Views (Holdings) Limited

Environmental Standards Statement

20 houses at Longsight Cricket Club, Manchester

03 September 2024

Watt Energy & Consulting Engineers Ltd
40 King Street, Manchester, M2 6BA

t. 0161 43 43 103
w. www.wece.co.uk
e. office@wece.co.uk

watt
Energy & Consulting Engineers

Issue Control

Director	Daniel Watt



First Issue Date	Revision Issue Date	Issue Revision	Issued By
16 Aug. 2024	-	-	DW
	03 Sep. 2024	*A*	*DK*

Document Disclaimer

© Watt Energy & Consulting Engineers Ltd (WE&CE) own the copyright in this report and it has been written for the sole and confidential use of the client showing reasonable skill and care, for the intended purposes as stated in the agreement under which this work was completed. It is not intended for and should not be relied upon by any third party. Any such party relies on this report at their own risk. No part of this report may be copied or duplicated without the express permission of WE&CE and the party for whom it was prepared.

Index

1 Executive Summary 5

2 Planning Statement 7

2.1 The Site and Proposed Development 7

2.2 Relevant Policies and Guidance 8

2.2.1 Local Planning Policy 8

2.2.1.1 Manchester Core Strategy 8

2.2.1.2 Guide to Development in Manchester, Supplementary Planning Document 2007 9

2.2.1.3 Manchester Residential Quality Guide 2017 9

2.2.1.4 Manchester's Great Outdoors 2015-25 10

2.2.1.5 Manchester Climate Change Framework 2020-25 10

2.2.2 Manchester City Council's Planning Document Targets 11

2.2.3 Places for Everyone Joint Development Plan for Manchester 12

2.2.4 National Planning Policy 13

2.3 Sustainable Design Strategy 14

2.3.1 Energy and Carbon Emissions 14

2.3.2 Choice and Impact of Renewable Technology 17

2.3.3 Energy and CO_2 Reduction Summary 18

2.3.4 Manchester City Council' Policy and Targets Summary 23

2.4 Adaptation to Climate Change 24

2.4.1 Flood Risk Zone 25

2.4.2 Green Blue Infrastructure 25

2.4.2.1 Sustainable Drainage Systems (SUDs) 25

2.4.2.2 Biodiversity 28

2.4.3 Internal Water Efficiency 28

2.4.4 Waste Management 29

2.4.4.1 Occupational Waste 29

2.4.4.2 Construction Waste 29

2.4.5 Materials 29

2.4.6 Pollution Control 30

2.4.7 Sustainable Transport 30

3 Feasibility Assessment of Renewable Energy and Low Carbon Technologies 32

4 Conclusion 35

1 Executive Summary

This Environmental Standards Statement has been prepared by Watt Energy on behalf of Views (Holdings) Limited to support a planning application for the development for 20 houses at Longsight Cricket Club, Manchester. The statement specifically addresses the following Manchester City Council approved climate change action plans in addition to planning policies, as stipulated in the Manchester Core Strategy (July 2012):

- Guide to Development in Manchester SPD (2007)
- Our Manchester Strategy 2016-2025
- Manchester: A Certain Future (2013)
- Manchester Climate Change Board – The Zero Carbon Framework 2020-2038
- Climate Change and Low Emissions Implementation Plan 2016-2020
- Meeting Our Objectives and Targets – Manchester Climate Change Framework – 2020-25
- Manchester Residential Quality Guidance 2017
- Core Strategy Policy DM 1 - Development Management
- Core Strategy Policy EN 4 - Reducing CO2 Emissions by Enabling Low and Zero Carbon Development
- Core Strategy Policy EN 6 - Target Framework for CO2 Reductions from Low or Zero Carbon Energy Supplies
- Core Strategy Policy EN 8 – Adaptation to Climate Change
- Core Strategy Policy EN 9 – Green Infrastructure
- Core Strategy Policy EN 14 – Flood Risk
- Core Strategy Policy EN 15 – Biodiversity and Geological Conservation
- Core Strategy Policy T 1 – Sustainable Transport
- Places for Everyone Joint Development Plan Document (DPD)- Policy JP-S2- Carbon and Energy

The statement details how the development will incorporate sustainable design and resource efficiency in line with the Energy Hierarchy, so to meet the policy requirements and council targets whilst reducing its overall environmental impact. The methodology and calculations are consistent with the MCC Appendix A EN6 Energy Target Explanation and all figures used within this report have been based on the most recent issue of drawings and modelled using Elmhurst Design SAP 10 to accurately predict Energy Usage and CO_2 reductions.

In relation to the planning documents and policies outlined above, the development is required to achieve a **10%** reduction in carbon emissions over Part L 2013 of the Building Regulations and also aim for a status of **carbon neutral**.

In order to achieve compliance, the development has been designed with a holistic low energy design concept involving a fabric first approach. The U-values, design air permeability and ventilation targets all aspire to move towards Passive House design standards along with the consideration and application of low zero carbon renewable technologies.

Following the LZC feasibility assessment, it is not proposed that the development incorporates LZC technologies due to the constraints of the site.

As a result of the above the predicted site wide reduction in CO_2 over Part L 2013 of the Building Regulations can be summarised as:

- 62.7% with SAP 10.1 carbon factors (proposed improvements to Part L)

This statement also examines how the design, specification and characteristics of the proposal will contribute to sustainability and meet the relevant objectives outlined within the National Planning Policy Framework (NPPF) 2023, in addition to the Manchester City Council approved climate change action plans and core strategy planning policies outlined above. The sustainability measures assessed included:

- Flood Risk Zone
- Green and Blue Infrastructure
- Sustainable Drainage Systems (SUDs)
- Biodiversity / Ecology
- Internal Water Efficiency
- Waste Management
- Materials
- Pollution Control
- Health and Wellbeing
- Sustainable Transport

The development therefore complies with all Manchester City Council's current and future policy requirements relating to creating a sustainable development.

In relation to the planning target centred around carbon emissions reduction, the proposed development is achieving a 62.7% reduction in these emissions, over the Part L1A of the Building Regulations. This surpasses all of Manchester City Council's planning targets and therefore allows compliance to be reached.

2 Planning Statement

The following statement relates to the proposed development at Longsight Cricket Club, Manchester.

2.1 The Site and Proposed Development

The Site is located southeast of the centre of Manchester, within Longsight. The site occupies approximately 0.28 hectares of land. A plan, with the site's extents denoted by the red outlined seen in Figure 1 (shown later in the subsection).

The site is bounded by East Road to the north, Armitage Ave to the east and Northmoor Road to the west.

The proposal is for a Purpose-Built housing facility consisting of 3 -storey houses (4 house types). The development consists of 20 houses. Also provided will be the associated ancillary facilities including refuse/ bin store and bike store (2 Bikes per dwelling).



Figure 1: Site Plan

2.2 Relevant Policies and Guidance

2.2.1 Local Planning Policy

2.2.1.1 Manchester Core Strategy

Manchester's Core Strategy (CS) was adopted on 11th July 2012 and is the key Development Plan Document (DPD) guiding the measures assessed in this report.

CS Policy DM 1 - Development Management: Stipulates that all new development should have regard for several development principles relevant to sustainability, including: waste management, designing for health, flood risk, green infrastructure, biodiversity. Additionally, subject to scheme viability, developers will be required to demonstrate that new non-domestic development will achieve a BREEAM Rating of 'Very Good' or for domestic development to achieve the Code for Sustainable Homes standard.

CS Policy EN 4 – Reducing CO2 Emissions: This policy targets the reducing of CO2 emissions through the following of the energy hierarchy; firstly, reducing the need for energy through efficient design measures, followed by clean energy and lastly, the application of renewable or LZC technologies. In addition to this point, MCC state within this policy all new development is required to use building materials that have low embodied carbon.

CS Policy EN 6 - Target Framework for CO2 Reductions from Low or Zero Carbon Energy Supplies: This Policy requires electricity intense residential development of 10 or more units to meet, as a minimum, a 15% reduction in domestic CO2 emissions over Part L of the 2010 Building Regulations, unless proven to be unviable. As Part L 2013 of the Building Regulations represents a 6% improvement on 2010 levels, this target is subsequently equivalent to a 9% improvement in CO2 emissions over Part L 2013. Section 2.3 provides evidence of how this target is achieved.

CS Policy EN 8 – Adaptation to Climate Change: Expects all new development to be adaptable to climate change in terms of its design, layout, siting, and function of both building associated external spaces.

CS Policy EN 9 – Green Infrastructure: Requires new developments to maintain existing green infrastructure whilst using every opportunity, in accordance with current Green Infrastructure Strategies, to enhance the quality and quantity of green infrastructure, improve the performance of its functions and create and improve linkages to and between area of green infrastructure.

CS Policy EN 14 – Flood Risk: This policy expects all new developments to minimise surface water run-off through the use of SUDs and Green Infrastructure.

CS Policy EN 15 – Biodiversity and Geological Enhancement: Developers will be expected to identify and implement reasonable opportunities to enhance, restore or create new biodiversity, either on or adjacent to the proposed site.

CS Policy T 1 – Sustainable Transport: Policy aims to deliver sustainable, high quality, integrated transport systems to encourage a shift away from car travel to public transport, cycling and walking.

2.2.1.2 Guide to Development in Manchester, Supplementary Planning Document 2007

The Development Guide in Manchester Supplementary Planning Documents (SPD) establish and set out the ongoing generation of the City by providing a set of set principles which will guide developers, architects, and residents in the design of the city. The MCC Core Strategy stipulates that all new residential developments should comply with the design guidance set out in the SPDs. These principles include the following environmental standards relevant to this report: energy strategy, water consumption, drainage management, weather resilience, waste management, construction management, biodiversity, and waterways.

2.2.1.3 Manchester Residential Quality Guide 2017

The Manchester Residential Quality Guide has been developed to help shape the creation of new homes and communities across the Greater Manchester city region, beginning with the Centre and its immediate surroundings. This document outlines the considerations, qualities, and opportunities that will help to deliver high quality residential development as part of successful and sustainable neighbourhoods across Manchester. The guidance includes the following nine components:

Make it Manchester – developers must understand the city's unique character, heritage old and new, density and scale in various parts of the city and appreciate how new homes will fit into what is already there.

Make it bring people together – new homes must encourage a sense of community and neighbourliness, offering a mix of tenures to promote a mix of people.

Make it animate streets and spaces – understand the relationship between new homes and its environment and create public space.

Make it easy to get around – make sure developments have good transport links, along with good walking and cycling provision.

Make work with the landscape – development should improve the connection with the local environment with improved biodiversity, as well as greening and water schemes.

Make it practical – dealing with waste, car parking, bike storage and visitors should be made as easy as possible.

Make it future proof – design must anticipate the impacts of climate change and extreme weather with efficient design and adaptability.

Make it a home – sufficient space, natural light, privacy and storage are essential for people to settle down and flourish.

Make it happen – ensuring proposals are delivered, to a high quality, with high design standards and high sustainability.

2.2.1.4 Manchester's Great Outdoors 2015-25

A Green and Blue Infrastructure Strategy for Manchester aims to invest to date in the city's green and blue infrastructure over the next 10 years (by 2025). Four objectives have been established to enable the vision to be achieved: 1. Improve the quality and function of existing green and blue Infrastructure, to maximize the benefits it delivers. 2. Use appropriate green and blue infrastructure as a key component of new developments to help create successful neighbourhoods and support the city's growth. 3. Improve connectivity and accessibility to green and blue infrastructure within the city and beyond. 4. Improve and promote a wider understanding and awareness of the benefits that green and blue infrastructure provides to residents, the economy, and the local environment.

2.2.1.5 Manchester Climate Change Framework 2020-25

Following the declaration of a climate emergency by MCC In July 2019, this framework was adopted and is an in-depth strategy to accompany the Draft Manchester Zero Carbon Framework 2020-38, which was published in February 2019. It is a framework that will continue to develop over the next five years, in line with changes in policy, climate science, rate of progress and other factors. The framework has set out four objectives to facilitate this:

Objective 1 – Staying within our carbon budgets.

- Direct CO2 emissions: staying within our 15-million-ton carbon budget for 2018-2100, including reducing the CO2 emitted from our homes, workplaces and ground transport by at least 50% during 2020-25.
- Indirect CO2 emissions: understanding and taking action on the things that we consume, and which generate greenhouse gases through their production, transportation and disposal.

Objective 2 – Climate adaptation and resilience

- Increase the amount of urban green infrastructure cover, aiming for a 10% increase by 2038 from 2018 levels, in line with the Greater Manchester aim.
- Respond to these risks by incorporating adaptation and resilience within our plans and strategies, and acting to make necessary changes to our buildings, infrastructure and our natural environment.

Objective 3 – Health and wellbeing

- Adapt the city's built and natural environment and prepare our residents to become more resilient to these changes. Increasing the amount and quality of green space to enable residents to benefit from the improved physical and mental health that will come as a result.
- Improving the energy efficiency of the city's homes and providing access to affordable, secure supplies of renewable energy are essential to help get 38,000 Manchester households out of fuel poverty.

Objective 4 – Inclusive, zero carbon and climate resilient economy

- Ensure that Manchester establishes an inclusive, zero carbon and climate resilient economy where everyone can benefit from playing an active role in decarbonizing and adapting the city to the changing climate.

2.2.2 Manchester City Council's Planning Document Targets

Manchester City Planning Policy currently uses the following documents to look to establish the carbon reduction targets to be achieved in new developments across the City.

These documents use different terminology to describe achieving the various reduced carbon emissions.

Please see below a summary of the terminology and targets set out within the current Manchester Planning Policy documents:

Planning Document:	Time of Production or Adoption:	Low Carbon Target:	Sustainable Design Definition:
Manchester Council's Core Strategy 2012-2027	Adopted 2012	Targets a **9%** reduction in carbon emissions over Part L Building Regulations.	**Low Carbon** (9% over Part L 2013)
Climate Change and Low Emission Strategies 2016-2020	Adopted 2016	Targets a **48%** reduction in carbon emissions from 1990 - 2020	**Low Carbon** (48% over 1990 emissions)
Manchester: A Certain Future	Produced in 2009, updated in 2013	Targets emitting 41% less CO_2 in 2020 than in 2005 – Equates to **10%** over Part L 2013 (if going by Part L requirements)	**Low Carbon** (10% over Part L 2013)

Table 1: Overview of Manchester Planning Documents Carbon Targets

2.2.3 Places for Everyone Joint Development Plan for Manchester

Places for Everyone is a long-term plan of nine Greater Manchester districts (Bolton, Bury, Manchester, Oldham, Rochdale, Salford, Tameside, Trafford and Wigan) for jobs, new homes, and sustainable growth. It has been published by the GMCA on behalf of the nine districts.

The plan is a joint development plan of the nine districts which will determine the kind of development that takes place in their boroughs, maximising the use of brownfield land and urban spaces while protecting Green Belt land from the risk of unplanned development.

It will also ensure all new developments are sustainably integrated into Greater Manchester's transport network or supported by new infrastructure.

The Key DPD policies considered in this report are:

Policy JP-S1: Carbon and Energy

As per policy JP S1, to help tackle climate change, the development should aim to maximise its economic, social and environmental benefits simultaneously, minimise its adverse impacts, utilise sustainable construction techniques and actively seek opportunities to secure net gains across each of the different objectives.

Evidence from the 5 Year Environment Plan indicates that to achieve net zero carbon emissions in new developments, a substantial increase in the use of renewable and photovoltaic technology will be necessary.

Therefore, the 'Places for everyone joint development plan' (Adopted 21 March 2024) set out the below best practice thresholds for Reducing Energy Demand and Onsite Renewable Energy Generation within residential developments.

Year	Space Heat Demand Threshold
2021 - 2025	Houses (30kWh/m2) Flats (25kWh/m2)

These have been seen as the starting point in relation to reducing energy demand for space heating and onsite renewable energy generation for this development. These threshold figures have since been achieved and results are further demonstrated in section 2.3.

Policy JP-S2: Carbon and Energy

The aim of delivering a carbon neutral Greater Manchester no later than 2038, with a dramatic reduction in greenhouse gas emissions, will be supported through a range of measures including:

An expectation that new development will, unless it can be demonstrated that it is not practicable or financially viable;

a) Be net zero carbon which applies:

- from adoption– to regulated operational carbon emissions;
- from 2028 - to all emissions 'in construction'.

From 2025 development should also calculate and minimise carbon emissions from unregulated emissions alongside regulated emissions. Development proposals should set out how this has been achieved in an energy statement in accordance with the energy hierarchy, which in order of importance seeks to:

I. Minimise energy demand;
II. Maximise energy efficiency;
III. Use renewable energy;
IV. Use low carbon energy; and
V. Utilise other energy sources.

2.2.4 National Planning Policy

The NPPF (revised 2023) sets out the Government's planning policies for England and how these are expected to be applied. The overall emphasis of the NPPF is to reiterate the Government's key objectives, including securing sustainable development.

The NPPF defines the purpose of the planning system as being to contribute to the achievement of sustainable development. It explains at Paragraph 8 that there are three dimensions to sustainable development. These are economic, social and environmental and should be pursued simultaneously through the planning system.

Paragraph 10 states that at the heart of the Framework is a presumption in favour of sustainable development.

2.3 Sustainable Design Strategy

2.3.1 Energy and Carbon Emissions

Building Services Strategy

In response to the policy requirements and climate change plan targets set out in section 2.2, developments should aim to assist and achieve the following carbon reduction targets:

1. Achieve a minimum of 10% CO2 reduction over the Part L 2013 Target Emission Rate (TER), as per Target 2 (Electricity intense buildings) in Table 12.1 of Policy EN6.
2. Reducing Energy Demand following best practice thresholds, i.e. 30kWh/m2 for Houses and 25kWh/m2 in Flats and Onsite Renewable Energy Generation within residential developments.
3. Assist in achieving carbon neutrality by 2038.

To achieve the most accurate calculations and estimates, the proposed units have been modelled using *SAP 2012* the governments Standard Assessment Procedure for residential dwellings.

The proposed strategy for minimising energy use and carbon emissions is based on the energy hierarchy described in CIBSE Guide F 2012 (Energy efficiency in buildings). The energy hierarchy has been adopted for the development to ensure that the correct approach to design is taken to promote an energy-efficient low carbon solution (see figure 2). This has ensured that the benefits of effective methods of energy use reduction have been maximised first. The approach adopted is as follows:

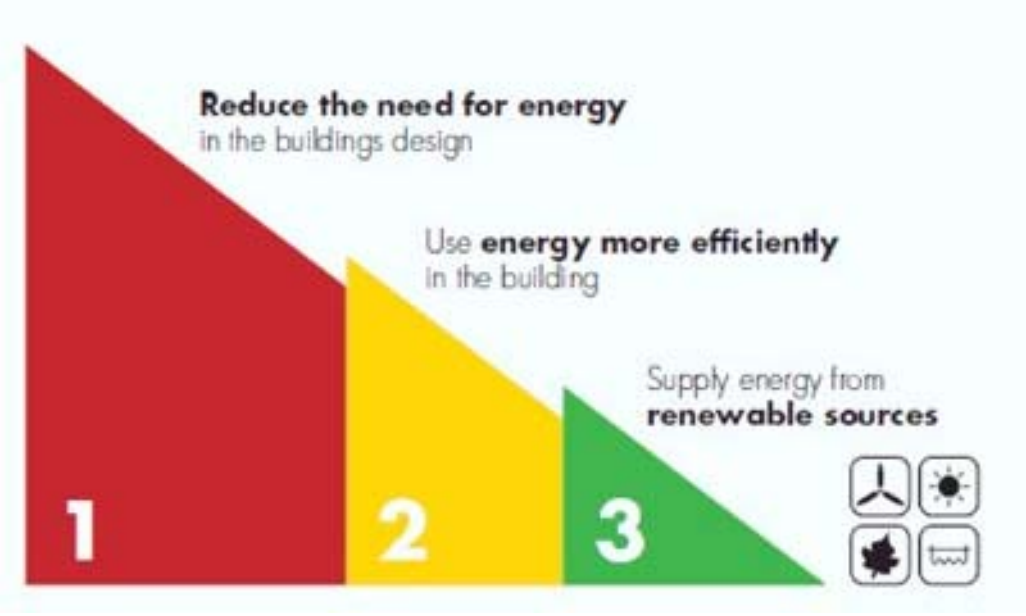


Fig 2: Energy Hierarchy

Minimise energy demand – Implement passive design measures and optimise the building envelope in terms of orientation, air tightness, and insulation. For example, the proposal is targeting a low carbon classification through a holistic low energy design concept as it will be designed with a fabric first approach whereby standards designed to exceed Building Regulations compliancy are aspired to for all fabric U-values and air permeability targets.

Meet demands efficiently – Specification of energy efficient decentralised plant, heating, ventilation, lighting, and system controls to facilitate efficient operation.

Particular attention is being paid to the wellbeing of occupants. The ventilation strategy has been developed to minimise noise ingress from the proposed location as far as possible while minimising the risk of overheating.

Additional Renewable Energy Measures

Opportunities for incorporating low and zero carbon technologies (LZCT) have been considered for this development. The viability of several separate technologies was examined in a LZCT study (see section 3).

Efficient and Sustainable Design Measures

In line with the above Sustainable Design Strategy, the following Energy Efficient design measures are specified.

- High levels of insulation throughout with minimal thermal bridges
- Passive solar gains and internal heat sources
- Excellent level of airtightness
- Good indoor air quality by openable windows

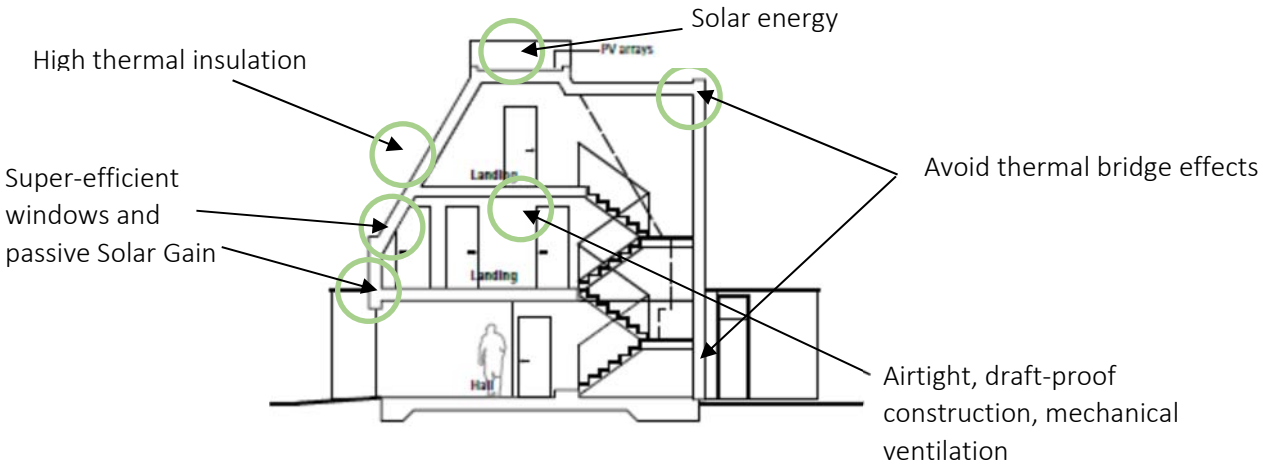


Fig 3. Efficient Design Measure examples

The Proposed specifications and key energy efficient design measures are as follows:

Residential Units:

- Ground floor U-values of 0.12 W/m²K
- External Wall U-values of 0.18 W/m²K
- External Sloped Roof U-values of 0.12 W/m²K
- Double Glazed Window U-values of 1.3 W/m²K
- Solid Frame Door U-values of 1.3 W/m²K
- 100% low energy lighting throughout
- 100 Efficient Electric Panel Heaters to each house
- Dimplex Edel ASHP HW unit to each house for hot water
- 200L hot water cylinders from Dimplex Edel Hot Water Heat Pump system
- Balanced Whole house mechanical ventilation using Vent Axia Sentinel Kinetic FH MVHR
- Assumed Air Permeability Rate of 3m³/hm² in all houses

2.3.2 Choice and Impact of Renewable Technology

All reasonable technologies were investigated for their suitability to the site and development; please refer to section 3 for details.

Following the feasibility study there are no LZC technologies currently proposed; the Manchester Planning target is already being met solely through energy efficiency measures and the total on-site energy is to be provided by a 100% renewable energy electricity provider, classifying the development as both Low Carbon and Carbon Neutral, therefore no LZC technologies are proposed at this stage.

Energy and CO_2 Reduction Summary

A summary of all stages of the energy demand assessment from baseline figures to final carbon reduction are shown in Figures 1 & 2 below:

	Summary of CO2 Emission Reductions	Total CO2 emissions (kgCO2/year)
	Carbon Factors (Gas / Electric)	0.210 / 0.136
BASELINE	Baseline emissions	22233.1
BE GREEN	Improved emissions (after incorporation of renewable energy technology) % CO2 displaced in total	8302.0
	% CO2 displaced in total	62.7%

Table 2: Summary of CO2 Reductions

	Energy Demand (kWh pa)	Energy saving achieved (%)	Regulated CO_2 emissions (kg pa)	Saving achieved on residu al CO_2 emissions (%)
Building Regulations Part L compliance ("Baseline" energy demand & emissions)	94035.4		22233.1	
Proposed scheme after on-site renewables	61044.4	35.1%	8302.0	**62.7%**
Total savings on residual emissions				**62.7%**

Table 3. Total Energy and Carbon Emissions Savings Based on SAP 10.1. Carbon Factors

For a full Breakdown of the figures and calculations please see Appendix A – Energy Demand Assessment Spreadsheet.

