779.8690	2140.1429	(97)
Space heating kWh													
	849.3732	640.7621	486.2124	222.4452	60.8060	0.0000	0.0000	0.0000	0.0000	262.0564	593.6848	889.6989	(98a)
Space heating requirement - total per year (kWh/year)												4005.0392	
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													
	849.3732	640.7621	486.2124	222.4452	60.8060	0.0000	0.0000	0.0000	0.0000	262.0564	593.6848	889.6989	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4005.0392	
Space heating per m2											(98c) / (4) =	23.3871	(99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Heat pump-Space and Water	1.0000	(303a)
Factor for control and charging method (Table 4c(3)) for space heating	1.0000	(305)
Factor for charging method (Table 4c(3)) for water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0000	(306)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating:		
Space heating requirement		
849.3732 640.7621 486.2124 222.4452 60.8060 0.0000 0.0000 0.0000 0.0000 262.0564 593.6848 889.6989		(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00		
307a 849.3732 640.7621 486.2124 222.4452 60.8060 0.0000 0.0000 0.0000 0.0000 262.0564 593.6848 889.6989		
Space heating requirement		
849.3732 640.7621 486.2124 222.4452 60.8060 0.0000 0.0000 0.0000 0.0000 262.0564 593.6848 889.6989		(307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system		
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000		(309)
Water heating		
Annual water heating requirement		
183.0537 161.6582 172.3351 154.2569 151.0929 137.9546 138.0407 142.8954 143.6489 157.8908 164.8785 181.5312		(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00		
310a 183.0537 161.6582 172.3351 154.2569 151.0929 137.9546 138.0407 142.8954 143.6489 157.8908 164.8785 181.5312		
Water heating fuel		
183.0537 161.6582 172.3351 154.2569 151.0929 137.9546 138.0407 142.8954 143.6489 157.8908 164.8785 181.5312		(310)
Cooling System Energy Efficiency Ratio	0.0000	(314)
Space coolin 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000		(315)
Pumps and Fa 13.5817 12.2674 13.5817 13.1436 13.5817 13.1436 13.5817 13.5817 13.1436 13.5817 13.1436 13.5817		(331)
Lighting 46.4452 37.2600 33.5485 24.5791 18.9856 15.5114 17.3193 22.5123 29.2412 38.3661 43.3344 47.7360		(332)
Electricity generated by PVs (Appendix M) (negative quantity)		
(333a)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		(333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)		
(334a)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		(334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)		
(335a)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		(335a)
Electricity generated by PVs (Appendix M) (negative quantity)		
(333b)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		(333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)		
(334b)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		(334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)		
(335b)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		(335b)
Annual totals kWh/year		
Space heating fuel - community heating	4005.0392	(307)
Space heating fuel - secondary	0.0000	(309)
Water heating fuel - community heating	1889.2369	(310)
Efficiency of water heater	0.0000	(311)
Electricity used for heat distribution	40.0504	(313)
Space cooling fuel	0.0000	(321)
Electricity for pumps and fans:		
(MEVCentralised, Database: in-use factor = 1.6000, SFP = 0.2880)		
mechanical ventilation fans (SFP = 0.2880)	159.9138	(330a)
Total electricity for the above, kWh/year	159.9138	(331)
Electricity for lighting (calculated in Appendix L)	374.8391	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(333)
Wind generation	0.0000	(334)
Hydro-electric generation (Appendix N)	0.0000	(335a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(335)
Appendix Q - special features		
Energy saved or generated	-0.0000	(336)
Energy used	0.0000	(337)
Total delivered energy for all uses	6429.0290	(338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Heat pump	4005.0392	4.4400	177.8237	(340a)
Space heating total			177.8237	(340)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Heat pump	1889.2369	4.4400	83.8821	(342a)
Water heating total			83.8821	(342)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(347a)
Pumps, fans and electric keep-hot	159.9138	16.4900	26.3698	(349)

Energy for lighting	374.8391	16.4900	61.8110	(350)
Additional standing charges			92.0000	(351)
Total energy cost			441.8866	(355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):			0.3600	(356)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =		0.7356	(357)
SAP value			88.0755	
SAP rating (Section 12)			88	(358)
SAP band			B	

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Heat pump			350.0000	(367)
Space and Water heating from Heat pump	1684.0789	0.1562	178.7152	(367)
Electrical energy for heat distribution (space & water)	40.0504	0.0000	8.9094	(372)
Overall CO2 factor for heat network			0.0447	(386)
Total CO2 associated with community systems			263.4645	(373)
Space and water heating			263.4645	(376)
Pumps, fans and electric keep-hot	159.9138	0.1387	22.1820	(378)
Energy for lighting	374.8391	0.1443	54.1009	(379)
Total CO2, kg/year			339.7473	(383)
CO2 emissions per m2			1.9800	(384)
EI value			97.8947	(384a)
EI rating			98	(385)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	116.6500 (1b)	x	2.6800 (2b)	=	312.6220	(1b) - (3b)
First floor	54.6000 (1c)	x	2.6100 (2c)	=	142.5060	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	171.2500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		455.1280	(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		4.0000 (17)
Infiltration rate		0.2000 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.1785	0.1700	0.1700	0.1573	0.1573	0.1403	0.1445	0.1360	0.1403	0.1488	0.1488	0.1615	(22b)

Mechanical extract ventilation - centralised

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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(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	
Doors			4.5200	1.2000	5.4240			(26)
Windows (Uw = 1.20)			24.6700	1.1450	28.2481			(27)

Heatloss Floor 1			37.1200	0.1100	4.0832	(28a)
External Wall 1	129.4400	29.1900	100.2500	0.1900	19.0475	(29a)
Wall to common	21.1900		21.1900	0.1700	3.6023	(29a)
Total net area of external elements Aum(A, m2)			187.7500			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		60.4051	(33)
Party Wall 1			6.7100	0.0000	0.0000	(32)
Party Ceiling 1			54.6000			(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		217.7500 (35)
Thermal bridges (User defined value 0.045 * total exposed area)		8.4488 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	68.8538 (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	75.0961	75.0961	75.0961	75.0961	75.0961	75.0961	75.0961	75.0961	75.0961	75.0961	75.0961	75.0961	(38)
Heat transfer coeff	143.9500	143.9500	143.9500	143.9500	143.9500	143.9500	143.9500	143.9500	143.9500	143.9500	143.9500	143.9500	(39)
Average = Sum(39)m / 12 =												143.9500	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8406	0.8406	0.8406	0.8406	0.8406	0.8406	0.8406	0.8406	0.8406	0.8406	0.8406	0.8406	(40)
HLP (average)												0.8406	
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												2.9642	(42)
Hot water usage for mixer showers	94.9855	93.5580	91.4780	87.4981	84.5611	81.2858	79.4241	81.4884	83.7513	87.2680	91.3333	94.6216	(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses	44.9868	43.3509	41.7151	40.0792	38.4433	36.8074	36.8074	38.4433	40.0792	41.7151	43.3509	44.9868	(42c)
Average daily hot water use (litres/day)												128.4705	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	139.9723	136.9090	133.1930	127.5773	123.0044	118.0932	116.2315	119.9317	123.8304	128.9830	134.6843	139.6084	(44)
Energy conte	221.6819	194.9566	204.7127	174.6469	165.5876	145.2093	140.5719	148.5005	152.6953	175.0288	191.8824	218.5930	(45)
Energy content (annual)										Total = Sum(45)m =		2134.0668	
Distribution loss (46)m = 0.15 x (45)m	33.2523	29.2435	30.7069	26.1970	24.8381	21.7814	21.0858	22.2751	22.9043	26.2543	28.7824	32.7889	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2200	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.7320	(55)
Total storage loss	22.6920	20.4960	22.6920	21.9600	22.6920	21.9600	22.6920	22.6920	21.9600	22.6920	21.9600	22.6920	(56)
If cylinder contains dedicated solar storage	22.6920	20.4960	22.6920	21.9600	22.6920	21.9600	22.6920	22.6920	21.9600	22.6920	21.9600	22.6920	(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	267.6363	236.4638	250.6671	219.1189	211.5420	189.6813	186.5263	194.4549	197.1673	220.9832	236.3544	264.5474	(62)
WWHRS	-84.5826	-74.8055	-78.3320	-64.8620	-60.4491	-51.7267	-48.4855	-51.5595	-53.5184	-63.0923	-71.4760	-83.0162	(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	183.0537	161.6582	172.3351	154.2569	151.0929	137.9546	138.0407	142.8954	143.6489	157.8908	164.8785	181.5312	(64)
										Total per year (kWh/year) = Sum(64)m =		1889.2369	(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	110.4728	98.0288	104.8305	93.6477	91.8214	83.8597	83.5037	86.1399	86.3488	94.9606	99.3785	109.4457	(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	177.8546	177.8546	177.8546	177.8546	177.8546	177.8546	177.8546	177.8546	177.8546	177.8546	177.8546	177.8546	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.0624	47.1295	38.3283	29.0170	21.6905	18.3121	19.7868	25.7197	34.5209	43.8322	51.1587	54.5371	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	511.6752	516.9848	503.6048	475.1204	439.1639	405.3699	382.7935	377.4839	390.8639	419.3483	455.3047	489.0987	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7497	55.7497	55.7497	55.7497	55.7497	55.7497	55.7497	55.7497	55.7497	55.7497	55.7497	55.7497	(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)	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	(71)
Water heating gains (Table 5)	148.4849	145.8762	140.9012	130.0663	123.4158	116.4718	112.2361	115.7795	119.9289	127.6352	138.0257	147.1044	(72)
Total internal gains	828.2570	825.0251	797.8689	749.2382	699.3049	655.1884	629.8510	634.0176	660.3482	705.8503	759.5237	805.7749	(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	12.0000	11.9814	0.7600	0.7000	0.7700	53.0072	(74)
South	2.0200	50.9848	0.7600	0.7000	0.7700	37.9697	(78)
Southwest	1.8700	40.4699	0.7600	0.7000	0.7700	27.9009	(79)
West	8.7800	22.3313	0.7600	0.7000	0.7700	72.2859	(80)

Solar gains	191.1638	317.7220	490.4850	725.0329	873.8675	965.7595	905.7798	786.2425	611.3591	393.1237	239.8007	158.6953	(83)

Total gains	1019.4208	1142.7470	1288.3538	1474.2711	1573.1723	1620.9479	1535.6308	1420.2601	1271.7073	1098.9740	999.3244	964.4702	(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	71.9573	71.9573	71.9573	71.9573	71.9573	71.9573	71.9573	71.9573	71.9573	71.9573	71.9573	71.9573	
alpha	5.7972	5.7972	5.7972	5.7972	5.7972	5.7972	5.7972	5.7972	5.7972	5.7972	5.7972	5.7972	
util living area													
	0.9949	0.9895	0.9679	0.8849	0.6955	0.4418	0.2904	0.3240	0.6357	0.9257	0.9876	0.9961	(86)
MIT	20.0520	20.1922	20.4714	20.7819	20.9572	20.9973	20.9998	20.9997	20.9803	20.7503	20.3422	20.0123	(87)
Th 2	20.2183	20.2183	20.2183	20.2183	20.2183	20.2183	20.2183	20.2183	20.2183	20.2183	20.2183	20.2183	(88)
util rest of house													
	0.9934	0.9865	0.9588	0.8560	0.6390	0.3738	0.2173	0.2451	0.5586	0.8993	0.9833	0.9950	(89)
MIT 2	19.1079	19.2859	19.6362	20.0052	20.1860	20.2171	20.2183	20.2182	20.2068	19.9775	19.4776	19.0572	(90)
Living area fraction										fLA = Living area / (4) =		0.1491	(91)
MIT	19.2487	19.4211	19.7608	20.1210	20.3010	20.3334	20.3348	20.3348	20.3222	20.0927	19.6065	19.1997	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2487	19.4211	19.7608	20.1210	20.3010	20.3334	20.3348	20.3348	20.3222	20.0927	19.6065	19.1997	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9909	0.9825	0.9522	0.8520	0.6452	0.3839	0.2282	0.2568	0.5692	0.8942	0.9789	0.9929	(94)
Useful gains	1010.1237	1122.7421	1226.8016	1256.1137	1015.0006	622.2827	350.4410	364.7770	723.8596	982.7508	978.2753	957.6496	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W													
	2036.7002	1989.5483	1779.3356	1471.3195	1050.9775	623.7979	350.4926	364.8798	737.3378	1222.5304	1670.7614	2029.6452	(97)
Space heating kWh													
	763.7729	582.4938	411.0853	154.9482	26.7668	0.0000	0.0000	0.0000	0.0000	178.3960	498.5900	797.5648	(98a)
Space heating requirement - total per year (kWh/year)												3413.6178	
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													
	763.7729	582.4938	411.0853	154.9482	26.7668	0.0000	0.0000	0.0000	0.0000	178.3960	498.5900	797.5648	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3413.6178	
Space heating per m2											(98c) / (4) =	19.9335	(99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(301)
Fraction of space heat from community system												1.0000	(302)
Fraction of heat from community Heat pump-Space and Water												1.0000	(303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000	(305)
Factor for charging method (Table 4c(3)) for water heating												1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system												1.0000	(306)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating:													
Space heating requirement													
	763.7729	582.4938	411.0853	154.9482	26.7668	0.0000	0.0000	0.0000	0.0000	178.3960	498.5900	797.5648	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00													
307a	763.7729	582.4938	411.0853	154.9482	26.7668	0.0000	0.0000	0.0000	0.0000	178.3960	498.5900	797.5648	
Space heating requirement													
	763.7729	582.4938	411.0853	154.9482	26.7668	0.0000	0.0000	0.0000	0.0000	178.3960	498.5900	797.5648	(307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000	(308)
Space heating fuel for secondary/supplementary system													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(309)
Water heating													
Annual water heating requirement													
	183.0537	161.6582	172.3351	154.2569	151.0929	137.9546	138.0407	142.8954	143.6489	157.8908	164.8785	181.5312	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00													
310a	183.0537	161.6582	172.3351	154.2569	151.0929	137.9546	138.0407	142.8954	143.6489	157.8908	164.8785	181.5312	
Water heating fuel													
	183.0537	161.6582	172.3351	154.2569	151.0929	137.9546	138.0407	142.8954	143.6489	157.8908	164.8785	181.5312	(310)
Cooling System Energy Efficiency Ratio												0.0000	(314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(315)
Pumps and Fa	13.5817	12.2674	13.5817	13.1436	13.5817	13.1436	13.5817	13.5817	13.1436	13.5817	13.1436	13.5817	(331)
Lighting	46.4452	37.2600	33.5485	24.5791	18.9856	15.5114	17.3193	22.5123	29.2412	38.3661	43.3344	47.7360	(332)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333a)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	(333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334a)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	(334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335a)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	(335a)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333b)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	(333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334b)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	(334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335b)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	(335b)
Annual totals kWh/year													
Space heating fuel - community heating												3413.6178	(307)
Space heating fuel - secondary												0.0000	(309)
Water heating fuel - community heating												1889.2369	(310)
Efficiency of water heater												0.0000	(311)
Electricity used for heat distribution												34.1362	(313)
Space cooling fuel												0.0000	(321)
Electricity for pumps and fans:													
(MEVCentralised, Database: in-use factor = 1.6000, SFP = 0.2880)													
mechanical ventilation fans (SFP = 0.2880)												159.9138	(330a)
Total electricity for the above, kWh/year												159.9138	(331)
Electricity for lighting (calculated in Appendix L)												374.8391	(332)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(333)
Wind generation												0.0000	(334)
Hydro-electric generation (Appendix N)												0.0000	(335a)

Electricity generated - Micro CHP (Appendix N)	0.0000 (335)
Appendix Q - special features	
Energy saved or generated	-0.0000 (336)
Energy used	0.0000 (337)
Total delivered energy for all uses	5837.6076 (338)

10b. Fuel costs - using BEDF prices (533)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Heat pump	3413.6178	4.8000	163.8537	(340a)
Space heating total			163.8537	(340)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Heat pump	1889.2369	4.8000	90.6834	(342a)
Water heating total			90.6834	(342)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(347a)
Pumps, fans and electric keep-hot	159.9138	21.5100	34.3975	(349)
Energy for lighting	374.8391	21.5100	80.6279	(350)
Additional standing charges			98.0000	(351)
Total energy cost			467.5624	(355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Heat pump			350.0000	(367)
Space and Water heating from Heat pump	1515.1013	0.1570	153.0951	(367)
Electrical energy for heat distribution (space & water)	34.1362	0.0000	8.0127	(372)
Overall CO2 factor for heat network			0.0447	(386)
Total CO2 associated with community systems			236.9476	(373)
Space and water heating			236.9476	(376)
Pumps, fans and electric keep-hot	159.9138	0.1387	22.1820	(378)
Energy for lighting	374.8391	0.1443	54.1009	(379)
Total CO2, kg/year			313.2305	(383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Heat pump			350.0000	(467a)
Space and Water heating from Heat pump	1515.1013	1.5811	1542.0961	(467)
Electrical energy for heat distribution (space & water)	34.1362	0.0000	82.6803	(472)
Overall CO2 factor for heat network			0.4611	(486)
Total CO2 associated with community systems			2444.9753	(473)
Space and water heating			2444.9753	(476)
Pumps, fans and electric keep-hot	159.9138	1.5128	241.9176	(478)
Energy for lighting	374.8391	1.5338	574.9408	(479)
Total Primary energy kWh/year			3261.8336	(483)

SAP 10 EPC IMPROVEMENTS

GSHP Heat Network_ WWHR

Current energy efficiency rating:	B 88
Current environmental impact rating:	A 98

N Solar water heating		SAP increase too small
U Solar photovoltaic panels		Recommended
V2 Wind turbine		Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 3.9	-£ 194	-121 kg (38.5%)

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.3	-£ 13	-13 kg (4.0%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar photovoltaic panels	£194	0.70 kg/m²	A 92	A 99
Total Savings	£194	0.70 kg/m²		

Potential energy efficiency rating:	A 92
Potential environmental impact rating:	A 99

Fuel prices for cost data on this page from database revision number 533 TEST (30 Nov 2023)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£115	£115	£0
Community scheme	£353	£353	£0
Space heating	£296	£296	£0
Water heating	£91	£91	£0
Lighting	£81	£81	£0
Generated (PV)	-£0	-£194	£194
Total cost of fuels	£468	£274	£194
Total cost of uses	£468	£274	£194
Delivered energy	34 kWh/m²	29 kWh/m²	5 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.2 tonnes	0.1 tonnes
CO2 emissions per m²	2 kg/m²	1 kg/m²	1 kg/m²

Primary energy	19 kWh/m²	11 kWh/m²	8 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	116.6500	(1b)	x 2.6800	(2b) =	312.6220	(1b) - (3b)
First floor	54.6000	(1c)	x 2.6100	(2c) =	142.5060	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	171.2500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		455.1280	(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	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		4.0000 (17)
Infiltration rate		0.2000 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700 (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	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Mechanical extract ventilation - centralised

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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(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	
Doors			4.5200	1.2000	5.4240			(26)
Windows (Uw = 1.20)			24.6700	1.1450	28.2481			(27)
Heatloss Floor 1			37.1200	0.1100	4.0832			(28a)
External Wall 1	129.4400	29.1900	100.2500	0.1900	19.0475			(29a)
Wall to common	21.1900		21.1900	0.1700	3.6023			(29a)
Total net area of external elements Aum(A, m2)			187.7500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		60.4051			(33)
Party Wall 1			6.7100	0.0000	0.0000			(32)
Party Ceiling 1			54.6000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		217.7500 (35)
Thermal bridges (User defined value 0.045 * total exposed area)		8.4488 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	68.8538 (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	75.0961	75.0961	75.0961	75.0961	75.0961	75.0961	75.0961	75.0961	75.0961	75.0961	75.0961	75.0961	(38)
Heat transfer coeff	143.9500	143.9500	143.9500	143.9500	143.9500	143.9500	143.9500	143.9500	143.9500	143.9500	143.9500	143.9500	(39)
Average = Sum(39)m / 12 =												143.9500	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8406	0.8406	0.8406	0.8406	0.8406	0.8406	0.8406	0.8406	0.8406	0.8406	0.8406	0.8406	(40)
HLP (average)												0.8406	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.9642 (42)
Hot water usage for mixer showers		

	94.9855	93.5580	91.4780	87.4981	84.5611	81.2858	79.4241	81.4884	83.7513	87.2680	91.3333	94.6216	(42a)

Hot water usage for baths
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42b)
Hot water usage for other uses
44.9868 43.3509 41.7151 40.0792 38.4433 36.8074 36.8074 38.4433 40.0792 41.7151 43.3509 44.9868 (42c)
Average daily hot water use (litres/day) 128.4705 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	139.9723	136.9090	133.1930	127.5773	123.0044	118.0932	116.2315	119.9317	123.8304	128.9830	134.6843	139.6084	(44)
Energy conte	221.6819	194.9566	204.7127	174.6469	165.5876	145.2093	140.5719	148.5005	152.6953	175.0288	191.8824	218.5930	(45)
Energy content (annual)										Total = Sum(45)m =		2134.0668	
Distribution loss (46)m = 0.15 x (45)m													
	33.2523	29.2435	30.7069	26.1970	24.8381	21.7814	21.0858	22.2751	22.9043	26.2543	28.7824	32.7889	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2200	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.7320	(55)
Total storage loss													
	22.6920	20.4960	22.6920	21.9600	22.6920	21.9600	22.6920	22.6920	21.9600	22.6920	21.9600	22.6920	(56)
If cylinder contains dedicated solar storage													
	22.6920	20.4960	22.6920	21.9600	22.6920	21.9600	22.6920	22.6920	21.9600	22.6920	21.9600	22.6920	(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													
	267.6363	236.4638	250.6671	219.1189	211.5420	189.6813	186.5263	194.4549	197.1673	220.9832	236.3544	264.5474	(62)
WWHRS	-84.5826	-74.8055	-78.3320	-64.8620	-60.4491	-51.7267	-48.4855	-51.5595	-53.5184	-63.0923	-71.4760	-83.0162	(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													
	183.0537	161.6582	172.3351	154.2569	151.0929	137.9546	138.0407	142.8954	143.6489	157.8908	164.8785	181.5312	(64)
									Total per year (kWh/year) = Sum(64)m =			1889.2369	(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													
	110.4728	98.0288	104.8305	93.6477	91.8214	83.8597	83.5037	86.1399	86.3488	94.9606	99.3785	109.4457	(65)

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	177.8546	177.8546	177.8546	177.8546	177.8546	177.8546	177.8546	177.8546	177.8546	177.8546	177.8546	177.8546	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	53.0624	47.1295	38.3283	29.0170	21.6905	18.3121	19.7868	25.7197	34.5209	43.8322	51.1587	54.5371	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	511.6752	516.9848	503.6048	475.1204	439.1639	405.3699	382.7935	377.4839	390.8639	419.3483	455.3047	489.0987	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.7497	55.7497	55.7497	55.7497	55.7497	55.7497	55.7497	55.7497	55.7497	55.7497	55.7497	55.7497	(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)													
	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	(71)
Water heating gains (Table 5)													
	148.4849	145.8762	140.9012	130.0663	123.4158	116.4718	112.2361	115.7795	119.9289	127.6352	138.0257	147.1044	(72)
Total internal gains													
	828.2570	825.0251	797.8689	749.2382	699.3049	655.1884	629.8510	634.0176	660.3482	705.8503	759.5237	805.7749	(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	12.0000	10.6334	0.7600	0.7000	0.7700	47.0433	(74)
South	2.0200	46.7521	0.7600	0.7000	0.7700	34.8175	(78)
Southwest	1.8700	36.7938	0.7600	0.7000	0.7700	25.3666	(79)
West	8.7800	19.6403	0.7600	0.7000	0.7700	63.5750	(80)

Solar gains	170.8024	314.4991	489.3352	699.4362	864.2253	892.3939	846.1224	718.6628	561.7718	363.8462	208.9584	143.2926	(83)
Total gains	999.0594	1139.5242	1287.2041	1448.6744	1563.5302	1547.5823	1475.9734	1352.6804	1222.1200	1069.6965	968.4821	949.0675	(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	71.9573	71.9573	71.9573	71.9573	71.9573	71.9573	71.9573	71.9573	71.9573	71.9573	71.9573	71.9573	
alpha	5.7972	5.7972	5.7972	5.7972	5.7972	5.7972	5.7972	5.7972	5.7972	5.7972	5.7972	5.7972	
util living area													
	0.9964	0.9916	0.9758	0.9190	0.7794	0.5830	0.4273	0.4855	0.7522	0.9547	0.9923	0.9973	(86)
MIT	19.9525	20.1168	20.3818	20.6948	20.9107	20.9859	20.9980	20.9960	20.9450	20.6461	20.2266	19.9053	(87)
Th 2	20.2183	20.2183	20.2183	20.2183	20.2183	20.2183	20.2183	20.2183	20.2183	20.2183	20.2183	20.2183	(88)
util rest of house													
	0.9954	0.9894	0.9692	0.8980	0.7331	0.5167	0.3523	0.4050	0.6869	0.9384	0.9897	0.9966	(89)
MIT 2	18.9805	19.1898	19.5243	19.9049	20.1420	20.2096	20.2175	20.2166	20.1789	19.8549	19.3309	18.9204	(90)
Living area fraction										fLA = Living area / (4) =		0.1491	(91)
MIT	19.1255	19.3281	19.6522	20.0227	20.2566	20.3254	20.3339	20.3328	20.2932	19.9729	19.4645	19.0673	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1255	19.3281	19.6522	20.0227	20.2566	20.3254	20.3339	20.3328	20.2932	19.9729	19.4645	19.0673	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9934	0.9859	0.9631	0.8920	0.7355	0.5260	0.3635	0.4170	0.6936	0.9320	0.9864	0.9950	(94)
Useful gains	992.4982	1123.4053	1239.7464	1292.1662	1149.9940	814.0441	536.5194	564.0159	847.6198	997.0025	955.3068	944.3110	(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	2134.1289	2076.9204	1893.2577	1601.1179	1231.7224	824.1710	537.4988	566.1328	891.5038	1349.2289	1779.8690	2140.1429	(97)
Space heating kWh	849.3732	640.7621	486.2124	222.4452	60.8060	0.0000	0.0000	0.0000	0.0000	262.0564	593.6848	889.6989	(98a)
Space heating requirement - total per year (kWh/year)												4005.0392	
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	849.3732	640.7621	486.2124	222.4452	60.8060	0.0000	0.0000	0.0000	0.0000	262.0564	593.6848	889.6989	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4005.0392	
Space heating per m2											(98c) / (4) =	23.3871	(99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Heat pump-Space and Water	1.0000	(303a)
Factor for control and charging method (Table 4c(3)) for space heating	1.0000	(305)
Factor for charging method (Table 4c(3)) for water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0000	(306)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating:		
Space heating requirement		
849.3732 640.7621 486.2124 222.4452 60.8060 0.0000 0.0000 0.0000 0.0000 262.0564 593.6848 889.6989		(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00		
307a 849.3732 640.7621 486.2124 222.4452 60.8060 0.0000 0.0000 0.0000 0.0000 262.0564 593.6848 889.6989		
Space heating requirement		
849.3732 640.7621 486.2124 222.4452 60.8060 0.0000 0.0000 0.0000 0.0000 262.0564 593.6848 889.6989		(307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system		
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000		(309)
Water heating		
Annual water heating requirement		
183.0537 161.6582 172.3351 154.2569 151.0929 137.9546 138.0407 142.8954 143.6489 157.8908 164.8785 181.5312		(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00		
310a 183.0537 161.6582 172.3351 154.2569 151.0929 137.9546 138.0407 142.8954 143.6489 157.8908 164.8785 181.5312		
Water heating fuel		
183.0537 161.6582 172.3351 154.2569 151.0929 137.9546 138.0407 142.8954 143.6489 157.8908 164.8785 181.5312		(310)
Cooling System Energy Efficiency Ratio	0.0000	(314)
Space coolin 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000		(315)
Pumps and Fa 13.5817 12.2674 13.5817 13.1436 13.5817 13.1436 13.5817 13.5817 13.1436 13.5817 13.1436 13.5817		(331)
Lighting 46.4452 37.2600 33.5485 24.5791 18.9856 15.5114 17.3193 22.5123 29.2412 38.3661 43.3344 47.7360		(332)
Electricity generated by PVs (Appendix M) (negative quantity)		
(333a)m -35.9735 -53.1048 -79.9671 -94.2197 -105.1815 -99.4267 -98.1456 -90.8596 -78.5685 -62.5654 -40.3675 -30.8179		(333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)		
(334a)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		(334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)		
(335a)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		(335a)
Electricity generated by PVs (Appendix M) (negative quantity)		
(333b)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		(333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)		
(334b)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		(334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)		
(335b)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		(335b)
Annual totals kWh/year		
Space heating fuel - community heating	4005.0392	(307)
Space heating fuel - secondary	0.0000	(309)
Water heating fuel - community heating	1889.2369	(310)
Efficiency of water heater	0.0000	(311)
Electricity used for heat distribution	40.0504	(313)
Space cooling fuel	0.0000	(321)
Electricity for pumps and fans:		
(MEVCentralised, Database: in-use factor = 1.6000, SFP = 0.2880)		
mechanical ventilation fans (SFP = 0.2880)	159.9138	(330a)
Total electricity for the above, kWh/year	159.9138	(331)
Electricity for lighting (calculated in Appendix L)	374.8391	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-869.1979	(333)
Wind generation	0.0000	(334)
Hydro-electric generation (Appendix N)	0.0000	(335a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(335)
Appendix Q - special features		
Energy saved or generated	-0.0000	(336)
Energy used	0.0000	(337)
Total delivered energy for all uses	5559.8312	(338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Heat pump	4005.0392	4.4400	177.8237	(340a)
Space heating total			177.8237	(340)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Heat pump	1889.2369	4.4400	83.8821	(342a)
Water heating total			83.8821	(342)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(347a)
Pumps, fans and electric keep-hot	159.9138	16.4900	26.3698	(349)
Energy for lighting	374.8391	16.4900	61.8110	(350)
Additional standing charges			92.0000	(351)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-869.1979	16.4900	-143.3307	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-143.3307	(352)
Total energy cost			298.5559	(355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):		0.3600	(356)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4970	(357)
SAP value		91.9433	
SAP rating (Section 12)		92	(358)
SAP band		A	

