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PJ Livesey Holdings Ltd
Chorlton Precinct Redevelopment,
Manchester

Energy and Sustainable Design Statement

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Energy and Sustainable Design Statement

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EXECUTIVE SUMMARY

This Energy and Sustainable Design Statement (ESDS) has been produced to accompany a detailed planning application for a residential-led redevelopment (the 'Proposed Development') of the Chorlton Precinct site in Manchester (the 'Site'), in accordance with Manchester City Council's (MCC) Core Strategy (2012) Policies EN4 and EN6, the City's Places for Everyone Plan (PfE) Document Policies JP-S1, JP-S2, JP-S3, JP-S4, JP-S6, JP-P1 and following the guidance detailed in chapter 4 of the City Council's Guide to Development in Manchester SPD (2007) and Manchester Climate Change Framework 2020-2025.

This ESDS sets a framework for the Energy and Sustainable Design Strategy for the Development Site and outlines the site's approach to energy efficiency, renewable energy generation, sustainable design/construction incorporating climate change resilience and carbon management measures. It summarises the key planning policy which is pertinent at the time of writing and is aimed at satisfying both energy and sustainable design related requirements.

The Proposed Development will adopt the use of an energy hierarchy and a holistic approach to sustainability to meet National best practice guidance and Manchester City Council's objectives for energy consumption reduction, carbon dioxide emissions [CO_2] reduction and sustainable design and construction. The energy hierarchy aims to reduce energy demand and CO_2 emissions through passive design measures and a 'fabric first' approach before seeking to reduce the remaining demand by the cleanest means possible. This includes exploiting local energy resources/supplying energy efficiently and cleanly, and finally exploring the opportunities for producing, storing, using renewable energy on-site.

ENERGY SUMMARY

The Proposed Development envelope and services will exceed the minimum standards set in Building Regulations Part L 2021, ensuring reduced energy consumption for space heating and cooling. Passive design strategies have been integral to the Proposed Development to reduce energy demand and associated CO_2 emissions. This includes insulated building fabric with high thermal performance (low U-values) and low airtightness.

Residential Element:

Heating to the residential element of the Proposed Development is expected to be served via Electric Panel Heaters. Domestic hot water is expected to be met via an Air Source Heat Pump, while ventilation will be via mechanical ventilation with heat recovery (MVHR). All lighting will be 100% energy-efficient LED lighting.

Non-Residential Element:

The non-residential elements (ground floor commercial units and amenity areas) are expected to be heated and cooled via an Air Source Heat Pump (Variable Refrigerant System) and MVHR for ventilation. The comms rooms are also expected to be cooled via a DX Split System. Transient zones are expected to be heated via Electric Panel Heaters, with an Instantaneous Electric Water Heater proposed for domestic hot water. All lighting will be 100% energy-efficient LED lighting.

Additionally, a site-wide **337.51 kWp** PV system (equivalent to 675 panels) based on 500W panels with an efficiency of 20.10% is proposed to contribute towards the development's electricity demands.

Consequently, this ESDS proposes to reduce the Proposed Development's energy consumption and CO_2 emissions by approximately **58.67%** and **69.84%,** respectively, compared to Part L 2021 of the Building Regulations.

This complies with the national target to exceed the Part L 2021 baseline and demonstrates compliance with Manchester City Council's requirement to adhere to the energy hierarchy that reflects national policy targets. Specifically, it aligns with the Places for Everyone Plan Policy JP-S2, which requires, as an interim measure, that development should be consistent with the Part L 2022 Building Regulations.

In line with the Places for Everyone Joint Development Plan, the total offset payment to the council amounts to £19,685.40, following the incorporation of renewable energy technologies in the form of an Air Source Heat Pump and solar PV, covering approximately 40% of the available roof space area.

The Proposed Development's space heat requirement and hot water energy demand reduction equate to 5.93 kWh/m² and approximately 18%, respectively. This represents a significant reduction in energy demand, in line with the Places for Everyone Joint Development Plan.

SUSTAINABLE DESIGN SUMMARY

In addition to the CO_2 emissions savings opportunities identified above, the Site shall register with the 'Considerate Constructors Scheme' (CCS) and shall seek to achieve satisfactory CCS score in all categories, including but not limited to:

Water: The Proposed Development aims to reduce water consumption by implementing various water efficiency measures, such as dual flush WCs, water meters, and low-flow fittings and fixtures. Indicative water efficiency calculations have been performed, achieving an estimated consumption of 108.12 and 108.34 l/p/d. This result exceeds the requirements set by MCC's PfE Plan Policy JP-S4 which encourages a water efficiency standard of 110 l/p/d and Part G of the Building Regulations, which mandates a maximum consumption of 125 l/p/d.

Material: The aim of the Proposed Development will be for its overall environmental impact to be minimised through the specification of sustainable materials. This includes using sustainable building materials and products and ensuring all timber and timber-based products used on the project are legally harvested and traded timber.

Sustainable Transport: The Proposed Development will ensure the principles of sustainable transport hierarchy have been met by prioritising sustainable modes of transport (walking, cycling and public transport) ahead of cars wherever feasible. As well as providing the infrastructure requirement for EV charging points.

This Energy and Sustainable Design Statement presents a vision for the Proposed Development Chorlton Precinct Redevelopment, Manchester to deliver a secure, sustainable, low carbon design driven by innovative technologies, enabling the Proposed Development to achieve any National and Local carbon / energy reduction targets whilst reducing its reliance on the UK National Grid.