Baseline energy demand

'Standard Assessment Procedure - SAP 2012' was used to produce example SAP reports to generate the figures used within the calculations.

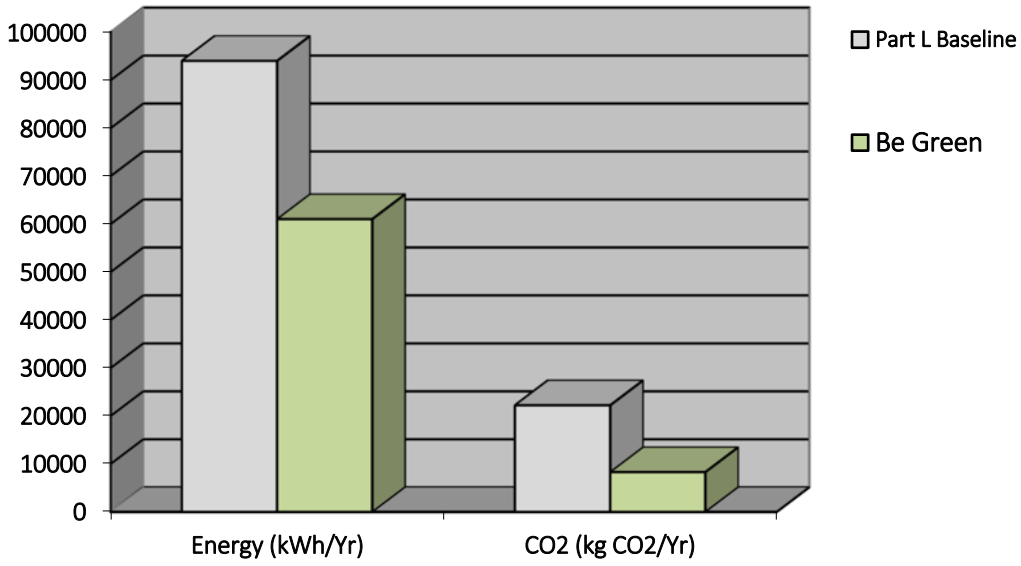
Baseline energy demand (kWh pa)	94035.4
Baseline carbon emissions (kg pa)	22233.1

Be Green stage

The following table demonstrates how the development achieves the reduction in carbon dioxide emissions from LZC technologies.

Energy saving from the use of renewables (kWh)	32990.9
Saving on residual emissions from the use of renewables (kg)	13931.1
Saving on residual emissions from the use of renewables (%)	62.7%

The chart below illustrates the improvements over the Part L Compliant Baseline:



Places for Everyone – Space Heating Demand

The below table demonstrates how threshold values for Reducing Heating Energy Demand is achieved, using Onsite Renewable Energy Generation within residential developments.

Baseline Total Main space heating demand (kWh/yr)	68422.84
Proposed Total Main space heating demand (kWh/yr) with On-site renewables	34711.52
Space heating saving achieved (%)	49.2% overall

Space heating demand Summary for 5 house types (20 no. houses) at Longsight Cricket Club as below:

House Type 3A – End Terrace

Area (sq.m)	108.62
Baseline Space heating demand (kWh/yr)	3909.22
Space heating demand with Onsite renewables (kWh/yr)	2230.85
Heating demand (kwh/sqm) - Places for everyone threshold < 30kwh/sq.m	20.5

House Type 3A – Mid Terrace

Area (sq.m)	108.62
Baseline Space heating demand (kWh/yr)	2953.71
Space heating demand with Onsite renewables (kWh/yr)	1251.92
Heating demand (kwh/sqm) - Places for everyone threshold < 30kwh/sq.m	11.52

House Type 4A – Mid Terrace

Area (sq.m)	112.31
Baseline Space heating demand (kWh/yr)	3095.8
Space heating demand with Onsite renewables (kWh/yr)	1306.99
Heating demand (kwh/sqm) - Places for everyone threshold < 30kwh/sq.m	11.63

House Type 4B – End Terrace

Area (sq.m)	106.05
Baseline Space heating demand (kWh/yr)	3530.46
Space heating demand with Onsite renewables (kWh/yr)	1963.75
Heating demand (kwh/sqm) - Places for everyone threshold < 30kwh/sq.m	18.51

House Type 4B – Mid Terrace

Area (sq.m)	116.96
Baseline Space heating demand (kWh/yr)	3616.52
Space heating demand with Onsite renewables (kWh/yr)	1924.37
Heating demand (kwh/sqm) - Places for everyone threshold < 30kwh/sq.m	16.45

2.3.3 Manchester City Council' Policy and Targets Summary

With regards to the Manchester City Council's planning documents policy and targets (outlined in section 2.2.1 to 2.2.3) the table below details how the Sustainable Design Strategy (outlined in section 2.3.1) achieves the current planning policy requirements and targets.

Planning Document:	Sustainable Design Strategy
Manchester Council's Core Strategy 2012-2027	The Sustainable Design Strategy achieves a **62.7%** reduction in carbon emissions over Part L 2013 - **exceeding** the N6 documents Low Carbon target of 9% over Part L 2013.
Climate Change and Low Emission Strategies 2016-2020	The Sustainable Design Strategy achieves a **62.7%** reduction in carbon emissions over Part L 2013 – **exceeding** the documents Low Carbon target of 48% over 1990 Emissions.
Manchester: A Certain Future	The Sustainable Design Strategy achieves a **62.7%** reduction in carbon emissions over Part L 2013 – **exceeding** the documents Low Carbon target of 10% over Part L 2013.

Table 4. Summary of MCC and Planning Targets

As a result of the sustainable design parameters outlined within section 2.3.1 and the energy and CO2 reduction figures summarised above, the development of 20 residential dwellings at Longsight Cricket Club, Manchester site achieves a total reduction of **62.7%** in carbon emissions over Part L.

The low carbon classification for Longsight BG development can be derived from its prioritisation of fabric first carbon reduction through exceeding Building Regulation design standards, before the incorporation of on-site renewable technologies.

2.4 Adaptation to Climate Change

In addition to the primary building design and fabric, many other issues that will influence creating a Sustainable Development, including flood prevention, material use, waste minimisation and transport. All these issues feature regularly within the separate climate change action plans, outlined within section 2.2, as areas that Manchester is aiming to significantly improve on in order to become a more carbon neutral and clean city.

All the sections of creating a sustainable development should be taken into consideration from the start of the development and promoted throughout the building construction on site in order to maximise their benefits. Additionally, features which enable more efficient usage should also be specified to encourage the building users to maintain efficient use once construction has been completed.

2.4.1 Flood Risk Zone

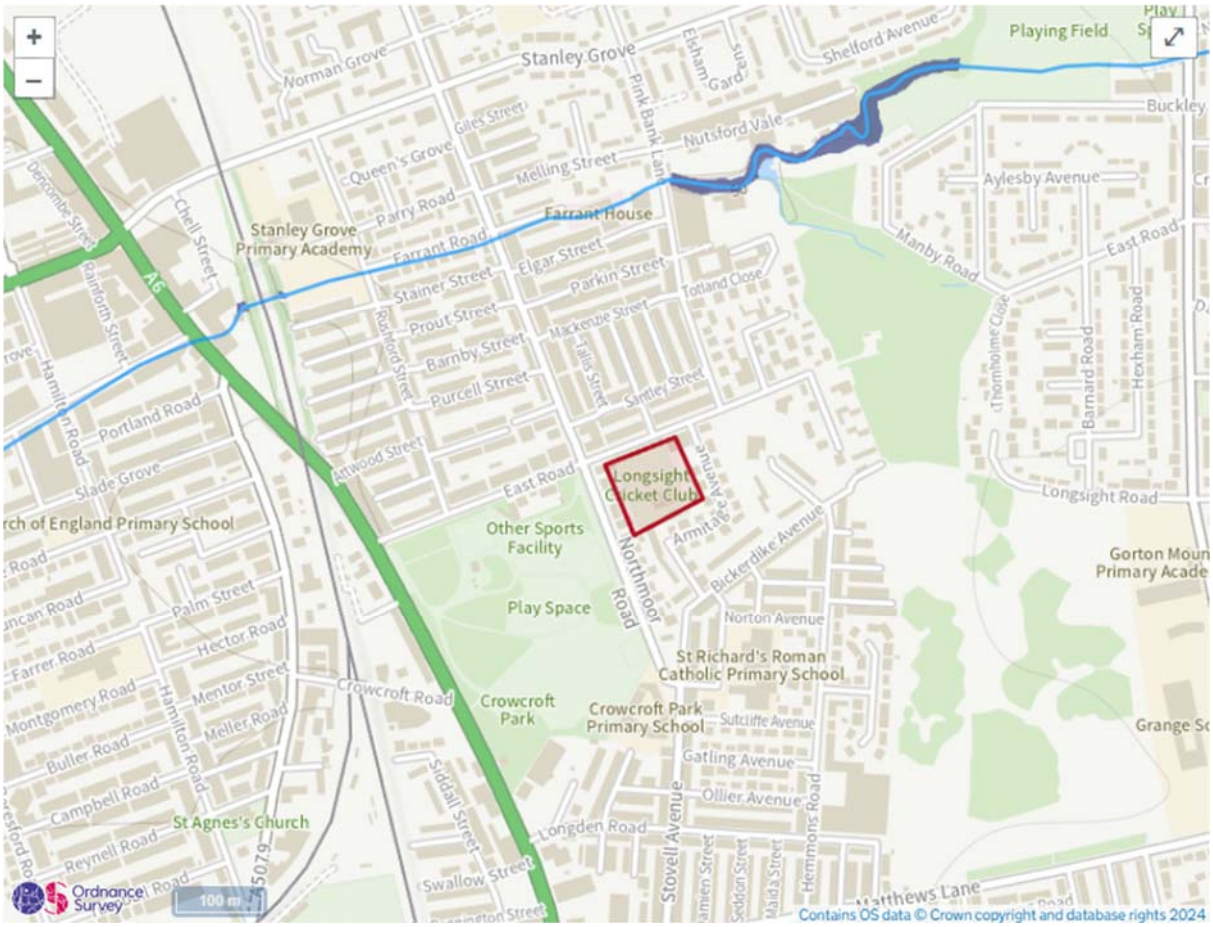


Fig 4: Flood Risk Map

The above map and snippet have been taken from a government licenced flood risk map for Manchester. It can be seen that the site is just located within flood risk zone 1 and therefore has minimal to no risk of flooding.

2.4.2 Green Blue Infrastructure

2.4.2.1 Sustainable Drainage Systems (SUDs)

Even though it has been shown that the proposed scheme is located on a site with a low to zero flood risk, a drainage strategy assessment should be undertaken, by a suitably qualified professional, to assess the feasibility of introducing on-site SUDs measures, that will reduce surface water run-off, and any flood risks associated.

By incorporating SuDs, flood risk can be managed and mitigated. Section 1.1 of the SuDs Manual (Ciria C753) states the following:

"Sustainable drainage systems (SuDS) can deliver multiple benefits. Surface water is a valuable resource, and this should be reflected in the way it is managed and used in the built environment.

It can add to and enhance biodiversity, beauty, tranquillity and the natural aesthetic of buildings, places and landscapes and it can help make them more resilient to the changing climate."

The general concept of SUDs is to manage the flood and pollution risks in developed areas. This is done by efficiently managing surface water run-off by either slowing down the surface water run-off, or by reducing the quantity of surface water run-off. There are different methods to achieve this such as:

- Harvesting – capturing rainwater and facilitate its use within the development
- Infiltrating – rainwater infiltrates into the ground
- Storing – capturing rainwater and control the flow through the means of storing and releasing it slowly i.e. attenuation
- Conveying & treating – capturing rainwater and removing any contaminants, then convey the flow towards a downstream system

The SuDS Manual describes the four pillars of SuDS design as Water Quality, Water Quantity, Amenity and Biodiversity as illustrated in Figure 3 below:

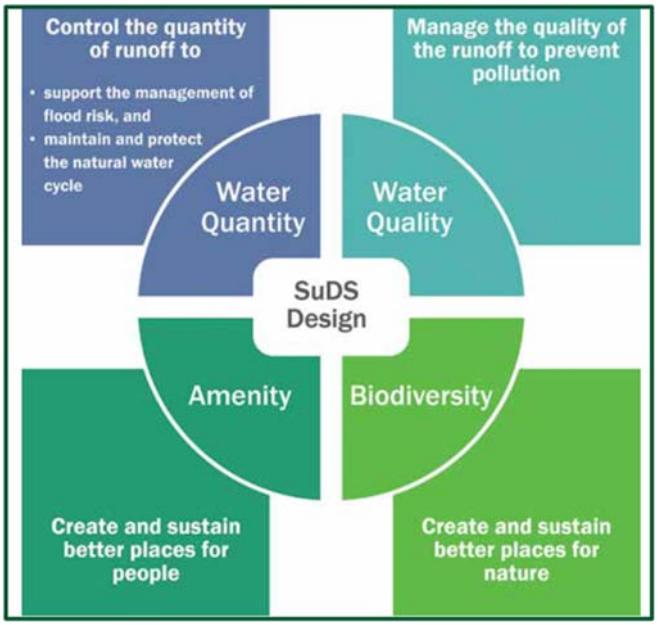


Fig 5. Representation of figure 2.1 of the SUDs Manual

SuDS are increasingly gaining popularity as a holistic solution to a wide range of pressing issues including flood risk, water pollution, groundwater depletion, biodiversity loss and urban decline.

Drainage Hierarchy

To alleviate pressure on existing sewer networks and to address issues of climate change the following hierarchy has been developed and implemented from a planning perspective.

The Planning Practice Guidance, states that:

"Generally, the aim should be to discharge surface run-off as high up the following hierarchy of drainage options as reasonable practicably:

1. *Into the ground (infiltration)*
2. *To a surface water body*
3. *To a surface water sewer*
4. *To a combined sewer"*

The "Building Regulations Approved Document H" refer to this discharge hierarchy.

Description	Benefit
Flood risk management	SuDS aim to have an attenuating affect by slowing down and storing surface water run-off
Drainage resilience	Future proofing designed to be resilient against climate change
Natural flow regime protection	Mimic natural drainage arrangements to emulate natural flow
Water quality	Filter out pollutants and discharge cleaner water
Water reuse	Can be strategically placed to clean and capture water for reuse
Biodiversity and ecology	SuDS use vegetation and natural landscape to support biodiversity and ecology
Amenity	Improve visual integrity and desirability of the site by implementing green and blue features
Carbon reduction	SuDS can reduce carbon use throughout the life cycle including construction, maintenance, and demolition
Microclimate	Aim in reducing heat island effects
Education	Educate and engage the general public about surface water management

Table 5. Outline of types of green/blue infrastructure and associated benefit

2.4.2.2 Biodiversity

Similarly, to the previous section on SUDs, there could be adverse impacts on the surrounding ecology as well potential for the enhancement. Therefore, an ecology report should be produced, by a suitably qualified professional, in order to ensure that any existing ecology on or near the site is adequately protected and to determine the possibility of new habitat creation, planting schemes, green wall areas.

2.4.3 Internal Water Efficiency

Part G of the Building Regulations requires all new dwellings to have an internal water consumption of no greater than 110 litres / person / day, unless specified to be less. Therefore, fittings proposed should have low flow rates, capacities, effective flush volumes etc. Example targets for these to achieve the required internal consumption are as follows:

Appliance	Unit of measure	Amount (litres)
WC (Dual flush)	Full flush volume	4
WC (Dual flush)	Part flush volume	2.6
Taps (excluding kitchen)	Flow rate l/min	5
Kitchen taps	Flow rate l/min	6
Bath	Capacity to Overflow	170
Shower	Flow rate l/min	8
Washing Machine	Litres / kg dry load	8.17
Dishwasher	Litres / place setting	1.25

Table 6. Internal Water Efficiency Flow Rates

The above rates will achieve a total internal water consumption of 106.31 with a bath present and 98.25 with only a shower present.

The specifying of 'A' rated appliances should be prioritised where possible.

2.4.4 Waste Management

2.4.4.1 Occupational Waste

Manchester City Council's Waste Storage and Collection Guidance for New Developments 2017 encourages all new developments to incorporate a waste management strategy into the build at the earliest stage possible.

2.4.4.2 Construction Waste

A target of at least 90% of waste generated on site, throughout the construction stage of the development, to be diverted from landfill' will be included as part of a Construction Environmental Management Plan (CEMP) to be agreed with MCC.

The proposal will also endeavour to maximise the use of recycled materials on site, whereby further promoting the minimising of waste production.

2.4.5 Materials

The construction of new buildings and building elements has a large environmental impact in terms of both, energy, and embodied carbon of new materials. Therefore, Manchester City Council promote the prioritising of environmentally friendly materials, where possible, and encourages the use of recycled building materials. This information should also be incorporated into the SWMP mentioned in the previous subsection (Waste Management) as a means of promoting the re-using and recycling of materials.

Where new materials are to be used, careful consideration of their environmental impact should be taken. This can be achieved by ensuring that only materials that score well under The Green Guide to Specification. This useful online tool can be used as a reference that provides guidance on the relative environmental impacts for a wide range of different building specifications. The BRE's Environmental Profile Methodology determines the Life Cycle Assessment (LCA) of materials, which is what the Guide's specifications are based on.

In order to take full advantage of low impact materials, elements key to the scheme should be specified to achieve ratings of between A+ and C under The Green Guide's ratings. Insulation materials that are specified will also have a global warming potential (GWP) of 5 or less, with an ODP of 0. Additionally, 100% of all timber used as part of the scheme will be responsibly sourced from suppliers that are either Forest Stewardship Council (FSC) accredited, Programme for the Endorsement of Forestry Certification accredited, or a similar recognised accreditation body.

To further promote embodied energy and carbon savings, the scheme will first prioritise the reusing of any demolished materials within the site, however if this is not possible secondary priority must be given to the redirecting from landfill, in line with the waste hierarchy.

Finally, in addition to the above policy points, the development is also recommended to register with the Considerate Constructors Scheme, or a similar approved scheme.

2.4.6 Pollution Control

To reduce emissions of gases with high global warming potential (GWP) and nitrogen oxide (NOx) into the atmosphere, new buildings will be specified with insulating materials that have a GWP of less than 5. This will follow throughout the development to reduce the impact that the construction phase has upon climate change.

Additionally, the following measures will be implemented:

- Pollution Prevention Guidance will be adhered to in respects of air (dust) and water (ground and surface) pollution during the demolition and construction phase.
- External light fittings will be controlled through a time switch, or daylight sensor, to prevent operation during daylight hours to limit the impact of artificial lighting for the development's residents and surrounding environment.

Sound insulation will be specified to achieve Building Regulation Part E compliance standard (this will be verified by pre-completion testing) in addition to meeting the requirements of the council. This will reduce the impact of sound pollution for the occupants within adjoining dwellings.

2.4.7 Sustainable Transport

A key message from all climate change adaptation plans (as mentioned in section 2.2), specifically Our Manchester Strategy 2016-2025, The Zero Carbon Framework (formulated by the Manchester Climate Change Board) and Manchester City Council's Core Strategy 2012-2027, is the need to increase the proportion of cycling, walking and public transport journeys. This is due to it providing both environmental and social benefits through the reducing of emissions, improving air quality, and promoting a more active lifestyle.

The proposed development acknowledges the benefits associated with these forms of sustainable transport and is allowing access to a large central cycle store, thereby encouraging all residents to commute in a sustainable manner.

Further to providing cycle provision, the site is located within New Islington adjacent to both Pollard and Carruthers Streets, which both have multiple bus stops. Also, New Islington Tram Stop is a five-minute walk southeast from the site. This proximity to several transport nodes with such a range of travel possibilities further reduces the reliance on cars and the negative environmental impacts associated.

Transport Links

- Train: The site is located in between 2 train stations namely, Levenshulme and Belle Vue, which is located approximately 0.8 miles southwest and north east of the site. This station provides access to additional Manchester stations as well as regional and national destinations.

- Bus: The nearest bus stop is located on East Road and is less than 0.1 miles from the site. These will provide frequent services to Stalybridge, Ashton-under-Lyne and Piccadilly station and Gardens, where further buses can be caught to more regional destinations.
- Metrolink: The closest Metrolink station to the site is the Burton Road Tram Stop. This provides an additional means of public transport to locations within central Manchester, Manchester Airport and also further afield to Altrincham, Bury, Eccles, East Didsbury, Rochdale, Ashton-Under-Lyne and Manchester Airport.

Local Amenities

- Crowcroft Park is situated within 0.3 miles from site; providing a recreational space for residents.
- The site is also only 3.5 miles from Deansgate, and within a 15-minute bus journey to the centre of town, where a multitude of shops and amenities can be accessed.
- Manchester Metropolitan and Manchester University are both less than 1.9 miles from the proposed development providing good access to higher education via the transport nodes mentioned earlier in this subsection.
- Due to its proximity to Central Manchester, the site has good access to music, theatre and art venues, places of religion and Manchester's City Library.

3 Feasibility Assessment of Renewable Energy and Low Carbon Technologies

Solar Hot Water (Thermal)

Solar water heating systems are one of the more familiar renewable technologies used at the moment. They use the energy from the sun to heat water, most commonly for hot water needs. Solar heating systems use a heat collector that is usually mounted on a roof in which the sun heats a fluid. This fluid is used to heat water that is stored in either a separate hot water cylinder or in a twin-coil hot water cylinder (the second coil is used to provide additional heating from a boiler or other heat source).

Solar hot water panels could be used however, PV will provide slightly better savings and avoid the need for water storage cylinders when compared.

Renewable Technology Not Chosen.

Photovoltaic Panels (PV)

Photovoltaic modules convert sunlight directly to DC electricity. The solar cells consist of a thin piece of semiconductor material, in most cases of silicon. Through a process called doping, very small amounts of impurities are added to the semiconductor, which creates two different layers called n-type and p-type layers.

Certain wavelengths of light are able to ionize the silicon atoms, which separates some of the positive charges (holes) from the negative charges (electrons). The holes move into the positive or p-layer and the electrons into the negative or n-layer. These opposite charges are attracted to each other, but most of them can only re-combine by the electrons passing through an external circuit, due to an internal potential energy barrier. This flow of electrons produces a DC current.

Additionally, the Manchester planning target is already being satisfied solely through the use of energy efficiency measures and the development is achieving a low carbon and carbon neutral status.

Renewable Technology Not Chosen.

Ground Source Heat pumps

A heat pump is a device that takes up heat at a certain temperature and releases it at a higher temperature. The essential components of a heat pump are heat exchangers (through which energy is extracted and emitted) and a means of pumping heat between the exchangers. The effectiveness of the heat pump is measured by the ratio of the heating capacity to the effective power input, usually known as the coefficient of performance (COP). Ground-source heat pumps (GSHP) extract heat from the ground. They are classified as either water-to-air or water-to-water units depending on whether the heat distribution system in the building uses air or water. Ground source heat pumps either use long shallow trenches or deep vertical boreholes to take low grade heat from the ground and then compress it to create higher temperatures.

Ground source heat pumps would not be suitable due to the lack of land space around the properties and the associated costs.

Renewable Technology Not Viable

Air Source Heat pumps

Air source heat pumps absorb heat from the outside air. This is usually used to heat radiators, underfloor heating systems, or warm air convectors and hot water in your home. An air source heat pump extracts heat from the outside air in the same way that a fridge extracts heat from its inside. The system performs down to air temperatures of -20°c which means that they are more than suitable for installations within the UK. Hot water and Heating can be provided 365 days a year. The hot water is produced without the aid of electrical immersions and at 55°c is more than hot enough for baths and showers.

There are two main types of air source heat pump system:

- An air-to-water system distributes heat via your wet central heating system. Heat pumps work much more efficiently at a lower temperature than a standard boiler system would. So they are more suitable for under-floor heating systems or larger radiators, which give out heat at lower temperatures over longer periods of time.
- An air-to-air system produces warm air which is circulated by fans to heat your home. They are unlikely to provide you with hot water as well.

An air source heat pump Hot water Only unit has been used to achieve low carbon and compliance targets for this development. The Dimplex Edel ASHPHW only units are a low carbon highly efficient form of hot water heating. It consists of a ducted system to supply extracted stale hot air to an internally m installed air source heat pump mounted on the top of a water cylinder. The heat pump collects energy from the air and converts this into heat, which is then transferred to the water within the cylinder – creating hot water up to 60°C.

Renewable Technology Chosen.

Biomass Heating

Biomass is any plant-derived organic material that renews itself over a short period.

Biomass energy systems are based on either the direct or indirect combustion of fuels derived from those plant sources. The most common form of biomass is the direct combustion of wood in treated or untreated forms. The use of biomass is becoming increasingly common in some European countries.