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Heat pump			350.0000	(367)
Space and Water heating from Heat pump	1684.0789	0.1562	178.7152	(367)
Electrical energy for heat distribution (space & water)	40.0504	0.0000	8.9094	(372)
Overall CO2 factor for heat network			0.0447	(386)
Total CO2 associated with community systems			263.4645	(373)
Space and water heating			263.4645	(376)
Pumps, fans and electric keep-hot	159.9138	0.1387	22.1820	(378)
Energy for lighting	374.8391	0.1443	54.1009	(379)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-869.1979	0.1336	-116.1675	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-116.1675	(380)
Total CO2, kg/year			223.5798	(383)
CO2 emissions per m2			1.3100	(384)
EI value			98.6146	(384a)
EI rating			99	(385)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	116.6500 (1b)	x	2.6800 (2b)	=	312.6220	(1b) - (3b)
First floor	54.6000 (1c)	x	2.6100 (2c)	=	142.5060	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	171.2500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	455.1280	(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	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		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.1785	0.1700	0.1700	0.1573	0.1573	0.1403	0.1445	0.1360	0.1403	0.1488	0.1488	0.1615	(22b)

Mechanical extract ventilation - centralised

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)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(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	
Doors			4.5200	1.2000	5.4240			(26)
Windows (Uw = 1.20)			24.6700	1.1450	28.2481			(27)
Heatloss Floor 1			37.1200	0.1100	4.0832			(28a)
External Wall 1	129.4400	29.1900	100.2500	0.1900	19.0475			(29a)
Wall to common	21.1900		21.1900	0.1700	3.6023			(29a)

Total net area of external elements Aum(A, m2)						187.7500							(31)
Fabric heat loss, W/K = Sum (A x U)						(26)...(30) + (32) =		60.4051					(33)
Party Wall 1						6.7100	0.0000	0.0000					(32)
Party Ceiling 1						54.6000							(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												217.7500	(35)
Thermal bridges (User defined value 0.045 * total exposed area)												8.4488	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss										(33) + (36) + (36a) =		68.8538	(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	75.0961	75.0961	75.0961	75.0961	75.0961	75.0961	75.0961	75.0961	75.0961	75.0961	75.0961	75.0961	(38)
Heat transfer coeff	143.9500	143.9500	143.9500	143.9500	143.9500	143.9500	143.9500	143.9500	143.9500	143.9500	143.9500	143.9500	(39)
Average = Sum(39)m / 12 =												143.9500	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8406	0.8406	0.8406	0.8406	0.8406	0.8406	0.8406	0.8406	0.8406	0.8406	0.8406	0.8406	(40)
HLP (average)												0.8406	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9642	(42)
Hot water usage for mixer showers	94.9855	93.5580	91.4780	87.4981	84.5611	81.2858	79.4241	81.4884	83.7513	87.2680	91.3333	94.6216	(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses	44.9868	43.3509	41.7151	40.0792	38.4433	36.8074	36.8074	38.4433	40.0792	41.7151	43.3509	44.9868	(42c)
Average daily hot water use (litres/day)												128.4705	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	139.9723	136.9090	133.1930	127.5773	123.0044	118.0932	116.2315	119.9317	123.8304	128.9830	134.6843	139.6084	(44)
Energy conte	221.6819	194.9566	204.7127	174.6469	165.5876	145.2093	140.5719	148.5005	152.6953	175.0288	191.8824	218.5930	(45)
Energy content (annual)											Total = Sum(45)m =	2134.0668	
Distribution loss (46)m = 0.15 x (45)m	33.2523	29.2435	30.7069	26.1970	24.8381	21.7814	21.0858	22.2751	22.9043	26.2543	28.7824	32.7889	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2200	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.7320	(55)
Total storage loss	22.6920	20.4960	22.6920	21.9600	22.6920	21.9600	22.6920	22.6920	21.9600	22.6920	21.9600	22.6920	(56)
If cylinder contains dedicated solar storage	22.6920	20.4960	22.6920	21.9600	22.6920	21.9600	22.6920	22.6920	21.9600	22.6920	21.9600	22.6920	(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	267.6363	236.4638	250.6671	219.1189	211.5420	189.6813	186.5263	194.4549	197.1673	220.9832	236.3544	264.5474	(62)
WWHRS	-84.5826	-74.8055	-78.3320	-64.8620	-60.4491	-51.7267	-48.4855	-51.5595	-53.5184	-63.0923	-71.4760	-83.0162	(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	183.0537	161.6582	172.3351	154.2569	151.0929	137.9546	138.0407	142.8954	143.6489	157.8908	164.8785	181.5312	(64)
										Total per year (kWh/year) = Sum(64)m =		1889.2369	(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	110.4728	98.0288	104.8305	93.6477	91.8214	83.8597	83.5037	86.1399	86.3488	94.9606	99.3785	109.4457	(65)

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	177.8546	177.8546	177.8546	177.8546	177.8546	177.8546	177.8546	177.8546	177.8546	177.8546	177.8546	177.8546	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.0624	47.1295	38.3283	29.0170	21.6905	18.3121	19.7868	25.7197	34.5209	43.8322	51.1587	54.5371	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	511.6752	516.9848	503.6048	475.1204	439.1639	405.3699	382.7935	377.4839	390.8639	419.3483	455.3047	489.0987	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7497	55.7497	55.7497	55.7497	55.7497	55.7497	55.7497	55.7497	55.7497	55.7497	55.7497	55.7497	(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)	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	-118.5698	(71)
Water heating gains (Table 5)	148.4849	145.8762	140.9012	130.0663	123.4158	116.4718	112.2361	115.7795	119.9289	127.6352	138.0257	147.1044	(72)
Total internal gains	828.2570	825.0251	797.8689	749.2382	699.3049	655.1884	629.8510	634.0176	660.3482	705.8503	759.5237	805.7749	(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	12.0000	11.9814	0.7600	0.7000	0.7700	53.0072	(74)
South	2.0200	50.9848	0.7600	0.7000	0.7700	37.9697	(78)
Southwest	1.8700	40.4699	0.7600	0.7000	0.7700	27.9009	(79)
West	8.7800	22.3313	0.7600	0.7000	0.7700	72.2859	(80)

Solar gains	191.1638	317.7220	490.4850	725.0329	873.8675	965.7595	905.7798	786.2425	611.3591	393.1237	239.8007	158.6953	(83)
Total gains	1019.4208	1142.7470	1288.3538	1474.2711	1573.1723	1620.9479	1535.6308	1420.2601	1271.7073	1098.9740	999.3244	964.4702	(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	71.9573	71.9573	71.9573	71.9573	71.9573	71.9573	71.9573	71.9573	71.9573	71.9573	71.9573	71.9573	
alpha	5.7972	5.7972	5.7972	5.7972	5.7972	5.7972	5.7972	5.7972	5.7972	5.7972	5.7972	5.7972	
util living area	0.9949	0.9895	0.9679	0.8849	0.6955	0.4418	0.2904	0.3240	0.6357	0.9257	0.9876	0.9961	(86)
MIT	20.0520	20.1922	20.4714	20.7819	20.9572	20.9973	20.9998	20.9997	20.9803	20.7503	20.3422	20.0123	(87)
Th 2	20.2183	20.2183	20.2183	20.2183	20.2183	20.2183	20.2183	20.2183	20.2183	20.2183	20.2183	20.2183	(88)
util rest of house	0.9934	0.9865	0.9588	0.8560	0.6390	0.3738	0.2173	0.2451	0.5586	0.8993	0.9833	0.9950	(89)
MIT 2	19.1079	19.2859	19.6362	20.0052	20.1860	20.2171	20.2183	20.2182	20.2068	19.9775	19.4776	19.0572	(90)
Living area fraction										fLA = Living area / (4) =		0.1491	(91)
MIT	19.2487	19.4211	19.7608	20.1210	20.3010	20.3334	20.3348	20.3348	20.3222	20.0927	19.6065	19.1997	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2487	19.4211	19.7608	20.1210	20.3010	20.3334	20.3348	20.3348	20.3222	20.0927	19.6065	19.1997	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9909	0.9825	0.9522	0.8520	0.6452	0.3839	0.2282	0.2568	0.5692	0.8942	0.9789	0.9929	(94)
Useful gains	1010.1237	1122.7421	1226.8016	1256.1137	1015.0006	622.2827	350.4410	364.7770	723.8596	982.7508	978.2753	957.6496	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	2036.7002	1989.5483	1779.3356	1471.3195	1050.9775	623.7979	350.4926	364.8798	737.3378	1222.5304	1670.7614	2029.6452	(97)
Space heating kWh	763.7729	582.4938	411.0853	154.9482	26.7668	0.0000	0.0000	0.0000	0.0000	178.3960	498.5900	797.5648	(98a)
Space heating requirement - total per year (kWh/year)												3413.6178	
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	763.7729	582.4938	411.0853	154.9482	26.7668	0.0000	0.0000	0.0000	0.0000	178.3960	498.5900	797.5648	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3413.6178	
Space heating per m2											(98c) / (4) =	19.9335	(99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(301)
Fraction of space heat from community system												1.0000	(302)
Fraction of heat from community Heat pump-Space and Water												1.0000	(303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000	(305)
Factor for charging method (Table 4c(3)) for water heating												1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system												1.0000	(306)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating:													
Space heating requirement													
	763.7729	582.4938	411.0853	154.9482	26.7668	0.0000	0.0000	0.0000	0.0000	178.3960	498.5900	797.5648	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00													
307a	763.7729	582.4938	411.0853	154.9482	26.7668	0.0000	0.0000	0.0000	0.0000	178.3960	498.5900	797.5648	
Space heating requirement													
	763.7729	582.4938	411.0853	154.9482	26.7668	0.0000	0.0000	0.0000	0.0000	178.3960	498.5900	797.5648	(307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000	(308)
Space heating fuel for secondary/supplementary system													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(309)
Water heating													
Annual water heating requirement													
	183.0537	161.6582	172.3351	154.2569	151.0929	137.9546	138.0407	142.8954	143.6489	157.8908	164.8785	181.5312	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00													
310a	183.0537	161.6582	172.3351	154.2569	151.0929	137.9546	138.0407	142.8954	143.6489	157.8908	164.8785	181.5312	
Water heating fuel													
	183.0537	161.6582	172.3351	154.2569	151.0929	137.9546	138.0407	142.8954	143.6489	157.8908	164.8785	181.5312	(310)
Cooling System Energy Efficiency Ratio												0.0000	(314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(315)
Pumps and Fa	13.5817	12.2674	13.5817	13.1436	13.5817	13.1436	13.5817	13.5817	13.1436	13.5817	13.1436	13.5817	(331)
Lighting	46.4452	37.2600	33.5485	24.5791	18.9856	15.5114	17.3193	22.5123	29.2412	38.3661	43.3344	47.7360	(332)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333a)m	-39.5319	-53.4987	-79.8777	-95.9973	-105.4210	-103.5135	-101.5615	-95.4005	-82.6683	-66.0697	-45.0752	-33.6326	(333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334a)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	(334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335a)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	(335a)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333b)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	(333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334b)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	(334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335b)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	(335b)
Annual totals kWh/year													
Space heating fuel - community heating												3413.6178	(307)
Space heating fuel - secondary												0.0000	(309)
Water heating fuel - community heating												1889.2369	(310)
Efficiency of water heater												0.0000	(311)
Electricity used for heat distribution												34.1362	(313)
Space cooling fuel												0.0000	(321)
Electricity for pumps and fans:													
(MEVCentralised, Database: in-use factor = 1.6000, SFP = 0.2880)													
mechanical ventilation fans (SFP = 0.2880)												159.9138	(330a)
Total electricity for the above, kWh/year												159.9138	(331)
Electricity for lighting (calculated in Appendix L)												374.8391	(332)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-902.2479	(333)
Wind generation												0.0000	(334)
Hydro-electric generation (Appendix N)												0.0000	(335a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(335)
Appendix Q - special features													
Energy saved or generated												-0.0000	(336)

Energy used	0.0000	(337)
Total delivered energy for all uses	4935.3598	(338)

10b. Fuel costs - using BEDF prices (533)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Heat pump	3413.6178	4.8000	163.8537	(340a)
Space heating total			163.8537	(340)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Heat pump	1889.2369	4.8000	90.6834	(342a)
Water heating total			90.6834	(342)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(347a)
Pumps, fans and electric keep-hot	159.9138	21.5100	34.3975	(349)
Energy for lighting	374.8391	21.5100	80.6279	(350)
Additional standing charges			98.0000	(351)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-902.2479	21.5100	-194.0735	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-194.0735	(352)
Total energy cost			273.4889	(355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Heat pump			350.0000	(367)
Space and Water heating from Heat pump	1515.1013	0.1570	153.0951	(367)
Electrical energy for heat distribution (space & water)	34.1362	0.0000	8.0127	(372)
Overall CO2 factor for heat network			0.0447	(386)
Total CO2 associated with community systems			236.9476	(373)
Space and water heating			236.9476	(376)
Pumps, fans and electric keep-hot	159.9138	0.1387	22.1820	(378)
Energy for lighting	374.8391	0.1443	54.1009	(379)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-902.2479	0.1337	-120.6072	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-120.6072	(380)
Total CO2, kg/year			192.6232	(383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Heat pump			350.0000	(467a)
Space and Water heating from Heat pump	1515.1013	1.5811	1542.0961	(467)
Electrical energy for heat distribution (space & water)	34.1362	0.0000	82.6803	(472)
Overall CO2 factor for heat network			0.4611	(486)
Total CO2 associated with community systems			2444.9753	(473)
Space and water heating			2444.9753	(476)
Pumps, fans and electric keep-hot	159.9138	1.5128	241.9176	(478)
Energy for lighting	374.8391	1.5338	574.9408	(479)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-902.2479	1.4940	-1347.9332	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1347.9332	(480)
Total Primary energy kWh/year			1913.9004	(483)

Full SAP Calculation Printout

Property Reference	House	**Issued on Date**	21/12/2023
Assessment Reference	GSHP Heat Network_WWHR	**Prop Type Ref**	
Property			

SAP Rating	83 B	**DER**	2.98	**TER**	10.34
Environmental	97 A	**% DER < TER**			71.18
CO_2 Emissions (t/year)	0.58	**DFEE**	49.21	**TFEE**	49.48
Compliance Check	See BREL	**% DFEE < TFEE**			0.56
% DPER < TPER	43.96	**DPER**	30.91	**TPER**	55.15

Assessor Details	Ms. Ruth Ferguson	**Assessor ID**	AE69-0001
Client	194 Goldhurst Terrace, 194 Goldhurst Terrace		

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)	
Ground floor	116.6500 (1b)	x	3.2400 (2b)	=	377.9460	(1b) - (3b)
First floor	95.9200 (1c)	x	2.5500 (2c)	=	244.5960	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	212.5700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	622.5420	(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		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1850	(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	0.2359	0.2313	0.2266	0.2035	0.1989	0.1758	0.1758	0.1711	0.1850	0.1989	0.2081	0.2174	(22b)

Mechanical extract ventilation - centralised

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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(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	
Doors			16.3400	1.2000	19.6080			(26)
Windows (Uw = 1.20)			13.2500	1.1450	15.1718			(27)
Heatloss Floor 1			116.6500	0.1200	13.9980			(28a)
External Wall 1	266.5400	29.5900	236.9500	0.1800	42.6510			(29a)
External Roof 1	95.9200		95.9200	0.0900	8.6328			(30)
Total net area of external elements Aum(A, m2)			479.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		100.0616			(33)
Party Wall 1			6.7100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	218.6000	(35)
Thermal bridges (User defined value 0.045 * total exposed area)	21.5600	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	121.6215	(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	102.7194	102.7194	102.7194	102.7194	102.7194	102.7194	102.7194	102.7194	102.7194	102.7194	102.7194	102.7194	(38)
Heat transfer coeff													
	224.3409	224.3409	224.3409	224.3409	224.3409	224.3409	224.3409	224.3409	224.3409	224.3409	224.3409	224.3409	(39)
Average = Sum(39)m / 12 =												224.3409	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0554	1.0554	1.0554	1.0554	1.0554	1.0554	1.0554	1.0554	1.0554	1.0554	1.0554	1.0554	(40)
HLP (average)												1.0554	
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												3.0183	(42)
Hot water usage for mixer showers													
	74.8263	73.7018	72.0632	68.9280	66.6143	64.0342	62.5676	64.1938	65.9764	68.7467	71.9493	74.5396	(42a)
Hot water usage for baths													
	32.3010	31.8213	31.1457	29.9002	28.9675	27.9333	27.3747	28.0455	28.7759	29.8825	31.1537	32.1918	(42b)
Hot water usage for other uses													
	45.5401	43.8841	42.2281	40.5721	38.9161	37.2601	37.2601	38.9161	40.5721	42.2281	43.8841	45.5401	(42c)
Average daily hot water use (litres/day)												140.3355	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	152.6674	149.4072	145.4370	139.4003	134.4979	129.2275	127.2023	131.1554	135.3244	140.8573	146.9871	152.2715	(44)
Energy conte	241.7878	212.7538	223.5313	190.8320	181.0601	158.9003	153.8402	162.3977	166.8685	191.1421	209.4101	238.4204	(45)
Energy content (annual)										Total = Sum(45)m =		2330.9443	
Distribution loss (46)m = 0.15 x (45)m													
	36.2682	31.9131	33.5297	28.6248	27.1590	23.8350	23.0760	24.3597	25.0303	28.6713	31.4115	35.7631	(46)
Water storage loss:													
Store volume												300.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0400	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												1.2240	(55)
Total storage loss													
	37.9440	34.2720	37.9440	36.7200	37.9440	36.7200	37.9440	37.9440	36.7200	37.9440	36.7200	37.9440	(56)
If cylinder contains dedicated solar storage													
	37.9440	34.2720	37.9440	36.7200	37.9440	36.7200	37.9440	37.9440	36.7200	37.9440	36.7200	37.9440	(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													
	302.9942	268.0370	284.7377	250.0640	242.2665	218.1323	215.0466	223.6041	226.1005	252.3485	268.6421	299.6268	(62)
WWHRS	-33.3156	-29.4646	-30.8536	-25.5480	-23.8099	-20.3743	-19.0976	-20.3084	-21.0800	-24.8510	-28.1532	-32.6987	(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													
	269.6786	238.5724	253.8841	224.5160	218.4566	197.7581	195.9490	203.2957	205.0205	227.4975	240.4889	266.9281	(64)
										Total per year (kWh/year) = Sum(64)m =		2742.0454	(64)
12Total per year (kWh/year)												2742	(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													
	129.3596	114.9672	123.2893	110.8372	109.1676	100.2200	100.1170	102.9624	102.8694	112.5199	117.0144	128.2399	(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	150.9135	150.9135	150.9135	150.9135	150.9135	150.9135	150.9135	150.9135	150.9135	150.9135	150.9135	150.9135	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	243.2457	269.3078	243.2457	251.3539	243.2457	251.3539	243.2457	243.2457	251.3539	243.2457	251.3539	243.2457	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	382.8404	386.8131	376.8021	355.4898	328.5868	303.3018	286.4099	282.4372	292.4482	313.7605	340.6635	365.9485	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	38.0913	38.0913	38.0913	38.0913	38.0913	38.0913	38.0913	38.0913	38.0913	38.0913	38.0913	38.0913	(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)													
	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	(71)
Water heating gains (Table 5)													
	173.8704	171.0822	165.7114	153.9406	146.7306	139.1944	134.5658	138.3903	142.8741	151.2364	162.5201	172.3655	(72)
Total internal gains													
	868.2306	895.4771	854.0332	829.0583	786.8372	762.1241	732.4955	732.3472	754.9503	776.5167	822.8115	849.8337	(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	1.5000	11.2829	0.7600	0.7000	0.7700	6.2396	(75)
Southeast	0.7500	36.7938	0.7600	0.7000	0.7700	10.1738	(77)
Southwest	6.1200	36.7938	0.7600	0.7000	0.7700	83.0178	(79)
Northwest	4.8800	11.2829	0.7600	0.7000	0.7700	20.2996	(81)

Solar gains	119.7308	212.7610	314.5238	428.9572	516.2906	528.3143	502.7939	435.2303	353.7730	241.4595	145.0152	101.4258	(83)
Total gains	987.9614	1108.2381	1168.5571	1258.0155	1303.1278	1290.4384	1235.2894	1167.5775	1108.7233	1017.9762	967.8267	951.2595	(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	57.5362	57.5362	57.5362	57.5362	57.5362	57.5362	57.5362	57.5362	57.5362	57.5362	57.5362	57.5362	
alpha	4.8357	4.8357	4.8357	4.8357	4.8357	4.8357	4.8357	4.8357	4.8357	4.8357	4.8357	4.8357	
util living area													

	0.9988	0.9977	0.9955	0.9868	0.9588	0.8697	0.7247	0.7738	0.9341	0.9897	0.9976	0.9990	(86)
MIT	19.4248	19.5695	19.8072	20.1592	20.5223	20.8210	20.9476	20.9267	20.7076	20.2433	19.7711	19.3911	(87)
Th 2	20.0374	20.0374	20.0374	20.0374	20.0374	20.0374	20.0374	20.0374	20.0374	20.0374	20.0374	20.0374	(88)
util rest of house													
	0.9985	0.9970	0.9939	0.9817	0.9399	0.8045	0.5986	0.6564	0.8950	0.9847	0.9967	0.9987	(89)
MIT 2	18.1740	18.3594	18.6637	19.1119	19.5645	19.9044	20.0142	20.0011	19.7886	19.2209	18.6181	18.1309	(90)
Living area fraction										fLA = Living area / (4) =		0.3116	(91)
MIT	18.5638	18.7365	19.0200	19.4383	19.8630	20.1900	20.3051	20.2895	20.0750	19.5395	18.9774	18.5236	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5638	18.7365	19.0200	19.4383	19.8630	20.1900	20.3051	20.2895	20.0750	19.5395	18.9774	18.5236	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9976	0.9956	0.9915	0.9773	0.9355	0.8166	0.6369	0.6908	0.8969	0.9811	0.9952	0.9980	(94)
Useful gains	985.6351	1103.3306	1158.6742	1229.4432	1219.0745	1053.7546	786.7695	806.6088	994.4037	998.7280	963.2131	949.3986	(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													
	3199.9477	3104.0834	2808.7531	2364.1616	1831.2910	1254.0735	831.1976	872.5820	1340.4310	2005.5014	2664.5935	3213.3782	(97)
Space heating kWh													
	1647.4486	1344.5059	1227.6586	816.9972	455.4891	0.0000	0.0000	0.0000	0.0000	749.0394	1224.9939	1684.4009	(98a)
Space heating requirement - total per year (kWh/year)												9150.5336	
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													
	1647.4486	1344.5059	1227.6586	816.9972	455.4891	0.0000	0.0000	0.0000	0.0000	749.0394	1224.9939	1684.4009	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9150.5336	
Space heating per m2											(98c) / (4) =	43.0472	(99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(301)
Fraction of space heat from community system												1.0000	(302)
Fraction of heat from community Heat pump-Space and Water												1.0000	(303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000	(305)
Factor for charging method (Table 4c(3)) for water heating												1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system												1.0000	(306)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating:													
Space heating requirement													
	1647.4486	1344.5059	1227.6586	816.9972	455.4891	0.0000	0.0000	0.0000	0.0000	749.0394	1224.9939	1684.4009	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00													
307a	1647.4486	1344.5059	1227.6586	816.9972	455.4891	0.0000	0.0000	0.0000	0.0000	749.0394	1224.9939	1684.4009	
Space heating requirement													
	1647.4486	1344.5059	1227.6586	816.9972	455.4891	0.0000	0.0000	0.0000	0.0000	749.0394	1224.9939	1684.4009	(307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000	(308)
Space heating fuel for secondary/supplementary system													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(309)
Water heating													
Annual water heating requirement													
	269.6786	238.5724	253.8841	224.5160	218.4566	197.7581	195.9490	203.2957	205.0205	227.4975	240.4889	266.9281	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00													
310a	269.6786	238.5724	253.8841	224.5160	218.4566	197.7581	195.9490	203.2957	205.0205	227.4975	240.4889	266.9281	
Water heating fuel													
	269.6786	238.5724	253.8841	224.5160	218.4566	197.7581	195.9490	203.2957	205.0205	227.4975	240.4889	266.9281	(310)
Cooling System Energy Efficiency Ratio												0.0000	(314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(315)
Pumps and Fa	21.6739	19.5764	21.6739	20.9747	21.6739	20.9747	21.6739	21.6739	20.9747	21.6739	20.9747	21.6739	(331)
Lighting	56.6562	45.4517	40.9243	29.9829	23.1596	18.9216	21.1270	27.4617	35.6700	46.8009	52.8615	58.2309	(332)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333a)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	(333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334a)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	(334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335a)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	(335a)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333b)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	(333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334b)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	(334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335b)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	(335b)
Annual totals kWh/year													
Space heating fuel - community heating												9150.5336	(307)
Space heating fuel - secondary												0.0000	(309)
Water heating fuel - community heating												2742.0454	(310)
Efficiency of water heater												0.0000	(311)
Electricity used for heat distribution												91.5053	(313)
Space cooling fuel												0.0000	(321)
Electricity for pumps and fans:													
(MEVCentralised, Database: in-use factor = 1.6000, SFP = 0.3360)													
mechanical ventilation fans (SFP = 0.3360)												255.1924	(330a)
Total electricity for the above, kWh/year												255.1924	(331)
Electricity for lighting (calculated in Appendix L)												457.2483	(332)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(333)
Wind generation												0.0000	(334)
Hydro-electric generation (Appendix N)												0.0000	(335a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(335)
Appendix Q - special features													
Energy saved or generated												-0.0000	(336)
Energy used												0.0000	(337)
Total delivered energy for all uses												12605.0197	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	

Efficiency of heat source Heat pump			350.0000	(367)
Space and Water heating from Heat pump	3397.8797	0.1541	402.8122	(367)
Electrical energy for heat distribution (space & water)	91.5053	0.0000	17.9578	(372)
Overall CO2 factor for heat network			0.0447	(386)
Total CO2 associated with community systems			531.0390	(373)
Space and water heating			531.0390	(376)
Pumps, fans and electric keep-hot	255.1924	0.1387	35.3983	(378)
Energy for lighting	457.2483	0.1443	65.9951	(379)
Total CO2, kg/year			632.4324	(383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.9800	(384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Heat pump			350.0000	(467a)
Space and Water heating from Heat pump	3397.8797	1.5704	4105.7634	(467)
Electrical energy for heat distribution (space & water)	91.5053	0.0000	185.3927	(472)
Overall CO2 factor for heat network			0.4610	(486)
Total CO2 associated with community systems			5482.3262	(473)
Space and water heating			5482.3262	(476)
Pumps, fans and electric keep-hot	255.1924	1.5128	386.0551	(478)
Energy for lighting	457.2483	1.5338	701.3427	(479)
Total Primary energy kWh/year			6569.7240	(483)
Dwelling Primary energy Rate (DPER)			30.9100	(484)