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1. INTRODUCTION

Instruction

1.1 BWB Consulting (BWB) was instructed by PJ Livesey Holdings Ltd (the Client) to prepare an Energy and Sustainable Design Statement (ESDS) to accompany a full planning application for a residential-led mixed-use redevelopment of Chorlton precinct (including Graeme House office building). The site is currently vacant and hoarded off.

1.2 A separate Prior Notice for Demolition submission has been made to Manchester City Council (MCC) as a local planning authority to confirm that the proposed demolition of the existing shopping precinct and Graeme House office building can be undertaken under permitted development rights. Subject to the notice being approved then demolition works are intended to commence in early 2025 for a circa 20-week period.

Development Description

1.3 It is proposed the existing Chorlton Shopping centre is to be demolished and replaced with a residential-led mixed-use development (**Figure 1.1**) providing 260 new homes, ground floor commercial uses with associated landscaping (hard/soft) and access.

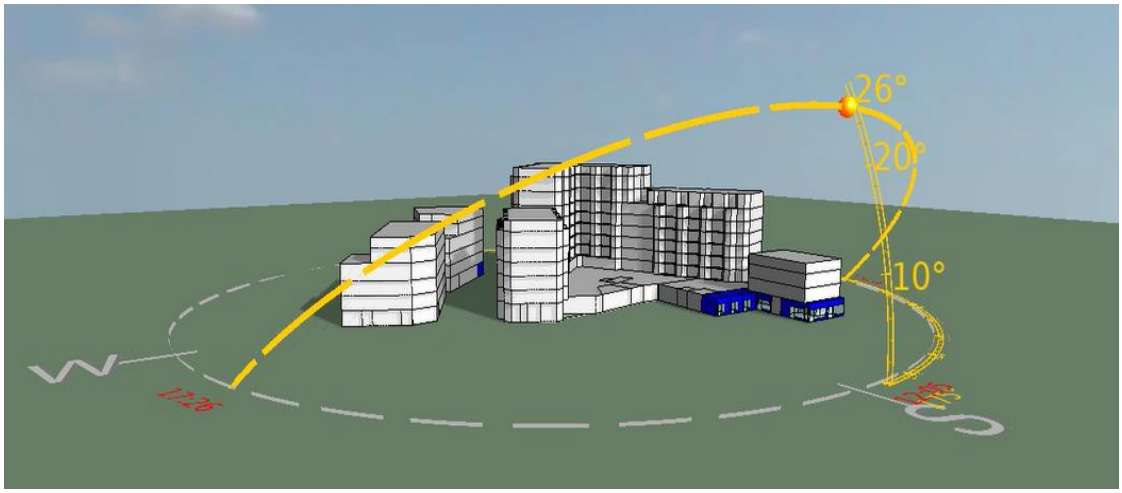


Figure 1.1: Proposed Development Thermal Model in IES VE

Purpose of the document

1.4 The purpose of this ESDS to demonstrate that climate change mitigation measures will be integrated into the scheme's design and that the proposed measures are appropriate to the site environment and energy demands of the Development.

1.5 This document will describe the policy context to which the ESDS responds, before demonstrating how it is proposed to reduce the sites energy demand and carbon dioxide emissions through a: lean energy efficient design; clean energy supply; and green on-site renewable energy generation. This document also identifies and highlights the key sustainable practices to be incorporated into the design and construction of the Proposed Development and determine if these are in line with current national best practice guidance and local planning policy (as per the statutory development plan).

1.6 An overheating assessment will also be completed to ensure compliance with Part O and CIBSE TM59 Guidance.

Modelling Methodology (SAP and DSM Calculations)

1.7 Energy models using the Standard Assessment Method (SAP) and Dynamic Simulation Modelling (DSM) have been produced to predict the primary energy demand and CO_2 emissions from the Proposed Development.

1.8 SAP is the Government adopted methodology for calculating the energy performance and CO_2 emission of domestic buildings within the UK. Its purpose is to provide accurate and reliable assessments of both residential / non-residential buildings that are needed to underpin energy and carbon dioxide policy initiatives.

1.9 The SAP modelling tool uses building geometry (in terms of floor area, heat loss areas, thermal bridges etc), construction details (in terms of u-values, g-value, light transmittance value etc), specification of heating, ventilation, and lighting equipment to calculate the regulated CO_2 emission and primary energy consumption of residential buildings in compliance with Approved Document Part L Volume 1: Dwellings, 2021 edition of the Building Regulations (England and Wales).

1.10 DSM is one of the Government adopted methodologies for calculating the energy performance of non-domestic buildings within the UK in compliance with Approved Document Part L Volume 2: Buildings other than dwellings, 2021 edition incorporating 2023 amendments of the Building Regulations (England and Wales). Unlike SBEM (Simplified Building Energy Model), DSM is a much more accurate tool providing full annual simulation performed multiple times per hour using real hourly weather data.

1.11 Performing the DSM calculation involves creating a three-dimensional model (**Figure 1.1**) of the Proposed Non-Domestic Development and then populating the model with the fabric and services specification. The DSM calculation is then run to simulate the Proposed Development energy consumption and resultant carbon dioxide emissions due to the predicted operation of the Proposed Development over a typical year.