The environmental benefits relate to the significantly lower amounts of energy used in biomass production and processing compared to the energy released when they are burnt. This can range from a four-fold return for biodiesel to an approximate 20-fold energy return for woody biomass. Biomass-fuels can be used to produce energy on a continuous basis (unlike renewables such as wind or solar energy) and it can be an economic alternative to fossil fuels as it is a potential source of both heat and electricity.

However, Biomass systems have particular design management and maintenance requirements associated with sourcing, transportation and storage and are therefore more commonly used in commercial developments rather than domestic installations. It can be less convenient to operate than mains-supplied fuels such as natural gas and are more management intensive and require expertise in facilities management. Sources of biomass can also fluctuate, so boilers should be specified to operate on a variety of fuels without risk of overheating or tripping out.

A communal biomass system would not be feasible for this development due to the expense associated with the necessary output to heat all dwellings on the site.

Renewable Technology Not Chosen

Wind

Wind turbines convert the kinetic energy in wind into mechanical energy that is then converted to electricity. Turbines are available in a range of sizes and designs and can either be free-standing, mounted on a building or integrated into a building structure.

The wind speed in the area is under the advised minimum and the built-up area means that a wind turbine wouldn’t be feasible.

Renewable Technology Not Viable

4 Conclusion

This statement has assessed the proposed development at Longsight BG Cricket Club site against the relevant climate change and sustainability policies and targets, as outlined within the Manchester City Council Core Strategy (July 2012), Our Manchester Strategy, Manchester: A Certain Future and The Zero Carbon Framework, through the following of the energy hierarchy, the modelling of houses in the Elmhurst SAP 10 software and addressing all aspects of a sustainable development. In addition, the proposal has been assessed against national sustainable design definitions to determine how it can be classified.

As part of this process, the development was designed with a fabric first approach; with U-values, design air permeability and ventilation targets all aspiring to exceed Building Regulations Part L 2013 standards. This approach demonstrates a holistic low energy design concept, involving very low limiting values and thus led to high-energy performance targets and being defined as a low carbon development.

Furthermore, an LZC feasibility assessment was carried out, with all suitable technologies investigated for their suitability to the site and development. The reduction rises further to 62.7% when using SAP 10.1 carbon factors. In addition to this renewable technology provision, the development can also be defined as carbon neutral because it will achieve net zero carbon emissions. This is to be achieved by obtaining all the energy used on site from a 100% renewable energy electricity provider.

Additionally, Places for everyone joint development plan' (Adopted 21 March 2024) set out best practice thresholds for Reducing Energy Demand and Onsite Renewable Energy Generation within residential developments. (i.e. space heating reduction of 30kWh/m2 for Houses and 25kWh/m2 in Flats). This has since been achieved in the development.

The development will also be adapting to climate change by incorporating sustainable drainage measures into the design, protecting existing ecology, enhancing biodiversity where possible and providing cycle storage provision to residents.

In addition to the following of the energy hierarchy through the efficient design and renewable technology measures mentioned and meeting all relevant Manchester City Council carbon targets the proposal will include many sustainability measures throughout construction and once completed, which will contribute heavily to the development's sustainability performance and accord with the requirements of the NPPF. The key measures to be included and therefore can be taken from this report include:

- The proposal sits within Flood Risk Zone 1 and therefore has minimal to no risk of flooding.
- A SUDs strategy will be produced to outline all measures to be incorporated that will ensure any additional surface water is collected, treated and removed.
- Internal water efficiency will be prioritised by ensuring that efficient water fixtures are proposed so that each dwelling achieves less than 110L per person per day and 'A' rated appliances will be specified where possible.

- Waste minimisation will be targeted from throughout construction and occupational phase. It is targeted that at least 90% of construction waste will be diverted from landfill. Whilst tri-separator refuse shoots will be installed on each floor to promote recycling.
- In addition to targeting Secure by Design accreditation through adoption crime prevention measures, the site layout promotes busy spaces and routes and facilitates natural surveillance. These will therefore reduce the fear of crime and subsequently improving mental health of residents, visitors and workers.
- Prioritising reusing existing materials and locally sourced materials for construction to reduce waste and transportation to landfill in addition and promote a low embodied carbon development.
- When new materials are specified that are not locally attainable then only those that score well on the BRE: The Green Guide to Specification are to be used; to further encourage the use of sustainable materials and reductions in embodied carbon.
- The proximity of the Manchester City Centre and Deansgate to the proposed site is highly sustainable in terms of transport and local amenities as it is near a number of public transport nodes including Levenshulme Train Station, multiple bus stops and additional Metrolink stations, as well as a multitude of shops and other local amenities.
- The development will also include significant cycle storage provision, as well as being located on a cycle route.

As a result of all the above, the proposed sustainable design and energy strategy allows the development to comply with Manchester City Council's planning policy requirement and is in line with all targets put forward in their planning documents.

House Type / Name	Type 3A - End Terrace X4	Type 3A - Mid Terrace X4	Type 4A - Mid Terrace X4	Type 4B- End Terrace X4	Type 4B- Mid Terrace X4	TOTAL (kWh/yr)	SAP 10.2	TOTAL (kgCO2/yr)
Frequency	4	4	4	4	4	20		
BASELINE Dwelling Emission Rate (TER)	Total Energy Demand (kWh/yr)	Total Energy Demand (kWh/yr)	Total Energy Demand (kWh/yr)	Total Energy Demand (kWh/yr)	Total Energy Demand (kWh/yr)	Total Energy Demand (kWh/yr)	Carbon Emission Factor	Associated Total CO2 (kgCO2/yr)
Main Heating Fuel Requirement (TER)	3909.22	2953.71	3095.8	3530.46	3616.52	68422.84	0.210	14368.8
Secondary Main Heating Fuel Requirement (TER)						0	0.136	0.0
Secondary Heating Fuel Requirement (TER)						0	0.136	0.0
Water Fuel Requirement (TER)	2945.53	2963.22	2973.94	2943.03	2975.1	59203.28	0.210	12432.7
Electricity Pumps Fans Requirement (TER)	86	86	86	86	86	1720	0.136	233.9
Electricity Lighting Requirement (TER)	250.04	250.04	251.42	238.43	257.7	4990.52	0.136	678.7
PV Energy Produced (TER)	-1843.65	-1843.65	-1882.2	-2252.91	-2252.91	-40301.3	0.136	-5481.0
TOTAL PER DEVELOPMENT						94035.4		22233.1

FINAL Dwelling Emission Rate (DER)	Total Energy Demand (kWh/yr)	Total Energy Demand (kWh/yr)	Total Energy Demand (kWh/yr)	Total Energy Demand (kWh/yr)	Total Energy Demand (kWh/yr)	Total Energy Demand (kWh/yr)	Carbon Emission Factor	Associated Total CO2 (kgCO2/yr)
Main Heating Fuel Requirement (DER)	2230.85	1251.92	1306.99	1963.75	1924.37	34711.52	0.136	4720.8
Secondary Main Heating Fuel Requirement (DER)						0	0.136	0.0
Secondary Heating Fuel Requirement (DER)						0	0.136	0.0
Water Fuel Requirement (DER)	748.99	748.99	752.78	745.89	756.8	15013.8	0.136	2041.9
Electricity Pumps Fans Requirement (DER)	303.69	303.69	314.7	272.51	302.68	5989.08	0.136	814.5
Electricity Lighting Requirement (DER)	267.05	267.05	268.53	254.65	275.23	5330.04	0.136	724.9
TOTAL PER DEVELOPMENT						61044.4		8302.0
PV Energy Produced (DER)						0.0	0.136	0.0
TOTAL PER DEVELOPMENT						61044.4		8302.0

watt
Energy & Consulting Engineers

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Tue 03 Sep 2024 13:43:06

Project Information			
Assessed By	Daniel Watt	Building Type	House, End-terrace
OCDEA Registration	EES/027301	Assessment Date	2024-09-03

Dwelling Details			
Assessment Type	As designed	Total Floor Area	109 m^2
Site Reference	Type 3A - End Terrace X4	Plot Reference	Type 3A - End Terrace X4
Address	Plot 1 Type 3A End Terrace		

Client Details	
Name	OLLIER SMURTHWAITE
Company	OLLIER SMURTHWAITE
Address	40 king st, Manchester, M3

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.49 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	4.91 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*60.31 kWh_{PE}/m^2*	
Dwelling primary energy	50.86 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*38.9 kWh/m^2*	
Dwelling fabric energy efficiency	37.3 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.18	Walls (1) (0.18)	OK
Party walls	*0.2*	N/A	N/A	**N/A**
Curtain walls	*1.6*	N/A	N/A	**N/A**
Floors	*0.18*	0.12	GF (0.12)	OK
Roofs	*0.16*	0.12	Roof (1) (0.12)	OK
Windows, doors, and roof windows	*1.6*	1.3	Front (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	129.6	0.18
Ground floor: GF, GF	37.3	0.12
Exposed roof: Roof (1)	50.2	0.12

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
Front, Windows	6.8	North West	0.7	1.3
Rear, Windows	6.98	South East	0.7	1.3
Front Door, Main Door	2.1	North West	N/A	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.03 **(!)**	
External wall	E3: Sill	Calculated by person with suitable expertise	0.04	
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.16	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.001 **(!)**	
External wall	E11: Eaves (insulation at rafter level)	Calculated by person with suitable expertise	0.04	
External wall	E13: Gable (insulation at rafter level)	Calculated by person with suitable expertise	0.04	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.08	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Main heating system 2: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	0.0%
Emitter type	
Flow temperature	
System type	Heat Pump
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	

Main heating 2 - type: Not applicable		
Function		
Ecodesign class		
Manufacturer		
Model		
Water heating - type: Cylinder thermostat and HW separately timed		
Manufacturer		
Model		

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	66.9 lm/W	**FAIL**
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.65 W/(l/s)	**OK**
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	86%	**OK**
Manufacturer/Model	Sentinel Kinetic FH, 408167A	
Commissioning		

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Type 3A - End Terrace X4	**Issued on Date**	03/09/2024
Assessment Reference	Type 3A - End Terrace X4	**Prop Type Ref**	Type 3A - End Terrace
Property	Plot 1 Type 3A End Terrace		

SAP Rating	79 C	**DER**	4.91	**TER**	11.49
Environmental	96 A	**% DER < TER**			57.27
CO_2 Emissions (t/year)	0.55	**DFEE**	37.34	**TFEE**	38.92
Compliance Check	See BREL	**% DFEE < TFEE**			4.06
% DPER < TPER	15.67	**DPER**	50.86	**TPER**	60.31

Assessor Details	Mr. Daniel Watt	**Assessor ID**	AV75-0001
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	37.3000 (1b)	x	2.4000 (2b)	=	89.5200	(1b) - (3b)
First floor	37.3000 (1c)	x	2.7000 (2c)	=	100.7100	(1c) - (3c)
Second floor	34.0600 (1d)	x	3.4100 (2d)	=	116.1446	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.6600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	306.3746	(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)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	77.4000 (23c)

Effective ac	0.2756	0.2724	0.2692	0.2532	0.2501	0.2341	0.2341	0.2309	0.2405	0.2501	0.2564	0.2628	(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	
Windows (Uw = 1.30)			13.7800	1.2357	17.0285			(27)
Main Door			2.1000	1.3000	2.7300			(26a)
GF			37.3000	0.1200	4.4760	110.0000	4103.0000	(28a)
External Wall	145.4800	15.8800	129.6000	0.1800	23.3280	70.0000	9072.0000	(29a)
Sloped Roof	50.2000		50.2000	0.1200	6.0240	9.0000	451.8000	(30)
Total net area of external elements Aum(A, m2)			232.9800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		53.5865			(33)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13626.8000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		125.4077 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.8000	0.0300	0.2640

E3 Sill	7.9000	0.0400	0.3160	
E5 Ground floor (normal)	17.4400	0.1600	2.7904	
E4 Jamb	18.6000	0.0500	0.9300	
E6 Intermediate floor within a dwelling	33.9200	0.0010	0.0339	
E11 Eaves (insulation at rafter level)	9.9200	0.0400	0.3968	
E13 Gable (insulation at rafter level)	10.8400	0.0400	0.4336	
E16 Corner (normal)	17.0200	0.0900	1.5318	
E18 Party wall between dwellings	17.0200	0.0600	1.0212	
P1 Party wall - Ground floor	9.9200	0.0800	0.7936	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.5113 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 62.0978 (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	27.8604	27.5381	27.2158	25.6045	25.2822	23.6709	23.6709	23.3486	24.3154	25.2822	25.9268	26.5713	(38)
Heat transfer coeff	89.9582	89.6359	89.3137	87.7023	87.3801	85.7687	85.7687	85.4465	86.4133	87.3801	88.0246	88.6691	(39)
Average = Sum(39)m / 12 =												87.6218	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8279	0.8249	0.8220	0.8071	0.8042	0.7893	0.7893	0.7864	0.7953	0.8042	0.8101	0.8160	(40)
HLP (average)												0.8064	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8065 (42)

Hot water usage for mixer showers

71.2762	70.2051	68.6442	65.6578	63.4539	60.9961	59.5991	61.1481	62.8462	65.4851	68.5357	71.0031	(42a)

Hot water usage for baths

30.7743	30.3173	29.6737	28.4870	27.5984	26.6131	26.0809	26.7200	27.4159	28.4702	29.6813	30.6703	(42b)

Hot water usage for other uses

43.3718	41.7946	40.2175	38.6403	37.0631	35.4860	35.4860	37.0631	38.6403	40.2175	41.7946	43.3718	(42c)

Average daily hot water use (litres/day) 133.6758 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.4223	142.3170	138.5354	132.7851	128.1154	123.0952	121.1660	124.9313	128.9023	134.1727	140.0116	145.0452	(44)
Energy conte	230.3134	202.6575	212.9237	181.7761	172.4680	151.3599	146.5397	154.6910	158.9495	182.0711	199.4722	227.1057	(45)
Energy content (annual)										Total = Sum(45)m =		2220.3279	
Distribution loss (46)m = 0.15 x (45)m	34.5470	30.3986	31.9386	27.2664	25.8702	22.7040	21.9810	23.2037	23.8424	27.3107	29.9208	34.0659	(46)

Water storage loss:

Store volume	201.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.6100	(48)
Temperature factor from Table 2b	0.5400	(49)
Enter (49) or (54) in (55)	0.8694	(55)

Total storage loss

26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)

If cylinder contains dedicated solar storage

26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

257.2648	227.0007	239.8751	207.8581	199.4194	177.4419	173.4911	181.6424	185.0315	209.0225	225.5542	254.0571	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

257.2648	227.0007	239.8751	207.8581	199.4194	177.4419	173.4911	181.6424	185.0315	209.0225	225.5542	254.0571	(64)
									Total per year (kWh/year) = Sum(64)m =		2537.6589	(64)
12Total per year (kWh/year)											2538	(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

76.5792	67.3836	70.7971	60.4406	57.3456	50.3272	48.7245	51.4348	52.8507	60.5386	66.3245	75.5127	(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	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	149.1063	165.0820	149.1063	154.0765	149.1063	154.0765	149.1063	149.1063	154.0765	149.1063	154.0765	149.1063	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	269.6166	272.4143	265.3640	250.3548	231.4083	213.6012	201.7050	198.9072	205.9576	220.9668	239.9133	257.7204	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	(71)
Water heating gains (Table 5)	102.9291	100.2732	95.1574	83.9452	77.0774	69.8988	65.4899	69.1327	73.4038	81.3692	92.1174	101.4955	(72)
Total internal gains	586.7500	602.8677	574.7259	553.4746	522.6901	502.6747	481.3993	482.2444	498.5359	516.5404	551.2053	573.4203	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	6.9800	36.7938	0.7200	0.7000	0.7700	89.7004	(77)
Northwest	6.8000	11.2829	0.7200	0.7000	0.7700	26.7975	(81)

Solar gains	116.4979	207.3401	307.3346	420.4314	507.0897	519.3333	494.0715	426.9881	346.1172	235.5297	141.1586	98.6490	(83)
Total gains	703.2479	810.2078	882.0605	973.9060	1029.7798	1022.0080	975.4708	909.2325	844.6531	752.0701	692.3639	672.0693	(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	42.0776	42.2288	42.3812	43.1599	43.3191	44.1329	44.1329	44.2993	43.8037	43.3191	43.0019	42.6893	
alpha	3.8052	3.8153	3.8254	3.8773	3.8879	3.9422	3.9422	3.9533	3.9202	3.8879	3.8668	3.8460	
util living area	0.9696	0.9483	0.9130	0.8276	0.6925	0.5146	0.3812	0.4232	0.6413	0.8631	0.9488	0.9737	(86)
MIT	19.5213	19.7825	20.1155	20.5369	20.8192	20.9580	20.9899	20.9850	20.9005	20.5283	19.9726	19.4886	(87)
Th 2	20.2292	20.2318	20.2343	20.2472	20.2497	20.2626	20.2626	20.2652	20.2574	20.2497	20.2446	20.2395	(88)
util rest of house	0.9649	0.9407	0.9001	0.8035	0.6532	0.4616	0.3195	0.3590	0.5875	0.8382	0.9399	0.9697	(89)
MIT 2	18.4845	18.8146	19.2316	19.7519	20.0763	20.2300	20.2568	20.2561	20.1736	19.7537	19.0667	18.4504	(90)
Living area fraction										fLA = Living area / (4) =		0.2590	(91)
MIT	18.7530	19.0653	19.4605	19.9552	20.2687	20.4185	20.4467	20.4449	20.3618	19.9543	19.3013	18.7192	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7530	19.0653	19.4605	19.9552	20.2687	20.4185	20.4467	20.4449	20.3618	19.9543	19.3013	18.7192	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9533	0.9263	0.8848	0.7932	0.6543	0.4731	0.3351	0.3749	0.5954	0.8271	0.9262	0.9590	(94)
Useful gains	670.3825	750.5297	780.4755	772.4920	673.7622	483.4640	326.8688	340.8998	502.8974	622.0646	641.2857	644.5200	(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	1300.1641	1269.7196	1157.5484	969.5635	748.7342	499.0471	329.9252	345.6186	541.1057	817.3777	1074.0153	1287.4089	(97)
Space heating kWh	468.5575	348.8956	280.5423	141.8914	55.7792	0.0000	0.0000	0.0000	0.0000	145.3130	311.5654	478.3094	(98a)
Space heating requirement - total per year (kWh/year)												2230.8537	
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	468.5575	348.8956	280.5423	141.8914	55.7792	0.0000	0.0000	0.0000	0.0000	145.3130	311.5654	478.3094	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2230.8537	
Space heating per m2											(98c) / (4) =	20.5306	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Fraction of main heating from main system 2 0.0000 (203)
Fraction of total heating from main system 1 1.0000 (204)
Fraction of total heating from main system 2 0.0000 (205)
Efficiency of main space heating system 1 (in %) 100.0000 (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	468.5575	348.8956	280.5423	141.8914	55.7792	0.0000	0.0000	0.0000	0.0000	145.3130	311.5654	478.3094	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	468.5575	348.8956	280.5423	141.8914	55.7792	0.0000	0.0000	0.0000	0.0000	145.3130	311.5654	478.3094	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Space heating fuel used, main system 2												0.0000	(213)
Water heating													
Water heating requirement	257.2648	227.0007	239.8751	207.8581	199.4194	177.4419	173.4911	181.6424	185.0315	209.0225	225.5542	254.0571	(64)
Efficiency of water heater												338.8093	(216)
(217)m	338.8093	338.8093	338.8093	338.8093	338.8093	338.8093	338.8093	338.8093	338.8093	338.8093	338.8093	338.8093	(217)
Fuel for water heating, kWh/month	75.9320	66.9995	70.7994	61.3496	58.8589	52.3722	51.2061	53.6120	54.6123	61.6933	66.5726	74.9853	(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	25.7932	23.2971	25.7932	24.9611	25.7932	24.9611	25.7932	25.7932	24.9611	25.7932	24.9611	25.7932	(231)
Lighting	33.0893	26.5455	23.9013	17.5111	13.5261	11.0509	12.3389	16.0386	20.8326	27.3335	30.8731	34.0090	(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 2230.8537 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 338.8093
Water heating fuel used 748.9932 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.8125)

mechanical ventilation fans (SFP = 0.8125)	303.6938	(230a)
Total electricity for the above, kWh/year	303.6938	(231)
Electricity for lighting (calculated in Appendix L)	267.0498	(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	3550.5905	(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	2230.8537	0.1558	347.5478	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	748.9932	0.1412	105.7727	(264)
Space and water heating			453.3205	(265)
Pumps, fans and electric keep-hot	303.6938	0.1387	42.1261	(267)
Energy for lighting	267.0498	0.1443	38.5435	(268)
Total CO2, kg/year			533.9901	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.9100	(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	2230.8537	1.5768	3517.5254	(275)
Space heating - main system 2	0.0000	0.0000	0.0000	(276)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	748.9932	1.5222	1140.1140	(278)
Space and water heating			4657.6394	(279)
Pumps, fans and electric keep-hot	303.6938	1.5128	459.4280	(281)
Energy for lighting	267.0498	1.5338	409.6099	(282)
Total Primary energy kWh/year			5526.6773	(286)
Dwelling Primary energy Rate (DPER)			50.8600	(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	37.3000 (1b)	x	2.4000 (2b)	=	89.5200	(1b) - (3b)
First floor	37.3000 (1c)	x	2.7000 (2c)	=	100.7100	(1c) - (3c)
Second floor	34.0600 (1d)	x	3.4100 (2d)	=	116.1446	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.6600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	306.3746	(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) =	0.1306	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3806	(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) =	0.3235	(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	0.4124	0.4043	0.3963	0.3558	0.3477	0.3073	0.3073	0.2992	0.3235	0.3477	0.3639	0.3801	(22b)
Effective ac	0.5850	0.5817	0.5785	0.5633	0.5605	0.5472	0.5472	0.5448	0.5523	0.5605	0.5662	0.5722	(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			2.1000	1.0000	2.1000			(26a)
TER Opening Type (Uw = 1.20)			13.7800	1.1450	15.7786			(27)
GF			37.3000	0.1300	4.8490			(28a)
External Wall	145.4800	15.8800	129.6000	0.1800	23.3280			(29a)
Sloped Roof	50.2000		50.2000	0.1100	5.5220			(30)
Total net area of external elements Aum(A, m2)			232.9800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.5776			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 125.4077 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	8.8000	0.0500	0.4400
E3 Sill	7.9000	0.0500	0.3950
E5 Ground floor (normal)	17.4400	0.1600	2.7904
E4 Jamb	18.6000	0.0500	0.9300
E6 Intermediate floor within a dwelling	33.9200	0.0000	0.0000
E11 Eaves (insulation at rafter level)	9.9200	0.0400	0.3968
E13 Gable (insulation at rafter level)	10.8400	0.0800	0.8672
E16 Corner (normal)	17.0200	0.0900	1.5318
E18 Party wall between dwellings	17.0200	0.0600	1.0212
P1 Party wall - Ground floor	9.9200	0.0800	0.7936

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.1660 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 60.7436 (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	59.1506	58.8167	58.4894	56.9522	56.6645	55.3256	55.3256	55.0777	55.8414	56.6645	57.2464	57.8547	(38)
Heat transfer coeff	119.8943	119.5604	119.2331	117.6958	117.4082	116.0693	116.0693	115.8213	116.5850	117.4082	117.9900	118.5983	(39)
Average = Sum(39)m / 12 =												117.6944	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1034	1.1003	1.0973	1.0832	1.0805	1.0682	1.0682	1.0659	1.0729	1.0805	1.0859	1.0915	(40)
HLP (average)												1.0831	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8065 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	71.2762	70.2051	68.6442	65.6578	63.4539	60.9961	59.5991	61.1481	62.8462	65.4851	68.5357	71.0031	(42a)
Hot water usage for baths	30.7743	30.3173	29.6737	28.4870	27.5984	26.6131	26.0809	26.7200	27.4159	28.4702	29.6813	30.6703	(42b)
Hot water usage for other uses	43.3718	41.7946	40.2175	38.6403	37.0631	35.4860	35.4860	37.0631	38.6403	40.2175	41.7946	43.3718	(42c)
Average daily hot water use (litres/day)												133.6758	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.4223	142.3170	138.5354	132.7851	128.1154	123.0952	121.1660	124.9313	128.9023	134.1727	140.0116	145.0452	(44)
Energy conte	230.3134	202.6575	212.9237	181.7761	172.4680	151.3599	146.5397	154.6910	158.9495	182.0711	199.4722	227.1057	(45)
Energy content (annual)										Total = Sum(45)m =		2220.3279	
Distribution loss (46)m = 0.15 x (45)m	34.5470	30.3986	31.9386	27.2664	25.8702	22.7040	21.9810	23.2037	23.8424	27.3107	29.9208	34.0659	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	276.9083	244.7432	259.5186	226.8680	219.0629	196.4517	193.1346	201.2859	204.0413	228.6660	244.5640	273.7006	(62)
WWHRS	-32.5845	-28.8180	-30.1766	-24.9874	-23.2873	-19.9271	-18.6785	-19.8627	-20.6174	-24.3056	-27.5353	-31.9811	(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	244.3238	215.9252	229.3420	201.8806	195.7755	176.5246	174.4561	181.4232	183.4239	204.3604	217.0287	241.7195	(64)
										Total per year (kWh/year) = Sum(64)m =		2466.1836	(64)
12Total per year (kWh/year)												2466	(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	113.8551	101.0522	108.0731	96.5140	94.6215	86.4006	86.0004	88.7107	88.9242	97.8146	102.3980	112.7886	(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	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	149.1063	165.0820	149.1063	154.0765	149.1063	154.0765	149.1063	149.1063	154.0765	149.1063	154.0765	149.1063	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	269.6166	272.4143	265.3640	250.3548	231.4083	213.6012	201.7050	198.9072	205.9576	220.9668	239.9133	257.7204	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	(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)	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	(71)
Water heating gains (Table 5)	153.0311	150.3753	145.2595	134.0473	127.1795	120.0009	115.5919	119.2348	123.5058	131.4712	142.2194	151.5976	(72)

