LOVE DESIGN STUDIO

December 2022

Land North of Raleigh Drive, Claygate

Energy and Sustainability Statement

Contents

December 2022
PR466_V1
Author: SK
Checked by: OE

Section Zero

0 Executive Summary

Executive Summary

An assessment of the site's sustainability and energy credentials has been carried out to support an outline planning application on the Land North of Raleigh Drive, Claygate.

The proposed development is for up to 60 new dwellings, including affordable homes, vehicular and pedestrian access from Raleigh Drive, the provision of landscape buffers along the boundaries, and large areas of open space including play areas.

The energy strategy follows the energy hierarchy; use less energy (Be Lean), supply energy efficiently (Be Clean), use renewable and low carbon energy (Be Green) as per Policy CC1 of Regulation 19 Draft Elmbridge Local Plan (2037).

The proposed energy strategy capitalises on passive design measures to maximise the fabric energy efficiency and energy demand. The scheme should then makes use of Air Source Heat Pumps (ASHPs) for space heating and domestic hot water, with the provision of photovoltaic solar panels to generate electricity on-site. Heat-pump solutions for space heating and hot water will remove the need for on-site combustion.

The scheme could look to utilise window reveals, balconies and external shutters where feasible, to reduce the requirement for active cooling. Wastewater Heat Recovery Systems should be included to help reduce the operational energy demand of the dwellings.

The proposed energy strategy has been set out within this report and the scheme is currently demonstrating a combined on-site regulated **CO_2 reduction of 64%** (Part L 2021 Baseline).

The site-wide results summary for the carbon emissions are set out on this page. Further detail may be found in the body of the report.

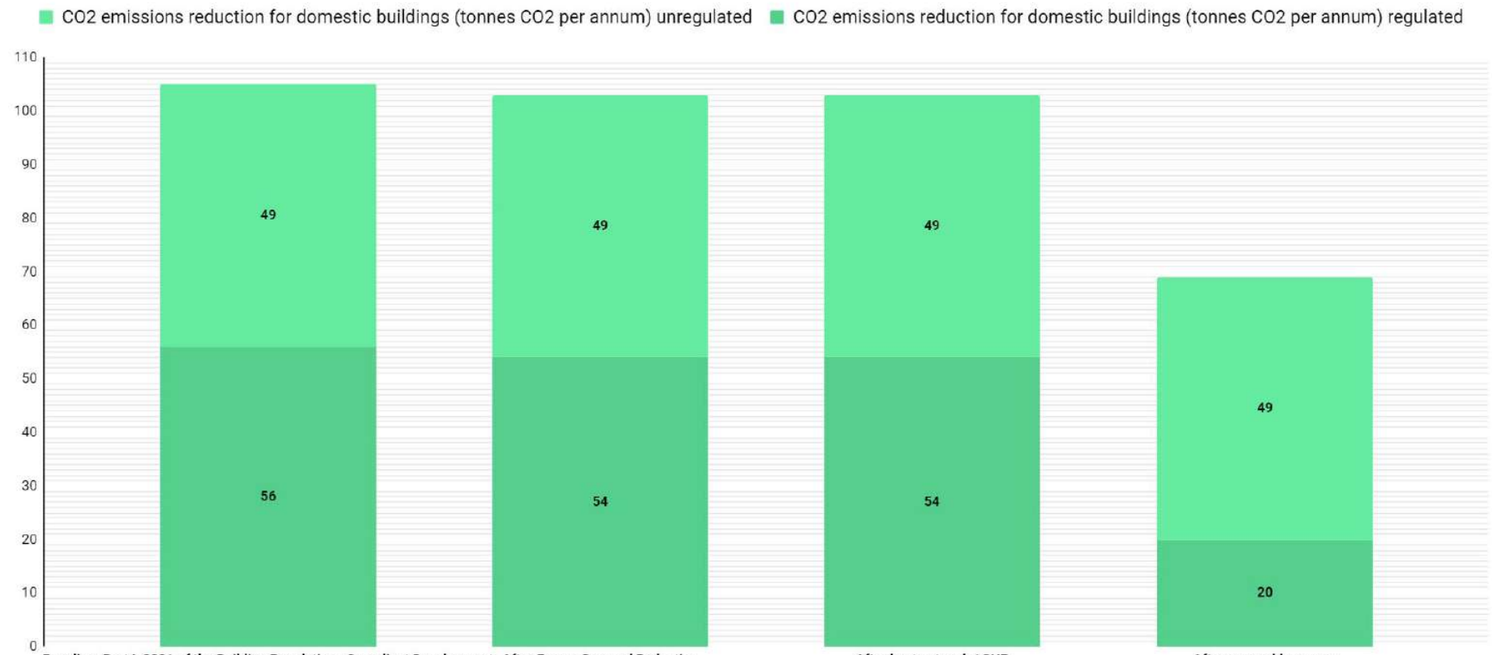


Figure 1: Total site-wide savings at each stage of the energy hierarchy

	Regulated domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	**(%)**
Savings from energy demand reduction	2	3%
Savings from heat network / CHP	0	0%
Savings from renewable energy	34	61%
Cumulative savings	**36**	**64%**

Table 1: Total site-wide savings at each stage of the energy hierarchy

Emissions within this report are based on the following CO_2 emission rates:

- Natural Gas 0.210 kgCO_2/kWh
- Grid electricity 0.136 kgCO_2/kWh

These represent the SAP 10.2 carbon factor figures. For the assessment of demand reduction measures (Be Lean stage) space heating and domestic hot water is assumed to be from gas boilers with an 89.5% efficient gas boiler, to standardize a benchmark target. However, the Be Green stage of the energy hierarchy results considers ASHPs as an alternative method for space heating and hot water.

Section One

1 Introduction

Site Overview

Love Design Studio prepared this Energy and Sustainability Statement to support and outline planning application at the Land North of Raleigh Drive, Claygate, Surrey.

The proposed development is for approximately 60 new dwellings, including affordable homes, vehicular and pedestrian access from Raleigh Drive, the provision of landscape buffers along the boundaries, and large areas of open space including play areas.

The purpose of this statement is to outline the potential sustainability credentials of the scheme and demonstrate the alignment of the proposed energy strategy with relevant national, regional and local planning policy requirements.

FIgure 2: Site boundary (Red)

Planning Policy

National Planning Policy Framework (2021)

The National Planning Policy Framework sets out the Government's planning policies for England and how these should be applied. It provides a framework within which locally prepared plans for housing and other development can be produced.

Planning law requires that applications for planning permission be determined in accordance with the development plan unless material considerations indicate otherwise. The National Planning Policy Framework must be considered in preparing the development plan and is a material consideration in planning decisions. Planning policies and decisions must also reflect relevant international obligations and statutory requirements.

The purpose of the planning system is to contribute to the achievement of sustainable development. In summary the framework advises:

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

New development should be planned for in ways that:

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

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

- *Provide a positive strategy for energy from these sources, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts);*
- *Consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and*
- *Identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers.*

Planning Policy - Existing

Elmbridge Local Development Framework

The Local Planning Authority, Elmbridge Borough Council, have a statutory guide to development within the borough and use policies and guides to do so. The current development framework within Elmbridge is comprised of the Core Strategy (2011) and the Local Development Management Plan (2015). The Local Plan documents include a variety of overarching spatial policies to guide future development and land use in the Borough.

The Borough of Elmbridge declared a climate emergency in July 2019 and pledged that to become carbon neutral by 2030. The Council is therefore committed to mitigating carbon emissions throughout the borough.

The policies and requirements of new development within the borough which relate to this proposal, found in the Core Strategy (2011), Local Development Plan (2015) and the Regulation 19 Draft Local Plan are expanded on in the following sections.

Core Strategy (2011)

The Core Strategy is the principal planning document that sets out the vision, spatial strategy and core policies that are used for shaping future development in the Borough up to 2026.

The scheme will adhere to the following policies pertaining to sustainability:

- CS14 Green Infrastructure
- CS15 Biodiversity
- CS26 Flooding
- CS27 Sustainable Buildings

It is worth noting that when the Code for Sustainable Homes was scrapped in 2016, Elmbridge announced that the requirements of Policy CS27 were no longer mandatory. Nonetheless, this scheme has employed key principles of the CFSH with an objective of demonstrating its proposed sustainability credentials.

Local Development Management Plan (2015)

The Elmbridge Local Plan (DMP), adopted in April 2015, is the overall strategic plan for Elmbridge and sets out an integrated economic, environmental, and social framework for the development of the area.

Policies within the DMP deemed relevant to this Energy and Sustainability statement are:

- DM2 - minimise energy and water consumption

Further explanation on how these policies have been complied with in this outline application are detailed in the sustainability section of the report.

Planning Policy - Draft

Regulation 19: Draft Elmbridge Local Plan 2022-2037

In 2022, Elmbridge Borough Council published the draft of their proposed Local Plan, following a period of stakeholder and public consultation. This Local Plan is due to replace existing policy, consisting of the Core Strategy (2011) and Development Management Plan (2015), and will remain in situ until 2037.

The proposed Local Plan will set out the spatial strategy for Elmbridge to deliver the Borough's vision for how the places and communities will grow and will lay out strategic and detailed development management policies to deliver sustainable growth.

Although the draft local plan has yet to be adopted, considerations regarding the sustainable criteria contained in the document have been made, with the following policies acknowledged:

POLICY CC1 - ENERGY EFFICIENCY, RENEWABLE AND LOW CARBON ENERGY

Developments will be expected to reduce carbon dioxide emissions by the Target Emissions Rate (TER) set out in Part L 2021 Building Regulations. This should be achieved by following the energy hierarchy below:

1. Be Lean - use less energy and manage demand during operation.
2. Be Clean - exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly.
3. Be Green - maximise opportunities for renewable energy by producing, storing, and using renewable energy on-site.

POLICY CC3 - SUSTAINABLE DESIGN STANDARDS

All developments must:

- Incorporate measures such as smart metering, water saving and recycling measures.
- Include water saving measures such as rainwater harvesting and greywater recycling, if a major development
- Meet a minimum internal water efficiency standard of 110 l/p/day, as set out in Building Regulations Part G
- Achieve a Home Quality Mark 4 star as a minimum and aim towards achieving a higher mark where possible, if a major residential development

Other policy extracts from the draft local plan that are deemed relevant to Energy and/or Sustainability have been set out below for reference:

POLICY CC2 - MINIMISING WASTE AND PROMOTING A CIRCULAR ECONOMY

POLICY CC4 SUSTAINABLE TRANSPORT

POLICY CC5 - MANAGING FLOOD RISK

POLICY ENV1 - GREEN AND BLUE INFRASTRUCTURE

POLICY ENV2 - LANDSCAPE, TREES AND WOODLANDS

POLICY ENV3 - LOCAL GREEN SPACES

POLICY ENV6 - PROTECTING, ENHANCING AND RECOVERING BIODIVERSITY

POLICY ENV7 - ENVIRONMENTAL QUALITY

POLICY ENV8 - AIR QUALITY

POLICY SS1 - RESPONDING TO THE CLIMATE EMERGENCY

POLICY SS2 - SUSTAINABLE PLACE MAKING

Figure 3: The energy hierarchy proposed in Regulation 19: Draft Elmbridge Local Plan 2022-2037

Section Two

2 Energy

Methodology and Assumptions

The scheme looks to meet operational energy targets, in reference to Requirement 19: Draft Elmbridge Local Plan (Policy CC1: 'Energy Efficiency, Renewable and Low Carbon Energy''):

1. **Be Lean** - use less energy and manage demand during operation.
2. **Be Clean** - exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly.
3. **Be Green** - maximise opportunities for renewable energy by producing, storing, and using renewable energy on-site.

On the 15th June 2022, Part L (2013) Building Regulations were replaced by Part L (2021). The aim of this update is to improve the energy efficiency of new buildings. Some of the changes are listed below:

- 31% lower CO2 emissions required under part L (2021) in comparison to its 2013 counterpart
- Air tightness testing now mandatory
- Improvements to thermal bridging and building fabric targets

To achieve compliance with Requirement 19: Draft Elmbridge Local Plan and Part L 2021, the following assumptions, definitions, and methodology have been applied:

- Elmhurst software has been used to calculate the domestic carbon dioxide emissions for the scheme using SAP 10.2 carbon factors
- Completed checklists at this stage represent anticipated targets, post-construction testing will be required to confirm airtightness, ventilation and thermal bridging.
- Building fabric will be selected based on the U-values provided by the manufacturer to achieve a high level of building efficiency.
- Renewable technology, for the purpose of the report, includes for the provision of low carbon technologies, including heat-pump technology and photovoltaic solar panels.
- Drawings used to model the scheme are based on drawings received 30/09/2022.
- A full copy of the SAP calculations is contained in the appendices

Be Lean

Passive Design Measures Summary

Overleaf sets out the inputs used for the SAP and SBEM calculations to generate carbon emission reduction findings.

In summary, the scheme benefits from:

- Being airtight, reducing draughts and heat loss.
- A well-insulated building fabric shell.
- Mechanical extract ventilation (wet rooms and kitchen)
- 100% efficient lighting.
- Passive solar shade solutions.

For the assessment of demand reduction measures space heating and domestic hot water is assumed to be from a gas boiler, to standardise a benchmark target. However, the subsequent sections of this report have set out an alternative method for space heating and hot water as a preferred solution.

The proposed scheme Dwelling Fabric Energy Efficiency score will provide an improvement on the Target Fabric Energy efficiency score under Part L (2021) Building Regulations.

See appendix A for the full proposed Be Lean considerations.

Table 2: SAP Model inputs

Whole Scheme Technical Information			
Building Fabric	**Input**	**Unit**	**Comment**
External Wall U-value	0.16	W/m²K	Include unheated areas
Roof U-value	0.12	W/m²K	Include roof to terraces
Ground Floor U-value	0.12	W/m²K	-
Windows U-value	1.2	W/m²K	-
Doors U-Value	1.0	W/m²K	-
Technical Information			
Building Fabric	**Input**	**Unit**	**Comment**
Windows g-value	0.50	-	-
Frame-Factor	0.7	-	-
Thermal Mass Parameter	Medium (250 kJ/m²K)		Default value
Thermal Bridge Y-value	<0.1	-	Thermal Bridging calculations to be carried out Post-Planning.
Ventilation Method	Titon CME2 Q Plus A		Mechanical Extract Ventilation to all west rooms and kitchens
Air permeability	3.0 @50Pa ($m^3/(h.m^2)$)		A low air permeability required to improve MEV efficiency

Table 3: Scheme overheating mitigation measures

Overheating Mitigation Measures	
1. Minimising Internal Heat	Pipe lengths minimised, insulated pipework.
2. Reducing heat entering	Balconies, internal blinds, ~300mm window reveals, shutters (TBC)
3. Use of thermal mass	-
4. Passive ventilation	Openable windows, dual aspect where possible
5. Mechanical Ventilation	Mechanical Extract Ventilation only
6. Active cooling	None

Be Clean

Heating Infrastructure

Once demand for energy has been minimised, planning applications should demonstrate how their energy systems will exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly to reduce CO_2 emissions.

As well as carbon dioxide emissions, all combustion processes can emit oxides of nitrogen (NO_x) and solid or liquid fuelled appliances (such as those using biomass or biodiesel) can also emit particulate matter. These pollutants contribute to poor air quality and can have negative impacts on the health of residents and occupants of the development. It is important that these impacts are considered in determining the heating strategy of a development.

Existing Networks, Planned Networks and Supplying Heat Beyond the Site Boundary

Where a heat network exists in the vicinity of the proposed development, the applicant should look to prioritise connection and provide evidence of active two-way correspondence with the network operator.

Applicants should investigate the potential for connecting the development to an existing heat network system by contacting the local borough, local heat network operators and nearby developments.

If there is not an existing network, the applicant must investigate whether a network is being planned for the area. Applicants should also investigate opportunities for expanding their heat network to supply heat to local developments and buildings outside the boundaries of their site, particularly if this has the potential to facilitate an area-wide heat network.

No existing or proposed heat networks are located in the area; nor does the scheme lie in a priority heat work area.

In consideration of the above, individual efficient space heating and domestic hot water systems are advised. Therefore, there are no CO_2 savings at this stage of the energy hierarchy.

Be Green

Renewable Energy

Energy assessments should explain how the opportunities for producing, storing, and using renewable energy on-site will be maximised.

The capacity for renewable technologies at the proposed site has been discussed with the wider design team. The following technologies were considered:

- Biomass
- Air Source Heat Pumps (ASHPs)
- Ground Source Heat Pumps (GSHPs)
- Photovoltaic Solar Panels
- Solar Thermal Hot Water
- Wind Technology

Of the above technologies it was decided that ASHPs and photovoltaic solar panels are the most feasible and applicable for the proposed scheme given the site constraints. A summary of each chosen technology is set out in the following sections.

A summary of the input details is set out on this page for reference use.

Table 4: Area-weighted Fabric Energy Efficiency ratings for the scheme

Technical Information		
Domestic Be Green Stage		
Space Heating System	Individual ASHPs	175.1% default efficiency, MCS certified
Heating Emitter	Underfloor	-
Domestic Hot Water System	Same as space heating	-
Storage	Yes	~180 litres, 80mm foam insulation
Space Cooling System	No	-
Low/Zero Carbon Technologies used	ASHPs	175.1% default efficiency, MCS certified
	Photovoltaic Solar Panels	South facing panels on roof of development

Be Green

Air Source Heat Pumps (ASHPs)

Where heat pumps are proposed, a high specification of energy efficiency will be expected to ensure the system operates efficiently and to reduce peak electricity demand. This applies to any type of heat pump proposals including ASHPs, ground source heat pumps (GSHPs), water source heat pumps (WSHPs) or hybrid and ambient loop types of systems.

The details of the ASHPs will be provided at the detailed design stage; therefore, conservative efficiencies have been used for the purpose of this report based on default SAP figures for the residential uses.

Specifically, for ASHPs, evidence that the heat pump complies with the minimum performance standards as set out in the Enhanced Capital Allowances (ECA) product criteria are typically required for the relevant ASHP technology as well as evidence that the heat pump complies with other relevant issues as outlined in the Microgeneration Certification Scheme Heat Pump Product Certification.

Refrigerant pipe-runs will be minimised and will be in accordance with the specific supplier guidance. Individual ASHPs have been proposed for this site. As such, a fully insulated hot water cylinder should be supplied.

As this is an outline application details regarding the location of the condensers have been omitted, however, in accordance with standard practice it is likely that the condensers will be located on flat roofs where available, or externally to the rear of each dwelling. In any event, the condensers will be situated as far away from any sensitive noise receptors as the site allows.

Further detail will be mapped out at the detailed design stage.

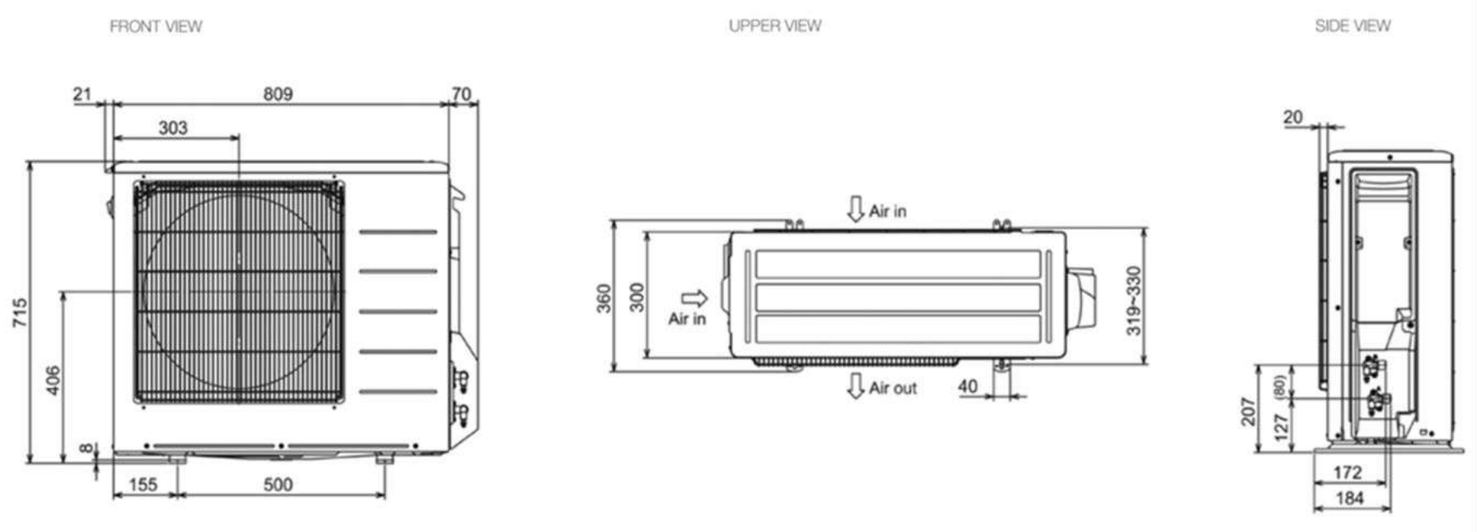


Figure 4: ©Mitsubishi QUHZ-W40VA example dimensions

Be Green

Photovoltaic Solar Panels

Photovoltaic solar panels are the preferred on-site renewable generation technology as electricity is off-set on-site and can be utilised by the tenants themselves. Possible location of the PV array is indicated in the adjoining figure.

At the outline planning stage it is suggested that Solar PV panels are considered for installation on all south facing roofs as highlighted in blue in the diagram to the right. The draft site layout indicates space for around 40 Solar PV panels, however further detail should be provided at the point of a reserved matters planning application submission, including details of Solar PV kWp output and the amount of carbon that could be offset on-site from the installation of Solar Panels.

Figure 5: Indicative space for photovoltaic solar panel array location on the roofs of the proposed development (blue)

Carbon Emission Results Summary

The energy strategy follows the energy hierarchy; use less energy (Be Lean), supply energy efficiently (Be Clean) and use renewable and low carbon energy (Be Green). The overall energy strategy capitalises on passive design measures to maximise the fabric energy efficiency and energy demand.

Following the energy hierarchy process, the applicant has opted for an individual ASHP solution per dwelling for space heating and domestic hot water, mechanical extract ventilation, a waste water heat recovery system and photovoltaic solar panels on the roof.

Overall. the scheme meets a combined on-site regulated **CO_2 reduction of 64%** (Part L 2021 Baseline).

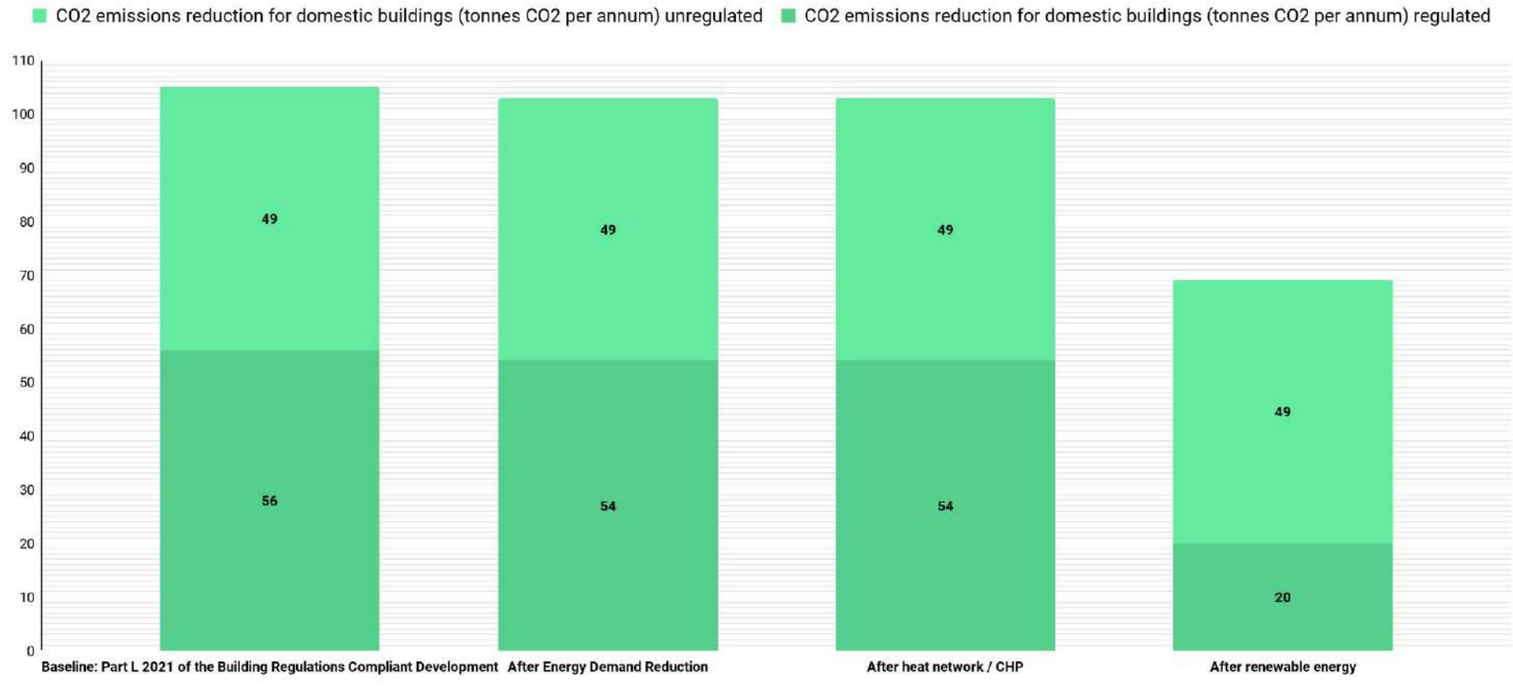


Figure 6: Total site-wide savings at each stage of the energy hierarchy

Table 5: Carbon dioxide emissions after each stage of the Energy Hierarchy for domestic buildings (SAP 10)

	Carbon dioxide emissions from domestic buildings (tonnes CO_2 per annum)	
	Regulated	**Unregulated**
Baseline: Part L 2013 of the Building Regulations Compliant Development	56	49
After energy demand reduction	54	49
After heat network / CHP	54	49
After renewable energy	20	49

Table 6: Total site-wide savings at each stage of the energy hierarchy

	Regulated domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	**(%)**
Savings from energy demand reduction	2	3%
Savings from heat network / CHP	0	0%
Savings from renewable energy	34	61%
Cumulative savings	**36**	**64%**

Section Three

3 Sustainability

Sustainability and Climate Change Appraisal

To meet the Local Authority's sustainability requirements, we have set out the sustainability credentials of the scheme in similar format to that of the, now defunct, Code for Sustainable Homes.

In a statement made on 25 March 2015, the Secretary of State for Communities and Local Government, Eric Pickles, confirmed that from 27 March 2015, changes to the 2008 Climate Change Act would mean local authorities in England could no longer require code level 3, 4, 5 or 6 as part of the conditions imposed on planning permissions. Applicants should work towards to the relevant Building Regulations standard; however, energy requirements for dwellings in the UK are now typically set by the Building Regulations equivalent to code level 4.

For the purpose of this assessment, we have used the Code as a method for assessing and demonstrating the residential part of the scheme's sustainability credentials and summarised the scheme's aspirations against each category

Energy Display Devices

The scheme will be provided with the ability to display energy consumption data and record energy use; this is to promote the specification of equipment to display energy consumption data, thus empowering dwelling occupants to reduce energy use.

Drying Space

To promote a reduced energy means of drying clothes. Space will look to be made available for the ability to dry clothes to avoid utilising heat energy.

Energy Labelled White Goods

Where white goods will be provided, the scheme will look to have them classified as energy efficient with at least an A-rating, where feasible. This is to promote the provision or purchase of energy efficient white goods, thus reducing the CO_2 emissions from appliance use in the dwelling.

External Lighting

All external space lighting, including lighting in common areas, will be provided by dedicated energy efficient fittings with appropriate control systems in-line with Building Regulations standards; this is to promote the provision of energy efficient external lighting, thus reducing CO_2 emissions associated with the dwelling.

Cycle Storage

Cycle parking will be provided within garden sheds for the houses and cycle stores for the apartments. This is to promote the wider use of bicycles as transport by providing adequate and secure cycle storage facilities, thus reducing the need for short car journeys and the associated CO2 emissions.

Sustainable Transport

The development will provide direct and safe pedestrian and cycle paths from the site to the local area. Located near the site are existing bus stops along Milbourne Lane and Hare Lane that provide regular bus services to nearby towns. Also within 0.5km of the site is Claygate railway station.

It is proposed that new residents will be supplied with a 'Travel Pack' containing information of travel routes to encourage sustainable transport.

Home Office

The scheme should promote working from home by providing occupants with the necessary space and services, thus reducing the need to commute.

Sustainability and Climate Change Appraisal

Water and Surface Water Run-Off

Indoor Water Use

The water consumption targets for the dwellings will be 105 l/p/day, which is an improvement to local policy requirement of 110 l/p/day. To reduce the consumption of potable water in the home from all sources, including borehole well water, using water efficient fittings, appliances, and water recycling systems. Rainwater harvesting in the form of rainwater butts will be used for landscape maintenance.

Waste Water Heat Recovery Systems will be installed in all showers.

External Water Use

Space should be made available for the provision of water butts in private amenity spaces; this is to promote the recycling of rainwater and reduce the number of mains potable water used for external water uses.

Management of Surface Water Run-off from Developments

It is proposed that hard landscaping will be minimised and permeable surfaces maximised to reduce surface water run-off.

Flood Risk

Part of the proposed site includes land that is principally within FLood Zone 1. It also includes land that is in Flood Zones 2 and 3.

Materials

Environmental Impact of Materials

To specify materials with lower environmental impacts over their life cycle; where feasible, key elements of the building Envelope will achieve an equivalent rating of A+ to D in the 2008 version of The Green Guide:

- Roof
- External walls
- Internal walls (including separating walls)
- Upper and ground floors (including separating floors)
- Windows.

Responsible Sourcing of Materials - Basic Building Elements

To promote the specification of responsibly sourced materials for the basic building elements; materials in the following Building Elements will be responsibly sourced:

a) Frame
b) Ground floor
c) Upper floors (including separating floors)
d) Roof
e) External walls
f) Internal walls (including separating walls)
g) Foundation/substructure (excluding sub-base materials)
h) Staircase

Additionally, timber in these elements will be legally sourced

Responsible Sourcing of Materials - Finishing Elements

To promote the specification of responsibly sourced materials for the finishing elements; materials in the following Finishing Elements will be responsibly sourced:

a) Staircase
b) Windows
c) External & internal doors
d) Skirting
e) Panelling
f) Furniture
g) Fascias
h) Any other significant use

Additionally, timber in these elements will be legally sourced

Sustainability and Climate Change Appraisal

Waste

Storage of Non-recyclable Waste and Recyclable Household Waste

To meet Elmbridge Borough Council requirements, the proposed houses will be provided with refuse bins and apartments will have access to a communal bin store.

Construction Site Waste Management

A compliant Site Waste Management Plan (SWMP) should be carried out setting out target benchmarks for waste, procedures for minimising hazardous waste and monitoring/measuring/reporting of hazardous and non-hazardous waste groups; this is to promote resource efficiency via the effective and appropriate management of construction site waste.

The SWMP should look to include procedures to sort and divert waste from landfill, through either:

a. Re-use on site (in situ or for new applications)
b. Re-use on other sites
c. Salvage/reclaim for re-use
d. Return to the supplier via a 'take-back' scheme
e. Recovery and recycling using an approved waste management contractor
f. Compost

according to the defined waste groups (in line with the waste streams generated by the scope of the works).

Composting

Space for individual home composting facilities will be provided to promote the provision of compost facilities to reduce the amount of household waste sent to landfill.

Pollution

Global Warming Potential (GWP) of Insulants

To promote the reduction of emissions of gases with high GWP associated with the manufacture, installation, use and disposal of foamed thermal and acoustic insulating materials; where feasible, insulating materials in the elements of the dwelling listed below will have a low GWP (in manufacture AND installation):

- Roofs: including loft access
- Walls: internal and external including lintels and all acoustic insulation
- Floors: including ground and upper floors
- Hot water cylinder: pipe insulation and other thermal stores
- Cold water storage tanks: where provided
- External doors

NOx Emissions

To promote the reduction of nitrogen oxide (NOX) emissions into the atmosphere; there will be no combustion boilers provided on-site within the dwellings.

Health and Wellbeing

Daylight

Living/kitchen spaces will look to meet at least a 1.5% Average Daylight Factor (ADF) and bedrooms meet at least a 1% ADF, where feasible; this is to promote good daylighting and thereby improve quality of life and reduce the need for energy to light the home.

Sound Insulation

Building materials will be chosen as such to improve the sound insulation between dwellings and to the main road; in-line with BS8223; this is to promote the provision of improved sound insulation to reduce the likelihood of noise complaints from neighbours.

Private Space

The scheme will look to improve quality of life by promoting the provision of an inclusive outdoor space which is at least partially private outdoor space (private or semi-private) has been provided that is:

- Of a minimum size that allows all occupants to use the space.
- Provided with inclusive access and usability.
- Accessible only to occupants of designated dwellings.

Sustainability and Climate Change Appraisal

Management

Home User Guide

The scheme will look to provide a Home User Guide to the owner/tenants prior to handover to promote the provision of guidance enabling occupants to understand and operate their home efficiently and make the best use of local facilities.

Considerate Constructors Scheme

There is a commitment to meet best practice under a nationally or locally recognised certification scheme such as the Considerate Constructors Scheme; this is to promote the environmentally and socially considerate, and accountable management of construction sites.

Construction Site Impacts

To promote construction sites managed in a manner that mitigates environmental impacts; where feasible, there will be procedures that will typically cover one or more of the following items:

- Monitor, report and set targets for CO_2 production or energy use arising from site activities
- Monitor and report CO_2 or energy use arising from commercial transport to and from site
- Monitor, report and set targets for water consumption from site activities
- Adopt best practice policies in respect of air (dust) pollution arising from site activities
- · Adopt best practice policies in respect of water (ground and surface) pollution occurring on the site

Where feasible, 80% of site timber is reclaimed, re-used or responsibly sourced

Security

The principles of Secure by Design will be carried out for the scheme, to promote the design of developments where people feel safe and secure- where crime and disorder, or the fear of crime, does not undermine quality of life or community cohesion.

Ecology

To minimise reductions and promote an improvement in ecological value and enhance the ecological value of the site, the scheme will look to promote:

- development on land that already has a limited value to wildlife, and discourage the development of ecologically valuable sites.
- the protection of existing ecological features from substantial damage during the clearing of the site and the completion of construction works.
- the most efficient use of a building's footprint by ensuring that land and material use is optimised across the development.

Ecological surveys have indicated that the proposed development has no significant ecological constraints.

Section Four

4 Conclusion

Conclusion

An assessment of the site's sustainability and energy credentials has been carried out to support an outline planning application on the Land North of Raleigh Drive, Claygate.

The proposed development is for up to 60 new dwellings, including affordable homes, vehicular and pedestrian access from Raleigh Drive, the provision of landscape buffers along the boundaries, and large areas of open space including play areas.

The energy strategy follows the energy hierarchy; use less energy (Be Lean), supply energy efficiently (Be Clean), use renewable and low carbon energy (Be Green) as per Policy CC1 of Regulation 19 Draft Elmbridge Local Plan (2037).

The proposed energy strategy capitalises on passive design measures to maximise the fabric energy efficiency and energy demand. The scheme should then makes use of Air Source Heat Pumps (ASHPs) for space heating and domestic hot water, with the provision of photovoltaic solar panels to generate electricity on-site. Heat-pump solutions for space heating and hot water will remove the need for on-site combustion.

The scheme could look to utilise window reveals, balconies and external shutters where feasible, to reduce the requirement for active cooling. Wastewater Heat Recovery Systems should be included to help reduce the operational energy demand of the dwellings.

The proposed energy strategy has been set out within this report and the scheme is currently demonstrating a combined on-site regulated **CO_2 reduction of 64%** (Part L 2021 Baseline).

The site-wide results summary for the carbon emissions are set out on this page. Further detail may be found in the body of the report.

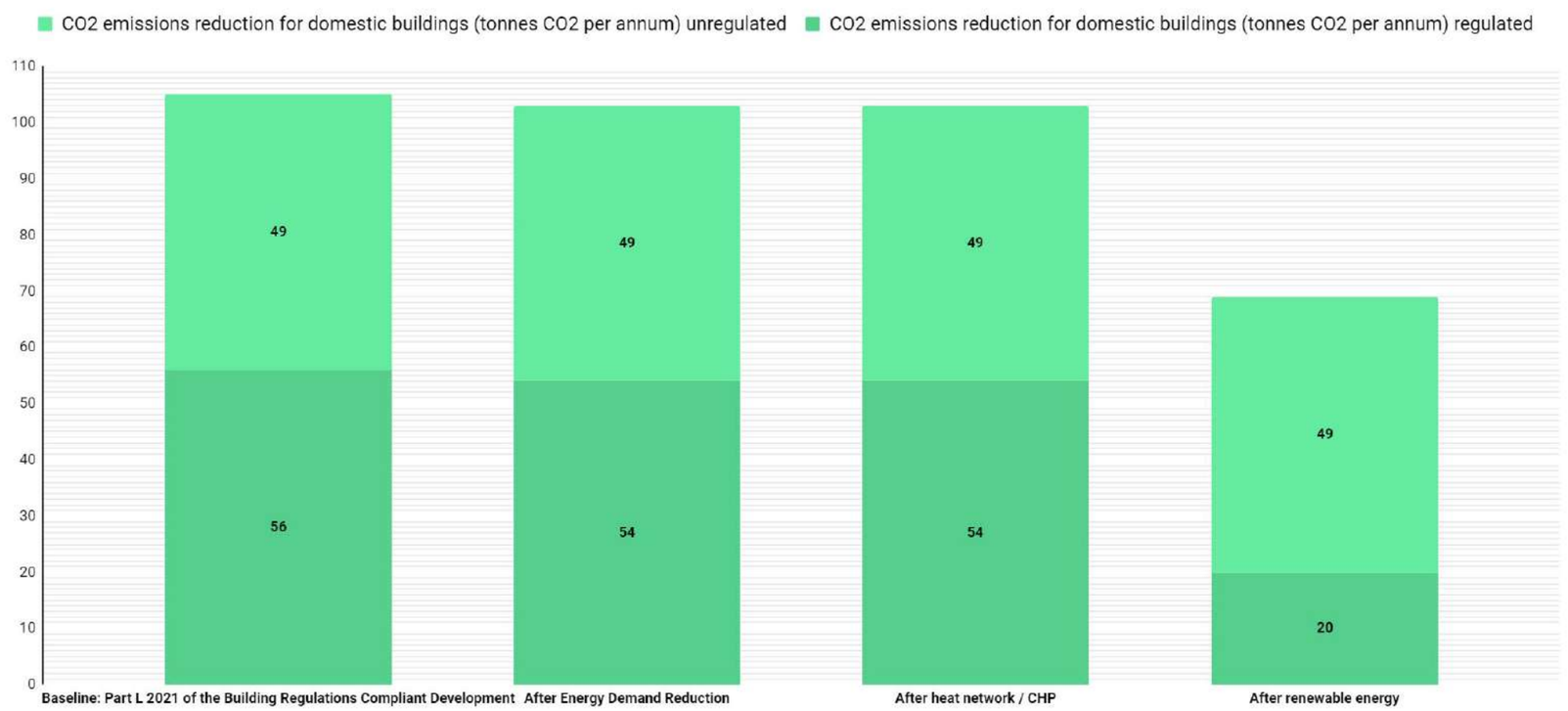


Figure 7: Total site-wide savings at each stage of the energy hierarchy

	Regulated domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	**(%)**
Savings from energy demand reduction	2	3%
Savings from heat network / CHP	0	0%
Savings from renewable energy	34	61%
Cumulative savings	**36**	**64%**

Table 7: Total site-wide savings at each stage of the energy hierarchy

Emissions within this report are based on the following CO_2 emission rates:

- Natural Gas 0.210 kgCO_2/kWh
- Grid electricity 0.136 kgCO_2/kWh

These represent the SAP 10.2 carbon factor figures. For the assessment of demand reduction measures (Be Lean stage) space heating and domestic hot water is assumed to be from gas boilers with an 89.5% efficient gas boiler, to standardize a benchmark target. However, the Be Green stage of the energy hierarchy results considers ASHPs as an alternative method for space heating and hot water.

Section Five

5 Appendices

Appendix A - Be Lean Considerations

Demand Reduction

Passive design measures, including optimising orientation and site layout, natural ventilation and lighting, thermal mass and solar shading are set out in this document. Active design measures, including high efficiency lighting and efficient low-energy extract systems, are also set out below. Building fabric details are set out in the tables at the end of this section (SAP 2012 carbon factor figures have been used throughout this assessment and then converted using SAP 10 carbon factors).

Building Insulation

Standard insulation materials are typically constructed from petrochemicals and include fibreglass, mineral wool, polystyrene, polyurethane foam, and multi-foils. These materials are typically inexpensive to both buy and install. However, these insulation materials contain many additives, and their process embodied energy is higher than natural insulation. Natural insulation products are typically defined as low impact to nature, generally being organic resources that have low embodied energy. They can be reused and recycled and are usually biodegradable. They tend to be more absorbent than standard man-made insulation materials reducing condensation issues. Thermal conductivity can be defined as the rate at which heat is transferred by conduction through a unit cross-section area of a material; the lower the thermal conductivity of the insulation materials the lower the rate of heat transfer through the wall, roof, or floor. This scheme will provide building insulation U-values improved upon the Building Regulations standard. At the detailed design stage both standard and natural insulation materials will be considered on merit, feasibility, and pricing.

Thermal Mass

Thermal mass is related to materials and the ability to absorb and store heat. High density materials like concrete, bricks and tiles require more energy to heat up; they are therefore considered to have high thermal mass. Lightweight materials such as timber have low thermal mass. For residential uses thermal mass is not commonly deemed to be the most reliable form of controlling heat build-up within spaces as heat may build up during the day in bedrooms during summer and may then be exhausted during the occupants sleeping period; therefore, for the SAP calculations the assumption of the thermal mass parameter is ‘medium’ (250 kJ/m²K).

Orientation & Site Layout

Orientation of dwellings is key in maximising the benefits of solar gain in the winter and improving daylight & sunlight access given the constraints of the site. Single aspect, south and southwest facing spaces should be minimised unless overheating mitigation measures are present.

Dual aspect facades, where feasible, promote better daylight and sunlight access. Facades also have significant opportunity for daylight and sunlight access to each dwelling.

Thermal Bridge Summary

Thermal Bridges (Linear) occur at junctions between elements, such as a wall and a floor or a window and a wall. At these locations heat can transfer more easily through the construction, resulting in greater heat loss from the dwelling and localised ‘cold spots’ in the building envelope. Improving junction details to reduce linear thermal bridging will help achieve Building Regulations compliance and in achieving healthy, low energy homes.

Accredited Construction Details (ACDs) to be implemented in the design and construction of the dwellings. ACD checklists to be completed and signed towards the end of construction.

Thermal junctions complied with are as follows:

- E5 Ground floor (normal)
- E6 Intermediate floor within a dwelling
- E14 Flat Roof
- E16 Corner (normal)
- E18 Party wall between dwellings

Lighting

Poorly lit areas can strain the eyes and increase the reliance of subsidiary lighting such as inefficient unregulated lamps. Health and wellbeing are proven to be linked to access to daylight and sunlight. Furthermore, inefficient lighting can lead to increased energy bills.

Within the property, all fixed light fittings will be low-energy lamps, including storage and infrequently accessed areas. The lux levels within each space will be designed to match relevant Building Regulations and industry guidance to reduce the requirement for additional unregulated lighting.

Appendix A - Be Lean Considerations

Materials

All construction materials will be considered, with particular focus given to minimising embodied carbon through the material's life cycle, from cradle to gate.

Natural Ventilation

Natural ventilation is a method of supplying fresh air to a space through passive means, typically by utilising differences in pressure and/or temperatures within a space.

The key for residential uses is to minimise the complexity of ventilation strategies; otherwise, the occupant may not manage the strategy appropriately.

All windows to habitable rooms will be 50-75% openable to allow for maximum dispersion of heat and pollution build-up such as CO_2.

Mechanical Extract Ventilation (MEV)

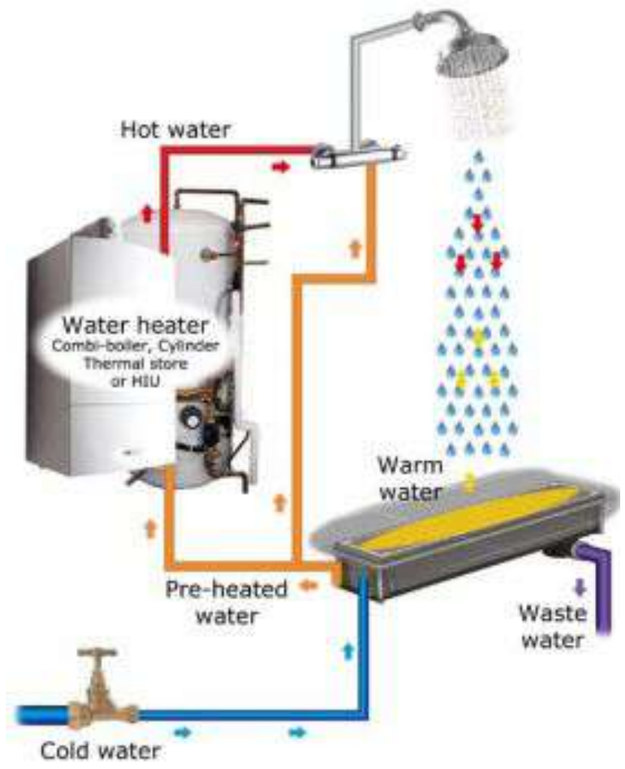
The dwelling will likely have the provision of mechanical ventilation extract systems for all wet rooms and kitchen. These systems allow for the elimination of condensation dampness, providing a healthier living environment, removing musty odours. They are low-energy, easy-installation systems with low maintenance.

© Titon image of a typical MEV unit

Waste Water Heat Recovery System (WWHRS)

WWHRS is a technology that utilises the leftover heat from the waste shower water to preheat the new cold water that replenishes the system. It is an example of an active design measure that reduces a scheme's hot water demand and energy use as it is used to heat up incoming water to the desired temperature through a heat exchanger.

WWHRS should be installed in all dwelling showers. The Recoup Drain+ Duo HE is a WWHRS that the scheme could install and was input into the SAP calculations.



©Recoup Drain+ Duo HE example WWHRS product diagram

Solar Shading

The scheme should utilise window reveals, balconies, and internal blinds, where feasible, to reduce the requirement for active cooling.

The proposed site also benefits from local shade from existing trees and neighbouring properties.

The scheme should adhere and comply with the requirements of the newly adopted Part O Building Regulations which governs overheating. In Particular, the scheme will adopt key principles of Table 1.2 (Limiting Solar Gains) and Table 1.4 (Removing Excess Heat) of the approved document.

Lateral hot-water pipework runs will be minimised to avoid heat loss; where there is hot water pipework and/or heat exchangers, these will be fully insulated.

Appendix B - SAP Inputs

Item	Comment		
General			
Description	Approximately 60 new dwellings		
Calculation method	Elmhurst Design SAP 10 & Approved Document Part L 2021		
Technical Information			
Building Fabric	**Input**	**Unit**	**Comment**
External Wall U-value	0.16	W/m^{2}K	
Roof U-value	0.12	W/m^{2}K	Including roof to terraces
Ground Floor U-value	0.12	W/m^{2}K	-
Windows U-value	1.2	W/m^{2}K	Not including frame
Windows g-value	0.63	-	-
Window Frame-Factor	0.70	-	-
Thermal Mass Parameter	Medium	TMP	Default value
Thermal Bridging Y-value	<0.1	-	Thermal Bridging calculations TBD
Ventilation Method	Titon CME2 Q Plus A	-	Mechanical Extract Ventilation, extract to all wet rooms including kitchen
Air permeability	3.0	@50Pa (m^3/(h.m^2))	-
Be Lean Stage			
Space Heating System	Gas Boiler		89.5% efficiency
Heating Emitter	Radiators		-
Domestic Hot Water System	Same as space heating		-
Storage	Yes		~180 litres, 80mm foam insulation
Space Cooling System	No		-
Be Clean Stage			
Space Heating System	Gas Boiler		89.5% efficiency
Heating Emitter	Radiators		-
Domestic Hot Water System	Same as space heating		-
Storage	Yes		~180 litres, 80mm foam insulation
Space Cooling System	No		-
Be Green Stage			
Space Heating System	ASHPs		175.1% default efficiency, MCS certified
Heating Emitter	Underfloor		-
Domestic Hot Water System	Same as space heating		-
Storage	Yes		~180 litres, 80mm foam insulation
Low/Zero Carbon Technologies used	ASHPs Photovoltaic Solar Panels		175.1% default efficiency, MCS certified 2 PV Panels per dwelling

Appendix C - SAP DER/TER Worksheets

Full SAP Calculation Printout

Property Reference	Plot 24 1BFA_Be Lean_MEV	Issued on Date	12/10/2022
Assessment Reference	00001	Prop Type Ref	1BFA
Property	1 Bedroom Apartment, House No. 24, Claygate, Surrey, Elmbridge, KT 10		

SAP Rating	84 B	DER	15.86	TER	15.03
Environmental	89 B	% DER<TER	-5.52		
CO_2 Emissions (t/year)	0.75	DFEE	31.45	TFEE	32.10
Compliance Check	See BREL	% DFEE < TFEE	2.02		
% DPER < TPER	-11.11	DPER	89.19	TPER	80.27

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

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

---

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)
Ground floor		50.0000 (1b)	x	2.5000 (2b)	=	125.0000 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	125.0000 (5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1600	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.3100	(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) =	0.2635	(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	0.3360	0.3294	0.3228	0.2899	0.2833	0.2503	0.2503	0.2437	0.2635	0.2833	0.2964	0.3096	(22b)
Effective ac	0.5564	0.5542	0.5521	0.5420	0.5401	0.5313	0.5313	0.5297	0.5347	0.5401	0.5439	0.5479	(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	
Window (Uw = 1.20)			6.3000	1.1450	7.2137			(27)
Opening Type 4			5.6000	1.2000	6.7200			(26a)
External Wall 1	35.0000	11.9000	23.1000	0.1400	3.2340	0.0000	0.0000	(29a)
External Roof 1	50.0000		50.0000	0.1132	5.6604	9.0000	450.0000	(30)
Total net area of external elements Aum(A, m2)			85.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		22.8281			(33)
Party Floor 1			50.0000			0.0000	0.0000	(32d)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 450.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 9.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 4.2500 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 27.0781 (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	22.9530	22.8626	22.7740	22.3578	22.2799	21.9174	21.9174	21.8503	22.0570	22.2799	22.4374	22.6021	(38)
Heat transfer coeff													
	50.0311	49.9407	49.8521	49.4359	49.3580	48.9955	48.9955	48.9284	49.1352	49.3580	49.5155	49.6802	(39)

Average = Sum(39)m / 12 = 49.4355

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0006	0.9988	0.9970	0.9887	0.9872	0.9799	0.9799	0.9786	0.9827	0.9872	0.9903	0.9936	(40)
HLP (average)												0.9887	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6901 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers													
	52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)
Hot water usage for baths													
	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)
Hot water usage for other uses													
	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day) 98.5597 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	
Distribution loss (46)m = 0.15 x (45)m													
	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)
Water storage loss:													
Store volume												180.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.8736	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.8736	(55)
Total storage loss													
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage													
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(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													
	220.1542	194.8927	207.3350	182.7455	177.5070	160.3200	158.3893	164.3985	165.9136	184.5850	195.7910	217.7889	(62)
WWHRS	-23.1922	-20.5114	-21.4783	-17.7849	-16.5749	-14.1833	-13.2946	-14.1374	-14.6746	-17.2997	-19.5984	-22.7627	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	196.9620	174.3813	185.8566	164.9606	160.9321	146.1368	145.0947	150.2611	151.2390	167.2854	176.1926	195.0262	(64)
										Total per year (kWh/year) = Sum(64)m =		2014.3284	(64)
12Total per year (kWh/year)												2014	(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													
	96.7373	86.0602	92.4749	83.5397	82.5571	76.0832	76.2005	78.1985	77.9431	84.9105	87.8773	95.9508	(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	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	81.5419	90.2785	81.5419	84.2599	81.5419	84.2599	81.5419	81.5419	84.2599	81.5419	84.2599	81.5419	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(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)													
	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)													
	130.0232	128.0657	124.2942	116.0273	110.9639	105.6711	102.4200	105.1055	108.2543	114.1271	122.0518	128.9662	(72)
Total internal gains													
	410.1506	418.4575	402.0993	388.3541	370.2261	354.9273	342.4617	343.6195	353.3363	367.6874	388.6767	402.5972	(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	2.1000	10.6334	0.7600	0.7000	0.7700	8.2326 (74)
South	4.2000	46.7521	0.7600	0.7000	0.7700	72.3927 (78)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	80.6253	134.2935	177.7592	213.6330	235.7173	233.1028	225.0660	208.2925	189.9066	146.6067	95.9660	69.4171	(83)
Total gains	490.7759	552.7510	579.8585	601.9871	605.9434	588.0301	567.5277	551.9120	543.2429	514.2942	484.6427	472.0142	(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	2.4984	2.5030	2.5074	2.5285	2.5325	2.5513	2.5513	2.5548	2.5440	2.5325	2.5245	2.5161	
alpha	1.1666	1.1669	1.1672	1.1686	1.1688	1.1701	1.1701	1.1703	1.1696	1.1688	1.1683	1.1677	
util living area	0.6758	0.6370	0.5973	0.5372	0.4641	0.3731	0.2934	0.3092	0.4130	0.5384	0.6313	0.6852	(86)
MIT	16.6464	17.0883	17.7356	18.5985	19.4438	20.1699	20.5675	20.5198	19.9924	18.9310	17.6641	16.5535	(87)
Th 2	20.0828	20.0843	20.0858	20.0927	20.0940	20.1001	20.1001	20.1012	20.0978	20.0940	20.0914	20.0887	(88)
util rest of house	0.6621	0.6221	0.5801	0.5161	0.4368	0.3362	0.2460	0.2624	0.3773	0.5138	0.6139	0.6718	(89)
MIT 2	15.2935	15.8054	16.5604	17.5636	18.5320	19.3454	19.7650	19.7196	19.1568	17.9606	16.4927	15.1889	(90)
Living area fraction									fLA = Living area / (4) =			0.3000	(91)
MIT	15.6994	16.1903	16.9130	17.8741	18.8056	19.5927	20.0057	19.9597	19.4075	18.2517	16.8442	15.5982	(92)
Temperature adjustment												-0.1500	
adjusted MIT	15.5494	16.0403	16.7630	17.7241	18.6556	19.4427	19.8557	19.8097	19.2575	18.1017	16.6942	15.4482	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.5751	0.5403	0.5048	0.4522	0.3881	0.3068	0.2322	0.2461	0.3404	0.4505	0.5334	0.5838	(94)
Useful gains	282.2490	298.6249	292.7073	272.2063	235.1811	180.3967	131.7753	135.8202	184.8947	231.6897	258.5207	275.5706	(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	562.8189	556.3526	511.6293	436.2248	343.3128	237.2722	159.5169	166.8304	253.4141	370.2698	475.0597	558.8149	(97)
Space heating kWh	208.7440	173.1930	162.8780	118.0933	80.4499	0.0000	0.0000	0.0000	0.0000	103.1036	155.9081	210.7338	(98a)
Space heating requirement - total per year (kWh/year)												1213.1037	
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	208.7440	173.1930	162.8780	118.0933	80.4499	0.0000	0.0000	0.0000	0.0000	103.1036	155.9081	210.7338	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1213.1037	
Space heating per m2											(98c) / (4) =	24.2621	(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 %)	89.5000 (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	208.7440	173.1930	162.8780	118.0933	80.4499	0.0000	0.0000	0.0000	0.0000	103.1036	155.9081	210.7338	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	233.2335	193.5118	181.9866	131.9478	89.8882	0.0000	0.0000	0.0000	0.0000	115.1996	174.1990	235.4567	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	196.9620	174.3813	185.8566	164.9606	160.9321	146.1368	145.0947	150.2611	151.2390	167.2854	176.1926	195.0262	(64)
Efficiency of water heater												89.5000	(216)
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)
Fuel for water heating, kWh/month	220.0692	194.8394	207.6611	184.3135	179.8124	163.2813	162.1170	167.8895	168.9821	186.9110	196.8632	217.9064	(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	20.5610	16.4948	14.8517	10.8810	8.4048	6.8668	7.6672	9.9661	12.9449	16.9844	19.1839	21.1325	(232)

Electricity generated by PVs (Appendix M) (negative quantity)
(233a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)
(234a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)
(235a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)
(235c)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)
(233b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)
(234b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)
(235b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)
(235d)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1355.4231	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	89.5000	
Water heating fuel used	2250.6462	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	165.9391	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(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	3858.0084	(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	1355.4231	0.2100	284.6389	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2250.6462	0.2100	472.6357	(264)
Space and water heating			757.2746	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	165.9391	0.1443	23.9501	(268)
Total CO2, kg/year			793.1540	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.8600	(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	1355.4231	1.1300	1531.6281	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2250.6462	1.1300	2543.2302	(278)
Space and water heating			4074.8583	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	165.9391	1.5338	254.5229	(282)
Total Primary energy kWh/year			4459.4820	(286)
Dwelling Primary energy Rate (DPER)			89.1900	(287)