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)	
Ground floor	116.6500 (1b)	x	3.2400 (2b)	=	377.9460	(1b) - (3b)
First floor	95.9200 (1c)	x	2.5500 (2c)	=	244.5960	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	212.5700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	622.5420	(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) =	0.0643	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3143	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2907	(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	0.3706	0.3634	0.3561	0.3198	0.3125	0.2761	0.2761	0.2689	0.2907	0.3125	0.3270	0.3416	(22b)
Effective ac	0.5687	0.5660	0.5634	0.5511	0.5488	0.5381	0.5381	0.5361	0.5422	0.5488	0.5535	0.5583	(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	
TER Opaque door			16.3400	1.0000	16.3400			(26)
TER Opening Type (Uw = 1.20)			13.2500	1.1450	15.1718			(27)
Heatloss Floor 1			116.6500	0.1300	15.1645			(28a)
External Wall 1	266.5400	29.5900	236.9500	0.1800	42.6510			(29a)
External Roof 1	95.9200		95.9200	0.1100	10.5512			(30)
Total net area of external elements Aum(A, m2)			479.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		99.8785			(33)
Party Wall 1			6.7100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	218.6000	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	16.9300	0.0500	0.8465
E3 Sill	9.1500	0.0500	0.4575

E4 Jamb	28.7000	0.0500	1.4350	
E5 Ground floor (normal)	47.8300	0.1600	7.6528	
E6 Intermediate floor within a dwelling	44.6200	0.0000	0.0000	
E16 Corner (normal)	34.7400	0.0900	3.1266	
E18 Party wall between dwellings	2.5500	0.0600	0.1530	
E17 Corner (inverted - internal area greater than external area)	14.1300	-0.0900	-1.2717	
E25 Staggered party wall between dwellings	2.5500	0.0600	0.1530	
P1 Party wall - Ground floor	2.6300	0.0800	0.2104	
P2 Party wall - Intermediate floor within a dwelling	2.6300	0.0000	0.0000	
E10 Eaves (insulation at ceiling level)	44.6200	0.0600	2.6772	
P4 Party wall - Roof (insulation at ceiling level)	2.6300	0.1200	0.3156	
E8 Balcony within a dwelling, wall insulation continuous	5.3300	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 15.7559 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 115.6344 (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	116.8290	116.2811	115.7441	113.2216	112.7497	110.5527	110.5527	110.1458	111.3989	112.7497	113.7044	114.7025	(38)
Heat transfer coeff	232.4634	231.9155	231.3784	228.8560	228.3840	226.1870	226.1870	225.7802	227.0333	228.3840	229.3388	230.3369	(39)
Average = Sum(39)m / 12 =												228.8537	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0936	1.0910	1.0885	1.0766	1.0744	1.0641	1.0641	1.0621	1.0680	1.0744	1.0789	1.0836	(40)
HLP (average)												1.0766	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 3.0183 (42)
Hot water usage for mixer showers

74.8263	73.7018	72.0632	68.9280	66.6143	64.0342	62.5676	64.1938	65.9764	68.7467	71.9493	74.5396	(42a)

Hot water usage for baths

32.3010	31.8213	31.1457	29.9002	28.9675	27.9333	27.3747	28.0455	28.7759	29.8825	31.1537	32.1918	(42b)

Hot water usage for other uses

45.5401	43.8841	42.2281	40.5721	38.9161	37.2601	37.2601	38.9161	40.5721	42.2281	43.8841	45.5401	(42c)

Average daily hot water use (litres/day) 140.3355 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	152.6674	149.4072	145.4370	139.4003	134.4979	129.2275	127.2023	131.1554	135.3244	140.8573	146.9871	152.2715	(44)
Energy conte	241.7878	212.7538	223.5313	190.8320	181.0601	158.9003	153.8402	162.3977	166.8685	191.1421	209.4101	238.4204	(45)
Energy content (annual)										Total = Sum(45)m =		2330.9443	
Distribution loss (46)m = 0.15 x (45)m	36.2682	31.9131	33.5297	28.6248	27.1590	23.8350	23.0760	24.3597	25.0303	28.6713	31.4115	35.7631	(46)
Water storage loss:													
Store volume												300.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1127	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.1409	(55)
Total storage loss	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(56)
If cylinder contains dedicated solar storage	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(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	300.4167	265.7089	282.1601	247.5696	239.6889	215.6379	212.4690	221.0265	223.6061	249.7709	266.1476	297.0492	(62)
WWHRS	-34.2075	-30.2534	-31.6796	-26.2319	-24.4472	-20.9197	-19.6089	-20.8521	-21.6443	-25.5162	-28.9068	-33.5740	(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	266.2092	235.4555	250.4805	221.3376	215.2416	194.7182	192.8602	200.1745	201.9618	224.2547	237.2408	263.4752	(64)
										Total per year (kWh/year) = Sum(64)m =		2703.4098	(64)
12Total per year (kWh/year)												2703	(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	127.2975	113.1047	121.2272	108.8417	107.1055	98.2244	98.0549	100.9003	100.8738	110.4578	115.0189	126.1778	(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	150.9135	150.9135	150.9135	150.9135	150.9135	150.9135	150.9135	150.9135	150.9135	150.9135	150.9135	150.9135	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	243.2457	269.3078	243.2457	251.3539	243.2457	251.3539	243.2457	243.2457	251.3539	243.2457	251.3539	243.2457	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	382.8404	386.8131	376.8021	355.4898	328.5868	303.3018	286.4099	282.4372	292.4482	313.7605	340.6635	365.9485	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.0913	38.0913	38.0913	38.0913	38.0913	38.0913	38.0913	38.0913	38.0913	38.0913	38.0913	38.0913	(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)	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	(71)
Water heating gains (Table 5)	171.0988	168.3106	162.9398	151.1690	143.9590	136.4228	131.7942	135.6187	140.1025	148.4648	159.7485	169.5939	(72)
Total internal gains	868.4590	895.7055	854.2616	829.2867	787.0656	759.3525	729.7239	729.5756	752.1787	776.7451	823.0399	850.0621	(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	1.5000	11.2829	0.6300	0.7000	0.7700	5.1723	(75)
Southeast	0.7500	36.7938	0.6300	0.7000	0.7700	8.4335	(77)
Southwest	6.1200	36.7938	0.6300	0.7000	0.7700	68.8174	(79)

Northwest				4.8800		11.2829		0.6300		0.7000		0.7700	16.8273 (81)
Solar gains	99.2505	176.3677	260.7237	355.5829	427.9777	437.9447	416.7897	360.7830	293.2592	200.1572	120.2100	84.0767 (83)	
Total gains	967.7095	1072.0732	1114.9853	1184.8697	1215.0433	1197.2973	1146.5135	1090.3586	1045.4379	976.9023	943.2499	934.1388 (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	55.5258	55.6570	55.7862	56.4011	56.5176	57.0666	57.0666	57.1694	56.8539	56.5176	56.2823	56.0384	
alpha	4.7017	4.7105	4.7191	4.7601	4.7678	4.8044	4.8044	4.8113	4.7903	4.7678	4.7522	4.7359	
util living area	0.9989	0.9980	0.9963	0.9899	0.9689	0.8960	0.7644	0.8072	0.9470	0.9914	0.9978	0.9991	(86)
MIT	19.3488	19.4905	19.7277	20.0928	20.4617	20.7864	20.9323	20.9097	20.6718	20.2002	19.7238	19.3336	(87)
Th 2	20.0061	20.0082	20.0103	20.0200	20.0218	20.0303	20.0303	20.0319	20.0270	20.0218	20.0181	20.0143	(88)
util rest of house	0.9986	0.9974	0.9950	0.9858	0.9538	0.8381	0.6393	0.6935	0.9133	0.9872	0.9970	0.9988	(89)
MIT 2	18.0550	18.2380	18.5433	19.0159	19.4807	19.8659	19.9989	19.9852	19.7415	19.1555	18.5441	18.0411	(90)
Living area fraction										fLA = Living area / (4) =		0.3116	(91)
MIT	18.4582	18.6283	18.9124	19.3515	19.7864	20.1528	20.2898	20.2733	20.0314	19.4811	18.9117	18.4439	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4582	18.6283	18.9124	19.3515	19.7864	20.1528	20.2898	20.2733	20.0314	19.4811	18.9117	18.4439	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9978	0.9961	0.9929	0.9819	0.9490	0.8469	0.6768	0.7260	0.9135	0.9838	0.9957	0.9981	(94)
Useful gains	965.5447	1067.8461	1107.1023	1163.3838	1153.0339	1013.9896	775.9143	791.6098	955.0298	961.1182	939.1528	932.3954	(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	3291.2573	3183.8055	2871.9506	2391.8831	1846.7992	1255.9658	834.5853	874.5108	1346.6251	2028.2899	2708.8882	3280.8895	(97)
Space heating kWh	1730.3302	1421.9247	1313.0471	884.5195	516.1614	0.0000	0.0000	0.0000	0.0000	793.9758	1274.2095	1747.2796	(98a)
Space heating requirement - total per year (kWh/year)												9681.4478	
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	1730.3302	1421.9247	1313.0471	884.5195	516.1614	0.0000	0.0000	0.0000	0.0000	793.9758	1274.2095	1747.2796	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9681.4478	
Space heating per m2											(98c) / (4) =	45.5448	(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	1730.3302	1421.9247	1313.0471	884.5195	516.1614	0.0000	0.0000	0.0000	0.0000	793.9758	1274.2095	1747.2796	(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)	1874.6806	1540.5468	1422.5862	958.3094	559.2215	0.0000	0.0000	0.0000	0.0000	860.2121	1380.5086	1893.0440	(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	266.2092	235.4555	250.4805	221.3376	215.2416	194.7182	192.8602	200.1745	201.9618	224.2547	237.2408	263.4752	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.4844	87.3997	87.2240	86.8397	85.9474	79.8000	79.8000	79.8000	79.8000	86.6478	87.2554	87.5068	(217)
Fuel for water heating, kWh/month	304.2932	269.4010	287.1691	254.8806	250.4342	244.0078	241.6794	250.8452	253.0849	258.8119	271.8926	301.0911	(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	50.5417	40.5464	36.5075	26.7470	20.6601	16.8795	18.8469	24.4979	31.8203	41.7500	47.1565	51.9464	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-94.4731	-126.2435	-171.8895	-182.4851	-187.8504	-171.9557	-169.6576	-164.4109	-154.0427	-139.0143	-101.3010	-82.5025	(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	-76.3255	-157.3379	-307.1210	-453.4942	-592.4617	-592.9572	-586.1047	-499.5353	-370.4839	-222.4463	-101.0117	-60.6130	(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												10489.1092	(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												3187.5909	(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)	407.9001	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-5765.7185	(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	8404.8817	(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	10489.1092	0.2100	2202.7129	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3187.5909	0.2100	669.3941	(264)
Space and water heating			2872.1070	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	407.9001	0.1443	58.8726	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1745.8262	0.1358	-237.1130	
PV Unit electricity exported	-4019.8923	0.1264	-508.1068	
Total			-745.2198	(269)
Total CO2, kg/year			2197.6891	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.3400	(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	10489.1092	1.1300	11852.6934	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3187.5909	1.1300	3601.9777	(278)
Space and water heating			15454.6711	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	407.9001	1.5338	625.6508	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1745.8262	1.5020	-2622.2744	
PV Unit electricity exported	-4019.8923	0.4640	-1865.1883	
Total			-4487.4627	(283)
Total Primary energy kWh/year			11722.9600	(286)
Target Primary Energy Rate (TPER)			55.1500	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	116.6500	(1b)	x 3.2400	(2b) =	377.9460	(1b) - (3b)
First floor	95.9200	(1c)	x 2.5500	(2c) =	244.5960	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	212.5700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		622.5420	(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) =	0.0643	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2643	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2444	(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	0.3117	0.3055	0.2994	0.2689	0.2628	0.2322	0.2322	0.2261	0.2444	0.2628	0.2750	0.2872	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5486	0.5467	0.5448	0.5361	0.5345	0.5270	0.5270	0.5256	0.5299	0.5345	0.5378	0.5412	(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	
Doors			16.3400	1.2000	19.6080			(26)
Windows (Uw = 1.20)			13.2500	1.1450	15.1718			(27)
Heatloss Floor 1			116.6500	0.1200	13.9980			(28a)
External Wall 1	266.5400	29.5900	236.9500	0.1800	42.6510			(29a)
External Roof 1	95.9200		95.9200	0.0900	8.6328			(30)
Total net area of external elements Aum(A, m2)			479.1100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	100.0616			(33)
Party Wall 1			6.7100	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							218.6000	(35)
Thermal bridges (User defined value 0.045 * total exposed area)							21.5600	(36)
Point Thermal bridges						(36a) =	0.0000	
Total fabric heat loss					(33) + (36) + (36a) =		121.6215	(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	112.6963	112.3089	111.9292	110.1455	109.8118	108.2583	108.2583	107.9706	108.8567	109.8118	110.4869	111.1927	(38)
Heat transfer coeff	234.3178	233.9304	233.5507	231.7670	231.4333	229.8798	229.8798	229.5921	230.4782	231.4333	232.1084	232.8142	(39)
Average = Sum(39)m / 12 =												231.7654	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1023	1.1005	1.0987	1.0903	1.0887	1.0814	1.0814	1.0801	1.0842	1.0887	1.0919	1.0952	(40)
HLP (average)												1.0903	
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												3.0183	(42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	32.3010	31.8213	31.1457	29.9002	28.9675	27.9333	27.3747	28.0455	28.7759	29.8825	31.1537	32.1918	(42b)
Hot water usage for other uses	45.5401	43.8841	42.2281	40.5721	38.9161	37.2601	37.2601	38.9161	40.5721	42.2281	43.8841	45.5401	(42c)
Average daily hot water use (litres/day)												71.3482	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	77.8411	75.7054	73.3738	70.4722	67.8836	65.1934	64.6348	66.9616	69.3480	72.1106	75.0378	77.7319	(44)
Energy conte	123.2812	107.8034	112.7728	96.4730	91.3843	80.1629	78.1702	82.9124	85.5130	97.8534	106.9051	121.7093	(45)
Energy content (annual)										Total = Sum(45)m =		1184.9411	
Distribution loss (46)m = 0.15 x (45)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	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
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	104.7891	91.6329	95.8569	82.0020	77.6767	68.1384	66.4446	70.4756	72.6860	83.1754	90.8694	103.4529	(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	104.7891	91.6329	95.8569	82.0020	77.6767	68.1384	66.4446	70.4756	72.6860	83.1754	90.8694	103.4529	(64)
										Total per year (kWh/year) = Sum(64)m =		1007.2000	(64)
12Total per year (kWh/year)												1007	(64)
Electric shower(s)	59.9234	53.3923	58.3023	55.6372	56.6812	54.0683	55.8706	56.6812	55.6372	58.3023	57.2060	59.9234	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		681.6253	(64a)
Heat gains from water heating, kWh/month	41.1781	36.2563	38.5398	34.4098	33.5895	30.5517	30.5788	31.7892	32.0808	35.3694	37.0188	40.8441	(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	150.9135	150.9135	150.9135	150.9135	150.9135	150.9135	150.9135	150.9135	150.9135	150.9135	150.9135	150.9135	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	243.2457	269.3078	243.2457	251.3539	243.2457	251.3539	243.2457	243.2457	251.3539	243.2457	251.3539	243.2457	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	382.8404	386.8131	376.8021	355.4898	328.5868	303.3018	286.4099	282.4372	292.4482	313.7605	340.6635	365.9485	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.0913	38.0913	38.0913	38.0913	38.0913	38.0913	38.0913	38.0913	38.0913	38.0913	38.0913	38.0913	(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)	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	(71)
Water heating gains (Table 5)	55.3469	53.9528	51.8008	47.7914	45.1471	42.4329	41.1006	42.7274	44.5567	47.5395	51.4151	54.8980	(72)
Total internal gains	749.7071	778.3477	740.1226	722.9091	685.2537	665.3626	639.0302	636.6843	656.6328	672.8198	711.7065	732.3662	(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	1.5000	11.2829	0.7600	0.7000	0.7700	6.2396	(75)
Southeast	0.7500	36.7938	0.7600	0.7000	0.7700	10.1738	(77)
Southwest	6.1200	36.7938	0.7600	0.7000	0.7700	83.0178	(79)
Northwest	4.8800	11.2829	0.7600	0.7000	0.7700	20.2996	(81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	119.7308	212.7610	314.5238	428.9572	516.2906	528.3143	502.7939	435.2303	353.7730	241.4595	145.0152	101.4258	(83)
Total gains	869.4379	991.1088	1054.6465	1151.8663	1201.5443	1193.6769	1141.8241	1071.9146	1010.4058	914.2794	856.7217	833.7920	(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	55.0864	55.1776	55.2673	55.6927	55.7730	56.1499	56.1499	56.2202	56.0041	55.7730	55.6107	55.4422	
alpha	4.6724	4.6785	4.6845	4.7128	4.7182	4.7433	4.7433	4.7480	4.7336	4.7182	4.7074	4.6961	
util living area	0.9993	0.9986	0.9971	0.9911	0.9707	0.8999	0.7724	0.8198	0.9540	0.9935	0.9986	0.9994	(86)
MIT	19.2790	19.4297	19.6790	20.0576	20.4411	20.7746	20.9264	20.8993	20.6446	20.1505	19.6568	19.2574	(87)
Th 2	19.9989	20.0004	20.0019	20.0088	20.0100	20.0160	20.0160	20.0171	20.0137	20.0100	20.0074	20.0047	(88)
util rest of house	0.9991	0.9981	0.9961	0.9874	0.9563	0.8428	0.6466	0.7072	0.9235	0.9903	0.9980	0.9993	(89)
MIT 2	18.4104	18.5621	18.8122	19.1942	19.5711	19.8803	19.9893	19.9760	19.7698	19.2887	18.7945	18.3932	(90)
Living area fraction									fLA = Living area / (4) =			0.3116	(91)
MIT	18.6811	18.8325	19.0823	19.4633	19.8422	20.1590	20.2814	20.2637	20.0424	19.5572	19.0633	18.6625	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6811	18.8325	19.0823	19.4633	19.8422	20.1590	20.2814	20.2637	20.0424	19.5572	19.0633	18.6625	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9987	0.9973	0.9947	0.9846	0.9531	0.8528	0.6847	0.7400	0.9247	0.9881	0.9973	0.9989	(94)
Useful gains	868.2877	988.4760	1049.0674	1134.1671	1145.1434	1017.9611	781.8312	793.1646	934.3047	903.4380	854.3825	832.8990	(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	3369.7418	3259.2326	2938.6051	2448.2165	1884.3772	1277.9003	846.2689	887.0834	1369.5943	2073.0041	2776.7717	3367.0827	(97)
Space heating kWh	1861.0819	1525.9484	1405.8160	946.1156	549.9899	0.0000	0.0000	0.0000	0.0000	870.1572	1384.1203	1885.4327	(98a)
Space heating requirement - total per year (kWh/year)												10428.6619	
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	1861.0819	1525.9484	1405.8160	946.1156	549.9899	0.0000	0.0000	0.0000	0.0000	870.1572	1384.1203	1885.4327	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												10428.6619	
Space heating per m2											(98c) / (4) =	49.0599	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	2160.8703	1701.1107	1744.9002	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.5596	0.6577	0.6112	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1209.2973	1118.8633	1066.4913	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1250.4087	1195.7495	1119.3719	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	29.6002	57.2033	39.3431	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	7.4000	14.3008	9.8358	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												31.5367	(107)
Energy for space heating												49.0599	(99)
Energy for space cooling												0.1484	(108)
Total												49.2083	(109)
Fabric Energy Efficiency (DFEE)												49.2	(109)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	116.6500 (1b)	x	3.2400 (2b)	=	377.9460	(1b) - (3b)
First floor	95.9200 (1c)	x	2.5500 (2c)	=	244.5960	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 212.5700						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		622.5420	(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) =	0.0643	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3143	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2907	(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	0.3706	0.3634	0.3561	0.3198	0.3125	0.2761	0.2761	0.2689	0.2907	0.3125	0.3270	0.3416	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5687	0.5660	0.5634	0.5511	0.5488	0.5381	0.5381	0.5361	0.5422	0.5488	0.5535	0.5583	(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	
TER Opaque door			16.3400	1.0000	16.3400			(26)
TER Opening Type (Uw = 1.20)			13.2500	1.1450	15.1718			(27)
Heatloss Floor 1			116.6500	0.1300	15.1645			(28a)
External Wall 1	266.5400	29.5900	236.9500	0.1800	42.6510			(29a)
External Roof 1	95.9200		95.9200	0.1100	10.5512			(30)
Total net area of external elements Aum(A, m2)			479.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		99.8785			(33)
Party Wall 1			6.7100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 218.6000 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	16.9300	0.0500	0.8465
E3 Sill	9.1500	0.0500	0.4575
E4 Jamb	28.7000	0.0500	1.4350
E5 Ground floor (normal)	47.8300	0.1600	7.6528
E6 Intermediate floor within a dwelling	44.6200	0.0000	0.0000
E16 Corner (normal)	34.7400	0.0900	3.1266
E18 Party wall between dwellings	2.5500	0.0600	0.1530
E17 Corner (inverted - internal area greater than external area)	14.1300	-0.0900	-1.2717
E25 Staggered party wall between dwellings	2.5500	0.0600	0.1530
P1 Party wall - Ground floor	2.6300	0.0800	0.2104
P2 Party wall - Intermediate floor within a dwelling	2.6300	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	44.6200	0.0600	2.6772
P4 Party wall - Roof (insulation at ceiling level)	2.6300	0.1200	0.3156
E8 Balcony within a dwelling, wall insulation continuous	5.3300	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		15.7559 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	115.6344 (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	116.8290	116.2811	115.7441	113.2216	112.7497	110.5527	110.5527	110.1458	111.3989	112.7497	113.7044	114.7025	(38)
Heat transfer coeff	232.4634	231.9155	231.3784	228.8560	228.3840	226.1870	226.1870	225.7802	227.0333	228.3840	229.3388	230.3369	(39)
Average = Sum(39)m / 12 =												228.8537	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0936	1.0910	1.0885	1.0766	1.0744	1.0641	1.0641	1.0621	1.0680	1.0744	1.0789	1.0836	(40)
HLP (average)												1.0766	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 3.0183 (42)

Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

32.3010	31.8213	31.1457	29.9002	28.9675	27.9333	27.3747	28.0455	28.7759	29.8825	31.1537	32.1918	(42b)

Hot water usage for other uses

45.5401	43.8841	42.2281	40.5721	38.9161	37.2601	37.2601	38.9161	40.5721	42.2281	43.8841	45.5401	(42c)

Average daily hot water use (litres/day) 71.3482 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	77.8411	75.7054	73.3738	70.4722	67.8836	65.1934	64.6348	66.9616	69.3480	72.1106	75.0378	77.7319	(44)
Energy conte	123.2812	107.8034	112.7728	96.4730	91.3843	80.1629	78.1702	82.9124	85.5130	97.8534	106.9051	121.7093	(45)
Energy content (annual)										Total = Sum(45)m =		1184.9411	
Distribution loss (46)m = 0.15 x (45)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	(46)
Water storage loss:													
Total storage loss													

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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	(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	(61)
Total heat required for water heating calculated for each month												
	104.7891	91.6329	95.8569	82.0020	77.6767	68.1384	66.4446	70.4756	72.6860	83.1754	90.8694	103.4529 (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												
	104.7891	91.6329	95.8569	82.0020	77.6767	68.1384	66.4446	70.4756	72.6860	83.1754	90.8694	103.4529 (64)
									Total per year (kWh/year) = Sum(64)m =			1007.2000 (64)
12Total per year (kWh/year)												1007 (64)
Electric shower(s)												
	59.9234	53.3923	58.3023	55.6372	56.6812	54.0683	55.8706	56.6812	55.6372	58.3023	57.2060	59.9234 (64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			681.6253 (64a)
Heat gains from water heating, kWh/month												
	41.1781	36.2563	38.5398	34.4098	33.5895	30.5517	30.5788	31.7892	32.0808	35.3694	37.0188	40.8441 (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	150.9135	150.9135	150.9135	150.9135	150.9135	150.9135	150.9135	150.9135	150.9135	150.9135	150.9135	150.9135	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	243.2457	269.3078	243.2457	251.3539	243.2457	251.3539	243.2457	243.2457	251.3539	243.2457	251.3539	243.2457	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	382.8404	386.8131	376.8021	355.4898	328.5868	303.3018	286.4099	282.4372	292.4482	313.7605	340.6635	365.9485	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	38.0913	38.0913	38.0913	38.0913	38.0913	38.0913	38.0913	38.0913	38.0913	38.0913	38.0913	38.0913	(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)													
	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	(71)
Water heating gains (Table 5)													
	55.3469	53.9528	51.8008	47.7914	45.1471	42.4329	41.1006	42.7274	44.5567	47.5395	51.4151	54.8980	(72)
Total internal gains													
	749.7071	778.3477	740.1226	722.9091	685.2537	665.3626	639.0302	636.6843	656.6328	672.8198	711.7065	732.3662	(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	1.5000	11.2829	0.6300	0.7000	0.7700	5.1723	(75)
Southeast	0.7500	36.7938	0.6300	0.7000	0.7700	8.4335	(77)
Southwest	6.1200	36.7938	0.6300	0.7000	0.7700	68.8174	(79)
Northwest	4.8800	11.2829	0.6300	0.7000	0.7700	16.8273	(81)

Solar gains	99.2505	176.3677	260.7237	355.5829	427.9777	437.9447	416.7897	360.7830	293.2592	200.1572	120.2100	84.0767	(83)
Total gains	848.9576	954.7154	1000.8464	1078.4920	1113.2314	1103.3074	1055.8199	997.4673	949.8920	872.9771	831.9165	816.4429	(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	55.5258	55.6570	55.7862	56.4011	56.5176	57.0666	57.0666	57.1694	56.8539	56.5176	56.2823	56.0384	
alpha	4.7017	4.7105	4.7191	4.7601	4.7678	4.8044	4.8044	4.8113	4.7903	4.7678	4.7522	4.7359	
util living area													
	0.9994	0.9988	0.9977	0.9931	0.9776	0.9187	0.8024	0.8442	0.9621	0.9946	0.9988	0.9995	(86)
MIT	19.2819	19.4246	19.6640	20.0349	20.4111	20.7527	20.9156	20.8880	20.6284	20.1432	19.6611	19.2671	(87)
Th 2	20.0061	20.0082	20.0103	20.0200	20.0218	20.0303	20.0303	20.0319	20.0270	20.0218	20.0181	20.0143	(88)
util rest of house													
	0.9992	0.9984	0.9968	0.9903	0.9661	0.8689	0.6816	0.7382	0.9360	0.9919	0.9983	0.9993	(89)
MIT 2	18.4187	18.5629	18.8036	19.1806	19.5527	19.8767	19.9983	19.9842	19.7671	19.2907	18.8069	18.4101	(90)
Living area fraction										fLA = Living area / (4) =		0.3116	(91)
MIT	18.6877	18.8314	19.0718	19.4469	19.8202	20.1497	20.2841	20.2658	20.0355	19.5563	19.0731	18.6771	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6877	18.8314	19.0718	19.4469	19.8202	20.1497	20.2841	20.2658	20.0355	19.5563	19.0731	18.6771	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9988	0.9977	0.9957	0.9879	0.9630	0.8765	0.7178	0.7684	0.9363	0.9900	0.9976	0.9990	(94)
Useful gains	847.9525	952.5567	996.5648	1065.4754	1072.0155	967.0010	757.8778	766.4900	889.4112	864.2792	829.9245	815.6560	(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													
	3344.6122	3230.9088	2908.8335	2413.7096	1854.5228	1255.2645	833.3012	872.8280	1347.5599	2045.4853	2745.9025	3334.6197	(97)
Space heating kWh													
	1857.5148	1531.0526	1422.7279	970.7287	582.1854	0.0000	0.0000	0.0000	0.0000	878.8173	1379.5042	1874.1090	(98a)
Space heating requirement - total per year (kWh/year)												10496.6399	
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													
	1857.5148	1531.0526	1422.7279	970.7287	582.1854	0.0000	0.0000	0.0000	0.0000	878.8173	1379.5042	1874.1090	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												10496.6399	
Space heating per m2											(98c) / (4) =	49.3797	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	2126.1580	1673.7840	1715.9293	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.5254	0.6221	0.5797	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1117.0302	1041.2859	994.7123	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1144.7819	1095.2251	1032.3556	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	19.9813	40.1308	28.0066	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	4.9953	10.0327	7.0016	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												22.0296	(107)
Energy for space heating												49.3797	(99)
Energy for space cooling												0.1036	(108)
Total												49.4833	(109)
Fabric Energy Efficiency (TFEE)												49.5	(109)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	116.6500	(1b)	x 3.2400	(2b) =	377.9460	(1b) - (3b)
First floor	95.9200	(1c)	x 2.5500	(2c) =	244.5960	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	212.5700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		622.5420	(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	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		4.0000 (17)
Infiltration rate		0.2000 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1850 (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													
	0.2359	0.2313	0.2266	0.2035	0.1989	0.1758	0.1758	0.1711	0.1850	0.1989	0.2081	0.2174	(22b)
Mechanical extract ventilation - centralised													
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)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(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	
Doors			16.3400	1.2000	19.6080			(26)
Windows (Uw = 1.20)			13.2500	1.1450	15.1718			(27)
Heatloss Floor 1			116.6500	0.1200	13.9980			(28a)
External Wall 1	266.5400	29.5900	236.9500	0.1800	42.6510			(29a)
External Roof 1	95.9200		95.9200	0.0900	8.6328			(30)
Total net area of external elements Aum(A, m2)			479.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		100.0616			(33)
Party Wall 1			6.7100	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							218.6000	(35)
Thermal bridges (User defined value 0.045 * total exposed area)							21.5600	(36)
Point Thermal bridges						(36a) =	0.0000	
Total fabric heat loss					(33) + (36) + (36a) =		121.6215	(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	102.7194	102.7194	102.7194	102.7194	102.7194	102.7194	102.7194	102.7194	102.7194	102.7194	102.7194	102.7194	(38)