Total internal gains

	639.8521	655.9697	627.8279	606.5767	575.7921	552.7767	531.5013	532.3465	548.6380	569.6424	604.3074	626.5223 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	6.9800	36.7938	0.6300	0.7000	0.7700	78.4878	(77)
Northwest	6.8000	11.2829	0.6300	0.7000	0.7700	23.4479	(81)

Solar gains	101.9357	181.4226	268.9178	367.8775	443.7035	454.4167	432.3125	373.6145	302.8525	206.0885	123.5138	86.3179	(83)
Total gains	741.7878	837.3923	896.7457	974.4542	1019.4956	1007.1934	963.8139	905.9610	851.4905	775.7309	727.8212	712.8403	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	31.5713	31.6595	31.7464	32.1611	32.2399	32.6118	32.6118	32.6816	32.4675	32.2399	32.0809	31.9163	
alpha	3.1048	3.1106	3.1164	3.1441	3.1493	3.1741	3.1741	3.1788	3.1645	3.1493	3.1387	3.1278	
util living area	0.9707	0.9561	0.9333	0.8791	0.7844	0.6352	0.4942	0.5378	0.7379	0.8969	0.9550	0.9738	(86)
MIT	18.8830	19.1421	19.5246	20.0573	20.5141	20.8279	20.9426	20.9239	20.7064	20.1267	19.4314	18.8487	(87)
Th 2	19.9981	20.0006	20.0030	20.0146	20.0168	20.0269	20.0269	20.0288	20.0230	20.0168	20.0124	20.0078	(88)
util rest of house	0.9656	0.9487	0.9214	0.8566	0.7424	0.5639	0.3977	0.4414	0.6753	0.8731	0.9461	0.9693	(89)
MIT 2	17.5282	17.8567	18.3396	19.0055	19.5483	19.8943	19.9960	19.9850	19.7759	19.1030	18.2340	17.4907	(90)
Living area fraction										fLA = Living area / (4) =		0.2590	(91)
MIT	17.8790	18.1896	18.6465	19.2779	19.7984	20.1361	20.2411	20.2281	20.0169	19.3681	18.5441	17.8424	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.8790	18.1896	18.6465	19.2779	19.7984	20.1361	20.2411	20.2281	20.0169	19.3681	18.5441	17.8424	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9506	0.9305	0.9007	0.8365	0.7319	0.5725	0.4199	0.4623	0.6748	0.8537	0.9282	0.9554	(94)
Useful gains	705.1577	779.1984	807.7002	815.1291	746.1735	576.6053	404.7176	418.7839	574.6180	662.2287	675.5457	681.0483	(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	1628.0483	1588.9036	1448.2621	1221.4314	950.8184	642.5684	422.6230	443.3806	689.8210	1029.4430	1350.2867	1617.9628	(97)
Space heating kWh	686.6306	544.1219	476.5781	292.5377	152.2558	0.0000	0.0000	0.0000	0.0000	273.2074	485.8135	697.0643	(98a)
Space heating requirement - total per year (kWh/year)												3608.2094	
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	686.6306	544.1219	476.5781	292.5377	152.2558	0.0000	0.0000	0.0000	0.0000	273.2074	485.8135	697.0643	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3608.2094	
Space heating per m2										(98c) / (4) =		33.2064	(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	686.6306	544.1219	476.5781	292.5377	152.2558	0.0000	0.0000	0.0000	0.0000	273.2074	485.8135	697.0643	(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)	743.9118	589.5145	516.3359	316.9422	164.9576	0.0000	0.0000	0.0000	0.0000	295.9994	526.3419	755.2160	(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	244.3238	215.9252	229.3420	201.8806	195.7755	176.5246	174.4561	181.4232	183.4239	204.3604	217.0287	241.7195	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.2472	86.0431	85.6613	84.8907	83.5024	79.8000	79.8000	79.8000	79.8000	84.7117	85.8116	86.2941	(217)
Fuel for water heating, kWh/month	283.2833	250.9500	267.7313	237.8124	234.4549	221.2087	218.6167	227.3473	229.8545	241.2423	252.9131	280.1114	(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	30.9814	24.8544	22.3786	16.3955	12.6644	10.3469	11.5529	15.0169	19.5054	25.5922	28.9063	31.8424	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-36.8269	-52.9402	-77.5506	-88.8800	-97.2329	-91.2091	-90.0560	-84.3327	-74.4647	-61.2787	-40.8383	-31.7182	(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	-17.7876	-37.7378	-75.6177	-114.4807	-152.2797	-153.3794	-151.6065	-127.9707	-93.2579	-54.3019	-23.8532	-14.0444	(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	3909.2193	(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	2945.5259	(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)	250.0373	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1843.6460	(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	5347.1365	(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	3909.2193	0.2100	820.9360	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2945.5259	0.2100	618.5604	(264)
Space and water heating			1439.4965	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	250.0373	0.1443	36.0881	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-827.3283	0.1342	-111.0249	
PV Unit electricity exported	-1016.3176	0.1257	-127.7066	
Total			-238.7314	(269)
Total CO2, kg/year			1248.7824	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.4900	(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	3909.2193	1.1300	4417.4178	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2945.5259	1.1300	3328.4443	(278)
Space and water heating			7745.8621	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	250.0373	1.5338	383.5155	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-827.3283	1.4959	-1237.6395	
PV Unit electricity exported	-1016.3176	0.4612	-468.7588	
Total			-1706.3983	(283)
Total Primary energy kWh/year			6553.0801	(286)
Target Primary Energy Rate (TPER)			60.3100	(287)

Predicted Energy Assessment

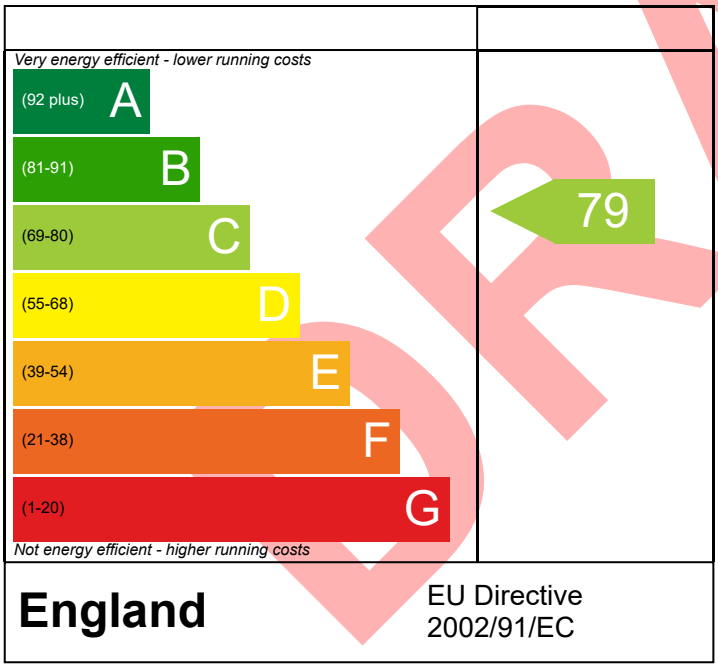
Plot 1 Type 3A End Terrace

Dwelling type:	House, End-Terrace
Date of assessment:	03/09/2024
Produced by:	Daniel Watt
Total floor area:	108.66 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

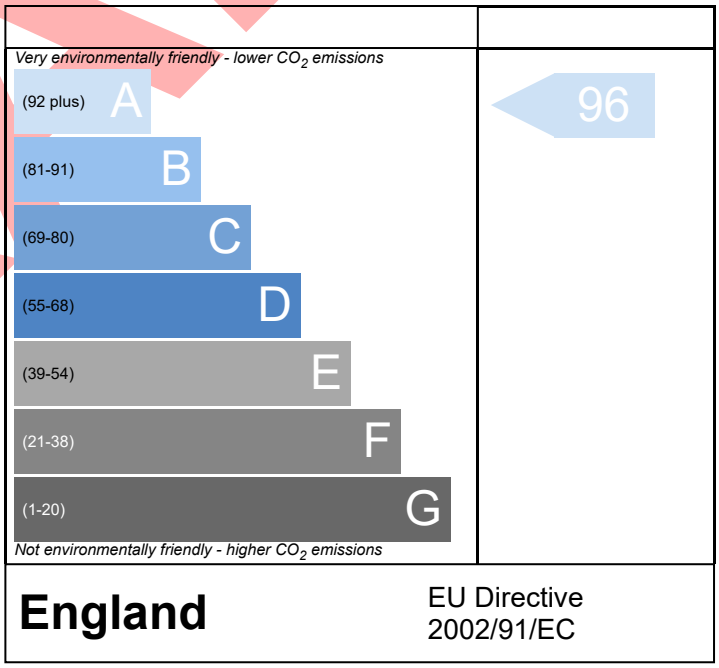
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Tue 03 Sep 2024 13:43:06

Project Information			
Assessed By	Daniel Watt	Building Type	House, Mid-terrace
OCDEA Registration	EES/027301	Assessment Date	2024-09-03

Dwelling Details			
Assessment Type	As designed	Total Floor Area	109 m^2
Site Reference	Type 3A - Mid Terrace X4	Plot Reference	Type 3A - Mid Terrace X4
Address	Plot 1 Type 3A End Terrace		

Client Details	
Name	OLLIER SMURTHWAITE
Company	OLLIER SMURTHWAITE
Address	40 king st, Manchester, M3

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*9.68 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	3.53 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*50.56 kWh_{PE}/m^2*	
Dwelling primary energy	36.74 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*30.5 kWh/m^2*	
Dwelling fabric energy efficiency	28.7 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.18	Walls (1) (0.18)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.12	GF (0.12)	OK
Roofs	*0.16*	0.12	Roof (1) (0.12)	OK
Windows, doors, and roof windows	*1.6*	1.3	Front (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	48.11	0.18
Party wall: Party Wall (1)	84.41	0 **(!)**
Ground floor: GF, GF	37.3	0.12
Exposed roof: Roof (1)	50.2	0.12

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
Front, Windows	6.8	North West	0.7	1.3
Rear, Windows	6.98	South East	0.7	1.3
Front Door, Main Door	2.1	North West	N/A	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.03 **(!)**	
External wall	E3: Sill	Calculated by person with suitable expertise	0.04	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.16	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.001 **(!)**	
External wall	E13: Gable (insulation at rafter level)	Calculated by person with suitable expertise	0.04	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.08	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Main heating system 2: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	0.0%
Emitter type	
Flow temperature	
System type	Heat Pump
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Main heating 2 - type: Not applicable	
Function	
Ecodesign class	
Manufacturer	
Model	

Water heating - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	66.9 lm/W	**FAIL**
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.65 W/(l/s)	**OK**
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	86%	**OK**
Manufacturer/Model	Sentinel Kinetic FH, 408167A	
Commissioning		

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Type 3A - Mid Terrace X4	**Issued on Date**	03/09/2024
Assessment Reference	Type 3A - Mid Terrace X4	**Prop Type Ref**	Type 3A - End Terrace
Property	Plot 1 Type 3A End Terrace		

SAP Rating	85 B	**DER**	3.53	**TER**	9.68
Environmental	97 A	**% DER < TER**			63.53
CO_2 Emissions (t/year)	0.39	**DFEE**	28.74	**TFEE**	30.47
Compliance Check	See BREL	**% DFEE < TFEE**			5.68
% DPER < TPER	27.33	**DPER**	36.74	**TPER**	50.56

Assessor Details	Mr. Daniel Watt	**Assessor ID**	AV75-0001
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	37.3000 (1b)	x	2.4000 (2b)	=	89.5200	(1b) - (3b)
First floor	37.3000 (1c)	x	2.7000 (2c)	=	100.7100	(1c) - (3c)
Second floor	34.0600 (1d)	x	3.4100 (2d)	=	116.1446	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.6600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	306.3746	(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)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	77.4000 (23c)

Effective ac	0.2756	0.2724	0.2692	0.2532	0.2501	0.2341	0.2341	0.2309	0.2405	0.2501	0.2564	0.2628	(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	
Windows (Uw = 1.30)			13.7800	1.2357	17.0285			(27)
Main Door			2.1000	1.3000	2.7300			(26a)
GF			37.3000	0.1200	4.4760	110.0000	4103.0000	(28a)
External Wall	63.9900	15.8800	48.1100	0.1800	8.6598	70.0000	3367.7000	(29a)
Sloped Roof	50.2000		50.2000	0.1200	6.0240	9.0000	451.8000	(30)
Total net area of external elements Aum(A, m2)			151.4900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.9183			(33)
Internal Walls			84.4100	0.0000	0.0000	140.0000	11817.4000	(32)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 19739.9000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	181.6667	(35)

List of Thermal Bridges

K1	Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	8.8000	0.0300	0.2640	
E3 Sill	7.9000	0.0400	0.3160	
E5 Ground floor (normal)	7.5200	0.1600	1.2032	
E4 Jamb	18.6000	0.0500	0.9300	
E6 Intermediate floor within a dwelling	7.5200	0.0010	0.0075	
E13 Gable (insulation at rafter level)	10.8400	0.0400	0.4336	
E18 Party wall between dwellings	17.0200	0.0600	1.0212	
P1 Party wall - Ground floor	9.9200	0.0800	0.7936	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.9691 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 43.8874 (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	27.8604	27.5381	27.2158	25.6045	25.2822	23.6709	23.6709	23.3486	24.3154	25.2822	25.9268	26.5713	(38)

Heat transfer coeff

	71.7478	71.4255	71.1033	69.4919	69.1697	67.5583	67.5583	67.2361	68.2029	69.1697	69.8142	70.4587	(39)

Average = Sum(39)m / 12 = 69.4114

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6603	0.6573	0.6544	0.6395	0.6366	0.6217	0.6217	0.6188	0.6277	0.6366	0.6425	0.6484	(40)
HLP (average)												0.6388	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8065 (42)

Hot water usage for mixer showers

71.2762	70.2051	68.6442	65.6578	63.4539	60.9961	59.5991	61.1481	62.8462	65.4851	68.5357	71.0031	(42a)

Hot water usage for baths

30.7743	30.3173	29.6737	28.4870	27.5984	26.6131	26.0809	26.7200	27.4159	28.4702	29.6813	30.6703	(42b)

Hot water usage for other uses

43.3718	41.7946	40.2175	38.6403	37.0631	35.4860	35.4860	37.0631	38.6403	40.2175	41.7946	43.3718	(42c)

Average daily hot water use (litres/day) 133.6758 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.4223	142.3170	138.5354	132.7851	128.1154	123.0952	121.1660	124.9313	128.9023	134.1727	140.0116	145.0452	(44)
Energy conte	230.3134	202.6575	212.9237	181.7761	172.4680	151.3599	146.5397	154.6910	158.9495	182.0711	199.4722	227.1057	(45)
Energy content (annual)										Total = Sum(45)m =		2220.3279	
Distribution loss (46)m = 0.15 x (45)m	34.5470	30.3986	31.9386	27.2664	25.8702	22.7040	21.9810	23.2037	23.8424	27.3107	29.9208	34.0659	(46)

Water storage loss:

Store volume 201.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.6100 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.8694 (55)

Total storage loss												
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)
If cylinder contains dedicated solar storage												
	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month												
	257.2648	227.0007	239.8751	207.8581	199.4194	177.4419	173.4911	181.6424	185.0315	209.0225	225.5542	254.0571	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	257.2648	227.0007	239.8751	207.8581	199.4194	177.4419	173.4911	181.6424	185.0315	209.0225	225.5542	254.0571	(64)
										Total per year (kWh/year) = Sum(64)m =		2537.6589	(64)
12Total per year (kWh/year)												2538	(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													
	76.5792	67.3836	70.7971	60.4406	57.3456	50.3272	48.7245	51.4348	52.8507	60.5386	66.3245	75.5127	(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	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	149.1063	165.0820	149.1063	154.0765	149.1063	154.0765	149.1063	149.1063	154.0765	149.1063	154.0765	149.1063	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	269.6166	272.4143	265.3640	250.3548	231.4083	213.6012	201.7050	198.9072	205.9576	220.9668	239.9133	257.7204	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	(71)
Water heating gains (Table 5)													
	102.9291	100.2732	95.1574	83.9452	77.0774	69.8988	65.4899	69.1327	73.4038	81.3692	92.1174	101.4955	(72)
Total internal gains													
	586.7500	602.8677	574.7259	553.4746	522.6901	502.6747	481.3993	482.2444	498.5359	516.5404	551.2053	573.4203	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	6.9800	36.7938	0.7200	0.7000	0.7700	89.7004	(77)
Northwest	6.8000	11.2829	0.7200	0.7000	0.7700	26.7975	(81)

Solar gains	116.4979	207.3401	307.3346	420.4314	507.0897	519.3333	494.0715	426.9881	346.1172	235.5297	141.1586	98.6490	(83)
Total gains	703.2479	810.2078	882.0605	973.9060	1029.7798	1022.0080	975.4708	909.2325	844.6531	752.0701	692.3639	672.0693	(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	76.4247	76.7695	77.1175	78.9056	79.2733	81.1640	81.1640	81.5531	80.3970	79.2733	78.5414	77.8229	
alpha	6.0950	6.1180	6.1412	6.2604	6.2849	6.4109	6.4109	6.4369	6.3598	6.2849	6.2361	6.1882	
util living area	0.9836	0.9622	0.9175	0.7917	0.6121	0.4221	0.3046	0.3399	0.5511	0.8428	0.9618	0.9868	(86)
MIT	20.2808	20.4736	20.6847	20.9003	20.9815	20.9986	20.9999	20.9997	20.9927	20.8778	20.5655	20.2585	(87)
Th 2	20.3760	20.3787	20.3813	20.3945	20.3972	20.4105	20.4105	20.4131	20.4052	20.3972	20.3919	20.3866	(88)
util rest of house	0.9803	0.9552	0.9034	0.7643	0.5757	0.3836	0.2639	0.2967	0.5057	0.8140	0.9535	0.9841	(89)
MIT 2	19.5305	19.7739	20.0343	20.2948	20.3812	20.4095	20.4104	20.4130	20.3998	20.2771	19.9017	19.5108	(90)
Living area fraction									fLA = Living area / (4) =			0.2590	(91)
MIT	19.7248	19.9551	20.2027	20.4516	20.5367	20.5621	20.5631	20.5649	20.5534	20.4327	20.0736	19.7045	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7248	19.9551	20.2027	20.4516	20.5367	20.5621	20.5631	20.5649	20.5534	20.4327	20.0736	19.7045	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9761	0.9497	0.8989	0.7670	0.5843	0.3935	0.2744	0.3079	0.5171	0.8158	0.9485	0.9804	(94)
Useful gains	686.4053	769.4243	792.9001	746.9643	601.6527	402.1621	267.6886	279.9351	436.7717	613.5267	656.7186	658.8718	(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	1106.6940	1075.3179	974.3090	802.7446	611.2303	402.7865	267.7374	280.0340	440.1371	680.1223	905.7430	1092.4250	(97)
Space heating kWh	312.6948	205.5605	134.9683	40.1618	7.1258	0.0000	0.0000	0.0000	0.0000	49.5471	179.2976	322.5636	(98a)
Space heating requirement - total per year (kWh/year)												1251.9194	
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	312.6948	205.5605	134.9683	40.1618	7.1258	0.0000	0.0000	0.0000	0.0000	49.5471	179.2976	322.5636	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1251.9194	
Space heating per m2											(98c) / (4) =	11.5214	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Fraction of main heating from main system 2	0.0000	(203)
Fraction of total heating from main system 1	1.0000	(204)
Fraction of total heating from main system 2	0.0000	(205)
Efficiency of main space heating system 1 (in %)	100.0000	(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	312.6948	205.5605	134.9683	40.1618	7.1258	0.0000	0.0000	0.0000	0.0000	49.5471	179.2976	322.5636	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	312.6948	205.5605	134.9683	40.1618	7.1258	0.0000	0.0000	0.0000	0.0000	49.5471	179.2976	322.5636	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Space heating fuel used, main system 2												0.0000	(213)
Water heating													
Water heating requirement	257.2648	227.0007	239.8751	207.8581	199.4194	177.4419	173.4911	181.6424	185.0315	209.0225	225.5542	254.0571	(64)
Efficiency of water heater												338.8093	(216)
(217)m	338.8093	338.8093	338.8093	338.8093	338.8093	338.8093	338.8093	338.8093	338.8093	338.8093	338.8093	338.8093	(217)
Fuel for water heating, kWh/month	75.9320	66.9995	70.7994	61.3496	58.8589	52.3722	51.2061	53.6120	54.6123	61.6933	66.5726	74.9853	(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	25.7932	23.2971	25.7932	24.9611	25.7932	24.9611	25.7932	25.7932	24.9611	25.7932	24.9611	25.7932	(231)
Lighting	33.0893	26.5455	23.9013	17.5111	13.5261	11.0509	12.3389	16.0386	20.8326	27.3335	30.8731	34.0090	(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	1251.9194	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	338.8093	
Water heating fuel used	748.9932	(219)
Space cooling fuel	0.0000	(221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.8125)

mechanical ventilation fans (SFP = 0.8125)	303.6938	(230a)
Total electricity for the above, kWh/year	303.6938	(231)
Electricity for lighting (calculated in Appendix L)	267.0498	(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	2571.6563	(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	1251.9194	0.1578	197.5830	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	748.9932	0.1412	105.7727	(264)
Space and water heating			303.3557	(265)
Pumps, fans and electric keep-hot	303.6938	0.1387	42.1261	(267)
Energy for lighting	267.0498	0.1443	38.5435	(268)
Total CO2, kg/year			384.0253	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.5300	(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	1251.9194	1.5842	1983.3252	(275)
Space heating - main system 2	0.0000	0.0000	0.0000	(276)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	748.9932	1.5222	1140.1140	(278)
Space and water heating			3123.4393	(279)
Pumps, fans and electric keep-hot	303.6938	1.5128	459.4280	(281)
Energy for lighting	267.0498	1.5338	409.6099	(282)
Total Primary energy kWh/year			3992.4772	(286)
Dwelling Primary energy Rate (DPER)			36.7400	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	37.3000 (1b)	x	2.4000 (2b)	=	89.5200	(1b) - (3b)
First floor	37.3000 (1c)	x	2.7000 (2c)	=	100.7100	(1c) - (3c)
Second floor	34.0600 (1d)	x	3.4100 (2d)	=	116.1446	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	108.6600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	306.3746	(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) =	0.1306	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3806	(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) =	0.3235	(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	0.4124	0.4043	0.3963	0.3558	0.3477	0.3073	0.3073	0.2992	0.3235	0.3477	0.3639	0.3801	(22b)
Effective ac	0.5850	0.5817	0.5785	0.5633	0.5605	0.5472	0.5472	0.5448	0.5523	0.5605	0.5662	0.5722	(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			2.1000	1.0000	2.1000			(26a)
TER Opening Type (Uw = 1.20)			13.7800	1.1450	15.7786			(27)
GF			37.3000	0.1300	4.8490			(28a)
External Wall	63.9900	15.8800	48.1100	0.1800	8.6598			(29a)
Sloped Roof	50.2000		50.2000	0.1100	5.5220			(30)
Total net area of external elements Aum(A, m2)			151.4900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.9094			(33)
Internal Walls			84.4100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 181.6667 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	8.8000	0.0500	0.4400
E3	Sill	7.9000	0.0500	0.3950
E5	Ground floor (normal)	7.5200	0.1600	1.2032
E4	Jamb	18.6000	0.0500	0.9300
E6	Intermediate floor within a dwelling	7.5200	0.0000	0.0000
E13	Gable (insulation at rafter level)	10.8400	0.0800	0.8672
E18	Party wall between dwellings	17.0200	0.0600	1.0212
P1	Party wall - Ground floor	9.9200	0.0800	0.7936

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.6502 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 42.5596 (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	59.1506	58.8167	58.4894	56.9522	56.6645	55.3256	55.3256	55.0777	55.8414	56.6645	57.2464	57.8547	(38)
Heat transfer coeff	101.7103	101.3764	101.0491	99.5118	99.2242	97.8853	97.8853	97.6373	98.4010	99.2242	99.8060	100.4143	(39)