1.12 The SAP and DSM calculations have been performed to inform this Energy and Sustainable Design Statement and to produce the most accurate estimate of the Site carbon dioxide emissions. Consequently, this report details the thermal element, controlled fittings and building services specification upon which the calculations have been performed.

1.13 The baseline CO_2 emissions are equivalent to the Building Regulations Approved Document Part L worst allowable Target Emissions Rate (TER) calculated within both SAP and DSM assessments of the Proposed Development.

1.14 Criterion 1 of Building Regulations Approved Document Part L (Volume 2) 2021 requires calculation of the Building Emission Rate (BER) / Primary Energy Rate (BPER) using Energy Model to demonstrate that the building will have a CO_2 emissions rate and energy rate of no more than the Target Emission Rate (TER) and Primary Energy Rate (TPER), which is also calculated within DSM using the building and a notional specification.

2. POLICY BACKGROUND

Introduction

2.1 This section of the ESDS reviews relevant policies at the international, national, regional, and local levels in relation to energy efficiency and renewable energy generation and discusses key issues for this Statement.

Climate Change

2.2 Climate change is a long-term change in the average weather patterns that have come to define Earth's local, regional, and global climates. These changes have a broad range of observed effects that are synonymous with the term.

Figure 2.1: Climate Change (Fossil Fuel Combustion)

2.3 Changes observed in Earth's climate since the early 20th century are primarily driven by human activities, particularly fossil fuel burning, which increases heat-trapping greenhouse gas levels in Earth's atmosphere, raising Earth's average surface temperature. These human-produced temperature increases are commonly referred to as global warming. Natural processes can also contribute to climate change, including internal variability (e.g., cyclical ocean patterns like El Niño, La Niña, and the Pacific Decadal Oscillation) and external forcing (e.g., volcanic activity, changes in the Sun's energy output, variations in Earth's orbit).

2.4 Scientists use observations from the ground, air, and space, along with theoretical models, to monitor and study past, present and future climate change. Climate data records provide evidence of climate change key indicators, such as global land and ocean temperature increases; rising sea levels; ice loss at Earth's poles and in mountain glaciers; frequency and severe changes in extreme weather such as hurricanes, heatwaves, wildfires, droughts, floods, and precipitation; and cloud and vegetation cover changes, to name but a few (**Figure 2.1**).

United Nations Framework Convention on Climate Change

2.5 The international mechanism for addressing climate change is the United Nations Framework Convention on Climate Change (UNFCCC). Signed in 1992 at the United Nations Conference on Environment and Development, the Convention constitutes the foundational climate agreement that has provided the platform for most subsequent international climate agreements. The Kyoto Protocol, which was signed in 1997 and which entered into force in 2005, was the first implementation of measures under the UNFCCC until 31 December 2020. The protocol was superseded by the Paris Agreement. Its supreme decision-making body, the Conference of the Parties (COP), meets annually to assess progress in dealing with climate change.

The Paris Agreement

2.6 The Paris Agreement is a legally binding international treaty on climate change. It was adopted by 196 Parties at the 2015 United Nations Climate Change Conference in 2015 and entered into force in 2016 (**Figure 2.2**). The 196 Parties to the UNFCCC reached a landmark agreement to combat climate change and to accelerate and intensify the actions and investments needed for a sustainable low carbon future.

Figure 2.2: United Nations Framework Convention on Climate Change (UN)

2.7 The Paris Agreement builds upon the Convention and for the first time brings all nations into a common cause to undertake ambitious efforts to combat climate change and adapt to its effects, with enhanced support to assist developing countries to do so. As such, it charts a new course in the global climate effort. Its goal is to limit global warming to well below 2, preferably to 1.5 degrees Celsius, compared to pre-industrial levels.

2.8 To achieve this long-term temperature goal, countries aim to reach global peaking of greenhouse gas emissions as soon as possible to achieve a climate neutral world by mid-century. The Paris Agreement works on a 5-year cycle of increasingly ambitious climate action carried out by countries. Countries are required to submit their plans for climate action known as nationally determined contributions (NDCs).

The Paris Agreement and Nationally Determined Contributions

2.9 Through the Paris Agreement, Parties also agreed to a long-term goal for adaptation – to increase the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production.

2.10 Nationally determined contributions (NDCs) are at the heart of the Paris Agreement and the achievement of these long-term goals. NDCs embody efforts by each country to reduce national emissions and adapt to the impacts of climate change. The Paris Agreement (Article 4, paragraph 2) requires each Party to prepare, communicate and maintain successive nationally determined contributions (NDCs) that it intends to achieve. Parties shall pursue domestic mitigation measures, with the aim of achieving the objectives of such contributions.

United Kingdom's (UK's) Nationally Determined Contributions

2.11 The UK's target under the Paris Agreement of 2015, when it shared a common plan on emissions with the EU, was for a 53% cut by 2030. However, that was widely regarded as not stretching, and the UK also had a domestic carbon budget under the Climate Change Act requiring a 57% reduction on average from 2028 to 2032.

Figure 2.3: United Kingdom's Nationally Determined Contribution (UK Gov)

2.12 In December 2020, the UK announced that it will cut its carbon emissions by 68% compared with 1990 levels before 2030, a significant increase on the current target of about 57% reductions. This represents the UK's nationally determined contribution (**Figure 2.3**) towards meeting the Paris Agreement.