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

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.0000 (1b)	x	2.5000 (2b)	=	125.0000 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 50.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	125.0000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1600	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4100	(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) =	0.3485	(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	0.4443	0.4356	0.4269	0.3834	0.3746	0.3311	0.3311	0.3224	0.3485	0.3746	0.3921	0.4095	(22b)
Effective ac	0.5987	0.5949	0.5911	0.5735	0.5702	0.5548	0.5548	0.5520	0.5607	0.5702	0.5769	0.5838	(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 Semi-glazed door			5.6000	1.0000	5.6000			(26a)
TER Opening Type (Uw = 1.20)			6.3000	1.1450	7.2137			(27)
External Wall 1	35.0000	11.9000	23.1000	0.1800	4.1580			(29a)
External Roof 1	50.0000		50.0000	0.1100	5.5000			(30)
Total net area of external elements Aum(A, m2)			85.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		22.4717			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 9.0000 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E5	Ground floor (normal)	10.0000	0.1600	1.6000
E6	Intermediate floor within a dwelling	36.0000	0.0000	0.0000
E16	Corner (normal)	15.5000	0.0900	1.3950
E18	Party wall between dwellings	15.5000	0.0600	0.9300

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.9250 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 26.3967 (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	24.6971	24.5390	24.3840	23.6560	23.5198	22.8857	22.8857	22.7683	23.1300	23.5198	23.7953	24.0834	(38)
Heat transfer coeff	51.0939	50.9357	50.7807	50.0527	49.9165	49.2825	49.2825	49.1650	49.5267	49.9165	50.1921	50.4801	(39)

Average = Sum(39)m / 12 = 50.0521

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0219	1.0187	1.0156	1.0011	0.9983	0.9856	0.9856	0.9833	0.9905	0.9983	1.0038	1.0096	(40)
HLP (average)												1.0010	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6901 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)

Hot water usage for baths

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)

Hot water usage for other uses

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383	(42c)

Average daily hot water use (litres/day) 98.5597 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)

Energy content (annual) Total = Sum(45)m = 1637.0557

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

	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167 (46)

Water storage loss:

Store volume 180.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.5520 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.8381 (55)

Total storage loss

	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)

If cylinder contains dedicated solar storage

	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (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

	219.0524	193.8975	206.2332	181.6793	176.4053	159.2538	157.2875	163.2967	164.8474	183.4833	194.7248	216.6872 (62)
WWHRS	-24.0268	-21.2495	-22.2513	-18.4249	-17.1714	-14.6937	-13.7730	-14.6462	-15.2026	-17.9222	-20.3037	-23.5819 (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

	195.0256	172.6480	183.9820	163.2544	159.2339	144.5601	143.5145	148.6505	149.6447	165.5610	174.4211	193.1053 (64)

Total per year (kWh/year) = Sum(64)m = 1993.6012 (64)

12Total per year (kWh/year) 1994 (64)

Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)

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

Heat gains from water heating, kWh/month

	95.8559	85.2640	91.5935	82.6867	81.6757	75.2302	75.3190	77.3171	77.0901	84.0291	87.0243	95.0694 (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	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)

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

	81.5419	90.2785	81.5419	84.2599	81.5419	84.2599	81.5419	81.5419	84.2599	81.5419	84.2599	81.5419	(67)

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

	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)

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

	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(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)

	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)

Water heating gains (Table 5)

	128.8385	126.8810	123.1095	114.8427	109.7792	104.4864	101.2353	103.9208	107.0696	112.9424	120.8671	127.7815	(72)

Total internal gains

	408.9659	417.2728	400.9146	387.1694	369.0415	353.7426	341.2770	342.4348	352.1516	366.5028	387.4920	401.4125	(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	2.1000	10.6334	0.6300	0.7000	0.7700	6.8244	(74)
South	4.2000	46.7521	0.6300	0.7000	0.7700	60.0098	(78)

Solar gains	66.8341	111.3223	147.3530	177.0905	195.3972	193.2299	186.5678	172.6635	157.4226	121.5292	79.5508	57.5431	(83)
Total gains	475.8000	528.5951	548.2677	564.2599	564.4387	546.9725	527.8449	515.0983	509.5742	488.0320	467.0428	458.9556	(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	2.4465	2.4541	2.4616	2.4974	2.5042	2.5364	2.5364	2.5425	2.5239	2.5042	2.4904	2.4762	
alpha	1.1631	1.1636	1.1641	1.1665	1.1669	1.1691	1.1691	1.1695	1.1683	1.1669	1.1660	1.1651	
util living area	0.6874	0.6524	0.6159	0.5574	0.4858	0.3926	0.3107	0.3261	0.4316	0.5551	0.6435	0.6949	(86)
MIT	16.5420	16.9623	17.6034	18.4857	19.3545	20.1179	20.5370	20.4887	19.9376	18.8506	17.5789	16.4660	(87)
Th 2	20.0651	20.0678	20.0703	20.0825	20.0847	20.0953	20.0953	20.0973	20.0912	20.0847	20.0801	20.0753	(88)
util rest of house	0.6736	0.6374	0.5987	0.5362	0.4580	0.3547	0.2612	0.2775	0.3950	0.5303	0.6262	0.6815	(89)
MIT 2	15.1654	15.6536	16.4034	17.4334	18.4320	19.2920	19.7360	19.6902	19.0981	17.8679	16.3908	15.0822	(90)
Living area fraction									fLA = Living area / (4) =			0.3000	(91)
MIT	15.5784	16.0462	16.7634	17.7491	18.7088	19.5398	19.9763	19.9298	19.3499	18.1627	16.7472	15.4973	(92)
Temperature adjustment												0.0000	
adjusted MIT	15.5784	16.0462	16.7634	17.7491	18.7088	19.5398	19.9763	19.9298	19.3499	18.1627	16.7472	15.4973	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.5887	0.5570	0.5243	0.4732	0.4109	0.3292	0.2543	0.2678	0.3619	0.4693	0.5480	0.5959	(94)
Useful gains	280.1272	294.4132	287.4423	266.9947	231.9039	180.0592	134.2148	137.9400	184.4155	229.0463	255.9550	273.5140	(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													
	576.2548	567.7415	521.1833	442.9222	349.8534	243.4434	166.3937	173.5410	260.0109	377.5057	484.2142	570.2910	(97)
Space heating kWh													
	220.3189	183.6766	173.9033	126.6678	87.7544	0.0000	0.0000	0.0000	0.0000	110.4538	164.3466	220.8020	(98a)
Space heating requirement - total per year (kWh/year)												1287.9235	
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													
	220.3189	183.6766	173.9033	126.6678	87.7544	0.0000	0.0000	0.0000	0.0000	110.4538	164.3466	220.8020	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1287.9235	
Space heating per m2											(98c) / (4) =	25.7585	(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													
	220.3189	183.6766	173.9033	126.6678	87.7544	0.0000	0.0000	0.0000	0.0000	110.4538	164.3466	220.8020	(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)													
	238.6987	198.9996	188.4109	137.2349	95.0752	0.0000	0.0000	0.0000	0.0000	119.6682	178.0570	239.2221	(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													
	195.0256	172.6480	183.9820	163.2544	159.2339	144.5601	143.5145	148.6505	149.6447	165.5610	174.4211	193.1053	(64)
Efficiency of water heater												79.8000	(216)
(217)m	84.3339	84.1989	83.9336	83.4973	82.7809	79.8000	79.8000	79.8000	79.8000	83.1734	83.9266	84.3611	(217)
Fuel for water heating, kWh/month													
	231.2540	205.0478	219.1994	195.5205	192.3557	181.1531	179.8428	186.2789	187.5247	199.0554	207.8258	228.9032	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	16.9428	13.5921	12.2382	8.9662	6.9258	5.6584	6.3179	8.2123	10.6669	13.9956	15.8080	17.4137	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-13.5587	-20.1733	-30.5869	-36.3482	-40.9391	-38.8766	-38.4309	-35.4294	-30.4165	-23.9460	-15.2869	-11.6040	(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	-4.7438	-10.2148	-20.7430	-31.8022	-42.6777	-43.0901	-42.5552	-35.7179	-25.7908	-14.7874	-6.3926	-3.7320	(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	1395.3668	(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	2413.9613	(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)	136.7380	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-617.8438	(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	3414.2222	(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	1395.3668	0.2100	293.0270	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2413.9613	0.2100	506.9319	(264)
Space and water heating			799.9589	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	136.7380	0.1443	19.7355	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-335.5964	0.1335	-44.7857	
PV Unit electricity exported	-282.2475	0.1253	-35.3694	
Total			-80.1551	(269)
Total CO2, kg/year			751.4686	(272)
Target Carbon Dioxide Emission Rate (TER)			15.0300	(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	1395.3668	1.1300	1576.7644	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2413.9613	1.1300	2727.7762	(278)
Space and water heating			4304.5407	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	136.7380	1.5338	209.7333	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-335.5964	1.4931	-501.0949	
PV Unit electricity exported	-282.2475	0.4600	-129.8224	
Total			-630.9173	(283)
Total Primary energy kWh/year			4013.4575	(286)
Target Primary Energy Rate (TPER)			80.2700	(287)

;

Full SAP Calculation Printout

Property Reference	Plot 29 2A_Be Lean_MEV	Issued on Date	12/10/2022
Assessment Reference	00001	Prop Type Ref	2A
Property	2A, House No. 29, Claygate, Surrey, Elmbridge, KT 10		

SAP Rating	84 B	DER	14.79	TER	11.94
Environmental	87 B	% DER<TER	-23.87		
CO_2 Emissions (t/year)	1.1	DFEE	39.81	TFEE	38.72
Compliance Check	See BREL	% DFEE < TFEE	-2.81		
% DPER < TPER	-32.62	DPER	82.70	TPER	62.36

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

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

---

1. Overall dwelling characteristics

			Area (m2)		Storey height (m)		Volume (m3)	
Ground floor			39.5500 (1b)	x	2.5000 (2b)	=	98.8750 (1b)	-
First floor			39.5500 (1c)	x	2.7500 (2c)	=	108.7625 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000							(4)
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6375	(5)

---

2. Ventilation rate

---

		m3 per hour		
Number of open chimneys		0 * 80	=	0.0000 (6a)
Number of open flues		0 * 20	=	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10	=	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20	=	0.0000 (6d)
Number of flues attached to other heater		0 * 35	=	0.0000 (6e)
Number of blocked chimneys		0 * 20	=	0.0000 (6f)
Number of intermittent extract fans		2 * 10	=	20.0000 (7a)
Number of passive vents		0 * 10	=	0.0000 (7b)
Number of flueless gas fires		0 * 40	=	0.0000 (7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		20.0000 / (5)	=	0.0963 (8)
Pressure test		Yes		
Pressure Test Method		Blower Door		
Measured/design AP50		3.0000		(17)
Infiltration rate		0.2463		(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)	0.2094		(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	0.2670	0.2617	0.2565	0.2303	0.2251	0.1989	0.1989	0.1937	0.2094	0.2251	0.2355	0.2460	(22b)
Effective ac	0.5356	0.5342	0.5329	0.5265	0.5253	0.5198	0.5198	0.5188	0.5219	0.5253	0.5277	0.5303	(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	
Window (Uw = 1.20)			16.8000	1.1450	19.2366			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			39.5500	0.1200	4.7460	0.0000	0.0000	(28a)
External Wall 1	112.0000	22.0000	90.0000	0.1400	12.6000	0.0000	0.0000	(29a)
External Roof 1	65.0000		65.0000	0.1132	7.3585	9.0000	585.0000	(30)
Total net area of external elements Aum(A, m2)			216.5500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.1411			(33)

Heat capacity Cm = Sum(A x k)									(28)...(30) + (32) + (32a)...(32e) =			585.0000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												7.3957	(35)
Thermal bridges (User defined value 0.050 * total exposed area)												10.8275	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss										(33) + (36) + (36a) =		59.9686	(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	36.7017	36.6069	36.5139	36.0775	35.9958	35.6156	35.6156	35.5452	35.7621	35.9958	36.1610	36.3337	(38)
Heat transfer coeff													
	96.6703	96.5755	96.4826	96.0461	95.9644	95.5843	95.5843	95.5139	95.7307	95.9644	96.1296	96.3023	(39)
Average = Sum(39)m / 12 =												96.0457	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2221	1.2209	1.2198	1.2142	1.2132	1.2084	1.2084	1.2075	1.2102	1.2132	1.2153	1.2175	(40)
HLP (average)												1.2142	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4456	(42)
Hot water usage for mixer showers													
	65.2237	64.2436	62.8152	60.0824	58.0656	55.8166	54.5382	55.9557	57.5095	59.9244	62.7159	64.9738	(42a)
Hot water usage for baths													
	28.1716	27.7532	27.1640	26.0777	25.2642	24.3623	23.8751	24.4601	25.0971	26.0623	27.1710	28.0763	(42b)
Hot water usage for other uses													
	39.6750	38.2323	36.7896	35.3468	33.9041	32.4614	32.4614	33.9041	35.3468	36.7896	38.2323	39.6750	(42c)
Average daily hot water use (litres/day)												122.3218	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	133.0703	130.2290	126.7688	121.5069	117.2340	112.6402	110.8746	114.3199	117.9535	122.7762	128.1192	132.7252	(44)
Energy conte	210.7509	185.4444	194.8389	166.3369	157.8194	138.5042	134.0932	141.5519	145.4485	166.6061	182.5293	207.8156	(45)
Energy content (annual)											Total = Sum(45)m =	2031.7393	
Distribution loss (46)m = 0.15 x (45)m													
	31.6126	27.8167	29.2258	24.9505	23.6729	20.7756	20.1140	21.2328	21.8173	24.9909	27.3794	31.1723	(46)
Water storage loss:													
Store volume												180.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.8736	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.8736	(55)
Total storage loss													
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage													
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(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													
	261.0953	230.9168	245.1834	215.0573	208.1639	187.2247	184.4377	191.8964	194.1689	216.9506	231.2497	258.1600	(62)
WWHRS	-28.7818	-25.4549	-26.6549	-22.0713	-20.5697	-17.6016	-16.4987	-17.5447	-18.2113	-21.4691	-24.3219	-28.2488	(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													
	232.3135	205.4619	218.5285	192.9860	187.5942	169.6231	167.9390	174.3516	175.9576	195.4815	206.9278	229.9112	(64)
										Total per year (kWh/year) = Sum(64)m =		2357.0758	(64)
12Total per year (kWh/year)												2357	(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													
	110.3502	98.0382	105.0595	94.2833	92.7505	85.0290	84.8615	87.3416	87.3380	95.6721	99.6673	109.3742	(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	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	109.9477	121.7278	109.9477	113.6126	109.9477	113.6126	109.9477	109.9477	113.6126	109.9477	113.6126	109.9477	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(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)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	148.3202	145.8901	141.2090	130.9491	124.6647	118.0958	114.0612	117.3946	121.3027	128.5915	138.4268	147.0084	(72)
Total internal gains													
	538.5006	550.1082	527.9581	509.2524	484.0154	463.7433	446.4449	447.5208	460.7826	479.5172	508.3051	527.5899	(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	5.2000	10.6334	0.7600	0.7000	0.7700	20.3854 (74)
South	9.5000	46.7521	0.7600	0.7000	0.7700	163.7455 (78)
West	2.1000	19.6403	0.7600	0.7000	0.7700	15.2059 (80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	199.3368	336.8764	456.7905	563.8643	633.1242	630.1580	606.8000	554.2669	493.4127	370.9196	238.2022	170.9900	(83)
Total gains	737.8374	886.9846	984.7486	1073.1167	1117.1396	1093.9013	1053.2449	1001.7876	954.1953	850.4368	746.5073	698.5800	(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	1.6810	1.6826	1.6842	1.6919	1.6933	1.7001	1.7001	1.7013	1.6975	1.6933	1.6904	1.6874	
alpha	1.1121	1.1122	1.1123	1.1128	1.1129	1.1133	1.1133	1.1134	1.1132	1.1129	1.1127	1.1125	
util living area	0.7189	0.6687	0.6174	0.5476	0.4676	0.3767	0.2985	0.3193	0.4304	0.5686	0.6737	0.7312	(86)
MIT	16.0571	16.6102	17.3861	18.3640	19.3005	20.0798	20.5106	20.4489	19.8501	18.6375	17.1798	15.9330	(87)
Th 2	19.9023	19.9033	19.9042	19.9086	19.9095	19.9133	19.9133	19.9140	19.9118	19.9095	19.9078	19.9060	(88)
util rest of house	0.7040	0.6518	0.5975	0.5228	0.4352	0.3323	0.2408	0.2618	0.3870	0.5397	0.6543	0.7167	(89)
MIT 2	14.5406	15.1772	16.0750	17.2006	18.2621	19.1222	19.5674	19.5118	18.8878	17.5372	15.8583	14.3996	(90)
Living area fraction									fLA = Living area / (4) =			0.2528	(91)
MIT	14.9240	15.5395	16.4065	17.4948	18.5247	19.3643	19.8059	19.7487	19.1311	17.8154	16.1925	14.7873	(92)
Temperature adjustment												-0.1500	
adjusted MIT	14.7740	15.3895	16.2565	17.3448	18.3747	19.2143	19.6559	19.5987	18.9811	17.6654	16.0425	14.6373	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6086	0.5614	0.5147	0.4531	0.3828	0.3006	0.2258	0.2435	0.3448	0.4671	0.5637	0.6206	(94)
Useful gains	449.0458	497.9469	506.8491	486.2476	427.6592	328.8519	237.8690	243.9154	328.9771	397.2211	420.7776	433.5565	(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	1012.5282	1013.0297	941.3321	811.0880	640.5292	441.0571	292.0970	305.5237	467.2735	678.0314	859.6356	1005.1363	(97)
Space heating kWh	419.2309	346.1356	323.2554	233.8851	158.3753	0.0000	0.0000	0.0000	0.0000	208.9229	315.9778	425.2554	(98a)
Space heating requirement - total per year (kWh/year)												2431.0383	
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	419.2309	346.1356	323.2554	233.8851	158.3753	0.0000	0.0000	0.0000	0.0000	208.9229	315.9778	425.2554	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2431.0383	
Space heating per m2										(98c) / (4) =		30.7337	(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 %)	89.5000 (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	419.2309	346.1356	323.2554	233.8851	158.3753	0.0000	0.0000	0.0000	0.0000	208.9229	315.9778	425.2554	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	468.4144	386.7437	361.1792	261.3241	176.9556	0.0000	0.0000	0.0000	0.0000	233.4334	353.0478	475.1457	(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	232.3135	205.4619	218.5285	192.9860	187.5942	169.6231	167.9390	174.3516	175.9576	195.4815	206.9278	229.9112	(64)
Efficiency of water heater												89.5000	(216)
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)
Fuel for water heating, kWh/month	259.5681	229.5664	244.1659	215.6268	209.6025	189.5230	187.6413	194.8063	196.6007	218.4151	231.2042	256.8840	(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	29.5849	23.7341	21.3699	15.6565	12.0935	9.8805	11.0321	14.3400	18.6262	24.4386	27.6034	30.4071 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	2716.2439 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	2633.6043 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	238.7670 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (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	5674.6151 (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	2716.2439	0.2100	570.4112	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2633.6043	0.2100	553.0569	(264)
Space and water heating			1123.4681	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	238.7670	0.1443	34.4615	(268)
Total CO2, kg/year			1169.8588	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.7900	(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	2716.2439	1.1300	3069.3556	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2633.6043	1.1300	2975.9728	(278)
Space and water heating			6045.3284	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	238.7670	1.5338	366.2288	(282)
Total Primary energy kWh/year			6541.6580	(286)
Dwelling Primary energy Rate (DPER)			82.7000	(287)

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

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5000 (2b)	=	98.8750 (1b)	-
First floor	39.5500 (1c)	x	2.7500 (2c)	=	108.7625 (1c)	-

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 79.1000 (4)
Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 207.6375 (5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3945	(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) =	0.3353	(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	0.4275	0.4191	0.4108	0.3688	0.3605	0.3185	0.3185	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5711	0.5776	(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			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			14.5700	1.1450	16.6832			(27)
Heatloss Floor 1			39.5500	0.1300	5.1415			(28a)
External Wall 1	112.0000	19.7700	92.2300	0.1800	16.6014			(29a)
External Roof 1	65.0000		65.0000	0.1100	7.1500			(30)
Total net area of external elements Aum(A, m2)			216.5500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.7761			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 7.3957 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	10.0000	0.1600	1.6000
E6 Intermediate floor within a dwelling	36.0000	0.0000	0.0000
E16 Corner (normal)	15.5000	0.0900	1.3950
E18 Party wall between dwellings	15.5000	0.0600	0.9300

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.9250 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 54.7011 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5221	40.2789	40.0406	38.9211	38.7116	37.7366	37.7366	37.5560	38.1122	38.7116	39.1353	39.5783	(38)
Heat transfer coeff	95.2232	94.9800	94.7417	93.6222	93.4127	92.4377	92.4377	92.2571	92.8133	93.4127	93.8364	94.2794	(39)

Average = Sum(39)m / 12 = 93.6212

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2038	1.2008	1.1977	1.1836	1.1809	1.1686	1.1686	1.1663	1.1734	1.1809	1.1863	1.1919	(40)
HLP (average)												1.1836	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.4456 (42)
Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
65.2237	64.2436	62.8152	60.0824	58.0656	55.8166	54.5382	55.9557	57.5095	59.9244	62.7159	64.9738	(42a)

Hot water usage for baths

28.1716	27.7532	27.1640	26.0777	25.2642	24.3623	23.8751	24.4601	25.0971	26.0623	27.1710	28.0763	(42b)

Hot water usage for other uses

39.6750	38.2323	36.7896	35.3468	33.9041	32.4614	32.4614	33.9041	35.3468	36.7896	38.2323	39.6750	(42c)

Average daily hot water use (litres/day) 122.3218 (43)

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

Daily hot water use

	133.0703	130.2290	126.7688	121.5069	117.2340	112.6402	110.8746	114.3199	117.9535	122.7762	128.1192	132.7252 (44)
Energy conte	210.7509	185.4444	194.8389	166.3369	157.8194	138.5042	134.0932	141.5519	145.4485	166.6061	182.5293	207.8156 (45)
Energy content (annual)											Total = Sum(45)m =	2031.7393
Distribution loss (46)m = 0.15 x (45)m												
	31.6126	27.8167	29.2258	24.9505	23.6729	20.7756	20.1140	21.2328	21.8173	24.9909	27.3794	31.1723 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8381 (55)
Total storage loss												
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage												
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (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												
	259.9935	229.9216	244.0816	213.9911	207.0621	186.1584	183.3359	190.7946	193.1027	215.8488	230.1835	257.0582 (62)
WWHRS	-29.8176	-26.3709	-27.6141	-22.8656	-21.3099	-18.2350	-17.0924	-18.1761	-18.8667	-22.2417	-25.1971	-29.2654 (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												
	230.1760	203.5507	216.4675	191.1255	185.7522	167.9234	166.2435	172.6185	174.2360	193.6071	204.9863	227.7928 (64)
										Total per year (kWh/year) = Sum(64)m =		2334.4796 (64)
12Total per year (kWh/year)												2334 (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												
	109.4688	97.2421	104.1781	93.4304	91.8691	84.1760	83.9801	86.4601	86.4850	94.7907	98.8143	108.4928 (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	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	111.6732	123.6381	111.6732	115.3956	111.6732	115.3956	111.6732	111.6732	115.3956	111.6732	115.3956	111.6732	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(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)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	147.1355	144.7054	140.0243	129.7644	123.4800	116.9111	112.8765	116.2099	120.1180	127.4068	137.2421	145.8237	(72)
Total internal gains													
	539.0413	550.8338	528.4989	509.8507	484.5562	464.3416	446.9857	448.0615	461.3809	480.0580	508.9034	528.1307	(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	4.5100	10.6334	0.6300	0.7000	0.7700	14.6562	(74)
South	8.2400	46.7521	0.6300	0.7000	0.7700	117.7334	(78)
West	1.8200	19.6403	0.6300	0.7000	0.7700	10.9242	(80)

Solar gains	143.3138	242.1958	328.4018	405.3731	455.1599	453.0255	436.2341	398.4711	354.7280	266.6694	171.2558	122.9342	(83)
Total gains	682.3552	793.0296	856.9006	915.2237	939.7161	917.3670	883.2197	846.5326	816.1089	746.7273	680.1591	651.0649	(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	1.7065	1.7109	1.7152	1.7357	1.7396	1.7579	1.7579	1.7614	1.7508	1.7396	1.7317	1.7236	
alpha	1.1138	1.1141	1.1143	1.1157	1.1160	1.1172	1.1172	1.1174	1.1167	1.1160	1.1154	1.1149	
util living area													
	0.7328	0.6913	0.6478	0.5831	0.5067	0.4130	0.3309	0.3509	0.4637	0.5960	0.6905	0.7421	(86)
MIT	15.9562	16.4505	17.1940	18.1826	19.1498	19.9874	20.4553	20.3927	19.7576	18.5191	17.0834	15.8584	(87)
Th 2	19.9169	19.9194	19.9218	19.9331	19.9353	19.9452	19.9452	19.9470	19.9414	19.9353	19.9310	19.9265	(88)
util rest of house													
	0.7185	0.6753	0.6288	0.5591	0.4746	0.3681	0.2711	0.2919	0.4205	0.5681	0.6719	0.7283	(89)
MIT 2	14.4328	15.0050	15.8705	17.0182	18.1235	19.0597	19.5501	19.4926	18.8192	17.4254	15.7623	14.3242	(90)
Living area fraction										fLA = Living area / (4) =		0.2528	(91)
MIT	14.8180	15.3705	16.2051	17.3126	18.3830	19.2943	19.7790	19.7202	19.0564	17.7019	16.0964	14.7121	(92)
Temperature adjustment												0.0000	
adjusted MIT	14.8180	15.3705	16.2051	17.3126	18.3830	19.2943	19.7790	19.7202	19.0564	17.7019	16.0964	14.7121	(93)

---
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6259	0.5861	0.5456	0.4877	0.4204	0.3372	0.2608	0.2779	0.3792	0.4962	0.5838	0.6353	(94)
Useful gains	427.1084	464.7826	467.5095	446.3725	395.0247	309.3069	230.3305	235.2856	309.4644	370.5085	397.0532	413.5988	(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	1001.5535	994.4895	919.4811	787.6085	624.2750	433.9284	293.8590	306.3108	460.0237	663.4117	844.1860	991.0726	(97)
Space heating kWh	427.3871	355.9630	336.2669	245.6899	170.5622	0.0000	0.0000	0.0000	0.0000	217.9200	321.9357	429.6405	(98a)
Space heating requirement - total per year (kWh/year)												2505.3653	
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	427.3871	355.9630	336.2669	245.6899	170.5622	0.0000	0.0000	0.0000	0.0000	217.9200	321.9357	429.6405	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2505.3653	
Space heating per m2											(98c) / (4) =	31.6734	(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	427.3871	355.9630	336.2669	245.6899	170.5622	0.0000	0.0000	0.0000	0.0000	217.9200	321.9357	429.6405	(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)	463.0413	385.6588	364.3195	266.1862	184.7911	0.0000	0.0000	0.0000	0.0000	236.0997	348.7927	465.4827	(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	230.1760	203.5507	216.4675	191.1255	185.7522	167.9234	166.2435	172.6185	174.2360	193.6071	204.9863	227.7928	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.4274	85.3001	85.0437	84.6241	83.8689	79.8000	79.8000	79.8000	79.8000	84.3257	85.0676	85.4604	(217)
Fuel for water heating, kWh/month	269.4403	238.6289	254.5367	225.8524	221.4792	210.4304	208.3252	216.3139	218.3409	229.5944	240.9686	266.5478	(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	23.2035	18.6147	16.7605	12.2794	9.4850	7.7493	8.6525	11.2469	14.6086	19.1673	21.6494	23.8484	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-36.8783	-51.9288	-74.5586	-83.7383	-90.2216	-84.1847	-83.1364	-78.5133	-70.3535	-59.3237	-40.5177	-31.8902	(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	-21.0307	-44.2191	-87.8492	-131.8895	-174.3420	-175.1578	-173.1036	-146.5967	-107.4864	-63.2290	-28.0761	-16.6329	(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	2714.3720	(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	2800.4586	(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)	187.2653	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1954.8578	(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	3833.2381 (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	2714.3720	0.2100	570.0181	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2800.4586	0.2100	588.0963	(264)
Space and water heating			1158.1144	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	187.2653	0.1443	27.0282	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-785.2451	0.1346	-105.7023	
PV Unit electricity exported	-1169.6127	0.1259	-147.2628	
Total			-252.9651	(269)
Total CO2, kg/year			944.1067	(272)
Target Carbon Dioxide Emission Rate (TER)			11.9400	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2714.3720	1.1300	3067.2403	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2800.4586	1.1300	3164.5182	(278)
Space and water heating			6231.7585	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	187.2653	1.5338	287.2338	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-785.2451	1.4975	-1175.9039	
PV Unit electricity exported	-1169.6127	0.4622	-540.5564	
Total			-1716.4604	(283)
Total Primary energy kWh/year			4932.6328	(286)
Target Primary Energy Rate (TPER)			62.3600	(287)

;

Full SAP Calculation Printout

Property Reference	Plot 37 4B_Be Lean_MEV	Issued on Date	12/10/2022
Assessment Reference	00001	Prop Type Ref	4B
Property	4B, House No. 37, Claygate, Surrey, Elmbridge, KT 10		

SAP Rating	86 B	DER	11.41	TER	8.41
Environmental	89 B	% DER<TER	-35.67		
CO_2 Emissions (t/year)	1.48	DFEE	35.81	TFEE	35.40
Compliance Check	See BREL	% DFEE < TFEE	-1.15		
% DPER < TPER	-45.87	DPER	63.89	TPER	43.80

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

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

---

1. Overall dwelling characteristics

			Area (m2)		Storey height (m)		Volume (m3)	
Ground floor			69.7000 (1b)	x	2.5000 (2b)	=	174.2500 (1b)	-
First floor			69.7000 (1c)	x	2.7500 (2c)	=	191.6750 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	139.4000							(4)
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	365.9250	(5)

---

2. Ventilation rate

---

		m3 per hour		
Number of open chimneys		0 * 80	=	0.0000 (6a)
Number of open flues		0 * 20	=	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10	=	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20	=	0.0000 (6d)
Number of flues attached to other heater		0 * 35	=	0.0000 (6e)
Number of blocked chimneys		0 * 20	=	0.0000 (6f)
Number of intermittent extract fans		2 * 10	=	20.0000 (7a)
Number of passive vents		0 * 10	=	0.0000 (7b)
Number of flueless gas fires		0 * 40	=	0.0000 (7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		20.0000 / (5)	=	0.0547 (8)
Pressure test				Yes
Pressure Test Method				Blower Door
Measured/design AP50				3.0000 (17)
Infiltration rate				0.2047 (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)	=	0.1740 (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	0.2218	0.2174	0.2131	0.1914	0.1870	0.1653	0.1653	0.1609	0.1740	0.1870	0.1957	0.2044	(22b)
Effective ac	0.5246	0.5236	0.5227	0.5183	0.5175	0.5137	0.5137	0.5129	0.5151	0.5175	0.5191	0.5209	(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	
Window (Uw = 1.20)			22.5500	1.1450	25.8206			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			69.7000	0.1200	8.3640	0.0000	0.0000	(28a)
External Wall 1	178.0000	27.7500	150.2500	0.1400	21.0350	0.0000	0.0000	(29a)
External Roof 1	70.0000		70.0000	0.1132	7.9245	9.0000	630.0000	(30)
Total net area of external elements Aum(A, m2)			317.7000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.3441			(33)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 630.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 4.5194 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 15.8850 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 84.2291 (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	63.3478	63.2325	63.1194	62.5884	62.4891	62.0266	62.0266	61.9409	62.2047	62.4891	62.6901	62.9002	(38)
Heat transfer coeff	147.5769	147.4616	147.3486	146.8176	146.7182	146.2557	146.2557	146.1701	146.4339	146.7182	146.9192	147.1293	(39)

Average = Sum(39)m / 12 = 146.8171

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0587	1.0578	1.0570	1.0532	1.0525	1.0492	1.0492	1.0486	1.0505	1.0525	1.0539	1.0554	(40)
HLP (average)												1.0532	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9159 (42)

Hot water usage for mixer showers

73.1105	72.0118	70.4107	67.3474	65.0868	62.5658	61.1328	62.7217	64.4635	67.1703	70.2994	72.8304	(42a)

Hot water usage for baths

31.5631	31.0944	30.4343	29.2171	28.3058	27.2952	26.7494	27.4048	28.1186	29.1999	30.4421	31.4564	(42b)

Hot water usage for other uses

44.4921	42.8742	41.2563	39.6384	38.0205	36.4026	36.4026	38.0205	39.6384	41.2563	42.8742	44.4921	(42c)

Average daily hot water use (litres/day) 137.1167 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.1657	145.9803	142.1013	136.2030	131.4131	126.2636	124.2848	128.1471	132.2204	137.6265	143.6157	148.7789	(44)
Energy conte	236.2420	207.8740	218.4044	186.4551	176.9073	155.2558	150.3117	158.6729	163.0410	186.7579	204.6068	232.9517	(45)

Energy content (annual) Total = Sum(45)m = 2277.4806

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

35.4363	31.1811	32.7607	27.9683	26.5361	23.2884	22.5468	23.8009	24.4562	28.0137	30.6910	34.9428	(46)

Water storage loss:

Store volume 180.0000 (47)

b) If manufacturer declared loss factor is not known :

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 0.8736 (55)

Total storage loss

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)

If cylinder contains dedicated solar storage

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

286.5864	253.3464	268.7488	235.1755	227.2517	203.9763	200.6561	209.0173	211.7615	237.1023	253.3273	283.2962	(62)
WWHRS -32.2621	-28.5328	-29.8779	-24.7401	-23.0569	-19.7299	-18.4937	-19.6662	-20.4134	-24.0651	-27.2628	-31.6646	(63a)
PV diverter 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

254.3243	224.8136	238.8709	210.4354	204.1948	184.2463	182.1624	189.3511	191.3481	213.0372	226.0644	251.6316	(64)

Total per year (kWh/year) = Sum(64)m = 2570.4801 (64)

12Total per year (kWh/year) 2570 (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

118.8260	105.4960	112.8950	100.9726	99.0972	90.5989	90.2542	93.0343	93.1875	102.3725	107.0081	117.7320	(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	145.7967	145.7967	145.7967	145.7967	145.7967	145.7967	145.7967	145.7967	145.7967	145.7967	145.7967	145.7967	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	162.1088	179.4776	162.1088	167.5124	162.1088	167.5124	162.1088	162.1088	167.5124	162.1088	167.5124	162.1088	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	308.7288	311.9325	303.8594	286.6728	264.9778	244.5875	230.9656	227.7620	235.8350	253.0216	274.7166	295.1069	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5797	37.5797	37.5797	37.5797	37.5797	37.5797	37.5797	37.5797	37.5797	37.5797	37.5797	37.5797	(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)	-116.6374	-116.6374	-116.6374	-116.6374	-116.6374	-116.6374	-116.6374	-116.6374	-116.6374	-116.6374	-116.6374	-116.6374	(71)
Water heating gains (Table 5)	159.7124	156.9881	151.7406	140.2398	133.1952	125.8318	121.3094	125.0461	129.4271	137.5975	148.6224	158.2419	(72)
Total internal gains	700.2890	718.1372	687.4478	664.1640	630.0208	604.6708	581.1228	581.6559	599.5135	622.4670	660.5905	685.1966	(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	3.2500	10.6334	0.7600	0.7000	0.7700	12.7409	(74)
East	9.5000	19.6403	0.7600	0.7000	0.7700	68.7885	(76)
South	4.6000	46.7521	0.7600	0.7000	0.7700	79.2873	(78)
West	5.2000	19.6403	0.7600	0.7000	0.7700	37.6526	(80)

Solar gains	198.4693	362.4221	549.6937	753.5203	897.2453	910.7399	869.9876	761.9797	621.3536	416.1137	242.4196	166.6650 (83)
Total gains	898.7583	1080.5593	1237.1415	1417.6843	1527.2660	1515.4107	1451.1104	1343.6355	1220.8671	1038.5807	903.0100	851.8616 (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	1.1858	1.1867	1.1877	1.1920	1.1928	1.1965	1.1965	1.1972	1.1951	1.1928	1.1911	1.1894	
alpha	1.0791	1.0791	1.0792	1.0795	1.0795	1.0798	1.0798	1.0798	1.0797	1.0795	1.0794	1.0793	
util living area	0.7561	0.7107	0.6562	0.5772	0.4899	0.3959	0.3177	0.3453	0.4701	0.6172	0.7169	0.7670	(86)
MIT	15.6058	16.1423	16.9904	18.0898	19.1268	19.9753	20.4437	20.3642	19.6709	18.3106	16.7666	15.4885	(87)
Th 2	20.0347	20.0354	20.0361	20.0392	20.0398	20.0426	20.0426	20.0431	20.0415	20.0398	20.0386	20.0374	(88)
util rest of house	0.7444	0.6972	0.6397	0.5561	0.4617	0.3567	0.2657	0.2932	0.4317	0.5930	0.7014	0.7557	(89)
MIT 2	14.1057	14.7282	15.7145	16.9855	18.1694	19.1180	19.6160	19.5415	18.8020	17.2655	15.4725	13.9709	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	14.4807	15.0817	16.0335	17.2616	18.4088	19.3323	19.8229	19.7472	19.0192	17.5267	15.7960	14.3503	(92)
Temperature adjustment												-0.1500	
adjusted MIT	14.3307	14.9317	15.8835	17.1116	18.2588	19.1823	19.6729	19.5972	18.8692	17.3767	15.6460	14.2003	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6449	0.5995	0.5478	0.4771	0.4008	0.3171	0.2436	0.2662	0.3771	0.5078	0.6035	0.6562	(94)
Useful gains	579.5679	647.7805	677.7353	676.3161	612.0651	480.5369	353.5464	357.7002	460.3510	527.3891	544.9215	559.0130	(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	1480.3035	1479.2892	1382.6452	1205.6045	962.2904	670.1879	449.4313	467.3280	698.3777	994.2717	1255.5743	1471.3332	(97)
Space heating kWh	670.1473	558.7738	524.4530	381.0877	260.5676	0.0000	0.0000	0.0000	0.0000	347.3607	511.6700	678.7663	(98a)
Space heating requirement - total per year (kWh/year)												3932.8264	
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	670.1473	558.7738	524.4530	381.0877	260.5676	0.0000	0.0000	0.0000	0.0000	347.3607	511.6700	678.7663	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3932.8264	
Space heating per m2											(98c) / (4) =	28.2125	(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 %)	89.5000	(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	670.1473	558.7738	524.4530	381.0877	260.5676	0.0000	0.0000	0.0000	0.0000	347.3607	511.6700	678.7663	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	748.7679	624.3283	585.9810	425.7963	291.1370	0.0000	0.0000	0.0000	0.0000	388.1125	571.6984	758.3980	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	254.3243	224.8136	238.8709	210.4354	204.1948	184.2463	182.1624	189.3511	191.3481	213.0372	226.0644	251.6316	(64)
Efficiency of water heater												89.5000	(216)
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)
Fuel for water heating, kWh/month	284.1613	251.1884	266.8948	235.1233	228.1506	205.8618	203.5335	211.5655	213.7967	238.0304	252.5859	281.1526	(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	45.6601	36.6303	32.9815	24.1637	18.6647	15.2492	17.0266	22.1318	28.7470	37.7176	42.6019	46.9292 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	4394.2194 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	2872.0448 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	368.5036 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (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	7720.7678 (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	4394.2194	0.2100	922.7861	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2872.0448	0.2100	603.1294	(264)
Space and water heating			1525.9155	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	368.5036	0.1443	53.1865	(268)
Total CO2, kg/year			1591.0312	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			11.4100	(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	4394.2194	1.1300	4965.4680	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2872.0448	1.1300	3245.4107	(278)
Space and water heating			8210.8786	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	368.5036	1.5338	565.2231	(282)
Total Primary energy kWh/year			8906.2025	(286)
Dwelling Primary energy Rate (DPER)			63.8900	(287)

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

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	69.7000 (1b)	x	2.5000 (2b)	=	174.2500 (1b)	-

First floor	69.7000 (1c) x	2.7500 (2c) =	191.6750 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	139.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	365.9250 (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) =	0.1093 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3593 (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) =	0.3054 (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	0.3894	0.3818	0.3741	0.3360	0.3283	0.2901	0.2901	0.2825	0.3054	0.3283	0.3436	0.3589	(22b)
Effective ac	0.5758	0.5729	0.5700	0.5564	0.5539	0.5421	0.5421	0.5399	0.5466	0.5539	0.5590	0.5644	(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			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			22.5500	1.1450	25.8206			(27)
Heatloss Floor 1			69.7000	0.1300	9.0610			(28a)
External Wall 1	178.0000	27.7500	150.2500	0.1800	27.0450			(29a)
External Roof 1	70.0000		70.0000	0.1100	7.7000			(30)
Total net area of external elements Aum(A, m2)			317.7000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	74.8266			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	4.5194 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	10.0000	0.1600	1.6000
E6 Intermediate floor within a dwelling	36.0000	0.0000	0.0000
E16 Corner (normal)	15.5000	0.0900	1.3950
E18 Party wall between dwellings	15.5000	0.0600	0.9300

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.9250 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	78.7516 (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	69.5330	69.1775	68.8290	67.1923	66.8860	65.4604	65.4604	65.1964	66.0096	66.8860	67.5055	68.1532	(38)
Heat transfer coeff	148.2846	147.9291	147.5807	145.9439	145.6376	144.2121	144.2121	143.9481	144.7612	145.6376	146.2571	146.9048	(39)
Average = Sum(39)m / 12 =												145.9424	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0637	1.0612	1.0587	1.0469	1.0447	1.0345	1.0345	1.0326	1.0385	1.0447	1.0492	1.0538	(40)
HLP (average)												1.0469	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9159 (42)

Hot water usage for mixer showers

73.1105	72.0118	70.4107	67.3474	65.0868	62.5658	61.1328	62.7217	64.4635	67.1703	70.2994	72.8304 (42a)

Hot water usage for baths

31.5631	31.0944	30.4343	29.2171	28.3058	27.2952	26.7494	27.4048	28.1186	29.1999	30.4421	31.4564 (42b)

Hot water usage for other uses

44.4921	42.8742	41.2563	39.6384	38.0205	36.4026	36.4026	38.0205	39.6384	41.2563	42.8742	44.4921 (42c)

Average daily hot water use (litres/day)	137.1167 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	149.1657	145.9803	142.1013	136.2030	131.4131	126.2636	124.2848	128.1471	132.2204	137.6265	143.6157	148.7789	(44)
Energy conte	236.2420	207.8740	218.4044	186.4551	176.9073	155.2558	150.3117	158.6729	163.0410	186.7579	204.6068	232.9517	(45)
Energy content (annual)											Total = Sum(45)m =	2277.4806	
Distribution loss (46)m = 0.15 x (45)m													
	35.4363	31.1811	32.7607	27.9683	26.5361	23.2884	22.5468	23.8009	24.4562	28.0137	30.6910	34.9428	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8381	(55)
Total storage loss													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(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													
	285.4846	252.3513	267.6470	234.1093	226.1499	202.9100	199.5544	207.9155	210.6952	236.0005	252.2610	282.1944	(62)
WWHRS	-33.4231	-29.5596	-30.9531	-25.6304	-23.8866	-20.4400	-19.1592	-20.3739	-21.1480	-24.9311	-28.2439	-32.8041	(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													
	252.0616	222.7917	236.6939	208.4788	202.2633	182.4701	180.3952	187.5417	189.5473	211.0694	224.0171	249.3903	(64)
										Total per year (kWh/year) = Sum(64)m =		2546.7202	(64)
12Total per year (kWh/year)												2547	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						0.0000	(64a)
Heat gains from water heating, kWh/month													
	117.9446	104.6999	112.0136	100.1197	98.2158	89.7459	89.3728	92.1529	92.3345	101.4911	106.1551	116.8506	(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	145.7967	145.7967	145.7967	145.7967	145.7967	145.7967	145.7967	145.7967	145.7967	145.7967	145.7967	145.7967	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	162.1088	179.4776	162.1088	167.5124	162.1088	167.5124	162.1088	162.1088	167.5124	162.1088	167.5124	162.1088	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	308.7288	311.9325	303.8594	286.6728	264.9778	244.5875	230.9656	227.7620	235.8350	253.0216	274.7166	295.1069	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5797	37.5797	37.5797	37.5797	37.5797	37.5797	37.5797	37.5797	37.5797	37.5797	37.5797	37.5797	(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)													
	-116.6374	-116.6374	-116.6374	-116.6374	-116.6374	-116.6374	-116.6374	-116.6374	-116.6374	-116.6374	-116.6374	-116.6374	(71)
Water heating gains (Table 5)													
	158.5277	155.8034	150.5559	139.0551	132.0105	124.6471	120.1247	123.8614	128.2424	136.4128	147.4377	157.0572	(72)
Total internal gains													
	699.1043	716.9525	686.2631	662.9793	628.8361	603.4861	579.9381	580.4712	598.3288	621.2823	659.4058	684.0119	(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	3.2500	10.6334	0.6300	0.7000	0.7700	10.5615	(74)
East	9.5000	19.6403	0.6300	0.7000	0.7700	57.0220	(76)
South	4.6000	46.7521	0.6300	0.7000	0.7700	65.7250	(78)
West	5.2000	19.6403	0.6300	0.7000	0.7700	31.2121	(80)

Solar gains	164.5206	300.4288	455.6672	624.6287	743.7691	754.9554	721.1739	631.6411	515.0694	344.9364	200.9531	138.1565	(83)
Total gains	863.6249	1017.3814	1141.9303	1287.6080	1372.6052	1358.4415	1301.1120	1212.1122	1113.3983	966.2186	860.3588	822.1684	(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	1.1802	1.1830	1.1858	1.1991	1.2016	1.2135	1.2135	1.2157	1.2089	1.2016	1.1965	1.1912	
alpha	1.0787	1.0789	1.0791	1.0799	1.0801	1.0809	1.0809	1.0810	1.0806	1.0801	1.0798	1.0794	
util living area													
	0.7646	0.7241	0.6752	0.6002	0.5158	0.4199	0.3394	0.3662	0.4912	0.6332	0.7263	0.7734	(86)
MIT	15.5374	16.0404	16.8632	17.9660	19.0211	19.9103	20.4039	20.3241	19.6083	18.2364	16.7074	15.4385	(87)
Th 2	20.0306	20.0327	20.0347	20.0444	20.0462	20.0547	20.0547	20.0562	20.0514	20.0462	20.0425	20.0387	(88)
util rest of house													
	0.7531	0.7109	0.6591	0.5794	0.4877	0.3802	0.2861	0.3132	0.4529	0.6096	0.7112	0.7623	(89)
MIT 2	14.0250	14.6104	15.5702	16.8520	18.0620	19.0638	19.5924	19.5171	18.7458	17.1876	15.4072	13.9139	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	14.4031	14.9679	15.8935	17.1305	18.3018	19.2754	19.7953	19.7189	18.9614	17.4498	15.7322	14.2951	(92)

Temperature adjustment												0.0000	
adjusted MIT	14.4031	14.9679	15.8935	17.1305	18.3018	19.2754	19.7953	19.7189	18.9614	17.4498	15.7322	14.2951	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6571	0.6161	0.5690	0.5012	0.4274	0.3435	0.2700	0.2922	0.4017	0.5275	0.6169	0.6664	(94)
Useful gains	567.4689	626.8081	649.7991	645.3142	586.6991	466.6618	351.2546	354.1500	447.2824	509.7260	530.7887	547.9228	(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													
	1498.1353	1489.3333	1386.2918	1201.1939	961.4681	674.2549	460.7951	477.7465	703.7411	997.5910	1262.5237	1483.0147	(97)
Space heating kWh													
	692.4158	579.6169	547.9506	400.2334	278.8281	0.0000	0.0000	0.0000	0.0000	362.9716	526.8491	695.7084	(98a)
Space heating requirement - total per year (kWh/year)												4084.5739	
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													
	692.4158	579.6169	547.9506	400.2334	278.8281	0.0000	0.0000	0.0000	0.0000	362.9716	526.8491	695.7084	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4084.5739	
Space heating per m2											(98c) / (4) =	29.3011	(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													
	692.4158	579.6169	547.9506	400.2334	278.8281	0.0000	0.0000	0.0000	0.0000	362.9716	526.8491	695.7084	(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)													
	750.1796	627.9707	593.6626	433.6223	302.0890	0.0000	0.0000	0.0000	0.0000	393.2520	570.8008	753.7469	(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													
	252.0616	222.7917	236.6939	208.4788	202.2633	182.4701	180.3952	187.5417	189.5473	211.0694	224.0171	249.3903	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.2053	86.1037	85.8783	85.4975	84.7800	79.8000	79.8000	79.8000	79.8000	85.2642	85.9093	86.2336	(217)
Fuel for water heating, kWh/month													
	292.3969	258.7480	275.6155	243.8420	238.5742	228.6592	226.0591	235.0146	237.5279	247.5475	260.7599	289.2030	(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	33.6830	27.0218	24.3301	17.8253	13.7688	11.2492	12.5603	16.3264	21.2063	27.8239	31.4270	34.6192	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-61.3140	-84.5136	-118.7631	-130.3848	-137.9071	-127.6554	-125.9509	-120.1300	-109.5843	-95.0183	-66.6675	-53.2277	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-40.7405	-84.9303	-167.4523	-249.6217	-328.3402	-329.3907	-325.6276	-276.5871	-203.8277	-120.9594	-54.2172	-32.2858	(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												4425.3239	(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												3033.9480	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												271.8411	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-3445.0971	(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	4372.0159 (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	4425.3239	0.2100	929.3180	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3033.9480	0.2100	637.1291	(264)
Space and water heating			1566.4471	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	271.8411	0.1443	39.2351	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1231.1167	0.1351	-166.3243	
PV Unit electricity exported	-2213.9805	0.1261	-279.2063	
Total			-445.5306	(269)
Total CO2, kg/year			1172.0809	(272)
Target Carbon Dioxide Emission Rate (TER)			8.4100	(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	4425.3239	1.1300	5000.6160	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3033.9480	1.1300	3428.3613	(278)
Space and water heating			8428.9772	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	271.8411	1.5338	416.9590	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1231.1167	1.4993	-1845.8585	
PV Unit electricity exported	-2213.9805	0.4629	-1024.8990	
Total			-2870.7575	(283)
Total Primary energy kWh/year			6105.2795	(286)
Target Primary Energy Rate (TPER)			43.8000	(287)

;

Full SAP Calculation Printout

Property Reference	Plot 44 2bFOG_Be Lean_MEV	Issued on Date	12/10/2022
Assessment Reference	00001	Prop Type Ref	2bFOG
Property	2bFOG, House No. 44, Claygate, Surrey, Elmbridge, KT 10		

SAP Rating	84 B	DER	15.03	TER	12.14
Environmental	88 B	% DER<TER	-23.81		
CO_2 Emissions (t/year)	0.99	DFEE	37.62	TFEE	36.40
Compliance Check	See BREL	% DFEE < TFEE	-3.37		
% DPER < TPER	-32.49	DPER	84.10	TPER	63.48

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

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

---

1. Overall dwelling characteristics

			Area (m2)		Storey height (m)		Volume (m3)	
Ground floor			35.0000 (1b)	x	2.5000 (2b)	=	87.5000 (1b)	-
First floor			35.0000 (1c)	x	2.7500 (2c)	=	96.2500 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000							(4)
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	183.7500	(5)

---

2. Ventilation rate

---

		m3 per hour		
Number of open chimneys		0 * 80	=	0.0000 (6a)
Number of open flues		0 * 20	=	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10	=	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20	=	0.0000 (6d)
Number of flues attached to other heater		0 * 35	=	0.0000 (6e)
Number of blocked chimneys		0 * 20	=	0.0000 (6f)
Number of intermittent extract fans		2 * 10	=	20.0000 (7a)
Number of passive vents		0 * 10	=	0.0000 (7b)
Number of flueless gas fires		0 * 40	=	0.0000 (7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		20.0000 / (5)	=	0.1088 (8)
Pressure test				Yes
Pressure Test Method				Blower Door
Measured/design AP50				3.0000 (17)
Infiltration rate				0.2588 (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)	=	0.2200 (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	0.2805	0.2750	0.2695	0.2420	0.2365	0.2090	0.2090	0.2035	0.2200	0.2365	0.2475	0.2585	(22b)
Effective ac	0.5393	0.5378	0.5363	0.5293	0.5280	0.5218	0.5218	0.5207	0.5242	0.5280	0.5306	0.5334	(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	
Window (Uw = 1.20)			14.7000	1.1450	16.8321			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			35.0000	0.1200	4.2000	0.0000	0.0000	(28a)
External Wall 1	73.5000	19.9000	53.6000	0.1400	7.5040	0.0000	0.0000	(29a)
External Roof 1	65.0000		65.0000	0.1132	7.3585	9.0000	585.0000	(30)
Total net area of external elements Aum(A, m2)			173.5000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.0946			(33)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 585.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 8.3571 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 8.6750 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 49.7696 (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	32.7046	32.6120	32.5211	32.0946	32.0148	31.6433	31.6433	31.5745	31.7864	32.0148	32.1763	32.3450	(38)
Heat transfer coeff	82.4742	82.3815	82.2907	81.8642	81.7844	81.4129	81.4129	81.3441	81.5560	81.7844	81.9458	82.1146	(39)

Average = Sum(39)m / 12 = 81.8638

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1782	1.1769	1.1756	1.1695	1.1683	1.1630	1.1630	1.1621	1.1651	1.1683	1.1707	1.1731	(40)
HLP (average)												1.1695	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2461 (42)

Hot water usage for mixer showers

61.8798	60.9498	59.5947	57.0020	55.0887	52.9549	51.7420	53.0869	54.5611	56.8521	59.5005	61.6427	(42a)

Hot water usage for baths

26.7336	26.3365	25.7774	24.7465	23.9746	23.1187	22.6564	23.2116	23.8161	24.7319	25.7840	26.6432	(42b)

Hot water usage for other uses

37.6326	36.2641	34.8957	33.5272	32.1587	30.7903	30.7903	32.1587	33.5272	34.8957	36.2641	37.6326	(42c)

Average daily hot water use (litres/day) 116.0487 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	126.2459	123.5505	120.2678	115.2758	111.2220	106.8639	105.1887	108.4572	111.9043	116.4797	121.5487	125.9184	(44)
Energy conte	199.9426	175.9342	184.8472	157.8067	149.7262	131.4016	127.2166	134.2926	137.9892	158.0618	173.1684	197.1578	(45)

Energy content (annual) Total = Sum(45)m = 1927.5450

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

29.9914	26.3901	27.7271	23.6710	22.4589	19.7102	19.0825	20.1439	20.6984	23.7093	25.9753	29.5737	(46)

Water storage loss:
Store volume 180.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 0.8736 (55)
Total storage loss

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)

If cylinder contains dedicated solar storage

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

250.2871	221.4066	235.1916	206.5272	200.0706	180.1220	177.5610	184.6371	186.7096	208.4063	221.8888	247.5023	(62)
WWHRS -27.3062	-24.1498	-25.2883	-20.9397	-19.5151	-16.6992	-15.6528	-16.6452	-17.2776	-20.3684	-23.0749	-26.8005	(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

222.9809	197.2568	209.9033	185.5874	180.5556	163.4228	161.9082	167.9919	169.4320	188.0379	198.8139	220.7017	(64)

Total per year (kWh/year) = Sum(64)m = 2266.5924 (64)
12Total per year (kWh/year) 2267 (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