Heat transfer coeff

	224.3409	224.3409	224.3409	224.3409	224.3409	224.3409	224.3409	224.3409	224.3409	224.3409	224.3409	224.3409	(39)
Average = Sum(39)m / 12 =												224.3409	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0554	1.0554	1.0554	1.0554	1.0554	1.0554	1.0554	1.0554	1.0554	1.0554	1.0554	1.0554	(40)
HLP (average)												1.0554	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0183	(42)
Hot water usage for mixer showers													
	74.8263	73.7018	72.0632	68.9280	66.6143	64.0342	62.5676	64.1938	65.9764	68.7467	71.9493	74.5396	(42a)
Hot water usage for baths													
	32.3010	31.8213	31.1457	29.9002	28.9675	27.9333	27.3747	28.0455	28.7759	29.8825	31.1537	32.1918	(42b)
Hot water usage for other uses													
	45.5401	43.8841	42.2281	40.5721	38.9161	37.2601	37.2601	38.9161	40.5721	42.2281	43.8841	45.5401	(42c)
Average daily hot water use (litres/day)												140.3355	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	152.6674	149.4072	145.4370	139.4003	134.4979	129.2275	127.2023	131.1554	135.3244	140.8573	146.9871	152.2715	(44)
Energy conte	241.7878	212.7538	223.5313	190.8320	181.0601	158.9003	153.8402	162.3977	166.8685	191.1421	209.4101	238.4204	(45)
Energy content (annual)										Total = Sum(45)m =		2330.9443	
Distribution loss (46)m = 0.15 x (45)m													
	36.2682	31.9131	33.5297	28.6248	27.1590	23.8350	23.0760	24.3597	25.0303	28.6713	31.4115	35.7631	(46)
Water storage loss:													
Store volume												300.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0400	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												1.2240	(55)
Total storage loss													
	37.9440	34.2720	37.9440	36.7200	37.9440	36.7200	37.9440	37.9440	36.7200	37.9440	36.7200	37.9440	(56)
If cylinder contains dedicated solar storage													
	37.9440	34.2720	37.9440	36.7200	37.9440	36.7200	37.9440	37.9440	36.7200	37.9440	36.7200	37.9440	(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													
	302.9942	268.0370	284.7377	250.0640	242.2665	218.1323	215.0466	223.6041	226.1005	252.3485	268.6421	299.6268	(62)
WWHRS	-33.3156	-29.4646	-30.8536	-25.5480	-23.8099	-20.3743	-19.0976	-20.3084	-21.0800	-24.8510	-28.1532	-32.6987	(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													
	269.6786	238.5724	253.8841	224.5160	218.4566	197.7581	195.9490	203.2957	205.0205	227.4975	240.4889	266.9281	(64)
									Total per year (kWh/year) = Sum(64)m =			2742.0454	(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													
	129.3596	114.9672	123.2893	110.8372	109.1676	100.2200	100.1170	102.9624	102.8694	112.5199	117.0144	128.2399	(65)

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	181.0962	181.0962	181.0962	181.0962	181.0962	181.0962	181.0962	181.0962	181.0962	181.0962	181.0962	181.0962	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	64.7282	57.4910	46.7549	35.3964	26.4592	22.3380	24.1370	31.3742	42.1104	53.4688	62.4060	66.5272	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	571.4036	577.3330	562.3912	530.5817	490.4280	452.6892	427.4774	421.5480	436.4899	468.2993	508.4530	546.1918	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	56.1279	56.1279	56.1279	56.1279	56.1279	56.1279	56.1279	56.1279	56.1279	56.1279	56.1279	56.1279	(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)													
	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	(71)
Water heating gains (Table 5)													
	173.8704	171.0822	165.7114	153.9406	146.7306	139.1944	134.5658	138.3903	142.8741	151.2364	162.5201	172.3655	(72)
Total internal gains													
	926.4955	922.3995	891.3507	836.4121	780.1112	730.7149	702.6735	707.8058	737.9676	789.4977	849.8723	901.5777	(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	1.5000	11.2829	0.7600	0.7000	0.7700	6.2396	(75)
Southeast	0.7500	36.7938	0.7600	0.7000	0.7700	10.1738	(77)
Southwest	6.1200	36.7938	0.7600	0.7000	0.7700	83.0178	(79)
Northwest	4.8800	11.2829	0.7600	0.7000	0.7700	20.2996	(81)

Solar gains	119.7308	212.7610	314.5238	428.9572	516.2906	528.3143	502.7939	435.2303	353.7730	241.4595	145.0152	101.4258	(83)
Total gains	1046.2263	1135.1605	1205.8745	1265.3693	1296.4018	1259.0292	1205.4674	1143.0360	1091.7407	1030.9573	994.8875	1003.0036	(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	57.5362	57.5362	57.5362	57.5362	57.5362	57.5362	57.5362	57.5362	57.5362	57.5362	57.5362	57.5362	
alpha	4.8357	4.8357	4.8357	4.8357	4.8357	4.8357	4.8357	4.8357	4.8357	4.8357	4.8357	4.8357	
util living area													
	0.9985	0.9975	0.9948	0.9865	0.9596	0.8782	0.7369	0.7837	0.9374	0.9892	0.9973	0.9988	(86)
MIT	19.4578	19.5846	19.8279	20.1631	20.5192	20.8116	20.9436	20.9223	20.7006	20.2503	19.7864	19.4205	(87)

Th 2	20.0374	20.0374	20.0374	20.0374	20.0374	20.0374	20.0374	20.0374	20.0374	20.0374	20.0374	20.0374	(88)
util rest of house	0.9980	0.9967	0.9930	0.9813	0.9409	0.8153	0.6110	0.6674	0.8996	0.9840	0.9963	0.9984	(89)
MIT 2	18.2163	18.3788	18.6901	19.1168	19.5609	19.8958	20.0121	19.9985	19.7812	19.2297	18.6376	18.1685	(90)
Living area fraction										fLA = Living area / (4) =		0.3116	(91)
MIT	18.6032	18.7545	19.0447	19.4428	19.8595	20.1812	20.3024	20.2863	20.0677	19.5477	18.9956	18.5587	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6032	18.7545	19.0447	19.4428	19.8595	20.1812	20.3024	20.2863	20.0677	19.5477	18.9956	18.5587	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9970	0.9951	0.9904	0.9768	0.9365	0.8263	0.6491	0.7013	0.9011	0.9802	0.9947	0.9976	(94)
Useful gains	1043.0984	1129.6202	1194.3517	1236.0278	1214.0832	1040.3896	782.4774	801.5558	983.7924	1010.5469	989.5868	1000.5523	(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	3208.7841	3108.1375	2814.2815	2365.1912	1830.5093	1252.0850	830.5950	871.8672	1338.7955	2007.3453	2668.6622	3221.2386	(97)
Space heating kWh	1611.2701	1329.5636	1205.2278	812.9977	458.6210	0.0000	0.0000	0.0000	0.0000	741.6180	1208.9343	1652.1906	(98a)
Space heating requirement - total per year (kWh/year)												9020.4231	
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	1611.2701	1329.5636	1205.2278	812.9977	458.6210	0.0000	0.0000	0.0000	0.0000	741.6180	1208.9343	1652.1906	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9020.4231	
Space heating per m2											(98c) / (4) =	42.4351	(99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(301)
Fraction of space heat from community system												1.0000	(302)
Fraction of heat from community Heat pump-Space and Water												1.0000	(303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000	(305)
Factor for charging method (Table 4c(3)) for water heating												1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system												1.0000	(306)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating:													
Space heating requirement	1611.2701	1329.5636	1205.2278	812.9977	458.6210	0.0000	0.0000	0.0000	0.0000	741.6180	1208.9343	1652.1906	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00													
307a	1611.2701	1329.5636	1205.2278	812.9977	458.6210	0.0000	0.0000	0.0000	0.0000	741.6180	1208.9343	1652.1906	
Space heating requirement	1611.2701	1329.5636	1205.2278	812.9977	458.6210	0.0000	0.0000	0.0000	0.0000	741.6180	1208.9343	1652.1906	(307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000	(308)
Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(309)
Water heating													
Annual water heating requirement	269.6786	238.5724	253.8841	224.5160	218.4566	197.7581	195.9490	203.2957	205.0205	227.4975	240.4889	266.9281	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00													
310a	269.6786	238.5724	253.8841	224.5160	218.4566	197.7581	195.9490	203.2957	205.0205	227.4975	240.4889	266.9281	
Water heating fuel	269.6786	238.5724	253.8841	224.5160	218.4566	197.7581	195.9490	203.2957	205.0205	227.4975	240.4889	266.9281	(310)
Cooling System Energy Efficiency Ratio												0.0000	(314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(315)
Pumps and Fa	21.6739	19.5764	21.6739	20.9747	21.6739	20.9747	21.6739	21.6739	20.9747	21.6739	20.9747	21.6739	(331)
Lighting	56.6562	45.4517	40.9243	29.9829	23.1596	18.9216	21.1270	27.4617	35.6700	46.8009	52.8615	58.2309	(332)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333a)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	(333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334a)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	(334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335a)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	(335a)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333b)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	(333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334b)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	(334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335b)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	(335b)

Annual totals kWh/year		
Space heating fuel - community heating	9020.4231	(307)
Space heating fuel - secondary	0.0000	(309)
Water heating fuel - community heating	2742.0454	(310)
Efficiency of water heater	0.0000	(311)
Electricity used for heat distribution	90.2042	(313)
Space cooling fuel	0.0000	(321)
Electricity for pumps and fans:		
(MEVCentralised, Database: in-use factor = 1.6000, SFP = 0.3360)		
mechanical ventilation fans (SFP = 0.3360)	255.1924	(330a)
Total electricity for the above, kWh/year	255.1924	(331)
Electricity for lighting (calculated in Appendix L)	457.2483	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(333)
Wind generation	0.0000	(334)
Hydro-electric generation (Appendix N)	0.0000	(335a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(335)
Appendix Q - special features		
Energy saved or generated	-0.0000	(336)
Energy used	0.0000	(337)
Total delivered energy for all uses	12474.9092	(338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Heat pump	9020.4231	4.4400	400.5068	(340a)
Space heating total			400.5068	(340)
Total CO2 associated with community systems			0.0000	(473)

Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Heat pump	2742.0454	4.4400	121.7468	(342a)
Water heating total			121.7468	(342)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(347a)
Pumps, fans and electric keep-hot	255.1924	16.4900	42.0812	(349)
Energy for lighting	457.2483	16.4900	75.4002	(350)
Additional standing charges			92.0000	(351)
Total energy cost			731.7351	(355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):		0.3600	(356)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.0227	(357)
SAP value		83.4215	
SAP rating (Section 12)		83	(358)
SAP band		B	

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Heat pump			350.0000	(367)
Space and Water heating from Heat pump	3360.7053	0.1540	396.9371	(367)
Electrical energy for heat distribution (space & water)	90.2042	0.0000	17.7522	(372)
Overall CO2 factor for heat network			0.0446	(386)
Total CO2 associated with community systems			524.9582	(373)
Space and water heating			524.9582	(376)
Pumps, fans and electric keep-hot	255.1924	0.1387	35.3983	(378)
Energy for lighting	457.2483	0.1443	65.9951	(379)
Total CO2, kg/year			626.3516	(383)
CO2 emissions per m2			2.9500	(384)
EI value			96.7414	(384a)
EI rating			97	(385)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	116.6500	(1b)	x 3.2400	(2b) =	377.9460	(1b) - (3b)
First floor	95.9200	(1c)	x 2.5500	(2c) =	244.5960	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	212.5700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		622.5420	(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		4.0000 (17)
Infiltration rate		0.2000 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1850 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.1943	0.1850	0.1850	0.1711	0.1711	0.1526	0.1573	0.1480	0.1526	0.1619	0.1619	0.1758	(22b)

Mechanical extract ventilation - centralised

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)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(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	
Doors			16.3400	1.2000	19.6080			(26)
Windows (Uw = 1.20)			13.2500	1.1450	15.1718			(27)
Heatloss Floor 1			116.6500	0.1200	13.9980			(28a)
External Wall 1	266.5400	29.5900	236.9500	0.1800	42.6510			(29a)
External Roof 1	95.9200		95.9200	0.0900	8.6328			(30)
Total net area of external elements Aum(A, m2)			479.1100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	100.0616			(33)
Party Wall 1			6.7100	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							218.6000	(35)
Thermal bridges (User defined value 0.045 * total exposed area)							21.5600	(36)
Point Thermal bridges						(36a) =	0.0000	
Total fabric heat loss					(33) + (36) + (36a) =		121.6215	(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	102.7194	102.7194	102.7194	102.7194	102.7194	102.7194	102.7194	102.7194	102.7194	102.7194	102.7194	102.7194	(38)
Heat transfer coeff	224.3409	224.3409	224.3409	224.3409	224.3409	224.3409	224.3409	224.3409	224.3409	224.3409	224.3409	224.3409	(39)
Average = Sum(39)m / 12 =												224.3409	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0554	1.0554	1.0554	1.0554	1.0554	1.0554	1.0554	1.0554	1.0554	1.0554	1.0554	1.0554	(40)
HLP (average)												1.0554	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 3.0183 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
74.8263	73.7018	72.0632	68.9280	66.6143	64.0342	62.5676	64.1938	65.9764	68.7467	71.9493	74.5396	(42a)

Hot water usage for baths

32.3010	31.8213	31.1457	29.9002	28.9675	27.9333	27.3747	28.0455	28.7759	29.8825	31.1537	32.1918	(42b)

Hot water usage for other uses

45.5401	43.8841	42.2281	40.5721	38.9161	37.2601	37.2601	38.9161	40.5721	42.2281	43.8841	45.5401	(42c)

Average daily hot water use (litres/day) 140.3355 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	152.6674	149.4072	145.4370	139.4003	134.4979	129.2275	127.2023	131.1554	135.3244	140.8573	146.9871	152.2715	(44)
Energy conte	241.7878	212.7538	223.5313	190.8320	181.0601	158.9003	153.8402	162.3977	166.8685	191.1421	209.4101	238.4204	(45)
Energy content (annual)										Total = Sum(45)m =		2330.9443	

Distribution loss (46)m = 0.15 x (45)m

36.2682	31.9131	33.5297	28.6248	27.1590	23.8350	23.0760	24.3597	25.0303	28.6713	31.4115	35.7631	(46)

Water storage loss:

Store volume	300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	2.0400 (48)
Temperature factor from Table 2b	0.6000 (49)
Enter (49) or (54) in (55)	1.2240 (55)

Total storage loss

37.9440	34.2720	37.9440	36.7200	37.9440	36.7200	37.9440	37.9440	36.7200	37.9440	36.7200	37.9440	(56)

If cylinder contains dedicated solar storage

37.9440	34.2720	37.9440	36.7200	37.9440	36.7200	37.9440	37.9440	36.7200	37.9440	36.7200	37.9440	(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

302.9942	268.0370	284.7377	250.0640	242.2665	218.1323	215.0466	223.6041	226.1005	252.3485	268.6421	299.6268	(62)
WWHRS -33.3156	-29.4646	-30.8536	-25.5480	-23.8099	-20.3743	-19.0976	-20.3084	-21.0800	-24.8510	-28.1532	-32.6987	(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

269.6786	238.5724	253.8841	224.5160	218.4566	197.7581	195.9490	203.2957	205.0205	227.4975	240.4889	266.9281	(64)
								Total per year (kWh/year) = Sum(64)m =			2742.0454	(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

129.3596	114.9672	123.2893	110.8372	109.1676	100.2200	100.1170	102.9624	102.8694	112.5199	117.0144	128.2399	(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	181.0962	181.0962	181.0962	181.0962	181.0962	181.0962	181.0962	181.0962	181.0962	181.0962	181.0962	181.0962	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.7282	57.4910	46.7549	35.3964	26.4592	22.3380	24.1370	31.3742	42.1104	53.4688	62.4060	66.5272	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	571.4036	577.3330	562.3912	530.5817	490.4280	452.6892	427.4774	421.5480	436.4899	468.2993	508.4530	546.1918	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.1279	56.1279	56.1279	56.1279	56.1279	56.1279	56.1279	56.1279	56.1279	56.1279	56.1279	56.1279	(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)	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	(71)
Water heating gains (Table 5)	173.8704	171.0822	165.7114	153.9406	146.7306	139.1944	134.5658	138.3903	142.8741	151.2364	162.5201	172.3655	(72)
Total internal gains	926.4955	922.3995	891.3507	836.4121	780.1112	730.7149	702.6735	707.8058	737.9676	789.4977	849.8723	901.5777	(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	1.5000	12.9236	0.7600	0.7000	0.7700	7.1469	(75)
Southeast	0.7500	40.4699	0.7600	0.7000	0.7700	11.1902	(77)
Southwest	6.1200	40.4699	0.7600	0.7000	0.7700	91.3122	(79)

Northwest				4.8800		12.9236		0.7600		0.7000		0.7700	23.2513 (81)
Solar gains	132.9006	213.0407	312.6094	441.8327	519.8274	569.8478	536.2390	473.5639	382.0204	258.5729	165.0094	111.4345 (83)	
Total gains	1059.3961	1135.4402	1203.9601	1278.2447	1299.9386	1300.5627	1238.9125	1181.3696	1119.9880	1048.0707	1014.8817	1013.0122 (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	57.5362	57.5362	57.5362	57.5362	57.5362	57.5362	57.5362	57.5362	57.5362	57.5362	57.5362	57.5362	
alpha	4.8357	4.8357	4.8357	4.8357	4.8357	4.8357	4.8357	4.8357	4.8357	4.8357	4.8357	4.8357	
util living area													
	0.9980	0.9969	0.9932	0.9802	0.9316	0.7622	0.5457	0.5850	0.8844	0.9826	0.9960	0.9984 (86)	
MIT	19.5674	19.6741	19.9410	20.2938	20.6669	20.9255	20.9889	20.9847	20.8227	20.3841	19.9123	19.5412 (87)	
Th 2	20.0374	20.0374	20.0374	20.0374	20.0374	20.0374	20.0374	20.0374	20.0374	20.0374	20.0374	20.0374 (88)	
util rest of house													
	0.9974	0.9959	0.9908	0.9720	0.8983	0.6546	0.3846	0.4210	0.8153	0.9736	0.9945	0.9979 (89)	
MIT 2	18.3569	18.4934	18.8346	19.2817	19.7363	19.9976	20.0352	20.0341	19.9114	19.3984	18.7987	18.3233 (90)	
Living area fraction										fLA = Living area / (4) =		0.3116 (91)	
MIT	18.7341	18.8613	19.1794	19.5971	20.0263	20.2868	20.3324	20.3303	20.1954	19.7056	19.1457	18.7028 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.7341	18.8613	19.1794	19.5971	20.0263	20.2868	20.3324	20.3303	20.1954	19.7056	19.1457	18.7028 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9961	0.9941	0.9877	0.9670	0.8978	0.6854	0.4357	0.4732	0.8289	0.9693	0.9924	0.9968 (94)	
Useful gains	1055.2794	1128.7562	1189.1704	1236.0594	1167.0667	891.4127	539.8544	559.0081	928.3494	1015.8621	1007.1396	1009.7376 (95)	
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)	
Heat loss rate W													
	3058.6878	2975.0485	2642.5966	2175.4593	1576.2858	961.6965	545.6951	567.6475	1120.6641	1818.4073	2500.4428	3051.6755 (97)	
Space heating kWh													
	1490.5358	1240.7084	1081.3491	676.3679	304.4590	0.0000	0.0000	0.0000	0.0000	597.0936	1075.1783	1519.2018 (98a)	
Space heating requirement - total per year (kWh/year)												7984.8940	
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													
	1490.5358	1240.7084	1081.3491	676.3679	304.4590	0.0000	0.0000	0.0000	0.0000	597.0936	1075.1783	1519.2018 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												7984.8940	
Space heating per m2											(98c) / (4) =	37.5636 (99)	

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (301)	
Fraction of space heat from community system												1.0000 (302)	
Fraction of heat from community Heat pump-Space and Water												1.0000 (303a)	
Factor for control and charging method (Table 4c(3)) for space heating												1.0000 (305)	
Factor for charging method (Table 4c(3)) for water heating												1.0000 (305a)	
Distribution loss factor (Table 12c) for community heating system												1.0000 (306)	
Efficiency of secondary/supplementary heating system, %												0.0000 (208)	
Space heating:													
Space heating requirement													
	1490.5358	1240.7084	1081.3491	676.3679	304.4590	0.0000	0.0000	0.0000	0.0000	597.0936	1075.1783	1519.2018 (98)	
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00													
307a	1490.5358	1240.7084	1081.3491	676.3679	304.4590	0.0000	0.0000	0.0000	0.0000	597.0936	1075.1783	1519.2018	
Space heating requirement													
	1490.5358	1240.7084	1081.3491	676.3679	304.4590	0.0000	0.0000	0.0000	0.0000	597.0936	1075.1783	1519.2018 (307)	
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000 (308)	
Space heating fuel for secondary/supplementary system													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)	
Water heating													
Annual water heating requirement													
	269.6786	238.5724	253.8841	224.5160	218.4566	197.7581	195.9490	203.2957	205.0205	227.4975	240.4889	266.9281 (64)	
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00													
310a	269.6786	238.5724	253.8841	224.5160	218.4566	197.7581	195.9490	203.2957	205.0205	227.4975	240.4889	266.9281	
Water heating fuel													
	269.6786	238.5724	253.8841	224.5160	218.4566	197.7581	195.9490	203.2957	205.0205	227.4975	240.4889	266.9281 (310)	
Cooling System Energy Efficiency Ratio												0.0000 (314)	
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (315)	
Pumps and Fa	21.6739	19.5764	21.6739	20.9747	21.6739	20.9747	21.6739	21.6739	20.9747	21.6739	20.9747	21.6739 (331)	
Lighting	56.6562	45.4517	40.9243	29.9829	23.1596	18.9216	21.1270	27.4617	35.6700	46.8009	52.8615	58.2309 (332)	
Electricity generated by PVs (Appendix M) (negative quantity)													
(333a)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 (333a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334a)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 (334a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335a)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 (335a)	
Electricity generated by PVs (Appendix M) (negative quantity)													
(333b)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 (333b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334b)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 (334b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335b)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 (335b)	
Annual totals kWh/year													
Space heating fuel - community heating												7984.8940 (307)	
Space heating fuel - secondary												0.0000 (309)	
Water heating fuel - community heating												2742.0454 (310)	
Efficiency of water heater												0.0000 (311)	
Electricity used for heat distribution												79.8489 (313)	
Space cooling fuel												0.0000 (321)	
Electricity for pumps and fans:													
(MEVCentralised, Database: in-use factor = 1.6000, SFP = 0.3360)													
mechanical ventilation fans (SFP = 0.3360)												255.1924 (330a)	
Total electricity for the above, kWh/year												255.1924 (331)	
Electricity for lighting (calculated in Appendix L)												457.2483 (332)	

Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (333)
Wind generation	0.0000 (334)
Hydro-electric generation (Appendix N)	0.0000 (335a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (335)
Appendix Q - special features	
Energy saved or generated	-0.0000 (336)
Energy used	0.0000 (337)
Total delivered energy for all uses	11439.3801 (338)

10b. Fuel costs - using BEDF prices (533)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Heat pump	7984.8940	4.8000	383.2749	(340a)
Space heating total			383.2749	(340)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Heat pump	2742.0454	4.8000	131.6182	(342a)
Water heating total			131.6182	(342)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(347a)
Pumps, fans and electric keep-hot	255.1924	21.5100	54.8919	(349)
Energy for lighting	457.2483	21.5100	98.3541	(350)
Additional standing charges			98.0000	(351)
Total energy cost			766.1391	(355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Heat pump			350.0000	(367)
Space and Water heating from Heat pump	3064.8398	0.1547	352.8608	(367)
Electrical energy for heat distribution (space & water)	79.8489	0.0000	16.2095	(372)
Overall CO2 factor for heat network			0.0447	(386)
Total CO2 associated with community systems			479.3393	(373)
Space and water heating			479.3393	(376)
Pumps, fans and electric keep-hot	255.1924	0.1387	35.3983	(378)
Energy for lighting	457.2483	0.1443	65.9951	(379)
Total CO2, kg/year			580.7327	(383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Heat pump			350.0000	(467a)
Space and Water heating from Heat pump	3064.8398	1.5726	3587.8206	(467)
Electrical energy for heat distribution (space & water)	79.8489	0.0000	167.2647	(472)
Overall CO2 factor for heat network			0.4611	(486)
Total CO2 associated with community systems			4946.2553	(473)
Space and water heating			4946.2553	(476)
Pumps, fans and electric keep-hot	255.1924	1.5128	386.0551	(478)
Energy for lighting	457.2483	1.5338	701.3427	(479)
Total Primary energy kWh/year			6033.6531	(483)

SAP 10 EPC IMPROVEMENTS

GSHP Heat Network_WWHR

Current energy efficiency rating:	B 83
Current environmental impact rating:	A 97

N	Solar water heating	SAP increase too small
U	Solar photovoltaic panels	Recommended
V2	Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 3.4	-£ 203	-126 kg (21.7%)

Measures omitted - SAP change or cost saving too small:			
N Solar water heating	+ 0.3	-£ 16	-15 kg (2.6%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar photovoltaic panels	£203	0.59 kg/m²	B 87	A 97
Total Savings	£203	0.59 kg/m²		

Potential energy efficiency rating:	B 87
Potential environmental impact rating:	A 97

Fuel prices for cost data on this page from database revision number 533 TEST (30 Nov 2023)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£153	£153	£0
Community scheme	£613	£613	£0
Space heating	£536	£536	£0
Water heating	£132	£132	£0
Lighting	£98	£98	£0
Generated (PV)	-£0	-£203	£203
Total cost of fuels	£766	£563	£203

Total cost of uses	£766	£563	£203
Delivered energy	54 kWh/m²	49 kWh/m²	4 kWh/m²
Carbon dioxide emissions	0.6 tonnes	0.5 tonnes	0.1 tonnes
CO2 emissions per m²	3 kg/m²	2 kg/m²	1 kg/m²
Primary energy	28 kWh/m²	22 kWh/m²	7 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	116.6500	(1b)	x 3.2400	(2b) =	377.9460	(1b) - (3b)
First floor	95.9200	(1c)	x 2.5500	(2c) =	244.5960	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	212.5700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		622.5420	(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	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		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1850	(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	0.2359	0.2313	0.2266	0.2035	0.1989	0.1758	0.1758	0.1711	0.1850	0.1989	0.2081	0.2174	(22b)

Mechanical extract ventilation - centralised

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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(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	
Doors			16.3400	1.2000	19.6080			(26)
Windows (Uw = 1.20)			13.2500	1.1450	15.1718			(27)
Heatloss Floor 1			116.6500	0.1200	13.9980			(28a)
External Wall 1	266.5400	29.5900	236.9500	0.1800	42.6510			(29a)
External Roof 1	95.9200		95.9200	0.0900	8.6328			(30)
Total net area of external elements Aum(A, m2)			479.1100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		100.0616			(33)
Party Wall 1			6.7100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	218.6000	(35)
Thermal bridges (User defined value 0.045 * total exposed area)	21.5600	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	121.6215	(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	102.7194	102.7194	102.7194	102.7194	102.7194	102.7194	102.7194	102.7194	102.7194	102.7194	102.7194	102.7194	(38)
Heat transfer coeff	224.3409	224.3409	224.3409	224.3409	224.3409	224.3409	224.3409	224.3409	224.3409	224.3409	224.3409	224.3409	(39)
Average = Sum(39)m / 12 =												224.3409	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0554	1.0554	1.0554	1.0554	1.0554	1.0554	1.0554	1.0554	1.0554	1.0554	1.0554	1.0554	(40)
HLP (average)												1.0554	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 3.0183 (42)

Hot water usage for mixer showers

	74.8263	73.7018	72.0632	68.9280	66.6143	64.0342	62.5676	64.1938	65.9764	68.7467	71.9493	74.5396 (42a)