2.13 The UK had already committed to reducing carbon emissions to zero by 2050, with an interim target of 53%. In April 2021, at the climate summit, the U.K. government confirmed its plan to put the U.K. on course to meet its target of reaching net zero carbon emissions by 2050. This commitment demonstrates the UK's dedication to addressing climate change and reducing greenhouse gas emissions.

Climate Change Act

2.14 The Climate Change Act (2008) sets a legally binding target for reducing UK CO_2 emissions by at least 80% on 1990 levels by 2050. It established the Committee on Climate Change, which is responsible for setting binding interim carbon budgets for the Government over successive five-year periods.

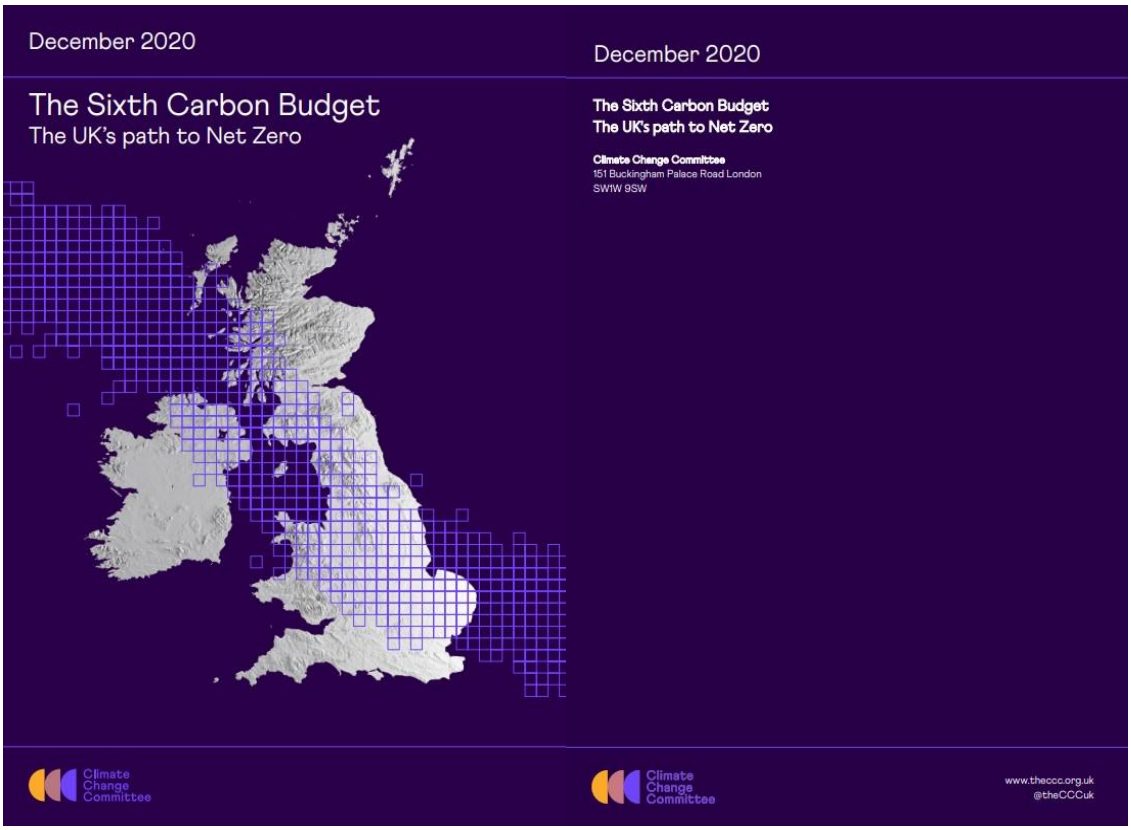


Figure 2.4: The Sixth Carbon Budget (UK Gov)

2.15 To meet these targets, the government has set five-yearly carbon budgets which currently run until 2037. The carbon budgets restrict the amount of greenhouse gas the UK can legally emit in a five-year period. The UK is currently in the fifth carbon budget period (2028 to 2032).

2.16 The Climate Change Committee (CCC) has published its recommendation on the level of the Sixth Carbon Budget in December 2020 (**Figure 2.4**).

Planning and Energy Act

2.17 The Planning and Energy Act (2008) allows local planning authorities' policies to impose reasonable requirements for a proportion of energy used in developments to be from renewable and low carbon sources in the locality of the development. This means local planning authorities have the power to set local energy efficiency standards for new homes that go beyond the minimum standards set through the Building Regulations.

UK Sustainable Development Strategy

2.18 The UK is committed to the delivery of the Sustainable Development Goals. The 2030 Agenda for Sustainable Development is a historic global agreement to eradicate extreme poverty, fight inequality and injustice and leave no one behind. Agreed by world leaders at the UN in 2015, the 17 Sustainable Development Goals (SDGs) succeed the Millennium Development Goals (MDGs).

Figure 2.5: The Sustainable Development Goals (UN)

2.19 It provides an ambitious, globally agreed, shared blueprint for the world to see by 2030 and is centred around the 17 Sustainable Development Goals (also known as the Global Goals or SDGs) – **Figure 2.5**.

2.20 The UK Sustainable Development strategy acts as an overarching document from which a range of specific policies and legislation was derived.

2.21 One of the keys aims of this strategy is to recognise the threats of climate change and ensure that the UK develops a strategy to mitigate and adapt to this phenomenon. The strategy will be implemented at a national level through the development of more specific strategies at a government department or sector level.