106.7565	94.8760	101.7372	91.4471	90.0595	82.6674	82.5751	84.9278	84.8578	92.8311	96.5548	105.8305	(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	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	99.7867	110.4781	99.7867	103.1129	99.7867	103.1129	99.7867	99.7867	103.1129	99.7867	103.1129	99.7867	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.2971	199.3444	194.1852	183.2019	169.3374	156.3068	147.6015	145.5542	150.7134	161.6967	175.5612	188.5918	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	(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)	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	(71)
Water heating gains (Table 5)	143.4899	141.1846	136.7436	127.0098	121.0477	114.8158	110.9880	114.1503	117.8580	124.7730	134.1039	142.2453	(72)
Total internal gains	500.2655	510.6989	490.4073	473.0165	449.8637	430.9273	415.0680	416.1830	428.3761	445.9482	472.4698	490.3157	(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	5.2000	10.6334	0.7600	0.7000	0.7700	20.3854 (74)
South	9.5000	46.7521	0.7600	0.7000	0.7700	163.7455 (78)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	184.1309	307.1305	407.8032	492.4192	545.5656	540.5262	521.4669	480.9670	436.4385	335.6236	219.2423	158.4855	(83)
Total gains	684.3964	817.8294	898.2105	965.4357	995.4293	971.4535	936.5349	897.1500	864.8146	781.5718	691.7121	648.8011	(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	1.9703	1.9725	1.9747	1.9850	1.9869	1.9960	1.9960	1.9977	1.9925	1.9869	1.9830	1.9789	
alpha	1.1314	1.1315	1.1316	1.1323	1.1325	1.1331	1.1331	1.1332	1.1328	1.1325	1.1322	1.1319	
util living area	0.7057	0.6551	0.6052	0.5378	0.4597	0.3694	0.2912	0.3103	0.4179	0.5535	0.6590	0.7180	(86)
MIT	16.2523	16.7988	17.5444	18.4804	19.3785	20.1282	20.5408	20.4847	19.9198	18.7633	17.3509	16.1296	(87)
Th 2	19.9375	19.9385	19.9396	19.9445	19.9454	19.9497	19.9497	19.9505	19.9480	19.9454	19.9435	19.9416	(88)
util rest of house	0.6907	0.6383	0.5856	0.5136	0.4282	0.3267	0.2362	0.2556	0.3762	0.5251	0.6396	0.7035	(89)
MIT 2	14.7750	15.4040	16.2672	17.3460	18.3652	19.1937	19.6204	19.5694	18.9797	17.6911	16.0649	14.6358	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	15.1443	15.7527	16.5865	17.6296	18.6185	19.4273	19.8505	19.7982	19.2147	17.9592	16.3864	15.0093	(92)
Temperature adjustment												-0.1500	
adjusted MIT	14.9943	15.6027	16.4365	17.4796	18.4685	19.2773	19.7005	19.6482	19.0647	17.8092	16.2364	14.8593	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.5974	0.5508	0.5059	0.4468	0.3782	0.2966	0.2221	0.2384	0.3367	0.4563	0.5520	0.6092	(94)
Useful gains	408.8328	450.4318	454.4188	431.3321	376.4593	288.0983	207.9666	213.8603	291.2235	356.6393	381.8028	395.2792	(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	882.0071	881.7064	817.6823	702.3625	553.5605	380.7943	252.4194	264.2236	404.9017	589.5985	748.6899	875.2805	(97)
Space heating kWh	352.0417	289.8165	270.2680	195.1419	131.7633	0.0000	0.0000	0.0000	0.0000	173.3217	264.1587	357.1210	(98a)
Space heating requirement - total per year (kWh/year)												2033.6329	
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	352.0417	289.8165	270.2680	195.1419	131.7633	0.0000	0.0000	0.0000	0.0000	173.3217	264.1587	357.1210	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2033.6329	
Space heating per m2										(98c) / (4) =		29.0519	(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 %)	89.5000 (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	352.0417	289.8165	270.2680	195.1419	131.7633	0.0000	0.0000	0.0000	0.0000	173.3217	264.1587	357.1210	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	393.3427	323.8173	301.9754	218.0356	147.2216	0.0000	0.0000	0.0000	0.0000	193.6555	295.1494	399.0179	(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	222.9809	197.2568	209.9033	185.5874	180.5556	163.4228	161.9082	167.9919	169.4320	188.0379	198.8139	220.7017	(64)
Efficiency of water heater												89.5000	(216)
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)
Fuel for water heating, kWh/month	249.1406	220.3987	234.5288	207.3603	201.7381	182.5953	180.9030	187.7004	189.3095	210.0982	222.1384	246.5941	(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	26.4734	21.2380	19.1224	14.0099	10.8217	8.8414	9.8719	12.8318	16.6673	21.8684	24.7003	27.2092 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	2272.2155 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	2532.5055 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	213.6556 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (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	5104.3766 (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	2272.2155	0.2100	477.1653	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2532.5055	0.2100	531.8261	(264)
Space and water heating			1008.9914	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	213.6556	0.1443	30.8371	(268)
Total CO2, kg/year			1051.7578	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.0300	(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	2272.2155	1.1300	2567.6035	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2532.5055	1.1300	2861.7312	(278)
Space and water heating			5429.3347	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	213.6556	1.5338	327.7121	(282)
Total Primary energy kWh/year			5887.1476	(286)
Dwelling Primary energy Rate (DPER)			84.1000	(287)

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

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	35.0000 (1b)	x	2.5000 (2b)	=	87.5000 (1b)	-
First floor	35.0000 (1c)	x	2.7500 (2c)	=	96.2500 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000					(4)

Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 183.7500 (5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1088	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3588	(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) =	0.3050	(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	0.3889	0.3813	0.3736	0.3355	0.3279	0.2898	0.2898	0.2821	0.3050	0.3279	0.3431	0.3584	(22b)
Effective ac	0.5756	0.5727	0.5698	0.5563	0.5538	0.5420	0.5420	0.5398	0.5465	0.5538	0.5589	0.5642	(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			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			12.3200	1.1450	14.1069			(27)
Heatloss Floor 1			35.0000	0.1300	4.5500			(28a)
External Wall 1	73.5000	17.5200	55.9800	0.1800	10.0764			(29a)
External Roof 1	65.0000		65.0000	0.1100	7.1500			(30)
Total net area of external elements Aum(A, m2)			173.5000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.0833			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 8.3571 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E5 Ground floor (normal)	10.0000	0.1600	1.6000
E6 Intermediate floor within a dwelling	36.0000	0.0000	0.0000
E16 Corner (normal)	15.5000	0.0900	1.3950
E18 Party wall between dwellings	15.5000	0.0600	0.9300

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.9250 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 45.0083 (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	34.9042	34.7261	34.5516	33.7318	33.5784	32.8644	32.8644	32.7322	33.1395	33.5784	33.8887	34.2131	(38)
Heat transfer coeff	79.9124	79.7344	79.5599	78.7401	78.5867	77.8727	77.8727	77.7405	78.1477	78.5867	78.8970	79.2214	(39)

Average = Sum(39)m / 12 = 78.7394

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1416	1.1391	1.1366	1.1249	1.1227	1.1125	1.1125	1.1106	1.1164	1.1227	1.1271	1.1317	(40)
HLP (average)												1.1248	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2461 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
61.8798	60.9498	59.5947	57.0020	55.0887	52.9549	51.7420	53.0869	54.5611	56.8521	59.5005	61.6427	(42a)

Hot water usage for baths

26.7336	26.3365	25.7774	24.7465	23.9746	23.1187	22.6564	23.2116	23.8161	24.7319	25.7840	26.6432	(42b)

Hot water usage for other uses

37.6326	36.2641	34.8957	33.5272	32.1587	30.7903	30.7903	32.1587	33.5272	34.8957	36.2641	37.6326	(42c)

Average daily hot water use (litres/day) 116.0487 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

	126.2459	123.5505	120.2678	115.2758	111.2220	106.8639	105.1887	108.4572	111.9043	116.4797	121.5487	125.9184	(44)
Energy conte	199.9426	175.9342	184.8472	157.8067	149.7262	131.4016	127.2166	134.2926	137.9892	158.0618	173.1684	197.1578	(45)
Energy content (annual)										Total = Sum(45)m =		1927.5450	
Distribution loss (46)m = 0.15 x (45)m													
	29.9914	26.3901	27.7271	23.6710	22.4589	19.7102	19.0825	20.1439	20.6984	23.7093	25.9753	29.5737	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8381	(55)
Total storage loss													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(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													
	249.1853	220.4115	234.0898	205.4609	198.9689	179.0558	176.4593	183.5353	185.6434	207.3045	220.8226	246.4005	(62)
WWHRS	-28.2888	-25.0189	-26.1983	-21.6933	-20.2173	-17.3001	-16.2161	-17.2442	-17.8994	-21.1014	-23.9053	-27.7650	(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													
	220.8965	195.3926	207.8915	183.7677	178.7515	161.7557	160.2432	166.2911	167.7440	186.2031	196.9172	218.6355	(64)
										Total per year (kWh/year) = Sum(64)m =		2244.4896	(64)
12Total per year (kWh/year)												2244	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	105.8751	94.0799	100.8558	90.5941	89.1781	81.8144	81.6937	84.0464	84.0048	91.9497	95.7018	104.9491	(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	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	102.0147	112.9448	102.0147	105.4152	102.0147	105.4152	102.0147	102.0147	105.4152	102.0147	105.4152	102.0147	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	197.2971	199.3444	194.1852	183.2019	169.3374	156.3068	147.6015	145.5542	150.7134	161.6967	175.5612	188.5918	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	(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)													
	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	(71)
Water heating gains (Table 5)													
	142.3052	139.9999	135.5589	125.8251	119.8630	113.6311	109.8033	112.9656	116.6733	123.5883	132.9192	141.0606	(72)
Total internal gains													
	501.3088	511.9810	491.4506	474.1340	450.9070	432.0449	416.1113	417.2264	429.4937	446.9915	473.5874	491.3590	(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	4.3600	10.6334	0.6300	0.7000	0.7700	14.1687	(74)
South	7.9600	46.7521	0.6300	0.7000	0.7700	113.7328	(78)

Solar gains	127.9015	213.3421	283.2792	342.0699	379.0012	375.5057	362.2629	334.1189	303.1747	233.1361	152.2911	110.0873	(83)
Total gains	629.2103	725.3231	774.7298	816.2039	829.9082	807.5506	778.3742	751.3453	732.6684	680.1276	625.8785	601.4463	(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	2.0335	2.0380	2.0425	2.0638	2.0678	2.0867	2.0867	2.0903	2.0794	2.0678	2.0596	2.0512	
alpha	1.1356	1.1359	1.1362	1.1376	1.1379	1.1391	1.1391	1.1394	1.1386	1.1379	1.1373	1.1367	
util living area													
	0.7184	0.6772	0.6353	0.5731	0.4984	0.4054	0.3232	0.3414	0.4509	0.5808	0.6752	0.7280	(86)
MIT	16.1724	16.6554	17.3663	18.3094	19.2367	20.0412	20.4894	20.4324	19.8331	18.6528	17.2675	16.0740	(87)
Th 2	19.9670	19.9691	19.9711	19.9806	19.9824	19.9907	19.9907	19.9922	19.9875	19.9824	19.9788	19.9750	(88)
util rest of house													
	0.7042	0.6614	0.6167	0.5499	0.4676	0.3626	0.2666	0.2857	0.4097	0.5537	0.6569	0.7142	(89)
MIT 2	14.6986	15.2577	16.0859	17.1818	18.2428	19.1427	19.6133	19.5603	18.9236	17.5947	15.9898	14.5885	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	15.0670	15.6072	16.4060	17.4637	18.4913	19.3674	19.8324	19.7783	19.1510	17.8592	16.3092	14.9599	(92)
Temperature adjustment												0.0000	
adjusted MIT	15.0670	15.6072	16.4060	17.4637	18.4913	19.3674	19.8324	19.7783	19.1510	17.8592	16.3092	14.9599	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6136	0.5749	0.5364	0.4813	0.4157	0.3332	0.2570	0.2728	0.3712	0.4854	0.5716	0.6230	(94)
Useful gains	386.0844	416.9732	415.5861	392.8533	345.0071	269.1134	200.0206	204.9689	272.0007	330.1363	357.7508	374.6902	(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													
	860.4193	853.7286	788.1211	674.3065	533.7021	371.2472	251.7119	262.6311	394.7204	570.4777	726.5802	852.4115	(97)
Space heating kWh													
	352.9052	293.4996	277.1661	202.6463	140.3891	0.0000	0.0000	0.0000	0.0000	178.8140	265.5572	355.4246	(98a)
Space heating requirement - total per year (kWh/year)												2066.4019	
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													
	352.9052	293.4996	277.1661	202.6463	140.3891	0.0000	0.0000	0.0000	0.0000	178.8140	265.5572	355.4246	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2066.4019	
Space heating per m2											(98c) / (4) =	29.5200	(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													
	352.9052	293.4996	277.1661	202.6463	140.3891	0.0000	0.0000	0.0000	0.0000	178.8140	265.5572	355.4246	(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)													
	382.3458	317.9844	300.2883	219.5518	152.1008	0.0000	0.0000	0.0000	0.0000	193.7313	287.7109	385.0754	(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													
	220.8965	195.3926	207.8915	183.7677	178.7515	161.7557	160.2432	166.2911	167.7440	186.2031	196.9172	218.6355	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.1049	84.9700	84.7056	84.2796	83.5238	79.8000	79.8000	79.8000	79.8000	83.9690	84.7311	85.1428	(217)
Fuel for water heating, kWh/month													
	259.5577	229.9548	245.4284	218.0453	214.0126	202.7013	200.8060	208.3848	210.2056	221.7521	232.4026	256.7869	(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	21.1966	17.0047	15.3109	11.2174	8.6646	7.0791	7.9042	10.2741	13.3451	17.5095	19.7769	21.7858	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-32.8758	-46.4160	-66.8238	-75.2705	-81.2975	-75.9472	-75.0213	-70.7638	-63.2615	-53.1477	-36.1717	-28.4162	(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	-18.3711	-38.6706	-76.8999	-115.5506	-152.8295	-153.5594	-151.7398	-128.4485	-94.1189	-55.3060	-24.5307	-14.5246	(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												2238.7887	(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												2700.0381	(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)												171.0690	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1729.9627	(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												3465.9331	(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	2238.7887	0.2100	470.1456	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2700.0381	0.2100	567.0080	(264)
Space and water heating			1037.1536	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	171.0690	0.1443	24.6905	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-705.4132	0.1345	-94.9107	
PV Unit electricity exported	-1024.5495	0.1259	-128.9753	
Total			-223.8859	(269)
Total CO2, kg/year			849.8875	(272)
Target Carbon Dioxide Emission Rate (TER)			12.1400	(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	2238.7887	1.1300	2529.8312	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2700.0381	1.1300	3051.0431	(278)
Space and water heating			5580.8743	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	171.0690	1.5338	262.3913	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-705.4132	1.4973	-1056.1853	
PV Unit electricity exported	-1024.5495	0.4621	-473.4277	
Total			-1529.6129	(283)
Total Primary energy kWh/year			4443.7534	(286)
Target Primary Energy Rate (TPER)			63.4800	(287)

;

Full SAP Calculation Printout

elmhurst energy

Property Reference	Plot 45 1BF_Be Lean_MEV	Issued on Date	12/10/2022
Assessment Reference	00001	Prop Type Ref	1BF
Property	1BF, House No. 45, Claygate, Surrey, Elmbridge, KT 10		

SAP Rating	83 B	DER	17.37	TER	10.79
Environmental	87 B	% DER<TER	-60.98		
CO_2 Emissions (t/year)	0.91	DFEE	45.26	TFEE	39.01
Compliance Check	See BREL	% DFEE < TFEE	-16.03		
% DPER < TPER	-68.20	DPER	96.97	TPER	57.65

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

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

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	55.7000 (1b)	x	2.5000 (2b)	=	139.2500	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	55.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	139.2500	(5)

---

2. Ventilation rate

---

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1436 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.2936 (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) =	0.2496 (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	0.3182	0.3120	0.3057	0.2745	0.2683	0.2371	0.2371	0.2309	0.2496	0.2683	0.2808	0.2933	(22b)
Effective ac	0.5506	0.5487	0.5467	0.5377	0.5360	0.5281	0.5281	0.5266	0.5311	0.5360	0.5394	0.5430	(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	
Window (Uw = 1.20)			17.2000	1.1450	19.6947			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			55.7000	0.1200	6.6840	0.0000	0.0000	(28a)
External Wall 1	54.0000	22.4000	31.6000	0.1400	4.4240	0.0000	0.0000	(29a)
External Roof 1	53.2500		53.2500	0.1132	6.0283	9.0000	479.2500	(30)
Total net area of external elements Aum(A, m2)			162.9500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.0310			(33)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 479.2500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 8.6041 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 8.1475 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 50.1785 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	25.3029	25.2125	25.1240	24.7080	24.6302	24.2679	24.2679	24.2008	24.4075	24.6302	24.7876	24.9522	(38)
Heat transfer coeff	75.4813	75.3910	75.3024	74.8865	74.8087	74.4464	74.4464	74.3793	74.5859	74.8087	74.9661	75.1307	(39)

Average = Sum(39)m / 12 = 74.8861

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3551	1.3535	1.3519	1.3445	1.3431	1.3366	1.3366	1.3354	1.3391	1.3431	1.3459	1.3488	(40)
HLP (average)												1.3445	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.8578 (42)
Hot water usage for mixer showers

55.3694	54.5373	53.3248	51.0048	49.2928	47.3835	46.2982	47.5016	48.8207	50.8707	53.2404	55.1572	(42a)

Hot water usage for baths

23.9339	23.5784	23.0779	22.1549	21.4639	20.6976	20.2837	20.7807	21.3219	22.1419	23.0838	23.8530	(42b)

Hot water usage for other uses

33.6561	32.4323	31.2084	29.9845	28.7607	27.5368	27.5368	28.7607	29.9845	31.2084	32.4323	33.6561	(42c)

Average daily hot water use (litres/day) 103.8357 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.9594	110.5480	107.6110	103.1443	99.5173	95.6179	94.1187	97.0430	100.1271	104.2209	108.7565	112.6663	(44)
Energy conte	178.9000	157.4188	165.3942	141.1994	133.9694	117.5733	113.8285	120.1595	123.4668	141.4268	154.9436	176.4082	(45)

Energy content (annual) Total = Sum(45)m = 1724.6886

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

26.8350	23.6128	24.8091	21.1799	20.0954	17.6360	17.0743	18.0239	18.5200	21.2140	23.2415	26.4612	(46)

Water storage loss:
Store volume 180.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 0.8736 (55)
Total storage loss

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)

If cylinder contains dedicated solar storage

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(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)

Total heat required for water heating calculated for each month

229.2445	202.8912	215.7386	189.9198	184.3139	166.2938	164.1729	170.5039	172.1872	191.7713	203.6640	226.7527	(62)
-24.4333	-21.6090	-22.6277	-18.7366	-17.4619	-14.9422	-14.0060	-14.8940	-15.4598	-18.2254	-20.6472	-23.9808	(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)

Output from w/h

204.8112	181.2822	193.1109	171.1832	166.8520	151.3515	150.1669	155.6100	156.7274	173.5458	183.0168	202.7718	(64)

Total per year (kWh/year) = Sum(64)m = 2090.4297 (64)
12Total per year (kWh/year) 2090 (64)
Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

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

Heat gains from water heating, kWh/month

99.7598	88.7197	95.2691	85.9251	84.8204	78.0695	78.1235	80.2286	80.0290	87.3000	90.4951	98.9313	(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	92.8919	92.8919	92.8919	92.8919	92.8919	92.8919	92.8919	92.8919	92.8919	92.8919	92.8919	92.8919	(66)

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

81.7042	90.4582	81.7042	84.4277	81.7042	84.4277	81.7042	81.7042	84.4277	81.7042	84.4277	81.7042	(67)

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

161.9877	163.6686	159.4327	150.4150	139.0318	128.3332	121.1859	119.5050	123.7409	132.7585	144.1417	154.8403	(68)

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

32.2892	32.2892	32.2892	32.2892	32.2892	32.2892	32.2892	32.2892	32.2892	32.2892	32.2892	32.2892	(69)
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)

-74.3135	-74.3135	-74.3135	-74.3135	-74.3135	-74.3135	-74.3135	-74.3135	-74.3135	-74.3135	-74.3135	-74.3135	(71)

Water heating gains (Table 5)

134.0858	132.0233	128.0499	119.3405	114.0059	108.4298	105.0047	107.8341	111.1514	117.3387	125.6876	132.9722	(72)

Total internal gains

431.6452	440.0177	423.0543	408.0507	388.6095	372.0583	358.7624	359.9109	370.1875	385.6690	408.1246	423.3843	(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	2.5000	10.6334	0.7600	0.7000	0.7700	9.8007 (74)
East	5.2000	19.6403	0.7600	0.7000	0.7700	37.6526 (76)
West	9.5000	19.6403	0.7600	0.7000	0.7700	68.7885 (80)

Solar gains	116.2418	226.9511	374.7373	551.2364	681.7749	701.1443	666.1605	567.7060	437.0852	269.3675	144.8100	95.7024 (83)
Total gains	547.8870	666.9688	797.7916	959.2871	1070.3844	1073.2026	1024.9229	927.6169	807.2727	655.0364	552.9346	519.0866 (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	1.7637	1.7658	1.7679	1.7777	1.7795	1.7882	1.7882	1.7898	1.7849	1.7795	1.7758	1.7719	
alpha	1.1176	1.1177	1.1179	1.1185	1.1186	1.1192	1.1192	1.1193	1.1190	1.1186	1.1184	1.1181	
util living area	0.7312	0.6790	0.6094	0.5129	0.4152	0.3228	0.2530	0.2821	0.4104	0.5731	0.6872	0.7428	(86)
MIT	15.9876	16.5595	17.4614	18.5679	19.5229	20.2320	20.5968	20.5246	19.9190	18.6332	17.1158	15.8677	(87)
Th 2	19.7979	19.7991	19.8004	19.8062	19.8073	19.8123	19.8123	19.8132	19.8104	19.8073	19.8051	19.8028	(88)
util rest of house	0.7151	0.6606	0.5873	0.4855	0.3808	0.2780	0.1966	0.2239	0.3634	0.5412	0.6662	0.7273	(89)
MIT 2	14.4041	15.0610	16.0967	17.3540	18.4162	19.1819	19.5475	19.4884	18.8806	17.4699	15.7288	14.2686	(90)
Living area fraction										fLA = Living area / (4) =		0.2693	(91)
MIT	14.8305	15.4645	16.4642	17.6809	18.7142	19.4647	19.8301	19.7674	19.1602	17.7832	16.1023	14.6992	(92)
Temperature adjustment												-0.1500	
adjusted MIT	14.6805	15.3145	16.3142	17.5309	18.5642	19.3147	19.6801	19.6174	19.0102	17.6332	15.9523	14.5492	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6204	0.5706	0.5076	0.4244	0.3407	0.2575	0.1898	0.2134	0.3277	0.4702	0.5758	0.6321	(94)
Useful gains	339.9117	380.5754	404.9709	407.1436	364.6298	276.3936	194.5323	197.9976	264.5621	307.9717	318.3739	328.1206	(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	783.5344	785.1632	739.0328	646.3367	513.5022	350.9894	229.3011	239.3087	366.2337	526.1428	663.6239	777.5428	(97)
Space heating kWh	330.0553	271.8830	248.5421	172.2191	110.7611	0.0000	0.0000	0.0000	0.0000	162.3193	248.5800	334.3701	(98a)
Space heating requirement - total per year (kWh/year)												1878.7299	
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	330.0553	271.8830	248.5421	172.2191	110.7611	0.0000	0.0000	0.0000	0.0000	162.3193	248.5800	334.3701	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1878.7299	
Space heating per m2										(98c) / (4) =		33.7294	(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 %)	89.5000 (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	330.0553	271.8830	248.5421	172.2191	110.7611	0.0000	0.0000	0.0000	0.0000	162.3193	248.5800	334.3701	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	368.7768	303.7799	277.7007	192.4235	123.7554	0.0000	0.0000	0.0000	0.0000	181.3623	277.7430	373.5979	(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	204.8112	181.2822	193.1109	171.1832	166.8520	151.3515	150.1669	155.6100	156.7274	173.5458	183.0168	202.7718	(64)
Efficiency of water heater												89.5000	(216)
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)
Fuel for water heating, kWh/month	228.8393	202.5500	215.7663	191.2661	186.4268	169.1078	167.7843	173.8659	175.1144	193.9060	204.4880	226.5607	(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	20.9867	16.8363	15.1592	11.1063	8.5788	7.0090	7.8259	10.1724	13.2129	17.3361	19.5810	21.5700	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year	
Space heating fuel - main system 1	2099.1395 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	2335.6756 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	169.3745 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (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	4690.1896 (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	2099.1395	0.2100	440.8193	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2335.6756	0.2100	490.4919	(264)
Space and water heating			931.3112	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	169.3745	0.1443	24.4460	(268)
Total CO2, kg/year			967.6864	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.3700	(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	2099.1395	1.1300	2372.0276	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2335.6756	1.1300	2639.3135	(278)
Space and water heating			5011.3411	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	169.3745	1.5338	259.7922	(282)
Total Primary energy kWh/year			5401.2342	(286)
Dwelling Primary energy Rate (DPER)			96.9700	(287)

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

---

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		55.7000 (1b)	x	2.5000 (2b)	=	139.2500 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	55.7000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	139.2500	(5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys		0 * 80 =	0.0000 (6a)
Number of open flues		0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)
Number of blocked chimneys		0 * 20 =	0.0000 (6f)
Number of intermittent extract fans		2 * 10 =	20.0000 (7a)
Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		20.0000 / (5) =	0.1436 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			5.0000 (17)
Infiltration rate			0.3936 (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) =		0.3346 (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	0.4266	0.4182	0.4099	0.3680	0.3597	0.3179	0.3179	0.3095	0.3346	0.3597	0.3764	0.3931	(22b)
Effective ac	0.5910	0.5875	0.5840	0.5677	0.5647	0.5505	0.5505	0.5479	0.5560	0.5647	0.5708	0.5773	(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			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			8.7500	1.1450	10.0191			(27)
Heatloss Floor 1			55.7000	0.1300	7.2410			(28a)
External Wall 1	54.0000	13.9500	40.0500	0.1800	7.2090			(29a)
External Roof 1	53.2500		53.2500	0.1100	5.8575			(30)
Total net area of external elements Aum(A, m2)			162.9500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.5266			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 8.6041 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	10.0000	0.1600	1.6000
E6 Intermediate floor within a dwelling	36.0000	0.0000	0.0000
E16 Corner (normal)	15.5000	0.0900	1.3950
E18 Party wall between dwellings	15.5000	0.0600	0.9300

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.9250 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 39.4516 (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	27.1575	26.9951	26.8360	26.0885	25.9486	25.2976	25.2976	25.1770	25.5483	25.9486	26.2315	26.5273	(38)
Heat transfer coeff	66.6091	66.4467	66.2876	65.5401	65.4002	64.7491	64.7491	64.6286	64.9999	65.4002	65.6831	65.9789	(39)

Average = Sum(39)m / 12 = 65.5394

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1959	1.1929	1.1901	1.1767	1.1742	1.1625	1.1625	1.1603	1.1670	1.1742	1.1792	1.1845	(40)
HLP (average)												1.1766	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.8578 (42)

Hot water usage for mixer showers

55.3694	54.5373	53.3248	51.0048	49.2928	47.3835	46.2982	47.5016	48.8207	50.8707	53.2404	55.1572	(42a)

Hot water usage for baths

23.9339	23.5784	23.0779	22.1549	21.4639	20.6976	20.2837	20.7807	21.3219	22.1419	23.0838	23.8530	(42b)

Hot water usage for other uses

33.6561	32.4323	31.2084	29.9845	28.7607	27.5368	27.5368	28.7607	29.9845	31.2084	32.4323	33.6561	(42c)

Average daily hot water use (litres/day) 103.8357 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.9594	110.5480	107.6110	103.1443	99.5173	95.6179	94.1187	97.0430	100.1271	104.2209	108.7565	112.6663	(44)

Energy conte	178.9000	157.4188	165.3942	141.1994	133.9694	117.5733	113.8285	120.1595	123.4668	141.4268	154.9436	176.4082	(45)
Energy content (annual)											Total = Sum(45)m =	1724.6886	
Distribution loss (46)m = 0.15 x (45)m													
	26.8350	23.6128	24.8091	21.1799	20.0954	17.6360	17.0743	18.0239	18.5200	21.2140	23.2415	26.4612	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8381	(55)
Total storage loss													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(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													
	228.1427	201.8961	214.6368	188.8536	183.2121	165.2275	163.0711	169.4022	171.1210	190.6695	202.5978	225.6509	(62)
WWHRS	-25.3126	-22.3866	-23.4420	-19.4109	-18.0903	-15.4800	-14.5100	-15.4299	-16.0162	-18.8813	-21.3902	-24.8438	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	202.8301	179.5094	191.1948	169.4427	165.1218	149.7476	148.5611	153.9722	155.1048	171.7882	181.2076	200.8071	(64)
										Total per year (kWh/year) = Sum(64)m =		2069.2875	(64)
12Total per year (kWh/year)												2069	(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													
	98.8784	87.9236	94.3877	85.0722	83.9390	77.2165	77.2421	79.3472	79.1761	86.4186	89.6421	98.0499	(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	92.8919	92.8919	92.8919	92.8919	92.8919	92.8919	92.8919	92.8919	92.8919	92.8919	92.8919	92.8919	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	85.5526	94.7190	85.5526	88.4044	85.5526	88.4044	85.5526	85.5526	88.4044	85.5526	88.4044	85.5526	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	161.9877	163.6686	159.4327	150.4150	139.0318	128.3332	121.1859	119.5050	123.7409	132.7585	144.1417	154.8403	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.2892	32.2892	32.2892	32.2892	32.2892	32.2892	32.2892	32.2892	32.2892	32.2892	32.2892	32.2892	(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)													
	-74.3135	-74.3135	-74.3135	-74.3135	-74.3135	-74.3135	-74.3135	-74.3135	-74.3135	-74.3135	-74.3135	-74.3135	(71)
Water heating gains (Table 5)													
	132.9011	130.8386	126.8652	118.1558	112.8212	107.2451	103.8200	106.6494	109.9668	116.1540	124.5029	131.7875	(72)
Total internal gains													
	434.3089	443.0938	425.7181	410.8428	391.2732	374.8503	361.4261	362.5746	372.9796	388.3327	410.9166	426.0480	(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	1.2700	10.6334	0.6300	0.7000	0.7700	4.1271	(74)
East	2.6500	19.6403	0.6300	0.7000	0.7700	15.9061	(76)
West	4.8300	19.6403	0.6300	0.7000	0.7700	28.9912	(80)

Solar gains	49.0245	95.7159	158.0436	232.4783	287.5276	295.6943	280.9414	239.4228	184.3377	113.6048	61.0731	40.3620	(83)
Total gains	483.3334	538.8097	583.7617	643.3210	678.8008	670.5446	642.3675	601.9974	557.3173	501.9375	471.9897	466.4100	(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	1.9986	2.0035	2.0083	2.0312	2.0355	2.0560	2.0560	2.0598	2.0481	2.0355	2.0268	2.0177	
alpha	1.1332	1.1336	1.1339	1.1354	1.1357	1.1371	1.1371	1.1373	1.1365	1.1357	1.1351	1.1345	
util living area													
	0.7354	0.7032	0.6594	0.5868	0.5025	0.4054	0.3247	0.3499	0.4741	0.6113	0.6977	0.7425	(86)
MIT	16.0282	16.4513	17.1976	18.2284	19.2147	20.0381	20.4849	20.4144	19.7613	18.5048	17.1146	15.9484	(87)
Th 2	19.9233	19.9257	19.9279	19.9387	19.9407	19.9501	19.9501	19.9519	19.9465	19.9407	19.9367	19.9324	(88)
util rest of house													
	0.7211	0.6874	0.6406	0.5628	0.4704	0.3608	0.2655	0.2910	0.4306	0.5836	0.6792	0.7286	(89)
MIT 2	14.5113	15.0032	15.8730	17.0684	18.1929	19.1105	19.5776	19.5143	18.8256	17.4103	15.7951	14.4230	(90)
Living area fraction										fLA = Living area / (4) =		0.2693	(91)
MIT	14.9198	15.3931	16.2297	17.3808	18.4681	19.3603	19.8220	19.7567	19.0776	17.7051	16.1505	14.8338	(92)
Temperature adjustment												0.0000	
adjusted MIT	14.9198	15.3931	16.2297	17.3808	18.4681	19.3603	19.8220	19.7567	19.0776	17.7051	16.1505	14.8338	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6302	0.5990	0.5578	0.4928	0.4189	0.3330	0.2577	0.2790	0.3895	0.5112	0.5923	0.6374	(94)
Useful gains	304.5908	322.7250	325.6079	317.0256	284.3741	223.2714	165.5088	167.9431	217.0812	256.6077	279.5804	297.2748	(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	707.3764	697.2349	644.9599	555.8320	442.6348	308.2264	208.6194	216.9393	323.5423	464.6718	594.4638	701.6052	(97)
Space heating kWh	299.6724	251.6707	237.5979	171.9406	117.7460	0.0000	0.0000	0.0000	0.0000	154.7997	226.7161	300.8219	(98a)
Space heating requirement - total per year (kWh/year)												1760.9652	
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	299.6724	251.6707	237.5979	171.9406	117.7460	0.0000	0.0000	0.0000	0.0000	154.7997	226.7161	300.8219	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1760.9652	
Space heating per m2											(98c) / (4) =	31.6152	(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													
	299.6724	251.6707	237.5979	171.9406	117.7460	0.0000	0.0000	0.0000	0.0000	154.7997	226.7161	300.8219	(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)													
	324.6722	272.6660	257.4191	186.2845	127.5688	0.0000	0.0000	0.0000	0.0000	167.7136	245.6295	325.9175	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.8301	179.5094	191.1948	169.4427	165.1218	149.7476	148.5611	153.9722	155.1048	171.7882	181.2076	200.8071	(64)
Efficiency of water heater												79.8000	(216)
(217)m	84.9335	84.8175	84.5482	84.0926	83.3149	79.8000	79.8000	79.8000	79.8000	83.8270	84.5634	84.9641	(217)
Fuel for water heating, kWh/month													
	238.8104	211.6419	226.1371	201.4953	198.1900	187.6536	186.1668	192.9477	194.3669	204.9318	214.2861	236.3435	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	17.7761	14.2607	12.8402	9.4073	7.2664	5.9367	6.6287	8.6162	11.1916	14.6840	16.5855	18.2702	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-44.0022	-58.3141	-78.8929	-83.3926	-85.7874	-78.7404	-77.8358	-75.4790	-70.7514	-64.1393	-47.0699	-38.5042	(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	-37.5536	-77.0951	-149.8331	-220.2854	-286.8091	-286.5030	-283.0383	-241.5532	-179.7084	-108.4569	-49.5337	-29.8330	(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	1907.8713	(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	2492.9711	(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)	143.4637	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2753.1121	(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	1877.1940	(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	1907.8713	0.2100	400.6530	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2492.9711	0.2100	523.5239	(264)
Space and water heating			924.1769	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	143.4637	0.1443	20.7062	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-802.9093	0.1359	-109.1029	
PV Unit electricity exported	-1950.2028	0.1265	-246.7880	
Total			-355.8909	(269)
Total CO2, kg/year			600.9215	(272)
Target Carbon Dioxide Emission Rate (TER)			10.7900	(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	1907.8713	1.1300	2155.8945	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2492.9711	1.1300	2817.0574	(278)
Space and water heating			4972.9519	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	143.4637	1.5338	220.0494	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-802.9093	1.5023	-1206.1917	
PV Unit electricity exported	-1950.2028	0.4645	-905.9391	
Total			-2112.1308	(283)
Total Primary energy kWh/year			3210.9712	(286)
Target Primary Energy Rate (TPER)			57.6500	(287)

;

Full SAP Calculation Printout

Property Reference	Plot 1 4A_Be Lean_MEV	Issued on Date	12/10/2022
Assessment Reference	00001	Prop Type Ref	4A
Property	4 Bedroom House, House No. 1, Claygate, Surrey, Elmbridge, KT 10		

SAP Rating	86 B	DER	11.83	TER	10.15
Environmental	89 B	% DER<TER	-16.55		
CO_2 Emissions (t/year)	1.18	DFEE	32.40	TFEE	33.22
Compliance Check	See BREL	% DFEE < TFEE	2.47		
% DPER < TPER	-25.38	DPER	66.42	TPER	52.97

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

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

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.0000 (1b)	x	2.5000 (2b)	=	97.5000 (1b)	-
First floor	39.0000 (1c)	x	2.7000 (2c)	=	105.3000 (1c)	-
Second floor	28.0000 (1d)	x	2.5000 (2d)	=	70.0000 (1d)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	272.8000	(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		3.0000	(17)
Infiltration rate		0.1500	(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) =	0.1275	(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	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)
Effective ac	0.5132	0.5127	0.5122	0.5098	0.5094	0.5073	0.5073	0.5070	0.5081	0.5094	0.5103	0.5112	(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	
Window (Uw = 1.20)			16.4000	1.1450	18.7786			(27)
Door			5.2000	1.0000	5.2000			(26)
Opening			0.9100	1.1450	1.0420			(27a)
Heatloss Floor 1			52.0000	0.1100	5.7200	0.0000	0.0000	(28a)
External Wall 1	105.0000	21.6000	83.4000	0.1400	11.6760	0.0000	0.0000	(29a)
External Roof 1	30.0000	0.9100	29.0900	0.1043	3.0331	9.0000	261.8100	(30)

Total net area of external elements Aum(A, m2) 187.0000 (31)
Fabric heat loss, W/K = Sum (A x U) (26)...(30) + (32) = 45.4497 (33)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 261.8100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 2.4699 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 9.3500 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 54.7997 (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	46.2015	46.1553	46.1100	45.8974	45.8576	45.6724	45.6724	45.6381	45.7437	45.8576	45.9381	46.0222	(38)
Heat transfer coeff	101.0012	100.9550	100.9097	100.6971	100.6573	100.4721	100.4721	100.4378	100.5434	100.6573	100.7378	100.8219	(39)

Average = Sum(39)m / 12 = 100.6969

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9528	0.9524	0.9520	0.9500	0.9496	0.9478	0.9478	0.9475	0.9485	0.9496	0.9504	0.9512	(40)
HLP (average)												0.9500	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7886 (42)
Hot water usage for mixer showers

70.9748	69.9082	68.3539	65.3801	63.1855	60.7381	59.3470	60.8895	62.5804	65.2082	68.2459	70.7029	(42a)

Hot water usage for baths

30.6447	30.1896	29.5487	28.3670	27.4821	26.5010	25.9710	26.6074	27.3004	28.3502	29.5563	30.5411	(42b)

Hot water usage for other uses

43.1877	41.6172	40.0467	38.4763	36.9058	35.3354	35.3354	36.9058	38.4763	40.0467	41.6172	43.1877	(42c)

Average daily hot water use (litres/day) 133.1104 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.8072	141.7150	137.9494	132.2234	127.5735	122.5745	120.6534	124.4028	128.3571	133.6052	139.4193	144.4317	(44)
Energy conte	229.3392	201.8003	212.0230	181.0072	171.7384	150.7196	145.9199	154.0367	158.2771	181.3009	198.6284	226.1451	(45)

Energy content (annual) Total = Sum(45)m = 2210.9358

Distribution loss (46)m = 0.15 x (45)m	34.4009	30.2700	31.8035	27.1511	25.7608	22.6079	21.8880	23.1055	23.7416	27.1951	29.7943	33.9218	(46)

Water storage loss:
Store volume 180.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 0.8736 (55)

Total storage loss	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(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

279.6836	247.2727	262.3675	229.7276	222.0829	199.4401	196.2643	204.3811	206.9975	231.6454	247.3488	276.4895	(62)
WWHRS	-31.3196	-27.6993	-29.0052	-24.0174	-22.3834	-19.1536	-17.9535	-19.0917	-19.8171	-23.3621	-26.4665	-30.7396	(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

248.3640	219.5733	233.3623	205.7102	199.6995	180.2865	178.3108	185.2894	187.1805	208.2832	220.8824	245.7499	(64)

Total per year (kWh/year) = Sum(64)m = 2512.6920 (64)
12Total per year (kWh/year) 2513 (64)
Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

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

Heat gains from water heating, kWh/month

116.5308	103.4765	110.7732	99.1612	97.3786	89.0906	88.7939	91.4927	91.6035	100.5581	105.0203	115.4688	(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	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	138.9644	153.8535	138.9644	143.5966	138.9644	143.5966	138.9644	138.9644	143.5966	138.9644	143.5966	138.9644	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	265.6788	268.4357	261.4884	246.6983	228.0285	210.4816	198.7591	196.0022	202.9495	217.7396	236.4094	253.9563	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	(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)	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	(71)
Water heating gains (Table 5)	156.6275	153.9829	148.8887	137.7239	130.8852	123.7370	119.3466	122.9741	127.2271	135.1588	145.8615	155.2000	(72)
Total internal gains	629.0991	644.1005	617.1699	595.8473	565.7066	542.6435	521.8986	522.7692	538.6016	559.6912	593.6959	615.9492	(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	9.5000	10.6334	0.7600	0.7000	0.7700	37.2426	(74)
East	1.7000	19.6403	0.7600	0.7000	0.7700	12.3095	(76)
South	5.2000	46.7521	0.7600	0.7000	0.7700	89.6291	(78)
South	0.9100	26.0000	0.7600	0.7000	1.0000	11.3284	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	150.5096	265.5702	389.4075	528.7847	636.4438	651.7761	620.0482	536.3448	436.9635	300.3775	181.9115	127.7677	(83)
Total gains	779.6088	909.6707	1006.5775	1124.6320	1202.1503	1194.4196	1141.9468	1059.1139	975.5650	860.0686	775.6074	743.7169	(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	0.7200	0.7204	0.7207	0.7222	0.7225	0.7238	0.7238	0.7241	0.7233	0.7225	0.7219	0.7213	
alpha	1.0480	1.0480	1.0480	1.0481	1.0482	1.0483	1.0483	1.0483	1.0482	1.0482	1.0481	1.0481	
util living area	0.6984	0.6553	0.6060	0.5322	0.4480	0.3577	0.2847	0.3101	0.4252	0.5618	0.6578	0.7094	(86)
MIT	15.9014	16.4038	17.1882	18.2249	19.2194	20.0317	20.4754	20.4004	19.7492	18.4756	17.0168	15.7854	(87)
Th 2	20.1228	20.1232	20.1235	20.1252	20.1255	20.1270	20.1270	20.1273	20.1265	20.1255	20.1249	20.1242	(88)
util rest of house	0.6865	0.6422	0.5906	0.5131	0.4232	0.3241	0.2413	0.2663	0.3918	0.5395	0.6426	0.6979	(89)
MIT 2	14.5015	15.0827	15.9934	17.1900	18.3247	19.2330	19.7078	19.6363	18.9381	17.4999	15.8103	14.3682	(90)

Living area fraction fLA = Living area / (4) = 0.2500 (91)

MIT	14.8515	15.4130	16.2921	17.4487	18.5484	19.4327	19.8997	19.8273	19.1409	17.7438	16.1119	14.7225	(92)
Temperature adjustment												-0.1500	
adjusted MIT	14.7015	15.2630	16.1421	17.2987	18.3984	19.2827	19.7497	19.6773	18.9909	17.5938	15.9619	14.5725	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.5873	0.5474	0.5030	0.4392	0.3673	0.2883	0.2209	0.2416	0.3424	0.4606	0.5476	0.5978	(94)
Useful gains	457.8418	497.9544	506.3511	493.9078	441.5544	344.3919	252.2335	255.8299	334.0467	396.1582	424.7476	444.6273	(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	1050.5604	1046.1918	972.9804	845.7257	674.2385	470.4815	316.4568	329.1649	491.7480	703.9799	892.7293	1045.7761	(97)
Space heating kWh	440.9827	368.4155	347.1722	253.3089	173.1170	0.0000	0.0000	0.0000	0.0000	229.0194	336.9468	447.2547	(98a)

Space heating requirement - total per year (kWh/year) 2596.2171

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

	440.9827	368.4155	347.1722	253.3089	173.1170	0.0000	0.0000	0.0000	0.0000	229.0194	336.9468	447.2547	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 2596.2171

Space heating per m2 (98c) / (4) = 24.4926 (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 %) 89.5000 (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	440.9827	368.4155	347.1722	253.3089	173.1170	0.0000	0.0000	0.0000	0.0000	229.0194	336.9468	447.2547	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	492.7181	411.6374	387.9019	283.0267	193.4268	0.0000	0.0000	0.0000	0.0000	255.8876	376.4769	499.7260	(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

	248.3640	219.5733	233.3623	205.7102	199.6995	180.2865	178.3108	185.2894	187.1805	208.2832	220.8824	245.7499	(64)

Efficiency of water heater 89.5000 (216)

(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)

Fuel for water heating, kWh/month

	277.5017	245.3333	260.7400	229.8438	223.1279	201.4374	199.2300	207.0273	209.1402	232.7187	246.7959	274.5808 (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	37.1258	29.7837	26.8169	19.6472	15.1761	12.3990	13.8441	17.9951	23.3739	30.6678	34.6392	38.1577 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	2900.8012 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	2807.4771 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	299.6266 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (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	6093.9050 (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	2900.8012	0.2100	609.1683	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2807.4771	0.2100	589.5702	(264)
Space and water heating			1198.7385	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	299.6266	0.1443	43.2454	(268)
Total CO2, kg/year			1253.9131	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			11.8300	(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	2900.8012	1.1300	3277.9054	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2807.4771	1.1300	3172.4491	(278)
Space and water heating			6450.3545	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	299.6266	1.5338	459.5773	(282)
Total Primary energy kWh/year			7040.0326	(286)
Dwelling Primary energy Rate (DPER)			66.4200	(287)

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

---

1. Overall dwelling characteristics

	Area	Storey height	Volume	

	(m2)		(m)		(m3)	
Ground floor	39.0000 (1b)	x	2.5000 (2b)	=	97.5000 (1b)	-
First floor	39.0000 (1c)	x	2.7000 (2c)	=	105.3000 (1c)	-
Second floor	28.0000 (1d)	x	2.5000 (2d)	=	70.0000 (1d)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	272.8000	(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) =	0.1466 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3966 (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) =	0.3371 (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	0.4298	0.4214	0.4130	0.3708	0.3624	0.3203	0.3203	0.3118	0.3371	0.3624	0.3793	0.3961	(22b)
Effective ac	0.5924	0.5888	0.5853	0.5688	0.5657	0.5513	0.5513	0.5486	0.5568	0.5657	0.5719	0.5785	(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			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			16.4000	1.1450	18.7786			(27)
Opening			0.9100	1.5918	1.4485			(27a)
Heatloss Floor 1			52.0000	0.1300	6.7600			(28a)
External Wall 1	105.0000	21.6000	83.4000	0.1800	15.0120			(29a)
External Roof 1	30.0000	0.9100	29.0900	0.1100	3.1999			(30)
Total net area of external elements Aum(A, m2)			187.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.3990			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K				2.4699 (35)
List of Thermal Bridges				
K1 Element	Length	Psi-value	Total	
E5 Ground floor (normal)	10.0000	0.1600	1.6000	
E6 Intermediate floor within a dwelling	36.0000	0.0000	0.0000	
E16 Corner (normal)	15.5000	0.0900	1.3950	
E18 Party wall between dwellings	15.5000	0.0600	0.9300	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				3.9250 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	54.3240 (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	53.3287	53.0058	52.6892	51.2024	50.9242	49.6292	49.6292	49.3894	50.1280	50.9242	51.4870	52.0753	(38)
Heat transfer coeff	107.6528	107.3298	107.0133	105.5264	105.2482	103.9532	103.9532	103.7134	104.4520	105.2482	105.8110	106.3993	(39)
Average = Sum(39)m / 12 =												105.5251	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0156	1.0125	1.0096	0.9955	0.9929	0.9807	0.9807	0.9784	0.9854	0.9929	0.9982	1.0038	(40)
HLP (average)												0.9955	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7886 (42)
Hot water usage for mixer showers												
	70.9748	69.9082	68.3539	65.3801	63.1855	60.7381	59.3470	60.8895	62.5804	65.2082	68.2459	70.7029 (42a)
Hot water usage for baths												
	30.6447	30.1896	29.5487	28.3670	27.4821	26.5010	25.9710	26.6074	27.3004	28.3502	29.5563	30.5411 (42b)

Hot water usage for other uses

	43.1877	41.6172	40.0467	38.4763	36.9058	35.3354	35.3354	36.9058	38.4763	40.0467	41.6172	43.1877 (42c)

Average daily hot water use (litres/day) 133.1104 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	144.8072	141.7150	137.9494	132.2234	127.5735	122.5745	120.6534	124.4028	128.3571	133.6052	139.4193	144.4317	(44)
Energy conte	229.3392	201.8003	212.0230	181.0072	171.7384	150.7196	145.9199	154.0367	158.2771	181.3009	198.6284	226.1451	(45)
Energy content (annual)										Total = Sum(45)m =		2210.9358	
Distribution loss (46)m = 0.15 x (45)m													
	34.4009	30.2700	31.8035	27.1511	25.7608	22.6079	21.8880	23.1055	23.7416	27.1951	29.7943	33.9218	(46)

Water storage loss:

Store volume	180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.5520 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	0.8381 (55)

Total storage loss

	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)

If cylinder contains dedicated solar storage

	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)

Total heat required for water heating calculated for each month

	278.5819	246.2775	261.2657	228.6614	220.9811	198.3738	195.1625	203.2793	205.9313	230.5436	246.2826	275.3877 (62)
WWHRS	-32.4467	-28.6961	-30.0489	-24.8817	-23.1889	-19.8429	-18.5995	-19.7787	-20.5302	-24.2029	-27.4189	-31.8459 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)

Output from w/h

	246.1351	217.5814	231.2168	203.7797	197.7923	178.5310	176.5630	183.5006	185.4011	206.3408	218.8637	243.5419 (64)
										Total per year (kWh/year) = Sum(64)m =		2489.2472 (64)

12Total per year (kWh/year) 2489 (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

	115.6494	102.6804	109.8918	98.3083	96.4972	88.2376	87.9125	90.6113	90.7505	99.6767	104.1673	114.5874 (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	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	(66)

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

	138.9644	153.8535	138.9644	143.5966	138.9644	143.5966	138.9644	138.9644	143.5966	138.9644	143.5966	138.9644 (67)

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

	265.6788	268.4357	261.4884	246.6983	228.0285	210.4816	198.7591	196.0022	202.9495	217.7396	236.4094	253.9563 (68)

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

	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428 (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)

	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425 (71)

Water heating gains (Table 5)

	155.4428	152.7982	147.7040	136.5392	129.7005	122.5523	118.1619	121.7894	126.0424	133.9741	144.6768	154.0153 (72)

Total internal gains

	627.9144	642.9158	615.9853	594.6626	564.5219	541.4588	520.7139	521.5845	537.4169	558.5065	592.5112	614.7645 (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	9.5000	10.6334	0.6300	0.7000	0.7700	30.8722	(74)
East	1.7000	19.6403	0.6300	0.7000	0.7700	10.2039	(76)
South	5.2000	46.7521	0.6300	0.7000	0.7700	74.2978	(78)
South	0.9100	26.0000	0.6300	0.7000	1.0000	9.3907	(82)

Solar gains	124.7646	220.1437	322.7984	438.3347	527.5784	540.2881	513.9873	444.6016	362.2197	248.9971	150.7951	105.9127	(83)
Total gains	752.6790	863.0595	938.7836	1032.9973	1092.1003	1081.7469	1034.7012	966.1860	899.6366	807.5036	743.3062	720.6772	(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	0.6756	0.6776	0.6796	0.6892	0.6910	0.6996	0.6996	0.7012	0.6963	0.6910	0.6873	0.6835	
alpha	1.0450	1.0452	1.0453	1.0459	1.0461	1.0466	1.0466	1.0467	1.0464	1.0461	1.0458	1.0456	
util living area													
	0.7185	0.6805	0.6363	0.5651	0.4833	0.3891	0.3128	0.3375	0.4548	0.5882	0.6780	0.7265	(86)
MIT	15.7306	16.2038	16.9756	18.0367	19.0667	19.9398	20.4196	20.3433	19.6545	18.3442	16.8776	15.6399	(87)
Th 2	20.0704	20.0729	20.0754	20.0871	20.0892	20.0995	20.0995	20.1013	20.0955	20.0892	20.0848	20.0802	(88)
util rest of house													

	0.7065	0.6671	0.6205	0.5453	0.4570	0.3531	0.2651	0.2900	0.4195	0.5653	0.6625	0.7148	(89)
MIT 2	14.2798	14.8290	15.7280	16.9606	18.1401	19.1242	19.6392	19.5669	18.8224	17.3356	15.6321	14.1796	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	14.6425	15.1727	16.0399	17.2296	18.3718	19.3281	19.8343	19.7610	19.0304	17.5877	15.9435	14.5446	(92)
Temperature adjustment												0.0000	
adjusted MIT	14.6425	15.1727	16.0399	17.2296	18.3718	19.3281	19.8343	19.7610	19.0304	17.5877	15.9435	14.5446	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6094	0.5732	0.5325	0.4700	0.3999	0.3188	0.2498	0.2702	0.3719	0.4874	0.5697	0.6174	(94)
Useful gains	458.7182	494.6927	499.8794	485.5133	436.6939	344.8753	258.4425	261.0750	334.5507	393.5484	423.4401	444.9207	(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													
	1113.3995	1102.5681	1020.8944	878.9955	702.1926	491.5015	336.2203	348.5843	514.9920	735.4453	935.7368	1100.6621	(97)
Space heating kWh													
	487.0829	408.4922	387.6352	283.3072	197.5311	0.0000	0.0000	0.0000	0.0000	254.3713	368.8536	487.8716	(98a)
Space heating requirement - total per year (kWh/year)												2875.1451	
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													
	487.0829	408.4922	387.6352	283.3072	197.5311	0.0000	0.0000	0.0000	0.0000	254.3713	368.8536	487.8716	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2875.1451	
Space heating per m2											(98c) / (4) =	27.1240	(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													
	487.0829	408.4922	387.6352	283.3072	197.5311	0.0000	0.0000	0.0000	0.0000	254.3713	368.8536	487.8716	(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)													
	527.7171	442.5701	419.9731	306.9417	214.0098	0.0000	0.0000	0.0000	0.0000	275.5919	399.6247	528.5716	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	246.1351	217.5814	231.2168	203.7797	197.7923	178.5310	176.5630	183.5006	185.4011	206.3408	218.8637	243.5419	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.5607	85.4507	85.2095	84.7989	84.0568	79.8000	79.8000	79.8000	79.8000	84.5302	85.2208	85.5859	(217)
Fuel for water heating, kWh/month													
	287.6732	254.6279	271.3511	240.3095	235.3078	223.7230	221.2569	229.9506	232.3322	244.1030	256.8197	284.5583	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	28.8741	23.1638	20.8565	15.2803	11.8030	9.6431	10.7671	13.9954	18.1787	23.8514	26.9401	29.6766	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-38.0116	-54.3942	-79.3326	-90.5233	-98.7020	-92.4737	-91.2922	-85.6318	-75.8488	-62.7588	-42.0589	-32.7664	(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	-19.0920	-40.4165	-80.8166	-122.1058	-162.1824	-163.2623	-161.3844	-136.3477	-99.5180	-58.0895	-25.5810	-15.0820	(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												3115.0001	(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												2982.0131	(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)												233.0302	(232)

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

PV generation	-1927.6727 (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	4488.3707 (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	3115.0001	0.2100	654.1500	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2982.0131	0.2100	626.2227	(264)
Space and water heating			1280.3728	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	233.0302	0.1443	33.6335	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-843.7944	0.1343	-113.3120	
PV Unit electricity exported	-1083.8783	0.1257	-136.2590	
Total			-249.5710	(269)
Total CO2, kg/year			1076.3645	(272)
Target Carbon Dioxide Emission Rate (TER)			10.1500	(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	3115.0001	1.1300	3519.9501	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2982.0131	1.1300	3369.6748	(278)
Space and water heating			6889.6249	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	233.0302	1.5338	357.4295	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-843.7944	1.4963	-1262.5624	
PV Unit electricity exported	-1083.8783	0.4614	-500.1543	
Total			-1762.7166	(283)
Total Primary energy kWh/year			5614.4386	(286)
Target Primary Energy Rate (TPER)			52.9700	(287)

;

Full SAP Calculation Printout

Property Reference	Plot 3 3A_Be Lean_MEV	Issued on Date	12/10/2022
Assessment Reference	00001	Prop Type Ref	3A
Property	3 Bedroom House, House No. 3, Claygate, Surrey, Elmbridge, KT 10		

SAP Rating	85 B	DER	13.42	TER	10.57
Environmental	88 B	% DER<TER	-26.96		
CO_2 Emissions (t/year)	1.17	DFEE	36.87	TFEE	36.53
Compliance Check	See BREL	% DFEE < TFEE	-0.91		
% DPER < TPER	-36.52	DPER	75.20	TPER	55.08

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

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

---

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		46.5000 (1b)	x	2.5000 (2b)	=	116.2500 (1b)	-
First floor		46.5000 (1c)	x	2.7500 (2c)	=	127.8750 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0000						(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)			=	244.1250	(5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.0819	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.2319	(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) =	0.1971	(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	0.2513	0.2464	0.2415	0.2169	0.2119	0.1873	0.1873	0.1824	0.1971	0.2119	0.2218	0.2316	(22b)
Effective ac	0.5316	0.5304	0.5292	0.5235	0.5225	0.5175	0.5175	0.5166	0.5194	0.5225	0.5246	0.5268	(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	
Window (Uw = 1.20)			14.7000	1.1450	16.8321			(27)
Door			5.2000	1.0000	5.2000			(26)
Opening			0.9100	1.1450	1.0420			(27a)
Heatloss Floor 1			46.5000	0.1200	5.5800	0.0000	0.0000	(28a)
External Wall 1	101.0000	19.9000	81.1000	0.1400	11.3540	0.0000	0.0000	(29a)
External Roof 1	75.0000	0.9100	74.0900	0.1132	8.3875	9.0000	666.8100	(30)
Total net area of external elements Aum(A, m2)			222.5000					(31)

Fabric heat loss, W/K = Sum (A x U) (26)...(30) + (32) = 48.3956 (33)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 666.8100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 7.1700 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 11.1250 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 59.5206 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.8254	42.7266	42.6297	42.1748	42.0897	41.6934	41.6934	41.6200	41.8460	42.0897	42.2619	42.4419	(38)
Heat transfer coeff	102.3460	102.2472	102.1503	101.6954	101.6103	101.2140	101.2140	101.1406	101.3666	101.6103	101.7824	101.9625	(39)

Average = Sum(39)m / 12 = 101.6950

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1005	1.0994	1.0984	1.0935	1.0926	1.0883	1.0883	1.0875	1.0900	1.0926	1.0944	1.0964	(40)
HLP (average)												1.0935	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6646 (42)

Hot water usage for mixer showers

68.8963	67.8609	66.3522	63.4655	61.3351	58.9594	57.6091	59.1064	60.7477	63.2985	66.2473	68.6323	(42a)

Hot water usage for baths

29.7509	29.3090	28.6868	27.5396	26.6806	25.7280	25.2135	25.8314	26.5041	27.5233	28.6942	29.6503	(42b)

Hot water usage for other uses

41.9181	40.3938	38.8695	37.3453	35.8210	34.2967	34.2967	35.8210	37.3453	38.8695	40.3938	41.9181	(42c)

Average daily hot water use (litres/day) 129.2112 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.5653	137.5638	133.9086	128.3503	123.8366	118.9841	117.1192	120.7587	124.5971	129.6914	135.3353	140.2008	(44)
Energy conte	222.6211	195.8890	205.8125	175.7052	166.7079	146.3048	141.6456	149.5245	153.6407	175.9900	192.8100	219.5205	(45)

Energy content (annual) Total = Sum(45)m = 2146.1718

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

33.3932	29.3834	30.8719	26.3558	25.0062	21.9457	21.2468	22.4287	23.0461	26.3985	28.9215	32.9281	(46)

Water storage loss:
Store volume 180.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 0.8736 (55)
Total storage loss

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)

If cylinder contains dedicated solar storage

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(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