Average = Sum(39)m / 12 = 99.5104

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9360	0.9330	0.9300	0.9158	0.9132	0.9008	0.9008	0.8986	0.9056	0.9132	0.9185	0.9241	(40)
HLP (average)												0.9158	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8065 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	71.2762	70.2051	68.6442	65.6578	63.4539	60.9961	59.5991	61.1481	62.8462	65.4851	68.5357	71.0031	(42a)
Hot water usage for baths	30.7743	30.3173	29.6737	28.4870	27.5984	26.6131	26.0809	26.7200	27.4159	28.4702	29.6813	30.6703	(42b)
Hot water usage for other uses	43.3718	41.7946	40.2175	38.6403	37.0631	35.4860	35.4860	37.0631	38.6403	40.2175	41.7946	43.3718	(42c)

Average daily hot water use (litres/day) 133.6758 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	145.4223	142.3170	138.5354	132.7851	128.1154	123.0952	121.1660	124.9313	128.9023	134.1727	140.0116	145.0452	(44)
Energy conte	230.3134	202.6575	212.9237	181.7761	172.4680	151.3599	146.5397	154.6910	158.9495	182.0711	199.4722	227.1057	(45)
Energy content (annual)										Total = Sum(45)m =		2220.3279	
Distribution loss (46)m = 0.15 x (45)m	34.5470	30.3986	31.9386	27.2664	25.8702	22.7040	21.9810	23.2037	23.8424	27.3107	29.9208	34.0659	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	276.9083	244.7432	259.5186	226.8680	219.0629	196.4517	193.1346	201.2859	204.0413	228.6660	244.5640	273.7006	(62)
WWHRS	-32.5845	-28.8180	-30.1766	-24.9874	-23.2873	-19.9271	-18.6785	-19.8627	-20.6174	-24.3056	-27.5353	-31.9811	(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	244.3238	215.9252	229.3420	201.8806	195.7755	176.5246	174.4561	181.4232	183.4239	204.3604	217.0287	241.7195	(64)
										Total per year (kWh/year) = Sum(64)m =		2466.1836	(64)
12Total per year (kWh/year)												2466	(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	113.8551	101.0522	108.0731	96.5140	94.6215	86.4006	86.0004	88.7107	88.9242	97.8146	102.3980	112.7886	(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	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	140.3269	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	149.1063	165.0820	149.1063	154.0765	149.1063	154.0765	149.1063	149.1063	154.0765	149.1063	154.0765	149.1063	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	269.6166	272.4143	265.3640	250.3548	231.4083	213.6012	201.7050	198.9072	205.9576	220.9668	239.9133	257.7204	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	37.0327	(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)	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	-112.2616	(71)
Water heating gains (Table 5)	153.0311	150.3753	145.2595	134.0473	127.1795	120.0009	115.5919	119.2348	123.5058	131.4712	142.2194	151.5976	(72)
Total internal gains	639.8521	655.9697	627.8279	606.5767	575.7921	552.7767	531.5013	532.3465	548.6380	569.6424	604.3074	626.5223	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	6.9800	36.7938	0.6300	0.7000	0.7700	78.4878	(77)
Northwest	6.8000	11.2829	0.6300	0.7000	0.7700	23.4479	(81)

Solar gains	101.9357	181.4226	268.9178	367.8775	443.7035	454.4167	432.3125	373.6145	302.8525	206.0885	123.5138	86.3179 (83)
Total gains	741.7878	837.3923	896.7457	974.4542	1019.4956	1007.1934	963.8139	905.9610	851.4905	775.7309	727.8212	712.8403 (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	53.9110	54.0886	54.2638	55.1021	55.2618	56.0177	56.0177	56.1599	55.7241	55.2618	54.9396	54.6068	
alpha	4.5941	4.6059	4.6176	4.6735	4.6841	4.7345	4.7345	4.7440	4.7149	4.6841	4.6626	4.6405	
util living area	0.9874	0.9769	0.9571	0.8985	0.7807	0.5954	0.4414	0.4866	0.7208	0.9187	0.9759	0.9893	(86)
MIT	19.7205	19.9211	20.1950	20.5628	20.8310	20.9642	20.9929	20.9890	20.9130	20.5748	20.0995	19.6961	(87)
Th 2	20.1370	20.1396	20.1421	20.1541	20.1563	20.1668	20.1668	20.1687	20.1628	20.1563	20.1518	20.1471	(88)
util rest of house	0.9845	0.9718	0.9473	0.8758	0.7357	0.5271	0.3604	0.4028	0.6555	0.8956	0.9696	0.9869	(89)
MIT 2	18.6407	18.8962	19.2418	19.6990	20.0041	20.1427	20.1637	20.1635	20.0970	19.7232	19.1331	18.6169	(90)
Living area fraction										fLA = Living area / (4) =		0.2590	(91)
MIT	18.9204	19.1616	19.4886	19.9227	20.2183	20.3554	20.3784	20.3773	20.3083	19.9438	19.3833	18.8964	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9204	19.1616	19.4886	19.9227	20.2183	20.3554	20.3784	20.3773	20.3083	19.9438	19.3833	18.8964	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9790	0.9643	0.9382	0.8687	0.7392	0.5430	0.3812	0.4242	0.6676	0.8888	0.9623	0.9820	(94)
Useful gains	726.2417	807.5094	841.2957	846.5373	753.6156	546.9260	367.3951	384.3096	568.4757	689.4622	700.3846	700.0398	(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	1487.0404	1445.7903	1312.4901	1096.8873	845.2164	563.3734	369.8509	388.3285	610.9072	927.1281	1225.9523	1475.7272	(97)
Space heating kWh	566.0342	428.9248	350.5686	180.2520	68.1510	0.0000	0.0000	0.0000	0.0000	176.8234	378.4087	577.1114	(98a)
Space heating requirement - total per year (kWh/year)												2726.2741	
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	566.0342	428.9248	350.5686	180.2520	68.1510	0.0000	0.0000	0.0000	0.0000	176.8234	378.4087	577.1114	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2726.2741	
Space heating per m2										(98c) / (4) =		25.0900	(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	566.0342	428.9248	350.5686	180.2520	68.1510	0.0000	0.0000	0.0000	0.0000	176.8234	378.4087	577.1114	(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)	613.2548	464.7073	379.8143	195.2893	73.8364	0.0000	0.0000	0.0000	0.0000	191.5746	409.9770	625.2561	(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	244.3238	215.9252	229.3420	201.8806	195.7755	176.5246	174.4561	181.4232	183.4239	204.3604	217.0287	241.7195	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.8798	85.5685	85.0084	83.8066	81.9446	79.8000	79.8000	79.8000	79.8000	83.7369	85.2938	85.9388	(217)
Fuel for water heating, kWh/month	284.4952	252.3418	269.7875	240.8887	238.9122	221.2087	218.6167	227.3473	229.8545	244.0506	254.4484	281.2694	(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	30.9814	24.8544	22.3786	16.3955	12.6644	10.3469	11.5529	15.0169	19.5054	25.5922	28.9063	31.8424	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-36.8269	-52.9402	-77.5506	-88.8800	-97.2329	-91.2091	-90.0560	-84.3327	-74.4647	-61.2787	-40.8383	-31.7182	(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	-17.7876	-37.7378	-75.6177	-114.4807	-152.2797	-153.3794	-151.6065	-127.9707	-93.2579	-54.3019	-23.8532	-14.0444	(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	(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	2953.7098	(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	2963.2211	(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)	250.0373	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1843.6460	(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	4409.3222	(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	2953.7098	0.2100	620.2791	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2963.2211	0.2100	622.2764	(264)
Space and water heating			1242.5555	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	250.0373	0.1443	36.0881	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-827.3283	0.1342	-111.0249	
PV Unit electricity exported	-1016.3176	0.1257	-127.7066	
Total			-238.7314	(269)
Total CO2, kg/year			1051.8414	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.6800	(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	2953.7098	1.1300	3337.6920	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2963.2211	1.1300	3348.4399	(278)
Space and water heating			6686.1319	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	250.0373	1.5338	383.5155	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-827.3283	1.4959	-1237.6395	
PV Unit electricity exported	-1016.3176	0.4612	-468.7588	
Total			-1706.3983	(283)
Total Primary energy kWh/year			5493.3499	(286)
Target Primary Energy Rate (TPER)			50.5600	(287)

Predicted Energy Assessment

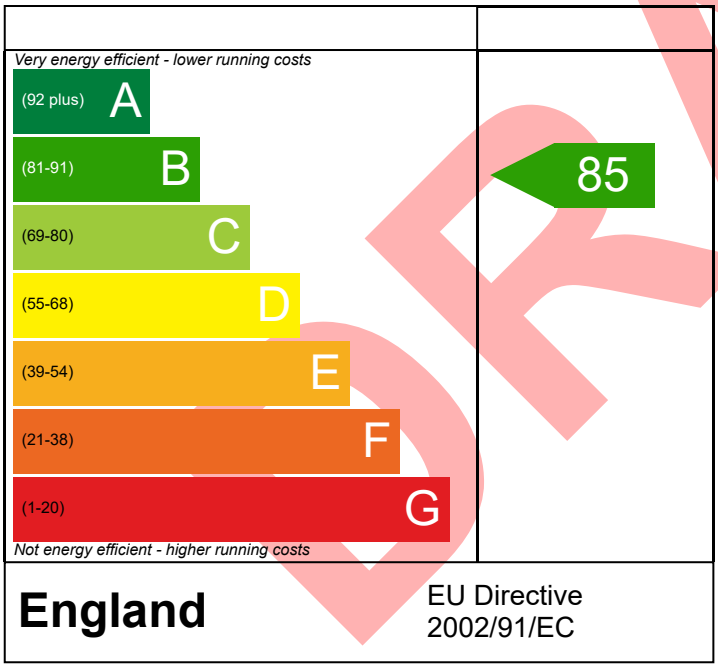
Plot 1 Type 3A End Terrace

Dwelling type:	House, Mid-Terrace
Date of assessment:	03/09/2024
Produced by:	Daniel Watt
Total floor area:	108.66 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

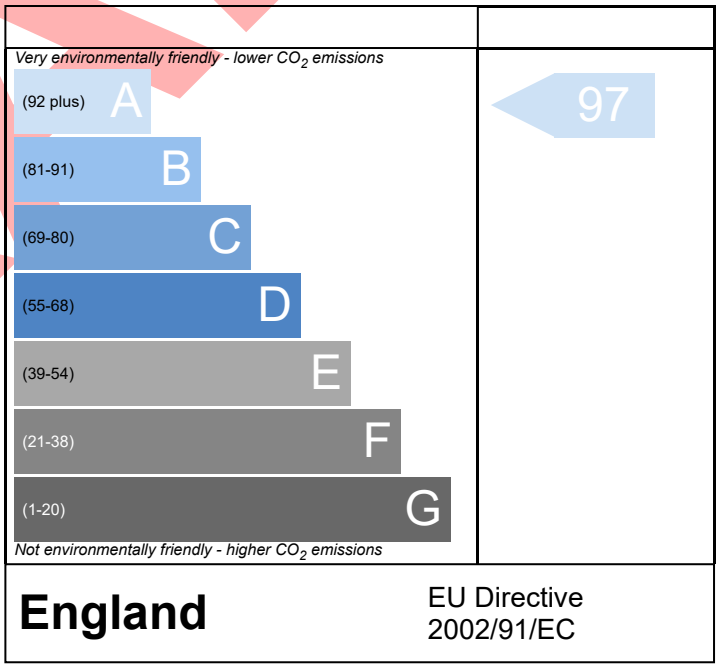
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Tue 03 Sep 2024 13:43:06

Project Information			
Assessed By	Daniel Watt	Building Type	House, Mid-terrace
OCDEA Registration	EES/027301	Assessment Date	2024-09-03

Dwelling Details			
Assessment Type	As designed	Total Floor Area	112 m^2
Site Reference	Type 4A - Mid Terrace X4	Plot Reference	Type 4A - Mid Terrace X4
Address	Plot 1 Type 3A End Terrace		

Client Details	
Name	OLLIER SMURTHWAITE
Company	OLLIER SMURTHWAITE
Address	40 king st, Manchester, M3

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*9.61 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	3.52 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*50.16 kWh_{PE}/m^2*	
Dwelling primary energy	36.56 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*30.8 kWh/m^2*	
Dwelling fabric energy efficiency	29.0 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.18	Walls (1) (0.18)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.12	GF (0.12)	OK
Roofs	*0.16*	0.12	Roof (1) (0.12)	OK
Windows, doors, and roof windows	*1.6*	1.3	Front (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	51.72	0.18
Party wall: Party Wall (1)	84.41	0 **(!)**
Ground floor: GF, GF	37.3	0.12
Exposed roof: Roof (1)	50.2	0.12

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
Front, Windows	6.8	North West	0.7	1.3
Rear, Windows	6.98	South East	0.7	1.3
Front Door, Main Door	2.1	North West	N/A	1.3
Rear Dormer, Windows	1.37	South East	0.7	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.03 **(!)**	
External wall	E3: Sill	Calculated by person with suitable expertise	0.04	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.16	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.001 **(!)**	
External wall	E13: Gable (insulation at rafter level)	Calculated by person with suitable expertise	0.04	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.08	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Main heating system 2: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	0.0%
Emitter type	
Flow temperature	
System type	Heat Pump
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls	
Main heating 1 - type: Programmer and room thermostats	
Function	
Ecodesign class	
Manufacturer	
Model	
Main heating 2 - type: Not applicable	
Function	
Ecodesign class	
Manufacturer	
Model	

Water heating - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	66.9 lm/W	**FAIL**
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.65 W/(l/s)	**OK**
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	86%	**OK**
Manufacturer/Model	Sentinel Kinetic FH, 408167A	
Commissioning		

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Type 4A - Mid Terrace X4	**Issued on Date**	03/09/2024
Assessment Reference	Type 4A - Mid Terrace X4	**Prop Type Ref**	Type 3A - End Terrace
Property	Plot 1 Type 3A End Terrace		

SAP Rating	85 B	**DER**	3.52	**TER**	9.61
Environmental	97 A	**% DER < TER**			63.37
CO_2 Emissions (t/year)	0.4	**DFEE**	29.02	**TFEE**	30.84
Compliance Check	See BREL	**% DFEE < TFEE**			5.90
% DPER < TPER	27.11	**DPER**	36.56	**TPER**	50.16

Assessor Details	Mr. Daniel Watt	**Assessor ID**	AV75-0001
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	38.0800 (1b)	x	2.4000 (2b)	=	91.3920	(1b) - (3b)
First floor	38.0800 (1c)	x	2.7000 (2c)	=	102.8160	(1c) - (3c)
Second floor	36.1500 (1d)	x	3.4100 (2d)	=	123.2715	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.3100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	317.4795	(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)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	77.4000 (23c)

Effective ac	0.2756	0.2724	0.2692	0.2532	0.2501	0.2341	0.2341	0.2309	0.2405	0.2501	0.2564	0.2628	(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	
Windows (Uw = 1.30)			15.1500	1.2357	18.7215			(27)
Main Door			2.1000	1.3000	2.7300			(26a)
GF			37.3000	0.1200	4.4760	110.0000	4103.0000	(28a)
External Wall	68.9700	17.2500	51.7200	0.1800	9.3096	150.0000	7758.0000	(29a)
Sloped Roof	50.2000		50.2000	0.1200	6.0240	9.0000	451.8000	(30)
Total net area of external elements Aum(A, m2)			156.4700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.2611			(33)
Internal Walls			84.4100	0.0000	0.0000	140.0000	11817.4000	(32)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 24130.2000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	214.8535 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	9.9500	0.0300	0.2985		
E3 Sill	9.0500	0.0400	0.3620		
E5 Ground floor (normal)	7.5200	0.1600	1.2032		
E4 Jamb	21.0000	0.0500	1.0500		
E6 Intermediate floor within a dwelling	7.5200	0.0010	0.0075		
E13 Gable (insulation at rafter level)	10.8400	0.0400	0.4336		
E18 Party wall between dwellings	20.2000	0.0600	1.2120		
P1 Party wall - Ground floor	9.9200	0.0800	0.7936		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				5.3604	(36)
Point Thermal bridges			(36a) =	0.0000	
Total fabric heat loss			(33) + (36) + (36a) =	46.6215	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	28.8702	28.5362	28.2023	26.5326	26.1986	24.5289	24.5289	24.1949	25.1968	26.1986	26.8665	27.5344	(38)
Heat transfer coeff	75.4917	75.1578	74.8238	73.1541	72.8201	71.1504	71.1504	70.8164	71.8183	72.8201	73.4880	74.1559	(39)
Average = Sum(39)m / 12 =												73.0706	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6722	0.6692	0.6662	0.6514	0.6484	0.6335	0.6335	0.6305	0.6395	0.6484	0.6543	0.6603	(40)
HLP (average)												0.6506	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8280	(42)
Hot water usage for mixer showers	71.6361	70.5596	68.9908	65.9893	63.7743	61.3041	59.9000	61.4569	63.1635	65.8158	68.8817	71.3617	(42a)
Hot water usage for baths	30.9291	30.4698	29.8229	28.6302	27.7372	26.7469	26.2120	26.8544	27.5537	28.6133	29.8306	30.8245	(42b)
Hot water usage for other uses	43.5916	42.0064	40.4213	38.8361	37.2510	35.6658	35.6658	37.2510	38.8361	40.4213	42.0064	43.5916	(42c)
Average daily hot water use (litres/day)												134.3510	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	146.1568	143.0358	139.2350	133.4557	128.7625	123.7169	121.7779	125.5622	129.5534	134.8504	140.7188	145.7778	(44)
Energy conte	231.4767	203.6810	213.9991	182.6942	173.3390	152.1243	147.2798	155.4723	159.7523	182.9907	200.4797	228.2528	(45)
Energy content (annual)										Total = Sum(45)m =		2231.5419	
Distribution loss (46)m = 0.15 x (45)m	34.7215	30.5522	32.0999	27.4041	26.0009	22.8186	22.0920	23.3208	23.9628	27.4486	30.0720	34.2379	(46)
Water storage loss:													
Store volume												201.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8694	(55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	258.4281	228.0242	240.9505	208.7762	200.2904	178.2063	174.2312	182.4237	185.8343	209.9421	226.5617	255.2042	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	258.4281	228.0242	240.9505	208.7762	200.2904	178.2063	174.2312	182.4237	185.8343	209.9421	226.5617	255.2042	(64)
										Total per year (kWh/year) = Sum(64)m =		2548.8729	(64)
12Total per year (kWh/year)												2549	(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	76.9660	67.7239	71.1547	60.7458	57.6352	50.5813	48.9705	51.6945	53.1176	60.8444	66.6595	75.8941	(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	141.4002	141.4002	141.4002	141.4002	141.4002	141.4002	141.4002	141.4002	141.4002	141.4002	141.4002	141.4002	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	149.9303	165.9943	149.9303	154.9280	149.9303	154.9280	149.9303	149.9303	154.9280	149.9303	154.9280	149.9303	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	274.8339	277.6859	270.4991	255.1994	235.8863	217.7346	205.6082	202.7563	209.9431	225.2428	244.5559	262.7075	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1400	37.1400	37.1400	37.1400	37.1400	37.1400	37.1400	37.1400	37.1400	37.1400	37.1400	37.1400	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-113.1201	-113.1201	-113.1201	-113.1201	-113.1201	-113.1201	-113.1201	-113.1201	-113.1201	-113.1201	-113.1201	-113.1201	(71)
Water heating gains (Table 5)	103.4489	100.7797	95.6380	84.3692	77.4667	70.2518	65.8206	69.4819	73.7745	81.7801	92.5826	102.0081	(72)
Total internal gains	593.6332	609.8799	581.4875	559.9166	528.7033	508.3345	486.7792	487.5886	504.0656	522.3733	557.4866	580.0660	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	8.3500	36.7938	0.7200	0.7000	0.7700	107.3063	(77)
Northwest	6.8000	11.2829	0.7200	0.7000	0.7700	26.7975	(81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	134.1039	237.3295	348.3674	471.2731	564.0367	575.8685	548.5774	476.9392	390.5471	268.6744	162.2465	113.7161	(83)
Total gains	727.7371	847.2094	929.8550	1031.1898	1092.7400	1084.2030	1035.3566	964.5278	894.6127	791.0477	719.7331	693.7821	(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	88.7890	89.1835	89.5816	91.6263	92.0465	94.2066	94.2066	94.6508	93.3305	92.0465	91.2099	90.3884	
alpha	6.9193	6.9456	6.9721	7.1084	7.1364	7.2804	7.2804	7.3101	7.2220	7.1364	7.0807	7.0259	
util living area	0.9904	0.9732	0.9311	0.8006	0.6118	0.4196	0.3023	0.3377	0.5504	0.8572	0.9737	0.9927	(86)
MIT	20.3573	20.5408	20.7388	20.9287	20.9896	20.9994	21.0000	20.9999	20.9963	20.9051	20.6167	20.3350	(87)
Th 2	20.3655	20.3681	20.3708	20.3840	20.3866	20.3999	20.3999	20.4026	20.3946	20.3866	20.3813	20.3761	(88)
util rest of house	0.9881	0.9672	0.9171	0.7713	0.5739	0.3804	0.2611	0.2938	0.5035	0.8268	0.9668	0.9909	(89)
MIT 2	19.6113	19.8437	20.0877	20.3153	20.3783	20.3996	20.3999	20.4025	20.3921	20.2966	19.9516	19.5917	(90)
Living area fraction									fLA = Living area / (4) =			0.2506	(91)
MIT	19.7982	20.0183	20.2508	20.4690	20.5315	20.5499	20.5503	20.5522	20.5435	20.4491	20.1183	19.7780	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7982	20.0183	20.2508	20.4690	20.5315	20.5499	20.5503	20.5522	20.5435	20.4491	20.1183	19.7780	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9855	0.9633	0.9142	0.7755	0.5829	0.3902	0.2714	0.3048	0.5151	0.8301	0.9633	0.9887	(94)
Useful gains	717.1959	816.1382	850.0391	799.6685	637.0066	423.0614	281.0467	294.0107	460.8391	656.6642	693.3209	685.9441	(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	1169.9884	1136.2604	1028.8879	846.3182	643.1081	423.3358	281.0621	294.0454	462.7599	717.2123	956.6863	1155.1986	(97)
Space heating kWh	336.8776	215.1221	133.0635	33.5878	4.5395	0.0000	0.0000	0.0000	0.0000	45.0478	189.6231	349.1254	(98a)
Space heating requirement - total per year (kWh/year)												1306.9869	
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	336.8776	215.1221	133.0635	33.5878	4.5395	0.0000	0.0000	0.0000	0.0000	45.0478	189.6231	349.1254	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1306.9869	
Space heating per m2											(98c) / (4) =	11.6373	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Fraction of main heating from main system 2	0.0000	(203)
Fraction of total heating from main system 1	1.0000	(204)
Fraction of total heating from main system 2	0.0000	(205)
Efficiency of main space heating system 1 (in %)	100.0000	(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	336.8776	215.1221	133.0635	33.5878	4.5395	0.0000	0.0000	0.0000	0.0000	45.0478	189.6231	349.1254	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	336.8776	215.1221	133.0635	33.5878	4.5395	0.0000	0.0000	0.0000	0.0000	45.0478	189.6231	349.1254	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Space heating fuel used, main system 2												0.0000	(213)
Water heating													
Water heating requirement	258.4281	228.0242	240.9505	208.7762	200.2904	178.2063	174.2312	182.4237	185.8343	209.9421	226.5617	255.2042	(64)
Efficiency of water heater												338.5955	(216)
(217)m	338.5955	338.5955	338.5955	338.5955	338.5955	338.5955	338.5955	338.5955	338.5955	338.5955	338.5955	338.5955	(217)
Fuel for water heating, kWh/month	76.3235	67.3441	71.1617	61.6595	59.1533	52.6310	51.4570	53.8766	54.8839	62.0038	66.9122	75.3714	(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	26.7281	24.1415	26.7281	25.8659	26.7281	25.8659	26.7281	26.7281	25.8659	26.7281	25.8659	26.7281	(231)
Lighting	33.2722	26.6922	24.0333	17.6079	13.6008	11.1120	12.4071	16.1272	20.9477	27.4845	31.0437	34.1969	(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												1306.9869	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												338.5955	
Water heating fuel used												752.7781	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.8125)

mechanical ventilation fans (SFP = 0.8125)	314.7016	(230a)
Total electricity for the above, kWh/year	314.7016	(231)
Electricity for lighting (calculated in Appendix L)	268.5255	(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	2642.9920	(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	1306.9869	0.1582	206.7586	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	752.7781	0.1412	106.3083	(264)
Space and water heating			313.0669	(265)
Pumps, fans and electric keep-hot	314.7016	0.1387	43.6530	(267)
Energy for lighting	268.5255	0.1443	38.7565	(268)
Total CO2, kg/year			395.4765	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.5200	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1306.9869	1.5856	2072.3325	(275)
Space heating - main system 2	0.0000	0.0000	0.0000	(276)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	752.7781	1.5222	1145.8798	(278)
Space and water heating			3218.2122	(279)
Pumps, fans and electric keep-hot	314.7016	1.5128	476.0805	(281)
Energy for lighting	268.5255	1.5338	411.8735	(282)
Total Primary energy kWh/year			4106.1662	(286)
Dwelling Primary energy Rate (DPER)			36.5600	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	38.0800 (1b)	x	2.4000 (2b)	=	91.3920	(1b) - (3b)
First floor	38.0800 (1c)	x	2.7000 (2c)	=	102.8160	(1c) - (3c)
Second floor	36.1500 (1d)	x	3.4100 (2d)	=	123.2715	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.3100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	317.4795	(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) =	0.1260	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3760	(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) =	0.3196	(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	0.4075	0.3995	0.3915	0.3516	0.3436	0.3036	0.3036	0.2956	0.3196	0.3436	0.3595	0.3755	(22b)
Effective ac	0.5830	0.5798	0.5766	0.5618	0.5590	0.5461	0.5461	0.5437	0.5511	0.5590	0.5646	0.5705	(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			2.1000	1.0000	2.1000			(26a)
TER Opening Type (Uw = 1.20)			15.1500	1.1450	17.3473			(27)
GF			37.3000	0.1300	4.8490			(28a)
External Wall	68.9700	17.2500	51.7200	0.1800	9.3096			(29a)
Sloped Roof	50.2000		50.2000	0.1100	5.5220			(30)
Total net area of external elements Aum(A, m2)			156.4700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.1279			(33)
Internal Walls			84.4100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 214.8535 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	9.9500	0.0500	0.4975
E3 Sill	9.0500	0.0500	0.4525
E5 Ground floor (normal)	7.5200	0.1600	1.2032
E4 Jamb	21.0000	0.0500	1.0500
E6 Intermediate floor within a dwelling	7.5200	0.0000	0.0000
E13 Gable (insulation at rafter level)	10.8400	0.0800	0.8672
E18 Party wall between dwellings	20.2000	0.0600	1.2120
P1 Party wall - Ground floor	9.9200	0.0800	0.7936