Hot water usage for baths

	32.3010	31.8213	31.1457	29.9002	28.9675	27.9333	27.3747	28.0455	28.7759	29.8825	31.1537	32.1918 (42b)

Hot water usage for other uses

	45.5401	43.8841	42.2281	40.5721	38.9161	37.2601	37.2601	38.9161	40.5721	42.2281	43.8841	45.5401 (42c)

Average daily hot water use (litres/day) 140.3355 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	152.6674	149.4072	145.4370	139.4003	134.4979	129.2275	127.2023	131.1554	135.3244	140.8573	146.9871	152.2715	(44)
Energy conte	241.7878	212.7538	223.5313	190.8320	181.0601	158.9003	153.8402	162.3977	166.8685	191.1421	209.4101	238.4204	(45)
Energy content (annual)										Total = Sum(45)m =		2330.9443	
Distribution loss (46)m = 0.15 x (45)m	36.2682	31.9131	33.5297	28.6248	27.1590	23.8350	23.0760	24.3597	25.0303	28.6713	31.4115	35.7631	(46)

Water storage loss:

Store volume 300.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 2.0400 (48)

Temperature factor from Table 2b 0.6000 (49)

Enter (49) or (54) in (55) 1.2240 (55)

Total storage loss

	37.9440	34.2720	37.9440	36.7200	37.9440	36.7200	37.9440	37.9440	36.7200	37.9440	36.7200	37.9440	(56)

If cylinder contains dedicated solar storage

	37.9440	34.2720	37.9440	36.7200	37.9440	36.7200	37.9440	37.9440	36.7200	37.9440	36.7200	37.9440	(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

	302.9942	268.0370	284.7377	250.0640	242.2665	218.1323	215.0466	223.6041	226.1005	252.3485	268.6421	299.6268	(62)
WWHRS	-33.3156	-29.4646	-30.8536	-25.5480	-23.8099	-20.3743	-19.0976	-20.3084	-21.0800	-24.8510	-28.1532	-32.6987	(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

	269.6786	238.5724	253.8841	224.5160	218.4566	197.7581	195.9490	203.2957	205.0205	227.4975	240.4889	266.9281	(64)
										Total per year (kWh/year) = Sum(64)m =		2742.0454	(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

	129.3596	114.9672	123.2893	110.8372	109.1676	100.2200	100.1170	102.9624	102.8694	112.5199	117.0144	128.2399	(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	181.0962	181.0962	181.0962	181.0962	181.0962	181.0962	181.0962	181.0962	181.0962	181.0962	181.0962	181.0962	(66)

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

	64.7282	57.4910	46.7549	35.3964	26.4592	22.3380	24.1370	31.3742	42.1104	53.4688	62.4060	66.5272	(67)

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

	571.4036	577.3330	562.3912	530.5817	490.4280	452.6892	427.4774	421.5480	436.4899	468.2993	508.4530	546.1918	(68)

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

	56.1279	56.1279	56.1279	56.1279	56.1279	56.1279	56.1279	56.1279	56.1279	56.1279	56.1279	56.1279	(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)

	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	(71)

Water heating gains (Table 5)

	173.8704	171.0822	165.7114	153.9406	146.7306	139.1944	134.5658	138.3903	142.8741	151.2364	162.5201	172.3655	(72)

Total internal gains

	926.4955	922.3995	891.3507	836.4121	780.1112	730.7149	702.6735	707.8058	737.9676	789.4977	849.8723	901.5777	(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	1.5000	11.2829	0.7600	0.7000	0.7700	6.2396	(75)
Southeast	0.7500	36.7938	0.7600	0.7000	0.7700	10.1738	(77)
Southwest	6.1200	36.7938	0.7600	0.7000	0.7700	83.0178	(79)
Northwest	4.8800	11.2829	0.7600	0.7000	0.7700	20.2996	(81)

Solar gains	119.7308	212.7610	314.5238	428.9572	516.2906	528.3143	502.7939	435.2303	353.7730	241.4595	145.0152	101.4258	(83)
Total gains	1046.2263	1135.1605	1205.8745	1265.3693	1296.4018	1259.0292	1205.4674	1143.0360	1091.7407	1030.9573	994.8875	1003.0036	(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	57.5362	57.5362	57.5362	57.5362	57.5362	57.5362	57.5362	57.5362	57.5362	57.5362	57.5362	57.5362	
alpha	4.8357	4.8357	4.8357	4.8357	4.8357	4.8357	4.8357	4.8357	4.8357	4.8357	4.8357	4.8357	
util living area	0.9985	0.9975	0.9948	0.9865	0.9596	0.8782	0.7369	0.7837	0.9374	0.9892	0.9973	0.9988	(86)
MIT	19.4578	19.5846	19.8279	20.1631	20.5192	20.8116	20.9436	20.9223	20.7006	20.2503	19.7864	19.4205	(87)
Th 2	20.0374	20.0374	20.0374	20.0374	20.0374	20.0374	20.0374	20.0374	20.0374	20.0374	20.0374	20.0374	(88)
util rest of house	0.9980	0.9967	0.9930	0.9813	0.9409	0.8153	0.6110	0.6674	0.8996	0.9840	0.9963	0.9984	(89)
MIT 2	18.2163	18.3788	18.6901	19.1168	19.5609	19.8958	20.0121	19.9985	19.7812	19.2297	18.6376	18.1685	(90)
Living area fraction										fLA = Living area / (4) =		0.3116	(91)
MIT	18.6032	18.7545	19.0447	19.4428	19.8595	20.1812	20.3024	20.2863	20.0677	19.5477	18.9956	18.5587	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6032	18.7545	19.0447	19.4428	19.8595	20.1812	20.3024	20.2863	20.0677	19.5477	18.9956	18.5587	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9970	0.9951	0.9904	0.9768	0.9365	0.8263	0.6491	0.7013	0.9011	0.9802	0.9947	0.9976	(94)
Useful gains	1043.0984	1129.6202	1194.3517	1236.0278	1214.0832	1040.3896	782.4774	801.5558	983.7924	1010.5469	989.5868	1000.5523	(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													
	3208.7841	3108.1375	2814.2815	2365.1912	1830.5093	1252.0850	830.5950	871.8672	1338.7955	2007.3453	2668.6622	3221.2386	(97)
Space heating kWh													
	1611.2701	1329.5636	1205.2278	812.9977	458.6210	0.0000	0.0000	0.0000	0.0000	741.6180	1208.9343	1652.1906	(98a)
Space heating requirement - total per year (kWh/year)												9020.4231	
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													
	1611.2701	1329.5636	1205.2278	812.9977	458.6210	0.0000	0.0000	0.0000	0.0000	741.6180	1208.9343	1652.1906	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9020.4231	
Space heating per m2											(98c) / (4) =	42.4351	(99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Heat pump-Space and Water	1.0000	(303a)
Factor for control and charging method (Table 4c(3)) for space heating	1.0000	(305)
Factor for charging method (Table 4c(3)) for water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0000	(306)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

Space heating:

Space heating requirement													
	1611.2701	1329.5636	1205.2278	812.9977	458.6210	0.0000	0.0000	0.0000	0.0000	741.6180	1208.9343	1652.1906	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00													
307a	1611.2701	1329.5636	1205.2278	812.9977	458.6210	0.0000	0.0000	0.0000	0.0000	741.6180	1208.9343	1652.1906	
Space heating requirement													
	1611.2701	1329.5636	1205.2278	812.9977	458.6210	0.0000	0.0000	0.0000	0.0000	741.6180	1208.9343	1652.1906	(307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000	(308)
Space heating fuel for secondary/supplementary system													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(309)

Water heating

Annual water heating requirement													
	269.6786	238.5724	253.8841	224.5160	218.4566	197.7581	195.9490	203.2957	205.0205	227.4975	240.4889	266.9281	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00													
310a	269.6786	238.5724	253.8841	224.5160	218.4566	197.7581	195.9490	203.2957	205.0205	227.4975	240.4889	266.9281	
Water heating fuel													
	269.6786	238.5724	253.8841	224.5160	218.4566	197.7581	195.9490	203.2957	205.0205	227.4975	240.4889	266.9281	(310)
Cooling System Energy Efficiency Ratio												0.0000	(314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(315)
Pumps and Fa	21.6739	19.5764	21.6739	20.9747	21.6739	20.9747	21.6739	21.6739	20.9747	21.6739	20.9747	21.6739	(331)
Lighting	56.6562	45.4517	40.9243	29.9829	23.1596	18.9216	21.1270	27.4617	35.6700	46.8009	52.8615	58.2309	(332)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333a)m	-36.7367	-54.6431	-82.9027	-98.4459	-110.5852	-104.8083	-103.5003	-95.5175	-82.1084	-64.7527	-41.3806	-31.4291	(333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334a)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	(334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335a)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	(335a)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333b)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	(333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334b)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	(334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335b)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	(335b)

Annual totals kWh/year		
Space heating fuel - community heating	9020.4231	(307)
Space heating fuel - secondary	0.0000	(309)
Water heating fuel - community heating	2742.0454	(310)
Efficiency of water heater	0.0000	(311)
Electricity used for heat distribution	90.2042	(313)
Space cooling fuel	0.0000	(321)
Electricity for pumps and fans:		
(MEVCentralised, Database: in-use factor = 1.6000, SFP = 0.3360)		
mechanical ventilation fans (SFP = 0.3360)	255.1924	(330a)
Total electricity for the above, kWh/year	255.1924	(331)
Electricity for lighting (calculated in Appendix L)	457.2483	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-906.8106	(333)
Wind generation	0.0000	(334)
Hydro-electric generation (Appendix N)	0.0000	(335a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(335)
Appendix Q - special features		
Energy saved or generated	-0.0000	(336)
Energy used	0.0000	(337)
Total delivered energy for all uses	11568.0986	(338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Heat pump	9020.4231	4.4400	400.5068	(340a)
Space heating total			400.5068	(340)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Heat pump	2742.0454	4.4400	121.7468	(342a)
Water heating total			121.7468	(342)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(347a)
Pumps, fans and electric keep-hot	255.1924	16.4900	42.0812	(349)
Energy for lighting	457.2483	16.4900	75.4002	(350)
Additional standing charges			92.0000	(351)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-906.8106	16.4900	-149.5331	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-149.5331	(352)
Total energy cost			582.2020	(355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):		0.3600	(356)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8137	(357)
SAP value		86.8094	
SAP rating (Section 12)		87	(358)
SAP band		B	

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Heat pump			350.0000	(367)
Space and Water heating from Heat pump	3360.7053	0.1540	396.9371	(367)
Electrical energy for heat distribution (space & water)	90.2042	0.0000	17.7522	(372)
Overall CO2 factor for heat network			0.0446	(386)
Total CO2 associated with community systems			524.9582	(373)
Space and water heating			524.9582	(376)
Pumps, fans and electric keep-hot	255.1924	0.1387	35.3983	(378)
Energy for lighting	457.2483	0.1443	65.9951	(379)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-906.8106	0.1335	-121.0486	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-121.0486	(380)
Total CO2, kg/year			505.3030	(383)
CO2 emissions per m2			2.3800	(384)
EI value			97.3712	(384a)
EI rating			97	(385)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	116.6500	(1b)	x 3.2400	(2b) =	377.9460	(1b) - (3b)
First floor	95.9200	(1c)	x 2.5500	(2c) =	244.5960	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	212.5700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		622.5420	(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		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1850	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.1943	0.1850	0.1850	0.1711	0.1711	0.1526	0.1573	0.1480	0.1526	0.1619	0.1619	0.1758	(22b)
Mechanical extract ventilation - centralised													
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)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(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	
Doors			16.3400	1.2000	19.6080			(26)
Windows (Uw = 1.20)			13.2500	1.1450	15.1718			(27)

Heatloss Floor 1			116.6500	0.1200	13.9980	(28a)
External Wall 1	266.5400	29.5900	236.9500	0.1800	42.6510	(29a)
External Roof 1	95.9200		95.9200	0.0900	8.6328	(30)
Total net area of external elements Aum(A, m2)			479.1100			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		100.0616	(33)
Party Wall 1			6.7100	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	218.6000	(35)
Thermal bridges (User defined value 0.045 * total exposed area)	21.5600	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	121.6215	(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	102.7194	102.7194	102.7194	102.7194	102.7194	102.7194	102.7194	102.7194	102.7194	102.7194	102.7194	102.7194	(38)
Heat transfer coeff	224.3409	224.3409	224.3409	224.3409	224.3409	224.3409	224.3409	224.3409	224.3409	224.3409	224.3409	224.3409	(39)
Average = Sum(39)m / 12 =												224.3409	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0554	1.0554	1.0554	1.0554	1.0554	1.0554	1.0554	1.0554	1.0554	1.0554	1.0554	1.0554	(40)
HLP (average)												1.0554	
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												3.0183	(42)
Hot water usage for mixer showers	74.8263	73.7018	72.0632	68.9280	66.6143	64.0342	62.5676	64.1938	65.9764	68.7467	71.9493	74.5396	(42a)
Hot water usage for baths	32.3010	31.8213	31.1457	29.9002	28.9675	27.9333	27.3747	28.0455	28.7759	29.8825	31.1537	32.1918	(42b)
Hot water usage for other uses	45.5401	43.8841	42.2281	40.5721	38.9161	37.2601	37.2601	38.9161	40.5721	42.2281	43.8841	45.5401	(42c)
Average daily hot water use (litres/day)												140.3355	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	152.6674	149.4072	145.4370	139.4003	134.4979	129.2275	127.2023	131.1554	135.3244	140.8573	146.9871	152.2715	(44)
Energy conte	241.7878	212.7538	223.5313	190.8320	181.0601	158.9003	153.8402	162.3977	166.8685	191.1421	209.4101	238.4204	(45)
Energy content (annual)										Total = Sum(45)m =		2330.9443	
Distribution loss (46)m = 0.15 x (45)m	36.2682	31.9131	33.5297	28.6248	27.1590	23.8350	23.0760	24.3597	25.0303	28.6713	31.4115	35.7631	(46)
Water storage loss:													
Store volume												300.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0400	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												1.2240	(55)
Total storage loss	37.9440	34.2720	37.9440	36.7200	37.9440	36.7200	37.9440	37.9440	36.7200	37.9440	36.7200	37.9440	(56)
If cylinder contains dedicated solar storage	37.9440	34.2720	37.9440	36.7200	37.9440	36.7200	37.9440	37.9440	36.7200	37.9440	36.7200	37.9440	(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	302.9942	268.0370	284.7377	250.0640	242.2665	218.1323	215.0466	223.6041	226.1005	252.3485	268.6421	299.6268	(62)
WWHRS	-33.3156	-29.4646	-30.8536	-25.5480	-23.8099	-20.3743	-19.0976	-20.3084	-21.0800	-24.8510	-28.1532	-32.6987	(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	269.6786	238.5724	253.8841	224.5160	218.4566	197.7581	195.9490	203.2957	205.0205	227.4975	240.4889	266.9281	(64)
									Total per year (kWh/year) = Sum(64)m =			2742.0454	(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	129.3596	114.9672	123.2893	110.8372	109.1676	100.2200	100.1170	102.9624	102.8694	112.5199	117.0144	128.2399	(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	181.0962	181.0962	181.0962	181.0962	181.0962	181.0962	181.0962	181.0962	181.0962	181.0962	181.0962	181.0962	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.7282	57.4910	46.7549	35.3964	26.4592	22.3380	24.1370	31.3742	42.1104	53.4688	62.4060	66.5272	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	571.4036	577.3330	562.3912	530.5817	490.4280	452.6892	427.4774	421.5480	436.4899	468.2993	508.4530	546.1918	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.1279	56.1279	56.1279	56.1279	56.1279	56.1279	56.1279	56.1279	56.1279	56.1279	56.1279	56.1279	(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)	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	-120.7308	(71)
Water heating gains (Table 5)	173.8704	171.0822	165.7114	153.9406	146.7306	139.1944	134.5658	138.3903	142.8741	151.2364	162.5201	172.3655	(72)
Total internal gains	926.4955	922.3995	891.3507	836.4121	780.1112	730.7149	702.6735	707.8058	737.9676	789.4977	849.8723	901.5777	(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	1.5000	12.9236	0.7600	0.7000	0.7700	7.1469	(75)
Southeast	0.7500	40.4699	0.7600	0.7000	0.7700	11.1902	(77)
Southwest	6.1200	40.4699	0.7600	0.7000	0.7700	91.3122	(79)
Northwest	4.8800	12.9236	0.7600	0.7000	0.7700	23.2513	(81)

Solar gains	132.9006	213.0407	312.6094	441.8327	519.8274	569.8478	536.2390	473.5639	382.0204	258.5729	165.0094	111.4345	(83)
Total gains	1059.3961	1135.4402	1203.9601	1278.2447	1299.9386	1300.5627	1238.9125	1181.3696	1119.9880	1048.0707	1014.8817	1013.0122	(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	57.5362	57.5362	57.5362	57.5362	57.5362	57.5362	57.5362	57.5362	57.5362	57.5362	57.5362	57.5362	
alpha	4.8357	4.8357	4.8357	4.8357	4.8357	4.8357	4.8357	4.8357	4.8357	4.8357	4.8357	4.8357	
util living area													
	0.9980	0.9969	0.9932	0.9802	0.9316	0.7622	0.5457	0.5850	0.8844	0.9826	0.9960	0.9984	(86)
MIT	19.5674	19.6741	19.9410	20.2938	20.6669	20.9255	20.9889	20.9847	20.8227	20.3841	19.9123	19.5412	(87)
Th 2	20.0374	20.0374	20.0374	20.0374	20.0374	20.0374	20.0374	20.0374	20.0374	20.0374	20.0374	20.0374	(88)
util rest of house													
	0.9974	0.9959	0.9908	0.9720	0.8983	0.6546	0.3846	0.4210	0.8153	0.9736	0.9945	0.9979	(89)
MIT 2	18.3569	18.4934	18.8346	19.2817	19.7363	19.9976	20.0352	20.0341	19.9114	19.3984	18.7987	18.3233	(90)
Living area fraction										fLA = Living area / (4) =		0.3116	(91)
MIT	18.7341	18.8613	19.1794	19.5971	20.0263	20.2868	20.3324	20.3303	20.1954	19.7056	19.1457	18.7028	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7341	18.8613	19.1794	19.5971	20.0263	20.2868	20.3324	20.3303	20.1954	19.7056	19.1457	18.7028	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9961	0.9941	0.9877	0.9670	0.8978	0.6854	0.4357	0.4732	0.8289	0.9693	0.9924	0.9968	(94)
Useful gains	1055.2794	1128.7562	1189.1704	1236.0594	1167.0667	891.4127	539.8544	559.0081	928.3494	1015.8621	1007.1396	1009.7376	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W													
	3058.6878	2975.0485	2642.5966	2175.4593	1576.2858	961.6965	545.6951	567.6475	1120.6641	1818.4073	2500.4428	3051.6755	(97)
Space heating kWh													
	1490.5358	1240.7084	1081.3491	676.3679	304.4590	0.0000	0.0000	0.0000	0.0000	597.0936	1075.1783	1519.2018	(98a)
Space heating requirement - total per year (kWh/year)												7984.8940	
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													
	1490.5358	1240.7084	1081.3491	676.3679	304.4590	0.0000	0.0000	0.0000	0.0000	597.0936	1075.1783	1519.2018	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7984.8940	
Space heating per m2											(98c) / (4) =	37.5636	(99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(301)
Fraction of space heat from community system												1.0000	(302)
Fraction of heat from community Heat pump-Space and Water												1.0000	(303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000	(305)
Factor for charging method (Table 4c(3)) for water heating												1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system												1.0000	(306)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating:													
Space heating requirement													
	1490.5358	1240.7084	1081.3491	676.3679	304.4590	0.0000	0.0000	0.0000	0.0000	597.0936	1075.1783	1519.2018	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00													
307a	1490.5358	1240.7084	1081.3491	676.3679	304.4590	0.0000	0.0000	0.0000	0.0000	597.0936	1075.1783	1519.2018	
Space heating requirement													
	1490.5358	1240.7084	1081.3491	676.3679	304.4590	0.0000	0.0000	0.0000	0.0000	597.0936	1075.1783	1519.2018	(307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000	(308)
Space heating fuel for secondary/supplementary system													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(309)
Water heating													
Annual water heating requirement													
	269.6786	238.5724	253.8841	224.5160	218.4566	197.7581	195.9490	203.2957	205.0205	227.4975	240.4889	266.9281	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00													
310a	269.6786	238.5724	253.8841	224.5160	218.4566	197.7581	195.9490	203.2957	205.0205	227.4975	240.4889	266.9281	
Water heating fuel													
	269.6786	238.5724	253.8841	224.5160	218.4566	197.7581	195.9490	203.2957	205.0205	227.4975	240.4889	266.9281	(310)
Cooling System Energy Efficiency Ratio												0.0000	(314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(315)
Pumps and Fa	21.6739	19.5764	21.6739	20.9747	21.6739	20.9747	21.6739	21.6739	20.9747	21.6739	20.9747	21.6739	(331)
Lighting	56.6562	45.4517	40.9243	29.9829	23.1596	18.9216	21.1270	27.4617	35.6700	46.8009	52.8615	58.2309	(332)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333a)m	-40.4216	-55.0561	-82.8076	-100.3698	-110.8480	-109.3321	-107.2828	-100.5082	-86.5507	-68.4721	-46.2906	-34.3364	(333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334a)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	(334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335a)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	(335a)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333b)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	(333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334b)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	(334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335b)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	(335b)
Annual totals kWh/year													
Space heating fuel - community heating												7984.8940	(307)
Space heating fuel - secondary												0.0000	(309)
Water heating fuel - community heating												2742.0454	(310)
Efficiency of water heater												0.0000	(311)
Electricity used for heat distribution												79.8489	(313)
Space cooling fuel												0.0000	(321)
Electricity for pumps and fans:													
(MEVCentralised, Database: in-use factor = 1.6000, SFP = 0.3360)													
mechanical ventilation fans (SFP = 0.3360)												255.1924	(330a)
Total electricity for the above, kWh/year												255.1924	(331)
Electricity for lighting (calculated in Appendix L)												457.2483	(332)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-942.2760	(333)
Wind generation												0.0000	(334)
Hydro-electric generation (Appendix N)												0.0000	(335a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(335)

Appendix Q - special features		
Energy saved or generated	-0.0000	(336)
Energy used	0.0000	(337)
Total delivered energy for all uses	10497.1041	(338)

10b. Fuel costs - using BEDF prices (533)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Heat pump	7984.8940	4.8000	383.2749	(340a)
Space heating total			383.2749	(340)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Heat pump	2742.0454	4.8000	131.6182	(342a)
Water heating total			131.6182	(342)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(347a)
Pumps, fans and electric keep-hot	255.1924	21.5100	54.8919	(349)
Energy for lighting	457.2483	21.5100	98.3541	(350)
Additional standing charges			98.0000	(351)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-942.2760	21.5100	-202.6836	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-202.6836	(352)
Total energy cost			563.4555	(355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Heat pump			350.0000	(367)
Space and Water heating from Heat pump	3064.8398	0.1547	352.8608	(367)
Electrical energy for heat distribution (space & water)	79.8489	0.0000	16.2095	(372)
Overall CO2 factor for heat network			0.0447	(386)
Total CO2 associated with community systems			479.3393	(373)
Space and water heating			479.3393	(376)
Pumps, fans and electric keep-hot	255.1924	0.1387	35.3983	(378)
Energy for lighting	457.2483	0.1443	65.9951	(379)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-942.2760	0.1335	-125.7953	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-125.7953	(380)
Total CO2, kg/year			454.9373	(383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Heat pump			350.0000	(467a)
Space and Water heating from Heat pump	3064.8398	1.5726	3587.8206	(467)
Electrical energy for heat distribution (space & water)	79.8489	0.0000	167.2647	(472)
Overall CO2 factor for heat network			0.4611	(486)
Total CO2 associated with community systems			4946.2553	(473)
Space and water heating			4946.2553	(476)
Pumps, fans and electric keep-hot	255.1924	1.5128	386.0551	(478)
Energy for lighting	457.2483	1.5338	701.3427	(479)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-942.2760	1.4933	-1407.1236	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1407.1236	(480)
Total Primary energy kWh/year			4626.5295	(483)

Full SAP Calculation Printout

Property Reference	2B4P SF flat	**Issued on Date**	21/12/2023
Assessment Reference	GSHP Heat Network_WWHR	**Prop Type Ref**	
Property			

SAP Rating	87 B	**DER**	2.19	**TER**	8.82
Environmental	98 A	**% DER < TER**			75.17
CO_2 Emissions (t/year)	0.26	**DFEE**	30.82	**TFEE**	32.20
Compliance Check	See BREL	**% DFEE < TFEE**			4.30
% DPER < TPER	50.37	**DPER**	22.80	**TPER**	45.95

Assessor Details	Ms. Ruth Ferguson	**Assessor ID**	AE69-0001
Client	194 Goldhurst Terrace, 194 Goldhurst Terrace		

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)	
Ground floor	77.1000 (1b)	x	2.8900 (2b)	=	222.8190	(1b) - (3b)
First floor	54.6000 (1c)	x	2.6100 (2c)	=	142.5060	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	131.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	365.3250	(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			4.0000	(17)
Infiltration rate			0.2000	(18)
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.1700	(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	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Mechanical extract ventilation - centralised

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)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(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	
Doors			4.5200	1.2000	5.4240			(26)
Windows (Uw = 1.20)			18.2300	1.1450	20.8740			(27)
External Wall 1	78.7500	18.2300	60.5200	0.1900	11.4988			(29a)
Wall to stairwell	11.7100	4.5200	7.1900	0.1700	1.2223			(29a)
External Roof 1	77.1000		77.1000	0.1100	8.4810			(30)
Total net area of external elements Aum(A, m2)			167.5600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.5001			(33)
Party Wall 1			29.3100	0.0000	0.0000			(32)
Party Floor 1			77.1000					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	265.8900	(35)
Thermal bridges (User defined value 0.045 * total exposed area)	7.5402	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	55.0403	(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	60.2786	60.2786	60.2786	60.2786	60.2786	60.2786	60.2786	60.2786	60.2786	60.2786	60.2786	60.2786	(38)
Heat transfer coeff	115.3190	115.3190	115.3190	115.3190	115.3190	115.3190	115.3190	115.3190	115.3190	115.3190	115.3190	115.3190	(39)
Average = Sum(39)m / 12 =												115.3190	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8756	0.8756	0.8756	0.8756	0.8756	0.8756	0.8756	0.8756	0.8756	0.8756	0.8756	0.8756	(40)
HLP (average)												0.8756	
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 2.8993 (42)

Hot water usage for mixer showers

93.5812	92.1749	90.1256	86.2046	83.3110	80.0841	78.2499	80.2837	82.5131	85.9779	89.9831	93.2227	(42a)

Hot water usage for baths

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

44.3214	42.7097	41.0980	39.4863	37.8746	36.2629	36.2629	37.8746	39.4863	41.0980	42.7097	44.3214	(42c)

Average daily hot water use (litres/day) 126.5709 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.9026	134.8846	131.2236	125.6909	121.1856	116.3470	114.5128	118.1583	121.9994	127.0759	132.6928	137.5441	(44)
Energy conte	218.4040	192.0739	201.6858	172.0646	163.1391	143.0622	138.4933	146.3047	150.4375	172.4407	189.0452	215.3608	(45)
Energy content (annual)											Total = Sum(45)m =	2102.5118	

Distribution loss (46)m = 0.15 x (45)m

32.7606	28.8111	30.2529	25.8097	24.4709	21.4593	20.7740	21.9457	22.5656	25.8661	28.3568	32.3041	(46)

Water storage loss:

Store volume 150.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.2200 (48)

Temperature factor from Table 2b 0.6000 (49)

Enter (49) or (54) in (55) 0.7320 (55)

Total storage loss

22.6920	20.4960	22.6920	21.9600	22.6920	21.9600	22.6920	22.6920	21.9600	22.6920	21.9600	22.6920	(56)

If cylinder contains dedicated solar storage

22.6920	20.4960	22.6920	21.9600	22.6920	21.9600	22.6920	22.6920	21.9600	22.6920	21.9600	22.6920	(57)
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)
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)

Primary loss / Combi loss

Total heat required for water heating calculated for each month

264.3584	233.5811	247.6402	216.5366	209.0935	187.5342	184.4477	192.2591	194.9095	218.3951	233.5172	261.3152	(62)
-83.3321	-73.6996	-77.1740	-63.9031	-59.5554	-50.9620	-47.7687	-50.7973	-52.7272	-62.1596	-70.4193	-81.7889	(63a)
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)
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)
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)

WWHRS / PV diverter / Solar input / FGHRS

Output from w/h

181.0263	159.8814	170.4662	152.6334	149.5381	136.5722	136.6790	141.4618	142.1823	156.2355	163.0979	179.5262	(64)
									Total per year (kWh/year) = Sum(64)m =		1869.3005	(64)
12Total per year (kWh/year)											1869	(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