272.9656	241.3614	256.1569	224.4256	217.0524	195.0253	191.9900	199.8689	202.3611	226.3345	241.5304	269.8650	(62)
WWHRS -30.4024	-26.8882	-28.1557	-23.3141	-21.7279	-18.5927	-17.4277	-18.5326	-19.2367	-22.6780	-25.6914	-29.8394	(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

242.5631	214.4733	228.0012	201.1115	195.3245	176.4326	174.5623	181.3363	183.1244	203.6565	215.8390	240.0255	(64)

Total per year (kWh/year) = Sum(64)m = 2456.4502 (64)

12Total per year (kWh/year) 2456 (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

114.2971	101.5110	108.7082	97.3983	95.7059	87.6227	87.3727	89.9924	90.0619	98.7922	103.0856	113.2661	(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	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	127.2049	140.8340	127.2049	131.4451	127.2049	131.4451	127.2049	127.2049	131.4451	127.2049	131.4451	127.2049	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.4900	247.0270	240.6338	227.0233	209.8424	193.6949	182.9074	180.3703	186.7636	200.3741	217.5549	233.7024	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	(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)	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	(71)
Water heating gains (Table 5)	153.6251	151.0581	146.1132	135.2754	128.6370	121.6982	117.4364	120.9576	125.0859	132.7853	143.1745	152.2394	(72)
Total internal gains	591.2890	604.8881	579.9208	559.7127	531.6534	509.8072	490.5177	491.5018	506.2636	526.3332	558.1435	579.1157	(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	
East	9.5000	19.6403	0.7600	0.7000	0.7700	68.7885	(76)
West	5.2000	19.6403	0.7600	0.7000	0.7700	37.6526	(80)
West	0.9100	26.0000	0.7600	0.7000	1.0000	11.3284	(82)

Solar gains	117.7695	231.7497	384.7390	565.4716	696.5661	714.5642	679.6807	581.5054	448.9262	275.8290	147.0980	96.6819	(83)
Total gains	709.0585	836.6378	964.6599	1125.1843	1228.2194	1224.3713	1170.1984	1073.0072	955.1897	802.1623	705.2414	675.7976	(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	1.8098	1.8115	1.8133	1.8214	1.8229	1.8300	1.8300	1.8314	1.8273	1.8229	1.8198	1.8166	
alpha	1.1207	1.1208	1.1209	1.1214	1.1215	1.1220	1.1220	1.1221	1.1218	1.1215	1.1213	1.1211	
util living area	0.7417	0.6977	0.6390	0.5522	0.4594	0.3645	0.2890	0.3178	0.4465	0.6006	0.7023	0.7521	(86)
MIT	15.9190	16.4336	17.2796	18.3681	19.3539	20.1254	20.5352	20.4603	19.8173	18.5139	17.0306	15.8083	(87)
Th 2	20.0004	20.0013	20.0021	20.0061	20.0069	20.0104	20.0104	20.0110	20.0090	20.0069	20.0054	20.0038	(88)
util rest of house	0.7288	0.6830	0.6212	0.5296	0.4300	0.3248	0.2378	0.2658	0.4067	0.5747	0.6853	0.7396	(89)
MIT 2	14.4317	15.0283	16.0103	17.2639	18.3820	19.2364	19.6651	19.5976	18.9235	17.4614	15.7417	14.3049	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	14.8035	15.3796	16.3276	17.5400	18.6250	19.4586	19.8827	19.8133	19.1469	17.7245	16.0639	14.6808	(92)
Temperature adjustment												-0.1500	
adjusted MIT	14.6535	15.2296	16.1776	17.3900	18.4750	19.3086	19.7327	19.6633	18.9969	17.5745	15.9139	14.5308	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6322	0.5894	0.5350	0.4587	0.3785	0.2939	0.2223	0.2458	0.3601	0.4959	0.5915	0.6427	(94)
Useful gains	448.2579	493.1544	516.0591	516.1266	464.9019	359.8356	260.0927	263.7462	343.9717	397.7567	417.1816	434.3396	(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	1059.6430	1056.1756	988.5703	863.3915	688.4086	476.5792	317.0686	330.0477	496.3867	708.6816	897.1017	1053.3513	(97)
Space heating kWh	454.8706	378.3503	351.5483	250.0307	166.2890	0.0000	0.0000	0.0000	0.0000	231.3281	345.5425	460.5447	(98a)
Space heating requirement - total per year (kWh/year)												2638.5041	
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	454.8706	378.3503	351.5483	250.0307	166.2890	0.0000	0.0000	0.0000	0.0000	231.3281	345.5425	460.5447	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2638.5041	
Space heating per m2										(98c) / (4) =		28.3710	(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 %)	89.5000 (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	454.8706	378.3503	351.5483	250.0307	166.2890	0.0000	0.0000	0.0000	0.0000	231.3281	345.5425	460.5447	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	508.2353	422.7377	392.7914	279.3639	185.7977	0.0000	0.0000	0.0000	0.0000	258.4672	386.0810	514.5751	(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	242.5631	214.4733	228.0012	201.1115	195.3245	176.4326	174.5623	181.3363	183.1244	203.6565	215.8390	240.0255	(64)
Efficiency of water heater												89.5000	(216)
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)
Fuel for water heating, kWh/month	271.0202	239.6349	254.7499	224.7056	218.2397	197.1314	195.0417	202.6104	204.6082	227.5492	241.1609	268.1850	(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	34.7815	27.9030	25.1236	18.4066	14.2178	11.6161	12.9699	16.8588	21.8979	28.7313	32.4519	35.7482 (232)

Electricity generated by PVs (Appendix M) (negative quantity)

(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)

Electricity generated by wind turbines (Appendix M) (negative quantity)

(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)

Electricity generated by hydro-electric generators (Appendix M) (negative quantity)

(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)

Electricity generated by PVs (Appendix M) (negative quantity)

(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)

Electricity generated by wind turbines (Appendix M) (negative quantity)

(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)

Electricity generated by hydro-electric generators (Appendix M) (negative quantity)

(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year

Space heating fuel - main system 1	2948.0493 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	2744.6371 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	280.7067 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (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	6059.3931 (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	2948.0493	0.2100	619.0904	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2744.6371	0.2100	576.3738	(264)
Space and water heating			1195.4641	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	280.7067	0.1443	40.5146	(268)
Total CO2, kg/year			1247.9081	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.4200	(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	2948.0493	1.1300	3331.2957	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2744.6371	1.1300	3101.4399	(278)
Space and water heating			6432.7356	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	280.7067	1.5338	430.5573	(282)
Total Primary energy kWh/year			6993.3937	(286)
Dwelling Primary energy Rate (DPER)			75.2000	(287)

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

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.5000 (1b)	x	2.5000 (2b)	=	116.2500 (1b)	-

First floor		46.5000 (1c) x	2.7500 (2c) =	127.8750 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0000			(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	244.1250 (5)

2. Ventilation rate

			m3 per hour
Number of open chimneys		0 * 80 =	0.0000 (6a)
Number of open flues		0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)
Number of blocked chimneys		0 * 20 =	0.0000 (6f)
Number of intermittent extract fans		3 * 10 =	30.0000 (7a)
Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)
			Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		30.0000 / (5) =	0.1229 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			5.0000 (17)
Infiltration rate			0.3729 (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) =	0.3170 (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	0.4041	0.3962	0.3883	0.3487	0.3407	0.3011	0.3011	0.2932	0.3170	0.3407	0.3566	0.3724	(22b)
Effective ac	0.5817	0.5785	0.5754	0.5608	0.5580	0.5453	0.5453	0.5430	0.5502	0.5580	0.5636	0.5693	(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			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			14.7000	1.1450	16.8321			(27)
Opening			0.9100	1.5918	1.4485			(27a)
Heatloss Floor 1			46.5000	0.1300	6.0450			(28a)
External Wall 1	101.0000	19.9000	81.1000	0.1800	14.5980			(29a)
External Roof 1	75.0000	0.9100	74.0900	0.1100	8.1499			(30)
Total net area of external elements Aum(A, m2)			222.5000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.2735			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K			7.1700 (35)
List of Thermal Bridges			
K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	10.0000	0.1600	1.6000
E6 Intermediate floor within a dwelling	36.0000	0.0000	0.0000
E16 Corner (normal)	15.5000	0.0900	1.3950
E18 Party wall between dwellings	15.5000	0.0600	0.9300
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			3.9250 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	56.1985 (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	46.8589	46.6034	46.3531	45.1770	44.9570	43.9327	43.9327	43.7430	44.3272	44.9570	45.4021	45.8675	(38)
Heat transfer coeff	103.0573	102.8019	102.5515	101.3755	101.1554	100.1311	100.1311	99.9415	100.5257	101.1554	101.6006	102.0659	(39)
Average = Sum(39)m / 12 =												101.3744	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1081	1.1054	1.1027	1.0901	1.0877	1.0767	1.0767	1.0746	1.0809	1.0877	1.0925	1.0975	(40)
HLP (average)												1.0900	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6646 (42)
Hot water usage for mixer showers	68.8963	67.8609	66.3522	63.4655	61.3351	58.9594	57.6091	59.1064	60.7477	63.2985	66.2473	68.6323 (42a)
Hot water usage for baths	29.7509	29.3090	28.6868	27.5396	26.6806	25.7280	25.2135	25.8314	26.5041	27.5233	28.6942	29.6503 (42b)
Hot water usage for other uses	41.9181	40.3938	38.8695	37.3453	35.8210	34.2967	34.2967	35.8210	37.3453	38.8695	40.3938	41.9181 (42c)
Average daily hot water use (litres/day)												129.2112 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	140.5653	137.5638	133.9086	128.3503	123.8366	118.9841	117.1192	120.7587	124.5971	129.6914	135.3353	140.2008	(44)
Energy conte	222.6211	195.8890	205.8125	175.7052	166.7079	146.3048	141.6456	149.5245	153.6407	175.9900	192.8100	219.5205	(45)
Energy content (annual)										Total = Sum(45)m =		2146.1718	
Distribution loss (46)m = 0.15 x (45)m													
	33.3932	29.3834	30.8719	26.3558	25.0062	21.9457	21.2468	22.4287	23.0461	26.3985	28.9215	32.9281	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8381	(55)
Total storage loss													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(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													
	271.8638	240.3663	255.0551	223.3594	215.9506	193.9590	190.8882	198.7672	201.2949	225.2327	240.4642	268.7632	(62)
WWHRS	-31.4965	-27.8558	-29.1690	-24.1531	-22.5098	-19.2618	-18.0548	-19.1995	-19.9290	-23.4941	-26.6159	-30.9132	(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													
	240.3673	212.5105	225.8862	199.2063	193.4408	174.6973	172.8334	179.5677	181.3659	201.7386	213.8482	237.8500	(64)
										Total per year (kWh/year) = Sum(64)m =		2433.3121	(64)
12Total per year (kWh/year)												2433	(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													
	113.4157	100.7149	107.8268	96.5453	94.8245	86.7697	86.4913	89.1110	89.2089	97.9108	102.2327	112.3847	(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	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	127.2049	140.8340	127.2049	131.4451	127.2049	131.4451	127.2049	127.2049	131.4451	127.2049	131.4451	127.2049	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.4900	247.0270	240.6338	227.0233	209.8424	193.6949	182.9074	180.3703	186.7636	200.3741	217.5549	233.7024	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	(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)													
	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	(71)
Water heating gains (Table 5)													
	152.4404	149.8734	144.9285	134.0907	127.4523	120.5135	116.2517	119.7729	123.9012	131.6006	141.9898	151.0547	(72)
Total internal gains													
	590.1043	603.7034	578.7361	558.5280	530.4687	508.6225	489.3330	490.3171	505.0789	525.1486	556.9588	577.9310	(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	
East	9.5000	19.6403	0.6300	0.7000	0.7700	57.0220	(76)
West	5.2000	19.6403	0.6300	0.7000	0.7700	31.2121	(80)
West	0.9100	26.0000	0.6300	0.7000	1.0000	9.3907	(82)
Solar gains	97.6248	192.1083	318.9284	468.7462	577.4166	592.3361	563.4195	482.0374	372.1362	228.6477	121.9365	80.1442	(83)
Total gains	687.7290	795.8117	897.6645	1027.2742	1107.8853	1100.9586	1052.7525	972.3545	877.2150	753.7963	678.8952	658.0752	(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	1.7973	1.8018	1.8062	1.8271	1.8311	1.8498	1.8498	1.8533	1.8426	1.8311	1.8231	1.8148	
alpha	1.1198	1.1201	1.1204	1.1218	1.1221	1.1233	1.1233	1.1236	1.1228	1.1221	1.1215	1.1210	
util living area													
	0.7492	0.7100	0.6573	0.5753	0.4855	0.3882	0.3100	0.3379	0.4669	0.6154	0.7104	0.7576	(86)
MIT	15.8563	16.3389	17.1559	18.2454	19.2505	20.0639	20.4989	20.4237	19.7589	18.4461	16.9787	15.7640	(87)
Th 2	19.9942	19.9964	19.9986	20.0090	20.0109	20.0199	20.0199	20.0216	20.0164	20.0109	20.0070	20.0029	(88)
util rest of house													
	0.7364	0.6955	0.6399	0.5529	0.4559	0.3477	0.2568	0.2845	0.4268	0.5899	0.6937	0.7452	(89)
MIT 2	14.3568	14.9180	15.8694	17.1314	18.2771	19.1855	19.6439	19.5757	18.8711	17.3899	15.6837	14.2536	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	14.7316	15.2732	16.1911	17.4099	18.5205	19.4051	19.8577	19.7877	19.0930	17.6540	16.0075	14.6312	(92)

Temperature adjustment												0.0000	
adjusted MIT	14.7316	15.2732	16.1911	17.4099	18.5205	19.4051	19.8577	19.7877	19.0930	17.6540	16.0075	14.6312	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6431	0.6046	0.5552	0.4825	0.4049	0.3197	0.2473	0.2706	0.3838	0.5142	0.6036	0.6518	(94)
Useful gains	442.2669	481.1320	498.3841	495.6761	448.6223	351.9780	260.3528	263.0858	336.6946	387.6348	409.7878	428.9205	(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	1075.0575	1066.3861	993.8342	862.6969	689.9276	481.1420	326.1924	338.5675	501.9296	713.5483	905.0033	1064.6694	(97)
Space heating kWh	470.7963	393.2907	368.6149	264.2550	179.5311	0.0000	0.0000	0.0000	0.0000	242.4797	356.5552	472.9972	(98a)
Space heating requirement - total per year (kWh/year)												2748.5200	
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	470.7963	393.2907	368.6149	264.2550	179.5311	0.0000	0.0000	0.0000	0.0000	242.4797	356.5552	472.9972	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2748.5200	
Space heating per m2											(98c) / (4) =	29.5540	(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	470.7963	393.2907	368.6149	264.2550	179.5311	0.0000	0.0000	0.0000	0.0000	242.4797	356.5552	472.9972	(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)	510.0718	426.1004	399.3661	286.3001	194.5083	0.0000	0.0000	0.0000	0.0000	262.7082	386.3003	512.4564	(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	240.3673	212.5105	225.8862	199.2063	193.4408	174.6973	172.8334	179.5677	181.3659	201.7386	213.8482	237.8500	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.5393	85.4205	85.1511	84.6943	83.8928	79.8000	79.8000	79.8000	79.8000	84.4733	85.1976	85.5708	(217)
Fuel for water heating, kWh/month	281.0022	248.7816	265.2770	235.2062	230.5810	218.9189	216.5832	225.0221	227.2755	238.8193	251.0026	277.9569	(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	26.4307	21.2037	19.0916	13.9873	10.8042	8.8271	9.8559	12.8111	16.6404	21.8331	24.6604	27.1653	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-42.8359	-60.0487	-85.8248	-95.9204	-102.9277	-95.8634	-94.6451	-89.5757	-80.5824	-68.3601	-46.9584	-37.0716	(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	-25.2493	-52.9949	-105.1224	-157.5989	-208.1269	-209.0526	-206.6232	-175.0921	-128.5088	-75.7284	-33.6892	-19.9783	(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												2977.8115	(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												2916.4265	(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)												213.3107	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2298.3790	(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	3895.1696 (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	2977.8115	0.2100	625.3404	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2916.4265	0.2100	612.4496	(264)
Space and water heating			1237.7900	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	213.3107	0.1443	30.7873	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-900.6141	0.1347	-121.3274	
PV Unit electricity exported	-1397.7649	0.1259	-176.0435	
Total			-297.3709	(269)
Total CO2, kg/year			983.1357	(272)
Target Carbon Dioxide Emission Rate (TER)			10.5700	(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	2977.8115	1.1300	3364.9270	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2916.4265	1.1300	3295.5619	(278)
Space and water heating			6660.4889	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	213.3107	1.5338	327.1830	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-900.6141	1.4979	-1349.0262	
PV Unit electricity exported	-1397.7649	0.4623	-646.2034	
Total			-1995.2297	(283)
Total Primary energy kWh/year			5122.5431	(286)
Target Primary Energy Rate (TPER)			55.0800	(287)

;

Full SAP Calculation Printout

elmhurst energy

Property Reference	Plot 9 2B_Be Lean_MEV	Issued on Date	12/10/2022
Assessment Reference	00001	Prop Type Ref	2B
Property	2 Bedroom House, House No. 9, Claygate, Surrey, Elmbridge, KT 10		

SAP Rating	84 B	DER	15.06	TER	12.09
Environmental	87 B	% DER<TER	-24.57		
CO_2 Emissions (t/year)	1.18	DFEE	43.78	TFEE	41.26
Compliance Check	See BREL	% DFEE < TFEE	-6.12		
% DPER < TPER	-33.07	DPER	84.07	TPER	63.18

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

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

---

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		41.8000 (1b)	x	2.5000 (2b)	=	104.5000 (1b)	-
First floor		41.8000 (1c)	x	2.7500 (2c)	=	114.9500 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	83.6000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	219.4500	(5)

---

2. Ventilation rate

---

			m3 per hour	
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		2 * 10 =	20.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		20.0000 / (5) =	0.0911	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			3.0000	(17)
Infiltration rate			0.2411	(18)
Number of sides sheltered			0	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.2411	(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	0.3074	0.3014	0.2954	0.2653	0.2592	0.2291	0.2291	0.2231	0.2411	0.2592	0.2713	0.2833	(22b)
Effective ac	0.5473	0.5454	0.5436	0.5352	0.5336	0.5262	0.5262	0.5249	0.5291	0.5336	0.5368	0.5401	(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	
Window (Uw = 1.20)			21.8000	1.1450	24.9618			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			41.8000	0.1200	5.0160	0.0000	0.0000	(28a)
External Wall 1	140.2800	27.0000	113.2800	0.1400	15.8592	0.0000	0.0000	(29a)
External Roof 1	65.0000		65.0000	0.1132	7.3585	9.0000	585.0000	(30)
Total net area of external elements Aum(A, m2)			247.0800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	58.3955			(33)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 585.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 6.9976 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 12.3540 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 70.7495 (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	39.6319	39.4990	39.3688	38.7569	38.6424	38.1094	38.1094	38.0107	38.3147	38.6424	38.8740	39.1161	(38)
Heat transfer coeff	110.3815	110.2486	110.1183	109.5064	109.3919	108.8590	108.8590	108.7603	109.0642	109.3919	109.6235	109.8656	(39)

Average = Sum(39)m / 12 = 109.5058

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3204	1.3188	1.3172	1.3099	1.3085	1.3021	1.3021	1.3010	1.3046	1.3085	1.3113	1.3142	(40)
HLP (average)												1.3099	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5276 (42)

Hot water usage for mixer showers

66.5997	65.5989	64.1404	61.3499	59.2906	56.9941	55.6887	57.1362	58.7228	61.1886	64.0390	66.3446	(42a)

Hot water usage for baths

28.7633	28.3361	27.7346	26.6254	25.7949	24.8740	24.3765	24.9739	25.6243	26.6097	27.7417	28.6661	(42b)

Hot water usage for other uses

40.5154	39.0422	37.5689	36.0956	34.6223	33.1490	33.1490	34.6223	36.0956	37.5689	39.0422	40.5154	(42c)

Average daily hot water use (litres/day) 124.9031 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	135.8785	132.9771	129.4438	124.0709	119.7078	115.0171	113.2143	116.7323	120.4427	125.3671	130.8228	135.5261	(44)
Energy conte	215.1983	189.3577	198.9504	169.8469	161.1497	141.4269	136.9229	144.5390	148.5178	170.1220	186.3811	212.2011	(45)

Energy content (annual) Total = Sum(45)m = 2074.6138

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

32.2797	28.4037	29.8426	25.4770	24.1725	21.2140	20.5384	21.6809	22.2777	25.5183	27.9572	31.8302	(46)

Water storage loss:

Store volume 180.0000 (47)

b) If manufacturer declared loss factor is not known :

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 0.8736 (55)

Total storage loss

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)

If cylinder contains dedicated solar storage

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(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

265.5427	234.8301	249.2948	218.5673	211.4941	190.1473	187.2673	194.8834	197.2383	220.4665	235.1016	262.5455	(62)
WWHRS -29.3890	-25.9919	-27.2172	-22.5369	-21.0036	-17.9729	-16.8468	-17.9148	-18.5955	-21.9220	-24.8350	-28.8448	(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

236.1537	208.8382	222.0776	196.0304	190.4905	172.1744	170.4205	176.9686	178.6428	198.5444	210.2666	233.7007	(64)

Total per year (kWh/year) = Sum(64)m = 2394.3084 (64)

12Total per year (kWh/year) 2394 (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

111.8290	99.3393	106.4265	95.4504	93.8578	86.0008	85.8024	88.3348	88.3585	96.8411	100.9481	110.8324	(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	126.3814	126.3814	126.3814	126.3814	126.3814	126.3814	126.3814	126.3814	126.3814	126.3814	126.3814	126.3814	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	114.3944	126.6510	114.3944	118.2076	114.3944	118.2076	114.3944	114.3944	118.2076	114.3944	118.2076	114.3944	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	226.7997	229.1532	223.2225	210.5968	194.6591	179.6800	169.6730	167.3195	173.2502	185.8759	201.8135	216.7927	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.6381	35.6381	35.6381	35.6381	35.6381	35.6381	35.6381	35.6381	35.6381	35.6381	35.6381	35.6381	(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)	-101.1051	-101.1051	-101.1051	-101.1051	-101.1051	-101.1051	-101.1051	-101.1051	-101.1051	-101.1051	-101.1051	-101.1051	(71)
Water heating gains (Table 5)	150.3078	147.8264	143.0464	132.5700	126.1530	119.4455	115.3258	118.7295	122.7202	130.1628	140.2056	148.9683	(72)
Total internal gains	555.4163	567.5450	544.5778	525.2888	499.1210	478.2475	460.3076	461.3579	475.0923	494.3475	524.1412	544.0698	(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	
East	9.5000	19.6403	0.7600	0.7000	0.7700	68.7885	(76)
South	7.1000	46.7521	0.7600	0.7000	0.7700	122.3782	(78)
West	5.2000	19.6403	0.7600	0.7000	0.7700	37.6526	(80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	228.8193	408.6454	598.2156	788.6649	913.5966	916.7924	880.0638	787.6711	665.5155	463.2483	277.7795	193.2780	(83)
Total gains	784.2357	976.1904	1142.7934	1313.9537	1412.7176	1395.0399	1340.3714	1249.0290	1140.6078	957.5958	801.9207	737.3479	(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	1.4722	1.4739	1.4757	1.4839	1.4855	1.4928	1.4928	1.4941	1.4899	1.4855	1.4823	1.4791	
alpha	1.0981	1.0983	1.0984	1.0989	1.0990	1.0995	1.0995	1.0996	1.0993	1.0990	1.0988	1.0986	
util living area	0.7303	0.6735	0.6096	0.5258	0.4380	0.3475	0.2736	0.2977	0.4157	0.5685	0.6838	0.7435	(86)
MIT	15.9006	16.5097	17.3795	18.4351	19.3865	20.1383	20.5435	20.4769	19.8698	18.5980	17.0593	15.7689	(87)
Th 2	19.8249	19.8262	19.8274	19.8331	19.8342	19.8392	19.8392	19.8401	19.8372	19.8342	19.8320	19.8297	(88)
util rest of house	0.7148	0.6556	0.5883	0.4992	0.4040	0.3021	0.2155	0.2390	0.3700	0.5376	0.6634	0.7285	(89)
MIT 2	14.3267	15.0257	16.0263	17.2319	18.2993	19.1197	19.5312	19.4742	18.8543	17.4513	15.6858	14.1775	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	14.7202	15.3967	16.3646	17.5327	18.5711	19.3743	19.7843	19.7249	19.1082	17.7380	16.0292	14.5754	(92)
Temperature adjustment												-0.1500	
adjusted MIT	14.5702	15.2467	16.2146	17.3827	18.4211	19.2243	19.6343	19.5749	18.9582	17.5880	15.8792	14.4254	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6181	0.5640	0.5061	0.4333	0.3572	0.2756	0.2044	0.2243	0.3307	0.4647	0.5710	0.6312	(94)
Useful gains	484.7081	550.5543	578.4177	569.2833	504.6917	384.5094	273.9761	280.1531	377.1940	444.9595	457.9028	465.4187	(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	1133.6347	1140.7125	1069.7529	928.9100	735.2333	503.4008	330.3110	345.3009	529.8537	764.4288	962.4020	1123.4174	(97)
Space heating kWh	482.8014	396.5863	365.5534	258.9312	171.5230	0.0000	0.0000	0.0000	0.0000	237.6851	363.2394	489.5510	(98a)
Space heating requirement - total per year (kWh/year)												2765.8708	
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	482.8014	396.5863	365.5534	258.9312	171.5230	0.0000	0.0000	0.0000	0.0000	237.6851	363.2394	489.5510	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2765.8708	
Space heating per m2										(98c) / (4) =		33.0846	(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 %)	89.5000	(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	482.8014	396.5863	365.5534	258.9312	171.5230	0.0000	0.0000	0.0000	0.0000	237.6851	363.2394	489.5510	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	539.4429	443.1132	408.4395	289.3086	191.6458	0.0000	0.0000	0.0000	0.0000	265.5700	405.8541	546.9844	(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	236.1537	208.8382	222.0776	196.0304	190.4905	172.1744	170.4205	176.9686	178.6428	198.5444	210.2666	233.7007	(64)
Efficiency of water heater												89.5000	(216)
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)
Fuel for water heating, kWh/month	263.8589	233.3388	248.1314	219.0284	212.8386	192.3736	190.4140	197.7303	199.6009	221.8373	234.9347	261.1181	(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	30.9605	24.8377	22.3636	16.3845	12.6559	10.3400	11.5451	15.0068	19.4923	25.5750	28.8869	31.8210 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	3090.3584 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	2675.2050 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	249.8691 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (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	6101.4325 (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	3090.3584	0.2100	648.9753	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2675.2050	0.2100	561.7930	(264)
Space and water heating			1210.7683	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	249.8691	0.1443	36.0638	(268)
Total CO2, kg/year			1258.7614	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.0600	(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	3090.3584	1.1300	3492.1050	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2675.2050	1.1300	3022.9816	(278)
Space and water heating			6515.0866	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	249.8691	1.5338	383.2576	(282)
Total Primary energy kWh/year			7028.4451	(286)
Dwelling Primary energy Rate (DPER)			84.0700	(287)

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

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	41.8000 (1b)	x	2.5000 (2b)	=	104.5000 (1b)	-
First floor	41.8000 (1c)	x	2.7500 (2c)	=	114.9500 (1c)	-

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 83.6000 (4)
Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 219.4500 (5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1367	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3867	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3867	(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	0.4930	0.4834	0.4737	0.4254	0.4157	0.3674	0.3674	0.3577	0.3867	0.4157	0.4350	0.4544	(22b)
Effective ac	0.6215	0.6168	0.6122	0.5905	0.5864	0.5675	0.5675	0.5640	0.5748	0.5864	0.5946	0.6032	(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			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			15.6800	1.1450	17.9542			(27)
Heatloss Floor 1			41.8000	0.1300	5.4340			(28a)
External Wall 1	140.2800	20.8800	119.4000	0.1800	21.4920			(29a)
External Roof 1	65.0000		65.0000	0.1100	7.1500			(30)
Total net area of external elements Aum(A, m2)			247.0800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	57.2302			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 6.9976 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	10.0000	0.1600	1.6000
E6 Intermediate floor within a dwelling	36.0000	0.0000	0.0000
E16 Corner (normal)	15.5000	0.0900	1.3950
E18 Party wall between dwellings	15.5000	0.0600	0.9300

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.9250 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 61.1552 (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	45.0116	44.6698	44.3348	42.7611	42.4667	41.0961	41.0961	40.8423	41.6240	42.4667	43.0623	43.6850	(38)
Heat transfer coeff	106.1668	105.8250	105.4900	103.9163	103.6219	102.2513	102.2513	101.9975	102.7792	103.6219	104.2175	104.8402	(39)

Average = Sum(39)m / 12 = 103.9149

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2699	1.2658	1.2618	1.2430	1.2395	1.2231	1.2231	1.2201	1.2294	1.2395	1.2466	1.2541	(40)
HLP (average)												1.2430	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5276 (42)
Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
66.5997	65.5989	64.1404	61.3499	59.2906	56.9941	55.6887	57.1362	58.7228	61.1886	64.0390	66.3446	(42a)

Hot water usage for baths

28.7633	28.3361	27.7346	26.6254	25.7949	24.8740	24.3765	24.9739	25.6243	26.6097	27.7417	28.6661	(42b)

Hot water usage for other uses

40.5154	39.0422	37.5689	36.0956	34.6223	33.1490	33.1490	34.6223	36.0956	37.5689	39.0422	40.5154	(42c)

Average daily hot water use (litres/day) 124.9031 (43)

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

Daily hot water use

	135.8785	132.9771	129.4438	124.0709	119.7078	115.0171	113.2143	116.7323	120.4427	125.3671	130.8228	135.5261 (44)
Energy conte	215.1983	189.3577	198.9504	169.8469	161.1497	141.4269	136.9229	144.5390	148.5178	170.1220	186.3811	212.2011 (45)
Energy content (annual)											Total = Sum(45)m =	2074.6138
Distribution loss (46)m = 0.15 x (45)m												
	32.2797	28.4037	29.8426	25.4770	24.1725	21.2140	20.5384	21.6809	22.2777	25.5183	27.9572	31.8302 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8381 (55)
Total storage loss												
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage												
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (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												
	264.4410	233.8349	248.1930	217.5011	210.3924	189.0811	186.1655	193.7817	196.1720	219.3647	234.0353	261.4437 (62)
WWHRS	-30.4466	-26.9272	-28.1967	-23.3479	-21.7594	-18.6197	-17.4530	-18.5595	-19.2647	-22.7109	-25.7287	-29.8828 (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												
	233.9943	206.9077	219.9964	194.1531	188.6329	170.4614	168.7125	175.2222	176.9074	196.6538	208.3066	231.5609 (64)
										Total per year (kWh/year) = Sum(64)m =		2371.5092 (64)
12Total per year (kWh/year)												2372 (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												
	110.9476	98.5432	105.5451	94.5974	92.9764	85.1478	84.9210	87.4534	87.5055	95.9597	100.0951	109.9510 (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	126.3814	126.3814	126.3814	126.3814	126.3814	126.3814	126.3814	126.3814	126.3814	126.3814	126.3814	126.3814	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	116.1162	128.5572	116.1162	119.9867	116.1162	119.9867	116.1162	116.1162	119.9867	116.1162	119.9867	116.1162	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	226.7997	229.1532	223.2225	210.5968	194.6591	179.6800	169.6730	167.3195	173.2502	185.8759	201.8135	216.7927	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.6381	35.6381	35.6381	35.6381	35.6381	35.6381	35.6381	35.6381	35.6381	35.6381	35.6381	35.6381	(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)													
	-101.1051	-101.1051	-101.1051	-101.1051	-101.1051	-101.1051	-101.1051	-101.1051	-101.1051	-101.1051	-101.1051	-101.1051	(71)
Water heating gains (Table 5)													
	149.1231	146.6417	141.8617	131.3853	124.9683	118.2608	114.1411	117.5448	121.5355	128.9781	139.0209	147.7836	(72)
Total internal gains													
	555.9534	568.2666	545.1149	525.8833	499.6581	478.8420	460.8447	461.8950	475.6868	494.8846	524.7357	544.6069	(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	
East	6.8300	19.6403	0.6300	0.7000	0.7700	40.9958	(76)
South	5.1100	46.7521	0.6300	0.7000	0.7700	73.0119	(78)
West	3.7400	19.6403	0.6300	0.7000	0.7700	22.4487	(80)

Solar gains	136.4564	243.6856	356.7099	470.2462	544.7188	546.6174	524.7215	469.6461	396.8305	276.2406	165.6518	115.2627	(83)
Total gains	692.4098	811.9521	901.8248	996.1295	1044.3769	1025.4594	985.5663	931.5411	872.5174	771.1252	690.3875	659.8696	(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	1.5306	1.5356	1.5404	1.5638	1.5682	1.5892	1.5892	1.5932	1.5811	1.5682	1.5592	1.5500	
alpha	1.1020	1.1024	1.1027	1.1043	1.1045	1.1059	1.1059	1.1062	1.1054	1.1045	1.1039	1.1033	
util living area													
	0.7490	0.7071	0.6583	0.5853	0.5037	0.4084	0.3275	0.3505	0.4706	0.6113	0.7075	0.7576	(86)
MIT	15.7731	16.2782	17.0759	18.1316	19.1334	19.9822	20.4509	20.3819	19.7165	18.4138	16.9271	15.6797	(87)
Th 2	19.8645	19.8677	19.8708	19.8857	19.8885	19.9016	19.9016	19.9040	19.8965	19.8885	19.8829	19.8770	(88)
util rest of house													
	0.7346	0.6908	0.6387	0.5604	0.4704	0.3620	0.2656	0.2892	0.4255	0.5825	0.6888	0.7437	(89)
MIT 2	14.2006	14.7858	15.7129	16.9363	18.0772	19.0239	19.5122	19.4508	18.7495	17.2863	15.5638	14.0984	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	14.5937	15.1589	16.0537	17.2351	18.3413	19.2635	19.7469	19.6835	18.9912	17.5682	15.9046	14.4937	(92)
Temperature adjustment												0.0000	
adjusted MIT	14.5937	15.1589	16.0537	17.2351	18.3413	19.2635	19.7469	19.6835	18.9912	17.5682	15.9046	14.4937	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6408	0.5995	0.5535	0.4881	0.4163	0.3318	0.2561	0.2755	0.3829	0.5076	0.5984	0.6497	(94)
Useful gains	443.6688	486.8036	499.1316	486.1747	434.7933	340.2234	252.3597	256.6605	334.0563	391.4012	413.1469	428.7389	(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	1092.8481	1085.6487	1007.8156	866.1562	688.1796	476.8499	321.7747	334.9137	502.7174	722.0551	917.5925	1079.1989	(97)
Space heating kWh	482.9894	402.4239	378.4610	273.5867	188.5194	0.0000	0.0000	0.0000	0.0000	246.0065	363.2008	483.9423	(98a)
Space heating requirement - total per year (kWh/year)												2819.1300	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	482.9894	402.4239	378.4610	273.5867	188.5194	0.0000	0.0000	0.0000	0.0000	246.0065	363.2008	483.9423	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2819.1300	
Space heating per m2											(98c) / (4) =	33.7217	(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	482.9894	402.4239	378.4610	273.5867	188.5194	0.0000	0.0000	0.0000	0.0000	246.0065	363.2008	483.9423	(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)	523.2821	435.9956	410.0335	296.4103	204.2464	0.0000	0.0000	0.0000	0.0000	266.5293	393.5004	524.3145	(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	233.9943	206.9077	219.9964	194.1531	188.6329	170.4614	168.7125	175.2222	176.9074	196.6538	208.3066	231.5609	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.6475	85.5247	85.2650	84.8288	84.0584	79.8000	79.8000	79.8000	79.8000	84.5631	85.2938	85.6729	(217)
Fuel for water heating, kWh/month	273.2062	241.9275	258.0150	228.8765	224.4069	213.6107	211.4192	219.5766	221.6884	232.5528	244.2225	270.2848	(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	24.1267	19.3553	17.4273	12.7680	9.8624	8.0576	8.9968	11.6943	15.1898	19.9298	22.5107	24.7972	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-38.8254	-54.5934	-78.2728	-87.7759	-94.4522	-88.0807	-86.9741	-82.1901	-73.7373	-62.2956	-42.6257	-33.5821	(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	-22.3781	-47.0242	-93.3743	-140.1190	-185.1624	-186.0158	-183.8434	-155.7264	-114.2199	-67.2291	-29.8703	-17.7014	(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	3054.3120	(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	2839.7871	(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)	194.7159	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2066.0697	(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	4108.7453 (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	3054.3120	0.2100	641.4055	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2839.7871	0.2100	596.3553	(264)
Space and water heating			1237.7608	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	194.7159	0.1443	28.1035	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-823.4054	0.1346	-110.8665	
PV Unit electricity exported	-1242.6644	0.1259	-156.4763	
Total			-267.3428	(269)
Total CO2, kg/year			1010.4508	(272)
Target Carbon Dioxide Emission Rate (TER)			12.0900	(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	3054.3120	1.1300	3451.3726	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2839.7871	1.1300	3208.9594	(278)
Space and water heating			6660.3319	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	194.7159	1.5338	298.6618	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-823.4054	1.4976	-1233.1518	
PV Unit electricity exported	-1242.6644	0.4622	-574.3767	
Total			-1807.5285	(283)
Total Primary energy kWh/year			5281.5660	(286)
Target Primary Energy Rate (TPER)			63.1800	(287)

;

Full SAP Calculation Printout

elmhurst energy

Property Reference	Plot 10 3B_Be Lean_MEV	Issued on Date	12/10/2022
Assessment Reference	00001	Prop Type Ref	3B
Property	3 Bedroom House, House No. 10, Claygate, Surrey, Elmbridge, KT 10		

SAP Rating	85 B	DER	13.43	TER	10.68
Environmental	88 B	% DER<TER	-25.75		
CO_2 Emissions (t/year)	1.28	DFEE	40.03	TFEE	39.67
Compliance Check	See BREL	% DFEE < TFEE	-0.90		
% DPER < TPER	-34.83	DPER	75.10	TPER	55.70

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

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

---

1. Overall dwelling characteristics

			Area (m2)		Storey height (m)		Volume (m3)	
Ground floor			51.1000	(1b)	x 2.5000	(2b) =	127.7500	(1b) -
First floor			51.1000	(1c)	x 2.7500	(2c) =	140.5250	(1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.2000							(4)
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		268.2750	(5)

---

2. Ventilation rate

---

		m3 per hour		
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		2 * 10 =	20.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		20.0000 / (5) =	0.0746	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			3.0000	(17)
Infiltration rate			0.2246	(18)
Number of sides sheltered			0	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.2246	(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	0.2863	0.2807	0.2751	0.2470	0.2414	0.2133	0.2133	0.2077	0.2246	0.2414	0.2526	0.2638	(22b)
Effective ac	0.5410	0.5394	0.5378	0.5305	0.5291	0.5228	0.5228	0.5216	0.5252	0.5291	0.5319	0.5348	(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	
Window (Uw = 1.20)			21.8000	1.1450	24.9618			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			51.1000	0.1200	6.1320	0.0000	0.0000	(28a)
External Wall 1	154.9000	27.0000	127.9000	0.1400	17.9060	0.0000	0.0000	(29a)
External Roof 1	65.0000		65.0000	0.1132	7.3585	9.0000	585.0000	(30)
Total net area of external elements Aum(A, m2)			271.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	61.5583			(33)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 585.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 5.7241 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 13.5500 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 75.1083 (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	47.8937	47.7529	47.6148	46.9661	46.8447	46.2797	46.2797	46.1751	46.4974	46.8447	47.0902	47.3469	(38)
Heat transfer coeff	123.0021	122.8612	122.7231	122.0744	121.9530	121.3881	121.3881	121.2834	121.6057	121.9530	122.1986	122.4552	(39)

Average = Sum(39)m / 12 = 122.0738

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2035	1.2022	1.2008	1.1945	1.1933	1.1878	1.1878	1.1867	1.1899	1.1933	1.1957	1.1982	(40)
HLP (average)												1.1945	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7590 (42)

Hot water usage for mixer showers

70.4788	69.4197	67.8762	64.9232	62.7440	60.3137	58.9323	60.4640	62.1431	64.7525	67.7689	70.2088	(42a)

Hot water usage for baths

30.4314	29.9795	29.3430	28.1695	27.2909	26.3165	25.7903	26.4222	27.1104	28.1529	29.3506	30.3285	(42b)

Hot water usage for other uses

42.8847	41.3253	39.7658	38.2064	36.6469	35.0875	35.0875	36.6469	38.2064	39.7658	41.3253	42.8847	(42c)

Average daily hot water use (litres/day) 132.1799 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	143.7949	140.7244	136.9851	131.2992	126.6818	121.7177	119.8100	123.5332	127.4598	132.6712	138.4448	143.4220	(44)
Energy conte	227.7360	200.3896	210.5410	179.7420	170.5380	149.6661	144.8999	152.9599	157.1707	180.0336	197.2399	224.5642	(45)

Energy content (annual) Total = Sum(45)m = 2195.4810

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

34.1604	30.0584	31.5811	26.9613	25.5807	22.4499	21.7350	22.9440	23.5756	27.0050	29.5860	33.6846	(46)

Water storage loss:

Store volume 180.0000 (47)

b) If manufacturer declared loss factor is not known :

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 0.8736 (55)

Total storage loss

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)

If cylinder contains dedicated solar storage

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

278.0805	245.8620	260.8854	228.4624	220.8824	198.3865	195.2443	203.3043	205.8911	230.3780	245.9604	274.9087	(62)
WWHRS -31.1008	-27.5058	-28.8025	-23.8496	-22.2269	-19.0198	-17.8280	-18.9583	-19.6786	-23.1989	-26.2815	-30.5248	(63a)
PV diverter 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

246.9797	218.3563	232.0830	204.6128	198.6555	179.3668	177.4163	184.3461	186.2126	207.1792	219.6789	244.3838	(64)

Total per year (kWh/year) = Sum(64)m = 2499.2708 (64)

12Total per year (kWh/year) 2499 (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

115.9978	103.0075	110.2804	98.7405	96.9794	88.7403	88.4548	91.1347	91.2356	100.1367	104.5586	114.9432	(65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.9490	137.9490	137.9490	137.9490	137.9490	137.9490	137.9490	137.9490	137.9490	137.9490	137.9490	137.9490	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	131.2854	145.3517	131.2854	135.6615	131.2854	135.6615	131.2854	131.2854	135.6615	131.2854	135.6615	131.2854	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	259.8361	262.5324	255.7378	241.2730	223.0138	205.8527	194.3881	191.6918	198.4863	212.9511	231.2103	248.3714	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7949	36.7949	36.7949	36.7949	36.7949	36.7949	36.7949	36.7949	36.7949	36.7949	36.7949	36.7949	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-110.3592	-110.3592	-110.3592	-110.3592	-110.3592	-110.3592	-110.3592	-110.3592	-110.3592	-110.3592	-110.3592	-110.3592	(71)
Water heating gains (Table 5)	155.9110	153.2849	148.2264	137.1396	130.3487	123.2504	118.8908	122.4929	126.7161	134.5924	145.2203	154.4935	(72)
Total internal gains	614.4171	628.5537	602.6343	581.4589	552.0326	529.1494	508.9489	509.8547	525.2487	546.2136	579.4769	601.5350	(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	5.2000	10.6334	0.7600	0.7000	0.7700	20.3854	(74)
South	9.5000	46.7521	0.7600	0.7000	0.7700	163.7455	(78)
West	7.1000	19.6403	0.7600	0.7000	0.7700	51.4103	(80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	235.5412	407.7000	573.4269	733.9715	841.5971	843.5670	809.9741	728.7904	629.0657	454.9578	283.3449	200.7628	(83)
Total gains	849.9584	1036.2537	1176.0612	1315.4304	1393.6296	1372.7165	1318.9231	1238.6452	1154.3144	1001.1713	862.8218	802.2978	(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	1.3211	1.3226	1.3241	1.3312	1.3325	1.3387	1.3387	1.3398	1.3363	1.3325	1.3298	1.3270	
alpha	1.0881	1.0882	1.0883	1.0887	1.0888	1.0892	1.0892	1.0893	1.0891	1.0888	1.0887	1.0885	
util living area	0.7333	0.6819	0.6268	0.5514	0.4676	0.3760	0.2989	0.3224	0.4386	0.5824	0.6891	0.7455	(86)
MIT	15.8285	16.3996	17.2242	18.2627	19.2416	20.0453	20.4879	20.4190	19.7836	18.5026	16.9843	15.7034	(87)
Th 2	19.9172	19.9183	19.9193	19.9244	19.9254	19.9298	19.9298	19.9306	19.9281	19.9254	19.9235	19.9214	(88)
util rest of house	0.7192	0.6658	0.6076	0.5272	0.4360	0.3327	0.2424	0.2659	0.3960	0.5544	0.6706	0.7320	(89)
MIT 2	14.2965	14.9549	15.9090	17.1041	18.2137	19.1027	19.5627	19.5006	18.8359	17.4056	15.6542	14.1543	(90)
Living area fraction									fLA = Living area / (4) =			0.2045	(91)
MIT	14.6098	15.2503	16.1780	17.3410	18.4239	19.2954	19.7519	19.6884	19.0297	17.6299	15.9262	14.4711	(92)
Temperature adjustment												-0.1500	
adjusted MIT	14.4598	15.1003	16.0280	17.1910	18.2739	19.1454	19.6019	19.5384	18.8797	17.4799	15.7762	14.3211	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6196	0.5703	0.5196	0.4531	0.3799	0.2973	0.2234	0.2430	0.3480	0.4752	0.5745	0.6319	(94)
Useful gains	526.6585	591.0245	611.1208	596.0082	529.4231	408.0887	294.6937	300.9450	401.7377	475.7812	495.7310	506.9667	(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	1249.6770	1253.2238	1169.3007	1012.1189	801.7087	551.7617	364.3964	380.6387	581.2385	839.0277	1060.2193	1239.3832	(97)
Space heating kWh	537.9257	444.9980	415.2859	299.5997	202.5805	0.0000	0.0000	0.0000	0.0000	270.2554	406.4316	544.9179	(98a)
Space heating requirement - total per year (kWh/year)												3121.9947	
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	537.9257	444.9980	415.2859	299.5997	202.5805	0.0000	0.0000	0.0000	0.0000	270.2554	406.4316	544.9179	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3121.9947	
Space heating per m2											(98c) / (4) =	30.5479	(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 %)	89.5000	(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	537.9257	444.9980	415.2859	299.5997	202.5805	0.0000	0.0000	0.0000	0.0000	270.2554	406.4316	544.9179	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	601.0343	497.2044	464.0066	334.7483	226.3469	0.0000	0.0000	0.0000	0.0000	301.9613	454.1135	608.8468	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	246.9797	218.3563	232.0830	204.6128	198.6555	179.3668	177.4163	184.3461	186.2126	207.1792	219.6789	244.3838	(64)
Efficiency of water heater												89.5000	(216)
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)
Fuel for water heating, kWh/month	275.9550	243.9735	259.3106	228.6177	221.9614	200.4098	198.2305	205.9733	208.0587	231.4851	245.4512	273.0546	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)

Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	36.1896	29.0326	26.1407	19.1518	14.7934	12.0863	13.4950	17.5413	22.7845	29.8944	33.7657	37.1954 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	3488.2622 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	2792.4814 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	292.0707 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (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	6658.8143 (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	3488.2622	0.2100	732.5351	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2792.4814	0.2100	586.4211	(264)
Space and water heating			1318.9562	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	292.0707	0.1443	42.1548	(268)
Total CO2, kg/year			1373.0402	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.4300	(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	3488.2622	1.1300	3941.7363	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2792.4814	1.1300	3155.5040	(278)
Space and water heating			7097.2403	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	292.0707	1.5338	447.9878	(282)
Total Primary energy kWh/year			7675.3289	(286)
Dwelling Primary energy Rate (DPER)			75.1000	(287)

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

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.1000 (1b)	x	2.5000 (2b)	=	127.7500 (1b)	-
First floor	51.1000 (1c)	x	2.7500 (2c)	=	140.5250 (1c)	-

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 102.2000 (4)
Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 268.2750 (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) =	0.1491	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3991	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3991	(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	0.5089	0.4989	0.4889	0.4390	0.4290	0.3791	0.3791	0.3692	0.3991	0.4290	0.4490	0.4689	(22b)
Effective ac	0.6295	0.6244	0.6195	0.5964	0.5920	0.5719	0.5719	0.5681	0.5796	0.5920	0.6008	0.6100	(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			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			20.3400	1.1450	23.2901			(27)
Heatloss Floor 1			51.1000	0.1300	6.6430			(28a)
External Wall 1	154.9000	25.5400	129.3600	0.1800	23.2848			(29a)
External Roof 1	65.0000		65.0000	0.1100	7.1500			(30)
Total net area of external elements Aum(A, m2)			271.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	65.5679			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 5.7241 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E5 Ground floor (normal)	10.0000	0.1600	1.6000	
E6 Intermediate floor within a dwelling	36.0000	0.0000	0.0000	
E16 Corner (normal)	15.5000	0.0900	1.3950	
E18 Party wall between dwellings	15.5000	0.0600	0.9300	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			3.9250	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	69.4929	(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	55.7271	55.2820	54.8458	52.7967	52.4133	50.6286	50.6286	50.2981	51.3160	52.4133	53.1889	53.9997	(38)
Heat transfer coeff	125.2200	124.7749	124.3386	122.2895	121.9062	120.1215	120.1215	119.7910	120.8089	121.9062	122.6817	123.4926	(39)
Average = Sum(39)m / 12 =												122.2877	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2252	1.2209	1.2166	1.1966	1.1928	1.1754	1.1754	1.1721	1.1821	1.1928	1.2004	1.2083	(40)
HLP (average)												1.1966	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---
4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7590 (42)
Hot water usage for mixer showers

70.4788	69.4197	67.8762	64.9232	62.7440	60.3137	58.9323	60.4640	62.1431	64.7525	67.7689	70.2088	(42a)

Hot water usage for baths

30.4314	29.9795	29.3430	28.1695	27.2909	26.3165	25.7903	26.4222	27.1104	28.1529	29.3506	30.3285	(42b)

Hot water usage for other uses

42.8847	41.3253	39.7658	38.2064	36.6469	35.0875	35.0875	36.6469	38.2064	39.7658	41.3253	42.8847	(42c)

Average daily hot water use (litres/day) 132.1799 (43)

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

Daily hot water use

	143.7949	140.7244	136.9851	131.2992	126.6818	121.7177	119.8100	123.5332	127.4598	132.6712	138.4448	143.4220 (44)
Energy conte	227.7360	200.3896	210.5410	179.7420	170.5380	149.6661	144.8999	152.9599	157.1707	180.0336	197.2399	224.5642 (45)
Energy content (annual)											Total = Sum(45)m =	2195.4810
Distribution loss (46)m = 0.15 x (45)m												
	34.1604	30.0584	31.5811	26.9613	25.5807	22.4499	21.7350	22.9440	23.5756	27.0050	29.5860	33.6846 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8381 (55)
Total storage loss												
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage												
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (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												
	276.9787	244.8669	259.7837	227.3962	219.7807	197.3203	194.1425	202.2026	204.8249	229.2763	244.8941	273.8069 (62)
WWHRS	-32.2200	-28.4956	-29.8390	-24.7078	-23.0268	-19.7042	-18.4696	-19.6405	-20.3867	-24.0337	-27.2273	-31.6233 (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												
	244.7587	216.3713	229.9447	202.6883	196.7539	177.6161	175.6730	182.5621	184.4382	205.2425	217.6669	242.1836 (64)
										Total per year (kWh/year) = Sum(64)m =		2475.8992 (64)
12Total per year (kWh/year)												2476 (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												
	115.1164	102.2114	109.3990	97.8876	96.0980	87.8873	87.5733	90.2533	90.3826	99.2553	103.7056	114.0617 (65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.9490	137.9490	137.9490	137.9490	137.9490	137.9490	137.9490	137.9490	137.9490	137.9490	137.9490	137.9490	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	132.0492	146.1973	132.0492	136.4508	132.0492	136.4508	132.0492	132.0492	136.4508	132.0492	136.4508	132.0492	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	259.8361	262.5324	255.7378	241.2730	223.0138	205.8527	194.3881	191.6918	198.4863	212.9511	231.2103	248.3714	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.7949	36.7949	36.7949	36.7949	36.7949	36.7949	36.7949	36.7949	36.7949	36.7949	36.7949	36.7949	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-110.3592	-110.3592	-110.3592	-110.3592	-110.3592	-110.3592	-110.3592	-110.3592	-110.3592	-110.3592	-110.3592	-110.3592	(71)
Water heating gains (Table 5)													
	154.7263	152.1002	147.0417	135.9550	129.1640	122.0658	117.7061	121.3082	125.5314	133.4077	144.0356	153.3088	(72)
Total internal gains													
	613.9963	628.2146	602.2134	581.0635	551.6117	528.7540	508.5281	509.4339	524.8533	545.7927	579.0815	601.1141	(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	4.8500	10.6334	0.6300	0.7000	0.7700	15.7611	(74)
South	8.8700	46.7521	0.6300	0.7000	0.7700	126.7349	(78)
West	6.2000	19.6403	0.6300	0.7000	0.7700	39.7354	(80)

Solar gains	182.2313	315.4101	443.5866	567.7300	650.9408	652.4498	626.4736	563.7073	486.6098	351.9603	219.2127	155.3262	(83)
Total gains	796.2276	943.6247	1045.8000	1148.7935	1202.5526	1181.2038	1135.0017	1073.1411	1011.4631	897.7530	798.2942	756.4404	(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	1.2977	1.3023	1.3069	1.3288	1.3330	1.3528	1.3528	1.3565	1.3451	1.3330	1.3246	1.3159	
alpha	1.0865	1.0868	1.0871	1.0886	1.0889	1.0902	1.0902	1.0904	1.0897	1.0889	1.0883	1.0877	
util living area													
	0.7497	0.7060	0.6579	0.5865	0.5059	0.4107	0.3301	0.3528	0.4711	0.6098	0.7071	0.7586	(86)
MIT	15.6922	16.2139	17.0126	18.0708	19.0847	19.9510	20.4308	20.3607	19.6865	18.3737	16.8664	15.5963	(87)
Th 2	19.8999	19.9033	19.9067	19.9227	19.9257	19.9398	19.9398	19.9424	19.9344	19.9257	19.9197	19.9133	(88)
util rest of house													
	0.7360	0.6903	0.6392	0.5627	0.4739	0.3661	0.2705	0.2939	0.4279	0.5823	0.6892	0.7454	(89)
MIT 2	14.1325	14.7370	15.6660	16.8947	18.0518	19.0220	19.5261	19.4626	18.7461	17.2670	15.5197	14.0279	(90)
Living area fraction										fLA = Living area / (4) =		0.2045	(91)
MIT	14.4514	15.0390	15.9414	17.1352	18.2630	19.2120	19.7111	19.6463	18.9384	17.4933	15.7951	14.3486	(92)
Temperature adjustment												0.0000	
adjusted MIT	14.4514	15.0390	15.9414	17.1352	18.2630	19.2120	19.7111	19.6463	18.9384	17.4933	15.7951	14.3486	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6394	0.5962	0.5509	0.4869	0.4160	0.3317	0.2563	0.2756	0.3811	0.5040	0.5958	0.6486	(94)
Useful gains	509.0880	562.6241	576.1165	559.3290	500.2702	391.8176	290.9275	295.7459	385.5061	452.5002	475.6134	490.6570	(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	1271.1626	1265.0988	1173.9307	1007.0776	800.0735	554.0010	373.7124	388.8728	584.5263	840.3400	1066.7315	1253.2776	(97)
Space heating kWh	566.9836	472.0630	444.7738	322.3790	223.0536	0.0000	0.0000	0.0000	0.0000	288.5529	425.6051	567.3897	(98a)
Space heating requirement - total per year (kWh/year)												3310.8006	
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	566.9836	472.0630	444.7738	322.3790	223.0536	0.0000	0.0000	0.0000	0.0000	288.5529	425.6051	567.3897	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3310.8006	
Space heating per m2											(98c) / (4) =	32.3953	(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	566.9836	472.0630	444.7738	322.3790	223.0536	0.0000	0.0000	0.0000	0.0000	288.5529	425.6051	567.3897	(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)	614.2834	511.4442	481.8785	349.2730	241.6616	0.0000	0.0000	0.0000	0.0000	312.6250	461.1106	614.7234	(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	244.7587	216.3713	229.9447	202.6883	196.7539	177.6161	175.6730	182.5621	184.4382	205.2425	217.6669	242.1836	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.8796	85.7601	85.5132	85.0953	84.3418	79.8000	79.8000	79.8000	79.8000	84.8237	85.5357	85.9018	(217)
Fuel for water heating, kWh/month	285.0023	252.2984	268.8997	238.1900	233.2814	222.5766	220.1416	228.7745	231.1255	241.9636	254.4747	281.9308	(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	27.4372	22.0112	19.8186	14.5200	11.2156	9.1633	10.2313	13.2990	17.2741	22.6645	25.5995	28.1998	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-46.6324	-65.1510	-92.8081	-103.3657	-110.6078	-102.8917	-101.5606	-96.2525	-86.8178	-73.9710	-51.0320	-40.3813	(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	-28.1880	-59.0754	-117.0285	-175.2330	-231.2177	-232.1880	-229.5106	-194.5975	-142.9577	-84.3714	-37.5936	-22.3122	(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	3586.9996	(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	2958.6592	(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)	221.4341	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2525.7455	(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	4327.3472 (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	3586.9996	0.2100	753.2699	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2958.6592	0.2100	621.3184	(264)
Space and water heating			1374.5883	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	221.4341	0.1443	31.9598	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-971.4719	0.1348	-130.9467	
PV Unit electricity exported	-1554.2736	0.1260	-195.8088	
Total			-326.7555	(269)
Total CO2, kg/year			1091.7218	(272)
Target Carbon Dioxide Emission Rate (TER)			10.6800	(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	3586.9996	1.1300	4053.3095	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2958.6592	1.1300	3343.2848	(278)
Space and water heating			7396.5944	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	221.4341	1.5338	339.6429	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-971.4719	1.4982	-1455.4401	
PV Unit electricity exported	-1554.2736	0.4624	-718.7583	
Total			-2174.1984	(283)
Total Primary energy kWh/year			5692.1397	(286)
Target Primary Energy Rate (TPER)			55.7000	(287)