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.0760 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 45.2039 (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	61.0820	60.7443	60.4132	58.8582	58.5673	57.2130	57.2130	56.9622	57.7346	58.5673	59.1559	59.7712	(38)
Heat transfer coeff	106.2860	105.9482	105.6172	104.0622	103.7712	102.4169	102.4169	102.1661	102.9386	103.7712	104.3598	104.9751	(39)

Average = Sum(39)m / 12 = 104.0608

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9464	0.9434	0.9404	0.9266	0.9240	0.9119	0.9119	0.9097	0.9166	0.9240	0.9292	0.9347	(40)
HLP (average)												0.9265	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8280 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	71.6361	70.5596	68.9908	65.9893	63.7743	61.3041	59.9000	61.4569	63.1635	65.8158	68.8817	71.3617	(42a)
Hot water usage for baths	30.9291	30.4698	29.8229	28.6302	27.7372	26.7469	26.2120	26.8544	27.5537	28.6133	29.8306	30.8245	(42b)
Hot water usage for other uses	43.5916	42.0064	40.4213	38.8361	37.2510	35.6658	35.6658	37.2510	38.8361	40.4213	42.0064	43.5916	(42c)

Average daily hot water use (litres/day) 134.3510 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	146.1568	143.0358	139.2350	133.4557	128.7625	123.7169	121.7779	125.5622	129.5534	134.8504	140.7188	145.7778	(44)
Energy conte	231.4767	203.6810	213.9991	182.6942	173.3390	152.1243	147.2798	155.4723	159.7523	182.9907	200.4797	228.2528	(45)
Energy content (annual)										Total = Sum(45)m =		2231.5419	
Distribution loss (46)m = 0.15 x (45)m	34.7215	30.5522	32.0999	27.4041	26.0009	22.8186	22.0920	23.3208	23.9628	27.4486	30.0720	34.2379	(46)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	278.0716	245.7668	260.5940	227.7860	219.9339	197.2161	193.8747	202.0672	204.8441	229.5856	245.5715	274.8477	(62)
WWHRS	-32.7490	-28.9635	-30.3289	-25.1136	-23.4049	-20.0278	-18.7728	-19.9630	-20.7215	-24.4284	-27.6744	-32.1426	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	245.3225	216.8032	230.2650	202.6725	196.5290	177.1884	175.1019	182.1042	184.1226	205.1572	217.8971	242.7051	(64)
										Total per year (kWh/year) = Sum(64)m =		2475.8688	(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	114.2419	101.3925	108.4306	96.8193	94.9111	86.6548	86.2465	88.9705	89.1911	98.1203	102.7330	113.1700	(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	141.4002	141.4002	141.4002	141.4002	141.4002	141.4002	141.4002	141.4002	141.4002	141.4002	141.4002	141.4002	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	149.9303	165.9943	149.9303	154.9280	149.9303	154.9280	149.9303	149.9303	154.9280	149.9303	154.9280	149.9303	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	274.8339	277.6859	270.4991	255.1994	235.8863	217.7346	205.6082	202.7563	209.9431	225.2428	244.5559	262.7075	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1400	37.1400	37.1400	37.1400	37.1400	37.1400	37.1400	37.1400	37.1400	37.1400	37.1400	37.1400	(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)	-113.1201	-113.1201	-113.1201	-113.1201	-113.1201	-113.1201	-113.1201	-113.1201	-113.1201	-113.1201	-113.1201	-113.1201	(71)
Water heating gains (Table 5)	153.5510	150.8817	145.7401	134.4712	127.5687	120.3539	115.9227	119.5840	123.8765	131.8822	142.6847	152.1102	(72)
Total internal gains	646.7353	662.9819	634.5896	613.0187	581.8054	558.4366	536.8813	537.6906	554.1677	575.4753	610.5886	633.1681	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	8.3500	36.7938	0.6300	0.7000	0.7700	93.8930	(77)
Northwest	6.8000	11.2829	0.6300	0.7000	0.7700	23.4479	(81)

Solar gains	117.3409	207.6633	304.8215	412.3640	493.5321	503.8849	480.0052	417.3218	341.7287	235.0901	141.9657	99.5016 (83)
Total gains	764.0762	870.6453	939.4111	1025.3827	1075.3375	1062.3215	1016.8865	955.0124	895.8964	810.5654	752.5543	732.6697 (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	63.0641	63.2652	63.4635	64.4118	64.5924	65.4466	65.4466	65.6072	65.1149	64.5924	64.2281	63.8516	
alpha	5.2043	5.2177	5.2309	5.2941	5.3062	5.3631	5.3631	5.3738	5.3410	5.3062	5.2819	5.2568	
util living area	0.9929	0.9851	0.9685	0.9137	0.7926	0.5984	0.4400	0.4865	0.7311	0.9348	0.9847	0.9942	(86)
MIT	19.8611	20.0491	20.3025	20.6374	20.8731	20.9777	20.9964	20.9940	20.9377	20.6380	20.2020	19.8371	(87)
Th 2	20.1283	20.1308	20.1333	20.1450	20.1472	20.1574	20.1574	20.1593	20.1534	20.1472	20.1427	20.1381	(88)
util rest of house	0.9910	0.9812	0.9600	0.8911	0.7448	0.5269	0.3573	0.4004	0.6617	0.9127	0.9800	0.9926	(89)
MIT 2	18.7980	19.0381	19.3586	19.7746	20.0379	20.1437	20.1560	20.1568	20.1096	19.7846	19.2427	18.7747	(90)
Living area fraction									fLA = Living area / (4) =			0.2506	(91)
MIT	19.0644	19.2914	19.5951	19.9908	20.2472	20.3526	20.3666	20.3665	20.3171	19.9984	19.4830	19.0409	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0644	19.2914	19.5951	19.9908	20.2472	20.3526	20.3666	20.3665	20.3171	19.9984	19.4830	19.0409	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9877	0.9762	0.9534	0.8864	0.7509	0.5439	0.3781	0.4219	0.6759	0.9081	0.9752	0.9899	(94)
Useful gains	754.7061	849.9407	895.6389	908.9051	807.4236	577.7834	384.4344	402.9068	605.5809	736.0704	733.8540	725.2477	(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	1569.2436	1524.7465	1383.0661	1154.1318	886.9505	589.1665	385.7601	405.2463	639.9750	975.2868	1292.2911	1557.9240	(97)
Space heating kWh	606.0159	453.4696	362.6458	176.5632	59.1680	0.0000	0.0000	0.0000	0.0000	177.9770	402.0747	619.5111	(98a)
Space heating requirement - total per year (kWh/year)												2857.4253	
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	606.0159	453.4696	362.6458	176.5632	59.1680	0.0000	0.0000	0.0000	0.0000	177.9770	402.0747	619.5111	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2857.4253	
Space heating per m2										(98c) / (4) =		25.4423	(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	606.0159	453.4696	362.6458	176.5632	59.1680	0.0000	0.0000	0.0000	0.0000	177.9770	402.0747	619.5111	(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)	656.5719	491.2996	392.8990	191.2928	64.1040	0.0000	0.0000	0.0000	0.0000	192.8244	435.6172	671.1930	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	245.3225	216.8032	230.2650	202.6725	196.5290	177.1884	175.1019	182.1042	184.1226	205.1572	217.8971	242.7051	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.0049	85.6746	85.0737	83.7520	81.7165	79.8000	79.8000	79.8000	79.8000	83.7427	85.4143	86.0676	(217)
Fuel for water heating, kWh/month	285.2425	253.0543	270.6652	241.9912	240.5011	222.0406	219.4259	228.2007	230.7301	244.9854	255.1062	281.9935	(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	31.1526	24.9917	22.5023	16.4861	12.7344	10.4041	11.6167	15.0999	19.6132	25.7336	29.0660	32.0184	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-37.5671	-53.9906	-79.0706	-90.5999	-99.0943	-92.9445	-91.7626	-85.9344	-75.8918	-62.4754	-41.6515	-32.3568	(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	-18.1895	-38.5836	-77.3008	-117.0134	-155.6360	-156.7587	-154.9534	-130.8086	-95.3381	-55.5222	-24.3927	-14.3628	(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	(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	3095.8020	(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	2973.9368	(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)	251.4190	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1882.1994	(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	4524.9584	(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	3095.8020	0.2100	650.1184	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2973.9368	0.2100	624.5267	(264)
Space and water heating			1274.6451	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	251.4190	0.1443	36.2875	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-843.3395	0.1342	-113.1786	
PV Unit electricity exported	-1038.8599	0.1257	-130.5422	
Total			-243.7208	(269)
Total CO2, kg/year			1079.1411	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.6100	(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	3095.8020	1.1300	3498.2563	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2973.9368	1.1300	3360.5485	(278)
Space and water heating			6858.8048	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	251.4190	1.5338	385.6349	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-843.3395	1.4960	-1261.6105	
PV Unit electricity exported	-1038.8599	0.4612	-479.1673	
Total			-1740.7778	(283)
Total Primary energy kWh/year			5633.7627	(286)
Target Primary Energy Rate (TPER)			50.1600	(287)

Predicted Energy Assessment

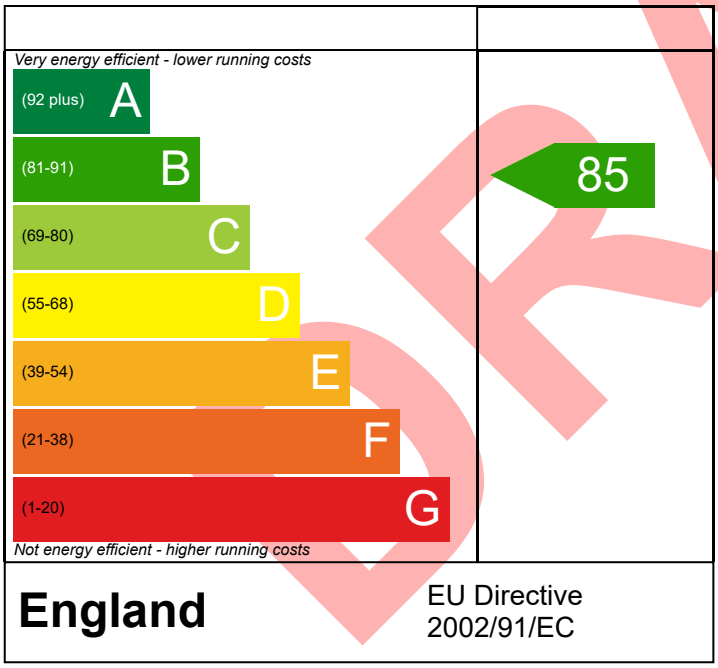
Plot 1 Type 3A End Terrace

Dwelling type:	House, Mid-Terrace
Date of assessment:	03/09/2024
Produced by:	Daniel Watt
Total floor area:	112.31 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

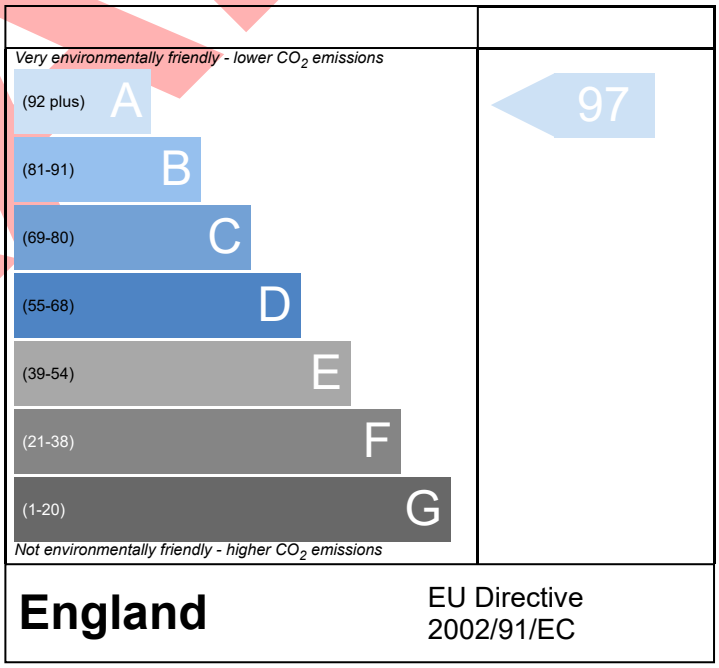
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Tue 03 Sep 2024 13:43:06

Project Information			
Assessed By	Daniel Watt	Building Type	House, End-terrace
OCDEA Registration	EES/027301	Assessment Date	2024-09-03

Dwelling Details			
Assessment Type	As designed	Total Floor Area	106 m^2
Site Reference	Type 4B- End Terrace X4	Plot Reference	Type 4B - End Terrace X4
Address	Plot 3 Plot 3 Type 4B End Terrace East Road, Manchester		

Client Details	
Name	OLLIER SMURTHWAITE
Company	OLLIER SMURTHWAITE
Address	40 king st, Manchester, M3

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*10.51 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	4.6 $kgCO_2/m^2$	**OK**
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*54.83 kWh_{PE}/m^2*	
Dwelling primary energy	47.53 kWh_{PE}/m^2	**OK**
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*36.7 kWh/m^2*	
Dwelling fabric energy efficiency	35.1 kWh/m^2	**OK**

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.18	Walls (1) (0.18)	**OK**
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.12	Ground Floor (0.12)	**OK**
Roofs	*0.16*	0.12	Roof (1) (0.12)	**OK**
Windows, doors, and roof windows	*1.6*	1.3	Front Windows (1.3)	**OK**
Rooflights	*2.2*	1.3	Front Roof Lights, East (1.3)	**OK**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	92.62	0.18
Party wall: Party Wall (1)	67.09	0 **(!)**
Ground floor: Ground Floor, Ground Floor	45.58	0.12
Exposed roof: Roof (1)	31.17	0.12
Exposed roof: Roof (2)	19.78	0.12

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
Front Windows, Windows	6.8	East	0.7	1.3
Front Door, Door	1.89	East	N/A	1.3
Front Roof Lights, Roof Lights	0.64	East	0.7	1.3
Rear Windows, Windows	7.55	West	0.7	1.3
Rear Roof Lights, Roof Lights	0.44	West	0.7	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.03 **(!)**	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Calculated by person with suitable expertise	0.04	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.16	
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.001 **(!)**	
External wall	E11: Eaves (insulation at rafter level)	Calculated by person with suitable expertise	0.04	
External wall	E12: Gable (insulation at ceiling level)	Calculated by person with suitable expertise	0.24	
External wall	E13: Gable (insulation at rafter level)	Calculated by person with suitable expertise	0.04	
External wall	E16: Corner (normal)	Calculated by person with suitable expertise	0.09	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.08	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.12	
Party wall	P5: Roof (insulation at rafter level)	Calculated by person with suitable expertise	0.08	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Main heating system 2: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	0.0%
Emitter type	
Flow temperature	
System type	Heat Pump
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	

Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls		
Main heating 1 - type: Programmer and room thermostats		
Function		
Ecodesign class		
Manufacturer		
Model		
Main heating 2 - type: Not applicable		
Function		
Ecodesign class		
Manufacturer		
Model		
Water heating - type: Cylinder thermostat and HW separately timed		
Manufacturer		
Model		

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	66.9 lm/W	**FAIL**
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.65 W/(l/s)	**OK**
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	86%	**OK**
Manufacturer/Model	Sentinel Kinetic FH, 408167A	
Commissioning		

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Type 4B- End Terrace X4	**Issued on Date**	03/09/2024
Assessment Reference	Type 4B - End Terrace X4	**Prop Type Ref**	
Property	Plot 3 Type 4B End Terrace, Plot 3, East Road, Manchester		

SAP Rating	80 C	**DER**	4.60	**TER**	10.51
Environmental	96 A	**% DER < TER**			56.23
CO_2 Emissions (t/year)	0.5	**DFEE**	35.08	**TFEE**	36.67
Compliance Check	See BREL	**% DFEE < TFEE**			4.32
% DPER < TPER	13.31	**DPER**	47.53	**TPER**	54.83

Assessor Details	Mr. Daniel Watt	**Assessor ID**	AV75-0001
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	45.5800 (1b)	x	2.4000 (2b)	=	109.3920	(1b) - (3b)
First floor	45.5800 (1c)	x	2.7200 (2c)	=	123.9776	(1c) - (3c)
Second floor	14.8900 (1d)	x	2.7900 (2d)	=	41.5431	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 106.0500						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	274.9127	(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)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	77.4000 (23c)

Effective ac	0.2756	0.2724	0.2692	0.2532	0.2501	0.2341	0.2341	0.2309	0.2405	0.2501	0.2564	0.2628	(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	
Windows (Uw = 1.30)			14.3500	1.2357	17.7329			(27)
Door			1.8900	1.3000	2.4570			(26)
Front Roof Lights			0.6400	1.2357	0.7909			(27a)
Rear Roof Lights			0.4400	1.2357	0.5437			(27a)
Ground Floor			45.5800	0.1200	5.4696	75.0000	3418.5000	(28a)
Brick	108.8600	16.2400	92.6200	0.1800	16.6716	70.0000	6483.4000	(29a)
Sloped Ceiling	32.2500	1.0800	31.1700	0.1200	3.7404	9.0000	280.5300	(30)
Insulated at ceiling	19.7800		19.7800	0.1200	2.3736	9.0000	178.0200	(30)
Total net area of external elements Aum(A, m2)			206.4700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		49.7797			(33)
Party Wall			67.0900	0.0000	0.0000	70.0000	4696.3000	(32)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 15056.7500 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 141.9778 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.2300	0.0300	0.3369
E3 Sill	10.3300	0.0400	0.4132
E4 Jamb	31.8800	0.0500	1.5940
E5 Ground floor (normal)	19.2100	0.1600	3.0736
E6 Intermediate floor within a dwelling	34.1000	0.0010	0.0341
E11 Eaves (insulation at rafter level)	9.2000	0.0400	0.3680
E12 Gable (insulation at ceiling level)	3.5200	0.2400	0.8448
E13 Gable (insulation at rafter level)	7.0000	0.0400	0.2800
E16 Corner (normal)	10.2400	0.0900	0.9216
E18 Party wall between dwellings	10.2400	0.0600	0.6144
P1 Party wall - Ground floor	9.8500	0.0800	0.7880
P4 Party wall - Roof (insulation at ceiling level)	3.5200	0.1200	0.4224
P5 Party wall - Roof (insulation at rafter level)	7.0000	0.0800	0.5600

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.2510 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 60.0307 (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	24.9994	24.7102	24.4210	22.9751	22.6860	21.2401	21.2401	20.9509	21.8184	22.6860	23.2643	23.8427	(38)
Heat transfer coeff	85.0300	84.7409	84.4517	83.0058	82.7167	81.2708	81.2708	80.9816	81.8491	82.7167	83.2950	83.8734	(39)

Average = Sum(39)m / 12 = 82.9335

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8018	0.7991	0.7963	0.7827	0.7800	0.7663	0.7663	0.7636	0.7718	0.7800	0.7854	0.7909	(40)
HLP (average)												0.7820	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7889 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	70.9808	69.9141	68.3597	65.3857	63.1909	60.7433	59.3521	60.8947	62.5857	65.2137	68.2516	70.7089	(42a)
Hot water usage for baths	30.6473	30.1921	29.5512	28.3694	27.4845	26.5032	25.9732	26.6097	27.3027	28.3526	29.5588	30.5437	(42b)
Hot water usage for other uses	43.1913	41.6207	40.0501	38.4795	36.9089	35.3384	35.3384	36.9089	38.4795	40.0501	41.6207	43.1913	(42c)

Average daily hot water use (litres/day) 133.1216 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.8194	141.7270	137.9610	132.2346	127.5843	122.5849	120.6636	124.4133	128.3679	133.6165	139.4311	144.4439	(44)
Energy conte	229.3586	201.8173	212.0410	181.0225	171.7530	150.7324	145.9322	154.0497	158.2905	181.3163	198.6452	226.1642	(45)

Energy content (annual) Total = Sum(45)m = 2211.1227

Distribution loss (46)m = 0.15 x (45)m	34.4038	30.2726	31.8061	27.1534	25.7629	22.6099	21.8898	23.1075	23.7436	27.1974	29.7968	33.9246	(46)

Water storage loss:

Store volume 201.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.6100 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.8694 (55)

Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	256.3100	226.1605	238.9924	207.1045	198.7044	176.8144	172.8836	181.0011	184.3725	208.2677	224.7272	253.1156	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	256.3100	226.1605	238.9924	207.1045	198.7044	176.8144	172.8836	181.0011	184.3725	208.2677	224.7272	253.1156	(64)

Total per year (kWh/year) = Sum(64)m = 2528.4537 (64)