109.3829	97.0703	103.8240	92.7891	91.0073	83.1458	82.8126	85.4098	85.5981	94.1001	98.4351	108.3710	(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	144.9633	144.9633	144.9633	144.9633	144.9633	144.9633	144.9633	144.9633	144.9633	144.9633	144.9633	144.9633	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	162.6045	180.0264	162.6045	168.0246	162.6045	168.0246	162.6045	162.6045	168.0246	162.6045	168.0246	162.6045	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	299.7580	302.8685	295.0301	278.3428	257.2782	237.4805	224.2544	221.1438	228.9823	245.6695	266.7341	286.5319	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4963	37.4963	37.4963	37.4963	37.4963	37.4963	37.4963	37.4963	37.4963	37.4963	37.4963	37.4963	(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)	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	(71)
Water heating gains (Table 5)	147.0200	144.4499	139.5484	128.8737	122.3216	115.4803	111.3072	114.7982	118.8862	126.4786	136.7154	145.6599	(72)
Total internal gains	675.8714	693.8338	663.6719	641.7301	608.6933	587.4743	564.6550	565.0354	582.3821	601.2415	637.9631	661.2852	(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	6.6900	10.6334	0.7600	0.7000	0.7700	26.2266	(74)
East	7.6700	19.6403	0.7600	0.7000	0.7700	55.5377	(76)
South	3.8700	46.7521	0.7600	0.7000	0.7700	66.7047	(78)

Solar gains	148.4690	268.0091	403.2461	555.0243	667.9747	682.3758	649.9634	563.5078	455.8579	306.4076	180.6707	125.1743	(83)
Total gains	824.3404	961.8428	1066.9181	1196.7544	1276.6679	1269.8501	1214.6184	1128.5433	1038.2400	907.6491	818.6339	786.4595	(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	84.3499	84.3499	84.3499	84.3499	84.3499	84.3499	84.3499	84.3499	84.3499	84.3499	84.3499	84.3499	
alpha	6.6233	6.6233	6.6233	6.6233	6.6233	6.6233	6.6233	6.6233	6.6233	6.6233	6.6233	6.6233	
util living area													

	0.9979	0.9938	0.9809	0.9254	0.7824	0.5744	0.4170	0.4684	0.7310	0.9564	0.9943	0.9985	(86)
MIT	20.1023	20.2670	20.4910	20.7657	20.9401	20.9930	20.9993	20.9985	20.9701	20.7304	20.3580	20.0625	(87)
Th 2	20.1883	20.1883	20.1883	20.1883	20.1883	20.1883	20.1883	20.1883	20.1883	20.1883	20.1883	20.1883	(88)
util rest of house	0.9972	0.9917	0.9745	0.9024	0.7313	0.5047	0.3405	0.3867	0.6590	0.9377	0.9920	0.9980	(89)
MIT 2	19.1335	19.3434	19.6257	19.9566	20.1410	20.1845	20.1880	20.1878	20.1695	19.9224	19.4602	19.0826	(90)
Living area fraction										fLA = Living area / (4) =		0.2323	(91)
MIT	19.3586	19.5580	19.8267	20.1446	20.3267	20.3724	20.3765	20.3761	20.3555	20.1102	19.6688	19.3103	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3586	19.5580	19.8267	20.1446	20.3267	20.3724	20.3765	20.3761	20.3555	20.1102	19.6688	19.3103	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9962	0.9896	0.9709	0.9010	0.7405	0.5207	0.3583	0.4057	0.6745	0.9355	0.9900	0.9972	(94)
Useful gains	821.2156	951.8049	1035.9066	1078.2183	945.3430	661.2387	435.1920	457.8224	700.3303	849.1319	810.4282	784.2329	(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	1736.5409	1690.3428	1536.8241	1296.7175	994.8181	665.6648	435.5053	458.5216	721.3831	1096.7026	1449.4212	1742.5032	(97)
Space heating kWh	681.0020	496.2975	372.6826	157.3194	36.8095	0.0000	0.0000	0.0000	0.0000	184.1926	460.0749	712.9531	(98a)
Space heating requirement - total per year (kWh/year)												3101.3316	
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	681.0020	496.2975	372.6826	157.3194	36.8095	0.0000	0.0000	0.0000	0.0000	184.1926	460.0749	712.9531	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3101.3316	
Space heating per m2											(98c) / (4) =	23.5485	(99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(301)
Fraction of space heat from community system												1.0000	(302)
Fraction of heat from community Heat pump-Space and Water												1.0000	(303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000	(305)
Factor for charging method (Table 4c(3)) for water heating												1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system												1.0000	(306)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating:													
Space heating requirement													
	681.0020	496.2975	372.6826	157.3194	36.8095	0.0000	0.0000	0.0000	0.0000	184.1926	460.0749	712.9531	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00													
307a	681.0020	496.2975	372.6826	157.3194	36.8095	0.0000	0.0000	0.0000	0.0000	184.1926	460.0749	712.9531	
Space heating requirement													
	681.0020	496.2975	372.6826	157.3194	36.8095	0.0000	0.0000	0.0000	0.0000	184.1926	460.0749	712.9531	(307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000	(308)
Space heating fuel for secondary/supplementary system													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(309)
Water heating													
Annual water heating requirement													
	181.0263	159.8814	170.4662	152.6334	149.5381	136.5722	136.6790	141.4618	142.1823	156.2355	163.0979	179.5262	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00													
310a	181.0263	159.8814	170.4662	152.6334	149.5381	136.5722	136.6790	141.4618	142.1823	156.2355	163.0979	179.5262	
Water heating fuel													
	181.0263	159.8814	170.4662	152.6334	149.5381	136.5722	136.6790	141.4618	142.1823	156.2355	163.0979	179.5262	(310)
Cooling System Energy Efficiency Ratio												0.0000	(314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(315)
Pumps and Fa	12.7188	11.4880	12.7188	12.3085	12.7188	12.3085	12.7188	12.7188	12.3085	12.7188	12.3085	12.7188	(331)
Lighting	39.4455	31.6446	28.4925	20.8748	16.1243	13.1737	14.7091	19.1195	24.8343	32.5840	36.8035	40.5418	(332)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333a)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	(333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334a)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	(334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335a)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	(335a)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333b)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	(333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334b)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	(334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335b)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	(335b)
Annual totals kWh/year													
Space heating fuel - community heating												3101.3316	(307)
Space heating fuel - secondary												0.0000	(309)
Water heating fuel - community heating												1869.3005	(310)
Efficiency of water heater												0.0000	(311)
Electricity used for heat distribution												31.0133	(313)
Space cooling fuel												0.0000	(321)
Electricity for pumps and fans:													
(MEVCentralised, Database: in-use factor = 1.6000, SFP = 0.3360)													
mechanical ventilation fans (SFP = 0.3360)												149.7540	(330a)
Total electricity for the above, kWh/year												149.7540	(331)
Electricity for lighting (calculated in Appendix L)												318.3476	(332)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(333)
Wind generation												0.0000	(334)
Hydro-electric generation (Appendix N)												0.0000	(335a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(335)
Appendix Q - special features													
Energy saved or generated												-0.0000	(336)
Energy used												0.0000	(337)
Total delivered energy for all uses												5438.7338	(338)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	

Efficiency of heat source Heat pump			350.0000	(367)
Space and Water heating from Heat pump	1420.1806	0.1566	138.7199	(367)
Electrical energy for heat distribution (space & water)	31.0133	0.0000	7.4814	(372)
Overall CO2 factor for heat network			0.0445	(386)
Total CO2 associated with community systems			221.2368	(373)
Space and water heating			221.2368	(376)
Pumps, fans and electric keep-hot	149.7540	0.1387	20.7727	(378)
Energy for lighting	318.3476	0.1443	45.9474	(379)
Total CO2, kg/year			287.9569	(383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.1900	(384)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Heat pump			350.0000	(467a)
Space and Water heating from Heat pump	1420.1806	1.5796	1399.6477	(467)
Electrical energy for heat distribution (space & water)	31.0133	0.0000	77.3912	(472)
Overall CO2 factor for heat network			0.4604	(486)
Total CO2 associated with community systems			2288.5672	(473)
Space and water heating			2288.5672	(476)
Pumps, fans and electric keep-hot	149.7540	1.5128	226.5479	(478)
Energy for lighting	318.3476	1.5338	488.2923	(479)
Total Primary energy kWh/year			3003.4073	(483)
Dwelling Primary energy Rate (DPER)			22.8000	(484)

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)	
Ground floor	77.1000 (1b)	x	2.8900 (2b)	=	222.8190	(1b) - (3b)
First floor	54.6000 (1c)	x	2.6100 (2c)	=	142.5060	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	131.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	365.3250	(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) =	0.1095	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3595	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3056	(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	0.3896	0.3820	0.3743	0.3361	0.3285	0.2903	0.2903	0.2827	0.3056	0.3285	0.3438	0.3590	(22b)
Effective ac	0.5759	0.5729	0.5701	0.5565	0.5540	0.5421	0.5421	0.5399	0.5467	0.5540	0.5591	0.5645	(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	
TER Opaque door			4.5200	1.0000	4.5200			(26)
TER Opening Type (Uw = 1.20)			18.2300	1.1450	20.8740			(27)
External Wall 1	78.7500	18.2300	60.5200	0.1800	10.8936			(29a)
Wall to stairwell	11.7100	4.5200	7.1900	0.1800	1.2942			(29a)
External Roof 1	77.1000		77.1000	0.1100	8.4810			(30)
Total net area of external elements Aum(A, m2)			167.5600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.0628			(33)
Party Wall 1			29.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K			265.8900	(35)
List of Thermal Bridges				
K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	11.2200	0.0500	0.5610	
E3 Sill	9.0700	0.0500	0.4535	

E4 Jamb	36.3600	0.0500	1.8180		
E7 Party floor between dwellings (in blocks of flats)	27.2400	0.0700	1.9068		
E16 Corner (normal)	5.7800	0.0900	0.5202		
E18 Party wall between dwellings	5.7800	0.0600	0.3468		
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	20.2800	0.0000	0.0000		
E10 Eaves (insulation at ceiling level)	27.2400	0.0600	1.6344		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				7.2407	(36)
Point Thermal bridges			(36a) =	0.0000	
Total fabric heat loss			(33) + (36) + (36a) =	53.3035	(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	69.4282	69.0729	68.7246	67.0889	66.7828	65.3582	65.3582	65.0944	65.9069	66.7828	67.4020	68.0492	(38)
Heat transfer coeff	122.7317	122.3764	122.0282	120.3924	120.0864	118.6617	118.6617	118.3979	119.2105	120.0864	120.7055	121.3528	(39)
Average = Sum(39)m / 12 =												120.3910	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9319	0.9292	0.9266	0.9141	0.9118	0.9010	0.9010	0.8990	0.9052	0.9118	0.9165	0.9214	(40)
HLP (average)												0.9141	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8993	(42)
Hot water usage for mixer showers	93.5812	92.1749	90.1256	86.2046	83.3110	80.0841	78.2499	80.2837	82.5131	85.9779	89.9831	93.2227	(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses	44.3214	42.7097	41.0980	39.4863	37.8746	36.2629	36.2629	37.8746	39.4863	41.0980	42.7097	44.3214	(42c)
Average daily hot water use (litres/day)												126.5709	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.9026	134.8846	131.2236	125.6909	121.1856	116.3470	114.5128	118.1583	121.9994	127.0759	132.6928	137.5441	(44)
Energy conte	218.4040	192.0739	201.6858	172.0646	163.1391	143.0622	138.4933	146.3047	150.4375	172.4407	189.0452	215.3608	(45)
Energy content (annual)										Total = Sum(45)m =		2102.5118	
Distribution loss (46)m = 0.15 x (45)m	32.7606	28.8111	30.2529	25.8097	24.4709	21.4593	20.7740	21.9457	22.5656	25.8661	28.3568	32.3041	(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	264.9990	234.1596	248.2807	217.1564	209.7340	188.1541	185.0882	192.8996	195.5294	219.0356	234.1370	261.9557	(62)
WWHRS	-42.7814	-37.8363	-39.6199	-32.8069	-30.5748	-26.1631	-24.5237	-26.0785	-27.0694	-31.9118	-36.1522	-41.9892	(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	222.2175	196.3233	208.6607	184.3495	179.1592	161.9910	160.5645	166.8211	168.4600	187.1239	197.9848	219.9665	(64)
									Total per year (kWh/year) = Sum(64)m =			2253.6220	(64)
12Total per year (kWh/year)												2254	(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	109.8953	97.5331	104.3364	93.2849	91.5197	83.6417	83.3250	85.9222	86.0939	94.6125	98.9310	108.8834	(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	144.9633	144.9633	144.9633	144.9633	144.9633	144.9633	144.9633	144.9633	144.9633	144.9633	144.9633	144.9633	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	162.6045	180.0264	162.6045	168.0246	162.6045	168.0246	162.6045	162.6045	168.0246	162.6045	168.0246	162.6045	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	299.7580	302.8685	295.0301	278.3428	257.2782	237.4805	224.2544	221.1438	228.9823	245.6695	266.7341	286.5319	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4963	37.4963	37.4963	37.4963	37.4963	37.4963	37.4963	37.4963	37.4963	37.4963	37.4963	37.4963	(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)	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	(71)
Water heating gains (Table 5)	147.7087	145.1386	140.2371	129.5624	123.0103	116.1690	111.9959	115.4869	119.5749	127.1673	137.4042	146.3486	(72)
Total internal gains	679.5601	697.5225	667.3606	645.4188	612.3820	588.1630	565.3437	565.7241	583.0708	604.9302	641.6519	664.9739	(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	6.6900	10.6334	0.6300	0.7000	0.7700	21.7405	(74)
East	7.6700	19.6403	0.6300	0.7000	0.7700	46.0378	(76)
South	3.8700	46.7521	0.6300	0.7000	0.7700	55.2947	(78)

Solar gains	123.0730	222.1654	334.2698	460.0859	553.7158	565.6536	538.7855	467.1183	377.8822	253.9958	149.7665	103.7629	(83)
Total gains	802.6331	919.6879	1001.6305	1105.5048	1166.0978	1153.8166	1104.1292	1032.8425	960.9530	858.9260	791.4184	768.7369	(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	79.2553	79.4854	79.7123	80.7953	81.0012	81.9737	81.9737	82.1564	81.5964	81.0012	80.5857	80.1559	
alpha	6.2837	6.2990	6.3142	6.3864	6.4001	6.4649	6.4649	6.4771	6.4398	6.4001	6.3724	6.3437	
util living area													
	0.9983	0.9956	0.9879	0.9524	0.8455	0.6424	0.4709	0.5233	0.7899	0.9697	0.9956	0.9987	(86)
MIT	19.9945	20.1501	20.3712	20.6737	20.8942	20.9853	20.9982	20.9967	20.9486	20.6637	20.2812	19.9743	(87)
Th 2	20.1405	20.1427	20.1450	20.1555	20.1575	20.1666	20.1666	20.1684	20.1631	20.1575	20.1535	20.1493	(88)
util rest of house													
	0.9977	0.9941	0.9835	0.9355	0.7985	0.5657	0.3828	0.4309	0.7183	0.9554	0.9938	0.9983	(89)
MIT 2	18.9588	19.1592	19.4415	19.8227	20.0698	20.1586	20.1661	20.1672	20.1293	19.8182	19.3356	18.9397	(90)
Living area fraction										fLA = Living area / (4) =		0.2323	(91)
MIT	19.1994	19.3895	19.6575	20.0204	20.2613	20.3506	20.3594	20.3599	20.3197	20.0146	19.5553	19.1801	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1994	19.3895	19.6575	20.0204	20.2613	20.3506	20.3594	20.3599	20.3197	20.0146	19.5553	19.1801	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9968	0.9922	0.9803	0.9322	0.8048	0.5831	0.4033	0.4524	0.7328	0.9524	0.9920	0.9975	(94)
Useful gains	800.0774	912.5463	981.8546	1030.5786	938.4720	672.8462	445.3422	467.3060	704.1492	818.0202	785.0822	766.8462	(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													
	1828.6310	1773.1670	1605.5878	1338.8166	1028.0978	682.3806	446.1019	468.8469	741.4522	1130.5674	1503.4237	1817.8793	(97)
Space heating kWh													
	765.2438	578.3371	464.0575	221.9314	66.6816	0.0000	0.0000	0.0000	0.0000	232.5351	517.2059	781.9686	(98a)
Space heating requirement - total per year (kWh/year)												3627.9610	
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													
	765.2438	578.3371	464.0575	221.9314	66.6816	0.0000	0.0000	0.0000	0.0000	232.5351	517.2059	781.9686	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3627.9610	
Space heating per m2											(98c) / (4) =	27.5472	(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													
	765.2438	578.3371	464.0575	221.9314	66.6816	0.0000	0.0000	0.0000	0.0000	232.5351	517.2059	781.9686	(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)													
	829.0833	626.5841	502.7708	240.4457	72.2444	0.0000	0.0000	0.0000	0.0000	251.9340	560.3531	847.2033	(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													
	222.2175	196.3233	208.6607	184.3495	179.1592	161.9910	160.5645	166.8211	168.4600	187.1239	197.9848	219.9665	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.6020	86.3324	85.7986	84.4769	82.0557	79.8000	79.8000	79.8000	79.8000	84.5482	86.1115	86.6544	(217)
Fuel for water heating, kWh/month													
	256.5963	227.4040	243.1984	218.2247	218.3384	202.9962	201.2087	209.0489	211.1028	221.3222	229.9169	253.8434	(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	33.7860	27.1044	24.4045	17.8798	13.8109	11.2836	12.5987	16.3763	21.2712	27.9089	31.5231	34.7250	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-42.7671	-61.1825	-89.1926	-101.7038	-110.8039	-103.7517	-102.4101	-96.1038	-85.1936	-70.5526	-47.3099	-36.8663	(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	-21.5112	-45.5404	-91.0780	-137.6403	-182.8584	-184.1152	-182.0131	-153.7654	-112.2065	-65.4793	-28.8284	-16.9938	(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												3930.6187	(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												2693.2007	(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)												272.6723	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2169.8675	(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	4812.6242	(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	3930.6187	0.2100	825.4299	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2693.2007	0.2100	565.5721	(264)
Space and water heating			1391.0021	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	272.6723	0.1443	39.3550	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-947.8378	0.1343	-127.2996	
PV Unit electricity exported	-1222.0297	0.1257	-153.6154	
Total			-280.9150	(269)
Total CO2, kg/year			1161.3714	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.8200	(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	3930.6187	1.1300	4441.5991	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2693.2007	1.1300	3043.3168	(278)
Space and water heating			7484.9159	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	272.6723	1.5338	418.2339	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-947.8378	1.4964	-1418.3007	
PV Unit electricity exported	-1222.0297	0.4614	-563.8621	
Total			-1982.1629	(283)
Total Primary energy kWh/year			6051.0877	(286)
Target Primary Energy Rate (TPER)			45.9500	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	77.1000 (1b)	x	2.8900 (2b)	=	222.8190	(1b) - (3b)
First floor	54.6000 (1c)	x	2.6100 (2c)	=	142.5060	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 131.7000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	365.3250	(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) = 0.1095	(8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	4.0000	(17)
Infiltration rate	0.3095	(18)
Number of sides sheltered	2	(19)
Shelter factor (20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) =	0.2631	(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	0.3354	0.3288	0.3223	0.2894	0.2828	0.2499	0.2499	0.2433	0.2631	0.2828	0.2960	0.3091	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5563	0.5541	0.5519	0.5419	0.5400	0.5312	0.5312	0.5296	0.5346	0.5400	0.5438	0.5478	(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	
Doors			4.5200	1.2000	5.4240			(26)
Windows (Uw = 1.20)			18.2300	1.1450	20.8740			(27)
External Wall 1	78.7500	18.2300	60.5200	0.1900	11.4988			(29a)
Wall to stairwell	11.7100	4.5200	7.1900	0.1700	1.2223			(29a)
External Roof 1	77.1000		77.1000	0.1100	8.4810			(30)
Total net area of external elements Aum(A, m2)			167.5600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	47.5001			(33)
Party Wall 1			29.3100	0.0000	0.0000			(32)
Party Floor 1			77.1000					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	265.8900	(35)
Thermal bridges (User defined value 0.045 * total exposed area)	7.5402	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	55.0403	(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	67.0600	66.7967	66.5386	65.3262	65.0994	64.0435	64.0435	63.8479	64.4502	65.0994	65.5583	66.0380	(38)
Heat transfer coeff	122.1004	121.8370	121.5789	120.3666	120.1397	119.0838	119.0838	118.8883	119.4905	120.1397	120.5986	121.0783	(39)
Average = Sum(39)m / 12 =												120.3655	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9271	0.9251	0.9232	0.9139	0.9122	0.9042	0.9042	0.9027	0.9073	0.9122	0.9157	0.9193	(40)
HLP (average)												0.9139	
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	2.8993	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

31.4429	30.9760	30.3184	29.1059	28.1980	27.1913	26.6475	27.3005	28.0115	29.0887	30.3262	31.3366	(42b)

Hot water usage for other uses

44.3214	42.7097	41.0980	39.4863	37.8746	36.2629	36.2629	37.8746	39.4863	41.0980	42.7097	44.3214	(42c)

Average daily hot water use (litres/day)	69.4447	(43)

Daily hot water use

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
75.7643	73.6856	71.4164	68.5922	66.0726	63.4542	62.9104	65.1751	67.4978	70.1867	73.0358	75.6580	(44)
Energy conte 119.9921	104.9274	109.7643	93.8993	88.9464	78.0244	76.0847	80.7004	83.2315	95.2427	104.0529	118.4622	(45)

Energy content (annual) Total = Sum(45)m =	1153.3284	

Distribution loss (46)m = 0.15 x (45)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	(46)

Water storage loss:

Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
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

101.9933	89.1883	93.2997	79.8144	75.6045	66.3207	64.6720	68.5954	70.7468	80.9563	88.4450	100.6928	(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

101.9933	89.1883	93.2997	79.8144	75.6045	66.3207	64.6720	68.5954	70.7468	80.9563	88.4450	100.6928	(64)

Total per year (kWh/year) = Sum(64)m =	980.3291	(64)
12Total per year (kWh/year)	980	(64)

Electric shower(s)

58.3255	51.9685	56.7476	54.1535	55.1697	52.6265	54.3808	55.1697	54.1535	56.7476	55.6805	58.3255	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	663.4489	(64a)

Heat gains from water heating, kWh/month

40.0797	35.2892	37.5118	33.4920	32.6935	29.7368	29.7632	30.9413	31.2251	34.4260	36.0314	39.7546	(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	144.9633	144.9633	144.9633	144.9633	144.9633	144.9633	144.9633	144.9633	144.9633	144.9633	144.9633	144.9633	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	162.6045	180.0264	162.6045	168.0246	162.6045	168.0246	162.6045	162.6045	168.0246	162.6045	168.0246	162.6045	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	299.7580	302.8685	295.0301	278.3428	257.2782	237.4805	224.2544	221.1438	228.9823	245.6695	266.7341	286.5319	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4963	37.4963	37.4963	37.4963	37.4963	37.4963	37.4963	37.4963	37.4963	37.4963	37.4963	37.4963	(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)	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	(71)
Water heating gains (Table 5)	53.8706	52.5137	50.4191	46.5166	43.9429	41.3011	40.0043	41.5877	43.3682	46.2715	50.0436	53.4336	(72)
Total internal gains	582.7220	601.8976	574.5426	559.3731	530.3146	513.2952	493.3521	491.8250	506.8641	521.0344	551.2913	569.0589	(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				6.6900		10.6334		0.7600		0.7000		0.7700	26.2266 (74)
East				7.6700		19.6403		0.7600		0.7000		0.7700	55.5377 (76)
South				3.8700		46.7521		0.7600		0.7000		0.7700	66.7047 (78)
Solar gains	148.4690	268.0091	403.2461	555.0243	667.9747	682.3758	649.9634	563.5078	455.8579	306.4076	180.6707	125.1743 (83)	
Total gains	731.1910	869.9066	977.7887	1114.3974	1198.2893	1195.6710	1143.3155	1055.3328	962.7219	827.4420	731.9620	694.2332 (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	79.6651	79.8373	80.0068	80.8127	80.9652	81.6832	81.6832	81.8175	81.4051	80.9652	80.6572	80.3376	
alpha	6.3110	6.3225	6.3338	6.3875	6.3977	6.4455	6.4455	6.4545	6.4270	6.3977	6.3771	6.3558	
util living area	0.9990	0.9967	0.9892	0.9507	0.8327	0.6243	0.4567	0.5146	0.7900	0.9746	0.9971	0.9993	(86)
MIT	19.9450	20.1173	20.3581	20.6792	20.9035	20.9873	20.9985	20.9969	20.9483	20.6419	20.2354	19.9179	(87)
Th 2	20.1445	20.1462	20.1479	20.1557	20.1571	20.1639	20.1639	20.1652	20.1613	20.1571	20.1542	20.1511	(88)
util rest of house	0.9987	0.9956	0.9853	0.9333	0.7842	0.5486	0.3708	0.4232	0.7183	0.9623	0.9959	0.9990	(89)
MIT 2	19.1736	19.3466	19.5865	19.9013	20.0955	20.1585	20.1636	20.1644	20.1348	19.8726	19.4713	19.1518	(90)
Living area fraction									fLA = Living area / (4) =			0.2323	(91)
MIT	19.3528	19.5257	19.7657	20.0821	20.2832	20.3511	20.3576	20.3578	20.3238	20.0514	19.6488	19.3298	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3528	19.5257	19.7657	20.0821	20.2832	20.3511	20.3576	20.3578	20.3238	20.0514	19.6488	19.3298	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9982	0.9945	0.9830	0.9315	0.7921	0.5659	0.3908	0.4445	0.7333	0.9604	0.9950	0.9987	(94)
Useful gains	729.8790	865.0992	961.1910	1038.0672	949.1685	676.6721	446.8191	469.1139	705.9358	794.6492	728.2658	693.3282	(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	1837.9535	1781.9505	1612.8350	1345.9455	1031.1824	684.8620	447.4641	470.5364	743.6862	1135.4855	1513.3717	1831.8949	(97)
Space heating kWh	824.4074	616.1240	484.8231	221.6724	61.0183	0.0000	0.0000	0.0000	0.0000	253.5822	565.2762	847.0936	(98a)
Space heating requirement - total per year (kWh/year)												3873.9972	
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	824.4074	616.1240	484.8231	221.6724	61.0183	0.0000	0.0000	0.0000	0.0000	253.5822	565.2762	847.0936	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3873.9972	
Space heating per m2											(98c) / (4) =	29.4153	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1119.3878	881.2202	903.5508	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9259	0.9681	0.9485	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1036.4354	853.1218	857.0237	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1320.8391	1263.0630	1163.5613	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	204.7707	304.9962	228.0640	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	51.1927	76.2491	57.0160	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												184.4577	(107)
Energy for space heating												29.4153	(99)
Energy for space cooling												1.4006	(108)
Total												30.8159	(109)
Fabric Energy Efficiency (DFEE)												30.8	(109)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	77.1000	(1b)	x 2.8900	(2b) =	222.8190	(1b) - (3b)
First floor	54.6000	(1c)	x 2.6100	(2c) =	142.5060	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	131.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		365.3250	(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) =	0.1095	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3595	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3056	(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	0.3896	0.3820	0.3743	0.3361	0.3285	0.2903	0.2903	0.2827	0.3056	0.3285	0.3438	0.3590	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5759	0.5729	0.5701	0.5565	0.5540	0.5421	0.5421	0.5399	0.5467	0.5540	0.5591	0.5645	(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	
TER Opaque door			4.5200	1.0000	4.5200			(26)
TER Opening Type (Uw = 1.20)			18.2300	1.1450	20.8740			(27)
External Wall 1	78.7500	18.2300	60.5200	0.1800	10.8936			(29a)
Wall to stairwell	11.7100	4.5200	7.1900	0.1800	1.2942			(29a)
External Roof 1	77.1000		77.1000	0.1100	8.4810			(30)
Total net area of external elements Aum(A, m2)			167.5600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.0628			(33)
Party Wall 1			29.3100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	265.8900	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.2200	0.0500	0.5610
E3 Sill	9.0700	0.0500	0.4535
E4 Jamb	36.3600	0.0500	1.8180
E7 Party floor between dwellings (in blocks of flats)	27.2400	0.0700	1.9068
E16 Corner (normal)	5.7800	0.0900	0.5202
E18 Party wall between dwellings	5.7800	0.0600	0.3468
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	20.2800	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	27.2400	0.0600	1.6344