;

Full SAP Calculation Printout

Property Reference	Plot 19 2BFA_Be Lean_MEV	Issued on Date	12/10/2022
Assessment Reference	00001	Prop Type Ref	2BFA
Property	3 Bedroom House, House No. 19, Claygate, Surrey, Elmbridge, KT 10		

SAP Rating	85 B	DER	13.59	TER	12.43
Environmental	89 B	% DER<TER	-9.33		
CO_2 Emissions (t/year)	0.9	DFEE	29.01	TFEE	28.98
Compliance Check	See BREL	% DFEE < TFEE	-0.08		
% DPER < TPER	-16.17	DPER	76.80	TPER	66.11

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

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

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.0000 (1b)	x	2.5000 (2b)	=	175.0000	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	175.0000	(5)

---

2. Ventilation rate

---

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1143 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.2643 (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) =	0.2246 (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	0.2864	0.2808	0.2752	0.2471	0.2415	0.2134	0.2134	0.2078	0.2246	0.2415	0.2527	0.2640	(22b)
Effective ac	0.5410	0.5394	0.5379	0.5305	0.5292	0.5228	0.5228	0.5216	0.5252	0.5292	0.5319	0.5348	(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	
Window (Uw = 1.20)			6.3000	1.1450	7.2137			(27)
Opening Type 4			5.6000	1.2000	6.7200			(26a)
External Wall 1	45.0000	11.9000	33.1000	0.1400	4.6340	0.0000	0.0000	(29a)
External Roof 1	70.0000		70.0000	0.1132	7.9245	9.0000	630.0000	(30)
Total net area of external elements Aum(A, m2)			115.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.4923			(33)
Party Floor 1			70.0000			0.0000	0.0000	(32d)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 630.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 9.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 5.7500 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 32.2423 (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	31.2438	31.1518	31.0617	30.6382	30.5589	30.1901	30.1901	30.1218	30.3322	30.5589	30.7192	30.8868	(38)
Heat transfer coeff	63.4861	63.3941	63.3039	62.8804	62.8012	62.4324	62.4324	62.3641	62.5744	62.8012	62.9615	63.1291	(39)

Average = Sum(39)m / 12 = 62.8801

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9069	0.9056	0.9043	0.8983	0.8972	0.8919	0.8919	0.8909	0.8939	0.8972	0.8994	0.9018	(40)
HLP (average)												0.8983	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2461 (42)

Hot water usage for mixer showers	61.8798	60.9498	59.5947	57.0020	55.0887	52.9549	51.7420	53.0869	54.5611	56.8521	59.5005	61.6427 (42a)
Hot water usage for baths	26.7336	26.3365	25.7774	24.7465	23.9746	23.1187	22.6564	23.2116	23.8161	24.7319	25.7840	26.6432 (42b)
Hot water usage for other uses	37.6326	36.2641	34.8957	33.5272	32.1587	30.7903	30.7903	32.1587	33.5272	34.8957	36.2641	37.6326 (42c)

Average daily hot water use (litres/day) 116.0487 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	126.2459	123.5505	120.2678	115.2758	111.2220	106.8639	105.1887	108.4572	111.9043	116.4797	121.5487	125.9184	(44)
Energy conte	199.9426	175.9342	184.8472	157.8067	149.7262	131.4016	127.2166	134.2926	137.9892	158.0618	173.1684	197.1578	(45)

Energy content (annual) Total = Sum(45)m = 1927.5450

Distribution loss (46)m = 0.15 x (45)m	29.9914	26.3901	27.7271	23.6710	22.4589	19.7102	19.0825	20.1439	20.6984	23.7093	25.9753	29.5737	(46)
Water storage loss:													
Store volume												180.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.8736	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.8736	(55)
Total storage loss	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	250.2871	221.4066	235.1916	206.5272	200.0706	180.1220	177.5610	184.6371	186.7096	208.4063	221.8888	247.5023	(62)
WWHRS	-27.3062	-24.1498	-25.2883	-20.9397	-19.5151	-16.6992	-15.6528	-16.6452	-17.2776	-20.3684	-23.0749	-26.8005	(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	222.9809	197.2568	209.9033	185.5874	180.5556	163.4228	161.9082	167.9919	169.4320	188.0379	198.8139	220.7017	(64)

Total per year (kWh/year) = Sum(64)m = 2266.5924 (64)

12Total per year (kWh/year) 2267 (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	106.7565	94.8760	101.7372	91.4471	90.0595	82.6674	82.5751	84.9278	84.8578	92.8311	96.5548	105.8305	(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	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	117.4221	130.0031	117.4221	121.3362	117.4221	121.3362	117.4221	117.4221	121.3362	117.4221	121.3362	117.4221	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.2971	199.3444	194.1852	183.2019	169.3374	156.3068	147.6015	145.5542	150.7134	161.6967	175.5612	188.5918	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	(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)	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	(71)
Water heating gains (Table 5)	143.4899	141.1846	136.7436	127.0098	121.0477	114.8158	110.9880	114.1503	117.8580	124.7730	134.1039	142.2453	(72)
Total internal gains	517.9010	530.2239	508.0428	491.2398	467.4991	449.1506	432.7035	433.8185	446.5994	463.5837	490.6931	507.9511	(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	
East	2.1000	19.6403	0.7600	0.7000	0.7700	15.2059	(76)
West	4.2000	19.6403	0.7600	0.7000	0.7700	30.4118	(80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	45.6176	89.2378	146.9619	214.3352	262.6758	268.8954	255.9994	219.8997	170.9228	105.8881	56.8798	37.5137	(83)
Total gains	563.5186	619.4617	655.0047	705.5749	730.1749	718.0460	688.7029	653.7182	617.5222	569.4718	547.5730	545.4648	(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	2.7565	2.7605	2.7644	2.7831	2.7866	2.8030	2.8030	2.8061	2.7967	2.7866	2.7795	2.7721	
alpha	1.1838	1.1840	1.1843	1.1855	1.1858	1.1869	1.1869	1.1871	1.1864	1.1858	1.1853	1.1848	
util living area	0.7038	0.6722	0.6317	0.5628	0.4818	0.3861	0.3059	0.3279	0.4457	0.5794	0.6651	0.7116	(86)
MIT	16.5092	16.9057	17.5793	18.5165	19.4124	20.1591	20.5597	20.5009	19.9263	18.7909	17.5152	16.4258	(87)
Th 2	20.1616	20.1627	20.1638	20.1690	20.1699	20.1744	20.1744	20.1752	20.1727	20.1699	20.1680	20.1659	(88)
util rest of house	0.6917	0.6591	0.6164	0.5436	0.4566	0.3517	0.2612	0.2834	0.4120	0.5571	0.6497	0.6999	(89)
MIT 2	15.1748	15.6376	16.4269	17.5188	18.5493	19.3903	19.8192	19.7628	19.1439	17.8536	16.3649	15.0796	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	15.5084	15.9546	16.7150	17.7682	18.7650	19.5825	20.0043	19.9473	19.3395	18.0880	16.6525	15.4162	(92)
Temperature adjustment												-0.1500	
adjusted MIT	15.3584	15.8046	16.5650	17.6182	18.6150	19.4325	19.8543	19.7973	19.1895	17.9380	16.5025	15.2662	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6010	0.5717	0.5347	0.4739	0.4030	0.3177	0.2425	0.2612	0.3669	0.4850	0.5635	0.6085	(94)
Useful gains	338.6590	354.1673	350.2242	334.3710	294.2678	228.1540	167.0328	170.7823	226.5654	276.1700	308.5498	331.9019	(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	702.0547	691.2880	637.1524	548.2070	434.2727	301.7060	203.1733	211.8694	318.4728	460.8323	591.9928	698.5971	(97)
Space heating kWh	270.3665	226.5451	213.4746	153.9619	104.1636	0.0000	0.0000	0.0000	0.0000	137.3888	204.0790	272.8212	(98a)
Space heating requirement - total per year (kWh/year)												1582.8007	
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	270.3665	226.5451	213.4746	153.9619	104.1636	0.0000	0.0000	0.0000	0.0000	137.3888	204.0790	272.8212	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1582.8007	
Space heating per m2											(98c) / (4) =	22.6114	(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 %)	89.5000	(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	270.3665	226.5451	213.4746	153.9619	104.1636	0.0000	0.0000	0.0000	0.0000	137.3888	204.0790	272.8212	(98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000	(210)
Space heating fuel (main heating system)	302.0854	253.1230	238.5191	172.0245	116.3839	0.0000	0.0000	0.0000	0.0000	153.5070	228.0212	304.8282	(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	222.9809	197.2568	209.9033	185.5874	180.5556	163.4228	161.9082	167.9919	169.4320	188.0379	198.8139	220.7017	(64)
Efficiency of water heater												89.5000	(216)
(217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	(217)
Fuel for water heating, kWh/month	249.1406	220.3987	234.5288	207.3603	201.7381	182.5953	180.9030	187.7004	189.3095	210.0982	222.1384	246.5941	(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	31.1521	24.9914	22.5020	16.4859	12.7342	10.4039	11.6165	15.0996	19.6129	25.7332	29.0656	32.0179	(232)

Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year	
Space heating fuel - main system 1	1768.4924 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	89.5000
Water heating fuel used	2532.5055 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	251.4153 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (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	4638.4132 (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	1768.4924	0.2100	371.3834	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2532.5055	0.2100	531.8261	(264)
Space and water heating			903.2095	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	251.4153	0.1443	36.2870	(268)
Total CO2, kg/year			951.4258	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.5900	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1768.4924	1.1300	1998.3964	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2532.5055	1.1300	2861.7312	(278)
Space and water heating			4860.1276	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	251.4153	1.5338	385.6292	(282)
Total Primary energy kWh/year			5375.8576	(286)
Dwelling Primary energy Rate (DPER)			76.8000	(287)

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

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.0000 (1b)	x	2.5000 (2b)	=	175.0000 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 70.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	175.0000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1143	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3643	(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) =	0.3096	(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	0.3948	0.3871	0.3793	0.3406	0.3329	0.2942	0.2942	0.2864	0.3096	0.3329	0.3483	0.3638	(22b)
Effective ac	0.5779	0.5749	0.5719	0.5580	0.5554	0.5433	0.5433	0.5410	0.5479	0.5554	0.5607	0.5662	(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 Semi-glazed door			5.6000	1.0000	5.6000			(26a)
TER Opening Type (Uw = 1.20)			6.3000	1.1450	7.2137			(27)
External Wall 1	45.0000	11.9000	33.1000	0.1800	5.9580			(29a)
External Roof 1	70.0000		70.0000	0.1100	7.7000			(30)
Total net area of external elements Aum(A, m2)			115.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.4717			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 9.0000 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E5	Ground floor (normal)	10.0000	0.1600	1.6000
E6	Intermediate floor within a dwelling	36.0000	0.0000	0.0000
E16	Corner (normal)	15.5000	0.0900	1.3950
E18	Party wall between dwellings	15.5000	0.0600	0.9300

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.9250 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 30.3967 (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	33.3755	33.2008	33.0295	32.2249	32.0743	31.3736	31.3736	31.2438	31.6435	32.0743	32.3789	32.6973	(38)
Heat transfer coeff	63.7723	63.5975	63.4262	62.6216	62.4711	61.7703	61.7703	61.6405	62.0402	62.4711	62.7756	63.0940	(39)

Average = Sum(39)m / 12 = 62.6209

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9110	0.9085	0.9061	0.8946	0.8924	0.8824	0.8824	0.8806	0.8863	0.8924	0.8968	0.9013	(40)
HLP (average)												0.8946	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2461 (42)

Hot water usage for mixer showers

61.8798	60.9498	59.5947	57.0020	55.0887	52.9549	51.7420	53.0869	54.5611	56.8521	59.5005	61.6427	(42a)

Hot water usage for baths

26.7336	26.3365	25.7774	24.7465	23.9746	23.1187	22.6564	23.2116	23.8161	24.7319	25.7840	26.6432	(42b)

Hot water usage for other uses

37.6326	36.2641	34.8957	33.5272	32.1587	30.7903	30.7903	32.1587	33.5272	34.8957	36.2641	37.6326	(42c)

Average daily hot water use (litres/day) 116.0487 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	126.2459	123.5505	120.2678	115.2758	111.2220	106.8639	105.1887	108.4572	111.9043	116.4797	121.5487	125.9184	(44)
Energy conte	199.9426	175.9342	184.8472	157.8067	149.7262	131.4016	127.2166	134.2926	137.9892	158.0618	173.1684	197.1578	(45)

Energy content (annual) Total = Sum(45)m = 1927.5450

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

29.9914	26.3901	27.7271	23.6710	22.4589	19.7102	19.0825	20.1439	20.6984	23.7093	25.9753	29.5737 (46)

Water storage loss:

Store volume 180.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.5520 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.8381 (55)

Total storage loss

25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)

If cylinder contains dedicated solar storage

25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (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

249.1853	220.4115	234.0898	205.4609	198.9689	179.0558	176.4593	183.5353	185.6434	207.3045	220.8226	246.4005 (62)
-28.2888	-25.0189	-26.1983	-21.6933	-20.2173	-17.3001	-16.2161	-17.2442	-17.8994	-21.1014	-23.9053	-27.7650 (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

220.8965	195.3926	207.8915	183.7677	178.7515	161.7557	160.2432	166.2911	167.7440	186.2031	196.9172	218.6355 (64)

Total per year (kWh/year) = Sum(64)m = 2244.4896 (64)

12Total per year (kWh/year) 2244 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)

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

Heat gains from water heating, kWh/month

105.8751	94.0799	100.8558	90.5941	89.1781	81.8144	81.6937	84.0464	84.0048	91.9497	95.7018	104.9491 (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	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	(66)

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

	117.4221	130.0031	117.4221	121.3362	117.4221	121.3362	117.4221	117.4221	121.3362	117.4221	121.3362	117.4221	(67)

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

	197.2971	199.3444	194.1852	183.2019	169.3374	156.3068	147.6015	145.5542	150.7134	161.6967	175.5612	188.5918	(68)

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

	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	(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)

	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	(71)

Water heating gains (Table 5)

	142.3052	139.9999	135.5589	125.8251	119.8630	113.6311	109.8033	112.9656	116.6733	123.5883	132.9192	141.0606	(72)

Total internal gains

	516.7163	529.0392	506.8581	490.0551	466.3144	447.9659	431.5188	432.6338	445.4147	462.3990	489.5084	506.7664	(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	
East	2.1000	19.6403	0.6300	0.7000	0.7700	12.6049	(76)
West	4.2000	19.6403	0.6300	0.7000	0.7700	25.2097	(80)

Solar gains	37.8146	73.9734	121.8237	177.6726	217.7444	222.9001	212.2100	182.2853	141.6860	87.7757	47.1504	31.0969	(83)
Total gains	554.5309	603.0126	628.6818	667.7276	684.0588	670.8661	643.7288	614.9191	587.1007	550.1747	536.6588	537.8633	(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	2.7441	2.7517	2.7591	2.7946	2.8013	2.8331	2.8331	2.8390	2.8207	2.8013	2.7877	2.7736	
alpha	1.1829	1.1834	1.1839	1.1863	1.1868	1.1889	1.1889	1.1893	1.1880	1.1868	1.1858	1.1849	
util living area	0.7083	0.6794	0.6426	0.5767	0.4983	0.4011	0.3191	0.3399	0.4572	0.5875	0.6695	0.7147	(86)
MIT	16.4702	16.8503	17.5072	18.4459	19.3504	20.1235	20.5391	20.4815	19.8962	18.7571	17.4897	16.4019	(87)
Th 2	20.1581	20.1603	20.1623	20.1721	20.1739	20.1825	20.1825	20.1840	20.1792	20.1739	20.1702	20.1664	(88)
util rest of house	0.6963	0.6664	0.6274	0.5577	0.4730	0.3664	0.2736	0.2949	0.4235	0.5653	0.6542	0.7030	(89)
MIT 2	15.1282	15.5729	16.3442	17.4423	18.4857	19.3613	19.8080	19.7526	19.1179	17.8188	16.3369	15.0524	(90)

Living area fraction fLA = Living area / (4) = 0.2500 (91)

MIT	15.4637	15.8923	16.6350	17.6932	18.7019	19.5518	19.9908	19.9348	19.3125	18.0534	16.6251	15.3898	(92)
Temperature adjustment												0.0000	
adjusted MIT	15.4637	15.8923	16.6350	17.6932	18.7019	19.5518	19.9908	19.9348	19.3125	18.0534	16.6251	15.3898	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6087	0.5818	0.5481	0.4902	0.4221	0.3371	0.2622	0.2801	0.3837	0.4973	0.5717	0.6149	(94)
Useful gains	337.5312	350.8348	344.6036	327.3075	288.7169	226.1766	168.7755	172.2154	225.2436	273.6085	306.8145	330.7478	(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													
	711.9350	699.0803	642.8222	550.6426	437.4157	305.8755	209.4477	217.8892	323.3823	465.6202	597.9458	706.0066	(97)
Space heating kWh													
	278.5565	234.0210	221.8746	160.8013	110.6319	0.0000	0.0000	0.0000	0.0000	142.8568	209.6145	279.1925	(98a)
Space heating requirement - total per year (kWh/year)												1637.5490	
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													
	278.5565	234.0210	221.8746	160.8013	110.6319	0.0000	0.0000	0.0000	0.0000	142.8568	209.6145	279.1925	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1637.5490	
Space heating per m2											(98c) / (4) =	23.3936	(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													
	278.5565	234.0210	221.8746	160.8013	110.6319	0.0000	0.0000	0.0000	0.0000	142.8568	209.6145	279.1925	(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)													
	301.7946	253.5438	240.3842	174.2159	119.8612	0.0000	0.0000	0.0000	0.0000	154.7744	227.1013	302.4838	(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													
	220.8965	195.3926	207.8915	183.7677	178.7515	161.7557	160.2432	166.2911	167.7440	186.2031	196.9172	218.6355	(64)
Efficiency of water heater												79.8000	(216)
(217)m	84.5810	84.4654	84.2060	83.7618	83.0166	79.8000	79.8000	79.8000	79.8000	83.4728	84.2002	84.6092	(217)
Fuel for water heating, kWh/month													
	261.1655	231.3286	246.8843	219.3933	215.3201	202.7013	200.8060	208.3848	210.2056	223.0703	233.8680	258.4064	(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	24.3980	19.5730	17.6233	12.9116	9.9733	8.1483	9.0980	11.8259	15.3606	20.1540	22.7639	25.0761	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-18.8009	-27.8705	-42.0897	-49.7906	-55.8513	-52.9245	-52.2973	-48.3192	-41.6479	-32.9731	-21.1557	-16.1004	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-6.8226	-14.6728	-29.7721	-45.6199	-61.2123	-61.8288	-61.0832	-51.2870	-37.0423	-21.2538	-9.1955	-5.3700	(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												1774.1593	(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												2711.5342	(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)												196.9058	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-864.9813	(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												3903.6179	(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	1774.1593	0.2100	372.5734	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2711.5342	0.2100	569.4222	(264)
Space and water heating			941.9956	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	196.9058	0.1443	28.4196	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-459.8210	0.1335	-61.4079	
PV Unit electricity exported	-405.1604	0.1253	-50.7742	
Total			-112.1821	(269)
Total CO2, kg/year			870.1623	(272)
Target Carbon Dioxide Emission Rate (TER)			12.4300	(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	1774.1593	1.1300	2004.8000	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2711.5342	1.1300	3064.0336	(278)
Space and water heating			5068.8336	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	196.9058	1.5338	302.0207	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-459.8210	1.4935	-686.7471	
PV Unit electricity exported	-405.1604	0.4600	-186.3652	
Total			-873.1123	(283)
Total Primary energy kWh/year			4627.8428	(286)
Target Primary Energy Rate (TPER)			66.1100	(287)

;

Full SAP Calculation Printout

elmhurst energy

Property Reference	Plot 19 2BFA_Be Green	Issued on Date	12/10/2022
Assessment Reference	Be Green	Prop Type Ref	2BFA
Property	3 Bedroom House, House No. 19, Claygate, Surrey, Elmbridge, KT 10		

SAP Rating	83 B	DER	4.23	TER	12.43
Environmental	97 A	% DER<TER	65.97		
CO_2 Emissions (t/year)	0.28	DFEE	29.01	TFEE	28.98
Compliance Check	See BREL	% DFEE < TFEE	-0.08		
% DPER < TPER	31.69	DPER	45.16	TPER	66.11

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

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

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.0000	(1b)	x 2.5000	(2b) =	175.0000	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		175.0000	(5)

---

2. Ventilation rate

---

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1143 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.2643 (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) =	0.2246 (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	0.2864	0.2808	0.2752	0.2471	0.2415	0.2134	0.2134	0.2078	0.2246	0.2415	0.2527	0.2640	(22b)
Effective ac	0.5410	0.5394	0.5379	0.5305	0.5292	0.5228	0.5228	0.5216	0.5252	0.5292	0.5319	0.5348	(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	
Window (Uw = 1.20)			6.3000	1.1450	7.2137			(27)
Opening Type 4			5.6000	1.2000	6.7200			(26a)
External Wall 1	45.0000	11.9000	33.1000	0.1400	4.6340	0.0000	0.0000	(29a)
External Roof 1	70.0000		70.0000	0.1132	7.9245	9.0000	630.0000	(30)
Total net area of external elements Aum(A, m2)			115.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.4923			(33)
Party Floor 1			70.0000			0.0000	0.0000	(32d)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 630.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 9.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 5.7500 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 32.2423 (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	31.2438	31.1518	31.0617	30.6382	30.5589	30.1901	30.1901	30.1218	30.3322	30.5589	30.7192	30.8868	(38)
Heat transfer coeff	63.4861	63.3941	63.3039	62.8804	62.8012	62.4324	62.4324	62.3641	62.5744	62.8012	62.9615	63.1291	(39)

Average = Sum(39)m / 12 = 62.8801

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9069	0.9056	0.9043	0.8983	0.8972	0.8919	0.8919	0.8909	0.8939	0.8972	0.8994	0.9018	(40)
HLP (average)												0.8983	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2461 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	61.8798	60.9498	59.5947	57.0020	55.0887	52.9549	51.7420	53.0869	54.5611	56.8521	59.5005	61.6427	(42a)
Hot water usage for baths	26.7336	26.3365	25.7774	24.7465	23.9746	23.1187	22.6564	23.2116	23.8161	24.7319	25.7840	26.6432	(42b)
Hot water usage for other uses	37.6326	36.2641	34.8957	33.5272	32.1587	30.7903	30.7903	32.1587	33.5272	34.8957	36.2641	37.6326	(42c)

Average daily hot water use (litres/day) 116.0487 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	126.2459	123.5505	120.2678	115.2758	111.2220	106.8639	105.1887	108.4572	111.9043	116.4797	121.5487	125.9184	(44)
Energy conte	199.9426	175.9342	184.8472	157.8067	149.7262	131.4016	127.2166	134.2926	137.9892	158.0618	173.1684	197.1578	(45)

Energy content (annual) Total = Sum(45)m = 1927.5450

Distribution loss (46)m = 0.15 x (45)m	29.9914	26.3901	27.7271	23.6710	22.4589	19.7102	19.0825	20.1439	20.6984	23.7093	25.9753	29.5737	(46)

Water storage loss:
Store volume 180.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 0.8736 (55)

Total storage loss	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	250.2871	221.4066	235.1916	206.5272	200.0706	180.1220	177.5610	184.6371	186.7096	208.4063	221.8888	247.5023	(62)
WWHRS	-27.3062	-24.1498	-25.2883	-20.9397	-19.5151	-16.6992	-15.6528	-16.6452	-17.2776	-20.3684	-23.0749	-26.8005	(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	222.9809	197.2568	209.9033	185.5874	180.5556	163.4228	161.9082	167.9919	169.4320	188.0379	198.8139	220.7017	(64)

Total per year (kWh/year) = Sum(64)m = 2266.5924 (64)
12Total per year (kWh/year) 2267 (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	106.7565	94.8760	101.7372	91.4471	90.0595	82.6674	82.5751	84.9278	84.8578	92.8311	96.5548	105.8305	(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	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	117.4221	130.0031	117.4221	121.3362	117.4221	121.3362	117.4221	117.4221	121.3362	117.4221	121.3362	117.4221	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.2971	199.3444	194.1852	183.2019	169.3374	156.3068	147.6015	145.5542	150.7134	161.6967	175.5612	188.5918	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	(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)	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	(71)
Water heating gains (Table 5)	143.4899	141.1846	136.7436	127.0098	121.0477	114.8158	110.9880	114.1503	117.8580	124.7730	134.1039	142.2453	(72)
Total internal gains	517.9010	530.2239	508.0428	491.2398	467.4991	449.1506	432.7035	433.8185	446.5994	463.5837	490.6931	507.9511	(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	
East	2.1000	19.6403	0.7600	0.7000	0.7700	15.2059	(76)
West	4.2000	19.6403	0.7600	0.7000	0.7700	30.4118	(80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	45.6176	89.2378	146.9619	214.3352	262.6758	268.8954	255.9994	219.8997	170.9228	105.8881	56.8798	37.5137	(83)
Total gains	563.5186	619.4617	655.0047	705.5749	730.1749	718.0460	688.7029	653.7182	617.5222	569.4718	547.5730	545.4648	(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	2.7565	2.7605	2.7644	2.7831	2.7866	2.8030	2.8030	2.8061	2.7967	2.7866	2.7795	2.7721	
alpha	1.1838	1.1840	1.1843	1.1855	1.1858	1.1869	1.1869	1.1871	1.1864	1.1858	1.1853	1.1848	
util living area	0.7038	0.6722	0.6317	0.5628	0.4818	0.3861	0.3059	0.3279	0.4457	0.5794	0.6651	0.7116	(86)
MIT	17.4171	17.7145	18.2197	18.9227	19.5946	20.1548	20.4552	20.4112	19.9801	19.1286	18.1717	17.3546	(87)
Th 2	20.1616	20.1627	20.1638	20.1690	20.1699	20.1744	20.1744	20.1752	20.1727	20.1699	20.1680	20.1659	(88)
util rest of house	0.6917	0.6591	0.6164	0.5436	0.4566	0.3517	0.2612	0.2834	0.4120	0.5571	0.6497	0.6999	(89)
MIT 2	16.1650	16.5124	17.1047	17.9250	18.6981	19.3301	19.6517	19.6097	19.1448	18.1764	17.0593	16.0948	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	16.4780	16.8129	17.3834	18.1744	18.9222	19.5363	19.8526	19.8100	19.3537	18.4144	17.3374	16.4098	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.4780	16.8129	17.3834	18.1744	18.9222	19.5363	19.8526	19.8100	19.3537	18.4144	17.3374	16.4098	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6261	0.5953	0.5559	0.4907	0.4143	0.3227	0.2424	0.2620	0.3748	0.5020	0.5863	0.6340	(94)
Useful gains	352.8405	368.7717	364.0939	346.1945	302.5215	231.6902	166.9635	171.2815	231.4665	285.9013	321.0336	345.8121	(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	773.1362	755.2093	688.9636	583.1808	453.5649	308.1834	203.0677	212.6632	328.7444	490.7550	644.5618	770.7909	(97)
Space heating kWh	312.7000	259.6861	241.7031	170.6301	112.3763	0.0000	0.0000	0.0000	0.0000	152.4112	232.9403	316.1842	(98a)
Space heating requirement - total per year (kWh/year)												1798.6314	
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	312.7000	259.6861	241.7031	170.6301	112.3763	0.0000	0.0000	0.0000	0.0000	152.4112	232.9403	316.1842	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1798.6314	
Space heating per m2											(98c) / (4) =	25.6947	(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 %)	219.3000	(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	312.7000	259.6861	241.7031	170.6301	112.3763	0.0000	0.0000	0.0000	0.0000	152.4112	232.9403	316.1842	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	142.5901	118.4159	110.2157	77.8067	51.2432	0.0000	0.0000	0.0000	0.0000	69.4990	106.2199	144.1788	(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	222.9809	197.2568	209.9033	185.5874	180.5556	163.4228	161.9082	167.9919	169.4320	188.0379	198.8139	220.7017	(64)
Efficiency of water heater												190.4000	(216)
(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(217)
Fuel for water heating, kWh/month	117.1118	103.6013	110.2433	97.4724	94.8296	85.8313	85.0358	88.2310	88.9874	98.7594	104.4190	115.9148	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	31.1521	24.9914	22.5020	16.4859	12.7342	10.4039	11.6165	15.0996	19.6129	25.7332	29.0656	32.0179	(232)

Electricity generated by PVs (Appendix M) (negative quantity)

(233a)m	-6.6832	-10.6560	-17.3019	-21.9510	-25.8760	-24.4139	-24.1009	-21.6152	-17.6367	-13.1101	-7.7530	-5.6449 (233a)

Electricity generated by wind turbines (Appendix M) (negative quantity)

(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)

Electricity generated by hydro-electric generators (Appendix M) (negative quantity)

(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)

Electricity generated by PVs (Appendix M) (negative quantity)

(233b)m	-0.8298	-1.8810	-4.0500	-6.6648	-9.4764	-10.3431	-10.1969	-8.3509	-5.8328	-2.9168	-1.1585	-0.6422 (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	820.1693 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	190.4000
Water heating fuel used	1190.4372 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	251.4153 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-259.0859 (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	2002.9359 (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	820.1693	0.1535	125.9344	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1190.4372	0.1408	167.5584	(264)
Space and water heating			293.4929	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	251.4153	0.1443	36.2870	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-196.7428	0.1324	-26.0474	
PV Unit electricity exported	-62.3431	0.1227	-7.6485	
Total			-33.6959	(269)
Total CO2, kg/year			296.0840	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			4.2300	(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	820.1693	1.5685	1286.4069	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1190.4372	1.5204	1809.9988	(278)
Space and water heating			3096.4057	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	251.4153	1.5338	385.6292	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-196.7428	1.4892	-292.9852	
PV Unit electricity exported	-62.3431	0.4501	-28.0610	
Total			-321.0463	(283)
Total Primary energy kWh/year			3160.9887	(286)
Dwelling Primary energy Rate (DPER)			45.1600	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF TARGET EMISSIONS

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	70.0000 (1b)	x	2.5000 (2b)	=	175.0000	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	175.0000	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1143 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3643 (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) =	0.3096 (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	0.3948	0.3871	0.3793	0.3406	0.3329	0.2942	0.2942	0.2864	0.3096	0.3329	0.3483	0.3638	(22b)
Effective ac	0.5779	0.5749	0.5719	0.5580	0.5554	0.5433	0.5433	0.5410	0.5479	0.5554	0.5607	0.5662	(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 Semi-glazed door			5.6000	1.0000	5.6000			(26a)
TER Opening Type (Uw = 1.20)			6.3000	1.1450	7.2137			(27)
External Wall 1	45.0000	11.9000	33.1000	0.1800	5.9580			(29a)
External Roof 1	70.0000		70.0000	0.1100	7.7000			(30)
Total net area of external elements Aum(A, m2)			115.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	26.4717			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		9.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	10.0000	0.1600	1.6000
E6 Intermediate floor within a dwelling	36.0000	0.0000	0.0000
E16 Corner (normal)	15.5000	0.0900	1.3950
E18 Party wall between dwellings	15.5000	0.0600	0.9300

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.9250 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	30.3967 (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	33.3755	33.2008	33.0295	32.2249	32.0743	31.3736	31.3736	31.2438	31.6435	32.0743	32.3789	32.6973	(38)
Heat transfer coeff	63.7723	63.5975	63.4262	62.6216	62.4711	61.7703	61.7703	61.6405	62.0402	62.4711	62.7756	63.0940	(39)
Average = Sum(39)m / 12 =												62.6209	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9110	0.9085	0.9061	0.8946	0.8924	0.8824	0.8824	0.8806	0.8863	0.8924	0.8968	0.9013	(40)
HLP (average)												0.8946	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.2461 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
61.8798	60.9498	59.5947	57.0020	55.0887	52.9549	51.7420	53.0869	54.5611	56.8521	59.5005	61.6427	(42a)

Hot water usage for baths

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
26.7336	26.3365	25.7774	24.7465	23.9746	23.1187	22.6564	23.2116	23.8161	24.7319	25.7840	26.6432	(42b)

Hot water usage for other uses

	37.6326	36.2641	34.8957	33.5272	32.1587	30.7903	30.7903	32.1587	33.5272	34.8957	36.2641	37.6326 (42c)
Average daily hot water use (litres/day)												116.0487 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
	126.2459	123.5505	120.2678	115.2758	111.2220	106.8639	105.1887	108.4572	111.9043	116.4797	121.5487	125.9184 (44)
Energy conte	199.9426	175.9342	184.8472	157.8067	149.7262	131.4016	127.2166	134.2926	137.9892	158.0618	173.1684	197.1578 (45)
Energy content (annual)											Total = Sum(45)m =	1927.5450
Distribution loss (46)m = 0.15 x (45)m												
	29.9914	26.3901	27.7271	23.6710	22.4589	19.7102	19.0825	20.1439	20.6984	23.7093	25.9753	29.5737 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8381 (55)
Total storage loss												
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage												
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (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												
	249.1853	220.4115	234.0898	205.4609	198.9689	179.0558	176.4593	183.5353	185.6434	207.3045	220.8226	246.4005 (62)
WWHRS	-28.2888	-25.0189	-26.1983	-21.6933	-20.2173	-17.3001	-16.2161	-17.2442	-17.8994	-21.1014	-23.9053	-27.7650 (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												
	220.8965	195.3926	207.8915	183.7677	178.7515	161.7557	160.2432	166.2911	167.7440	186.2031	196.9172	218.6355 (64)
											Total per year (kWh/year) = Sum(64)m =	2244.4896 (64)
12Total per year (kWh/year)												2244 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
											Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000 (64a)
Heat gains from water heating, kWh/month												
	105.8751	94.0799	100.8558	90.5941	89.1781	81.8144	81.6937	84.0464	84.0048	91.9497	95.7018	104.9491 (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	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	117.4221	130.0031	117.4221	121.3362	117.4221	121.3362	117.4221	117.4221	121.3362	117.4221	121.3362	117.4221	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	197.2971	199.3444	194.1852	183.2019	169.3374	156.3068	147.6015	145.5542	150.7134	161.6967	175.5612	188.5918	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	(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)													
	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	(71)
Water heating gains (Table 5)													
	142.3052	139.9999	135.5589	125.8251	119.8630	113.6311	109.8033	112.9656	116.6733	123.5883	132.9192	141.0606	(72)
Total internal gains													
	516.7163	529.0392	506.8581	490.0551	466.3144	447.9659	431.5188	432.6338	445.4147	462.3990	489.5084	506.7664	(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	
East	2.1000	19.6403	0.6300	0.7000	0.7700	12.6049	(76)
West	4.2000	19.6403	0.6300	0.7000	0.7700	25.2097	(80)

Solar gains	37.8146	73.9734	121.8237	177.6726	217.7444	222.9001	212.2100	182.2853	141.6860	87.7757	47.1504	31.0969	(83)
Total gains	554.5309	603.0126	628.6818	667.7276	684.0588	670.8661	643.7288	614.9191	587.1007	550.1747	536.6588	537.8633	(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	2.7441	2.7517	2.7591	2.7946	2.8013	2.8331	2.8331	2.8390	2.8207	2.8013	2.7877	2.7736	
alpha	1.1829	1.1834	1.1839	1.1863	1.1868	1.1889	1.1889	1.1893	1.1880	1.1868	1.1858	1.1849	
util living area													
	0.7083	0.6794	0.6426	0.5767	0.4983	0.4011	0.3191	0.3399	0.4572	0.5875	0.6695	0.7147	(86)
MIT	16.4702	16.8503	17.5072	18.4459	19.3504	20.1235	20.5391	20.4815	19.8962	18.7571	17.4897	16.4019	(87)
Th 2	20.1581	20.1603	20.1623	20.1721	20.1739	20.1825	20.1825	20.1840	20.1792	20.1739	20.1702	20.1664	(88)
util rest of house													
	0.6963	0.6664	0.6274	0.5577	0.4730	0.3664	0.2736	0.2949	0.4235	0.5653	0.6542	0.7030	(89)
MIT 2	15.1282	15.5729	16.3442	17.4423	18.4857	19.3613	19.8080	19.7526	19.1179	17.8188	16.3369	15.0524	(90)
Living area fraction											fLA = Living area / (4) =	0.2500	(91)

MIT	15.4637	15.8923	16.6350	17.6932	18.7019	19.5518	19.9908	19.9348	19.3125	18.0534	16.6251	15.3898 (92)
Temperature adjustment												0.0000
adjusted MIT	15.4637	15.8923	16.6350	17.6932	18.7019	19.5518	19.9908	19.9348	19.3125	18.0534	16.6251	15.3898 (93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6087	0.5818	0.5481	0.4902	0.4221	0.3371	0.2622	0.2801	0.3837	0.4973	0.5717	0.6149	(94)
Useful gains	337.5312	350.8348	344.6036	327.3075	288.7169	226.1766	168.7755	172.2154	225.2436	273.6085	306.8145	330.7478	(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													
	711.9350	699.0803	642.8222	550.6426	437.4157	305.8755	209.4477	217.8892	323.3823	465.6202	597.9458	706.0066	(97)
Space heating kWh													
	278.5565	234.0210	221.8746	160.8013	110.6319	0.0000	0.0000	0.0000	0.0000	142.8568	209.6145	279.1925	(98a)
Space heating requirement - total per year (kWh/year)												1637.5490	
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													
	278.5565	234.0210	221.8746	160.8013	110.6319	0.0000	0.0000	0.0000	0.0000	142.8568	209.6145	279.1925	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1637.5490	
Space heating per m2											(98c) / (4) =	23.3936	(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													
	278.5565	234.0210	221.8746	160.8013	110.6319	0.0000	0.0000	0.0000	0.0000	142.8568	209.6145	279.1925	(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)													
	301.7946	253.5438	240.3842	174.2159	119.8612	0.0000	0.0000	0.0000	0.0000	154.7744	227.1013	302.4838	(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													
	220.8965	195.3926	207.8915	183.7677	178.7515	161.7557	160.2432	166.2911	167.7440	186.2031	196.9172	218.6355	(64)
Efficiency of water heater												79.8000	(216)
(217)m	84.5810	84.4654	84.2060	83.7618	83.0166	79.8000	79.8000	79.8000	79.8000	83.4728	84.2002	84.6092	(217)
Fuel for water heating, kWh/month													
	261.1655	231.3286	246.8843	219.3933	215.3201	202.7013	200.8060	208.3848	210.2056	223.0703	233.8680	258.4064	(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	24.3980	19.5730	17.6233	12.9116	9.9733	8.1483	9.0980	11.8259	15.3606	20.1540	22.7639	25.0761	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-18.8009	-27.8705	-42.0897	-49.7906	-55.8513	-52.9245	-52.2973	-48.3192	-41.6479	-32.9731	-21.1557	-16.1004	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-6.8226	-14.6728	-29.7721	-45.6199	-61.2123	-61.8288	-61.0832	-51.2870	-37.0423	-21.2538	-9.1955	-5.3700	(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												1774.1593	(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												2711.5342	(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)												196.9058	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-864.9813	(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	3903.6179 (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	1774.1593	0.2100	372.5734	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2711.5342	0.2100	569.4222	(264)
Space and water heating			941.9956	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	196.9058	0.1443	28.4196	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-459.8210	0.1335	-61.4079	
PV Unit electricity exported	-405.1604	0.1253	-50.7742	
Total			-112.1821	(269)
Total CO2, kg/year			870.1623	(272)
Target Carbon Dioxide Emission Rate (TER)			12.4300	(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	1774.1593	1.1300	2004.8000	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2711.5342	1.1300	3064.0336	(278)
Space and water heating			5068.8336	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	196.9058	1.5338	302.0207	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-459.8210	1.4935	-686.7471	
PV Unit electricity exported	-405.1604	0.4600	-186.3652	
Total			-873.1123	(283)
Total Primary energy kWh/year			4627.8428	(286)
Target Primary Energy Rate (TPER)			66.1100	(287)

;

Full SAP Calculation Printout

Property Reference	Plot 24 1BFA_Be Green	Issued on Date	12/10/2022
Assessment Reference	Be Green	Prop Type Ref	1BFA
Property	1 Bedroom Apartment, House No. 24, Claygate, Surrey, Elmbridge, KT 10		

SAP Rating	84 B	DER	4.70	TER	15.03
Environmental	97 A	% DER<TER	68.73		
CO_2 Emissions (t/year)	0.22	DFEE	31.45	TFEE	32.10
Compliance Check	See BREL	% DFEE < TFEE	2.02		
% DPER < TPER	37.03	DPER	50.55	TPER	80.27

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

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

---

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		50.0000	(1b)	x 2.5000	(2b) =	125.0000	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		125.0000	(5)

---

2. Ventilation rate

---

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1600 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.3100 (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) =	0.2635 (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	0.3360	0.3294	0.3228	0.2899	0.2833	0.2503	0.2503	0.2437	0.2635	0.2833	0.2964	0.3096	(22b)
Effective ac	0.5564	0.5542	0.5521	0.5420	0.5401	0.5313	0.5313	0.5297	0.5347	0.5401	0.5439	0.5479	(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	
Window (Uw = 1.20)			6.3000	1.1450	7.2137			(27)
Opening Type 4			5.6000	1.2000	6.7200			(26a)
External Wall 1	35.0000	11.9000	23.1000	0.1400	3.2340	0.0000	0.0000	(29a)
External Roof 1	50.0000		50.0000	0.1132	5.6604	9.0000	450.0000	(30)
Total net area of external elements Aum(A, m2)			85.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		22.8281			(33)
Party Floor 1			50.0000			0.0000	0.0000	(32d)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 450.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 9.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 4.2500 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 27.0781 (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	22.9530	22.8626	22.7740	22.3578	22.2799	21.9174	21.9174	21.8503	22.0570	22.2799	22.4374	22.6021	(38)
Heat transfer coeff													
	50.0311	49.9407	49.8521	49.4359	49.3580	48.9955	48.9955	48.9284	49.1352	49.3580	49.5155	49.6802	(39)

Average = Sum(39)m / 12 = 49.4355

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0006	0.9988	0.9970	0.9887	0.9872	0.9799	0.9799	0.9786	0.9827	0.9872	0.9903	0.9936	(40)
HLP (average)												0.9887	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.6901 (42)

Hot water usage for mixer showers												
	52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556 (42a)
Hot water usage for baths												
	22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476 (42b)
Hot water usage for other uses												
	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383 (42c)

Average daily hot water use (litres/day) 98.5597 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415	(44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445	(45)
Energy content (annual)										Total = Sum(45)m =		1637.0557	
Distribution loss (46)m = 0.15 x (45)m													
	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167	(46)
Water storage loss:													
Store volume												180.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.8736	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.8736	(55)
Total storage loss													
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage													
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(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													
	220.1542	194.8927	207.3350	182.7455	177.5070	160.3200	158.3893	164.3985	165.9136	184.5850	195.7910	217.7889	(62)
WWHRS	-23.1922	-20.5114	-21.4783	-17.7849	-16.5749	-14.1833	-13.2946	-14.1374	-14.6746	-17.2997	-19.5984	-22.7627	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	196.9620	174.3813	185.8566	164.9606	160.9321	146.1368	145.0947	150.2611	151.2390	167.2854	176.1926	195.0262	(64)
									Total per year (kWh/year) = Sum(64)m =			2014.3284	(64)
12Total per year (kWh/year)												2014	(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													
	96.7373	86.0602	92.4749	83.5397	82.5571	76.0832	76.2005	78.1985	77.9431	84.9105	87.8773	95.9508	(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	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	81.5419	90.2785	81.5419	84.2599	81.5419	84.2599	81.5419	81.5419	84.2599	81.5419	84.2599	81.5419	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	(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)													
	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	(71)
Water heating gains (Table 5)													
	130.0232	128.0657	124.2942	116.0273	110.9639	105.6711	102.4200	105.1055	108.2543	114.1271	122.0518	128.9662	(72)
Total internal gains													
	410.1506	418.4575	402.0993	388.3541	370.2261	354.9273	342.4617	343.6195	353.3363	367.6874	388.6767	402.5972	(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	2.1000	10.6334	0.7600	0.7000	0.7700	8.2326	(74)
South	4.2000	46.7521	0.7600	0.7000	0.7700	72.3927	(78)

Solar gains	80.6253	134.2935	177.7592	213.6330	235.7173	233.1028	225.0660	208.2925	189.9066	146.6067	95.9660	69.4171	(83)
Total gains	490.7759	552.7510	579.8585	601.9871	605.9434	588.0301	567.5277	551.9120	543.2429	514.2942	484.6427	472.0142	(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	2.4984	2.5030	2.5074	2.5285	2.5325	2.5513	2.5513	2.5548	2.5440	2.5325	2.5245	2.5161	
alpha	1.1666	1.1669	1.1672	1.1686	1.1688	1.1701	1.1701	1.1703	1.1696	1.1688	1.1683	1.1677	
util living area	0.6758	0.6370	0.5973	0.5372	0.4641	0.3731	0.2934	0.3092	0.4130	0.5384	0.6313	0.6852	(86)
MIT	17.5187	17.8501	18.3356	18.9829	19.6169	20.1615	20.4597	20.4240	20.0284	19.2323	18.2821	17.4490	(87)
Th 2	20.0828	20.0843	20.0858	20.0927	20.0940	20.1001	20.1001	20.1012	20.0978	20.0940	20.0914	20.0887	(88)
util rest of house	0.6621	0.6221	0.5801	0.5161	0.4368	0.3362	0.2460	0.2624	0.3773	0.5138	0.6139	0.6718	(89)
MIT 2	16.2330	16.6173	17.1840	17.9382	18.6649	19.2765	19.5912	19.5575	19.1345	18.2363	17.1347	16.1561	(90)
Living area fraction										fLA = Living area / (4) =		0.3000	(91)
MIT	16.6187	16.9872	17.5295	18.2516	18.9505	19.5420	19.8518	19.8175	19.4026	18.5351	17.4789	16.5440	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.6187	16.9872	17.5295	18.2516	18.9505	19.5420	19.8518	19.8175	19.4026	18.5351	17.4789	16.5440	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.5991	0.5621	0.5242	0.4677	0.3987	0.3114	0.2320	0.2465	0.3470	0.4655	0.5546	0.6082	(94)
Useful gains	294.0086	310.7242	303.9827	281.5428	241.5935	183.0938	131.6461	136.0651	188.5077	239.3992	268.7724	287.0873	(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	616.3184	603.6410	549.8411	462.3049	357.8697	242.1370	159.3228	167.2105	260.5462	391.6609	513.9182	613.2510	(97)
Space heating kWh	239.7985	196.8401	182.9187	130.1487	86.5095	0.0000	0.0000	0.0000	0.0000	113.2827	176.5050	242.6658	(98a)
Space heating requirement - total per year (kWh/year)												1368.6689	
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	239.7985	196.8401	182.9187	130.1487	86.5095	0.0000	0.0000	0.0000	0.0000	113.2827	176.5050	242.6658	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1368.6689	
Space heating per m2											(98c) / (4) =	27.3734	(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 %)	219.3000	(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	239.7985	196.8401	182.9187	130.1487	86.5095	0.0000	0.0000	0.0000	0.0000	113.2827	176.5050	242.6658	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	109.3472	89.7584	83.4103	59.3473	39.4480	0.0000	0.0000	0.0000	0.0000	51.6565	80.4856	110.6547	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	196.9620	174.3813	185.8566	164.9606	160.9321	146.1368	145.0947	150.2611	151.2390	167.2854	176.1926	195.0262	(64)
Efficiency of water heater												190.4000	(216)
(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(217)
Fuel for water heating, kWh/month	103.4464	91.5868	97.6138	86.6390	84.5232	76.7525	76.2052	78.9186	79.4323	87.8600	92.5381	102.4297	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	20.5610	16.4948	14.8517	10.8810	8.4048	6.8668	7.6672	9.9661	12.9449	16.9844	19.1839	21.1325	(232)

Electricity generated by PVs (Appendix M) (negative quantity)

(233a)m	-6.5797	-10.4257	-16.8246	-21.2078	-24.8776	-23.3864	-23.0918	-20.7724	-17.0240	-12.7660	-7.6104	-5.5647 (233a)

Electricity generated by wind turbines (Appendix M) (negative quantity)

(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)

Electricity generated by hydro-electric generators (Appendix M) (negative quantity)

(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)

Electricity generated by PVs (Appendix M) (negative quantity)

(233b)m	-0.9332	-2.1113	-4.5274	-7.4080	-10.4748	-11.3707	-11.2059	-9.1937	-6.4455	-3.2609	-1.3011	-0.7224 (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	624.1080 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	190.4000
Water heating fuel used	1057.9456 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	165.9391 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-259.0859 (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	1588.9068 (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	624.1080	0.1536	95.8558	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1057.9456	0.1407	148.8140	(264)
Space and water heating			244.6698	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	165.9391	0.1443	23.9501	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-190.1311	0.1325	-25.1967	
PV Unit electricity exported	-68.9548	0.1229	-8.4735	
Total			-33.6702	(269)
Total CO2, kg/year			234.9498	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			4.7000	(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	624.1080	1.5686	978.9853	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1057.9456	1.5201	1608.1931	(278)
Space and water heating			2587.1784	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	165.9391	1.5338	254.5229	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-190.1311	1.4897	-283.2320	
PV Unit electricity exported	-68.9548	0.4509	-31.0890	
Total			-314.3210	(283)
Total Primary energy kWh/year			2527.3803	(286)
Dwelling Primary energy Rate (DPER)			50.5500	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF TARGET EMISSIONS

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.0000 (1b)	x	2.5000 (2b)	=	125.0000 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	125.0000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1600	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4100	(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) =	0.3485	(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	0.4443	0.4356	0.4269	0.3834	0.3746	0.3311	0.3311	0.3224	0.3485	0.3746	0.3921	0.4095	(22b)
Effective ac	0.5987	0.5949	0.5911	0.5735	0.5702	0.5548	0.5548	0.5520	0.5607	0.5702	0.5769	0.5838	(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 Semi-glazed door			5.6000	1.0000	5.6000			(26a)
TER Opening Type (Uw = 1.20)			6.3000	1.1450	7.2137			(27)
External Wall 1	35.0000	11.9000	23.1000	0.1800	4.1580			(29a)
External Roof 1	50.0000		50.0000	0.1100	5.5000			(30)
Total net area of external elements Aum(A, m2)			85.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	22.4717			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	9.0000	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	10.0000	0.1600	1.6000
E6 Intermediate floor within a dwelling	36.0000	0.0000	0.0000
E16 Corner (normal)	15.5000	0.0900	1.3950
E18 Party wall between dwellings	15.5000	0.0600	0.9300

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.9250	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	26.3967	(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	24.6971	24.5390	24.3840	23.6560	23.5198	22.8857	22.8857	22.7683	23.1300	23.5198	23.7953	24.0834	(38)
Heat transfer coeff	51.0939	50.9357	50.7807	50.0527	49.9165	49.2825	49.2825	49.1650	49.5267	49.9165	50.1921	50.4801	(39)
Average = Sum(39)m / 12 =												50.0521	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0219	1.0187	1.0156	1.0011	0.9983	0.9856	0.9856	0.9833	0.9905	0.9983	1.0038	1.0096	(40)
HLP (average)												1.0010	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.6901	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
52.5569	51.7671	50.6162	48.4141	46.7890	44.9767	43.9465	45.0888	46.3409	48.2867	50.5361	52.3556	(42a)

Hot water usage for baths

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
22.7244	22.3869	21.9117	21.0354	20.3792	19.6517	19.2587	19.7306	20.2445	21.0230	21.9173	22.6476	(42b)

Hot water usage for other uses

	31.9383	30.7769	29.6155	28.4541	27.2927	26.1314	26.1314	27.2927	28.4541	29.6155	30.7769	31.9383 (42c)
Average daily hot water use (litres/day)												98.5597 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
	107.2197	104.9310	102.1434	97.9036	94.4609	90.7597	89.3366	92.1121	95.0395	98.9252	103.2304	106.9415 (44)
Energy conte	169.8097	149.4203	156.9906	134.0251	127.1626	111.5996	108.0448	114.0541	117.1932	134.2406	147.0706	167.4445 (45)
Energy content (annual)										Total = Sum(45)m =		1637.0557
Distribution loss (46)m = 0.15 x (45)m												
	25.4715	22.4130	23.5486	20.1038	19.0744	16.7399	16.2067	17.1081	17.5790	20.1361	22.0606	25.1167 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8381 (55)
Total storage loss												
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage												
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (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												
	219.0524	193.8975	206.2332	181.6793	176.4053	159.2538	157.2875	163.2967	164.8474	183.4833	194.7248	216.6872 (62)
WWHRS	-24.0268	-21.2495	-22.2513	-18.4249	-17.1714	-14.6937	-13.7730	-14.6462	-15.2026	-17.9222	-20.3037	-23.5819 (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												
	195.0256	172.6480	183.9820	163.2544	159.2339	144.5601	143.5145	148.6505	149.6447	165.5610	174.4211	193.1053 (64)
										Total per year (kWh/year) = Sum(64)m =		1993.6012 (64)
12Total per year (kWh/year)												1994 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000 (64a)
Heat gains from water heating, kWh/month												
	95.8559	85.2640	91.5935	82.6867	81.6757	75.2302	75.3190	77.3171	77.0901	84.0291	87.0243	95.0694 (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	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050	84.5050 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	81.5419	90.2785	81.5419	84.2599	81.5419	84.2599	81.5419	81.5419	84.2599	81.5419	84.2599	81.5419 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	147.2339	148.7618	144.9117	136.7153	126.3689	116.6447	110.1484	108.6205	112.4706	120.6670	131.0134	140.7376 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505	31.4505 (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)												
	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040	-67.6040 (71)
Water heating gains (Table 5)												
	128.8385	126.8810	123.1095	114.8427	109.7792	104.4864	101.2353	103.9208	107.0696	112.9424	120.8671	127.7815 (72)
Total internal gains												
	408.9659	417.2728	400.9146	387.1694	369.0415	353.7426	341.2770	342.4348	352.1516	366.5028	387.4920	401.4125 (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	2.1000	10.6334	0.6300	0.7000	0.7700	6.8244	(74)
South	4.2000	46.7521	0.6300	0.7000	0.7700	60.0098	(78)

Solar gains	66.8341	111.3223	147.3530	177.0905	195.3972	193.2299	186.5678	172.6635	157.4226	121.5292	79.5508	57.5431 (83)
Total gains	475.8000	528.5951	548.2677	564.2599	564.4387	546.9725	527.8449	515.0983	509.5742	488.0320	467.0428	458.9556 (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	2.4465	2.4541	2.4616	2.4974	2.5042	2.5364	2.5364	2.5425	2.5239	2.5042	2.4904	2.4762
alpha	1.1631	1.1636	1.1641	1.1665	1.1669	1.1691	1.1691	1.1695	1.1683	1.1669	1.1660	1.1651
util living area												
	0.6874	0.6524	0.6159	0.5574	0.4858	0.3926	0.3107	0.3261	0.4316	0.5551	0.6435	0.6949 (86)
MIT	16.5420	16.9623	17.6034	18.4857	19.3545	20.1179	20.5370	20.4887	19.9376	18.8506	17.5789	16.4660 (87)
Th 2	20.0651	20.0678	20.0703	20.0825	20.0847	20.0953	20.0953	20.0973	20.0912	20.0847	20.0801	20.0753 (88)
util rest of house												
	0.6736	0.6374	0.5987	0.5362	0.4580	0.3547	0.2612	0.2775	0.3950	0.5303	0.6262	0.6815 (89)
MIT 2	15.1654	15.6536	16.4034	17.4334	18.4320	19.2920	19.7360	19.6902	19.0981	17.8679	16.3908	15.0822 (90)
Living area fraction										fLA = Living area / (4) =		0.3000 (91)