12Total per year (kWh/year) 2528 (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	76.2617	67.1043	70.5036	60.1900	57.1079	50.1185	48.5225	51.2215	52.6316	60.2877	66.0495	75.1996	(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	139.4460	139.4460	139.4460	139.4460	139.4460	139.4460	139.4460	139.4460	139.4460	139.4460	139.4460	139.4460	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	142.1815	157.4153	142.1815	146.9209	142.1815	146.9209	142.1815	142.1815	146.9209	142.1815	146.9209	142.1815	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	265.7539	268.5116	261.5623	246.7681	228.0930	210.5411	198.8153	196.0576	203.0069	217.8012	236.4762	254.0282	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9446	36.9446	36.9446	36.9446	36.9446	36.9446	36.9446	36.9446	36.9446	36.9446	36.9446	36.9446	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-111.5568	-111.5568	-111.5568	-111.5568	-111.5568	-111.5568	-111.5568	-111.5568	-111.5568	-111.5568	-111.5568	-111.5568	(71)
Water heating gains (Table 5)	102.5023	99.8575	94.7629	83.5972	76.7579	69.6090	65.2184	68.8461	73.0994	81.0318	91.7355	101.0747	(72)
Total internal gains	575.2716	590.6182	563.3406	542.1200	511.8662	491.9048	471.0490	471.9191	487.8611	505.8483	539.9664	562.1182	(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				6.8000		19.6403		0.7200		0.7000		0.7700	46.6466 (76)
West				7.5500		19.6403		0.7200		0.7000		0.7700	51.7914 (80)
East				0.6400		26.4634		0.7200		0.7000		1.0000	7.6824 (82)
West				0.4400		26.4634		0.7200		0.7000		1.0000	5.2817 (82)
Solar gains	111.4022	218.6790	362.0333	531.0324	653.5214	670.2080	637.5667	545.8324	422.0409	259.9780	139.0398	91.5262	(83)
Total gains	686.6737	809.2972	925.3739	1073.1524	1165.3877	1162.1129	1108.6157	1017.7515	909.9020	765.8263	679.0062	653.6444	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	49.1877	49.3555	49.5245	50.3872	50.5633	51.4629	51.4629	51.6467	51.0993	50.5633	50.2123	49.8660	
alpha	4.2792	4.2904	4.3016	4.3591	4.3709	4.4309	4.4309	4.4431	4.4066	4.3709	4.3475	4.3244	
util living area	0.9764	0.9538	0.9053	0.7855	0.6192	0.4405	0.3211	0.3633	0.5895	0.8578	0.9569	0.9803	(86)
MIT	19.7267	19.9927	20.3418	20.7242	20.9185	20.9858	20.9972	20.9953	20.9514	20.6523	20.1325	19.6904	(87)
Th 2	20.2518	20.2541	20.2565	20.2683	20.2707	20.2826	20.2826	20.2850	20.2778	20.2707	20.2660	20.2612	(88)
util rest of house	0.9724	0.9464	0.8909	0.7577	0.5792	0.3934	0.2694	0.3080	0.5364	0.8311	0.9487	0.9769	(89)
MIT 2	18.7506	19.0864	19.5198	19.9821	20.1961	20.2722	20.2811	20.2824	20.2391	19.9120	19.2746	18.7115	(90)
Living area fraction										fLA = Living area / (4) =		0.3218	(91)
MIT	19.0647	19.3781	19.7843	20.2209	20.4286	20.5019	20.5116	20.5118	20.4683	20.1502	19.5507	19.0265	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0647	19.3781	19.7843	20.2209	20.4286	20.5019	20.5116	20.5118	20.4683	20.1502	19.5507	19.0265	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9643	0.9358	0.8804	0.7558	0.5881	0.4079	0.2859	0.3256	0.5508	0.8262	0.9389	0.9696	(94)
Useful gains	662.1328	757.3285	814.7108	811.0596	685.3131	474.0225	317.0027	331.4132	501.1377	632.7363	637.5123	633.7862	(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	1255.4439	1226.8834	1121.8854	939.7046	722.0014	479.6516	317.8987	332.9814	521.2434	789.9643	1037.0784	1243.5505	(97)
Space heating kWh	441.4234	315.5409	228.5379	92.6244	27.2960	0.0000	0.0000	0.0000	0.0000	116.9776	287.6876	453.6646	(98a)
Space heating requirement - total per year (kWh/year)												1963.7525	
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	441.4234	315.5409	228.5379	92.6244	27.2960	0.0000	0.0000	0.0000	0.0000	116.9776	287.6876	453.6646	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1963.7525	
Space heating per m2											(98c) / (4) =	18.5172	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Fraction of main heating from main system 2	0.0000	(203)
Fraction of total heating from main system 1	1.0000	(204)
Fraction of total heating from main system 2	0.0000	(205)
Efficiency of main space heating system 1 (in %)	100.0000	(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	441.4234	315.5409	228.5379	92.6244	27.2960	0.0000	0.0000	0.0000	0.0000	116.9776	287.6876	453.6646	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	441.4234	315.5409	228.5379	92.6244	27.2960	0.0000	0.0000	0.0000	0.0000	116.9776	287.6876	453.6646	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Space heating fuel used, main system 2												0.0000	(213)
Water heating													
Water heating requirement	256.3100	226.1605	238.9924	207.1045	198.7044	176.8144	172.8836	181.0011	184.3725	208.2677	224.7272	253.1156	(64)
Efficiency of water heater												338.9848	(216)
(217)m	338.9848	338.9848	338.9848	338.9848	338.9848	338.9848	338.9848	338.9848	338.9848	338.9848	338.9848	338.9848	(217)
Fuel for water heating, kWh/month	75.6110	66.7170	70.5024	61.0955	58.6175	52.1600	51.0004	53.3950	54.3896	61.4386	66.2942	74.6687	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	23.1444	20.9047	23.1444	22.3979	23.1444	22.3979	23.1444	23.1444	22.3979	23.1444	22.3979	23.1444	(231)
Lighting	31.5526	25.3127	22.7912	16.6978	12.8979	10.5377	11.7659	15.2937	19.8651	26.0640	29.4393	32.4295	(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	1963.7525	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	338.9848	
Water heating fuel used	745.8900	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.8125)		
mechanical ventilation fans (SFP = 0.8125)	272.5072	(230a)
Total electricity for the above, kWh/year	272.5072	(231)
Electricity for lighting (calculated in Appendix L)	254.6474	(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	3236.7971	(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	1963.7525	0.1566	307.5503	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	745.8900	0.1412	105.3334	(264)
Space and water heating			412.8838	(265)
Pumps, fans and electric keep-hot	272.5072	0.1387	37.8001	(267)
Energy for lighting	254.6474	0.1443	36.7535	(268)
Total CO2, kg/year			487.4374	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.6000	(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	1963.7525	1.5798	3102.2986	(275)
Space heating - main system 2	0.0000	0.0000	0.0000	(276)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	745.8900	1.5222	1135.3866	(278)
Space and water heating			4237.6852	(279)
Pumps, fans and electric keep-hot	272.5072	1.5128	412.2489	(281)
Energy for lighting	254.6474	1.5338	390.5868	(282)
Total Primary energy kWh/year			5040.5208	(286)
Dwelling Primary energy Rate (DPER)			47.5300	(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	45.5800 (1b)	x	2.4000 (2b)	=	109.3920	(1b) - (3b)
First floor	45.5800 (1c)	x	2.7200 (2c)	=	123.9776	(1c) - (3c)
Second floor	14.8900 (1d)	x	2.7900 (2d)	=	41.5431	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.0500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	274.9127	(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) =	0.1455	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3955	(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													
	0.4286	0.4202	0.4118	0.3698	0.3614	0.3194	0.3194	0.3110	0.3362	0.3614	0.3782	0.3950	(22b)
Effective ac	0.5919	0.5883	0.5848	0.5684	0.5653	0.5510	0.5510	0.5483	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			1.8900	1.0000	1.8900			(26)
TER Opening Type (Uw = 1.20)			14.3500	1.1450	16.4313			(27)
Front Roof Lights			0.6400	1.9373	1.2399			(27a)
Rear Roof Lights			0.4400	1.9373	0.8524			(27a)
Ground Floor			45.5800	0.1300	5.9254			(28a)
Brick	108.8600	16.2400	92.6200	0.1800	16.6716			(29a)
Sloped Ceiling	32.2500	1.0800	31.1700	0.1100	3.4287			(30)
Insulated at ceiling	19.7800		19.7800	0.1100	2.1758			(30)
Total net area of external elements Aum(A, m2)			206.4700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.6150			(33)
Party Wall			67.0900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 141.9778 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	11.2300	0.0500	0.5615
E3	Sill	10.3300	0.0500	0.5165
E4	Jamb	31.8800	0.0500	1.5940
E5	Ground floor (normal)	19.2100	0.1600	3.0736
E6	Intermediate floor within a dwelling	34.1000	0.0000	0.0000
E11	Eaves (insulation at rafter level)	9.2000	0.0400	0.3680
E12	Gable (insulation at ceiling level)	3.5200	0.0600	0.2112
E13	Gable (insulation at rafter level)	7.0000	0.0800	0.5600
E16	Corner (normal)	10.2400	0.0900	0.9216
E18	Party wall between dwellings	10.2400	0.0600	0.6144
P1	Party wall - Ground floor	9.8500	0.0800	0.7880
P4	Party wall - Roof (insulation at ceiling level)	3.5200	0.1200	0.4224
P5	Party wall - Roof (insulation at rafter level)	7.0000	0.0800	0.5600

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.1912 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 58.8062 (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	53.6942	53.3706	53.0534	51.5635	51.2848	49.9872	49.9872	49.7469	50.4870	51.2848	51.8487	52.4382	(38)
Heat transfer coeff	112.5004	112.1768	111.8596	110.3698	110.0910	108.7934	108.7934	108.5531	109.2932	110.0910	110.6549	111.2445	(39)

Average = Sum(39)m / 12 = 110.3684

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0608	1.0578	1.0548	1.0407	1.0381	1.0259	1.0259	1.0236	1.0306	1.0381	1.0434	1.0490	(40)
HLP (average)												1.0407	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7889 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
70.9808	69.9141	68.3597	65.3857	63.1909	60.7433	59.3521	60.8947	62.5857	65.2137	68.2516	70.7089	(42a)

Hot water usage for baths

30.6473	30.1921	29.5512	28.3694	27.4845	26.5032	25.9732	26.6097	27.3027	28.3526	29.5588	30.5437	(42b)

Hot water usage for other uses

43.1913	41.6207	40.0501	38.4795	36.9089	35.3384	35.3384	36.9089	38.4795	40.0501	41.6207	43.1913	(42c)

Average daily hot water use (litres/day) 133.1216 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.8194	141.7270	137.9610	132.2346	127.5843	122.5849	120.6636	124.4133	128.3679	133.6165	139.4311	144.4439	(44)
Energy conte	229.3586	201.8173	212.0410	181.0225	171.7530	150.7324	145.9322	154.0497	158.2905	181.3163	198.6452	226.1642	(45)
Energy content (annual)										Total = Sum(45)m =		2211.1227	
Distribution loss (46)m = 0.15 x (45)m	34.4038	30.2726	31.8061	27.1534	25.7629	22.6099	21.8898	23.1075	23.7436	27.1974	29.7968	33.9246	(46)

Water storage loss:

Store volume 150.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.3938 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.7527 (55)

Total storage loss

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

If cylinder contains dedicated solar storage

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

Total heat required for water heating calculated for each month

275.9535	243.9030	258.6359	226.1144	218.3479	195.8242	192.5271	200.6446	203.3823	227.9112	243.7370	272.7591	(62)
WWHRS -32.4495	-28.6986	-30.0515	-24.8838	-23.1908	-19.8446	-18.6011	-19.7804	-20.5319	-24.2049	-27.4212	-31.8485	(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												
243.5040	215.2045	228.5844	201.2305	195.1570	175.9797	173.9260	180.8642	182.8504	203.7063	216.3158	240.9105	(64)
									Total per year (kWh/year) = Sum(64)m =		2458.2333	(64)
12Total per year (kWh/year)											2458	(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												
113.5376	100.7728	107.7795	96.2635	94.3838	86.1920	85.7984	88.4974	88.7051	97.5636	102.1230	112.4755	(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	139.4460	139.4460	139.4460	139.4460	139.4460	139.4460	139.4460	139.4460	139.4460	139.4460	139.4460	139.4460	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	142.1815	157.4153	142.1815	146.9209	142.1815	146.9209	142.1815	142.1815	146.9209	142.1815	146.9209	142.1815	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	265.7539	268.5116	261.5623	246.7681	228.0930	210.5411	198.8153	196.0576	203.0069	217.8012	236.4762	254.0282	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.9446	36.9446	36.9446	36.9446	36.9446	36.9446	36.9446	36.9446	36.9446	36.9446	36.9446	36.9446	(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)													
	-111.5568	-111.5568	-111.5568	-111.5568	-111.5568	-111.5568	-111.5568	-111.5568	-111.5568	-111.5568	-111.5568	-111.5568	(71)
Water heating gains (Table 5)													
	152.6044	149.9596	144.8650	133.6993	126.8599	119.7111	115.3204	118.9482	123.2015	131.1338	141.8375	151.1768	(72)
Total internal gains													
	628.3736	643.7203	616.4426	595.2220	564.9683	542.0069	521.1510	522.0211	537.9631	558.9503	593.0684	615.2203	(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	6.8000	19.6403	0.6300	0.7000	0.7700	40.8158	(76)
West	7.5500	19.6403	0.6300	0.7000	0.7700	45.3175	(80)
East	0.6400	26.4634	0.6300	0.7000	1.0000	6.7221	(82)
West	0.4400	26.4634	0.6300	0.7000	1.0000	4.6215	(82)

Solar gains	97.4769	191.3441	316.7792	464.6533	571.8313	586.4320	557.8708	477.6034	369.2858	227.4807	121.6598	80.0854	(83)
Total gains	725.8505	835.0644	933.2218	1059.8754	1136.7995	1128.4389	1079.0219	999.6245	907.2489	786.4311	714.7283	695.3057	(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	37.1770	37.2843	37.3900	37.8947	37.9907	38.4438	38.4438	38.5289	38.2680	37.9907	37.7971	37.5968	
alpha	3.4785	3.4856	3.4927	3.5263	3.5327	3.5629	3.5629	3.5686	3.5512	3.5327	3.5198	3.5065	
util living area													
	0.9772	0.9623	0.9328	0.8592	0.7369	0.5695	0.4297	0.4776	0.7033	0.8984	0.9628	0.9802	(86)
MIT	19.1592	19.4207	19.8151	20.3275	20.7052	20.9147	20.9760	20.9651	20.8157	20.3055	19.6554	19.1247	(87)
Th 2	20.0330	20.0355	20.0379	20.0495	20.0517	20.0618	20.0618	20.0637	20.0579	20.0517	20.0473	20.0427	(88)
util rest of house													
	0.9729	0.9553	0.9202	0.8332	0.6905	0.4998	0.3437	0.3888	0.6376	0.8737	0.9547	0.9764	(89)
MIT 2	17.8844	18.2159	18.7114	19.3438	19.7784	20.0001	20.0500	20.0452	19.9099	19.3331	18.5243	17.8469	(90)
Living area fraction									fLA = Living area / (4) =			0.3218	(91)
MIT	18.2947	18.6036	19.0666	19.6603	20.0766	20.2945	20.3480	20.3413	20.2014	19.6461	18.8883	18.2581	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2947	18.6036	19.0666	19.6603	20.0766	20.2945	20.3480	20.3413	20.2014	19.6461	18.8883	18.2581	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9624	0.9418	0.9045	0.8211	0.6918	0.5177	0.3705	0.4159	0.6484	0.8610	0.9418	0.9668	(94)
Useful gains	698.5312	786.4528	844.0602	870.2849	786.4841	584.2447	399.7480	415.7441	588.2753	677.1274	673.1071	672.1952	(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													
	1574.4065	1537.2270	1405.6995	1187.6164	922.1926	619.5195	407.7579	427.8369	666.8440	995.8900	1304.4350	1563.8885	(97)
Space heating kWh													
	651.6512	504.5202	417.8597	228.4786	100.9671	0.0000	0.0000	0.0000	0.0000	237.1593	454.5561	663.4198	(98a)
Space heating requirement - total per year (kWh/year)												3258.6121	
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													
	651.6512	504.5202	417.8597	228.4786	100.9671	0.0000	0.0000	0.0000	0.0000	237.1593	454.5561	663.4198	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3258.6121	
Space heating per m2											(98c) / (4) =	30.7271	(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													
	651.6512	504.5202	417.8597	228.4786	100.9671	0.0000	0.0000	0.0000	0.0000	237.1593	454.5561	663.4198	(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)													
	706.0143	546.6091	452.7190	247.5392	109.3901	0.0000	0.0000	0.0000	0.0000	256.9440	492.4768	718.7647	(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													
	243.5040	215.2045	228.5844	201.2305	195.1570	175.9797	173.9260	180.8642	182.8504	203.7063	216.3158	240.9105	(64)

Efficiency of water heater											79.8000	(216)
(217)m	86.1568	85.9031	85.3945	84.3453	82.6564	79.8000	79.8000	79.8000	79.8000	84.4017	85.6841	86.2098 (217)
Fuel for water heating, kWh/month												
	282.6290	250.5200	267.6805	238.5795	236.1065	220.5259	217.9524	226.6468	229.1358	241.3534	252.4575	279.4466 (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	29.5425	23.7001	21.3393	15.6341	12.0762	9.8664	11.0163	14.3195	18.5996	24.4036	27.5638	30.3636 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-42.9714	-60.7450	-87.5277	-98.6288	-106.4897	-99.3945	-98.1240	-92.5513	-82.7647	-69.5219	-47.2842	-37.1286 (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	-23.7667	-50.0620	-99.6416	-149.8747	-198.4107	-199.4887	-197.1837	-166.8801	-122.1896	-71.7158	-31.7678	-18.7926 (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	3530.4573	(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	2943.0340	(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)	238.4250	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2252.9057	(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	4545.0106	(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	3530.4573	0.2100	741.3960	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2943.0340	0.2100	618.0371	(264)
Space and water heating			1359.4332	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	238.4250	0.1443	34.4121	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-923.1317	0.1345	-124.2048	
PV Unit electricity exported	-1329.7740	0.1258	-167.3482	
Total			-291.5531	(269)
Total CO2, kg/year			1114.2215	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.5100	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3530.4573	1.1300	3989.4167	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2943.0340	1.1300	3325.6284	(278)
Space and water heating			7315.0452	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	238.4250	1.5338	365.7042	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-923.1317	1.4973	-1382.1698	
PV Unit electricity exported	-1329.7740	0.4619	-614.2794	
Total			-1996.4492	(283)
Total Primary energy kWh/year			5814.4010	(286)
Target Primary Energy Rate (TPER)			54.8300	(287)

Predicted Energy Assessment

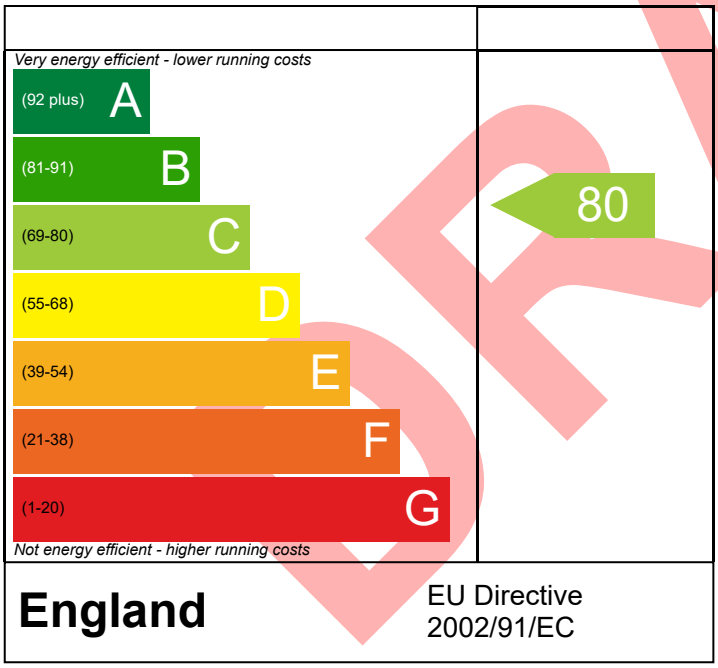
Plot 3 Type 4B End Terrace, Plot 3, East Road, Manchester

Dwelling type:	House, End-Terrace
Date of assessment:	03/09/2024
Produced by:	Daniel Watt
Total floor area:	106.05 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

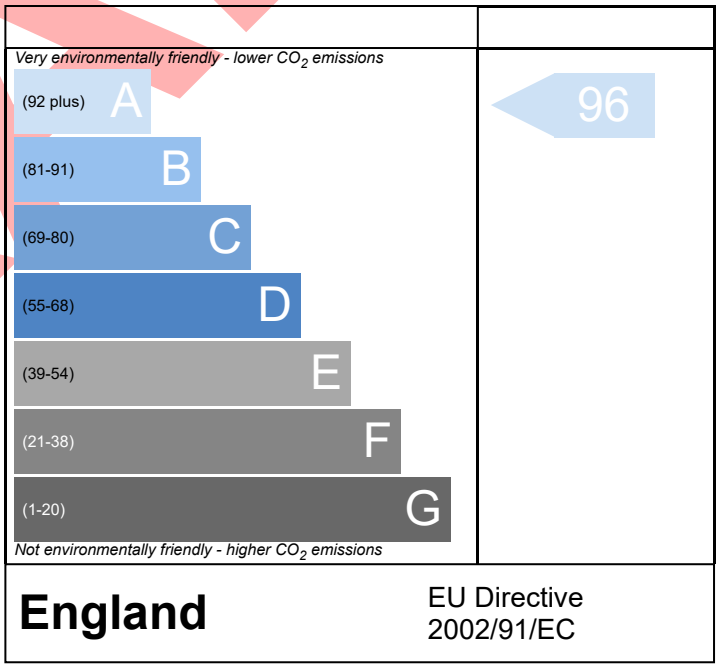
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Tue 03 Sep 2024 13:43:06

Project Information			
Assessed By	Daniel Watt	Building Type	House, Mid-terrace
OCDEA Registration	EES/027301	Assessment Date	2024-09-03

Dwelling Details			
Assessment Type	As designed	Total Floor Area	117 m^2
Site Reference	Type 4B- Mid Terrace X4	Plot Reference	Type 4B Mid Terrace X4
Address	Plot 14 Plot 14 Type 4B Mid Terrace East Road, Manchester		

Client Details	
Name	OLLIER SMURTHWAITE
Company	OLLIER SMURTHWAITE
Address	40 king st, Manchester, M3

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*9.76 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	4.19 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*50.92 kWh_{PE}/m^2*	
Dwelling primary energy	43.36 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*34.0 kWh/m^2*	
Dwelling fabric energy efficiency	32.4 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.18	Walls (1) (0.18)	OK
Party walls	*0.2*	0	Party Wall (1) (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.12	Ground Floor (0.12)	OK
Roofs	*0.16*	0.12	Roof (1) (0.12)	OK
Windows, doors, and roof windows	*1.6*	1.3	Front Windows (1.3)	OK
Rooflights	*2.2*	1.3	Front Roof Lights, East (1.3)	OK

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Walls (1)	75.96	0.18
Party wall: Party Wall (1)	67.09	0 **(!)**
Ground floor: Ground Floor, Ground Floor	45.58	0.12
Exposed roof: Roof (1)	31.17	0.12
Exposed roof: Roof (2)	19.78	0.12

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
Front Windows, Windows	6.8	East	0.7	1.3
Front Door, Door	1.89	East	N/A	1.3
Front Roof Lights, Roof Lights	0.64	East	0.7	1.3
Rear Windows, Windows	7.55	West	0.7	1.3
Rear Roof Lights, Roof Lights	0.44	West	0.7	1.3

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Calculated by person with suitable expertise	0.03 **(!)**	

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Calculated by person with suitable expertise	0.04	
External wall	E4: Jamb	Calculated by person with suitable expertise	0.05	
External wall	E5: Ground floor (normal)	Calculated by person with suitable expertise	0.16	
External wall	E6: Intermediate floor within a dwelling	Calculated by person with suitable expertise	0.001 **(!)**	
External wall	E11: Eaves (insulation at rafter level)	Calculated by person with suitable expertise	0.04	
External wall	E18: Party wall between dwellings	Calculated by person with suitable expertise	0.06	
Party wall	P1: Ground floor	Calculated by person with suitable expertise	0.08	
Party wall	P4: Roof (insulation at ceiling level)	Calculated by person with suitable expertise	0.12	
Party wall	P5: Roof (insulation at rafter level)	Calculated by person with suitable expertise	0.08	

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	3 m^3/hm^2, Design value **(!)**	OK
Air permeability test certificate reference		

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Main heating system 2: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	0.0%
Emitter type	
Flow temperature	
System type	Heat Pump
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: N/A	
Efficiency	
Manufacturer	
Model	

6 Controls		
Main heating 1 - type: Programmer and room thermostats		
Function		
Ecodesign class		
Manufacturer		
Model		
Main heating 2 - type: Not applicable		
Function		
Ecodesign class		
Manufacturer		
Model		
Water heating - type: Cylinder thermostat and HW separately timed		
Manufacturer		
Model		

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	66.9 lm/W	**FAIL**
External lights control	N/A	

8 Mechanical ventilation		
System type: Balanced whole-house mechanical ventilation with heat recovery		
Maximum permitted specific fan power	*1.5 W/(l/s)*	
Specific fan power	0.65 W/(l/s)	**OK**
Minimum permitted heat recovery efficiency	*73%*	
Heat recovery efficiency	86%	**OK**
Manufacturer/Model	Sentinel Kinetic FH, 408167A	
Commissioning		

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Full SAP Calculation Printout

Property Reference	Type 4B- Mid Terrace X4	**Issued on Date**	03/09/2024
Assessment Reference	Type 4B Mid Terrace X4	**Prop Type Ref**	
Property	Plot 14 Type 4B Mid Terrace , Plot 14 , East Road, Manchester		

SAP Rating	81 B	**DER**	4.19	**TER**	9.76
Environmental	96 A	**% DER < TER**			57.07
CO_2 Emissions (t/year)	0.5	**DFEE**	32.41	**TFEE**	34.04
Compliance Check	See BREL	**% DFEE < TFEE**			4.77
% DPER < TPER	14.85	**DPER**	43.36	**TPER**	50.92

Assessor Details	Mr. Daniel Watt	**Assessor ID**	AV75-0001
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	45.5800 (1b)	x	2.4000 (2b)	=	109.3920	(1b) - (3b)
First floor	45.5800 (1c)	x	2.7200 (2c)	=	123.9776	(1c) - (3c)
Second floor	25.8000 (1d)	x	2.7900 (2d)	=	71.9820	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.9600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	305.3516	(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)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	77.4000 (23c)