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		7.2407	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	53.3035	(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	69.4282	69.0729	68.7246	67.0889	66.7828	65.3582	65.3582	65.0944	65.9069	66.7828	67.4020	68.0492	(38)
Heat transfer coeff	122.7317	122.3764	122.0282	120.3924	120.0864	118.6617	118.6617	118.3979	119.2105	120.0864	120.7055	121.3528	(39)
Average = Sum(39)m / 12 =												120.3910	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9319	0.9292	0.9266	0.9141	0.9118	0.9010	0.9010	0.8990	0.9052	0.9118	0.9165	0.9214	(40)
HLP (average)												0.9141	
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	2.8993	(42)

Hot water usage for mixer showers

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	31.4429	30.9760	30.3184	29.1059	28.1980	27.1913	26.6475	27.3005	28.0115	29.0887	30.3262	31.3366	(42b)
Hot water usage for other uses	44.3214	42.7097	41.0980	39.4863	37.8746	36.2629	36.2629	37.8746	39.4863	41.0980	42.7097	44.3214	(42c)
Average daily hot water use (litres/day)												69.4447	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	75.7643	73.6856	71.4164	68.5922	66.0726	63.4542	62.9104	65.1751	67.4978	70.1867	73.0358	75.6580	(44)
Energy conte	119.9921	104.9274	109.7643	93.8993	88.9464	78.0244	76.0847	80.7004	83.2315	95.2427	104.0529	118.4622	(45)
Energy content (annual)										Total = Sum(45)m =		1153.3284	
Distribution loss (46)m = 0.15 x (45)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	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
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	101.9933	89.1883	93.2997	79.8144	75.6045	66.3207	64.6720	68.5954	70.7468	80.9563	88.4450	100.6928	(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	101.9933	89.1883	93.2997	79.8144	75.6045	66.3207	64.6720	68.5954	70.7468	80.9563	88.4450	100.6928	(64)

											Total per year (kWh/year) = Sum(64)m =	980.3291	(64)
12Total per year (kWh/year)												980	(64)
Electric shower(s)													
58.3255	51.9685	56.7476	54.1535	55.1697	52.6265	54.3808	55.1697	54.1535	56.7476	55.6805	58.3255	(64a)	
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	663.4489	(64a)	
Heat gains from water heating, kWh/month													
40.0797	35.2892	37.5118	33.4920	32.6935	29.7368	29.7632	30.9413	31.2251	34.4260	36.0314	39.7546	(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	144.9633	144.9633	144.9633	144.9633	144.9633	144.9633	144.9633	144.9633	144.9633	144.9633	144.9633	144.9633	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	162.6045	180.0264	162.6045	168.0246	162.6045	168.0246	162.6045	162.6045	168.0246	162.6045	168.0246	162.6045	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	299.7580	302.8685	295.0301	278.3428	257.2782	237.4805	224.2544	221.1438	228.9823	245.6695	266.7341	286.5319	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4963	37.4963	37.4963	37.4963	37.4963	37.4963	37.4963	37.4963	37.4963	37.4963	37.4963	37.4963	(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)													
-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	(71)	
Water heating gains (Table 5)													
53.8706	52.5137	50.4191	46.5166	43.9429	41.3011	40.0043	41.5877	43.3682	46.2715	50.0436	53.4336	(72)	
Total internal gains													
582.7220	601.8976	574.5426	559.3731	530.3146	513.2952	493.3521	491.8250	506.8641	521.0344	551.2913	569.0589	(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	6.6900	10.6334	0.6300	0.7000	0.7700	21.7405	(74)
East	7.6700	19.6403	0.6300	0.7000	0.7700	46.0378	(76)
South	3.8700	46.7521	0.6300	0.7000	0.7700	55.2947	(78)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	123.0730	222.1654	334.2698	460.0859	553.7158	565.6536	538.7855	467.1183	377.8822	253.9958	149.7665	103.7629	(83)
Total gains	705.7950	824.0630	908.8124	1019.4590	1084.0304	1078.9488	1032.1375	958.9433	884.7462	775.0302	701.0578	672.8218	(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	79.2553	79.4854	79.7123	80.7953	81.0012	81.9737	81.9737	82.1564	81.5964	81.0012	80.5857	80.1559	
alpha	6.2837	6.2990	6.3142	6.3864	6.4001	6.4649	6.4649	6.4771	6.4398	6.4001	6.3724	6.3437	
util living area													
0.9992	0.9976	0.9927	0.9669	0.8774	0.6806	0.5028	0.5616	0.8321	0.9816	0.9978	0.9994	(86)	
MIT	19.9171	20.0747	20.3008	20.6194	20.8661	20.9797	20.9974	20.9950	20.9301	20.6054	20.2098	19.8974	(87)
Th 2	20.1405	20.1427	20.1450	20.1555	20.1575	20.1666	20.1666	20.1684	20.1631	20.1575	20.1535	20.1493	(88)
util rest of house													
0.9989	0.9967	0.9900	0.9542	0.8351	0.6020	0.4093	0.4635	0.7646	0.9722	0.9968	0.9992	(89)	
MIT 2	19.1424	19.3014	19.5279	19.8465	20.0683	20.1577	20.1660	20.1670	20.1257	19.8387	19.4453	19.1299	(90)
Living area fraction											fLA = Living area / (4) =	0.2323	(91)
MIT	19.3224	19.4811	19.7075	20.0261	20.2536	20.3487	20.3592	20.3594	20.3126	20.0169	19.6229	19.3082	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3224	19.4811	19.7075	20.0261	20.2536	20.3487	20.3592	20.3594	20.3126	20.0169	19.6229	19.3082	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9958	0.9881	0.9518	0.8405	0.6198	0.4311	0.4864	0.7779	0.9701	0.9960	0.9989	(94)
Useful gains	704.7501	820.6358	898.0055	970.3212	911.1053	668.7686	444.9525	466.4472	688.2803	751.8903	698.2377	672.0843	(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													
1843.7254	1784.3842	1611.6831	1339.4993	1027.1739	682.1519	446.0721	468.7826	740.6031	1130.8373	1511.5839	1833.4262	(97)	
Space heating kWh													
847.3976	647.6389	530.9761	265.8083	86.3550	0.0000	0.0000	0.0000	0.0000	281.9366	585.6093	864.0384	(98a)	
Space heating requirement - total per year (kWh/year)												4109.7602	
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													
847.3976	647.6389	530.9761	265.8083	86.3550	0.0000	0.0000	0.0000	0.0000	281.9366	585.6093	864.0384	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												4109.7602	
Space heating per m2											(98c) / (4) =	31.2055	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W													
0.0000	0.0000	0.0000	0.0000	0.0000	1115.4202	878.0968	899.8240	0.0000	0.0000	0.0000	0.0000	(100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8906	0.9491	0.9234	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	993.3519	833.4205	830.8839	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1184.4106	1133.1148	1050.8982	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
0.0000	0.0000	0.0000	0.0000	0.0000	137.5623	222.9725	163.6906	0.0000	0.0000	0.0000	0.0000	(104)	
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)													
0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)	

Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	34.3906	55.7431	40.9227	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												131.0564 (107)
Energy for space heating												31.2055 (99)
Energy for space cooling												0.9951 (108)
Total												32.2006 (109)
Fabric Energy Efficiency (TFEE)												32.2 (109)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	77.1000 (1b)	x	2.8900 (2b)	=	222.8190	(1b) - (3b)
First floor	54.6000 (1c)	x	2.6100 (2c)	=	142.5060	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	131.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	365.3250	(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	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		4.0000 (17)
Infiltration rate		0.2000 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700 (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													
	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)
Mechanical extract ventilation - centralised													
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)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(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	
Doors			4.5200	1.2000	5.4240			(26)
Windows (Uw = 1.20)			18.2300	1.1450	20.8740			(27)
External Wall 1	78.7500	18.2300	60.5200	0.1900	11.4988			(29a)
Wall to stairwell	11.7100	4.5200	7.1900	0.1700	1.2223			(29a)
External Roof 1	77.1000		77.1000	0.1100	8.4810			(30)
Total net area of external elements Aum(A, m2)			167.5600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.5001			(33)
Party Wall 1			29.3100	0.0000	0.0000			(32)
Party Floor 1			77.1000					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		265.8900 (35)
Thermal bridges (User defined value 0.045 * total exposed area)		7.5402 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	55.0403 (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	60.2786	60.2786	60.2786	60.2786	60.2786	60.2786	60.2786	60.2786	60.2786	60.2786	60.2786	60.2786	(38)
Heat transfer coeff	115.3190	115.3190	115.3190	115.3190	115.3190	115.3190	115.3190	115.3190	115.3190	115.3190	115.3190	115.3190	(39)
Average = Sum(39)m / 12 =												115.3190	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8756	0.8756	0.8756	0.8756	0.8756	0.8756	0.8756	0.8756	0.8756	0.8756	0.8756	0.8756	(40)
HLP (average)												0.8756	
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												2.8993	(42)
Hot water usage for mixer showers													
	93.5812	92.1749	90.1256	86.2046	83.3110	80.0841	78.2499	80.2837	82.5131	85.9779	89.9831	93.2227	(42a)
Hot water usage for baths													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses													
	44.3214	42.7097	41.0980	39.4863	37.8746	36.2629	36.2629	37.8746	39.4863	41.0980	42.7097	44.3214	(42c)
Average daily hot water use (litres/day)												126.5709	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	137.9026	134.8846	131.2236	125.6909	121.1856	116.3470	114.5128	118.1583	121.9994	127.0759	132.6928	137.5441	(44)
Energy conte	218.4040	192.0739	201.6858	172.0646	163.1391	143.0622	138.4933	146.3047	150.4375	172.4407	189.0452	215.3608	(45)
Energy content (annual)										Total = Sum(45)m =		2102.5118	
Distribution loss (46)m = 0.15 x (45)m													
	32.7606	28.8111	30.2529	25.8097	24.4709	21.4593	20.7740	21.9457	22.5656	25.8661	28.3568	32.3041	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2200	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.7320	(55)
Total storage loss													
	22.6920	20.4960	22.6920	21.9600	22.6920	21.9600	22.6920	22.6920	21.9600	22.6920	21.9600	22.6920	(56)
If cylinder contains dedicated solar storage													
	22.6920	20.4960	22.6920	21.9600	22.6920	21.9600	22.6920	22.6920	21.9600	22.6920	21.9600	22.6920	(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													
	264.3584	233.5811	247.6402	216.5366	209.0935	187.5342	184.4477	192.2591	194.9095	218.3951	233.5172	261.3152	(62)
WWHRS	-83.3321	-73.6996	-77.1740	-63.9031	-59.5554	-50.9620	-47.7687	-50.7973	-52.7272	-62.1596	-70.4193	-81.7889	(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													
	181.0263	159.8814	170.4662	152.6334	149.5381	136.5722	136.6790	141.4618	142.1823	156.2355	163.0979	179.5262	(64)
										Total per year (kWh/year) = Sum(64)m =		1869.3005	(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													
	109.3829	97.0703	103.8240	92.7891	91.0073	83.1458	82.8126	85.4098	85.5981	94.1001	98.4351	108.3710	(65)

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	173.9559	173.9559	173.9559	173.9559	173.9559	173.9559	173.9559	173.9559	173.9559	173.9559	173.9559	173.9559	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	45.0654	40.0267	32.5519	24.6439	18.4216	15.5523	16.8048	21.8435	29.3183	37.2263	43.4486	46.3179	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	447.4000	452.0426	440.3434	415.4371	383.9974	354.4485	334.7080	330.0654	341.7646	366.6709	398.1106	427.6595	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.2949	55.2949	55.2949	55.2949	55.2949	55.2949	55.2949	55.2949	55.2949	55.2949	55.2949	55.2949	(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)													
	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	(71)
Water heating gains (Table 5)													
	147.0200	144.4499	139.5484	128.8737	122.3216	115.4803	111.3072	114.7982	118.8862	126.4786	136.7154	145.6599	(72)
Total internal gains													
	752.7655	749.7993	725.7239	682.2348	638.0207	598.7612	576.1002	579.9872	603.2493	643.6560	691.5548	732.9175	(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	6.6900	10.6334	0.7600	0.7000	0.7700	26.2266	(74)
East	7.6700	19.6403	0.7600	0.7000	0.7700	55.5377	(76)
South	3.8700	46.7521	0.7600	0.7000	0.7700	66.7047	(78)

Solar gains	148.4690	268.0091	403.2461	555.0243	667.9747	682.3758	649.9634	563.5078	455.8579	306.4076	180.6707	125.1743	(83)
Total gains	901.2346	1017.8084	1128.9700	1237.2591	1305.9954	1281.1370	1226.0636	1143.4951	1059.1072	950.0636	872.2256	858.0918	(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	84.3499	84.3499	84.3499	84.3499	84.3499	84.3499	84.3499	84.3499	84.3499	84.3499	84.3499	84.3499	
alpha	6.6233	6.6233	6.6233	6.6233	6.6233	6.6233	6.6233	6.6233	6.6233	6.6233	6.6233	6.6233	
util living area													
	0.9965	0.9915	0.9746	0.9149	0.7699	0.5697	0.4131	0.4624	0.7196	0.9465	0.9918	0.9975	(86)
MIT	20.1637	20.3104	20.5347	20.7856	20.9455	20.9933	20.9993	20.9986	20.9727	20.7558	20.3996	20.1200	(87)
Th 2	20.1883	20.1883	20.1883	20.1883	20.1883	20.1883	20.1883	20.1883	20.1883	20.1883	20.1883	20.1883	(88)
util rest of house													
	0.9954	0.9887	0.9665	0.8898	0.7182	0.5004	0.3373	0.3816	0.6476	0.9248	0.9887	0.9966	(89)
MIT 2	19.2118	19.3982	19.6793	19.9786	20.1456	20.1847	20.1881	20.1878	20.1713	19.9512	19.5127	19.1561	(90)
Living area fraction										fLA = Living area / (4) =		0.2323	(91)
MIT	19.4330	19.6101	19.8781	20.1661	20.3315	20.3726	20.3765	20.3762	20.3575	20.1381	19.7188	19.3800	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4330	19.6101	19.8781	20.1661	20.3315	20.3726	20.3765	20.3762	20.3575	20.1381	19.7188	19.3800	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9939	0.9861	0.9626	0.8890	0.7278	0.5163	0.3550	0.4004	0.6633	0.9232	0.9862	0.9954	(94)
Useful gains	895.7225	1003.7066	1086.7899	1099.9815	950.5434	661.4760	435.2115	457.8816	702.4709	877.1169	860.2051	854.1834	(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	1745.1186	1696.3538	1542.7469	1299.1956	995.3731	665.6897	435.5075	458.5281	721.6085	1099.9274	1455.1837	1750.5444	(97)
Space heating kWh	631.9507	465.4589	339.2320	143.4342	33.3533	0.0000	0.0000	0.0000	0.0000	165.7710	428.3845	666.8926	(98a)
Space heating requirement - total per year (kWh/year)												2874.4772	
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	631.9507	465.4589	339.2320	143.4342	33.3533	0.0000	0.0000	0.0000	0.0000	165.7710	428.3845	666.8926	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2874.4772	
Space heating per m2											(98c) / (4) =	21.8259	(99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Heat pump-Space and Water	1.0000	(303a)
Factor for control and charging method (Table 4c(3)) for space heating	1.0000	(305)
Factor for charging method (Table 4c(3)) for water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0000	(306)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating:		
Space heating requirement		

	631.9507	465.4589	339.2320	143.4342	33.3533	0.0000	0.0000	0.0000	0.0000	165.7710	428.3845	666.8926	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00													
307a	631.9507	465.4589	339.2320	143.4342	33.3533	0.0000	0.0000	0.0000	0.0000	165.7710	428.3845	666.8926	
Space heating requirement													
	631.9507	465.4589	339.2320	143.4342	33.3533	0.0000	0.0000	0.0000	0.0000	165.7710	428.3845	666.8926	(307)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system		

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(309)

Water heating

Annual water heating requirement

	181.0263	159.8814	170.4662	152.6334	149.5381	136.5722	136.6790	141.4618	142.1823	156.2355	163.0979	179.5262	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00													
310a	181.0263	159.8814	170.4662	152.6334	149.5381	136.5722	136.6790	141.4618	142.1823	156.2355	163.0979	179.5262	
Water heating fuel													
	181.0263	159.8814	170.4662	152.6334	149.5381	136.5722	136.6790	141.4618	142.1823	156.2355	163.0979	179.5262	(310)
Cooling System Energy Efficiency Ratio												0.0000	(314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(315)
Pumps and Fa	12.7188	11.4880	12.7188	12.3085	12.7188	12.3085	12.7188	12.7188	12.3085	12.7188	12.3085	12.7188	(331)
Lighting	39.4455	31.6446	28.4925	20.8748	16.1243	13.1737	14.7091	19.1195	24.8343	32.5840	36.8035	40.5418	(332)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333a)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	(333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334a)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	(334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335a)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	(335a)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333b)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	(333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334b)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	(334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335b)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	(335b)

Annual totals kWh/year		
Space heating fuel - community heating	2874.4772	(307)
Space heating fuel - secondary	0.0000	(309)
Water heating fuel - community heating	1869.3005	(310)
Efficiency of water heater	0.0000	(311)
Electricity used for heat distribution	28.7448	(313)
Space cooling fuel	0.0000	(321)
Electricity for pumps and fans:		
(MEVCentralised, Database: in-use factor = 1.6000, SFP = 0.3360)		
mechanical ventilation fans (SFP = 0.3360)	149.7540	(330a)
Total electricity for the above, kWh/year	149.7540	(331)
Electricity for lighting (calculated in Appendix L)	318.3476	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(333)
Wind generation	0.0000	(334)
Hydro-electric generation (Appendix N)	0.0000	(335a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(335)
Appendix Q - special features		
Energy saved or generated	-0.0000	(336)
Energy used	0.0000	(337)
Total delivered energy for all uses	5211.8794	(338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Heat pump	2874.4772	4.4400	127.6268	(340a)
Space heating total			127.6268	(340)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Heat pump	1869.3005	4.4400	82.9969	(342a)
Water heating total			82.9969	(342)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(347a)
Pumps, fans and electric keep-hot	149.7540	16.4900	24.6944	(349)
Energy for lighting	318.3476	16.4900	52.4955	(350)
Additional standing charges			92.0000	(351)
Total energy cost			379.8137	(355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):		0.3600 (356)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7738 (357)
SAP value		87.4565
SAP rating (Section 12)		87 (358)
SAP band		B

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Heat pump			350.0000	(367)
Space and Water heating from Heat pump	1355.3651	0.1566	128.6377	(367)
Electrical energy for heat distribution (space & water)	28.7448	0.0000	7.1286	(372)
Overall CO2 factor for heat network			0.0444	(386)
Total CO2 associated with community systems			210.8017	(373)
Space and water heating			210.8017	(376)
Pumps, fans and electric keep-hot	149.7540	0.1387	20.7727	(378)
Energy for lighting	318.3476	0.1443	45.9474	(379)
Total CO2, kg/year			277.5218	(383)
CO2 emissions per m2			2.1100	(384)
EI value			97.8954	(384a)
EI rating			98	(385)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	77.1000	(1b)	x 2.8900	(2b) =	222.8190	(1b) - (3b)
First floor	54.6000	(1c)	x 2.6100	(2c) =	142.5060	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	131.7000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	365.3250	(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	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		4.0000 (17)
Infiltration rate		0.2000 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.1785	0.1700	0.1700	0.1573	0.1573	0.1403	0.1445	0.1360	0.1403	0.1488	0.1488	0.1615	(22b)

Mechanical extract ventilation - centralised

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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(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	
Doors			4.5200	1.2000	5.4240			(26)
Windows (Uw = 1.20)			18.2300	1.1450	20.8740			(27)
External Wall 1	78.7500	18.2300	60.5200	0.1900	11.4988			(29a)
Wall to stairwell	11.7100	4.5200	7.1900	0.1700	1.2223			(29a)
External Roof 1	77.1000		77.1000	0.1100	8.4810			(30)
Total net area of external elements Aum(A, m2)			167.5600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.5001			(33)
Party Wall 1			29.3100	0.0000	0.0000			(32)
Party Floor 1			77.1000					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	265.8900 (35)

Thermal bridges (User defined value 0.045 * total exposed area) 7.5402 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 55.0403 (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	60.2786	60.2786	60.2786	60.2786	60.2786	60.2786	60.2786	60.2786	60.2786	60.2786	60.2786	60.2786	(38)
Heat transfer coeff	115.3190	115.3190	115.3190	115.3190	115.3190	115.3190	115.3190	115.3190	115.3190	115.3190	115.3190	115.3190	(39)
Average = Sum(39)m / 12 =												115.3190	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8756	0.8756	0.8756	0.8756	0.8756	0.8756	0.8756	0.8756	0.8756	0.8756	0.8756	0.8756	(40)
HLP (average)												0.8756	
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 2.8993 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	93.5812	92.1749	90.1256	86.2046	83.3110	80.0841	78.2499	80.2837	82.5131	85.9779	89.9831	93.2227	(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses	44.3214	42.7097	41.0980	39.4863	37.8746	36.2629	36.2629	37.8746	39.4863	41.0980	42.7097	44.3214	(42c)
Average daily hot water use (litres/day)												126.5709	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.9026	134.8846	131.2236	125.6909	121.1856	116.3470	114.5128	118.1583	121.9994	127.0759	132.6928	137.5441	(44)
Energy conte	218.4040	192.0739	201.6858	172.0646	163.1391	143.0622	138.4933	146.3047	150.4375	172.4407	189.0452	215.3608	(45)
Energy content (annual)											Total = Sum(45)m =	2102.5118	
Distribution loss (46)m = 0.15 x (45)m	32.7606	28.8111	30.2529	25.8097	24.4709	21.4593	20.7740	21.9457	22.5656	25.8661	28.3568	32.3041	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2200	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.7320	(55)
Total storage loss	22.6920	20.4960	22.6920	21.9600	22.6920	21.9600	22.6920	22.6920	21.9600	22.6920	21.9600	22.6920	(56)
If cylinder contains dedicated solar storage	22.6920	20.4960	22.6920	21.9600	22.6920	21.9600	22.6920	22.6920	21.9600	22.6920	21.9600	22.6920	(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	264.3584	233.5811	247.6402	216.5366	209.0935	187.5342	184.4477	192.2591	194.9095	218.3951	233.5172	261.3152	(62)
WWHRS	-83.3321	-73.6996	-77.1740	-63.9031	-59.5554	-50.9620	-47.7687	-50.7973	-52.7272	-62.1596	-70.4193	-81.7889	(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	181.0263	159.8814	170.4662	152.6334	149.5381	136.5722	136.6790	141.4618	142.1823	156.2355	163.0979	179.5262	(64)
										Total per year (kWh/year) = Sum(64)m =		1869.3005	(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	109.3829	97.0703	103.8240	92.7891	91.0073	83.1458	82.8126	85.4098	85.5981	94.1001	98.4351	108.3710	(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	173.9559	173.9559	173.9559	173.9559	173.9559	173.9559	173.9559	173.9559	173.9559	173.9559	173.9559	173.9559	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.0654	40.0267	32.5519	24.6439	18.4216	15.5523	16.8048	21.8435	29.3183	37.2263	43.4486	46.3179	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	447.4000	452.0426	440.3434	415.4371	383.9974	354.4485	334.7080	330.0654	341.7646	366.6709	398.1106	427.6595	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2949	55.2949	55.2949	55.2949	55.2949	55.2949	55.2949	55.2949	55.2949	55.2949	55.2949	55.2949	(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)	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	(71)
Water heating gains (Table 5)	147.0200	144.4499	139.5484	128.8737	122.3216	115.4803	111.3072	114.7982	118.8862	126.4786	136.7154	145.6599	(72)
Total internal gains	752.7655	749.7993	725.7239	682.2348	638.0207	598.7612	576.1002	579.9872	603.2493	643.6560	691.5548	732.9175	(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	6.6900	11.9814	0.7600	0.7000	0.7700	29.5515	(74)
East	7.6700	22.3313	0.7600	0.7000	0.7700	63.1473	(76)
South	3.8700	50.9848	0.7600	0.7000	0.7700	72.7439	(78)

Solar gains	165.4427	269.3038	401.6930	571.9471	672.1159	735.3058	692.6114	613.0910	493.0099	329.1520	206.3690	138.0676	(83)
Total gains	918.2083	1019.1032	1127.4168	1254.1819	1310.1366	1334.0670	1268.7116	1193.0782	1096.2592	972.8080	897.9238	870.9851	(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	84.3499	84.3499	84.3499	84.3499	84.3499	84.3499	84.3499	84.3499	84.3499	84.3499	84.3499	84.3499	
alpha	6.6233	6.6233	6.6233	6.6233	6.6233	6.6233	6.6233	6.6233	6.6233	6.6233	6.6233	6.6233	
util living area													
	0.9949	0.9891	0.9656	0.8775	0.6822	0.4313	0.2817	0.3092	0.6009	0.9108	0.9863	0.9962	(86)
MIT	20.2513	20.3751	20.6097	20.8540	20.9766	20.9990	21.0000	20.9999	20.9918	20.8389	20.5007	20.2140	(87)
Th 2	20.1883	20.1883	20.1883	20.1883	20.1883	20.1883	20.1883	20.1883	20.1883	20.1883	20.1883	20.1883	(88)
util rest of house													
	0.9931	0.9854	0.9543	0.8435	0.6212	0.3618	0.2080	0.2308	0.5212	0.8765	0.9808	0.9949	(89)
MIT 2	19.3236	19.4803	19.7719	20.0541	20.1725	20.1879	20.1883	20.1883	20.1843	20.0444	19.6402	19.2762	(90)
Living area fraction										fLA = Living area / (4) =		0.2323	(91)
MIT	19.5392	19.6882	19.9665	20.2399	20.3593	20.3763	20.3769	20.3768	20.3719	20.2290	19.8402	19.4941	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5392	19.6882	19.9665	20.2399	20.3593	20.3763	20.3769	20.3768	20.3719	20.2290	19.8402	19.4941	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9912	0.9825	0.9506	0.8459	0.6344	0.3779	0.2251	0.2491	0.5396	0.8785	0.9778	0.9933	(94)
Useful gains	910.1304	1001.2910	1071.7451	1060.8743	831.1812	504.1730	285.6175	297.1367	591.5437	854.5640	877.9561	865.1624	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W													
	1665.1084	1624.6350	1449.1594	1192.3876	848.6674	504.6751	285.6288	297.1591	596.4158	995.0919	1365.3965	1659.9171	(97)
Space heating kWh													
	561.7036	418.8872	280.7962	94.6896	13.0097	0.0000	0.0000	0.0000	0.0000	104.5527	350.9571	591.2975	(98a)
Space heating requirement - total per year (kWh/year)												2415.8937	
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													
	561.7036	418.8872	280.7962	94.6896	13.0097	0.0000	0.0000	0.0000	0.0000	104.5527	350.9571	591.2975	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2415.8937	
Space heating per m2											(98c) / (4) =	18.3439	(99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(301)
Fraction of space heat from community system												1.0000	(302)
Fraction of heat from community Heat pump-Space and Water												1.0000	(303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000	(305)
Factor for charging method (Table 4c(3)) for water heating												1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system												1.0000	(306)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating:													
Space heating requirement													
	561.7036	418.8872	280.7962	94.6896	13.0097	0.0000	0.0000	0.0000	0.0000	104.5527	350.9571	591.2975	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00													
307a	561.7036	418.8872	280.7962	94.6896	13.0097	0.0000	0.0000	0.0000	0.0000	104.5527	350.9571	591.2975	
Space heating requirement													
	561.7036	418.8872	280.7962	94.6896	13.0097	0.0000	0.0000	0.0000	0.0000	104.5527	350.9571	591.2975	(307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000	(308)
Space heating fuel for secondary/supplementary system													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(309)
Water heating													
Annual water heating requirement													
	181.0263	159.8814	170.4662	152.6334	149.5381	136.5722	136.6790	141.4618	142.1823	156.2355	163.0979	179.5262	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00													
310a	181.0263	159.8814	170.4662	152.6334	149.5381	136.5722	136.6790	141.4618	142.1823	156.2355	163.0979	179.5262	
Water heating fuel													
	181.0263	159.8814	170.4662	152.6334	149.5381	136.5722	136.6790	141.4618	142.1823	156.2355	163.0979	179.5262	(310)
Cooling System Energy Efficiency Ratio												0.0000	(314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(315)
Pumps and Fa	12.7188	11.4880	12.7188	12.3085	12.7188	12.3085	12.7188	12.7188	12.3085	12.7188	12.3085	12.7188	(331)
Lighting	39.4455	31.6446	28.4925	20.8748	16.1243	13.1737	14.7091	19.1195	24.8343	32.5840	36.8035	40.5418	(332)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333a)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	(333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334a)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	(334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335a)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	(335a)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333b)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	(333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334b)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	(334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335b)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	(335b)
Annual totals kWh/year													
Space heating fuel - community heating												2415.8937	(307)
Space heating fuel - secondary												0.0000	(309)
Water heating fuel - community heating												1869.3005	(310)
Efficiency of water heater												0.0000	(311)
Electricity used for heat distribution												24.1589	(313)
Space cooling fuel												0.0000	(321)
Electricity for pumps and fans:													
(MEVCentralised, Database: in-use factor = 1.6000, SFP = 0.3360)													
mechanical ventilation fans (SFP = 0.3360)												149.7540	(330a)
Total electricity for the above, kWh/year												149.7540	(331)
Electricity for lighting (calculated in Appendix L)												318.3476	(332)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(333)
Wind generation												0.0000	(334)
Hydro-electric generation (Appendix N)												0.0000	(335a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(335)
Appendix Q - special features													
Energy saved or generated												-0.0000	(336)
Energy used												0.0000	(337)
Total delivered energy for all uses												4753.2959	(338)