MIT	15.5784	16.0462	16.7634	17.7491	18.7088	19.5398	19.9763	19.9298	19.3499	18.1627	16.7472	15.4973 (92)
Temperature adjustment												0.0000
adjusted MIT	15.5784	16.0462	16.7634	17.7491	18.7088	19.5398	19.9763	19.9298	19.3499	18.1627	16.7472	15.4973 (93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.5887	0.5570	0.5243	0.4732	0.4109	0.3292	0.2543	0.2678	0.3619	0.4693	0.5480	0.5959	(94)
Useful gains	280.1272	294.4132	287.4423	266.9947	231.9039	180.0592	134.2148	137.9400	184.4155	229.0463	255.9550	273.5140	(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													
	576.2548	567.7415	521.1833	442.9222	349.8534	243.4434	166.3937	173.5410	260.0109	377.5057	484.2142	570.2910	(97)
Space heating kWh													
	220.3189	183.6766	173.9033	126.6678	87.7544	0.0000	0.0000	0.0000	0.0000	110.4538	164.3466	220.8020	(98a)
Space heating requirement - total per year (kWh/year)												1287.9235	
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													
	220.3189	183.6766	173.9033	126.6678	87.7544	0.0000	0.0000	0.0000	0.0000	110.4538	164.3466	220.8020	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1287.9235	
Space heating per m2											(98c) / (4) =	25.7585	(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													
	220.3189	183.6766	173.9033	126.6678	87.7544	0.0000	0.0000	0.0000	0.0000	110.4538	164.3466	220.8020	(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)													
	238.6987	198.9996	188.4109	137.2349	95.0752	0.0000	0.0000	0.0000	0.0000	119.6682	178.0570	239.2221	(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													
	195.0256	172.6480	183.9820	163.2544	159.2339	144.5601	143.5145	148.6505	149.6447	165.5610	174.4211	193.1053	(64)
Efficiency of water heater												79.8000	(216)
(217)m	84.3339	84.1989	83.9336	83.4973	82.7809	79.8000	79.8000	79.8000	79.8000	83.1734	83.9266	84.3611	(217)
Fuel for water heating, kWh/month													
	231.2540	205.0478	219.1994	195.5205	192.3557	181.1531	179.8428	186.2789	187.5247	199.0554	207.8258	228.9032	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	16.9428	13.5921	12.2382	8.9662	6.9258	5.6584	6.3179	8.2123	10.6669	13.9956	15.8080	17.4137	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-13.5587	-20.1733	-30.5869	-36.3482	-40.9391	-38.8766	-38.4309	-35.4294	-30.4165	-23.9460	-15.2869	-11.6040	(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	-4.7438	-10.2148	-20.7430	-31.8022	-42.6777	-43.0901	-42.5552	-35.7179	-25.7908	-14.7874	-6.3926	-3.7320	(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												1395.3668	(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												2413.9613	(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)												136.7380	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-617.8438	(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	3414.2222 (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	1395.3668	0.2100	293.0270	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2413.9613	0.2100	506.9319	(264)
Space and water heating			799.9589	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	136.7380	0.1443	19.7355	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-335.5964	0.1335	-44.7857	
PV Unit electricity exported	-282.2475	0.1253	-35.3694	
Total			-80.1551	(269)
Total CO2, kg/year			751.4686	(272)
Target Carbon Dioxide Emission Rate (TER)			15.0300	(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	1395.3668	1.1300	1576.7644	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2413.9613	1.1300	2727.7762	(278)
Space and water heating			4304.5407	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	136.7380	1.5338	209.7333	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-335.5964	1.4931	-501.0949	
PV Unit electricity exported	-282.2475	0.4600	-129.8224	
Total			-630.9173	(283)
Total Primary energy kWh/year			4013.4575	(286)
Target Primary Energy Rate (TPER)			80.2700	(287)

;

Full SAP Calculation Printout

elmhurst energy

Property Reference	Plot 29 2A_Be Green	Issued on Date	12/10/2022
Assessment Reference	Be Green	Prop Type Ref	2A
Property	2A, House No. 29, Claygate, Surrey, Elmbridge, KT 10		

SAP Rating	81 B	DER	4.68	TER	11.94
Environmental	96 A	% DER<TER	60.80		
CO_2 Emissions (t/year)	0.34	DFEE	39.81	TFEE	38.72
Compliance Check	See BREL	% DFEE < TFEE	-2.81		
% DPER < TPER	20.54	DPER	49.55	TPER	62.36

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

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

---

1. Overall dwelling characteristics

			Area (m2)		Storey height (m)		Volume (m3)	
Ground floor			39.5500 (1b)	x	2.5000 (2b)	=	98.8750 (1b)	-
First floor			39.5500 (1c)	x	2.7500 (2c)	=	108.7625 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000							(4)
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6375	(5)

---

2. Ventilation rate

---

		m3 per hour		
Number of open chimneys		0 * 80	=	0.0000 (6a)
Number of open flues		0 * 20	=	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10	=	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20	=	0.0000 (6d)
Number of flues attached to other heater		0 * 35	=	0.0000 (6e)
Number of blocked chimneys		0 * 20	=	0.0000 (6f)
Number of intermittent extract fans		2 * 10	=	20.0000 (7a)
Number of passive vents		0 * 10	=	0.0000 (7b)
Number of flueless gas fires		0 * 40	=	0.0000 (7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		20.0000 / (5)	=	0.0963 (8)
Pressure test		Yes		
Pressure Test Method		Blower Door		
Measured/design AP50		3.0000		(17)
Infiltration rate		0.2463		(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)	0.2094		(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	0.2670	0.2617	0.2565	0.2303	0.2251	0.1989	0.1989	0.1937	0.2094	0.2251	0.2355	0.2460	(22b)
Effective ac	0.5356	0.5342	0.5329	0.5265	0.5253	0.5198	0.5198	0.5188	0.5219	0.5253	0.5277	0.5303	(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	
Window (Uw = 1.20)			16.8000	1.1450	19.2366			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			39.5500	0.1200	4.7460	0.0000	0.0000	(28a)
External Wall 1	112.0000	22.0000	90.0000	0.1400	12.6000	0.0000	0.0000	(29a)
External Roof 1	65.0000		65.0000	0.1132	7.3585	9.0000	585.0000	(30)
Total net area of external elements Aum(A, m2)			216.5500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.1411			(33)

Heat capacity Cm = Sum(A x k)									(28)...(30) + (32) + (32a)...(32e) =			585.0000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												7.3957	(35)
Thermal bridges (User defined value 0.050 * total exposed area)												10.8275	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss										(33) + (36) + (36a) =		59.9686	(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	36.7017	36.6069	36.5139	36.0775	35.9958	35.6156	35.6156	35.5452	35.7621	35.9958	36.1610	36.3337	(38)
Heat transfer coeff													
	96.6703	96.5755	96.4826	96.0461	95.9644	95.5843	95.5843	95.5139	95.7307	95.9644	96.1296	96.3023	(39)
Average = Sum(39)m / 12 =												96.0457	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2221	1.2209	1.2198	1.2142	1.2132	1.2084	1.2084	1.2075	1.2102	1.2132	1.2153	1.2175	(40)
HLP (average)												1.2142	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4456	(42)
Hot water usage for mixer showers													
	65.2237	64.2436	62.8152	60.0824	58.0656	55.8166	54.5382	55.9557	57.5095	59.9244	62.7159	64.9738	(42a)
Hot water usage for baths													
	28.1716	27.7532	27.1640	26.0777	25.2642	24.3623	23.8751	24.4601	25.0971	26.0623	27.1710	28.0763	(42b)
Hot water usage for other uses													
	39.6750	38.2323	36.7896	35.3468	33.9041	32.4614	32.4614	33.9041	35.3468	36.7896	38.2323	39.6750	(42c)
Average daily hot water use (litres/day)												122.3218	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	133.0703	130.2290	126.7688	121.5069	117.2340	112.6402	110.8746	114.3199	117.9535	122.7762	128.1192	132.7252	(44)
Energy conte	210.7509	185.4444	194.8389	166.3369	157.8194	138.5042	134.0932	141.5519	145.4485	166.6061	182.5293	207.8156	(45)
Energy content (annual)											Total = Sum(45)m =	2031.7393	
Distribution loss (46)m = 0.15 x (45)m													
	31.6126	27.8167	29.2258	24.9505	23.6729	20.7756	20.1140	21.2328	21.8173	24.9909	27.3794	31.1723	(46)
Water storage loss:													
Store volume												180.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.8736	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.8736	(55)
Total storage loss													
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)
If cylinder contains dedicated solar storage													
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(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													
	261.0953	230.9168	245.1834	215.0573	208.1639	187.2247	184.4377	191.8964	194.1689	216.9506	231.2497	258.1600	(62)
WWHRS	-28.7818	-25.4549	-26.6549	-22.0713	-20.5697	-17.6016	-16.4987	-17.5447	-18.2113	-21.4691	-24.3219	-28.2488	(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													
	232.3135	205.4619	218.5285	192.9860	187.5942	169.6231	167.9390	174.3516	175.9576	195.4815	206.9278	229.9112	(64)
										Total per year (kWh/year) = Sum(64)m =		2357.0758	(64)
12Total per year (kWh/year)												2357	(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													
	110.3502	98.0382	105.0595	94.2833	92.7505	85.0290	84.8615	87.3416	87.3380	95.6721	99.6673	109.3742	(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	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	109.9477	121.7278	109.9477	113.6126	109.9477	113.6126	109.9477	109.9477	113.6126	109.9477	113.6126	109.9477	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(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)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	148.3202	145.8901	141.2090	130.9491	124.6647	118.0958	114.0612	117.3946	121.3027	128.5915	138.4268	147.0084	(72)
Total internal gains													
	538.5006	550.1082	527.9581	509.2524	484.0154	463.7433	446.4449	447.5208	460.7826	479.5172	508.3051	527.5899	(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	5.2000	10.6334	0.7600	0.7000	0.7700	20.3854 (74)
South	9.5000	46.7521	0.7600	0.7000	0.7700	163.7455 (78)
West	2.1000	19.6403	0.7600	0.7000	0.7700	15.2059 (80)

Solar gains	199.3368	336.8764	456.7905	563.8643	633.1242	630.1580	606.8000	554.2669	493.4127	370.9196	238.2022	170.9900 (83)
Total gains	737.8374	886.9846	984.7486	1073.1167	1117.1396	1093.9013	1053.2449	1001.7876	954.1953	850.4368	746.5073	698.5800 (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	1.6810	1.6826	1.6842	1.6919	1.6933	1.7001	1.7001	1.7013	1.6975	1.6933	1.6904	1.6874	
alpha	1.1121	1.1122	1.1123	1.1128	1.1129	1.1133	1.1133	1.1134	1.1132	1.1129	1.1127	1.1125	
util living area	0.7189	0.6687	0.6174	0.5476	0.4676	0.3767	0.2985	0.3193	0.4304	0.5686	0.6737	0.7312	(86)
MIT	17.0724	17.4872	18.0692	18.8027	19.5050	20.0895	20.4126	20.3664	19.9172	19.0078	17.9145	16.9794	(87)
Th 2	19.9023	19.9033	19.9042	19.9086	19.9095	19.9133	19.9133	19.9140	19.9118	19.9095	19.9078	19.9060	(88)
util rest of house	0.7040	0.6518	0.5975	0.5228	0.4352	0.3323	0.2408	0.2618	0.3870	0.5397	0.6543	0.7167	(89)
MIT 2	15.6190	16.0966	16.7702	17.6156	18.4119	19.0580	19.3919	19.3504	18.8818	17.8683	16.6087	15.5141	(90)
Living area fraction									fLA = Living area / (4) =			0.2528	(91)
MIT	15.9865	16.4482	17.0987	17.9157	18.6883	19.3188	19.6500	19.6073	19.1436	18.1564	16.9388	15.8846	(92)
Temperature adjustment												0.0000	
adjusted MIT	15.9865	16.4482	17.0987	17.9157	18.6883	19.3188	19.6500	19.6073	19.1436	18.1564	16.9388	15.8846	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6360	0.5863	0.5365	0.4702	0.3942	0.3055	0.2255	0.2440	0.3525	0.4847	0.5884	0.6485	(94)
Useful gains	469.2374	520.0436	528.3151	504.5930	440.4062	334.2289	237.5013	244.4237	336.3780	412.2190	439.2356	453.0168	(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	1129.7329	1115.2776	1022.5870	865.9267	670.6290	451.0445	291.5324	306.3380	482.8297	725.1459	945.8040	1125.2568	(97)
Space heating kWh	491.4086	399.9973	367.7383	260.1603	171.2858	0.0000	0.0000	0.0000	0.0000	232.8176	364.7292	500.1466	(98a)
Space heating requirement - total per year (kWh/year)												2788.2837	
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	491.4086	399.9973	367.7383	260.1603	171.2858	0.0000	0.0000	0.0000	0.0000	232.8176	364.7292	500.1466	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2788.2837	
Space heating per m2										(98c) / (4) =		35.2501	(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 %)	219.3000 (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	491.4086	399.9973	367.7383	260.1603	171.2858	0.0000	0.0000	0.0000	0.0000	232.8176	364.7292	500.1466	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	224.0805	182.3973	167.6873	118.6321	78.1057	0.0000	0.0000	0.0000	0.0000	106.1640	166.3152	228.0650	(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	232.3135	205.4619	218.5285	192.9860	187.5942	169.6231	167.9390	174.3516	175.9576	195.4815	206.9278	229.9112	(64)
Efficiency of water heater												190.4000	(216)
(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(217)
Fuel for water heating, kWh/month	122.0134	107.9107	114.7734	101.3582	98.5264	89.0877	88.2032	91.5712	92.4147	102.6688	108.6806	120.7517	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	29.5849	23.7341	21.3699	15.6565	12.0935	9.8805	11.0321	14.3400	18.6262	24.4386	27.6034	30.4071	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-6.7545	-10.8045	-17.5929	-22.3786	-26.3924	-24.7200	-24.3980	-21.8553	-17.8041	-13.2917	-7.8436	-5.7017	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-0.7585	-1.7325	-3.7590	-6.2372	-8.9600	-10.0371	-9.8997	-8.1108	-5.6654	-2.7351	-1.0678	-0.5853	(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	1271.4472	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	190.4000	
Water heating fuel used	1237.9600	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	238.7670	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-259.0859	(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	2489.0883	(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	1271.4472	0.1537	195.3657	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1237.9600	0.1408	174.2818	(264)
Space and water heating			369.6475	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	238.7670	0.1443	34.4615	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-199.5375	0.1324	-26.4213	
PV Unit electricity exported	-59.5484	0.1221	-7.2712	
Total			-33.6925	(269)
Total CO2, kg/year			370.4165	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			4.6800	(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	1271.4472	1.5689	1994.7260	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1237.9600	1.5206	1882.3835	(278)
Space and water heating			3877.1095	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	238.7670	1.5338	366.2288	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-199.5375	1.4893	-297.1619	
PV Unit electricity exported	-59.5484	0.4479	-26.6735	
Total			-323.8354	(283)
Total Primary energy kWh/year			3919.5029	(286)
Dwelling Primary energy Rate (DPER)			49.5500	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF TARGET EMISSIONS

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5500 (1b)	x	2.5000 (2b)	=	98.8750 (1b)	-
First floor	39.5500 (1c)	x	2.7500 (2c)	=	108.7625 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.1000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	207.6375	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1445	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3945	(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) =	0.3353	(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	0.4275	0.4191	0.4108	0.3688	0.3605	0.3185	0.3185	0.3102	0.3353	0.3605	0.3772	0.3940	(22b)
Effective ac	0.5914	0.5878	0.5844	0.5680	0.5650	0.5507	0.5507	0.5481	0.5562	0.5650	0.5711	0.5776	(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			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			14.5700	1.1450	16.6832			(27)
Heatloss Floor 1			39.5500	0.1300	5.1415			(28a)
External Wall 1	112.0000	19.7700	92.2300	0.1800	16.6014			(29a)
External Roof 1	65.0000		65.0000	0.1100	7.1500			(30)
Total net area of external elements Aum(A, m2)			216.5500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.7761			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K				7.3957 (35)
List of Thermal Bridges				
K1 Element	Length	Psi-value	Total	
E5 Ground floor (normal)	10.0000	0.1600	1.6000	
E6 Intermediate floor within a dwelling	36.0000	0.0000	0.0000	
E16 Corner (normal)	15.5000	0.0900	1.3950	
E18 Party wall between dwellings	15.5000	0.0600	0.9300	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				3.9250 (36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	54.7011	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.5221	40.2789	40.0406	38.9211	38.7116	37.7366	37.7366	37.5560	38.1122	38.7116	39.1353	39.5783	(38)
Heat transfer coeff	95.2232	94.9800	94.7417	93.6222	93.4127	92.4377	92.4377	92.2571	92.8133	93.4127	93.8364	94.2794	(39)
Average = Sum(39)m / 12 =												93.6212	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2038	1.2008	1.1977	1.1836	1.1809	1.1686	1.1686	1.1663	1.1734	1.1809	1.1863	1.1919	(40)
HLP (average)												1.1836	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4456 (42)
Hot water usage for mixer showers		

	65.2237	64.2436	62.8152	60.0824	58.0656	55.8166	54.5382	55.9557	57.5095	59.9244	62.7159	64.9738 (42a)
Hot water usage for baths												
	28.1716	27.7532	27.1640	26.0777	25.2642	24.3623	23.8751	24.4601	25.0971	26.0623	27.1710	28.0763 (42b)
Hot water usage for other uses												
	39.6750	38.2323	36.7896	35.3468	33.9041	32.4614	32.4614	33.9041	35.3468	36.7896	38.2323	39.6750 (42c)
Average daily hot water use (litres/day)												122.3218 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	133.0703	130.2290	126.7688	121.5069	117.2340	112.6402	110.8746	114.3199	117.9535	122.7762	128.1192	132.7252	(44)
Energy conte	210.7509	185.4444	194.8389	166.3369	157.8194	138.5042	134.0932	141.5519	145.4485	166.6061	182.5293	207.8156	(45)
Energy content (annual)										Total = Sum(45)m =		2031.7393	
Distribution loss (46)m = 0.15 x (45)m													
	31.6126	27.8167	29.2258	24.9505	23.6729	20.7756	20.1140	21.2328	21.8173	24.9909	27.3794	31.1723	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8381	(55)
Total storage loss													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(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													
	259.9935	229.9216	244.0816	213.9911	207.0621	186.1584	183.3359	190.7946	193.1027	215.8488	230.1835	257.0582	(62)
WWHRS	-29.8176	-26.3709	-27.6141	-22.8656	-21.3099	-18.2350	-17.0924	-18.1761	-18.8667	-22.2417	-25.1971	-29.2654	(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													
	230.1760	203.5507	216.4675	191.1255	185.7522	167.9234	166.2435	172.6185	174.2360	193.6071	204.9863	227.7928	(64)
										Total per year (kWh/year) = Sum(64)m =		2334.4796	(64)
12Total per year (kWh/year)												2334	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Heat gains from water heating, kWh/month													
	109.4688	97.2421	104.1781	93.4304	91.8691	84.1760	83.9801	86.4601	86.4850	94.7907	98.8143	108.4928	(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	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	122.2781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	111.6732	123.6381	111.6732	115.3956	111.6732	115.3956	111.6732	111.6732	115.3956	111.6732	115.3956	111.6732	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.5493	219.8067	214.1180	202.0072	186.7196	172.3514	162.7525	160.4951	166.1838	178.2946	193.5822	207.9504	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	35.2278	(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)													
	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	-97.8225	(71)
Water heating gains (Table 5)													
	147.1355	144.7054	140.0243	129.7644	123.4800	116.9111	112.8765	116.2099	120.1180	127.4068	137.2421	145.8237	(72)
Total internal gains													
	539.0413	550.8338	528.4989	509.8507	484.5562	464.3416	446.9857	448.0615	461.3809	480.0580	508.9034	528.1307	(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	4.5100	10.6334	0.6300	0.7000	0.7700	14.6562	(74)
South	8.2400	46.7521	0.6300	0.7000	0.7700	117.7334	(78)
West	1.8200	19.6403	0.6300	0.7000	0.7700	10.9242	(80)

Solar gains	143.3138	242.1958	328.4018	405.3731	455.1599	453.0255	436.2341	398.4711	354.7280	266.6694	171.2558	122.9342	(83)
Total gains	682.3552	793.0296	856.9006	915.2237	939.7161	917.3670	883.2197	846.5326	816.1089	746.7273	680.1591	651.0649	(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	1.7065	1.7109	1.7152	1.7357	1.7396	1.7579	1.7579	1.7614	1.7508	1.7396	1.7317	1.7236	
alpha	1.1138	1.1141	1.1143	1.1157	1.1160	1.1172	1.1172	1.1174	1.1167	1.1160	1.1154	1.1149	
util living area													
	0.7328	0.6913	0.6478	0.5831	0.5067	0.4130	0.3309	0.3509	0.4637	0.5960	0.6905	0.7421	(86)
MIT	15.9562	16.4505	17.1940	18.1826	19.1498	19.9874	20.4553	20.3927	19.7576	18.5191	17.0834	15.8584	(87)

Th 2	19.9169	19.9194	19.9218	19.9331	19.9353	19.9452	19.9452	19.9470	19.9414	19.9353	19.9310	19.9265	(88)
util rest of house	0.7185	0.6753	0.6288	0.5591	0.4746	0.3681	0.2711	0.2919	0.4205	0.5681	0.6719	0.7283	(89)
MIT 2	14.4328	15.0050	15.8705	17.0182	18.1235	19.0597	19.5501	19.4926	18.8192	17.4254	15.7623	14.3242	(90)
Living area fraction										fLA = Living area / (4) =		0.2528	(91)
MIT	14.8180	15.3705	16.2051	17.3126	18.3830	19.2943	19.7790	19.7202	19.0564	17.7019	16.0964	14.7121	(92)
Temperature adjustment												0.0000	
adjusted MIT	14.8180	15.3705	16.2051	17.3126	18.3830	19.2943	19.7790	19.7202	19.0564	17.7019	16.0964	14.7121	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6259	0.5861	0.5456	0.4877	0.4204	0.3372	0.2608	0.2779	0.3792	0.4962	0.5838	0.6353	(94)
Useful gains	427.1084	464.7826	467.5095	446.3725	395.0247	309.3069	230.3305	235.2856	309.4644	370.5085	397.0532	413.5988	(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	1001.5535	994.4895	919.4811	787.6085	624.2750	433.9284	293.8590	306.3108	460.0237	663.4117	844.1860	991.0726	(97)
Space heating kWh	427.3871	355.9630	336.2669	245.6899	170.5622	0.0000	0.0000	0.0000	0.0000	217.9200	321.9357	429.6405	(98a)
Space heating requirement - total per year (kWh/year)												2505.3653	
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	427.3871	355.9630	336.2669	245.6899	170.5622	0.0000	0.0000	0.0000	0.0000	217.9200	321.9357	429.6405	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2505.3653	
Space heating per m2											(98c) / (4) =	31.6734	(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	427.3871	355.9630	336.2669	245.6899	170.5622	0.0000	0.0000	0.0000	0.0000	217.9200	321.9357	429.6405	(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)	463.0413	385.6588	364.3195	266.1862	184.7911	0.0000	0.0000	0.0000	0.0000	236.0997	348.7927	465.4827	(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	230.1760	203.5507	216.4675	191.1255	185.7522	167.9234	166.2435	172.6185	174.2360	193.6071	204.9863	227.7928	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.4274	85.3001	85.0437	84.6241	83.8689	79.8000	79.8000	79.8000	79.8000	84.3257	85.0676	85.4604	(217)
Fuel for water heating, kWh/month	269.4403	238.6289	254.5367	225.8524	221.4792	210.4304	208.3252	216.3139	218.3409	229.5944	240.9686	266.5478	(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	23.2035	18.6147	16.7605	12.2794	9.4850	7.7493	8.6525	11.2469	14.6086	19.1673	21.6494	23.8484	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-36.8783	-51.9288	-74.5586	-83.7383	-90.2216	-84.1847	-83.1364	-78.5133	-70.3535	-59.3237	-40.5177	-31.8902	(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	-21.0307	-44.2191	-87.8492	-131.8895	-174.3420	-175.1578	-173.1036	-146.5967	-107.4864	-63.2290	-28.0761	-16.6329	(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	2714.3720 (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	2800.4586 (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)	187.2653 (232)

Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1954.8578 (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	3833.2381 (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	2714.3720	0.2100	570.0181	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2800.4586	0.2100	588.0963	(264)
Space and water heating			1158.1144	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	187.2653	0.1443	27.0282	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-785.2451	0.1346	-105.7023	
PV Unit electricity exported	-1169.6127	0.1259	-147.2628	
Total			-252.9651	(269)
Total CO2, kg/year			944.1067	(272)
Target Carbon Dioxide Emission Rate (TER)			11.9400	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2714.3720	1.1300	3067.2403	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2800.4586	1.1300	3164.5182	(278)
Space and water heating			6231.7585	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	187.2653	1.5338	287.2338	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-785.2451	1.4975	-1175.9039	
PV Unit electricity exported	-1169.6127	0.4622	-540.5564	
Total			-1716.4604	(283)
Total Primary energy kWh/year			4932.6328	(286)
Target Primary Energy Rate (TPER)			62.3600	(287)

;

Full SAP Calculation Printout

Property Reference	Plot 37 4B_Be Green	Issued on Date	12/10/2022
Assessment Reference	Be Green	Prop Type Ref	4B
Property	4B, House No. 37, Claygate, Surrey, Elmbridge, KT 10		

SAP Rating	83 B	DER	3.56	TER	8.41
Environmental	96 A	% DER<TER	57.67		
CO_2 Emissions (t/year)	0.45	DFEE	35.81	TFEE	35.40
Compliance Check	See BREL	% DFEE < TFEE	-1.15		
% DPER < TPER	13.67	DPER	37.81	TPER	43.80

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

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

---

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		69.7000 (1b)	x	2.5000 (2b)	=	174.2500 (1b)	-
First floor		69.7000 (1c)	x	2.7500 (2c)	=	191.6750 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	139.4000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	365.9250	(5)

---

2. Ventilation rate

---

			m3 per hour	
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		2 * 10 =	20.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		20.0000 / (5) =	0.0547	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			3.0000	(17)
Infiltration rate			0.2047	(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) =	0.1740	(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	0.2218	0.2174	0.2131	0.1914	0.1870	0.1653	0.1653	0.1609	0.1740	0.1870	0.1957	0.2044	(22b)
Effective ac	0.5246	0.5236	0.5227	0.5183	0.5175	0.5137	0.5137	0.5129	0.5151	0.5175	0.5191	0.5209	(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	
Window (Uw = 1.20)			22.5500	1.1450	25.8206			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			69.7000	0.1200	8.3640	0.0000	0.0000	(28a)
External Wall 1	178.0000	27.7500	150.2500	0.1400	21.0350	0.0000	0.0000	(29a)
External Roof 1	70.0000		70.0000	0.1132	7.9245	9.0000	630.0000	(30)
Total net area of external elements Aum(A, m2)			317.7000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.3441			(33)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 630.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 4.5194 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 15.8850 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 84.2291 (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	63.3478	63.2325	63.1194	62.5884	62.4891	62.0266	62.0266	61.9409	62.2047	62.4891	62.6901	62.9002	(38)
Heat transfer coeff	147.5769	147.4616	147.3486	146.8176	146.7182	146.2557	146.2557	146.1701	146.4339	146.7182	146.9192	147.1293	(39)

Average = Sum(39)m / 12 = 146.8171

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0587	1.0578	1.0570	1.0532	1.0525	1.0492	1.0492	1.0486	1.0505	1.0525	1.0539	1.0554	(40)
HLP (average)												1.0532	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9159 (42)

Hot water usage for mixer showers	73.1105	72.0118	70.4107	67.3474	65.0868	62.5658	61.1328	62.7217	64.4635	67.1703	70.2994	72.8304 (42a)
Hot water usage for baths	31.5631	31.0944	30.4343	29.2171	28.3058	27.2952	26.7494	27.4048	28.1186	29.1999	30.4421	31.4564 (42b)
Hot water usage for other uses	44.4921	42.8742	41.2563	39.6384	38.0205	36.4026	36.4026	38.0205	39.6384	41.2563	42.8742	44.4921 (42c)

Average daily hot water use (litres/day) 137.1167 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.1657	145.9803	142.1013	136.2030	131.4131	126.2636	124.2848	128.1471	132.2204	137.6265	143.6157	148.7789	(44)
Energy conte	236.2420	207.8740	218.4044	186.4551	176.9073	155.2558	150.3117	158.6729	163.0410	186.7579	204.6068	232.9517	(45)

Energy content (annual) Total = Sum(45)m = 2277.4806

Distribution loss (46)m = 0.15 x (45)m	35.4363	31.1811	32.7607	27.9683	26.5361	23.2884	22.5468	23.8009	24.4562	28.0137	30.6910	34.9428 (46)

Water storage loss:
Store volume 180.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 0.8736 (55)
Total storage loss

	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (56)

If cylinder contains dedicated solar storage

	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)

Total heat required for water heating calculated for each month

	286.5864	253.3464	268.7488	235.1755	227.2517	203.9763	200.6561	209.0173	211.7615	237.1023	253.3273	283.2962 (62)
WWHRS	-32.2621	-28.5328	-29.8779	-24.7401	-23.0569	-19.7299	-18.4937	-19.6662	-20.4134	-24.0651	-27.2628	-31.6646 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)

Output from w/h

	254.3243	224.8136	238.8709	210.4354	204.1948	184.2463	182.1624	189.3511	191.3481	213.0372	226.0644	251.6316 (64)

Total per year (kWh/year) = Sum(64)m = 2570.4801 (64)
12Total per year (kWh/year) 2570 (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

	118.8260	105.4960	112.8950	100.9726	99.0972	90.5989	90.2542	93.0343	93.1875	102.3725	107.0081	117.7320 (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	145.7967	145.7967	145.7967	145.7967	145.7967	145.7967	145.7967	145.7967	145.7967	145.7967	145.7967	145.7967	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	162.1088	179.4776	162.1088	167.5124	162.1088	167.5124	162.1088	162.1088	167.5124	162.1088	167.5124	162.1088	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	308.7288	311.9325	303.8594	286.6728	264.9778	244.5875	230.9656	227.7620	235.8350	253.0216	274.7166	295.1069	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5797	37.5797	37.5797	37.5797	37.5797	37.5797	37.5797	37.5797	37.5797	37.5797	37.5797	37.5797	(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)	-116.6374	-116.6374	-116.6374	-116.6374	-116.6374	-116.6374	-116.6374	-116.6374	-116.6374	-116.6374	-116.6374	-116.6374	(71)
Water heating gains (Table 5)	159.7124	156.9881	151.7406	140.2398	133.1952	125.8318	121.3094	125.0461	129.4271	137.5975	148.6224	158.2419	(72)
Total internal gains	700.2890	718.1372	687.4478	664.1640	630.0208	604.6708	581.1228	581.6559	599.5135	622.4670	660.5905	685.1966	(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	3.2500	10.6334	0.7600	0.7000	0.7700	12.7409	(74)
East	9.5000	19.6403	0.7600	0.7000	0.7700	68.7885	(76)
South	4.6000	46.7521	0.7600	0.7000	0.7700	79.2873	(78)
West	5.2000	19.6403	0.7600	0.7000	0.7700	37.6526	(80)

Solar gains	198.4693	362.4221	549.6937	753.5203	897.2453	910.7399	869.9876	761.9797	621.3536	416.1137	242.4196	166.6650 (83)
Total gains	898.7583	1080.5593	1237.1415	1417.6843	1527.2660	1515.4107	1451.1104	1343.6355	1220.8671	1038.5807	903.0100	851.8616 (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	1.1858	1.1867	1.1877	1.1920	1.1928	1.1965	1.1965	1.1972	1.1951	1.1928	1.1911	1.1894	
alpha	1.0791	1.0791	1.0792	1.0795	1.0795	1.0798	1.0798	1.0798	1.0797	1.0795	1.0794	1.0793	
util living area	0.7561	0.7107	0.6562	0.5772	0.4899	0.3959	0.3177	0.3453	0.4701	0.6172	0.7169	0.7670	(86)
MIT	16.7314	17.1337	17.7698	18.5944	19.3722	20.0086	20.3598	20.3002	19.7802	18.7600	17.6020	16.6434	(87)
Th 2	20.0347	20.0354	20.0361	20.0392	20.0398	20.0426	20.0426	20.0431	20.0415	20.0398	20.0386	20.0374	(88)
util rest of house	0.7444	0.6972	0.6397	0.5561	0.4617	0.3567	0.2657	0.2932	0.4317	0.5930	0.7014	0.7557	(89)
MIT 2	15.3233	15.7903	16.5303	17.4843	18.3724	19.0845	19.4580	19.4023	18.8473	17.6944	16.3494	15.2229	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	15.6753	16.1262	16.8402	17.7618	18.6223	19.3155	19.6835	19.6268	19.0805	17.9608	16.6625	15.5780	(92)
Temperature adjustment												0.0000	
adjusted MIT	15.6753	16.1262	16.8402	17.7618	18.6223	19.3155	19.6835	19.6268	19.0805	17.9608	16.6625	15.5780	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6744	0.6273	0.5727	0.4968	0.4142	0.3235	0.2443	0.2681	0.3876	0.5293	0.6312	0.6861	(94)
Useful gains	606.1351	677.8832	708.5544	704.3301	632.6303	490.2662	354.4875	360.1876	473.2544	549.6738	569.9667	584.4297	(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	1678.7343	1655.4296	1523.6078	1301.0728	1015.6326	689.6718	450.9765	471.6553	729.3162	1079.9662	1404.9213	1674.0361	(97)
Space heating kWh	798.0138	656.9112	606.3997	429.6547	284.9537	0.0000	0.0000	0.0000	0.0000	394.5375	601.1673	810.6672	(98a)
Space heating requirement - total per year (kWh/year)												4582.3050	
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	798.0138	656.9112	606.3997	429.6547	284.9537	0.0000	0.0000	0.0000	0.0000	394.5375	601.1673	810.6672	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4582.3050	
Space heating per m2											(98c) / (4) =	32.8716	(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 %)	219.3000	(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	798.0138	656.9112	606.3997	429.6547	284.9537	0.0000	0.0000	0.0000	0.0000	394.5375	601.1673	810.6672	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	363.8914	299.5491	276.5160	195.9210	129.9379	0.0000	0.0000	0.0000	0.0000	179.9077	274.1301	369.6613	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	254.3243	224.8136	238.8709	210.4354	204.1948	184.2463	182.1624	189.3511	191.3481	213.0372	226.0644	251.6316	(64)
Efficiency of water heater												190.4000	(216)
(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(217)
Fuel for water heating, kWh/month	133.5737	118.0744	125.4574	110.5228	107.2452	96.7680	95.6736	99.4491	100.4979	111.8893	118.7313	132.1594	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	45.6601	36.6303	32.9815	24.1637	18.6647	15.2492	17.0266	22.1318	28.7470	37.7176	42.6019	46.9292	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-13.2398	-21.0091	-33.8916	-42.6022	-49.6280	-45.4962	-44.8978	-40.4626	-33.2978	-25.6112	-15.3082	-11.1951	(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	-1.7861	-4.0649	-8.8122	-14.6294	-21.0769	-24.0179	-23.6977	-19.4696	-13.6411	-6.4426	-2.5147	-1.3790	(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	2089.5144	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	190.4000	
Water heating fuel used	1350.0421	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	368.5036	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-518.1718	(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	3289.8882	(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	2089.5144	0.1535	320.8335	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1350.0421	0.1408	190.1389	(264)
Space and water heating			510.9723	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	368.5036	0.1443	53.1865	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-376.6397	0.1328	-50.0048	
PV Unit electricity exported	-141.5321	0.1218	-17.2448	
Total			-67.2496	(269)
Total CO2, kg/year			496.9092	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			3.5600	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2089.5144	1.5685	3277.3020	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1350.0421	1.5208	2053.1023	(278)
Space and water heating			5330.4043	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	368.5036	1.5338	565.2231	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-376.6397	1.4906	-561.4126	
PV Unit electricity exported	-141.5321	0.4469	-63.2553	
Total			-624.6678	(283)
Total Primary energy kWh/year			5270.9596	(286)
Dwelling Primary energy Rate (DPER)			37.8100	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF TARGET EMISSIONS

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	69.7000 (1b)	x	2.5000 (2b)	=	174.2500 (1b)	-
First floor	69.7000 (1c)	x	2.7500 (2c)	=	191.6750 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	139.4000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	365.9250	(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) =	0.1093	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3593	(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) =	0.3054	(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	0.3894	0.3818	0.3741	0.3360	0.3283	0.2901	0.2901	0.2825	0.3054	0.3283	0.3436	0.3589	(22b)
Effective ac	0.5758	0.5729	0.5700	0.5564	0.5539	0.5421	0.5421	0.5399	0.5466	0.5539	0.5590	0.5644	(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			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			22.5500	1.1450	25.8206			(27)
Heatloss Floor 1			69.7000	0.1300	9.0610			(28a)
External Wall 1	178.0000	27.7500	150.2500	0.1800	27.0450			(29a)
External Roof 1	70.0000		70.0000	0.1100	7.7000			(30)
Total net area of external elements Aum(A, m2)			317.7000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.8266			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							4.5194	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	10.0000	0.1600	1.6000
E6 Intermediate floor within a dwelling	36.0000	0.0000	0.0000
E16 Corner (normal)	15.5000	0.0900	1.3950
E18 Party wall between dwellings	15.5000	0.0600	0.9300

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.9250	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	78.7516	(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	69.5330	69.1775	68.8290	67.1923	66.8860	65.4604	65.4604	65.1964	66.0096	66.8860	67.5055	68.1532	(38)
Heat transfer coeff	148.2846	147.9291	147.5807	145.9439	145.6376	144.2121	144.2121	143.9481	144.7612	145.6376	146.2571	146.9048	(39)
Average = Sum(39)m / 12 =												145.9424	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0637	1.0612	1.0587	1.0469	1.0447	1.0345	1.0345	1.0326	1.0385	1.0447	1.0492	1.0538	(40)
HLP (average)												1.0469	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9159	(42)

Hot water usage for mixer showers
73.1105 72.0118 70.4107 67.3474 65.0868 62.5658 61.1328 62.7217 64.4635 67.1703 70.2994 72.8304 (42a)
Hot water usage for baths
31.5631 31.0944 30.4343 29.2171 28.3058 27.2952 26.7494 27.4048 28.1186 29.1999 30.4421 31.4564 (42b)
Hot water usage for other uses
44.4921 42.8742 41.2563 39.6384 38.0205 36.4026 36.4026 38.0205 39.6384 41.2563 42.8742 44.4921 (42c)
Average daily hot water use (litres/day) 137.1167 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.1657	145.9803	142.1013	136.2030	131.4131	126.2636	124.2848	128.1471	132.2204	137.6265	143.6157	148.7789	(44)
Energy conte	236.2420	207.8740	218.4044	186.4551	176.9073	155.2558	150.3117	158.6729	163.0410	186.7579	204.6068	232.9517	(45)

Energy content (annual) Total = Sum(45)m = 2277.4806
Distribution loss (46)m = 0.15 x (45)m
35.4363 31.1811 32.7607 27.9683 26.5361 23.2884 22.5468 23.8009 24.4562 28.0137 30.6910 34.9428 (46)
Water storage loss:
Store volume 180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.5520 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.8381 (55)
Total storage loss
25.9803 23.4661 25.9803 25.1422 25.9803 25.1422 25.9803 25.9803 25.1422 25.9803 25.1422 25.9803 (56)
If cylinder contains dedicated solar storage
25.9803 23.4661 25.9803 25.1422 25.9803 25.1422 25.9803 25.9803 25.1422 25.9803 25.1422 25.9803 (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

	285.4846	252.3513	267.6470	234.1093	226.1499	202.9100	199.5544	207.9155	210.6952	236.0005	252.2610	282.1944	(62)
WWHRS	-33.4231	-29.5596	-30.9531	-25.6304	-23.8866	-20.4400	-19.1592	-20.3739	-21.1480	-24.9311	-28.2439	-32.8041	(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

	252.0616	222.7917	236.6939	208.4788	202.2633	182.4701	180.3952	187.5417	189.5473	211.0694	224.0171	249.3903	(64)

Total per year (kWh/year) = Sum(64)m = 2546.7202 (64)
12Total per year (kWh/year) 2547 (64)
Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month

	117.9446	104.6999	112.0136	100.1197	98.2158	89.7459	89.3728	92.1529	92.3345	101.4911	106.1551	116.8506	(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	145.7967	145.7967	145.7967	145.7967	145.7967	145.7967	145.7967	145.7967	145.7967	145.7967	145.7967	145.7967	(66)

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

	162.1088	179.4776	162.1088	167.5124	162.1088	167.5124	162.1088	162.1088	167.5124	162.1088	167.5124	162.1088	(67)

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

	308.7288	311.9325	303.8594	286.6728	264.9778	244.5875	230.9656	227.7620	235.8350	253.0216	274.7166	295.1069	(68)

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

	37.5797	37.5797	37.5797	37.5797	37.5797	37.5797	37.5797	37.5797	37.5797	37.5797	37.5797	37.5797	(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)

	-116.6374	-116.6374	-116.6374	-116.6374	-116.6374	-116.6374	-116.6374	-116.6374	-116.6374	-116.6374	-116.6374	-116.6374	(71)

Water heating gains (Table 5)

	158.5277	155.8034	150.5559	139.0551	132.0105	124.6471	120.1247	123.8614	128.2424	136.4128	147.4377	157.0572	(72)

Total internal gains

	699.1043	716.9525	686.2631	662.9793	628.8361	603.4861	579.9381	580.4712	598.3288	621.2823	659.4058	684.0119	(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	3.2500	10.6334	0.6300	0.7000	0.7700	10.5615	(74)
East	9.5000	19.6403	0.6300	0.7000	0.7700	57.0220	(76)
South	4.6000	46.7521	0.6300	0.7000	0.7700	65.7250	(78)
West	5.2000	19.6403	0.6300	0.7000	0.7700	31.2121	(80)

Solar gains	164.5206	300.4288	455.6672	624.6287	743.7691	754.9554	721.1739	631.6411	515.0694	344.9364	200.9531	138.1565	(83)
Total gains	863.6249	1017.3814	1141.9303	1287.6080	1372.6052	1358.4415	1301.1120	1212.1122	1113.3983	966.2186	860.3588	822.1684	(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	1.1802	1.1830	1.1858	1.1991	1.2016	1.2135	1.2135	1.2157	1.2089	1.2016	1.1965	1.1912
alpha	1.0787	1.0789	1.0791	1.0799	1.0801	1.0809	1.0809	1.0810	1.0806	1.0801	1.0798	1.0794
util living area	0.7646	0.7241	0.6752	0.6002	0.5158	0.4199	0.3394	0.3662	0.4912	0.6332	0.7263	0.7734 (86)

MIT	15.5374	16.0404	16.8632	17.9660	19.0211	19.9103	20.4039	20.3241	19.6083	18.2364	16.7074	15.4385	(87)
Th 2	20.0306	20.0327	20.0347	20.0444	20.0462	20.0547	20.0547	20.0562	20.0514	20.0462	20.0425	20.0387	(88)
util rest of house	0.7531	0.7109	0.6591	0.5794	0.4877	0.3802	0.2861	0.3132	0.4529	0.6096	0.7112	0.7623	(89)
MIT 2	14.0250	14.6104	15.5702	16.8520	18.0620	19.0638	19.5924	19.5171	18.7458	17.1876	15.4072	13.9139	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	14.4031	14.9679	15.8935	17.1305	18.3018	19.2754	19.7953	19.7189	18.9614	17.4498	15.7322	14.2951	(92)
Temperature adjustment												0.0000	
adjusted MIT	14.4031	14.9679	15.8935	17.1305	18.3018	19.2754	19.7953	19.7189	18.9614	17.4498	15.7322	14.2951	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6571	0.6161	0.5690	0.5012	0.4274	0.3435	0.2700	0.2922	0.4017	0.5275	0.6169	0.6664	(94)
Useful gains	567.4689	626.8081	649.7991	645.3142	586.6991	466.6618	351.2546	354.1500	447.2824	509.7260	530.7887	547.9228	(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	1498.1353	1489.3333	1386.2918	1201.1939	961.4681	674.2549	460.7951	477.7465	703.7411	997.5910	1262.5237	1483.0147	(97)
Space heating kWh	692.4158	579.6169	547.9506	400.2334	278.8281	0.0000	0.0000	0.0000	0.0000	362.9716	526.8491	695.7084	(98a)
Space heating requirement - total per year (kWh/year)												4084.5739	
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	692.4158	579.6169	547.9506	400.2334	278.8281	0.0000	0.0000	0.0000	0.0000	362.9716	526.8491	695.7084	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4084.5739	
Space heating per m2											(98c) / (4) =	29.3011	(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	692.4158	579.6169	547.9506	400.2334	278.8281	0.0000	0.0000	0.0000	0.0000	362.9716	526.8491	695.7084	(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)	750.1796	627.9707	593.6626	433.6223	302.0890	0.0000	0.0000	0.0000	0.0000	393.2520	570.8008	753.7469	(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	252.0616	222.7917	236.6939	208.4788	202.2633	182.4701	180.3952	187.5417	189.5473	211.0694	224.0171	249.3903	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.2053	86.1037	85.8783	85.4975	84.7800	79.8000	79.8000	79.8000	79.8000	85.2642	85.9093	86.2336	(217)
Fuel for water heating, kWh/month	292.3969	258.7480	275.6155	243.8420	238.5742	228.6592	226.0591	235.0146	237.5279	247.5475	260.7599	289.2030	(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	33.6830	27.0218	24.3301	17.8253	13.7688	11.2492	12.5603	16.3264	21.2063	27.8239	31.4270	34.6192	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-61.3140	-84.5136	-118.7631	-130.3848	-137.9071	-127.6554	-125.9509	-120.1300	-109.5843	-95.0183	-66.6675	-53.2277	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-40.7405	-84.9303	-167.4523	-249.6217	-328.3402	-329.3907	-325.6276	-276.5871	-203.8277	-120.9594	-54.2172	-32.2858	(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												4425.3239	(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												3033.9480	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:

Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	271.8411 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-3445.0971 (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	4372.0159 (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	4425.3239	0.2100	929.3180	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3033.9480	0.2100	637.1291	(264)
Space and water heating			1566.4471	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	271.8411	0.1443	39.2351	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1231.1167	0.1351	-166.3243	
PV Unit electricity exported	-2213.9805	0.1261	-279.2063	
Total			-445.5306	(269)
Total CO2, kg/year			1172.0809	(272)
Target Carbon Dioxide Emission Rate (TER)			8.4100	(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	4425.3239	1.1300	5000.6160	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3033.9480	1.1300	3428.3613	(278)
Space and water heating			8428.9772	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	271.8411	1.5338	416.9590	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1231.1167	1.4993	-1845.8585	
PV Unit electricity exported	-2213.9805	0.4629	-1024.8990	
Total			-2870.7575	(283)
Total Primary energy kWh/year			6105.2795	(286)
Target Primary Energy Rate (TPER)			43.8000	(287)

;

Full SAP Calculation Printout

Property Reference	Plot 44 2bFOG_Be Green	Issued on Date	12/10/2022
Assessment Reference	Be Green	Prop Type Ref	2bFOG
Property	2bFOG, House No. 44, Claygate, Surrey, Elmbridge, KT 10		

SAP Rating	81 B	DER	4.67	TER	12.14
Environmental	96 A	% DER<TER	61.53		
CO_2 Emissions (t/year)	0.3	DFEE	37.62	TFEE	36.40
Compliance Check	See BREL	% DFEE < TFEE	-3.37		
% DPER < TPER	21.79	DPER	49.65	TPER	63.48

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

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

---

1. Overall dwelling characteristics

			Area (m2)		Storey height (m)		Volume (m3)	
Ground floor			35.0000 (1b)	x	2.5000 (2b)	=	87.5000 (1b)	-
First floor			35.0000 (1c)	x	2.7500 (2c)	=	96.2500 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)		70.0000						(4)
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	183.7500	(5)

---

2. Ventilation rate

---

		m3 per hour		
Number of open chimneys		0 * 80	=	0.0000 (6a)
Number of open flues		0 * 20	=	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10	=	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20	=	0.0000 (6d)
Number of flues attached to other heater		0 * 35	=	0.0000 (6e)
Number of blocked chimneys		0 * 20	=	0.0000 (6f)
Number of intermittent extract fans		2 * 10	=	20.0000 (7a)
Number of passive vents		0 * 10	=	0.0000 (7b)
Number of flueless gas fires		0 * 40	=	0.0000 (7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		20.0000 / (5)	=	0.1088 (8)
Pressure test				Yes
Pressure Test Method				Blower Door
Measured/design AP50				3.0000 (17)
Infiltration rate				0.2588 (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)	=	0.2200 (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	0.2805	0.2750	0.2695	0.2420	0.2365	0.2090	0.2090	0.2035	0.2200	0.2365	0.2475	0.2585	(22b)
Effective ac	0.5393	0.5378	0.5363	0.5293	0.5280	0.5218	0.5218	0.5207	0.5242	0.5280	0.5306	0.5334	(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	
Window (Uw = 1.20)			14.7000	1.1450	16.8321			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			35.0000	0.1200	4.2000	0.0000	0.0000	(28a)
External Wall 1	73.5000	19.9000	53.6000	0.1400	7.5040	0.0000	0.0000	(29a)
External Roof 1	65.0000		65.0000	0.1132	7.3585	9.0000	585.0000	(30)
Total net area of external elements Aum(A, m2)			173.5000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.0946			(33)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 585.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 8.3571 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 8.6750 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 49.7696 (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	32.7046	32.6120	32.5211	32.0946	32.0148	31.6433	31.6433	31.5745	31.7864	32.0148	32.1763	32.3450	(38)
Heat transfer coeff	82.4742	82.3815	82.2907	81.8642	81.7844	81.4129	81.4129	81.3441	81.5560	81.7844	81.9458	82.1146	(39)

Average = Sum(39)m / 12 = 81.8638

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1782	1.1769	1.1756	1.1695	1.1683	1.1630	1.1630	1.1621	1.1651	1.1683	1.1707	1.1731	(40)
HLP (average)												1.1695	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2461 (42)

Hot water usage for mixer showers

61.8798	60.9498	59.5947	57.0020	55.0887	52.9549	51.7420	53.0869	54.5611	56.8521	59.5005	61.6427	(42a)

Hot water usage for baths

26.7336	26.3365	25.7774	24.7465	23.9746	23.1187	22.6564	23.2116	23.8161	24.7319	25.7840	26.6432	(42b)

Hot water usage for other uses

37.6326	36.2641	34.8957	33.5272	32.1587	30.7903	30.7903	32.1587	33.5272	34.8957	36.2641	37.6326	(42c)

Average daily hot water use (litres/day) 116.0487 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	126.2459	123.5505	120.2678	115.2758	111.2220	106.8639	105.1887	108.4572	111.9043	116.4797	121.5487	125.9184	(44)
Energy conte	199.9426	175.9342	184.8472	157.8067	149.7262	131.4016	127.2166	134.2926	137.9892	158.0618	173.1684	197.1578	(45)

Energy content (annual) Total = Sum(45)m = 1927.5450

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

29.9914	26.3901	27.7271	23.6710	22.4589	19.7102	19.0825	20.1439	20.6984	23.7093	25.9753	29.5737	(46)

Water storage loss:
Store volume 180.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 0.8736 (55)
Total storage loss

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)

If cylinder contains dedicated solar storage

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

250.2871	221.4066	235.1916	206.5272	200.0706	180.1220	177.5610	184.6371	186.7096	208.4063	221.8888	247.5023	(62)
WWHRS -27.3062	-24.1498	-25.2883	-20.9397	-19.5151	-16.6992	-15.6528	-16.6452	-17.2776	-20.3684	-23.0749	-26.8005	(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

222.9809	197.2568	209.9033	185.5874	180.5556	163.4228	161.9082	167.9919	169.4320	188.0379	198.8139	220.7017	(64)

Total per year (kWh/year) = Sum(64)m = 2266.5924 (64)
12Total per year (kWh/year) 2267 (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

106.7565	94.8760	101.7372	91.4471	90.0595	82.6674	82.5751	84.9278	84.8578	92.8311	96.5548	105.8305	(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	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	99.7867	110.4781	99.7867	103.1129	99.7867	103.1129	99.7867	99.7867	103.1129	99.7867	103.1129	99.7867	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.2971	199.3444	194.1852	183.2019	169.3374	156.3068	147.6015	145.5542	150.7134	161.6967	175.5612	188.5918	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	(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)	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	(71)
Water heating gains (Table 5)	143.4899	141.1846	136.7436	127.0098	121.0477	114.8158	110.9880	114.1503	117.8580	124.7730	134.1039	142.2453	(72)
Total internal gains	500.2655	510.6989	490.4073	473.0165	449.8637	430.9273	415.0680	416.1830	428.3761	445.9482	472.4698	490.3157	(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	5.2000	10.6334	0.7600	0.7000	0.7700	20.3854 (74)
South	9.5000	46.7521	0.7600	0.7000	0.7700	163.7455 (78)

Solar gains	184.1309	307.1305	407.8032	492.4192	545.5656	540.5262	521.4669	480.9670	436.4385	335.6236	219.2423	158.4855 (83)
Total gains	684.3964	817.8294	898.2105	965.4357	995.4293	971.4535	936.5349	897.1500	864.8146	781.5718	691.7121	648.8011 (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	1.9703	1.9725	1.9747	1.9850	1.9869	1.9960	1.9960	1.9977	1.9925	1.9869	1.9830	1.9789	
alpha	1.1314	1.1315	1.1316	1.1323	1.1325	1.1331	1.1331	1.1332	1.1328	1.1325	1.1322	1.1319	
util living area	0.7057	0.6551	0.6052	0.5378	0.4597	0.3694	0.2912	0.3103	0.4179	0.5535	0.6590	0.7180	(86)
MIT	17.2203	17.6302	18.1894	18.8914	19.5651	20.1274	20.4368	20.3948	19.9711	19.1037	18.0444	17.1283	(87)
Th 2	19.9375	19.9385	19.9396	19.9445	19.9454	19.9497	19.9497	19.9505	19.9480	19.9454	19.9435	19.9416	(88)
util rest of house	0.6907	0.6383	0.5856	0.5136	0.4282	0.3267	0.2362	0.2556	0.3762	0.5251	0.6396	0.7035	(89)
MIT 2	15.8051	16.2771	16.9248	17.7351	18.4998	19.1223	19.4423	19.4042	18.9613	17.9942	16.7741	15.7017	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	16.1589	16.6154	17.2409	18.0242	18.7661	19.3735	19.6909	19.6519	19.2138	18.2716	17.0916	16.0584	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.1589	16.6154	17.2409	18.0242	18.7661	19.3735	19.6909	19.6519	19.2138	18.2716	17.0916	16.0584	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6237	0.5745	0.5266	0.4629	0.3889	0.3010	0.2215	0.2386	0.3437	0.4727	0.5755	0.6361	(94)
Useful gains	426.8723	469.8688	473.0049	446.9394	387.1221	292.4303	207.4478	214.0503	297.2478	369.4532	398.0724	412.7296	(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	978.0512	965.1303	883.8780	746.9466	577.8964	388.6273	251.6397	264.5202	417.0568	627.4156	818.7721	973.7464	(97)
Space heating kWh	410.0771	332.8157	305.6896	216.0052	141.9360	0.0000	0.0000	0.0000	0.0000	191.9240	302.9038	417.3965	(98a)
Space heating requirement - total per year (kWh/year)												2318.7478	
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	410.0771	332.8157	305.6896	216.0052	141.9360	0.0000	0.0000	0.0000	0.0000	191.9240	302.9038	417.3965	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2318.7478	
Space heating per m2											(98c) / (4) =	33.1250	(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 %)	219.3000 (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	410.0771	332.8157	305.6896	216.0052	141.9360	0.0000	0.0000	0.0000	0.0000	191.9240	302.9038	417.3965	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	186.9937	151.7627	139.3933	98.4976	64.7223	0.0000	0.0000	0.0000	0.0000	87.5166	138.1230	190.3313	(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	222.9809	197.2568	209.9033	185.5874	180.5556	163.4228	161.9082	167.9919	169.4320	188.0379	198.8139	220.7017	(64)
Efficiency of water heater												190.4000	(216)
(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(217)
Fuel for water heating, kWh/month	117.1118	103.6013	110.2433	97.4724	94.8296	85.8313	85.0358	88.2310	88.9874	98.7594	104.4190	115.9148	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)

Lighting	26.4734	21.2380	19.1224	14.0099	10.8217	8.8414	9.8719	12.8318	16.6673	21.8684	24.7003	27.2092 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-6.7117	-10.7102	-17.3991	-22.0808	-26.0044	-24.3893	-24.0734	-21.5860	-17.6100	-13.1577	-7.7857	-5.6683 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-0.8012	-1.8268	-3.9529	-6.5350	-9.3480	-10.3677	-10.2243	-8.3801	-5.8594	-2.8692	-1.1258	-0.6187 (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	1057.3406 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	190.4000
Water heating fuel used	1190.4372 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	213.6556 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-259.0859 (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	2202.3474 (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	1057.3406	0.1537	162.5005	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1190.4372	0.1408	167.5584	(264)
Space and water heating			330.0590	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	213.6556	0.1443	30.8371	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-197.1767	0.1324	-26.1138	
PV Unit electricity exported	-61.9092	0.1223	-7.5732	
Total			-33.6870	(269)
Total CO2, kg/year			327.2091	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			4.6700	(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	1057.3406	1.5690	1658.9461	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1190.4372	1.5204	1809.9988	(278)
Space and water heating			3468.9448	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	213.6556	1.5338	327.7121	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-197.1767	1.4894	-293.6652	
PV Unit electricity exported	-61.9092	0.4488	-27.7828	
Total			-321.4481	(283)
Total Primary energy kWh/year			3475.2088	(286)
Dwelling Primary energy Rate (DPER)			49.6500	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF TARGET EMISSIONS

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	35.0000 (1b)	x	2.5000 (2b)	=	87.5000 (1b)	-
First floor	35.0000 (1c)	x	2.7500 (2c)	=	96.2500 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	183.7500	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1088	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3588	(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) =	0.3050	(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	0.3889	0.3813	0.3736	0.3355	0.3279	0.2898	0.2898	0.2821	0.3050	0.3279	0.3431	0.3584	(22b)
Effective ac	0.5756	0.5727	0.5698	0.5563	0.5538	0.5420	0.5420	0.5398	0.5465	0.5538	0.5589	0.5642	(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			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			12.3200	1.1450	14.1069			(27)
Heatloss Floor 1			35.0000	0.1300	4.5500			(28a)
External Wall 1	73.5000	17.5200	55.9800	0.1800	10.0764			(29a)
External Roof 1	65.0000		65.0000	0.1100	7.1500			(30)
Total net area of external elements Aum(A, m2)			173.5000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.0833			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 8.3571 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E5 Ground floor (normal)	10.0000	0.1600	1.6000
E6 Intermediate floor within a dwelling	36.0000	0.0000	0.0000
E16 Corner (normal)	15.5000	0.0900	1.3950
E18 Party wall between dwellings	15.5000	0.0600	0.9300