Effective ac	0.2756	0.2724	0.2692	0.2532	0.2501	0.2341	0.2341	0.2309	0.2405	0.2501	0.2564	0.2628	(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	
Windows (Uw = 1.30)			14.3500	1.2357	17.7329			(27)
Door			1.8900	1.3000	2.4570			(26)
Front Roof Lights			0.6400	1.2357	0.7909			(27a)
Rear Roof Lights			0.4400	1.2357	0.5437			(27a)
Ground Floor			45.5800	0.1200	5.4696	75.0000	3418.5000	(28a)
Brick	92.2000	16.2400	75.9600	0.1800	13.6728	70.0000	5317.2000	(29a)
Sloped Ceiling	32.2500	1.0800	31.1700	0.1200	3.7404	9.0000	280.5300	(30)
Insulated at ceiling	19.7800		19.7800	0.1200	2.3736	9.0000	178.0200	(30)
Total net area of external elements Aum(A, m2)			189.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.7809			(33)
Party Wall			67.0900	0.0000	0.0000	70.0000	4696.3000	(32)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13890.5500 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 118.7633 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	11.2300	0.0300	0.3369
E3 Sill	10.3300	0.0400	0.4132
E4 Jamb	31.8800	0.0500	1.5940
E5 Ground floor (normal)	9.2000	0.1600	1.4720
E6 Intermediate floor within a dwelling	18.4000	0.0010	0.0184
E11 Eaves (insulation at rafter level)	9.2000	0.0400	0.3680
E18 Party wall between dwellings	40.9600	0.0600	2.4576
P1 Party wall - Ground floor	19.7600	0.0800	1.5808
P4 Party wall - Roof (insulation at ceiling level)	14.0800	0.1200	1.6896
P5 Party wall - Roof (insulation at rafter level)	14.0400	0.0800	1.1232

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.0537 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 57.8346 (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	27.7673	27.4461	27.1250	25.5190	25.1978	23.5918	23.5918	23.2707	24.2342	25.1978	25.8402	26.4826	(38)
Heat transfer coeff	85.6019	85.2807	84.9595	83.3536	83.0324	81.4264	81.4264	81.1052	82.0688	83.0324	83.6748	84.3172	(39)
Average = Sum(39)m / 12 =												83.2733	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7319	0.7291	0.7264	0.7127	0.7099	0.6962	0.6962	0.6934	0.7017	0.7099	0.7154	0.7209	(40)
HLP (average)												0.7120	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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

Assumed occupancy 2.8508 (42)
Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
72.0177	70.9354	69.3583	66.3408	64.1140	61.6306	60.2191	61.7843	63.5000	66.1663	69.2487	71.7418	(42a)

Hot water usage for baths

31.0932	30.6314	29.9811	28.7821	27.8843	26.8888	26.3511	26.9968	27.6999	28.7652	29.9888	30.9881	(42b)

Hot water usage for other uses

43.8247	42.2310	40.6374	39.0438	37.4502	35.8565	35.8565	37.4502	39.0438	40.6374	42.2310	43.8247	(42c)

Average daily hot water use (litres/day) 135.0668 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	146.9356	143.7979	139.9769	134.1668	129.4485	124.3760	122.4267	126.2313	130.2437	135.5689	141.4685	146.5545	(44)
Energy conte	232.7100	204.7663	215.1393	183.6676	174.2626	152.9348	148.0645	156.3007	160.6035	183.9657	201.5479	229.4690	(45)
Energy content (annual)										Total = Sum(45)m =		2243.4318	
Distribution loss (46)m = 0.15 x (45)m	34.9065	30.7149	32.2709	27.5501	26.1394	22.9402	22.2097	23.4451	24.0905	27.5949	30.2322	34.4203	(46)
Water storage loss:													
Store volume												201.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8694	(55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.6614	229.1095	242.0907	209.7496	201.2140	179.0168	175.0159	183.2521	186.6855	210.9171	227.6299	256.4204	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	259.6614	229.1095	242.0907	209.7496	201.2140	179.0168	175.0159	183.2521	186.6855	210.9171	227.6299	256.4204	(64)
										Total per year (kWh/year) = Sum(64)m =		2560.7628	(64)
12Total per year (kWh/year)												2561	(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	77.3761	68.0848	71.5338	61.0695	57.9423	50.8508	49.2315	51.9700	53.4007	61.1686	67.0147	76.2984	(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	142.5381	142.5381	142.5381	142.5381	142.5381	142.5381	142.5381	142.5381	142.5381	142.5381	142.5381	142.5381	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	153.6750	170.1402	153.6750	158.7975	153.6750	158.7975	153.6750	153.6750	158.7975	153.6750	158.7975	153.6750	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.2010	284.1190	276.7658	261.1116	241.3510	222.7789	210.3716	207.4536	214.8068	230.4610	250.2215	268.7937	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.2538	37.2538	37.2538	37.2538	37.2538	37.2538	37.2538	37.2538	37.2538	37.2538	37.2538	37.2538	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-114.0305	-114.0305	-114.0305	-114.0305	-114.0305	-114.0305	-114.0305	-114.0305	-114.0305	-114.0305	-114.0305	-114.0305	(71)
Water heating gains (Table 5)	104.0001	101.3166	96.1476	84.8187	77.8794	70.6261	66.1713	69.8521	74.1676	82.2159	93.0759	102.5517	(72)
Total internal gains	604.6376	621.3373	592.3498	570.4893	538.6669	517.9640	495.9793	496.7421	513.5333	532.1133	567.8564	590.7818	(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	6.8000	19.6403	0.7200	0.7000	0.7700	46.6466	(76)
West	7.5500	19.6403	0.7200	0.7000	0.7700	51.7914	(80)

East				0.6400		26.4634		0.7200	0.7000		1.0000		7.6824 (82)
West				0.4400		26.4634		0.7200	0.7000		1.0000		5.2817 (82)
Solar gains	111.4022	218.6790	362.0333	531.0324	653.5214	670.2080	637.5667	545.8324	422.0409	259.9780	139.0398	91.5262 (83)	
Total gains	716.0397	840.0162	954.3831	1101.5216	1192.1884	1188.1720	1133.5460	1042.5745	935.5742	792.0913	706.8962	682.3080 (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	45.0748	45.2445	45.4156	46.2906	46.4696	47.3862	47.3862	47.5738	47.0153	46.4696	46.1129	45.7616	
alpha	4.0050	4.0163	4.0277	4.0860	4.0980	4.1591	4.1591	4.1716	4.1344	4.0980	4.0742	4.0508	
util living area	0.9677	0.9410	0.8885	0.7665	0.6045	0.4305	0.3143	0.3547	0.5728	0.8369	0.9439	0.9724	(86)
MIT	19.6732	19.9497	20.3071	20.7020	20.9065	20.9824	20.9963	20.9940	20.9447	20.6358	20.1017	19.6383	(87)
Th 2	20.3127	20.3152	20.3176	20.3297	20.3321	20.3442	20.3442	20.3466	20.3393	20.3321	20.3272	20.3224	(88)
util rest of house	0.9631	0.9332	0.8744	0.7412	0.5690	0.3887	0.2681	0.3055	0.5258	0.8118	0.9352	0.9685	(89)
MIT 2	18.7386	19.0873	19.5316	20.0126	20.2426	20.3303	20.3420	20.3428	20.2924	19.9476	19.2910	18.7015	(90)
Living area fraction									fLA = Living area / (4) =			0.2918	(91)
MIT	19.0113	19.3390	19.7579	20.2137	20.4364	20.5206	20.5329	20.5328	20.4828	20.1484	19.5276	18.9748	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0113	19.3390	19.7579	20.2137	20.4364	20.5206	20.5329	20.5328	20.4828	20.1484	19.5276	18.9748	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9522	0.9198	0.8614	0.7366	0.5747	0.4000	0.2815	0.3196	0.5363	0.8042	0.9226	0.9585	(94)
Useful gains	681.8148	772.6690	822.1212	811.3602	685.1201	475.3039	319.0440	333.1898	501.7445	637.0124	652.2075	654.0220	(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	1259.3167	1231.3676	1126.3872	943.0416	725.4002	482.0953	320.2429	335.1956	523.8256	792.8255	1039.8727	1245.7733	(97)
Space heating kWh	429.6614	308.2454	226.3739	94.8106	29.9684	0.0000	0.0000	0.0000	0.0000	115.9249	279.1189	440.2630	(98a)
Space heating requirement - total per year (kWh/year)												1924.3666	
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	429.6614	308.2454	226.3739	94.8106	29.9684	0.0000	0.0000	0.0000	0.0000	115.9249	279.1189	440.2630	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1924.3666	
Space heating per m2										(98c) / (4) =		16.4532	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Fraction of main heating from main system 2	0.0000 (203)
Fraction of total heating from main system 1	1.0000 (204)
Fraction of total heating from main system 2	0.0000 (205)
Efficiency of main space heating system 1 (in %)	100.0000 (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	429.6614	308.2454	226.3739	94.8106	29.9684	0.0000	0.0000	0.0000	0.0000	115.9249	279.1189	440.2630	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	429.6614	308.2454	226.3739	94.8106	29.9684	0.0000	0.0000	0.0000	0.0000	115.9249	279.1189	440.2630	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Space heating fuel used, main system 2												0.0000	(213)
Water heating													
Water heating requirement	259.6614	229.1095	242.0907	209.7496	201.2140	179.0168	175.0159	183.2521	186.6855	210.9171	227.6299	256.4204	(64)
Efficiency of water heater												338.3688	(216)
(217)m	338.3688	338.3688	338.3688	338.3688	338.3688	338.3688	338.3688	338.3688	338.3688	338.3688	338.3688	338.3688	(217)
Fuel for water heating, kWh/month	76.7392	67.7100	71.5464	61.9884	59.4659	52.9058	51.7234	54.1575	55.1722	62.3335	67.2727	75.7813	(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	25.7070	23.2193	25.7070	24.8778	25.7070	24.8778	25.7070	25.7070	24.8778	25.7070	24.8778	25.7070	(231)
Lighting	34.1032	27.3588	24.6336	18.0476	13.9405	11.3895	12.7170	16.5300	21.4709	28.1710	31.8190	35.0510	(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												1924.3666	(211)
Space heating fuel - main system 2												0.0000	(213)

Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	338.3688	
Water heating fuel used	756.7963	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.8125)		
mechanical ventilation fans (SFP = 0.8125)	302.6798	(230a)
Total electricity for the above, kWh/year	302.6798	(231)
Electricity for lighting (calculated in Appendix L)	275.2323	(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	3259.0749	(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	1924.3666	0.1565	301.1786	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	756.7963	0.1412	106.8771	(264)
Space and water heating			408.0557	(265)
Pumps, fans and electric keep-hot	302.6798	0.1387	41.9854	(267)
Energy for lighting	275.2323	0.1443	39.7245	(268)
Total CO2, kg/year			489.7656	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.1900	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1924.3666	1.5794	3039.3302	(275)
Space heating - main system 2	0.0000	0.0000	0.0000	(276)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	756.7963	1.5222	1152.0010	(278)
Space and water heating			4191.3312	(279)
Pumps, fans and electric keep-hot	302.6798	1.5128	457.8940	(281)
Energy for lighting	275.2323	1.5338	422.1605	(282)
Total Primary energy kWh/year			5071.3856	(286)
Dwelling Primary energy Rate (DPER)			43.3600	(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	45.5800 (1b)	x	2.4000 (2b)	=	109.3920	(1b) - (3b)
First floor	45.5800 (1c)	x	2.7200 (2c)	=	123.9776	(1c) - (3c)
Second floor	25.8000 (1d)	x	2.7900 (2d)	=	71.9820	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.9600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	305.3516	(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) =	0.1310	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3810	(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) =	0.3238	(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	0.4129	0.4048	0.3967	0.3562	0.3481	0.3077	0.3077	0.2996	0.3238	0.3481	0.3643	0.3805 (22b)
Effective ac	0.5852	0.5819	0.5787	0.5635	0.5606	0.5473	0.5473	0.5449	0.5524	0.5606	0.5664	0.5724 (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			1.8900	1.0000	1.8900			(26)
TER Opening Type (Uw = 1.20)			14.3500	1.1450	16.4313			(27)
Front Roof Lights			0.6400	1.9373	1.2399			(27a)
Rear Roof Lights			0.4400	1.9373	0.8524			(27a)
Ground Floor			45.5800	0.1300	5.9254			(28a)
Brick	92.2000	16.2400	75.9600	0.1800	13.6728			(29a)
Sloped Ceiling	32.2500	1.0800	31.1700	0.1100	3.4287			(30)
Insulated at ceiling	19.7800		19.7800	0.1100	2.1758			(30)
Total net area of external elements Aum(A, m2)			189.8100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.6162			(33)
Party Wall			67.0900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 118.7633 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.2300	0.0500	0.5615
E3 Sill	10.3300	0.0500	0.5165
E4 Jamb	31.8800	0.0500	1.5940
E5 Ground floor (normal)	9.2000	0.1600	1.4720
E6 Intermediate floor within a dwelling	18.4000	0.0000	0.0000
E11 Eaves (insulation at rafter level)	9.2000	0.0400	0.3680
E18 Party wall between dwellings	40.9600	0.0600	2.4576
P1 Party wall - Ground floor	19.7600	0.0800	1.5808
P4 Party wall - Roof (insulation at ceiling level)	14.0800	0.1200	1.6896
P5 Party wall - Roof (insulation at rafter level)	14.0400	0.0800	1.1232

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.3632 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 56.9794 (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	58.9728	58.6393	58.3123	56.7767	56.4894	55.1518	55.1518	54.9041	55.6670	56.4894	57.0706	57.6783	(38)
Heat transfer coeff	115.9523	115.6187	115.2918	113.7561	113.4688	112.1313	112.1313	111.8836	112.6465	113.4688	114.0500	114.6577	(39)
Average = Sum(39)m / 12 =												113.7547	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9914	0.9885	0.9857	0.9726	0.9702	0.9587	0.9587	0.9566	0.9631	0.9702	0.9751	0.9803	(40)
HLP (average)												0.9726	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

---

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8508 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	72.0177	70.9354	69.3583	66.3408	64.1140	61.6306	60.2191	61.7843	63.5000	66.1663	69.2487	71.7418	(42a)
Hot water usage for baths	31.0932	30.6314	29.9811	28.7821	27.8843	26.8888	26.3511	26.9968	27.6999	28.7652	29.9888	30.9881	(42b)
Hot water usage for other uses	43.8247	42.2310	40.6374	39.0438	37.4502	35.8565	35.8565	37.4502	39.0438	40.6374	42.2310	43.8247	(42c)
Average daily hot water use (litres/day)												135.0668	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	146.9356	143.7979	139.9769	134.1668	129.4485	124.3760	122.4267	126.2313	130.2437	135.5689	141.4685	146.5545	(44)
Energy conte	232.7100	204.7663	215.1393	183.6676	174.2626	152.9348	148.0645	156.3007	160.6035	183.9657	201.5479	229.4690	(45)
Energy content (annual)										Total = Sum(45)m =		2243.4318	
Distribution loss (46)m = 0.15 x (45)m	34.9065	30.7149	32.2709	27.5501	26.1394	22.9402	22.2097	23.4451	24.0905	27.5949	30.2322	34.4203	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	279.3049	246.8520	261.7342	228.7594	220.8575	198.0266	194.6594	202.8956	205.6953	230.5606	246.6397	276.0639	(62)
WWHRS	-32.9235	-29.1178	-30.4905	-25.2473	-23.5296	-20.1345	-18.8728	-20.0694	-20.8319	-24.5585	-27.8218	-32.3138	(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	246.3814	217.7342	231.2437	203.5121	197.3278	177.8922	175.7866	182.8262	184.8634	206.0021	218.8179	243.7501	(64)
										Total per year (kWh/year) = Sum(64)m =		2486.1378	(64)
12Total per year (kWh/year)												2486	(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	114.6520	101.7534	108.8097	97.1429	95.2182	86.9243	86.5074	89.2459	89.4741	98.4445	103.0881	113.5744	(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	142.5381	142.5381	142.5381	142.5381	142.5381	142.5381	142.5381	142.5381	142.5381	142.5381	142.5381	142.5381	(66)

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

	153.6750	170.1402	153.6750	158.7975	153.6750	158.7975	153.6750	153.6750	158.7975	153.6750	158.7975	153.6750	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	281.2010	284.1190	276.7658	261.1116	241.3510	222.7789	210.3716	207.4536	214.8068	230.4610	250.2215	268.7937	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2538	37.2538	37.2538	37.2538	37.2538	37.2538	37.2538	37.2538	37.2538	37.2538	37.2538	37.2538	(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)													
	-114.0305	-114.0305	-114.0305	-114.0305	-114.0305	-114.0305	-114.0305	-114.0305	-114.0305	-114.0305	-114.0305	-114.0305	(71)
Water heating gains (Table 5)													
	154.1022	151.4187	146.2496	134.9208	127.9815	120.7282	116.2734	119.9542	124.2696	132.3179	143.1780	152.6537	(72)
Total internal gains													
	657.7396	674.4393	645.4518	623.5913	591.7690	568.0660	546.0814	546.8442	563.6354	585.2153	620.9584	643.8838	(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	6.8000	19.6403	0.6300	0.7000	0.7700	40.8158	(76)
West	7.5500	19.6403	0.6300	0.7000	0.7700	45.3175	(80)
East	0.6400	26.4634	0.6300	0.7000	1.0000	6.7221	(82)
West	0.4400	26.4634	0.6300	0.7000	1.0000	4.6215	(82)

Solar gains	97.4769	191.3441	316.7792	464.6533	571.8313	586.4320	557.8708	477.6034	369.2858	227.4807	121.6598	80.0854	(83)
Total gains	755.2165	865.7834	962.2310	1088.2446	1163.6002	1154.4980	1103.9522	1024.4475	932.9212	812.6961	742.6183	723.9692	(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	33.2765	33.3725	33.4671	33.9189	34.0048	34.4104	34.4104	34.4866	34.2531	34.0048	33.8315	33.6522	
alpha	3.2184	3.2248	3.2311	3.2613	3.2670	3.2940	3.2940	3.2991	3.2835	3.2670	3.2554	3.2435	
util living area													
	0.9700	0.9528	0.9212	0.8462	0.7270	0.5652	0.4289	0.4752	0.6924	0.8844	0.9531	0.9735	(86)
MIT	19.0159	19.2901	19.7032	20.2444	20.6525	20.8914	20.9669	20.9535	20.7816	20.2344	19.5461	18.9796	(87)
Th 2	20.0905	20.0929	20.0952	20.1062	20.1083	20.1179	20.1179	20.1197	20.1142	20.1083	20.1041	20.0998	(88)
util rest of house													
	0.9652	0.9455	0.9086	0.8219	0.6848	0.5017	0.3495	0.3936	0.6330	0.8606	0.9446	0.9692	(89)
MIT 2	17.7600	18.1073	18.6267	19.2969	19.7735	20.0334	20.0994	20.0920	19.9285	19.3002	18.4422	17.7198	(90)
Living area fraction										fLA = Living area / (4) =		0.2918	(91)
MIT	18.1265	18.4525	18.9408	19.5734	20.0300	20.2838	20.3525	20.3434	20.1775	19.5728	18.7643	18.0874	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1265	18.4525	18.9408	19.5734	20.0300	20.2838	20.3525	20.3434	20.1775	19.5728	18.7643	18.0874	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9510	0.9281	0.8889	0.8054	0.6809	0.5142	0.3712	0.4150	0.6376	0.8436	0.9277	0.9561	(94)
Useful gains	718.2475	803.5134	855.2857	876.4395	792.2427	593.5884	409.7439	425.1787	594.7889	685.5684	688.9555	692.2210	(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													
	1603.2120	1566.9218	1434.3264	1214.1622	945.1977	637.3321	420.7779	441.2034	684.6069	1018.1307	1330.3148	1592.2948	(97)
Space heating kWh													
	658.4136	513.0105	430.8062	243.1604	113.7985	0.0000	0.0000	0.0000	0.0000	247.4263	461.7787	669.6550	(98a)
Space heating requirement - total per year (kWh/year)												3338.0492	
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													
	658.4136	513.0105	430.8062	243.1604	113.7985	0.0000	0.0000	0.0000	0.0000	247.4263	461.7787	669.6550	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3338.0492	
Space heating per m2											(98c) / (4) =	28.5401	(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													
	658.4136	513.0105	430.8062	243.1604	113.7985	0.0000	0.0000	0.0000	0.0000	247.4263	461.7787	669.6550	(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)													
	713.3409	555.8077	466.7457	263.4457	123.2920	0.0000	0.0000	0.0000	0.0000	268.0675	500.3019	725.5200	(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													
	246.3814	217.7342	231.2437	203.5121	197.3278	177.8922	175.7866	182.8262	184.8634	206.0021	218.8179	243.7501	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.1541	85.9129	85.4345	84.4600	82.8721	79.8000	79.8000	79.8000	79.8000	84.4717	85.6927	86.2055	(217)
Fuel for water heating, kWh/month													
	285.9776	253.4359	270.6678	240.9568	238.1113	222.9226	220.2840	229.1055	231.6585	243.8711	255.3517	282.7547	(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	31.9306	25.6159	23.0643	16.8979	13.0524	10.6639	11.9069	15.4770	20.1031	26.3763	29.7920	32.8181	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-43.4958	-61.7558	-89.3602	-101.1209	-109.5263	-102.3389	-101.0266	-95.1236	-84.8067	-70.8745	-47.9553	-37.5498	(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	-23.2423	-49.0513	-97.8091	-147.3826	-195.3740	-196.5443	-194.2812	-164.3077	-120.1476	-70.3632	-31.0967	-18.3714	(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	3616.5214	(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	2975.0975	(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)	257.6985	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2252.9057	(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	4682.4117	(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	3616.5214	0.2100	759.4695	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2975.0975	0.2100	624.7705	(264)
Space and water heating			1384.2400	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	257.6985	0.1443	37.1939	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-944.9345	0.1345	-127.0563	
PV Unit electricity exported	-1307.9712	0.1258	-164.5336	
Total			-291.5899	(269)
Total CO2, kg/year			1141.7731	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.7600	(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	3616.5214	1.1300	4086.6692	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2975.0975	1.1300	3361.8602	(278)
Space and water heating			7448.5293	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	257.6985	1.5338	395.2665	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-944.9345	1.4969	-1414.5067	
PV Unit electricity exported	-1307.9712	0.4617	-603.9444	
Total			-2018.4511	(283)
Total Primary energy kWh/year			5955.4456	(286)
Target Primary Energy Rate (TPER)			50.9200	(287)

Predicted Energy Assessment

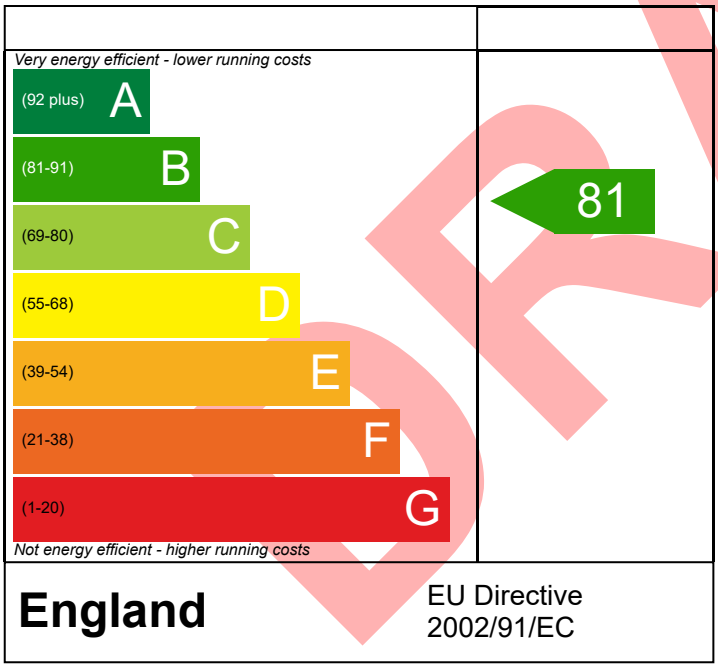
Plot 14 Type 4B Mid Terrace , Plot 14 , East Road, Manchester

Dwelling type:	House, Mid-Terrace
Date of assessment:	03/09/2024
Produced by:	Daniel Watt
Total floor area:	116.96 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

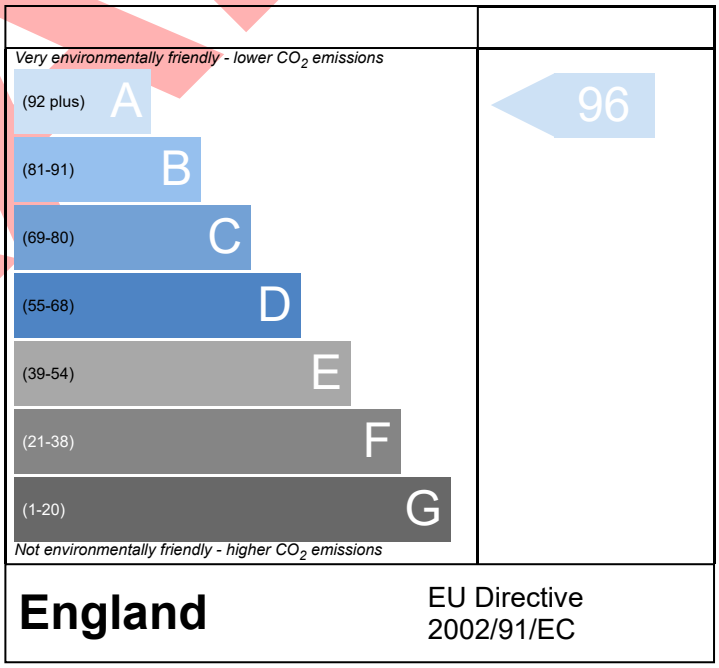
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

DRAFT