Building Regulations

2.22 Whilst not planning policy, the Building Regulations and specifically Approved Document Part L: Conservation of Fuel and Power has relevance to the requirements for energy efficiency and carbon emissions of new buildings. The primary mechanism for reducing carbon emissions in new residential and commercial development is progressive changes to Part L aiming to deliver zero carbon buildings.

2.23 On this basis, a minimum requirement for the reduction in carbon emissions to be delivered by new buildings' is set within the Building Regulations, with each update requiring lower carbon emissions than the previous version to achieve compliance.

2.24 The update in June 2022 required new residential and buildings other than dwellings to achieve 31% and 27% reduction in carbon emissions over the 2013 (with 2016 amendments) Regulations respectively. This uplift is regarded as a first step towards making all buildings 'net zero ready' from 2025 when the Future Buildings Standard comes into effect, mandating a 75% reduction in emissions.

Approved Document 2021 Part L Volume 1 & 2

2.25 This approved document took effect on 15 June 2022 for use in England. Part L amendments introduce a new principal performance metric measuring energy efficiency. 'Primary energy' will be used in combination with CO_2 metrics to assess compliance with Part L. Primary energy calculations take into account factors such as the efficiency of the building's heating system; power station efficiency for electricity; and energy used to produce fuel and deliver it to the building.

Figure 2.6: Approved Document 2021 Part L Volume 1 and Volume 2 (UK Gov)

The Future Homes / Buildings Standard

2.26 The Future Homes / Buildings Standard: 2021 Consultation on changes to Part L is a document published by the UK government in January 2021, outlining proposed changes to Part L (Conservation of fuel and power) and Part F (Ventilation) of the Building Regulations. The main goal is to improve the energy efficiency of buildings and reduce carbon emissions.

2.27 The consultation sought feedback from industry professionals, architects, engineers, and other stakeholders to refine the proposed changes before implementing them as part of the 2025 Future Homes / Buildings Standard.

Clean Growth Strategy

2.28 The UK's Clean Growth Strategy is a government plan published in 2017, aimed at cutting greenhouse gas emissions while driving economic growth. The strategy outlines a comprehensive approach to decarbonise all sectors of the UK economy, including power, transport, and buildings, while ensuring a secure and affordable energy supply for businesses and consumers.

2.29 The Clean Growth Strategy is a critical component of the UK's efforts to meet its legally binding climate change targets, grow the low-carbon economy, and create new economic opportunities for businesses and workers across the country.

National Design Guide (2021)

2.30 The UK's National Design Guide is a government document published in 2019 and updated January 2021, which sets out the principles and standards for creating well-designed, sustainable, and beautiful places across the country. The guide aims to promote good design practices in the planning and development process, addressing various aspects of the built environment.

National Planning Policy Framework

2.31 The National Planning Policy Framework (NPPF) is a key document in England's planning system, first published in 2012 and updated several times since. It sets out the government's planning policies and provides guidance on how these should be applied in England. The NPPF covers various aspects of planning, including housing, the economy, transport, and the environment. Its core principles include: a presumption in favour of sustainable development, encouraging local authorities to plan for and approve new development where possible.

Draft National Planning Policy Framework

2.32 Updated in December 2024, the draft National Planning Policy Framework (NPPF) 2024 is a comprehensive set of proposed reforms intended to address key challenges in England's planning system. These revisions are aimed at meeting the growing demand for housing, promoting economic growth, and enhancing environmental protections.

Planning Policy Guidance (The Guidance)

2.33 The UK's Planning Policy Guidance (PPG) is a collection of documents that provide detailed guidance on various aspects of the planning system in England. These documents support the National Planning Policy Framework (NPPF) and offer practical advice on implementing planning policies.

2.34 The Planning Policy Guidance plays a crucial role in supporting the effective implementation of planning policies and promoting sustainable development in England.

Net Zero Strategy: Build Back Greener

2.35 The UK's Net Zero Strategy: Build Back Greener (**Figure 2.7**) is a comprehensive government plan published in 2021, outlining the country's pathway to achieve net zero emissions by 2050. The strategy focuses on decarbonising all sectors of the UK economy while promoting sustainable growth and job creation. The Net Zero Strategy is a critical component of the UK's efforts to combat climate change and transition to a sustainable, low-carbon economy.