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.9250	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	45.0083	(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	34.9042	34.7261	34.5516	33.7318	33.5784	32.8644	32.8644	32.7322	33.1395	33.5784	33.8887	34.2131	(38)
Heat transfer coeff	79.9124	79.7344	79.5599	78.7401	78.5867	77.8727	77.8727	77.7405	78.1477	78.5867	78.8970	79.2214	(39)
Average = Sum(39)m / 12 =												78.7394	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1416	1.1391	1.1366	1.1249	1.1227	1.1125	1.1125	1.1106	1.1164	1.1227	1.1271	1.1317	(40)
HLP (average)												1.1248	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2461 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
61.8798	60.9498	59.5947	57.0020	55.0887	52.9549	51.7420	53.0869	54.5611	56.8521	59.5005	61.6427	(42a)

Hot water usage for baths
26.7336 26.3365 25.7774 24.7465 23.9746 23.1187 22.6564 23.2116 23.8161 24.7319 25.7840 26.6432 (42b)
Hot water usage for other uses
37.6326 36.2641 34.8957 33.5272 32.1587 30.7903 30.7903 32.1587 33.5272 34.8957 36.2641 37.6326 (42c)
Average daily hot water use (litres/day) 116.0487 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	126.2459	123.5505	120.2678	115.2758	111.2220	106.8639	105.1887	108.4572	111.9043	116.4797	121.5487	125.9184	(44)
Energy conte	199.9426	175.9342	184.8472	157.8067	149.7262	131.4016	127.2166	134.2926	137.9892	158.0618	173.1684	197.1578	(45)
Energy content (annual)											Total = Sum(45)m =	1927.5450	
Distribution loss (46)m = 0.15 x (45)m													
	29.9914	26.3901	27.7271	23.6710	22.4589	19.7102	19.0825	20.1439	20.6984	23.7093	25.9753	29.5737	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8381	(55)
Total storage loss													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(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													
	249.1853	220.4115	234.0898	205.4609	198.9689	179.0558	176.4593	183.5353	185.6434	207.3045	220.8226	246.4005	(62)
WWHRS	-28.2888	-25.0189	-26.1983	-21.6933	-20.2173	-17.3001	-16.2161	-17.2442	-17.8994	-21.1014	-23.9053	-27.7650	(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													
	220.8965	195.3926	207.8915	183.7677	178.7515	161.7557	160.2432	166.2911	167.7440	186.2031	196.9172	218.6355	(64)
											Total per year (kWh/year) = Sum(64)m =	2244.4896	(64)
12Total per year (kWh/year)												2244	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
											Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000	(64a)
Heat gains from water heating, kWh/month													
	105.8751	94.0799	100.8558	90.5941	89.1781	81.8144	81.6937	84.0464	84.0048	91.9497	95.7018	104.9491	(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	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	112.3062	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	102.0147	112.9448	102.0147	105.4152	102.0147	105.4152	102.0147	102.0147	105.4152	102.0147	105.4152	102.0147	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	197.2971	199.3444	194.1852	183.2019	169.3374	156.3068	147.6015	145.5542	150.7134	161.6967	175.5612	188.5918	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	34.2306	(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)													
	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	-89.8450	(71)
Water heating gains (Table 5)													
	142.3052	139.9999	135.5589	125.8251	119.8630	113.6311	109.8033	112.9656	116.6733	123.5883	132.9192	141.0606	(72)
Total internal gains													
	501.3088	511.9810	491.4506	474.1340	450.9070	432.0449	416.1113	417.2264	429.4937	446.9915	473.5874	491.3590	(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	4.3600	10.6334	0.6300	0.7000	0.7700	14.1687	(74)
South	7.9600	46.7521	0.6300	0.7000	0.7700	113.7328	(78)

Solar gains	127.9015	213.3421	283.2792	342.0699	379.0012	375.5057	362.2629	334.1189	303.1747	233.1361	152.2911	110.0873	(83)
Total gains	629.2103	725.3231	774.7298	816.2039	829.9082	807.5506	778.3742	751.3453	732.6684	680.1276	625.8785	601.4463	(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	2.0335	2.0380	2.0425	2.0638	2.0678	2.0867	2.0867	2.0903	2.0794	2.0678	2.0596	2.0512	
alpha	1.1356	1.1359	1.1362	1.1376	1.1379	1.1391	1.1391	1.1394	1.1386	1.1379	1.1373	1.1367	
util living area													
	0.7184	0.6772	0.6353	0.5731	0.4984	0.4054	0.3232	0.3414	0.4509	0.5808	0.6752	0.7280	(86)
MIT	16.1724	16.6554	17.3663	18.3094	19.2367	20.0412	20.4894	20.4324	19.8331	18.6528	17.2675	16.0740	(87)
Th 2	19.9670	19.9691	19.9711	19.9806	19.9824	19.9907	19.9907	19.9922	19.9875	19.9824	19.9788	19.9750	(88)
util rest of house													

	0.7042	0.6614	0.6167	0.5499	0.4676	0.3626	0.2666	0.2857	0.4097	0.5537	0.6569	0.7142	(89)
MIT 2	14.6986	15.2577	16.0859	17.1818	18.2428	19.1427	19.6133	19.5603	18.9236	17.5947	15.9898	14.5885	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	15.0670	15.6072	16.4060	17.4637	18.4913	19.3674	19.8324	19.7783	19.1510	17.8592	16.3092	14.9599	(92)
Temperature adjustment												0.0000	
adjusted MIT	15.0670	15.6072	16.4060	17.4637	18.4913	19.3674	19.8324	19.7783	19.1510	17.8592	16.3092	14.9599	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6136	0.5749	0.5364	0.4813	0.4157	0.3332	0.2570	0.2728	0.3712	0.4854	0.5716	0.6230	(94)
Useful gains	386.0844	416.9732	415.5861	392.8533	345.0071	269.1134	200.0206	204.9689	272.0007	330.1363	357.7508	374.6902	(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													
	860.4193	853.7286	788.1211	674.3065	533.7021	371.2472	251.7119	262.6311	394.7204	570.4777	726.5802	852.4115	(97)
Space heating kWh													
	352.9052	293.4996	277.1661	202.6463	140.3891	0.0000	0.0000	0.0000	0.0000	178.8140	265.5572	355.4246	(98a)
Space heating requirement - total per year (kWh/year)												2066.4019	
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													
	352.9052	293.4996	277.1661	202.6463	140.3891	0.0000	0.0000	0.0000	0.0000	178.8140	265.5572	355.4246	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2066.4019	
Space heating per m2											(98c) / (4) =	29.5200	(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													
	352.9052	293.4996	277.1661	202.6463	140.3891	0.0000	0.0000	0.0000	0.0000	178.8140	265.5572	355.4246	(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)													
	382.3458	317.9844	300.2883	219.5518	152.1008	0.0000	0.0000	0.0000	0.0000	193.7313	287.7109	385.0754	(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													
	220.8965	195.3926	207.8915	183.7677	178.7515	161.7557	160.2432	166.2911	167.7440	186.2031	196.9172	218.6355	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.1049	84.9700	84.7056	84.2796	83.5238	79.8000	79.8000	79.8000	79.8000	83.9690	84.7311	85.1428	(217)
Fuel for water heating, kWh/month													
	259.5577	229.9548	245.4284	218.0453	214.0126	202.7013	200.8060	208.3848	210.2056	221.7521	232.4026	256.7869	(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	21.1966	17.0047	15.3109	11.2174	8.6646	7.0791	7.9042	10.2741	13.3451	17.5095	19.7769	21.7858	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-32.8758	-46.4160	-66.8238	-75.2705	-81.2975	-75.9472	-75.0213	-70.7638	-63.2615	-53.1477	-36.1717	-28.4162	(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	-18.3711	-38.6706	-76.8999	-115.5506	-152.8295	-153.5594	-151.7398	-128.4485	-94.1189	-55.3060	-24.5307	-14.5246	(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												2238.7887	(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												2700.0381	(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)												171.0690	(232)

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

PV generation	-1729.9627 (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	3465.9331 (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	2238.7887	0.2100	470.1456	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2700.0381	0.2100	567.0080	(264)
Space and water heating			1037.1536	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	171.0690	0.1443	24.6905	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-705.4132	0.1345	-94.9107	
PV Unit electricity exported	-1024.5495	0.1259	-128.9753	
Total			-223.8859	(269)
Total CO2, kg/year			849.8875	(272)
Target Carbon Dioxide Emission Rate (TER)			12.1400	(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	2238.7887	1.1300	2529.8312	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2700.0381	1.1300	3051.0431	(278)
Space and water heating			5580.8743	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	171.0690	1.5338	262.3913	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-705.4132	1.4973	-1056.1853	
PV Unit electricity exported	-1024.5495	0.4621	-473.4277	
Total			-1529.6129	(283)
Total Primary energy kWh/year			4443.7534	(286)
Target Primary Energy Rate (TPER)			63.4800	(287)

;

Full SAP Calculation Printout

elmhurst energy

Property Reference	Plot 45 1BF_Be Green	Issued on Date	12/10/2022
Assessment Reference	Be Green	Prop Type Ref	1BF
Property	1BF, House No. 45, Claygate, Surrey, Elmbridge, KT 10		

SAP Rating	81 B	DER	5.40	TER	10.79
Environmental	96 A	% DER<TER	49.95		
CO_2 Emissions (t/year)	0.28	DFEE	45.26	TFEE	39.01
Compliance Check	See BREL	% DFEE < TFEE	-16.03		
% DPER < TPER	0.58	DPER	57.32	TPER	57.65

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

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

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	55.7000 (1b)	x	2.5000 (2b)	=	139.2500 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	55.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	139.2500	(5)

---

2. Ventilation rate

---

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1436	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.2936	(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) =	0.2496	(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	0.3182	0.3120	0.3057	0.2745	0.2683	0.2371	0.2371	0.2309	0.2496	0.2683	0.2808	0.2933	(22b)
Effective ac	0.5506	0.5487	0.5467	0.5377	0.5360	0.5281	0.5281	0.5266	0.5311	0.5360	0.5394	0.5430	(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	
Window (Uw = 1.20)			17.2000	1.1450	19.6947			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			55.7000	0.1200	6.6840	0.0000	0.0000	(28a)
External Wall 1	54.0000	22.4000	31.6000	0.1400	4.4240	0.0000	0.0000	(29a)
External Roof 1	53.2500		53.2500	0.1132	6.0283	9.0000	479.2500	(30)
Total net area of external elements Aum(A, m2)			162.9500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.0310			(33)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 479.2500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 8.6041 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 8.1475 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 50.1785 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	25.3029	25.2125	25.1240	24.7080	24.6302	24.2679	24.2679	24.2008	24.4075	24.6302	24.7876	24.9522	(38)
Heat transfer coeff	75.4813	75.3910	75.3024	74.8865	74.8087	74.4464	74.4464	74.3793	74.5859	74.8087	74.9661	75.1307	(39)

Average = Sum(39)m / 12 = 74.8861

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3551	1.3535	1.3519	1.3445	1.3431	1.3366	1.3366	1.3354	1.3391	1.3431	1.3459	1.3488	(40)
HLP (average)												1.3445	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.8578 (42)

Hot water usage for mixer showers												
	55.3694	54.5373	53.3248	51.0048	49.2928	47.3835	46.2982	47.5016	48.8207	50.8707	53.2404	55.1572 (42a)
Hot water usage for baths												
	23.9339	23.5784	23.0779	22.1549	21.4639	20.6976	20.2837	20.7807	21.3219	22.1419	23.0838	23.8530 (42b)
Hot water usage for other uses												
	33.6561	32.4323	31.2084	29.9845	28.7607	27.5368	27.5368	28.7607	29.9845	31.2084	32.4323	33.6561 (42c)

Average daily hot water use (litres/day) 103.8357 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	112.9594	110.5480	107.6110	103.1443	99.5173	95.6179	94.1187	97.0430	100.1271	104.2209	108.7565	112.6663	(44)
Energy conte	178.9000	157.4188	165.3942	141.1994	133.9694	117.5733	113.8285	120.1595	123.4668	141.4268	154.9436	176.4082	(45)
Energy content (annual)										Total = Sum(45)m =		1724.6886	
Distribution loss (46)m = 0.15 x (45)m													
	26.8350	23.6128	24.8091	21.1799	20.0954	17.6360	17.0743	18.0239	18.5200	21.2140	23.2415	26.4612	(46)

Water storage loss:
Store volume 180.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 0.8736 (55)

Total storage loss												
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (56)
If cylinder contains dedicated solar storage												
	27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820 (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												
	229.2445	202.8912	215.7386	189.9198	184.3139	166.2938	164.1729	170.5039	172.1872	191.7713	203.6640	226.7527 (62)
WWHRS	-24.4333	-21.6090	-22.6277	-18.7366	-17.4619	-14.9422	-14.0060	-14.8940	-15.4598	-18.2254	-20.6472	-23.9808 (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												
	204.8112	181.2822	193.1109	171.1832	166.8520	151.3515	150.1669	155.6100	156.7274	173.5458	183.0168	202.7718 (64)

Total per year (kWh/year) = Sum(64)m = 2090.4297 (64)
12Total per year (kWh/year) 2090 (64)
Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)

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

Heat gains from water heating, kWh/month												
	99.7598	88.7197	95.2691	85.9251	84.8204	78.0695	78.1235	80.2286	80.0290	87.3000	90.4951	98.9313 (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	92.8919	92.8919	92.8919	92.8919	92.8919	92.8919	92.8919	92.8919	92.8919	92.8919	92.8919	92.8919	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	81.7042	90.4582	81.7042	84.4277	81.7042	84.4277	81.7042	81.7042	84.4277	81.7042	84.4277	81.7042	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	161.9877	163.6686	159.4327	150.4150	139.0318	128.3332	121.1859	119.5050	123.7409	132.7585	144.1417	154.8403	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.2892	32.2892	32.2892	32.2892	32.2892	32.2892	32.2892	32.2892	32.2892	32.2892	32.2892	32.2892	(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)													
	-74.3135	-74.3135	-74.3135	-74.3135	-74.3135	-74.3135	-74.3135	-74.3135	-74.3135	-74.3135	-74.3135	-74.3135	(71)
Water heating gains (Table 5)													
	134.0858	132.0233	128.0499	119.3405	114.0059	108.4298	105.0047	107.8341	111.1514	117.3387	125.6876	132.9722	(72)
Total internal gains													
	431.6452	440.0177	423.0543	408.0507	388.6095	372.0583	358.7624	359.9109	370.1875	385.6690	408.1246	423.3843	(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	2.5000	10.6334	0.7600	0.7000	0.7700	9.8007 (74)
East	5.2000	19.6403	0.7600	0.7000	0.7700	37.6526 (76)
West	9.5000	19.6403	0.7600	0.7000	0.7700	68.7885 (80)

Solar gains	116.2418	226.9511	374.7373	551.2364	681.7749	701.1443	666.1605	567.7060	437.0852	269.3675	144.8100	95.7024 (83)
Total gains	547.8870	666.9688	797.7916	959.2871	1070.3844	1073.2026	1024.9229	927.6169	807.2727	655.0364	552.9346	519.0866 (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	1.7637	1.7658	1.7679	1.7777	1.7795	1.7882	1.7882	1.7898	1.7849	1.7795	1.7758	1.7719
alpha	1.1176	1.1177	1.1179	1.1185	1.1186	1.1192	1.1192	1.1193	1.1190	1.1186	1.1184	1.1181
util living area	0.7312	0.6790	0.6094	0.5129	0.4152	0.3228	0.2530	0.2821	0.4104	0.5731	0.6872	0.7428 (86)
MIT	17.0207	17.4497	18.1261	18.9561	19.6723	20.2041	20.4778	20.4236	19.9693	19.0050	17.8669	16.9308 (87)
Th 2	19.7979	19.7991	19.8004	19.8062	19.8073	19.8123	19.8123	19.8132	19.8104	19.8073	19.8051	19.8028 (88)
util rest of house	0.7151	0.6606	0.5873	0.4855	0.3808	0.2780	0.1966	0.2239	0.3634	0.5412	0.6662	0.7273 (89)
MIT 2	15.4909	15.9839	16.7610	17.7054	18.5024	19.0779	19.3522	19.3081	18.8515	17.7927	16.4863	15.3905 (90)
Living area fraction									fLA = Living area / (4) =			0.2693 (91)
MIT	15.9029	16.3786	17.1286	18.0422	18.8174	19.3812	19.6553	19.6085	19.1525	18.1192	16.8581	15.8053 (92)
Temperature adjustment												0.0000
adjusted MIT	15.9029	16.3786	17.1286	18.0422	18.8174	19.3812	19.6553	19.6085	19.1525	18.1192	16.8581	15.8053 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.6480	0.5957	0.5287	0.4393	0.3492	0.2603	0.1885	0.2130	0.3343	0.4878	0.6009	0.6601 (94)
Useful gains	355.0086	397.3414	421.7708	421.3889	373.7815	279.3888	193.2237	197.5507	269.8919	319.4981	332.2517	342.6443 (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	875.7992	865.3854	800.3596	684.6293	532.4452	355.9456	227.4562	238.6442	376.8480	562.4980	731.5260	871.9153 (97)
Space heating kWh	387.4682	314.5256	281.6700	189.5331	118.0457	0.0000	0.0000	0.0000	0.0000	180.7919	287.4776	393.7776 (98a)
Space heating requirement - total per year (kWh/year)												2153.2898
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	387.4682	314.5256	281.6700	189.5331	118.0457	0.0000	0.0000	0.0000	0.0000	180.7919	287.4776	393.7776 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2153.2898
Space heating per m2											(98c) / (4) =	38.6587 (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 %) 219.3000 (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	387.4682	314.5256	281.6700	189.5331	118.0457	0.0000	0.0000	0.0000	0.0000	180.7919	287.4776	393.7776 (98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000 (210)
Space heating fuel (main heating system)	176.6841	143.4225	128.4405	86.4264	53.8284	0.0000	0.0000	0.0000	0.0000	82.4405	131.0887	179.5612 (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	204.8112	181.2822	193.1109	171.1832	166.8520	151.3515	150.1669	155.6100	156.7274	173.5458	183.0168	202.7718 (64)
Efficiency of water heater (217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000 (216) 190.4000 (217)
Fuel for water heating, kWh/month	107.5689	95.2113	101.4238	89.9071	87.6323	79.4913	78.8692	81.7279	82.3148	91.1480	96.1223	106.4978 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)

Lighting	20.9867	16.8363	15.1592	11.1063	8.5788	7.0090	7.8259	10.1724	13.2129	17.3361	19.5810	21.5700 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-4.2265	-7.5763	-14.0901	-19.8663	-24.7026	-23.5978	-23.1006	-19.9073	-14.9427	-9.8396	-5.0853	-3.4454 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-0.4161	-1.1329	-3.0516	-6.0537	-9.5810	-10.9622	-10.6473	-8.1266	-4.9293	-1.9453	-0.6171	-0.3044 (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	981.8923 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	190.4000
Water heating fuel used	1097.9148 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	169.3745 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-228.1478 (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	2021.0337 (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	981.8923	0.1539	151.1376	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1097.9148	0.1407	154.4687	(264)
Space and water heating			305.6063	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	169.3745	0.1443	24.4460	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-170.3803	0.1307	-22.2747	
PV Unit electricity exported	-57.7676	0.1188	-6.8653	
Total			-29.1400	(269)
Total CO2, kg/year			300.9123	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.4000	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	981.8923	1.5699	1541.4328	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1097.9148	1.5202	1669.0725	(278)
Space and water heating			3210.5052	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	169.3745	1.5338	259.7922	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-170.3803	1.4830	-252.6664	
PV Unit electricity exported	-57.7676	0.4358	-25.1734	
Total			-277.8398	(283)
Total Primary energy kWh/year			3192.4577	(286)
Dwelling Primary energy Rate (DPER)			57.3200	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF TARGET EMISSIONS

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	55.7000 (1b)	x	2.5000 (2b)	=	139.2500 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	55.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	139.2500	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1436	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3936	(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) =	0.3346	(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	0.4266	0.4182	0.4099	0.3680	0.3597	0.3179	0.3179	0.3095	0.3346	0.3597	0.3764	0.3931	(22b)
Effective ac	0.5910	0.5875	0.5840	0.5677	0.5647	0.5505	0.5505	0.5479	0.5560	0.5647	0.5708	0.5773	(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			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			8.7500	1.1450	10.0191			(27)
Heatloss Floor 1			55.7000	0.1300	7.2410			(28a)
External Wall 1	54.0000	13.9500	40.0500	0.1800	7.2090			(29a)
External Roof 1	53.2500		53.2500	0.1100	5.8575			(30)
Total net area of external elements Aum(A, m2)			162.9500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.5266			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 8.6041 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E5 Ground floor (normal)	10.0000	0.1600	1.6000
E6 Intermediate floor within a dwelling	36.0000	0.0000	0.0000
E16 Corner (normal)	15.5000	0.0900	1.3950
E18 Party wall between dwellings	15.5000	0.0600	0.9300

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.9250	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	39.4516	(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	27.1575	26.9951	26.8360	26.0885	25.9486	25.2976	25.2976	25.1770	25.5483	25.9486	26.2315	26.5273	(38)
Heat transfer coeff	66.6091	66.4467	66.2876	65.5401	65.4002	64.7491	64.7491	64.6286	64.9999	65.4002	65.6831	65.9789	(39)
Average = Sum(39)m / 12 =												65.5394	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1959	1.1929	1.1901	1.1767	1.1742	1.1625	1.1625	1.1603	1.1670	1.1742	1.1792	1.1845	(40)
HLP (average)												1.1766	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.8578 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
55.3694	54.5373	53.3248	51.0048	49.2928	47.3835	46.2982	47.5016	48.8207	50.8707	53.2404	55.1572	(42a)

Hot water usage for baths

	23.9339	23.5784	23.0779	22.1549	21.4639	20.6976	20.2837	20.7807	21.3219	22.1419	23.0838	23.8530 (42b)
Hot water usage for other uses												
	33.6561	32.4323	31.2084	29.9845	28.7607	27.5368	27.5368	28.7607	29.9845	31.2084	32.4323	33.6561 (42c)
Average daily hot water use (litres/day)												103.8357 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	112.9594	110.5480	107.6110	103.1443	99.5173	95.6179	94.1187	97.0430	100.1271	104.2209	108.7565	112.6663	(44)
Energy conte	178.9000	157.4188	165.3942	141.1994	133.9694	117.5733	113.8285	120.1595	123.4668	141.4268	154.9436	176.4082	(45)
Energy content (annual)										Total = Sum(45)m =		1724.6886	
Distribution loss (46)m = 0.15 x (45)m													
	26.8350	23.6128	24.8091	21.1799	20.0954	17.6360	17.0743	18.0239	18.5200	21.2140	23.2415	26.4612	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8381	(55)
Total storage loss													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(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													
	228.1427	201.8961	214.6368	188.8536	183.2121	165.2275	163.0711	169.4022	171.1210	190.6695	202.5978	225.6509	(62)
WWHRS	-25.3126	-22.3866	-23.4420	-19.4109	-18.0903	-15.4800	-14.5100	-15.4299	-16.0162	-18.8813	-21.3902	-24.8438	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	202.8301	179.5094	191.1948	169.4427	165.1218	149.7476	148.5611	153.9722	155.1048	171.7882	181.2076	200.8071	(64)
									Total per year (kWh/year) = Sum(64)m =			2069.2875	(64)
12Total per year (kWh/year)												2069	(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													
	98.8784	87.9236	94.3877	85.0722	83.9390	77.2165	77.2421	79.3472	79.1761	86.4186	89.6421	98.0499	(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	92.8919	92.8919	92.8919	92.8919	92.8919	92.8919	92.8919	92.8919	92.8919	92.8919	92.8919	92.8919	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	85.5526	94.7190	85.5526	88.4044	85.5526	88.4044	85.5526	85.5526	88.4044	85.5526	88.4044	85.5526	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	161.9877	163.6686	159.4327	150.4150	139.0318	128.3332	121.1859	119.5050	123.7409	132.7585	144.1417	154.8403	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.2892	32.2892	32.2892	32.2892	32.2892	32.2892	32.2892	32.2892	32.2892	32.2892	32.2892	32.2892	(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)													
	-74.3135	-74.3135	-74.3135	-74.3135	-74.3135	-74.3135	-74.3135	-74.3135	-74.3135	-74.3135	-74.3135	-74.3135	(71)
Water heating gains (Table 5)													
	132.9011	130.8386	126.8652	118.1558	112.8212	107.2451	103.8200	106.6494	109.9668	116.1540	124.5029	131.7875	(72)
Total internal gains													
	434.3089	443.0938	425.7181	410.8428	391.2732	374.8503	361.4261	362.5746	372.9796	388.3327	410.9166	426.0480	(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	1.2700	10.6334	0.6300	0.7000	0.7700	4.1271	(74)
East	2.6500	19.6403	0.6300	0.7000	0.7700	15.9061	(76)
West	4.8300	19.6403	0.6300	0.7000	0.7700	28.9912	(80)

Solar gains	49.0245	95.7159	158.0436	232.4783	287.5276	295.6943	280.9414	239.4228	184.3377	113.6048	61.0731	40.3620	(83)
Total gains	483.3334	538.8097	583.7617	643.3210	678.8008	670.5446	642.3675	601.9974	557.3173	501.9375	471.9897	466.4100	(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	1.9986	2.0035	2.0083	2.0312	2.0355	2.0560	2.0560	2.0598	2.0481	2.0355	2.0268	2.0177	
alpha	1.1332	1.1336	1.1339	1.1354	1.1357	1.1371	1.1371	1.1373	1.1365	1.1357	1.1351	1.1345	
util living area													
	0.7354	0.7032	0.6594	0.5868	0.5025	0.4054	0.3247	0.3499	0.4741	0.6113	0.6977	0.7425	(86)
MIT	16.0282	16.4513	17.1976	18.2284	19.2147	20.0381	20.4849	20.4144	19.7613	18.5048	17.1146	15.9484	(87)
Th 2	19.9233	19.9257	19.9279	19.9387	19.9407	19.9501	19.9501	19.9519	19.9465	19.9407	19.9367	19.9324	(88)
util rest of house													

	0.7211	0.6874	0.6406	0.5628	0.4704	0.3608	0.2655	0.2910	0.4306	0.5836	0.6792	0.7286	(89)
MIT 2	14.5113	15.0032	15.8730	17.0684	18.1929	19.1105	19.5776	19.5143	18.8256	17.4103	15.7951	14.4230	(90)
Living area fraction										fLA = Living area / (4) =		0.2693	(91)
MIT	14.9198	15.3931	16.2297	17.3808	18.4681	19.3603	19.8220	19.7567	19.0776	17.7051	16.1505	14.8338	(92)
Temperature adjustment												0.0000	
adjusted MIT	14.9198	15.3931	16.2297	17.3808	18.4681	19.3603	19.8220	19.7567	19.0776	17.7051	16.1505	14.8338	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6302	0.5990	0.5578	0.4928	0.4189	0.3330	0.2577	0.2790	0.3895	0.5112	0.5923	0.6374	(94)
Useful gains	304.5908	322.7250	325.6079	317.0256	284.3741	223.2714	165.5088	167.9431	217.0812	256.6077	279.5804	297.2748	(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													
	707.3764	697.2349	644.9599	555.8320	442.6348	308.2264	208.6194	216.9393	323.5423	464.6718	594.4638	701.6052	(97)
Space heating kWh													
	299.6724	251.6707	237.5979	171.9406	117.7460	0.0000	0.0000	0.0000	0.0000	154.7997	226.7161	300.8219	(98a)
Space heating requirement - total per year (kWh/year)												1760.9652	
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													
	299.6724	251.6707	237.5979	171.9406	117.7460	0.0000	0.0000	0.0000	0.0000	154.7997	226.7161	300.8219	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1760.9652	
Space heating per m2											(98c) / (4) =	31.6152	(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													
	299.6724	251.6707	237.5979	171.9406	117.7460	0.0000	0.0000	0.0000	0.0000	154.7997	226.7161	300.8219	(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)													
	324.6722	272.6660	257.4191	186.2845	127.5688	0.0000	0.0000	0.0000	0.0000	167.7136	245.6295	325.9175	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.8301	179.5094	191.1948	169.4427	165.1218	149.7476	148.5611	153.9722	155.1048	171.7882	181.2076	200.8071	(64)
Efficiency of water heater												79.8000	(216)
(217)m	84.9335	84.8175	84.5482	84.0926	83.3149	79.8000	79.8000	79.8000	79.8000	83.8270	84.5634	84.9641	(217)
Fuel for water heating, kWh/month													
	238.8104	211.6419	226.1371	201.4953	198.1900	187.6536	186.1668	192.9477	194.3669	204.9318	214.2861	236.3435	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	17.7761	14.2607	12.8402	9.4073	7.2664	5.9367	6.6287	8.6162	11.1916	14.6840	16.5855	18.2702	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-44.0022	-58.3141	-78.8929	-83.3926	-85.7874	-78.7404	-77.8358	-75.4790	-70.7514	-64.1393	-47.0699	-38.5042	(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	-37.5536	-77.0951	-149.8331	-220.2854	-286.8091	-286.5030	-283.0383	-241.5532	-179.7084	-108.4569	-49.5337	-29.8330	(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												1907.8713	(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												2492.9711	(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)												143.4637	(232)

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

PV generation	-2753.1121 (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	1877.1940 (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	1907.8713	0.2100	400.6530	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2492.9711	0.2100	523.5239	(264)
Space and water heating			924.1769	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	143.4637	0.1443	20.7062	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-802.9093	0.1359	-109.1029	
PV Unit electricity exported	-1950.2028	0.1265	-246.7880	
Total			-355.8909	(269)
Total CO2, kg/year			600.9215	(272)
Target Carbon Dioxide Emission Rate (TER)			10.7900	(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	1907.8713	1.1300	2155.8945	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2492.9711	1.1300	2817.0574	(278)
Space and water heating			4972.9519	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	143.4637	1.5338	220.0494	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-802.9093	1.5023	-1206.1917	
PV Unit electricity exported	-1950.2028	0.4645	-905.9391	
Total			-2112.1308	(283)
Total Primary energy kWh/year			3210.9712	(286)
Target Primary Energy Rate (TPER)			57.6500	(287)

;

Full SAP Calculation Printout

Property Reference	Plot 1 4A_Be Green	Issued on Date	12/10/2022
Assessment Reference	Be Green	Prop Type Ref	4A
Property	4 Bedroom House, House No. 1, Claygate, Surrey, Elmbridge, KT 10		

SAP Rating	84 B	DER	3.49	TER	10.06
Environmental	97 A	% DER<TER	65.31		
CO_2 Emissions (t/year)	0.34	DFEE	31.80	TFEE	32.75
Compliance Check	See BREL	% DFEE < TFEE	2.91		
% DPER < TPER	28.47	DPER	37.51	TPER	52.44

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

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

---

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		39.0000	(1b)	x 2.5000	(2b) =	97.5000	(1b) -
First floor		39.0000	(1c)	x 2.7500	(2c) =	107.2500	(1c) -
Second floor		28.0000	(1d)	x 2.5000	(2d) =	70.0000	(1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		274.7500	(5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.0728	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.2228	(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) =	0.1894	(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	0.2415	0.2367	0.2320	0.2083	0.2036	0.1799	0.1799	0.1752	0.1894	0.2036	0.2130	0.2225	(22b)
Effective ac	0.5291	0.5280	0.5269	0.5217	0.5207	0.5162	0.5162	0.5153	0.5179	0.5207	0.5227	0.5248	(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	
Window (Uw = 1.20)			16.4000	1.1450	18.7786			(27)
Door			5.2000	1.0000	5.2000			(26)
Opening			0.9100	1.1450	1.0420			(27a)
Heatloss Floor 1			38.0000	0.1100	4.1800	0.0000	0.0000	(28a)
External Wall 1	105.0000	21.6000	83.4000	0.1400	11.6760	0.0000	0.0000	(29a)
External Roof 1	30.0000	0.9100	29.0900	0.1043	3.0331	9.0000	261.8100	(30)

Total net area of external elements Aum(A, m2) 173.0000 (31)
Fabric heat loss, W/K = Sum (A x U) (26)...(30) + (32) = 43.9097 (33)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 261.8100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 2.4699 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 8.6500 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 52.5597 (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	47.9767	47.8740	47.7735	47.3010	47.2126	46.8010	46.8010	46.7248	46.9595	47.2126	47.3914	47.5784	(38)
Heat transfer coeff	100.5364	100.4337	100.3331	99.8606	99.7722	99.3607	99.3607	99.2845	99.5192	99.7722	99.9511	100.1380	(39)

Average = Sum(39)m / 12 = 99.8602

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9485	0.9475	0.9465	0.9421	0.9412	0.9374	0.9374	0.9366	0.9389	0.9412	0.9429	0.9447	(40)
HLP (average)												0.9421	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7886 (42)
Hot water usage for mixer showers

70.9748	69.9082	68.3539	65.3801	63.1855	60.7381	59.3470	60.8895	62.5804	65.2082	68.2459	70.7029	(42a)

Hot water usage for baths

30.6447	30.1896	29.5487	28.3670	27.4821	26.5010	25.9710	26.6074	27.3004	28.3502	29.5563	30.5411	(42b)

Hot water usage for other uses

43.1877	41.6172	40.0467	38.4763	36.9058	35.3354	35.3354	36.9058	38.4763	40.0467	41.6172	43.1877	(42c)

Average daily hot water use (litres/day) 133.1104 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.8072	141.7150	137.9494	132.2234	127.5735	122.5745	120.6534	124.4028	128.3571	133.6052	139.4193	144.4317	(44)
Energy conte	229.3392	201.8003	212.0230	181.0072	171.7384	150.7196	145.9199	154.0367	158.2771	181.3009	198.6284	226.1451	(45)

Energy content (annual) Total = Sum(45)m = 2210.9358

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

34.4009	30.2700	31.8035	27.1511	25.7608	22.6079	21.8880	23.1055	23.7416	27.1951	29.7943	33.9218	(46)

Water storage loss:
Store volume 180.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 0.8736 (55)
Total storage loss

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)

If cylinder contains dedicated solar storage

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(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

279.6836	247.2727	262.3675	229.7276	222.0829	199.4401	196.2643	204.3811	206.9975	231.6454	247.3488	276.4895	(62)
WWHRS -31.3196	-27.6993	-29.0052	-24.0174	-22.3834	-19.1536	-17.9535	-19.0917	-19.8171	-23.3621	-26.4665	-30.7396	(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

248.3640	219.5733	233.3623	205.7102	199.6995	180.2865	178.3108	185.2894	187.1805	208.2832	220.8824	245.7499	(64)

Total per year (kWh/year) = Sum(64)m = 2512.6920 (64)
12Total per year (kWh/year) 2513 (64)
Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month

116.5308	103.4765	110.7732	99.1612	97.3786	89.0906	88.7939	91.4927	91.6035	100.5581	105.0203	115.4688	(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	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	138.9644	153.8535	138.9644	143.5966	138.9644	143.5966	138.9644	138.9644	143.5966	138.9644	143.5966	138.9644	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	265.6788	268.4357	261.4884	246.6983	228.0285	210.4816	198.7591	196.0022	202.9495	217.7396	236.4094	253.9563	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	(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)	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	(71)
Water heating gains (Table 5)	156.6275	153.9829	148.8887	137.7239	130.8852	123.7370	119.3466	122.9741	127.2271	135.1588	145.8615	155.2000	(72)
Total internal gains	629.0991	644.1005	617.1699	595.8473	565.7066	542.6435	521.8986	522.7692	538.6016	559.6912	593.6959	615.9492	(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	9.5000	10.6334	0.7600	0.7000	0.7700	37.2426	(74)
East	1.7000	19.6403	0.7600	0.7000	0.7700	12.3095	(76)
South	5.2000	46.7521	0.7600	0.7000	0.7700	89.6291	(78)
South	0.9100	26.0000	0.7600	0.7000	1.0000	11.3284	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	150.5096	265.5702	389.4075	528.7847	636.4438	651.7761	620.0482	536.3448	436.9635	300.3775	181.9115	127.7677	(83)
Total gains	779.6088	909.6707	1006.5775	1124.6320	1202.1503	1194.4196	1141.9468	1059.1139	975.5650	860.0686	775.6074	743.7169	(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	0.7234	0.7241	0.7248	0.7283	0.7289	0.7319	0.7319	0.7325	0.7308	0.7289	0.7276	0.7262	
alpha	1.0482	1.0483	1.0483	1.0486	1.0486	1.0488	1.0488	1.0488	1.0487	1.0486	1.0485	1.0484	
util living area	0.6974	0.6542	0.6047	0.5302	0.4458	0.3552	0.2825	0.3077	0.4227	0.5597	0.6561	0.7081	(86)
MIT	16.9569	17.3347	17.9233	18.7027	19.4467	20.0544	20.3848	20.3291	19.8429	18.8898	17.7966	16.8728	(87)
Th 2	20.1265	20.1273	20.1281	20.1319	20.1326	20.1359	20.1359	20.1365	20.1346	20.1326	20.1312	20.1297	(88)
util rest of house	0.6856	0.6411	0.5894	0.5112	0.4213	0.3221	0.2397	0.2645	0.3897	0.5376	0.6409	0.6966	(89)
MIT 2	15.6492	16.0866	16.7703	17.6717	18.5210	19.2023	19.5561	19.5032	18.9807	17.9034	16.6365	15.5540	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	15.9762	16.3986	17.0586	17.9295	18.7524	19.4153	19.7633	19.7097	19.1963	18.1500	16.9265	15.8837	(92)
Temperature adjustment												0.0000	
adjusted MIT	15.9762	16.3986	17.0586	17.9295	18.7524	19.4153	19.7633	19.7097	19.1963	18.1500	16.9265	15.8837	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6147	0.5724	0.5249	0.4554	0.3775	0.2919	0.2197	0.2413	0.3496	0.4779	0.5719	0.6253	(94)
Useful gains	479.1919	520.7244	528.3217	512.2077	453.8642	348.6711	250.9233	255.5431	341.0668	411.0661	443.5393	465.0591	(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	1173.8784	1154.8465	1059.3745	901.6875	703.6346	478.4562	314.3040	328.5977	507.1774	753.2790	982.1738	1169.9847	(97)
Space heating kWh	516.8468	426.1301	395.1032	280.4255	185.8292	0.0000	0.0000	0.0000	0.0000	254.6064	387.8168	524.4646	(98a)
Space heating requirement - total per year (kWh/year)												2971.2226	
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	516.8468	426.1301	395.1032	280.4255	185.8292	0.0000	0.0000	0.0000	0.0000	254.6064	387.8168	524.4646	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2971.2226	
Space heating per m2											(98c) / (4) =	28.0304	(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 %)	219.3000	(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	516.8468	426.1301	395.1032	280.4255	185.8292	0.0000	0.0000	0.0000	0.0000	254.6064	387.8168	524.4646	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	235.6802	194.3138	180.1656	127.8730	84.7374	0.0000	0.0000	0.0000	0.0000	116.0996	176.8430	239.1540	(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	248.3640	219.5733	233.3623	205.7102	199.6995	180.2865	178.3108	185.2894	187.1805	208.2832	220.8824	245.7499	(64)
Efficiency of water heater												190.4000	(216)
(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(217)
Fuel for water heating, kWh/month													

	130.4433	115.3221	122.5642	108.0411	104.8842	94.6883	93.6507	97.3159	98.3091	109.3925	116.0097	129.0703 (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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	37.1258	29.7837	26.8169	19.6472	15.1761	12.3990	13.8441	17.9951	23.3739	30.6678	34.6392	38.1577 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-13.0297	-20.5586	-32.9959	-41.2798	-47.9902	-44.3673	-43.7856	-39.5327	-32.6187	-25.0076	-15.0303	-11.0295 (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	-1.9963	-4.5154	-9.7079	-15.9518	-22.7146	-25.1468	-24.8098	-20.3995	-14.3202	-7.0461	-2.7927	-1.5447 (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	1354.8667 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	190.4000
Water heating fuel used	1319.6912 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	299.6266 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-518.1718 (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	2456.0127 (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	1354.8667	0.1535	208.0175	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1319.6912	0.1408	185.8449	(264)
Space and water heating			393.8624	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	299.6266	0.1443	43.2454	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.2260	0.1328	-48.7592	
PV Unit electricity exported	-150.9459	0.1225	-18.4880	
Total			-67.2471	(269)
Total CO2, kg/year			369.8607	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			3.4900	(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	1354.8667	1.5684	2124.9898	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1319.6912	1.5207	2006.8731	(278)
Space and water heating			4131.8628	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	299.6266	1.5338	459.5773	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.2260	1.4906	-547.3957	
PV Unit electricity exported	-150.9459	0.4493	-67.8253	
Total			-615.2210	(283)
Total Primary energy kWh/year			3976.2191	(286)
Dwelling Primary energy Rate (DPER)			37.5100	(287)

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

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.0000 (1b)	x	2.5000 (2b)	=	97.5000 (1b)	-
First floor	39.0000 (1c)	x	2.7500 (2c)	=	107.2500 (1c)	-
Second floor	28.0000 (1d)	x	2.5000 (2d)	=	70.0000 (1d)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	274.7500	(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) =	0.1456	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3956	(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) =	0.3362	(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	0.4287	0.4203	0.4119	0.3699	0.3615	0.3194	0.3194	0.3110	0.3362	0.3615	0.3783	0.3951	(22b)
Effective ac	0.5919	0.5883	0.5848	0.5684	0.5653	0.5510	0.5510	0.5484	0.5565	0.5653	0.5715	0.5780	(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			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			16.4000	1.1450	18.7786			(27)
Opening			0.9100	1.5918	1.4485			(27a)
Heatloss Floor 1			38.0000	0.1300	4.9400			(28a)
External Wall 1	105.0000	21.6000	83.4000	0.1800	15.0120			(29a)
External Roof 1	30.0000	0.9100	29.0900	0.1100	3.1999			(30)
Total net area of external elements Aum(A, m2)			173.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	48.5790			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K			2.4699 (35)
List of Thermal Bridges			
K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	10.0000	0.1600	1.6000
E6 Intermediate floor within a dwelling	36.0000	0.0000	0.0000
E16 Corner (normal)	15.5000	0.0900	1.3950
E18 Party wall between dwellings	15.5000	0.0600	0.9300
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			3.9250 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =		52.5040 (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	53.6660	53.3425	53.0253	51.5357	51.2570	49.9596	49.9596	49.7193	50.4593	51.2570	51.8208	52.4103	(38)
Heat transfer coeff	106.1701	105.8465	105.5294	104.0397	103.7610	102.4636	102.4636	102.2234	102.9634	103.7610	104.3248	104.9143	(39)
Average = Sum(39)m / 12 =												104.0384	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0016	0.9986	0.9956	0.9815	0.9789	0.9666	0.9666	0.9644	0.9714	0.9789	0.9842	0.9898	(40)
HLP (average)												0.9815	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---
4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7886 (42)

Hot water usage for mixer showers

70.9748	69.9082	68.3539	65.3801	63.1855	60.7381	59.3470	60.8895	62.5804	65.2082	68.2459	70.7029 (42a)

Hot water usage for baths

30.6447	30.1896	29.5487	28.3670	27.4821	26.5010	25.9710	26.6074	27.3004	28.3502	29.5563	30.5411 (42b)

Hot water usage for other uses

43.1877	41.6172	40.0467	38.4763	36.9058	35.3354	35.3354	36.9058	38.4763	40.0467	41.6172	43.1877 (42c)

Average daily hot water use (litres/day) 133.1104 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.8072	141.7150	137.9494	132.2234	127.5735	122.5745	120.6534	124.4028	128.3571	133.6052	139.4193	144.4317	(44)
Energy conte	229.3392	201.8003	212.0230	181.0072	171.7384	150.7196	145.9199	154.0367	158.2771	181.3009	198.6284	226.1451	(45)

Energy content (annual) Total = Sum(45)m = 2210.9358

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

34.4009	30.2700	31.8035	27.1511	25.7608	22.6079	21.8880	23.1055	23.7416	27.1951	29.7943	33.9218 (46)

Water storage loss:

Store volume 180.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.5520 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.8381 (55)

Total storage loss

25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)

If cylinder contains dedicated solar storage

25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)

Total heat required for water heating calculated for each month

278.5819	246.2775	261.2657	228.6614	220.9811	198.3738	195.1625	203.2793	205.9313	230.5436	246.2826	275.3877 (62)
WWHRS -32.4467	-28.6961	-30.0489	-24.8817	-23.1889	-19.8429	-18.5995	-19.7787	-20.5302	-24.2029	-27.4189	-31.8459 (63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)

Output from w/h

246.1351	217.5814	231.2168	203.7797	197.7923	178.5310	176.5630	183.5006	185.4011	206.3408	218.8637	243.5419 (64)

Total per year (kWh/year) = Sum(64)m = 2489.2472 (64)

12Total per year (kWh/year) 2489 (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

115.6494	102.6804	109.8918	98.3083	96.4972	88.2376	87.9125	90.6113	90.7505	99.6767	104.1673	114.5874 (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	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	139.4281	(66)

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

138.9644	153.8535	138.9644	143.5966	138.9644	143.5966	138.9644	138.9644	143.5966	138.9644	143.5966	138.9644 (67)

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

265.6788	268.4357	261.4884	246.6983	228.0285	210.4816	198.7591	196.0022	202.9495	217.7396	236.4094	253.9563 (68)

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

36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428	36.9428 (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)

-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425	-111.5425 (71)

Water heating gains (Table 5)

155.4428	152.7982	147.7040	136.5392	129.7005	122.5523	118.1619	121.7894	126.0424	133.9741	144.6768	154.0153 (72)

Total internal gains

627.9144	642.9158	615.9853	594.6626	564.5219	541.4588	520.7139	521.5845	537.4169	558.5065	592.5112	614.7645 (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	9.5000	10.6334	0.6300	0.7000	0.7700	30.8722	(74)
East	1.7000	19.6403	0.6300	0.7000	0.7700	10.2039	(76)
South	5.2000	46.7521	0.6300	0.7000	0.7700	74.2978	(78)
South	0.9100	26.0000	0.6300	0.7000	1.0000	9.3907	(82)

Solar gains	124.7646	220.1437	322.7984	438.3347	527.5784	540.2881	513.9873	444.6016	362.2197	248.9971	150.7951	105.9127	(83)
Total gains	752.6790	863.0595	938.7836	1032.9973	1092.1003	1081.7469	1034.7012	966.1860	899.6366	807.5036	743.3062	720.6772	(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	0.6850	0.6871	0.6891	0.6990	0.7009	0.7098	0.7098	0.7114	0.7063	0.7009	0.6971	0.6932	
alpha	1.0457	1.0458	1.0459	1.0466	1.0467	1.0473	1.0473	1.0474	1.0471	1.0467	1.0465	1.0462	
util living area													
	0.7158	0.6775	0.6331	0.5617	0.4798	0.3858	0.3097	0.3343	0.4513	0.5849	0.6750	0.7238	(86)
MIT	15.7547	16.2286	16.9993	18.0578	19.0830	19.9505	20.4262	20.3505	19.6666	18.3621	16.8995	15.6641	(87)
Th 2	20.0820	20.0845	20.0870	20.0988	20.1010	20.1112	20.1112	20.1131	20.1073	20.1010	20.0965	20.0919	(88)
util rest of house													
	0.7038	0.6643	0.6175	0.5421	0.4539	0.3504	0.2629	0.2877	0.4166	0.5622	0.6597	0.7122	(89)
MIT 2	14.3132	14.8633	15.7609	16.9906	18.1648	19.1429	19.6539	19.5821	18.8423	17.3619	15.6629	14.2131	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	14.6736	15.2046	16.0705	17.2574	18.3943	19.3448	19.8470	19.7742	19.0483	17.6119	15.9721	14.5759	(92)
Temperature adjustment												0.0000	
adjusted MIT	14.6736	15.2046	16.0705	17.2574	18.3943	19.3448	19.8470	19.7742	19.0483	17.6119	15.9721	14.5759	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6070	0.5706	0.5299	0.4674	0.3973	0.3165	0.2478	0.2682	0.3694	0.4848	0.5671	0.6149	(94)
Useful gains	456.8504	492.4961	497.4532	482.8060	433.9260	342.3713	256.4409	259.1043	332.3558	391.4479	421.5280	443.1196	(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													
	1101.3658	1090.7086	1009.9682	869.4995	694.6123	486.1700	332.6976	344.9205	509.4975	727.5667	925.5787	1088.5790	(97)
Space heating kWh													
	479.5195	401.9988	381.3111	278.4194	193.9506	0.0000	0.0000	0.0000	0.0000	250.0724	362.9165	480.2218	(98a)
Space heating requirement - total per year (kWh/year)												2828.4102	
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													
	479.5195	401.9988	381.3111	278.4194	193.9506	0.0000	0.0000	0.0000	0.0000	250.0724	362.9165	480.2218	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2828.4102	
Space heating per m2											(98c) / (4) =	26.6831	(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													
	479.5195	401.9988	381.3111	278.4194	193.9506	0.0000	0.0000	0.0000	0.0000	250.0724	362.9165	480.2218	(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)													
	519.5227	435.5350	413.1215	301.6461	210.1307	0.0000	0.0000	0.0000	0.0000	270.9344	393.1923	520.2836	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	246.1351	217.5814	231.2168	203.7797	197.7923	178.5310	176.5630	183.5006	185.4011	206.3408	218.8637	243.5419	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.5282	85.4170	85.1739	84.7601	84.0158	79.8000	79.8000	79.8000	79.8000	84.4919	85.1857	85.5532	(217)
Fuel for water heating, kWh/month													
	287.7826	254.7285	271.4643	240.4192	235.4227	223.7230	221.2569	229.9506	232.3322	244.2135	256.9253	284.6671	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	28.8741	23.1638	20.8565	15.2803	11.8030	9.6431	10.7671	13.9954	18.1787	23.8514	26.9401	29.6766	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-38.0116	-54.3942	-79.3326	-90.5233	-98.7020	-92.4737	-91.2922	-85.6318	-75.8488	-62.7588	-42.0589	-32.7664	(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	-19.0920	-40.4165	-80.8166	-122.1058	-162.1824	-163.2623	-161.3844	-136.3477	-99.5180	-58.0895	-25.5810	-15.0820	(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												3064.3664	(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	2982.8861 (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)	233.0302 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1927.6727 (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	4438.6100 (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	3064.3664	0.2100	643.5169	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2982.8861	0.2100	626.4061	(264)
Space and water heating			1269.9230	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	233.0302	0.1443	33.6335	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-843.7944	0.1343	-113.3120	
PV Unit electricity exported	-1083.8783	0.1257	-136.2590	
Total			-249.5710	(269)
Total CO2, kg/year			1065.9148	(272)
Target Carbon Dioxide Emission Rate (TER)			10.0600	(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	3064.3664	1.1300	3462.7340	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2982.8861	1.1300	3370.6613	(278)
Space and water heating			6833.3953	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	233.0302	1.5338	357.4295	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-843.7944	1.4963	-1262.5624	
PV Unit electricity exported	-1083.8783	0.4614	-500.1543	
Total			-1762.7166	(283)
Total Primary energy kWh/year			5558.2090	(286)
Target Primary Energy Rate (TPER)			52.4400	(287)

;

Full SAP Calculation Printout

Property Reference	Plot 3 3A_Be Green	Issued on Date	12/10/2022
Assessment Reference	Be Green	Prop Type Ref	3A
Property	3 Bedroom House, House No. 3, Claygate, Surrey, Elmbridge, KT 10		

SAP Rating	82 B	DER	4.08	TER	10.57
Environmental	96 A	% DER<TER	61.40		
CO_2 Emissions (t/year)	0.35	DFEE	36.87	TFEE	36.53
Compliance Check	See BREL	% DFEE < TFEE	-0.91		
% DPER < TPER	20.87	DPER	43.58	TPER	55.08

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

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

---

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		46.5000 (1b)	x	2.5000 (2b)	=	116.2500 (1b)	-
First floor		46.5000 (1c)	x	2.7500 (2c)	=	127.8750 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	244.1250	(5)

---

2. Ventilation rate

---

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.0819	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.2319	(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) =	0.1971	(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	0.2513	0.2464	0.2415	0.2169	0.2119	0.1873	0.1873	0.1824	0.1971	0.2119	0.2218	0.2316	(22b)
Effective ac	0.5316	0.5304	0.5292	0.5235	0.5225	0.5175	0.5175	0.5166	0.5194	0.5225	0.5246	0.5268	(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	
Window (Uw = 1.20)			14.7000	1.1450	16.8321			(27)
Door			5.2000	1.0000	5.2000			(26)
Opening			0.9100	1.1450	1.0420			(27a)
Heatloss Floor 1			46.5000	0.1200	5.5800	0.0000	0.0000	(28a)
External Wall 1	101.0000	19.9000	81.1000	0.1400	11.3540	0.0000	0.0000	(29a)
External Roof 1	75.0000	0.9100	74.0900	0.1132	8.3875	9.0000	666.8100	(30)
Total net area of external elements Aum(A, m2)			222.5000					(31)

Fabric heat loss, W/K = Sum (A x U) (26)...(30) + (32) = 48.3956 (33)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 666.8100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 7.1700 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 11.1250 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 59.5206 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.8254	42.7266	42.6297	42.1748	42.0897	41.6934	41.6934	41.6200	41.8460	42.0897	42.2619	42.4419	(38)
Heat transfer coeff	102.3460	102.2472	102.1503	101.6954	101.6103	101.2140	101.2140	101.1406	101.3666	101.6103	101.7824	101.9625	(39)

Average = Sum(39)m / 12 = 101.6950

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1005	1.0994	1.0984	1.0935	1.0926	1.0883	1.0883	1.0875	1.0900	1.0926	1.0944	1.0964	(40)
HLP (average)												1.0935	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6646 (42)

Hot water usage for mixer showers

68.8963	67.8609	66.3522	63.4655	61.3351	58.9594	57.6091	59.1064	60.7477	63.2985	66.2473	68.6323	(42a)

Hot water usage for baths

29.7509	29.3090	28.6868	27.5396	26.6806	25.7280	25.2135	25.8314	26.5041	27.5233	28.6942	29.6503	(42b)

Hot water usage for other uses

41.9181	40.3938	38.8695	37.3453	35.8210	34.2967	34.2967	35.8210	37.3453	38.8695	40.3938	41.9181	(42c)

Average daily hot water use (litres/day) 129.2112 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.5653	137.5638	133.9086	128.3503	123.8366	118.9841	117.1192	120.7587	124.5971	129.6914	135.3353	140.2008	(44)
Energy conte	222.6211	195.8890	205.8125	175.7052	166.7079	146.3048	141.6456	149.5245	153.6407	175.9900	192.8100	219.5205	(45)

Energy content (annual) Total = Sum(45)m = 2146.1718

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

33.3932	29.3834	30.8719	26.3558	25.0062	21.9457	21.2468	22.4287	23.0461	26.3985	28.9215	32.9281	(46)

Water storage loss:
Store volume 180.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 0.8736 (55)
Total storage loss

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)

If cylinder contains dedicated solar storage

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(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

272.9656	241.3614	256.1569	224.4256	217.0524	195.0253	191.9900	199.8689	202.3611	226.3345	241.5304	269.8650	(62)
WWHRS -30.4024	-26.8882	-28.1557	-23.3141	-21.7279	-18.5927	-17.4277	-18.5326	-19.2367	-22.6780	-25.6914	-29.8394	(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

242.5631	214.4733	228.0012	201.1115	195.3245	176.4326	174.5623	181.3363	183.1244	203.6565	215.8390	240.0255	(64)

Total per year (kWh/year) = Sum(64)m = 2456.4502 (64)
12Total per year (kWh/year) 2456 (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

114.2971	101.5110	108.7082	97.3983	95.7059	87.6227	87.3727	89.9924	90.0619	98.7922	103.0856	113.2661	(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	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	127.2049	140.8340	127.2049	131.4451	127.2049	131.4451	127.2049	127.2049	131.4451	127.2049	131.4451	127.2049	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.4900	247.0270	240.6338	227.0233	209.8424	193.6949	182.9074	180.3703	186.7636	200.3741	217.5549	233.7024	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	(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)	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	(71)
Water heating gains (Table 5)	153.6251	151.0581	146.1132	135.2754	128.6370	121.6982	117.4364	120.9576	125.0859	132.7853	143.1745	152.2394	(72)
Total internal gains	591.2890	604.8881	579.9208	559.7127	531.6534	509.8072	490.5177	491.5018	506.2636	526.3332	558.1435	579.1157	(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	
East	9.5000	19.6403	0.7600	0.7000	0.7700	68.7885	(76)
West	5.2000	19.6403	0.7600	0.7000	0.7700	37.6526	(80)
West	0.9100	26.0000	0.7600	0.7000	1.0000	11.3284	(82)