10b. Fuel costs - using BEDF prices (533)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Heat pump	2415.8937	4.8000	115.9629	(340a)
Space heating total			115.9629	(340)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Heat pump	1869.3005	4.8000	89.7264	(342a)
Water heating total			89.7264	(342)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(347a)
Pumps, fans and electric keep-hot	149.7540	21.5100	32.2121	(349)
Energy for lighting	318.3476	21.5100	68.4766	(350)
Additional standing charges			98.0000	(351)
Total energy cost			404.3780	(355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Heat pump			350.0000	(367)
Space and Water heating from Heat pump	1224.3412	0.1575	108.6842	(367)
Electrical energy for heat distribution (space & water)	24.1589	0.0000	6.4302	(372)
Overall CO2 factor for heat network			0.0444	(386)
Total CO2 associated with community systems			190.1497	(373)
Space and water heating			190.1497	(376)
Pumps, fans and electric keep-hot	149.7540	0.1387	20.7727	(378)
Energy for lighting	318.3476	0.1443	45.9474	(379)
Total CO2, kg/year			256.8699	(383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Heat pump			350.0000	(467a)
Space and Water heating from Heat pump	1224.3412	1.5829	1092.6072	(467)
Electrical energy for heat distribution (space & water)	24.1589	0.0000	66.6447	(472)
Overall CO2 factor for heat network			0.4599	(486)
Total CO2 associated with community systems			1970.7803	(473)
Space and water heating			1970.7803	(476)
Pumps, fans and electric keep-hot	149.7540	1.5128	226.5479	(478)
Energy for lighting	318.3476	1.5338	488.2923	(479)
Total Primary energy kWh/year			2685.6204	(483)

SAP 10 EPC IMPROVEMENTS

GSHP Heat Network_WWHR

Current energy efficiency rating: B 87
Current environmental impact rating: A 98

N Solar water heating	Not applicable
U Solar photovoltaic panels	Not applicable
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 87
Potential environmental impact rating: A 98

Fuel prices for cost data on this page from database revision number 533 TEST (30 Nov 2023)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£101	£101	£0
Community scheme	£304	£304	£0
Space heating	£246	£246	£0
Water heating	£90	£90	£0
Lighting	£68	£68	£0
Total cost of fuels	£405	£405	£0
Total cost of uses	£404	£404	£0
Delivered energy	36 kWh/m²	36 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	2 kg/m²	2 kg/m²	0 kg/m²
Primary energy	20 kWh/m²	20 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	77.1000 (1b)	x	2.8900 (2b)	=	222.8190	(1b) - (3b)
First floor	54.6000 (1c)	x	2.6100 (2c)	=	142.5060	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	131.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		365.3250	(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	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		4.0000 (17)
Infiltration rate		0.2000 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700 (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	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Mechanical extract ventilation - centralised

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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(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	
Doors			4.5200	1.2000	5.4240			(26)
Windows (Uw = 1.20)			18.2300	1.1450	20.8740			(27)
External Wall 1	78.7500	18.2300	60.5200	0.1900	11.4988			(29a)
Wall to stairwell	11.7100	4.5200	7.1900	0.1700	1.2223			(29a)
External Roof 1	77.1000		77.1000	0.1100	8.4810			(30)
Total net area of external elements Aum(A, m2)			167.5600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.5001			(33)
Party Wall 1			29.3100	0.0000	0.0000			(32)
Party Floor 1			77.1000					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	265.8900	(35)
Thermal bridges (User defined value 0.045 * total exposed area)	7.5402	(36)
Point Thermal bridges	(36a) = 0.0000	
Total fabric heat loss	(33) + (36) + (36a) = 55.0403	(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	60.2786	60.2786	60.2786	60.2786	60.2786	60.2786	60.2786	60.2786	60.2786	60.2786	60.2786	60.2786	(38)
Heat transfer coeff	115.3190	115.3190	115.3190	115.3190	115.3190	115.3190	115.3190	115.3190	115.3190	115.3190	115.3190	115.3190	(39)
Average = Sum(39)m / 12 =												115.3190	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8756	0.8756	0.8756	0.8756	0.8756	0.8756	0.8756	0.8756	0.8756	0.8756	0.8756	0.8756	(40)
HLP (average)												0.8756	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8993	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
93.5812	92.1749	90.1256	86.2046	83.3110	80.0841	78.2499	80.2837	82.5131	85.9779	89.9831	93.2227	(42a)

Hot water usage for baths

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)

Hot water usage for other uses

44.3214	42.7097	41.0980	39.4863	37.8746	36.2629	36.2629	37.8746	39.4863	41.0980	42.7097	44.3214	(42c)

Average daily hot water use (litres/day)	126.5709	(43)

Daily hot water use

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
137.9026	134.8846	131.2236	125.6909	121.1856	116.3470	114.5128	118.1583	121.9994	127.0759	132.6928	137.5441	(44)
Energy conte 218.4040	192.0739	201.6858	172.0646	163.1391	143.0622	138.4933	146.3047	150.4375	172.4407	189.0452	215.3608	(45)

Energy content (annual)	Total = Sum(45)m =	2102.5118

Distribution loss (46)m = 0.15 x (45)m

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
32.7606	28.8111	30.2529	25.8097	24.4709	21.4593	20.7740	21.9457	22.5656	25.8661	28.3568	32.3041	(46)

Water storage loss:

Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2200	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.7320	(55)
Total storage loss													
	22.6920	20.4960	22.6920	21.9600	22.6920	21.9600	22.6920	22.6920	21.9600	22.6920	21.9600	22.6920	(56)
If cylinder contains dedicated solar storage													
	22.6920	20.4960	22.6920	21.9600	22.6920	21.9600	22.6920	22.6920	21.9600	22.6920	21.9600	22.6920	(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													
	264.3584	233.5811	247.6402	216.5366	209.0935	187.5342	184.4477	192.2591	194.9095	218.3951	233.5172	261.3152	(62)
WWHRS	-83.3321	-73.6996	-77.1740	-63.9031	-59.5554	-50.9620	-47.7687	-50.7973	-52.7272	-62.1596	-70.4193	-81.7889	(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													
	181.0263	159.8814	170.4662	152.6334	149.5381	136.5722	136.6790	141.4618	142.1823	156.2355	163.0979	179.5262	(64)
										Total per year (kWh/year) = Sum(64)m =		1869.3005	(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													
	109.3829	97.0703	103.8240	92.7891	91.0073	83.1458	82.8126	85.4098	85.5981	94.1001	98.4351	108.3710	(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	173.9559	173.9559	173.9559	173.9559	173.9559	173.9559	173.9559	173.9559	173.9559	173.9559	173.9559	173.9559	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	45.0654	40.0267	32.5519	24.6439	18.4216	15.5523	16.8048	21.8435	29.3183	37.2263	43.4486	46.3179	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	447.4000	452.0426	440.3434	415.4371	383.9974	354.4485	334.7080	330.0654	341.7646	366.6709	398.1106	427.6595	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.2949	55.2949	55.2949	55.2949	55.2949	55.2949	55.2949	55.2949	55.2949	55.2949	55.2949	55.2949	(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)													
	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	(71)
Water heating gains (Table 5)													
	147.0200	144.4499	139.5484	128.8737	122.3216	115.4803	111.3072	114.7982	118.8862	126.4786	136.7154	145.6599	(72)
Total internal gains													
	752.7655	749.7993	725.7239	682.2348	638.0207	598.7612	576.1002	579.9872	603.2493	643.6560	691.5548	732.9175	(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	6.6900	10.6334	0.7600	0.7000	0.7700	26.2266	(74)
East	7.6700	19.6403	0.7600	0.7000	0.7700	55.5377	(76)
South	3.8700	46.7521	0.7600	0.7000	0.7700	66.7047	(78)

Solar gains	148.4690	268.0091	403.2461	555.0243	667.9747	682.3758	649.9634	563.5078	455.8579	306.4076	180.6707	125.1743	(83)
Total gains	901.2346	1017.8084	1128.9700	1237.2591	1305.9954	1281.1370	1226.0636	1143.4951	1059.1072	950.0636	872.2256	858.0918	(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	84.3499	84.3499	84.3499	84.3499	84.3499	84.3499	84.3499	84.3499	84.3499	84.3499	84.3499	84.3499	
alpha	6.6233	6.6233	6.6233	6.6233	6.6233	6.6233	6.6233	6.6233	6.6233	6.6233	6.6233	6.6233	
util living area													
	0.9965	0.9915	0.9746	0.9149	0.7699	0.5697	0.4131	0.4624	0.7196	0.9465	0.9918	0.9975	(86)
MIT	20.1637	20.3104	20.5347	20.7856	20.9455	20.9933	20.9993	20.9986	20.9727	20.7558	20.3996	20.1200	(87)
Th 2	20.1883	20.1883	20.1883	20.1883	20.1883	20.1883	20.1883	20.1883	20.1883	20.1883	20.1883	20.1883	(88)
util rest of house													
	0.9954	0.9887	0.9665	0.8898	0.7182	0.5004	0.3373	0.3816	0.6476	0.9248	0.9887	0.9966	(89)
MIT 2	19.2118	19.3982	19.6793	19.9786	20.1456	20.1847	20.1881	20.1878	20.1713	19.9512	19.5127	19.1561	(90)
Living area fraction										fLA = Living area / (4) =		0.2323	(91)
MIT	19.4330	19.6101	19.8781	20.1661	20.3315	20.3726	20.3765	20.3762	20.3575	20.1381	19.7188	19.3800	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4330	19.6101	19.8781	20.1661	20.3315	20.3726	20.3765	20.3762	20.3575	20.1381	19.7188	19.3800	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9939	0.9861	0.9626	0.8890	0.7278	0.5163	0.3550	0.4004	0.6633	0.9232	0.9862	0.9954	(94)
Useful gains	895.7225	1003.7066	1086.7899	1099.9815	950.5434	661.4760	435.2115	457.8816	702.4709	877.1169	860.2051	854.1834	(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													
	1745.1186	1696.3538	1542.7469	1299.1956	995.3731	665.6897	435.5075	458.5281	721.6085	1099.9274	1455.1837	1750.5444	(97)
Space heating kWh													
	631.9507	465.4589	339.2320	143.4342	33.3533	0.0000	0.0000	0.0000	0.0000	165.7710	428.3845	666.8926	(98a)
Space heating requirement - total per year (kWh/year)												2874.4772	
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													
	631.9507	465.4589	339.2320	143.4342	33.3533	0.0000	0.0000	0.0000	0.0000	165.7710	428.3845	666.8926	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2874.4772	
Space heating per m2											(98c) / (4) =	21.8259	(99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(301)
Fraction of space heat from community system												1.0000	(302)
Fraction of heat from community Heat pump-Space and Water												1.0000	(303a)
Factor for control and charging method (Table 4c(3)) for space heating												1.0000	(305)
Factor for charging method (Table 4c(3)) for water heating												1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system												1.0000	(306)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating:													
Space heating requirement													
	631.9507	465.4589	339.2320	143.4342	33.3533	0.0000	0.0000	0.0000	0.0000	165.7710	428.3845	666.8926	(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00													
307a	631.9507	465.4589	339.2320	143.4342	33.3533	0.0000	0.0000	0.0000	0.0000	165.7710	428.3845	666.8926	
Space heating requirement													
	631.9507	465.4589	339.2320	143.4342	33.3533	0.0000	0.0000	0.0000	0.0000	165.7710	428.3845	666.8926	(307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)												0.0000	(308)
Space heating fuel for secondary/supplementary system													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(309)
Water heating													
Annual water heating requirement													
	181.0263	159.8814	170.4662	152.6334	149.5381	136.5722	136.6790	141.4618	142.1823	156.2355	163.0979	179.5262	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00													
310a	181.0263	159.8814	170.4662	152.6334	149.5381	136.5722	136.6790	141.4618	142.1823	156.2355	163.0979	179.5262	
Water heating fuel													
	181.0263	159.8814	170.4662	152.6334	149.5381	136.5722	136.6790	141.4618	142.1823	156.2355	163.0979	179.5262	(310)
Cooling System Energy Efficiency Ratio												0.0000	(314)
Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(315)
Pumps and Fa	12.7188	11.4880	12.7188	12.3085	12.7188	12.3085	12.7188	12.7188	12.3085	12.7188	12.3085	12.7188	(331)
Lighting	39.4455	31.6446	28.4925	20.8748	16.1243	13.1737	14.7091	19.1195	24.8343	32.5840	36.8035	40.5418	(332)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333a)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	(333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334a)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	(334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335a)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	(335a)
Electricity generated by PVs (Appendix M) (negative quantity)													
(333b)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	(333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(334b)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	(334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(335b)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	(335b)
Annual totals kWh/year													
Space heating fuel - community heating												2874.4772	(307)
Space heating fuel - secondary												0.0000	(309)
Water heating fuel - community heating												1869.3005	(310)
Efficiency of water heater												0.0000	(311)
Electricity used for heat distribution												28.7448	(313)
Space cooling fuel												0.0000	(321)
Electricity for pumps and fans:													
(MEVCentralised, Database: in-use factor = 1.6000, SFP = 0.3360)													
mechanical ventilation fans (SFP = 0.3360)												149.7540	(330a)
Total electricity for the above, kWh/year												149.7540	(331)
Electricity for lighting (calculated in Appendix L)												318.3476	(332)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(333)
Wind generation												0.0000	(334)
Hydro-electric generation (Appendix N)												0.0000	(335a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(335)
Appendix Q - special features													
Energy saved or generated												-0.0000	(336)
Energy used												0.0000	(337)
Total delivered energy for all uses												5211.8794	(338)

10b. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Heat pump	2874.4772	4.4400	127.6268	(340a)
Space heating total			127.6268	(340)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Heat pump	1869.3005	4.4400	82.9969	(342a)
Water heating total			82.9969	(342)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(347a)
Pumps, fans and electric keep-hot	149.7540	16.4900	24.6944	(349)
Energy for lighting	318.3476	16.4900	52.4955	(350)
Additional standing charges			92.0000	(351)
Total energy cost			379.8137	(355)

11b. SAP rating - Community heating scheme

Energy cost deflator (Table 12):		0.3600	(356)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7738	(357)
SAP value		87.4565	
SAP rating (Section 12)		87	(358)
SAP band		B	

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Heat pump			350.0000	(367)
Space and Water heating from Heat pump	1355.3651	0.1566	128.6377	(367)
Electrical energy for heat distribution (space & water)	28.7448	0.0000	7.1286	(372)
Overall CO2 factor for heat network			0.0444	(386)
Total CO2 associated with community systems			210.8017	(373)

Space and water heating			210.8017 (376)
Pumps, fans and electric keep-hot	149.7540	0.1387	20.7727 (378)
Energy for lighting	318.3476	0.1443	45.9474 (379)
Total CO2, kg/year			277.5218 (383)
CO2 emissions per m2			2.1100 (384)
EI value			97.8954 (384a)
EI rating			98 (385)
EI band			A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	77.1000 (1b)	x	2.8900 (2b)	=	222.8190	(1b) - (3b)
First floor	54.6000 (1c)	x	2.6100 (2c)	=	142.5060	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	131.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	365.3250	(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		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500	(22a)
Adj infilt rate	0.1785	0.1700	0.1700	0.1573	0.1573	0.1403	0.1445	0.1360	0.1403	0.1488	0.1488	0.1615	(22b)

Mechanical extract ventilation - centralised

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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(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	
Doors			4.5200	1.2000	5.4240			(26)
Windows (Uw = 1.20)			18.2300	1.1450	20.8740			(27)
External Wall 1	78.7500	18.2300	60.5200	0.1900	11.4988			(29a)
Wall to stairwell	11.7100	4.5200	7.1900	0.1700	1.2223			(29a)
External Roof 1	77.1000		77.1000	0.1100	8.4810			(30)
Total net area of external elements Aum(A, m2)			167.5600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.5001			(33)
Party Wall 1			29.3100	0.0000	0.0000			(32)
Party Floor 1			77.1000					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	265.8900	(35)
Thermal bridges (User defined value 0.045 * total exposed area)	7.5402	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	55.0403	(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	60.2786	60.2786	60.2786	60.2786	60.2786	60.2786	60.2786	60.2786	60.2786	60.2786	60.2786	60.2786	(38)
Heat transfer coeff	115.3190	115.3190	115.3190	115.3190	115.3190	115.3190	115.3190	115.3190	115.3190	115.3190	115.3190	115.3190	(39)
Average = Sum(39)m / 12 =												115.3190	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8756	0.8756	0.8756	0.8756	0.8756	0.8756	0.8756	0.8756	0.8756	0.8756	0.8756	0.8756	(40)
HLP (average)												0.8756	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8993	(42)
Hot water usage for mixer showers													
	93.5812	92.1749	90.1256	86.2046	83.3110	80.0841	78.2499	80.2837	82.5131	85.9779	89.9831	93.2227	(42a)
Hot water usage for baths													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses													
	44.3214	42.7097	41.0980	39.4863	37.8746	36.2629	36.2629	37.8746	39.4863	41.0980	42.7097	44.3214	(42c)
Average daily hot water use (litres/day)												126.5709	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	137.9026	134.8846	131.2236	125.6909	121.1856	116.3470	114.5128	118.1583	121.9994	127.0759	132.6928	137.5441	(44)
Energy conte	218.4040	192.0739	201.6858	172.0646	163.1391	143.0622	138.4933	146.3047	150.4375	172.4407	189.0452	215.3608	(45)
Energy content (annual)											Total = Sum(45)m =	2102.5118	
Distribution loss (46)m = 0.15 x (45)m													
	32.7606	28.8111	30.2529	25.8097	24.4709	21.4593	20.7740	21.9457	22.5656	25.8661	28.3568	32.3041	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2200	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												0.7320	(55)
Total storage loss													
	22.6920	20.4960	22.6920	21.9600	22.6920	21.9600	22.6920	22.6920	21.9600	22.6920	21.9600	22.6920	(56)
If cylinder contains dedicated solar storage													
	22.6920	20.4960	22.6920	21.9600	22.6920	21.9600	22.6920	22.6920	21.9600	22.6920	21.9600	22.6920	(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													
	264.3584	233.5811	247.6402	216.5366	209.0935	187.5342	184.4477	192.2591	194.9095	218.3951	233.5172	261.3152	(62)
WWHRS	-83.3321	-73.6996	-77.1740	-63.9031	-59.5554	-50.9620	-47.7687	-50.7973	-52.7272	-62.1596	-70.4193	-81.7889	(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													
	181.0263	159.8814	170.4662	152.6334	149.5381	136.5722	136.6790	141.4618	142.1823	156.2355	163.0979	179.5262	(64)
										Total per year (kWh/year) = Sum(64)m =		1869.3005	(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													
	109.3829	97.0703	103.8240	92.7891	91.0073	83.1458	82.8126	85.4098	85.5981	94.1001	98.4351	108.3710	(65)

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	173.9559	173.9559	173.9559	173.9559	173.9559	173.9559	173.9559	173.9559	173.9559	173.9559	173.9559	173.9559	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	45.0654	40.0267	32.5519	24.6439	18.4216	15.5523	16.8048	21.8435	29.3183	37.2263	43.4486	46.3179	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	447.4000	452.0426	440.3434	415.4371	383.9974	354.4485	334.7080	330.0654	341.7646	366.6709	398.1106	427.6595	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.2949	55.2949	55.2949	55.2949	55.2949	55.2949	55.2949	55.2949	55.2949	55.2949	55.2949	55.2949	(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)													
	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	-115.9706	(71)
Water heating gains (Table 5)													
	147.0200	144.4499	139.5484	128.8737	122.3216	115.4803	111.3072	114.7982	118.8862	126.4786	136.7154	145.6599	(72)
Total internal gains													
	752.7655	749.7993	725.7239	682.2348	638.0207	598.7612	576.1002	579.9872	603.2493	643.6560	691.5548	732.9175	(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	6.6900	11.9814	0.7600	0.7000	0.7700	29.5515	(74)
East	7.6700	22.3313	0.7600	0.7000	0.7700	63.1473	(76)
South	3.8700	50.9848	0.7600	0.7000	0.7700	72.7439	(78)

Solar gains	165.4427	269.3038	401.6930	571.9471	672.1159	735.3058	692.6114	613.0910	493.0099	329.1520	206.3690	138.0676	(83)
Total gains	918.2083	1019.1032	1127.4168	1254.1819	1310.1366	1334.0670	1268.7116	1193.0782	1096.2592	972.8080	897.9238	870.9851	(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	84.3499	84.3499	84.3499	84.3499	84.3499	84.3499	84.3499	84.3499	84.3499	84.3499	84.3499	84.3499	
alpha	6.6233	6.6233	6.6233	6.6233	6.6233	6.6233	6.6233	6.6233	6.6233	6.6233	6.6233	6.6233	
util living area													
	0.9949	0.9891	0.9656	0.8775	0.6822	0.4313	0.2817	0.3092	0.6009	0.9108	0.9863	0.9962	(86)
MIT	20.2513	20.3751	20.6097	20.8540	20.9766	20.9990	21.0000	20.9999	20.9918	20.8389	20.5007	20.2140	(87)
Th 2	20.1883	20.1883	20.1883	20.1883	20.1883	20.1883	20.1883	20.1883	20.1883	20.1883	20.1883	20.1883	(88)
util rest of house													
	0.9931	0.9854	0.9543	0.8435	0.6212	0.3618	0.2080	0.2308	0.5212	0.8765	0.9808	0.9949	(89)
MIT 2	19.3236	19.4803	19.7719	20.0541	20.1725	20.1879	20.1883	20.1883	20.1843	20.0444	19.6402	19.2762	(90)
Living area fraction										fLA = Living area / (4) =		0.2323	(91)
MIT	19.5392	19.6882	19.9665	20.2399	20.3593	20.3763	20.3769	20.3768	20.3719	20.2290	19.8402	19.4941	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5392	19.6882	19.9665	20.2399	20.3593	20.3763	20.3769	20.3768	20.3719	20.2290	19.8402	19.4941	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9912	0.9825	0.9506	0.8459	0.6344	0.3779	0.2251	0.2491	0.5396	0.8785	0.9778	0.9933	(94)
Useful gains	910.1304	1001.2910	1071.7451	1060.8743	831.1812	504.1730	285.6175	297.1367	591.5437	854.5640	877.9561	865.1624	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1665.1084	1624.6350	1449.1594	1192.3876	848.6674	504.6751	285.6288	297.1591	596.4158	995.0919	1365.3965	1659.9171	(97)
Space heating kWh	561.7036	418.8872	280.7962	94.6896	13.0097	0.0000	0.0000	0.0000	0.0000	104.5527	350.9571	591.2975	(98a)
Space heating requirement - total per year (kWh/year)												2415.8937	
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	561.7036	418.8872	280.7962	94.6896	13.0097	0.0000	0.0000	0.0000	0.0000	104.5527	350.9571	591.2975	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2415.8937	
Space heating per m2											(98c) / (4) =	18.3439	(99)

9b. Energy requirements

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(301)
Fraction of space heat from community system	1.0000	(302)
Fraction of heat from community Heat pump-Space and Water	1.0000	(303a)
Factor for control and charging method (Table 4c(3)) for space heating	1.0000	(305)
Factor for charging method (Table 4c(3)) for water heating	1.0000	(305a)
Distribution loss factor (Table 12c) for community heating system	1.0000	(306)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating:		
Space heating requirement		
561.7036 418.8872 280.7962 94.6896 13.0097 0.0000 0.0000 0.0000 0.0000 104.5527 350.9571 591.2975		(98)
Space heat from Heat pump = (98) x 1.00 x 1.00 x 1.00		
307a 561.7036 418.8872 280.7962 94.6896 13.0097 0.0000 0.0000 0.0000 0.0000 104.5527 350.9571 591.2975		
Space heating requirement		
561.7036 418.8872 280.7962 94.6896 13.0097 0.0000 0.0000 0.0000 0.0000 104.5527 350.9571 591.2975		(307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	(308)
Space heating fuel for secondary/supplementary system		
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000		(309)
Water heating		
Annual water heating requirement		
181.0263 159.8814 170.4662 152.6334 149.5381 136.5722 136.6790 141.4618 142.1823 156.2355 163.0979 179.5262		(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.00		
310a 181.0263 159.8814 170.4662 152.6334 149.5381 136.5722 136.6790 141.4618 142.1823 156.2355 163.0979 179.5262		
Water heating fuel		
181.0263 159.8814 170.4662 152.6334 149.5381 136.5722 136.6790 141.4618 142.1823 156.2355 163.0979 179.5262		(310)
Cooling System Energy Efficiency Ratio	0.0000	(314)
Space coolin 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000		(315)
Pumps and Fa 12.7188 11.4880 12.7188 12.3085 12.7188 12.3085 12.7188 12.7188 12.3085 12.7188 12.3085 12.7188		(331)
Lighting 39.4455 31.6446 28.4925 20.8748 16.1243 13.1737 14.7091 19.1195 24.8343 32.5840 36.8035 40.5418		(332)
Electricity generated by PVs (Appendix M) (negative quantity)		
(333a)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		(333a)
Electricity generated by wind turbines (Appendix M) (negative quantity)		
(334a)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		(334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)		
(335a)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		(335a)
Electricity generated by PVs (Appendix M) (negative quantity)		
(333b)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		(333b)
Electricity generated by wind turbines (Appendix M) (negative quantity)		
(334b)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		(334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)		
(335b)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		(335b)
Annual totals kWh/year		
Space heating fuel - community heating	2415.8937	(307)
Space heating fuel - secondary	0.0000	(309)
Water heating fuel - community heating	1869.3005	(310)
Efficiency of water heater	0.0000	(311)
Electricity used for heat distribution	24.1589	(313)
Space cooling fuel	0.0000	(321)
Electricity for pumps and fans:		
(MEVCentralised, Database: in-use factor = 1.6000, SFP = 0.3360)		
mechanical ventilation fans (SFP = 0.3360)	149.7540	(330a)
Total electricity for the above, kWh/year	149.7540	(331)
Electricity for lighting (calculated in Appendix L)	318.3476	(332)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(333)
Wind generation	0.0000	(334)
Hydro-electric generation (Appendix N)	0.0000	(335a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(335)
Appendix Q - special features		
Energy saved or generated	-0.0000	(336)
Energy used	0.0000	(337)
Total delivered energy for all uses	4753.2959	(338)

10b. Fuel costs - using BEDF prices (533)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating from Heat pump	2415.8937	4.8000	115.9629	(340a)
Space heating total			115.9629	(340)
Total CO2 associated with community systems			0.0000	(473)
Space heating - secondary	0.0000	0.0000	0.0000	(341)
Water heating from Heat pump	1869.3005	4.8000	89.7264	(342a)
Water heating total			89.7264	(342)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(347a)
Pumps, fans and electric keep-hot	149.7540	21.5100	32.2121	(349)
Energy for lighting	318.3476	21.5100	68.4766	(350)
Additional standing charges			98.0000	(351)
Total energy cost			404.3780	(355)

12b. Carbon dioxide emissions - Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Efficiency of heat source Heat pump			350.0000	(367)
Space and Water heating from Heat pump	1224.3412	0.1575	108.6842	(367)
Electrical energy for heat distribution (space & water)	24.1589	0.0000	6.4302	(372)
Overall CO2 factor for heat network			0.0444	(386)
Total CO2 associated with community systems			190.1497	(373)
Space and water heating			190.1497	(376)
Pumps, fans and electric keep-hot	149.7540	0.1387	20.7727	(378)
Energy for lighting	318.3476	0.1443	45.9474	(379)
Total CO2, kg/year			256.8699	(383)

13b. Primary energy - Community heating scheme

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Efficiency of heat source Heat pump			350.0000	(467a)
Space and Water heating from Heat pump	1224.3412	1.5829	1092.6072	(467)
Electrical energy for heat distribution (space & water)	24.1589	0.0000	66.6447	(472)
Overall CO2 factor for heat network			0.4599	(486)
Total CO2 associated with community systems			1970.7803	(473)
Space and water heating			1970.7803	(476)
Pumps, fans and electric keep-hot	149.7540	1.5128	226.5479	(478)
Energy for lighting	318.3476	1.5338	488.2923	(479)
Total Primary energy kWh/year			2685.6204	(483)