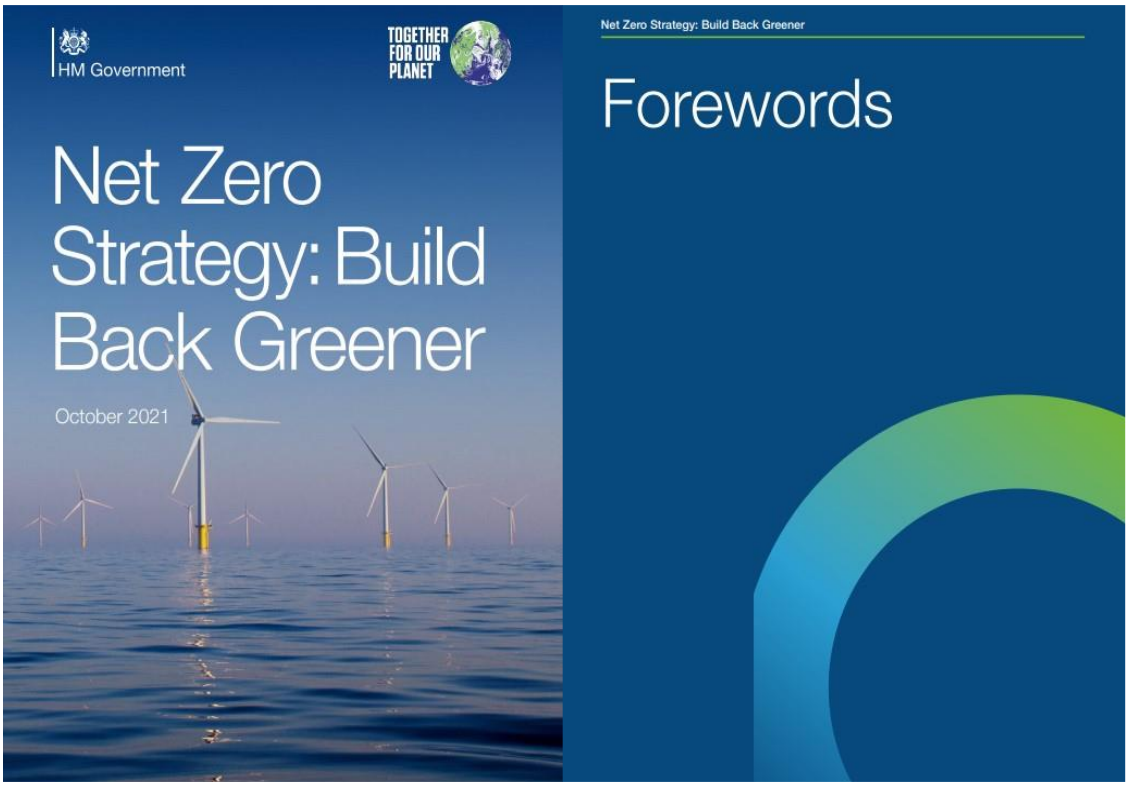


Figure 2.7: Net Zero Strategy: Build Back Greener (UK Gov)

Heat and Buildings Strategy

2.36 The UK's Heat and Buildings Strategy is a government plan published in 2021, outlining the country's approach to reducing emissions from homes and workplaces. The strategy focuses on improving energy efficiency and transitioning to low-carbon heating technologies.

Manchester City Council's Adopted Core Strategy Development Plan (2012)

2.37 Adopted in July 2012, Manchester City Council's (MCC) Core Strategy (**Figure 2.8**) is the key document in Manchester's Local Development Framework and covers a period of 15 years from 2012-27. The document outlines Council's vision for Manchester in 2027 along with the planning policies which will be used to deliver that vision.

2.38 The content within this City's plan is to be consistent with the Government's national planning policy as set out in the NPPF, enabling the delivery of sustainable development in accordance with the NPPF. It will be essential that as a minimum new development reduces CO_2 emissions in line with the Government programme for achieving zero carbon levels for new development.

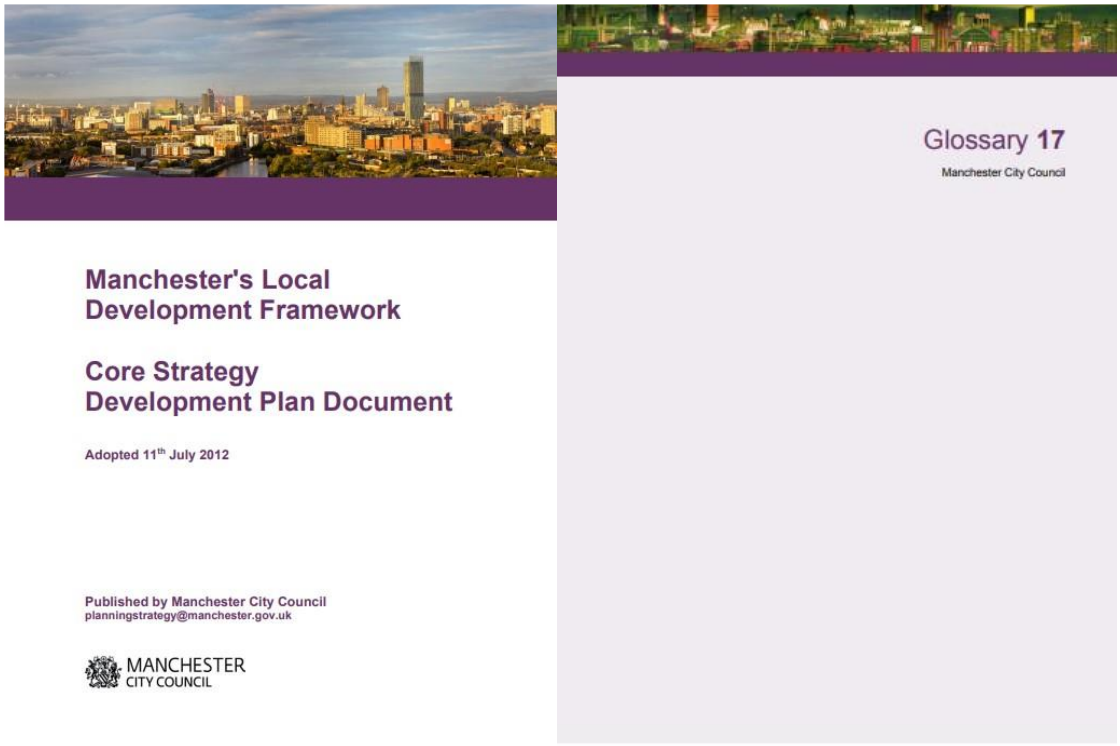


Figure 2.8: Manchester City Council Adopted Core Strategy Development Plan (2012)

2.39 Within the City Plan the policies relating to energy and sustainability are Policy EN4 (Reducing CO_2 emissions by enabling Low and Zero Carbon Development) and EN6 (Target Framework for CO_2 Reductions from low or zero carbon energy supplies).