Solar gains	117.7695	231.7497	384.7390	565.4716	696.5661	714.5642	679.6807	581.5054	448.9262	275.8290	147.0980	96.6819	(83)
Total gains	709.0585	836.6378	964.6599	1125.1843	1228.2194	1224.3713	1170.1984	1073.0072	955.1897	802.1623	705.2414	675.7976	(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	1.8098	1.8115	1.8133	1.8214	1.8229	1.8300	1.8300	1.8314	1.8273	1.8229	1.8198	1.8166	
alpha	1.1207	1.1208	1.1209	1.1214	1.1215	1.1220	1.1220	1.1221	1.1218	1.1215	1.1213	1.1211	
util living area	0.7417	0.6977	0.6390	0.5522	0.4594	0.3645	0.2890	0.3178	0.4465	0.6006	0.7023	0.7521	(86)
MIT	16.9695	17.3555	17.9900	18.8064	19.5458	20.1244	20.4318	20.3756	19.8934	18.9157	17.8033	16.8865	(87)
Th 2	20.0004	20.0013	20.0021	20.0061	20.0069	20.0104	20.0104	20.0110	20.0090	20.0069	20.0054	20.0038	(88)
util rest of house	0.7288	0.6830	0.6212	0.5296	0.4300	0.3248	0.2378	0.2658	0.4067	0.5747	0.6853	0.7396	(89)
MIT 2	15.5625	16.0101	16.7468	17.6881	18.5269	19.1686	19.4901	19.4396	18.9336	17.8364	16.5462	15.4683	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	15.9142	16.3465	17.0576	17.9677	18.7816	19.4075	19.7256	19.6736	19.1735	18.1063	16.8605	15.8228	(92)
Temperature adjustment												0.0000	
adjusted MIT	15.9142	16.3465	17.0576	17.9677	18.7816	19.4075	19.7256	19.6736	19.1735	18.1063	16.8605	15.8228	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6603	0.6157	0.5579	0.4760	0.3895	0.2984	0.2219	0.2464	0.3687	0.5153	0.6176	0.6711	(94)
Useful gains	468.1806	515.0850	538.1519	535.5921	478.3905	365.3610	259.6180	264.4015	352.1790	413.3551	435.5265	453.5582	(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	1188.6712	1170.3708	1078.4655	922.1437	719.5646	486.5897	316.3497	331.0970	514.2839	762.7121	993.4482	1185.0933	(97)
Space heating kWh	536.0450	440.3521	401.9934	278.3172	179.4335	0.0000	0.0000	0.0000	0.0000	259.9216	401.7036	544.2621	(98a)
Space heating requirement - total per year (kWh/year)												3042.0285	
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	536.0450	440.3521	401.9934	278.3172	179.4335	0.0000	0.0000	0.0000	0.0000	259.9216	401.7036	544.2621	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3042.0285	
Space heating per m2											(98c) / (4) =	32.7100	(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 %)	219.3000	(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	536.0450	440.3521	401.9934	278.3172	179.4335	0.0000	0.0000	0.0000	0.0000	259.9216	401.7036	544.2621	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	244.4346	200.7989	183.3075	126.9116	81.8210	0.0000	0.0000	0.0000	0.0000	118.5233	183.1754	248.1815	(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	242.5631	214.4733	228.0012	201.1115	195.3245	176.4326	174.5623	181.3363	183.1244	203.6565	215.8390	240.0255	(64)
Efficiency of water heater												190.4000	(216)
(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(217)
Fuel for water heating, kWh/month	127.3966	112.6435	119.7485	105.6258	102.5864	92.6642	91.6819	95.2397	96.1788	106.9625	113.3608	126.0638	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	34.7815	27.9030	25.1236	18.4066	14.2178	11.6161	12.9699	16.8588	21.8979	28.7313	32.4519	35.7482	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-8.4742	-14.6792	-26.3362	-36.0954	-44.0942	-41.4736	-40.6389	-35.4185	-27.2032	-18.7126	-10.0721	-6.9797	(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	-1.0277	-2.6720	-6.8567	-13.1321	-20.4423	-23.4034	-22.7848	-17.5892	-10.9290	-4.4903	-1.5015	-0.7631	(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	1387.1539	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	190.4000	
Water heating fuel used	1290.1524	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	280.7067	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-435.7700	(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	2522.2429	(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	1387.1539	0.1537	213.1977	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1290.1524	0.1408	181.6658	(264)
Space and water heating			394.8635	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	280.7067	0.1443	40.5146	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-310.1780	0.1313	-40.7184	
PV Unit electricity exported	-125.5921	0.1194	-14.9940	
Total			-55.7124	(269)
Total CO2, kg/year			379.6658	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			4.0800	(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	1387.1539	1.5690	2176.4552	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1290.1524	1.5207	1961.8809	(278)
Space and water heating			4138.3360	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	280.7067	1.5338	430.5573	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-310.1780	1.4850	-460.6087	
PV Unit electricity exported	-125.5921	0.4378	-54.9831	
Total			-515.5917	(283)
Total Primary energy kWh/year			4053.3016	(286)
Dwelling Primary energy Rate (DPER)			43.5800	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF TARGET EMISSIONS

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	46.5000 (1b)	x	2.5000 (2b)	=	116.2500 (1b)	-
First floor	46.5000 (1c)	x	2.7500 (2c)	=	127.8750 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	244.1250	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1229	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3729	(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) =	0.3170	(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	0.4041	0.3962	0.3883	0.3487	0.3407	0.3011	0.3011	0.2932	0.3170	0.3407	0.3566	0.3724	(22b)
Effective ac	0.5817	0.5785	0.5754	0.5608	0.5580	0.5453	0.5453	0.5430	0.5502	0.5580	0.5636	0.5693	(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			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			14.7000	1.1450	16.8321			(27)
Opening			0.9100	1.5918	1.4485			(27a)
Heatloss Floor 1			46.5000	0.1300	6.0450			(28a)
External Wall 1	101.0000	19.9000	81.1000	0.1800	14.5980			(29a)
External Roof 1	75.0000	0.9100	74.0900	0.1100	8.1499			(30)
Total net area of external elements Aum(A, m2)			222.5000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.2735			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 7.1700 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E5 Ground floor (normal)	10.0000	0.1600	1.6000
E6 Intermediate floor within a dwelling	36.0000	0.0000	0.0000
E16 Corner (normal)	15.5000	0.0900	1.3950
E18 Party wall between dwellings	15.5000	0.0600	0.9300

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.9250 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	56.1985 (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	46.8589	46.6034	46.3531	45.1770	44.9570	43.9327	43.9327	43.7430	44.3272	44.9570	45.4021	45.8675	(38)
Heat transfer coeff	103.0573	102.8019	102.5515	101.3755	101.1554	100.1311	100.1311	99.9415	100.5257	101.1554	101.6006	102.0659	(39)
Average = Sum(39)m / 12 =												101.3744	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1081	1.1054	1.1027	1.0901	1.0877	1.0767	1.0767	1.0746	1.0809	1.0877	1.0925	1.0975	(40)
HLP (average)												1.0900	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6646 (42)

Hot water usage for mixer showers

68.8963	67.8609	66.3522	63.4655	61.3351	58.9594	57.6091	59.1064	60.7477	63.2985	66.2473	68.6323 (42a)

Hot water usage for baths

29.7509	29.3090	28.6868	27.5396	26.6806	25.7280	25.2135	25.8314	26.5041	27.5233	28.6942	29.6503 (42b)

Hot water usage for other uses

41.9181	40.3938	38.8695	37.3453	35.8210	34.2967	34.2967	35.8210	37.3453	38.8695	40.3938	41.9181 (42c)

Average daily hot water use (litres/day) 129.2112 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	140.5653	137.5638	133.9086	128.3503	123.8366	118.9841	117.1192	120.7587	124.5971	129.6914	135.3353	140.2008	(44)
Energy conte	222.6211	195.8890	205.8125	175.7052	166.7079	146.3048	141.6456	149.5245	153.6407	175.9900	192.8100	219.5205	(45)
Energy content (annual)										Total = Sum(45)m =		2146.1718	
Distribution loss (46)m = 0.15 x (45)m													
	33.3932	29.3834	30.8719	26.3558	25.0062	21.9457	21.2468	22.4287	23.0461	26.3985	28.9215	32.9281	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8381	(55)
Total storage loss													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(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													
	271.8638	240.3663	255.0551	223.3594	215.9506	193.9590	190.8882	198.7672	201.2949	225.2327	240.4642	268.7632	(62)
WWHRS	-31.4965	-27.8558	-29.1690	-24.1531	-22.5098	-19.2618	-18.0548	-19.1995	-19.9290	-23.4941	-26.6159	-30.9132	(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													
	240.3673	212.5105	225.8862	199.2063	193.4408	174.6973	172.8334	179.5677	181.3659	201.7386	213.8482	237.8500	(64)
										Total per year (kWh/year) = Sum(64)m =		2433.3121	(64)
12Total per year (kWh/year)												2433	(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													
	113.4157	100.7149	107.8268	96.5453	94.8245	86.7697	86.4913	89.1110	89.2089	97.9108	102.2327	112.3847	(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	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	127.2049	140.8340	127.2049	131.4451	127.2049	131.4451	127.2049	127.2049	131.4451	127.2049	131.4451	127.2049	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.4900	247.0270	240.6338	227.0233	209.8424	193.6949	182.9074	180.3703	186.7636	200.3741	217.5549	233.7024	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	(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)													
	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	(71)
Water heating gains (Table 5)													
	152.4404	149.8734	144.9285	134.0907	127.4523	120.5135	116.2517	119.7729	123.9012	131.6006	141.9898	151.0547	(72)
Total internal gains													
	590.1043	603.7034	578.7361	558.5280	530.4687	508.6225	489.3330	490.3171	505.0789	525.1486	556.9588	577.9310	(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	
East	9.5000	19.6403	0.6300	0.7000	0.7700	57.0220	(76)
West	5.2000	19.6403	0.6300	0.7000	0.7700	31.2121	(80)
West	0.9100	26.0000	0.6300	0.7000	1.0000	9.3907	(82)

Solar gains	97.6248	192.1083	318.9284	468.7462	577.4166	592.3361	563.4195	482.0374	372.1362	228.6477	121.9365	80.1442	(83)
Total gains	687.7290	795.8117	897.6645	1027.2742	1107.8853	1100.9586	1052.7525	972.3545	877.2150	753.7963	678.8952	658.0752	(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	1.7973	1.8018	1.8062	1.8271	1.8311	1.8498	1.8498	1.8533	1.8426	1.8311	1.8231	1.8148	
alpha	1.1198	1.1201	1.1204	1.1218	1.1221	1.1233	1.1233	1.1236	1.1228	1.1221	1.1215	1.1210	
util living area													
	0.7492	0.7100	0.6573	0.5753	0.4855	0.3882	0.3100	0.3379	0.4669	0.6154	0.7104	0.7576	(86)

MIT	15.8563	16.3389	17.1559	18.2454	19.2505	20.0639	20.4989	20.4237	19.7589	18.4461	16.9787	15.7640	(87)
Th 2	19.9942	19.9964	19.9986	20.0090	20.0109	20.0199	20.0199	20.0216	20.0164	20.0109	20.0070	20.0029	(88)
util rest of house	0.7364	0.6955	0.6399	0.5529	0.4559	0.3477	0.2568	0.2845	0.4268	0.5899	0.6937	0.7452	(89)
MIT 2	14.3568	14.9180	15.8694	17.1314	18.2771	19.1855	19.6439	19.5757	18.8711	17.3899	15.6837	14.2536	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	14.7316	15.2732	16.1911	17.4099	18.5205	19.4051	19.8577	19.7877	19.0930	17.6540	16.0075	14.6312	(92)
Temperature adjustment												0.0000	
adjusted MIT	14.7316	15.2732	16.1911	17.4099	18.5205	19.4051	19.8577	19.7877	19.0930	17.6540	16.0075	14.6312	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6431	0.6046	0.5552	0.4825	0.4049	0.3197	0.2473	0.2706	0.3838	0.5142	0.6036	0.6518	(94)
Useful gains	442.2669	481.1320	498.3841	495.6761	448.6223	351.9780	260.3528	263.0858	336.6946	387.6348	409.7878	428.9205	(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	1075.0575	1066.3861	993.8342	862.6969	689.9276	481.1420	326.1924	338.5675	501.9296	713.5483	905.0033	1064.6694	(97)
Space heating kWh	470.7963	393.2907	368.6149	264.2550	179.5311	0.0000	0.0000	0.0000	0.0000	242.4797	356.5552	472.9972	(98a)
Space heating requirement - total per year (kWh/year)												2748.5200	
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	470.7963	393.2907	368.6149	264.2550	179.5311	0.0000	0.0000	0.0000	0.0000	242.4797	356.5552	472.9972	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2748.5200	
Space heating per m2											(98c) / (4) =	29.5540	(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	470.7963	393.2907	368.6149	264.2550	179.5311	0.0000	0.0000	0.0000	0.0000	242.4797	356.5552	472.9972	(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)	510.0718	426.1004	399.3661	286.3001	194.5083	0.0000	0.0000	0.0000	0.0000	262.7082	386.3003	512.4564	(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	240.3673	212.5105	225.8862	199.2063	193.4408	174.6973	172.8334	179.5677	181.3659	201.7386	213.8482	237.8500	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.5393	85.4205	85.1511	84.6943	83.8928	79.8000	79.8000	79.8000	79.8000	84.4733	85.1976	85.5708	(217)
Fuel for water heating, kWh/month	281.0022	248.7816	265.2770	235.2062	230.5810	218.9189	216.5832	225.0221	227.2755	238.8193	251.0026	277.9569	(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	26.4307	21.2037	19.0916	13.9873	10.8042	8.8271	9.8559	12.8111	16.6404	21.8331	24.6604	27.1653	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-42.8359	-60.0487	-85.8248	-95.9204	-102.9277	-95.8634	-94.6451	-89.5757	-80.5824	-68.3601	-46.9584	-37.0716	(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	-25.2493	-52.9949	-105.1224	-157.5989	-208.1269	-209.0526	-206.6232	-175.0921	-128.5088	-75.7284	-33.6892	-19.9783	(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												2977.8115	(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												2916.4265	(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)	213.3107 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2298.3790 (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	3895.1696 (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	2977.8115	0.2100	625.3404	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2916.4265	0.2100	612.4496	(264)
Space and water heating			1237.7900	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	213.3107	0.1443	30.7873	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-900.6141	0.1347	-121.3274	
PV Unit electricity exported	-1397.7649	0.1259	-176.0435	
Total			-297.3709	(269)
Total CO2, kg/year			983.1357	(272)
Target Carbon Dioxide Emission Rate (TER)			10.5700	(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	2977.8115	1.1300	3364.9270	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2916.4265	1.1300	3295.5619	(278)
Space and water heating			6660.4889	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	213.3107	1.5338	327.1830	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-900.6141	1.4979	-1349.0262	
PV Unit electricity exported	-1397.7649	0.4623	-646.2034	
Total			-1995.2297	(283)
Total Primary energy kWh/year			5122.5431	(286)
Target Primary Energy Rate (TPER)			55.0800	(287)

;

Full SAP Calculation Printout

elmhurst energy

Property Reference	Plot 9 2B_Be Green	Issued on Date	12/10/2022
Assessment Reference	Be Green	Prop Type Ref	2B
Property	2 Bedroom House, House No. 9, Claygate, Surrey, Elmbridge, KT 10		

SAP Rating	80 C	DER	4.81	TER	12.09
Environmental	96 A	% DER<TER	60.22		
CO_2 Emissions (t/year)	0.37	DFEE	43.78	TFEE	41.26
Compliance Check	See BREL	% DFEE < TFEE	-6.12		
% DPER < TPER	19.60	DPER	50.80	TPER	63.18

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

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

---

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		41.8000 (1b)	x	2.5000 (2b)	=	104.5000 (1b)	-
First floor		41.8000 (1c)	x	2.7500 (2c)	=	114.9500 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	83.6000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	219.4500	(5)

---

2. Ventilation rate

---

			m3 per hour	
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		2 * 10 =	20.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		20.0000 / (5) =	0.0911	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			3.0000	(17)
Infiltration rate			0.2411	(18)
Number of sides sheltered			0	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.2411	(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	0.3074	0.3014	0.2954	0.2653	0.2592	0.2291	0.2291	0.2231	0.2411	0.2592	0.2713	0.2833	(22b)
Effective ac	0.5473	0.5454	0.5436	0.5352	0.5336	0.5262	0.5262	0.5249	0.5291	0.5336	0.5368	0.5401	(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	
Window (Uw = 1.20)			21.8000	1.1450	24.9618			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			41.8000	0.1200	5.0160	0.0000	0.0000	(28a)
External Wall 1	140.2800	27.0000	113.2800	0.1400	15.8592	0.0000	0.0000	(29a)
External Roof 1	65.0000		65.0000	0.1132	7.3585	9.0000	585.0000	(30)
Total net area of external elements Aum(A, m2)			247.0800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	58.3955			(33)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 585.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 6.9976 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 12.3540 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 70.7495 (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	39.6319	39.4990	39.3688	38.7569	38.6424	38.1094	38.1094	38.0107	38.3147	38.6424	38.8740	39.1161	(38)
Heat transfer coeff	110.3815	110.2486	110.1183	109.5064	109.3919	108.8590	108.8590	108.7603	109.0642	109.3919	109.6235	109.8656	(39)

Average = Sum(39)m / 12 = 109.5058

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3204	1.3188	1.3172	1.3099	1.3085	1.3021	1.3021	1.3010	1.3046	1.3085	1.3113	1.3142	(40)
HLP (average)												1.3099	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5276 (42)
Hot water usage for mixer showers

66.5997	65.5989	64.1404	61.3499	59.2906	56.9941	55.6887	57.1362	58.7228	61.1886	64.0390	66.3446	(42a)

Hot water usage for baths

28.7633	28.3361	27.7346	26.6254	25.7949	24.8740	24.3765	24.9739	25.6243	26.6097	27.7417	28.6661	(42b)

Hot water usage for other uses

40.5154	39.0422	37.5689	36.0956	34.6223	33.1490	33.1490	34.6223	36.0956	37.5689	39.0422	40.5154	(42c)

Average daily hot water use (litres/day) 124.9031 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	135.8785	132.9771	129.4438	124.0709	119.7078	115.0171	113.2143	116.7323	120.4427	125.3671	130.8228	135.5261	(44)
Energy conte	215.1983	189.3577	198.9504	169.8469	161.1497	141.4269	136.9229	144.5390	148.5178	170.1220	186.3811	212.2011	(45)

Energy content (annual) Total = Sum(45)m = 2074.6138

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

32.2797	28.4037	29.8426	25.4770	24.1725	21.2140	20.5384	21.6809	22.2777	25.5183	27.9572	31.8302	(46)

Water storage loss:
Store volume 180.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 0.8736 (55)
Total storage loss

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)

If cylinder contains dedicated solar storage

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(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

265.5427	234.8301	249.2948	218.5673	211.4941	190.1473	187.2673	194.8834	197.2383	220.4665	235.1016	262.5455	(62)
WWHRS -29.3890	-25.9919	-27.2172	-22.5369	-21.0036	-17.9729	-16.8468	-17.9148	-18.5955	-21.9220	-24.8350	-28.8448	(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

236.1537	208.8382	222.0776	196.0304	190.4905	172.1744	170.4205	176.9686	178.6428	198.5444	210.2666	233.7007	(64)

Total per year (kWh/year) = Sum(64)m = 2394.3084 (64)
12Total per year (kWh/year) 2394 (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

111.8290	99.3393	106.4265	95.4504	93.8578	86.0008	85.8024	88.3348	88.3585	96.8411	100.9481	110.8324	(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	126.3814	126.3814	126.3814	126.3814	126.3814	126.3814	126.3814	126.3814	126.3814	126.3814	126.3814	126.3814	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	114.3944	126.6510	114.3944	118.2076	114.3944	118.2076	114.3944	114.3944	118.2076	114.3944	118.2076	114.3944	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	226.7997	229.1532	223.2225	210.5968	194.6591	179.6800	169.6730	167.3195	173.2502	185.8759	201.8135	216.7927	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.6381	35.6381	35.6381	35.6381	35.6381	35.6381	35.6381	35.6381	35.6381	35.6381	35.6381	35.6381	(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)	-101.1051	-101.1051	-101.1051	-101.1051	-101.1051	-101.1051	-101.1051	-101.1051	-101.1051	-101.1051	-101.1051	-101.1051	(71)
Water heating gains (Table 5)	150.3078	147.8264	143.0464	132.5700	126.1530	119.4455	115.3258	118.7295	122.7202	130.1628	140.2056	148.9683	(72)
Total internal gains	555.4163	567.5450	544.5778	525.2888	499.1210	478.2475	460.3076	461.3579	475.0923	494.3475	524.1412	544.0698	(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	
East	9.5000	19.6403	0.7600	0.7000	0.7700	68.7885	(76)
South	7.1000	46.7521	0.7600	0.7000	0.7700	122.3782	(78)
West	5.2000	19.6403	0.7600	0.7000	0.7700	37.6526	(80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	228.8193	408.6454	598.2156	788.6649	913.5966	916.7924	880.0638	787.6711	665.5155	463.2483	277.7795	193.2780	(83)
Total gains	784.2357	976.1904	1142.7934	1313.9537	1412.7176	1395.0399	1340.3714	1249.0290	1140.6078	957.5958	801.9207	737.3479	(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	1.4722	1.4739	1.4757	1.4839	1.4855	1.4928	1.4928	1.4941	1.4899	1.4855	1.4823	1.4791	
alpha	1.0981	1.0983	1.0984	1.0989	1.0990	1.0995	1.0995	1.0996	1.0993	1.0990	1.0988	1.0986	
util living area	0.7303	0.6735	0.6096	0.5258	0.4380	0.3475	0.2736	0.2977	0.4157	0.5685	0.6838	0.7435	(86)
MIT	16.9540	17.4108	18.0631	18.8549	19.5685	20.1323	20.4362	20.3863	19.9310	18.9771	17.8230	16.8552	(87)
Th 2	19.8249	19.8262	19.8274	19.8331	19.8342	19.8392	19.8392	19.8401	19.8372	19.8342	19.8320	19.8297	(88)
util rest of house	0.7148	0.6556	0.5883	0.4992	0.4040	0.3021	0.2155	0.2390	0.3700	0.5376	0.6634	0.7285	(89)
MIT 2	15.4381	15.9627	16.7134	17.6191	18.4199	19.0365	19.3452	19.3026	18.8370	17.7839	16.4592	15.3275	(90)
Living area fraction									fLA = Living area / (4) =			0.2500	(91)
MIT	15.8170	16.3247	17.0508	17.9280	18.7070	19.3105	19.6179	19.5735	19.1105	18.0822	16.8002	15.7094	(92)
Temperature adjustment												0.0000	
adjusted MIT	15.8170	16.3247	17.0508	17.9280	18.7070	19.3105	19.6179	19.5735	19.1105	18.0822	16.8002	15.7094	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6462	0.5894	0.5278	0.4493	0.3672	0.2794	0.2035	0.2242	0.3378	0.4825	0.5965	0.6598	(94)
Useful gains	506.7737	575.4096	603.1281	590.3547	518.8160	389.8397	272.7667	280.0587	385.3165	462.0256	478.3752	486.5166	(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	1271.2677	1259.5585	1161.8402	988.6285	766.5143	512.7752	328.5284	345.1552	546.4620	818.4936	1063.3669	1264.4869	(97)
Space heating kWh	568.7836	459.7481	415.6818	286.7571	184.2875	0.0000	0.0000	0.0000	0.0000	265.2122	421.1940	578.8100	(98a)
Space heating requirement - total per year (kWh/year)												3180.4743	
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	568.7836	459.7481	415.6818	286.7571	184.2875	0.0000	0.0000	0.0000	0.0000	265.2122	421.1940	578.8100	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3180.4743	
Space heating per m2											(98c) / (4) =	38.0440	(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 %)	219.3000 (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	568.7836	459.7481	415.6818	286.7571	184.2875	0.0000	0.0000	0.0000	0.0000	265.2122	421.1940	578.8100	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	259.3632	209.6434	189.5494	130.7602	84.0344	0.0000	0.0000	0.0000	0.0000	120.9358	192.0629	263.9352	(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	236.1537	208.8382	222.0776	196.0304	190.4905	172.1744	170.4205	176.9686	178.6428	198.5444	210.2666	233.7007	(64)
Efficiency of water heater												190.4000	(216)
(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(217)
Fuel for water heating, kWh/month	124.0303	109.6839	116.6374	102.9571	100.0475	90.4277	89.5066	92.9457	93.8250	104.2775	110.4341	122.7420	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	30.9605	24.8377	22.3636	16.3845	12.6559	10.3400	11.5451	15.0068	19.4923	25.5750	28.8869	31.8210 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-6.7814	-10.8608	-17.6974	-22.5167	-26.5502	-24.8580	-24.5334	-21.9676	-17.8847	-13.3628	-7.8785	-5.7229 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-0.7316	-1.6762	-3.6546	-6.0991	-8.8022	-9.8991	-9.7643	-7.9985	-5.5847	-2.6641	-1.0330	-0.5642 (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	1450.2847 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	190.4000
Water heating fuel used	1257.5149 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	249.8691 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-259.0859 (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	2698.5828 (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	1450.2847	0.1538	223.0817	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1257.5149	0.1408	177.0484	(264)
Space and water heating			400.1301	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	249.8691	0.1443	36.0638	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-200.6145	0.1324	-26.5636	
PV Unit electricity exported	-58.4714	0.1219	-7.1292	
Total			-33.6928	(269)
Total CO2, kg/year			402.5011	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			4.8100	(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	1450.2847	1.5695	2276.1713	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1257.5149	1.5206	1912.1688	(278)
Space and water heating			4188.3401	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	249.8691	1.5338	383.2576	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-200.6145	1.4892	-298.7649	
PV Unit electricity exported	-58.4714	0.4473	-26.1518	
Total			-324.9166	(283)
Total Primary energy kWh/year			4246.6811	(286)
Dwelling Primary energy Rate (DPER)			50.8000	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF TARGET EMISSIONS

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	41.8000 (1b)	x	2.5000 (2b)	=	104.5000 (1b)	-
First floor	41.8000 (1c)	x	2.7500 (2c)	=	114.9500 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	83.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	219.4500	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1367	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3867	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3867	(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	0.4930	0.4834	0.4737	0.4254	0.4157	0.3674	0.3674	0.3577	0.3867	0.4157	0.4350	0.4544	(22b)
Effective ac	0.6215	0.6168	0.6122	0.5905	0.5864	0.5675	0.5675	0.5640	0.5748	0.5864	0.5946	0.6032	(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			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			15.6800	1.1450	17.9542			(27)
Heatloss Floor 1			41.8000	0.1300	5.4340			(28a)
External Wall 1	140.2800	20.8800	119.4000	0.1800	21.4920			(29a)
External Roof 1	65.0000		65.0000	0.1100	7.1500			(30)
Total net area of external elements Aum(A, m2)			247.0800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		57.2302			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 6.9976 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E5 Ground floor (normal)	10.0000	0.1600	1.6000
E6 Intermediate floor within a dwelling	36.0000	0.0000	0.0000
E16 Corner (normal)	15.5000	0.0900	1.3950
E18 Party wall between dwellings	15.5000	0.0600	0.9300

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	3.9250	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	61.1552	(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	45.0116	44.6698	44.3348	42.7611	42.4667	41.0961	41.0961	40.8423	41.6240	42.4667	43.0623	43.6850	(38)
Heat transfer coeff	106.1668	105.8250	105.4900	103.9163	103.6219	102.2513	102.2513	101.9975	102.7792	103.6219	104.2175	104.8402	(39)

Average = Sum(39)m / 12 = 103.9149

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2699	1.2658	1.2618	1.2430	1.2395	1.2231	1.2231	1.2201	1.2294	1.2395	1.2466	1.2541	(40)
HLP (average)												1.2430	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5276 (42)

Hot water usage for mixer showers

	66.5997	65.5989	64.1404	61.3499	59.2906	56.9941	55.6887	57.1362	58.7228	61.1886	64.0390	66.3446 (42a)
Hot water usage for baths												
	28.7633	28.3361	27.7346	26.6254	25.7949	24.8740	24.3765	24.9739	25.6243	26.6097	27.7417	28.6661 (42b)
Hot water usage for other uses												
	40.5154	39.0422	37.5689	36.0956	34.6223	33.1490	33.1490	34.6223	36.0956	37.5689	39.0422	40.5154 (42c)
Average daily hot water use (litres/day)												124.9031 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	135.8785	132.9771	129.4438	124.0709	119.7078	115.0171	113.2143	116.7323	120.4427	125.3671	130.8228	135.5261	(44)
Energy conte	215.1983	189.3577	198.9504	169.8469	161.1497	141.4269	136.9229	144.5390	148.5178	170.1220	186.3811	212.2011	(45)
Energy content (annual)										Total = Sum(45)m =		2074.6138	
Distribution loss (46)m = 0.15 x (45)m													
	32.2797	28.4037	29.8426	25.4770	24.1725	21.2140	20.5384	21.6809	22.2777	25.5183	27.9572	31.8302	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8381	(55)
Total storage loss													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(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													
	264.4410	233.8349	248.1930	217.5011	210.3924	189.0811	186.1655	193.7817	196.1720	219.3647	234.0353	261.4437	(62)
WWHRS	-30.4466	-26.9272	-28.1967	-23.3479	-21.7594	-18.6197	-17.4530	-18.5595	-19.2647	-22.7109	-25.7287	-29.8828	(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													
	233.9943	206.9077	219.9964	194.1531	188.6329	170.4614	168.7125	175.2222	176.9074	196.6538	208.3066	231.5609	(64)
									Total per year (kWh/year) = Sum(64)m =			2371.5092	(64)
12Total per year (kWh/year)												2372	(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													
	110.9476	98.5432	105.5451	94.5974	92.9764	85.1478	84.9210	87.4534	87.5055	95.9597	100.0951	109.9510	(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	126.3814	126.3814	126.3814	126.3814	126.3814	126.3814	126.3814	126.3814	126.3814	126.3814	126.3814	126.3814	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	116.1162	128.5572	116.1162	119.9867	116.1162	119.9867	116.1162	116.1162	119.9867	116.1162	119.9867	116.1162	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	226.7997	229.1532	223.2225	210.5968	194.6591	179.6800	169.6730	167.3195	173.2502	185.8759	201.8135	216.7927	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.6381	35.6381	35.6381	35.6381	35.6381	35.6381	35.6381	35.6381	35.6381	35.6381	35.6381	35.6381	(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)													
	-101.1051	-101.1051	-101.1051	-101.1051	-101.1051	-101.1051	-101.1051	-101.1051	-101.1051	-101.1051	-101.1051	-101.1051	(71)
Water heating gains (Table 5)													
	149.1231	146.6417	141.8617	131.3853	124.9683	118.2608	114.1411	117.5448	121.5355	128.9781	139.0209	147.7836	(72)
Total internal gains													
	555.9534	568.2666	545.1149	525.8833	499.6581	478.8420	460.8447	461.8950	475.6868	494.8846	524.7357	544.6069	(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	
East	6.8300	19.6403	0.6300	0.7000	0.7700	40.9958	(76)
South	5.1100	46.7521	0.6300	0.7000	0.7700	73.0119	(78)
West	3.7400	19.6403	0.6300	0.7000	0.7700	22.4487	(80)

Solar gains	136.4564	243.6856	356.7099	470.2462	544.7188	546.6174	524.7215	469.6461	396.8305	276.2406	165.6518	115.2627	(83)
Total gains	692.4098	811.9521	901.8248	996.1295	1044.3769	1025.4594	985.5663	931.5411	872.5174	771.1252	690.3875	659.8696	(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	1.5306	1.5356	1.5404	1.5638	1.5682	1.5892	1.5892	1.5932	1.5811	1.5682	1.5592	1.5500	
alpha	1.1020	1.1024	1.1027	1.1043	1.1045	1.1059	1.1059	1.1062	1.1054	1.1045	1.1039	1.1033	
util living area													
	0.7490	0.7071	0.6583	0.5853	0.5037	0.4084	0.3275	0.3505	0.4706	0.6113	0.7075	0.7576	(86)
MIT	15.7731	16.2782	17.0759	18.1316	19.1334	19.9822	20.4509	20.3819	19.7165	18.4138	16.9271	15.6797	(87)

Th 2	19.8645	19.8677	19.8708	19.8857	19.8885	19.9016	19.9016	19.9040	19.8965	19.8885	19.8829	19.8770	(88)
util rest of house	0.7346	0.6908	0.6387	0.5604	0.4704	0.3620	0.2656	0.2892	0.4255	0.5825	0.6888	0.7437	(89)
MIT 2	14.2006	14.7858	15.7129	16.9363	18.0772	19.0239	19.5122	19.4508	18.7495	17.2863	15.5638	14.0984	(90)
Living area fraction										fLA = Living area / (4) =		0.2500	(91)
MIT	14.5937	15.1589	16.0537	17.2351	18.3413	19.2635	19.7469	19.6835	18.9912	17.5682	15.9046	14.4937	(92)
Temperature adjustment												0.0000	
adjusted MIT	14.5937	15.1589	16.0537	17.2351	18.3413	19.2635	19.7469	19.6835	18.9912	17.5682	15.9046	14.4937	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6408	0.5995	0.5535	0.4881	0.4163	0.3318	0.2561	0.2755	0.3829	0.5076	0.5984	0.6497	(94)
Useful gains	443.6688	486.8036	499.1316	486.1747	434.7933	340.2234	252.3597	256.6605	334.0563	391.4012	413.1469	428.7389	(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	1092.8481	1085.6487	1007.8156	866.1562	688.1796	476.8499	321.7747	334.9137	502.7174	722.0551	917.5925	1079.1989	(97)
Space heating kWh	482.9894	402.4239	378.4610	273.5867	188.5194	0.0000	0.0000	0.0000	0.0000	246.0065	363.2008	483.9423	(98a)
Space heating requirement - total per year (kWh/year)												2819.1300	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	482.9894	402.4239	378.4610	273.5867	188.5194	0.0000	0.0000	0.0000	0.0000	246.0065	363.2008	483.9423	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2819.1300	
Space heating per m2											(98c) / (4) =	33.7217	(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	482.9894	402.4239	378.4610	273.5867	188.5194	0.0000	0.0000	0.0000	0.0000	246.0065	363.2008	483.9423	(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)	523.2821	435.9956	410.0335	296.4103	204.2464	0.0000	0.0000	0.0000	0.0000	266.5293	393.5004	524.3145	(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	233.9943	206.9077	219.9964	194.1531	188.6329	170.4614	168.7125	175.2222	176.9074	196.6538	208.3066	231.5609	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.6475	85.5247	85.2650	84.8288	84.0584	79.8000	79.8000	79.8000	79.8000	84.5631	85.2938	85.6729	(217)
Fuel for water heating, kWh/month	273.2062	241.9275	258.0150	228.8765	224.4069	213.6107	211.4192	219.5766	221.6884	232.5528	244.2225	270.2848	(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	24.1267	19.3553	17.4273	12.7680	9.8624	8.0576	8.9968	11.6943	15.1898	19.9298	22.5107	24.7972	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-38.8254	-54.5934	-78.2728	-87.7759	-94.4522	-88.0807	-86.9741	-82.1901	-73.7373	-62.2956	-42.6257	-33.5821	(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	-22.3781	-47.0242	-93.3743	-140.1190	-185.1624	-186.0158	-183.8434	-155.7264	-114.2199	-67.2291	-29.8703	-17.7014	(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												3054.3120	(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												2839.7871	(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)												194.7159	(232)

Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2066.0697 (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	4108.7453 (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	3054.3120	0.2100	641.4055	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2839.7871	0.2100	596.3553	(264)
Space and water heating			1237.7608	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	194.7159	0.1443	28.1035	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-823.4054	0.1346	-110.8665	
PV Unit electricity exported	-1242.6644	0.1259	-156.4763	
Total			-267.3428	(269)
Total CO2, kg/year			1010.4508	(272)
Target Carbon Dioxide Emission Rate (TER)			12.0900	(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	3054.3120	1.1300	3451.3726	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2839.7871	1.1300	3208.9594	(278)
Space and water heating			6660.3319	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	194.7159	1.5338	298.6618	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-823.4054	1.4976	-1233.1518	
PV Unit electricity exported	-1242.6644	0.4622	-574.3767	
Total			-1807.5285	(283)
Total Primary energy kWh/year			5281.5660	(286)
Target Primary Energy Rate (TPER)			63.1800	(287)

;

Full SAP Calculation Printout

elmhurst energy

Property Reference	Plot 10 3B_Be Green	Issued on Date	12/10/2022
Assessment Reference	Be Green	Prop Type Ref	3B
Property	3 Bedroom House, House No. 10, Claygate, Surrey, Elmbridge, KT 10		

SAP Rating	82 B	DER	4.04	TER	10.68
Environmental	96 A	% DER<TER	62.17		
CO_2 Emissions (t/year)	0.38	DFEE	40.03	TFEE	39.67
Compliance Check	See BREL	% DFEE < TFEE	-0.90		
% DPER < TPER	22.51	DPER	43.16	TPER	55.70

Assessor Details	Mr. Andy Love	Assessor ID	U860-0001
Client			

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

---

1. Overall dwelling characteristics

			Area (m2)		Storey height (m)		Volume (m3)	
Ground floor			51.1000	(1b)	x 2.5000	(2b) =	127.7500	(1b) -
First floor			51.1000	(1c)	x 2.7500	(2c) =	140.5250	(1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.2000							(4)
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		268.2750	(5)

---

2. Ventilation rate

---

		m3 per hour		
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		2 * 10 =	20.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		20.0000 / (5) =	0.0746	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			3.0000	(17)
Infiltration rate			0.2246	(18)
Number of sides sheltered			0	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.2246	(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	0.2863	0.2807	0.2751	0.2470	0.2414	0.2133	0.2133	0.2077	0.2246	0.2414	0.2526	0.2638	(22b)
Effective ac	0.5410	0.5394	0.5378	0.5305	0.5291	0.5228	0.5228	0.5216	0.5252	0.5291	0.5319	0.5348	(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	
Window (Uw = 1.20)			21.8000	1.1450	24.9618			(27)
Door			5.2000	1.0000	5.2000			(26)
Heatloss Floor 1			51.1000	0.1200	6.1320	0.0000	0.0000	(28a)
External Wall 1	154.9000	27.0000	127.9000	0.1400	17.9060	0.0000	0.0000	(29a)
External Roof 1	65.0000		65.0000	0.1132	7.3585	9.0000	585.0000	(30)
Total net area of external elements Aum(A, m2)			271.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	61.5583			(33)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 585.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 5.7241 (35)
Thermal bridges (User defined value 0.050 * total exposed area) 13.5500 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 75.1083 (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	47.8937	47.7529	47.6148	46.9661	46.8447	46.2797	46.2797	46.1751	46.4974	46.8447	47.0902	47.3469	(38)
Heat transfer coeff	123.0021	122.8612	122.7231	122.0744	121.9530	121.3881	121.3881	121.2834	121.6057	121.9530	122.1986	122.4552	(39)

Average = Sum(39)m / 12 = 122.0738

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2035	1.2022	1.2008	1.1945	1.1933	1.1878	1.1878	1.1867	1.1899	1.1933	1.1957	1.1982	(40)
HLP (average)												1.1945	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7590 (42)
Hot water usage for mixer showers

70.4788	69.4197	67.8762	64.9232	62.7440	60.3137	58.9323	60.4640	62.1431	64.7525	67.7689	70.2088	(42a)

Hot water usage for baths

30.4314	29.9795	29.3430	28.1695	27.2909	26.3165	25.7903	26.4222	27.1104	28.1529	29.3506	30.3285	(42b)

Hot water usage for other uses

42.8847	41.3253	39.7658	38.2064	36.6469	35.0875	35.0875	36.6469	38.2064	39.7658	41.3253	42.8847	(42c)

Average daily hot water use (litres/day) 132.1799 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	143.7949	140.7244	136.9851	131.2992	126.6818	121.7177	119.8100	123.5332	127.4598	132.6712	138.4448	143.4220	(44)
Energy conte	227.7360	200.3896	210.5410	179.7420	170.5380	149.6661	144.8999	152.9599	157.1707	180.0336	197.2399	224.5642	(45)

Energy content (annual) Total = Sum(45)m = 2195.4810

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

34.1604	30.0584	31.5811	26.9613	25.5807	22.4499	21.7350	22.9440	23.5756	27.0050	29.5860	33.6846	(46)

Water storage loss:
Store volume 180.0000 (47)
b) If manufacturer declared loss factor is not known :
Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)
Volume factor from Table 2a 0.8736 (52)
Temperature factor from Table 2b 0.5400 (53)
Enter (49) or (54) in (55) 0.8736 (55)
Total storage loss

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(56)

If cylinder contains dedicated solar storage

27.0820	24.4612	27.0820	26.2084	27.0820	26.2084	27.0820	27.0820	26.2084	27.0820	26.2084	27.0820	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

278.0805	245.8620	260.8854	228.4624	220.8824	198.3865	195.2443	203.3043	205.8911	230.3780	245.9604	274.9087	(62)
WWHRS -31.1008	-27.5058	-28.8025	-23.8496	-22.2269	-19.0198	-17.8280	-18.9583	-19.6786	-23.1989	-26.2815	-30.5248	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

246.9797	218.3563	232.0830	204.6128	198.6555	179.3668	177.4163	184.3461	186.2126	207.1792	219.6789	244.3838	(64)

Total per year (kWh/year) = Sum(64)m = 2499.2708 (64)
12Total per year (kWh/year) 2499 (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

115.9978	103.0075	110.2804	98.7405	96.9794	88.7403	88.4548	91.1347	91.2356	100.1367	104.5586	114.9432	(65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.9490	137.9490	137.9490	137.9490	137.9490	137.9490	137.9490	137.9490	137.9490	137.9490	137.9490	137.9490	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	131.2854	145.3517	131.2854	135.6615	131.2854	135.6615	131.2854	131.2854	135.6615	131.2854	135.6615	131.2854	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	259.8361	262.5324	255.7378	241.2730	223.0138	205.8527	194.3881	191.6918	198.4863	212.9511	231.2103	248.3714	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7949	36.7949	36.7949	36.7949	36.7949	36.7949	36.7949	36.7949	36.7949	36.7949	36.7949	36.7949	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-110.3592	-110.3592	-110.3592	-110.3592	-110.3592	-110.3592	-110.3592	-110.3592	-110.3592	-110.3592	-110.3592	-110.3592	(71)
Water heating gains (Table 5)	155.9110	153.2849	148.2264	137.1396	130.3487	123.2504	118.8908	122.4929	126.7161	134.5924	145.2203	154.4935	(72)
Total internal gains	614.4171	628.5537	602.6343	581.4589	552.0326	529.1494	508.9489	509.8547	525.2487	546.2136	579.4769	601.5350	(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	5.2000	10.6334	0.7600	0.7000	0.7700	20.3854 (74)
South	9.5000	46.7521	0.7600	0.7000	0.7700	163.7455 (78)
West	7.1000	19.6403	0.7600	0.7000	0.7700	51.4103 (80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	235.5412	407.7000	573.4269	733.9715	841.5971	843.5670	809.9741	728.7904	629.0657	454.9578	283.3449	200.7628	(83)
Total gains	849.9584	1036.2537	1176.0612	1315.4304	1393.6296	1372.7165	1318.9231	1238.6452	1154.3144	1001.1713	862.8218	802.2978	(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	1.3211	1.3226	1.3241	1.3312	1.3325	1.3387	1.3387	1.3398	1.3363	1.3325	1.3298	1.3270	
alpha	1.0881	1.0882	1.0883	1.0887	1.0888	1.0892	1.0892	1.0893	1.0891	1.0888	1.0887	1.0885	
util living area	0.7333	0.6819	0.6268	0.5514	0.4676	0.3760	0.2989	0.3224	0.4386	0.5824	0.6891	0.7455	(86)
MIT	16.8991	17.3274	17.9459	18.7248	19.4590	20.0618	20.3937	20.3421	19.8655	18.9048	17.7660	16.8053	(87)
Th 2	19.9172	19.9183	19.9193	19.9244	19.9254	19.9298	19.9298	19.9306	19.9281	19.9254	19.9235	19.9214	(88)
util rest of house	0.7192	0.6658	0.6076	0.5272	0.4360	0.3327	0.2424	0.2659	0.3960	0.5544	0.6706	0.7320	(89)
MIT 2	15.4377	15.9318	16.6477	17.5453	18.3777	19.0456	19.3906	19.3443	18.8451	17.7716	16.4576	15.3322	(90)
Living area fraction									fLA = Living area / (4) =			0.2045	(91)
MIT	15.7366	16.2172	16.9131	17.7865	18.5988	19.2534	19.5958	19.5483	19.0537	18.0034	16.7252	15.6334	(92)
Temperature adjustment												0.0000	
adjusted MIT	15.7366	16.2172	16.9131	17.7865	18.5988	19.2534	19.5958	19.5483	19.0537	18.0034	16.7252	15.6334	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6485	0.5968	0.5427	0.4710	0.3917	0.3024	0.2231	0.2436	0.3565	0.4943	0.6009	0.6612	(94)
Useful gains	551.1808	618.4332	638.2977	619.6102	545.9330	415.0635	294.2124	301.6819	411.4812	494.8895	518.4734	530.4677	(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	1406.7222	1390.4433	1277.9326	1084.8102	841.3354	564.8676	363.6497	381.8383	602.4039	902.8618	1176.1816	1400.0841	(97)
Space heating kWh	636.5229	518.7908	475.8884	334.9440	219.7794	0.0000	0.0000	0.0000	0.0000	303.5314	473.5499	646.9946	(98a)
Space heating requirement - total per year (kWh/year)												3610.0014	
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	636.5229	518.7908	475.8884	334.9440	219.7794	0.0000	0.0000	0.0000	0.0000	303.5314	473.5499	646.9946	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3610.0014	
Space heating per m2										(98c) / (4) =		35.3229	(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 %)	219.3000 (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	636.5229	518.7908	475.8884	334.9440	219.7794	0.0000	0.0000	0.0000	0.0000	303.5314	473.5499	646.9946	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	290.2521	236.5667	217.0034	152.7332	100.2186	0.0000	0.0000	0.0000	0.0000	138.4092	215.9370	295.0272	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	246.9797	218.3563	232.0830	204.6128	198.6555	179.3668	177.4163	184.3461	186.2126	207.1792	219.6789	244.3838	(64)
Efficiency of water heater												190.4000	(216)
(217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	(217)
Fuel for water heating, kWh/month	129.7162	114.6829	121.8923	107.4647	104.3359	94.2052	93.1808	96.8204	97.8007	108.8126	115.3776	128.3529	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	36.1896	29.0326	26.1407	19.1518	14.7934	12.0863	13.4950	17.5413	22.7845	29.8944	33.7657	37.1954 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-13.0884	-20.6706	-33.1877	-41.5038	-48.1658	-44.1962	-43.6174	-39.3923	-32.5164	-25.1013	-15.0975	-11.0772 (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	-1.9376	-4.4034	-9.5161	-15.7278	-22.5390	-25.3180	-24.9781	-20.5399	-14.4225	-6.9524	-2.7255	-1.4969 (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	1646.1475 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	190.4000
Water heating fuel used	1312.6422 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	292.0707 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-518.1718 (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	2732.6886 (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	1646.1475	0.1537	252.9526	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1312.6422	0.1408	184.8476	(264)
Space and water heating			437.8002	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	292.0707	0.1443	42.1548	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.6146	0.1328	-48.8345	
PV Unit electricity exported	-150.5572	0.1221	-18.3889	
Total			-67.2234	(269)
Total CO2, kg/year			412.7317	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			4.0400	(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	1646.1475	1.5689	2582.6238	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1312.6422	1.5207	1996.1364	(278)
Space and water heating			4578.7602	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	292.0707	1.5338	447.9878	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-367.6146	1.4909	-548.0645	
PV Unit electricity exported	-150.5572	0.4480	-67.4571	
Total			-615.5216	(283)
Total Primary energy kWh/year			4411.2265	(286)
Dwelling Primary energy Rate (DPER)			43.1600	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF TARGET EMISSIONS

---

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	51.1000 (1b)	x	2.5000 (2b)	=	127.7500 (1b)	-
First floor	51.1000 (1c)	x	2.7500 (2c)	=	140.5250 (1c)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	268.2750	(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) =	0.1491	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3991	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3991	(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	0.5089	0.4989	0.4889	0.4390	0.4290	0.3791	0.3791	0.3692	0.3991	0.4290	0.4490	0.4689	(22b)
Effective ac	0.6295	0.6244	0.6195	0.5964	0.5920	0.5719	0.5719	0.5681	0.5796	0.5920	0.6008	0.6100	(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			5.2000	1.0000	5.2000			(26)
TER Opening Type (Uw = 1.20)			20.3400	1.1450	23.2901			(27)
Heatloss Floor 1			51.1000	0.1300	6.6430			(28a)
External Wall 1	154.9000	25.5400	129.3600	0.1800	23.2848			(29a)
External Roof 1	65.0000		65.0000	0.1100	7.1500			(30)
Total net area of external elements Aum(A, m2)			271.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		65.5679			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K			5.7241 (35)
List of Thermal Bridges			
K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	10.0000	0.1600	1.6000
E6 Intermediate floor within a dwelling	36.0000	0.0000	0.0000
E16 Corner (normal)	15.5000	0.0900	1.3950
E18 Party wall between dwellings	15.5000	0.0600	0.9300
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			3.9250 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =		69.4929 (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	55.7271	55.2820	54.8458	52.7967	52.4133	50.6286	50.6286	50.2981	51.3160	52.4133	53.1889	53.9997	(38)
Heat transfer coeff	125.2200	124.7749	124.3386	122.2895	121.9062	120.1215	120.1215	119.7910	120.8089	121.9062	122.6817	123.4926	(39)
Average = Sum(39)m / 12 =												122.2877	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2252	1.2209	1.2166	1.1966	1.1928	1.1754	1.1754	1.1721	1.1821	1.1928	1.2004	1.2083	(40)
HLP (average)												1.1966	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.7590 (42)
Hot water usage for mixer showers		

	70.4788	69.4197	67.8762	64.9232	62.7440	60.3137	58.9323	60.4640	62.1431	64.7525	67.7689	70.2088 (42a)
Hot water usage for baths												
	30.4314	29.9795	29.3430	28.1695	27.2909	26.3165	25.7903	26.4222	27.1104	28.1529	29.3506	30.3285 (42b)
Hot water usage for other uses												
	42.8847	41.3253	39.7658	38.2064	36.6469	35.0875	35.0875	36.6469	38.2064	39.7658	41.3253	42.8847 (42c)
Average daily hot water use (litres/day)												132.1799 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	143.7949	140.7244	136.9851	131.2992	126.6818	121.7177	119.8100	123.5332	127.4598	132.6712	138.4448	143.4220	(44)
Energy conte	227.7360	200.3896	210.5410	179.7420	170.5380	149.6661	144.8999	152.9599	157.1707	180.0336	197.2399	224.5642	(45)
Energy content (annual)										Total = Sum(45)m =		2195.4810	
Distribution loss (46)m = 0.15 x (45)m													
	34.1604	30.0584	31.5811	26.9613	25.5807	22.4499	21.7350	22.9440	23.5756	27.0050	29.5860	33.6846	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8381	(55)
Total storage loss													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage													
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(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													
	276.9787	244.8669	259.7837	227.3962	219.7807	197.3203	194.1425	202.2026	204.8249	229.2763	244.8941	273.8069	(62)
WWHRS	-32.2200	-28.4956	-29.8390	-24.7078	-23.0268	-19.7042	-18.4696	-19.6405	-20.3867	-24.0337	-27.2273	-31.6233	(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													
	244.7587	216.3713	229.9447	202.6883	196.7539	177.6161	175.6730	182.5621	184.4382	205.2425	217.6669	242.1836	(64)
										Total per year (kWh/year) = Sum(64)m =		2475.8992	(64)
12Total per year (kWh/year)												2476	(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													
	115.1164	102.2114	109.3990	97.8876	96.0980	87.8873	87.5733	90.2533	90.3826	99.2553	103.7056	114.0617	(65)

---

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.9490	137.9490	137.9490	137.9490	137.9490	137.9490	137.9490	137.9490	137.9490	137.9490	137.9490	137.9490	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	132.0492	146.1973	132.0492	136.4508	132.0492	136.4508	132.0492	132.0492	136.4508	132.0492	136.4508	132.0492	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	259.8361	262.5324	255.7378	241.2730	223.0138	205.8527	194.3881	191.6918	198.4863	212.9511	231.2103	248.3714	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.7949	36.7949	36.7949	36.7949	36.7949	36.7949	36.7949	36.7949	36.7949	36.7949	36.7949	36.7949	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-110.3592	-110.3592	-110.3592	-110.3592	-110.3592	-110.3592	-110.3592	-110.3592	-110.3592	-110.3592	-110.3592	-110.3592	(71)
Water heating gains (Table 5)													
	154.7263	152.1002	147.0417	135.9550	129.1640	122.0658	117.7061	121.3082	125.5314	133.4077	144.0356	153.3088	(72)
Total internal gains													
	613.9963	628.2146	602.2134	581.0635	551.6117	528.7540	508.5281	509.4339	524.8533	545.7927	579.0815	601.1141	(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	4.8500	10.6334	0.6300	0.7000	0.7700	15.7611	(74)
South	8.8700	46.7521	0.6300	0.7000	0.7700	126.7349	(78)
West	6.6200	19.6403	0.6300	0.7000	0.7700	39.7354	(80)

Solar gains	182.2313	315.4101	443.5866	567.7300	650.9408	652.4498	626.4736	563.7073	486.6098	351.9603	219.2127	155.3262	(83)
Total gains	796.2276	943.6247	1045.8000	1148.7935	1202.5526	1181.2038	1135.0017	1073.1411	1011.4631	897.7530	798.2942	756.4404	(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	1.2977	1.3023	1.3069	1.3288	1.3330	1.3528	1.3528	1.3565	1.3451	1.3330	1.3246	1.3159	
alpha	1.0865	1.0868	1.0871	1.0886	1.0889	1.0902	1.0902	1.0904	1.0897	1.0889	1.0883	1.0877	
util living area													
	0.7497	0.7060	0.6579	0.5865	0.5059	0.4107	0.3301	0.3528	0.4711	0.6098	0.7071	0.7586	(86)
MIT	15.6922	16.2139	17.0126	18.0708	19.0847	19.9510	20.4308	20.3607	19.6865	18.3737	16.8664	15.5963	(87)

Th 2	19.8999	19.9033	19.9067	19.9227	19.9257	19.9398	19.9398	19.9424	19.9344	19.9257	19.9197	19.9133	(88)
util rest of house	0.7360	0.6903	0.6392	0.5627	0.4739	0.3661	0.2705	0.2939	0.4279	0.5823	0.6892	0.7454	(89)
MIT 2	14.1325	14.7370	15.6660	16.8947	18.0518	19.0220	19.5261	19.4626	18.7461	17.2670	15.5197	14.0279	(90)
Living area fraction										fLA = Living area / (4) =		0.2045	(91)
MIT	14.4514	15.0390	15.9414	17.1352	18.2630	19.2120	19.7111	19.6463	18.9384	17.4933	15.7951	14.3486	(92)
Temperature adjustment												0.0000	
adjusted MIT	14.4514	15.0390	15.9414	17.1352	18.2630	19.2120	19.7111	19.6463	18.9384	17.4933	15.7951	14.3486	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.6394	0.5962	0.5509	0.4869	0.4160	0.3317	0.2563	0.2756	0.3811	0.5040	0.5958	0.6486	(94)
Useful gains	509.0880	562.6241	576.1165	559.3290	500.2702	391.8176	290.9275	295.7459	385.5061	452.5002	475.6134	490.6570	(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	1271.1626	1265.0988	1173.9307	1007.0776	800.0735	554.0010	373.7124	388.8728	584.5263	840.3400	1066.7315	1253.2776	(97)
Space heating kWh	566.9836	472.0630	444.7738	322.3790	223.0536	0.0000	0.0000	0.0000	0.0000	288.5529	425.6051	567.3897	(98a)
Space heating requirement - total per year (kWh/year)												3310.8006	
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	566.9836	472.0630	444.7738	322.3790	223.0536	0.0000	0.0000	0.0000	0.0000	288.5529	425.6051	567.3897	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3310.8006	
Space heating per m2											(98c) / (4) =	32.3953	(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	566.9836	472.0630	444.7738	322.3790	223.0536	0.0000	0.0000	0.0000	0.0000	288.5529	425.6051	567.3897	(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)	614.2834	511.4442	481.8785	349.2730	241.6616	0.0000	0.0000	0.0000	0.0000	312.6250	461.1106	614.7234	(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	244.7587	216.3713	229.9447	202.6883	196.7539	177.6161	175.6730	182.5621	184.4382	205.2425	217.6669	242.1836	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.8796	85.7601	85.5132	85.0953	84.3418	79.8000	79.8000	79.8000	79.8000	84.8237	85.5357	85.9018	(217)
Fuel for water heating, kWh/month	285.0023	252.2984	268.8997	238.1900	233.2814	222.5766	220.1416	228.7745	231.1255	241.9636	254.4747	281.9308	(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	27.4372	22.0112	19.8186	14.5200	11.2156	9.1633	10.2313	13.2990	17.2741	22.6645	25.5995	28.1998	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-46.6324	-65.1510	-92.8081	-103.3657	-110.6078	-102.8917	-101.5606	-96.2525	-86.8178	-73.9710	-51.0320	-40.3813	(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	-28.1880	-59.0754	-117.0285	-175.2330	-231.2177	-232.1880	-229.5106	-194.5975	-142.9577	-84.3714	-37.5936	-22.3122	(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												3586.9996	(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												2958.6592	(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)												221.4341	(232)

Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2525.7455 (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	4327.3472 (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	3586.9996	0.2100	753.2699	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2958.6592	0.2100	621.3184	(264)
Space and water heating			1374.5883	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	221.4341	0.1443	31.9598	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-971.4719	0.1348	-130.9467	
PV Unit electricity exported	-1554.2736	0.1260	-195.8088	
Total			-326.7555	(269)
Total CO2, kg/year			1091.7218	(272)
Target Carbon Dioxide Emission Rate (TER)			10.6800	(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	3586.9996	1.1300	4053.3095	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2958.6592	1.1300	3343.2848	(278)
Space and water heating			7396.5944	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	221.4341	1.5338	339.6429	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-971.4719	1.4982	-1455.4401	
PV Unit electricity exported	-1554.2736	0.4624	-718.7583	
Total			-2174.1984	(283)
Total Primary energy kWh/year			5692.1397	(286)
Target Primary Energy Rate (TPER)			55.7000	(287)

;

LOVE DESIGN STUDIO

lovedesignstudio.co.uk

We help design teams within the built environment create sustainable spaces and buildings.

Our work encompasses all stages of a building's lifetime; from advising developers on new development to landowners on improving their building stock. Our experience of each RIBA Stage enabling us to better advise on the other.

Environmental consultants, designers, engineers and technicians in the built environment.

Whether it be a single house extension, commercial property, school, or multi-residential masterplan; Love Design Studio will look to maximise the scheme's sustainability credentials where most value is obtained.