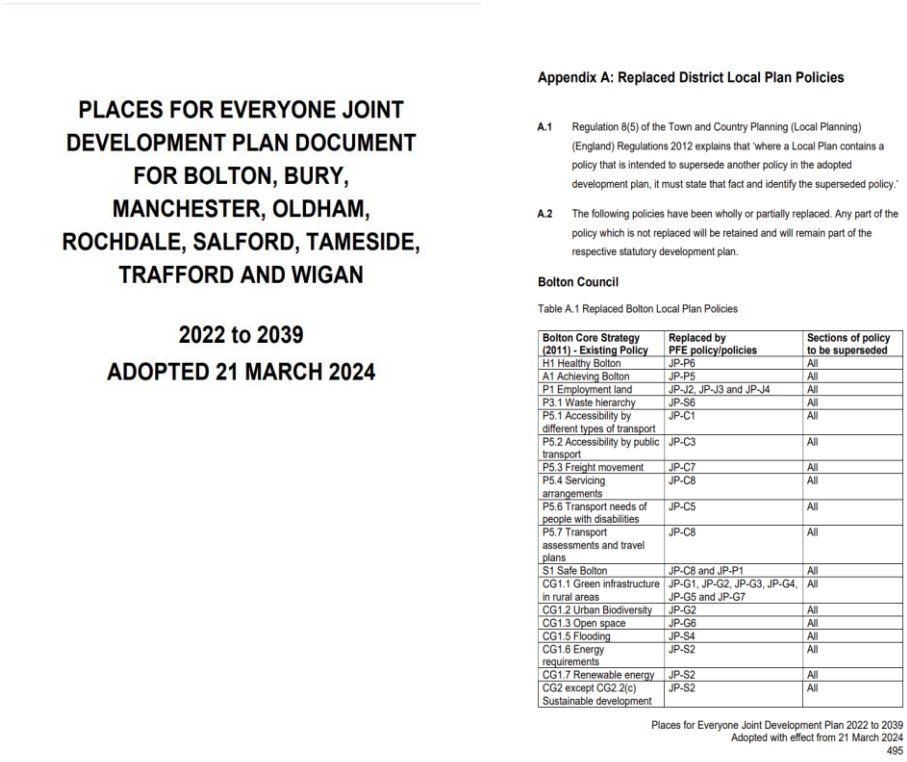
2.40 Policy EN4 focuses on promoting sustainable development and addressing climate change through energy-efficient measures and renewable energy initiatives.

2.41 Policy EN6 covers a target framework for CO_2 emissions reduction from the implementation of low or zero carbon energy requiring residential development of 10 or more units and all other development over 1,000 sq m expected to meet up to 15% increase on Part L 2010.

2.42 Other relevant policies could include EN8 (Adaptation to Climate Change) and EN9 (Green Infrastructure).

Places for Everyone Joint Development Plan (2024)

2.43 Adopted in March 2024, the Places for Everyone (PfE) Joint Development Plan (**Figure 2.9**) of Bolton, Bury, Manchester, Oldham, Rochdale, Salford, Tameside, Trafford, and Wigan Councils is an ambitious and strategic spatial plan to help deliver better, more affordable homes, better jobs, and better transport and infrastructure for everyone in these boroughs; and making best use of brownfield land while protecting green spaces including Green Belt land from unplanned development.



PLACES FOR EVERYONE JOINT DEVELOPMENT PLAN DOCUMENT FOR BOLTON, BURY, MANCHESTER, OLDHAM, ROCHDALE, SALFORD, TAMESIDE, TRAFFORD AND WIGAN

2022 to 2039
ADOPTED 21 MARCH 2024

Appendix A: Replaced District Local Plan Policies

A.1 Regulation 8(5) of the Town and Country Planning (Local Planning) (England) Regulations 2012 explains that 'where a Local Plan contains a policy that is intended to supersede another policy in the adopted development plan, it must state that fact and identify the superseded policy.'

A.2 The following policies have been wholly or partially replaced. Any part of the policy which is not replaced will be retained and will remain part of the respective statutory development plan.

Bolton Council

Table A.1 Replaced Bolton Local Plan Policies

Bolton Core Strategy (2011) - Existing Policy	Replaced by PFE policy/policies	Sections of policy to be superseded
H1 Healthy Bolton	JP-P6	All
A1 Achieving Bolton	JP-P5	All
P1 Employment land	JP-J2, JP-J3 and JP-J4	All
P3.1 Waste hierarchy	JP-S6	All
P5.1 Accessibility by different types of transport	JP-C1	All
P5.2 Accessibility by public transport	JP-C3	All
P5.3 Freight movement	JP-C7	All
P5.4 Servicing arrangements	JP-C8	All
P5.6 Transport needs of people with disabilities	JP-C5	All
P5.7 Transport assessments and travel plans	JP-C8	All
S1 Safe Bolton	JP-C8 and JP-P1	All
CG1.1 Green infrastructure in rural areas	JP-G1, JP-G2, JP-G3, JP-G4, JP-G5 and JP-G7	All
CG1.2 Urban Biodiversity	JP-G2	All
CG1.3 Open space	JP-G6	All
CG1.5 Flooding	JP-S4	All
CG1.6 Energy requirements	JP-S2	All
CG1.7 Renewable energy	JP-S2	All
CG2 except CG2.2(c) Sustainable development	JP-S2	All

Places for Everyone Joint Development Plan 2022 to 2039
Adopted with effect from 21 March 2024
495

Figure 2.9: MCC Places for Everyone Joint Development Plan (2024)

2.44 The Plan plays a critical role in helping to tackle climate change and meet the Councils' commitment to be carbon neutral by 2038, by setting out expectations for new development including setting out a pathway for new development to be zero carbon by 2028.

2.45 Within the Plan the policies relating to energy and sustainability are Policy JP-S1 (Sustainable Development), JP-S2 (Carbon and Energy), JP-S3 (Heat and Energy Networks), JP-S4 (Flood Risk and the Water Environment), JP-S6 (Resource Efficiency) and JP-P1 (Sustainable Places).

2.46 Policies within this Plan that replaces the existing policies of MCC Core Strategy (2012) and are outlined as follows:

i. JP-S1 (Sustainable Development) replaced SP1 (Spatial Principles (Partially))
ii. JP-S2 (Carbon and Energy) replaced EN4 (Reducing CO2 Emissions by Enabling Low and Zero Carbon Development (Partially) and EN6 (Target Framework for CO_2 Reductions from Low or Zero Carbon Energy Supplies (Partially).

2.47 Policy JP-S1 focuses on promoting and enhancing sustainable development and addressing climate change through the utilisation of sustainable construction techniques. The policy stipulates the following (**Table 2.1**) best practices threshold for reducing energy demand and onsite renewable energy generation within residential developments

Table 2.1: Places for Everyone Joint Development Plan Best Practice Thresholds

ENERGY DEMAND AND RENEWABLE ENERGY GENERATION BEST PRACTICE THRESHOLDS			
	Space Heat Demand	Hot Water Energy Demand	Renewable Energy Generation
2021 – 2025	Houses (30 kWh/m^2) Flats (25 kWh/m^2)	20% energy demand reduction in the total heat required for water heating	*Photovoltaic installation: 20% ground floorspace
2025 – Onwards	Houses (20 kWh/m^2) Flats (15 kWh/m^2)	^20% energy demand reduction in the total heat required for water heating	*Photovoltaic installation: 40% ground floorspace

*Ground floorspace used as a proxy for available roof area
^will need to be reviewed with Future Homes Standard 2025 to determine if savings already embedded

2.48 Policy JP-S2 stipulates that development should be 'net zero carbon' for regulated operational carbon emissions (unless it can be demonstrated that it is not practicable or financially viable) by 2025. The policy further states that from 2025, 'development should also calculate and minimise carbon emissions from unregulated emissions alongside regulated emissions.' Additionally, 'any residual carbon emissions that cannot be fully mitigated on-site should be offset, in agreement with the relevant local planning authority, through a financial contribution to a carbon offset fund.'

2.49 While the Policy JP-S2 encourages carbon offsetting to achieve net-zero carbon development, it does not explicitly require considering unregulated emissions in achieving net zero but rather minimising them. Additionally, it does not specify a particular carbon offset price per tonne.

2.50 Policy JP-S3 focuses on the importance of decentralised energy structure as paramount in helping to achieve the delivery of the Council's low carbon growth, carbon reductions and an increase in local energy generation.

2.51 Policy JP-S4 focuses on the sustainability aspect rather than energy. The policy states "[…] *As a minimum, residential development should meet the mandatory water efficiency standard of 125 litres/person/day as set out in Building Regulations. District local plans may and should consider setting a tighter water efficiency standard of 110 litres/person/day where there is a clear local need with reference to national guidance on housing optional technical standards.* […]"

2.52 Policy JP-S6 focuses on the promotion of sustainable development through the use of a Zero Waste Strategy, in addition to the utilisation of sustainable design and construction techniques to help combat climate change.

2.53 Policy JP-P1 focuses on energy and sustainability for Greater Manchester with the aim of becoming one of the most liveable city regions in the world. Key attributes mentioned include the City to be resilient, socially inclusive, durable, resource-efficient, well connected to other places and incorporating high quality and well managed green infrastructure to name a few.

Manchester Climate Change Framework 2020-2025 (2020)

2.54 Formally endorsed in March 2020, this document is Manchester's high-level strategy for meeting their climate change commitments. Manchester has established a devolved, partnership-based approach to climate change action which requires every single resident, school and organisation to be actively involved.

2.55 Produced by the Manchester Climate Change Partnership and Agency, the document's objectives and targets cover staying within their carbon budgets, climate adaptation and resilience, health and wellbeing, and inclusive, zero carbon and climate resilient economy.

Guide to Development in Manchester SPD (2007)

2.56 Adopted in April 2007, the Guide to Development in Manchester SPD (**Figure 2.10**) does not create new planning policy but rather expands on and provides further detail on existing policies. It is effectively a hybrid document acting as both a Supplementary Planning Document and planning guidance.

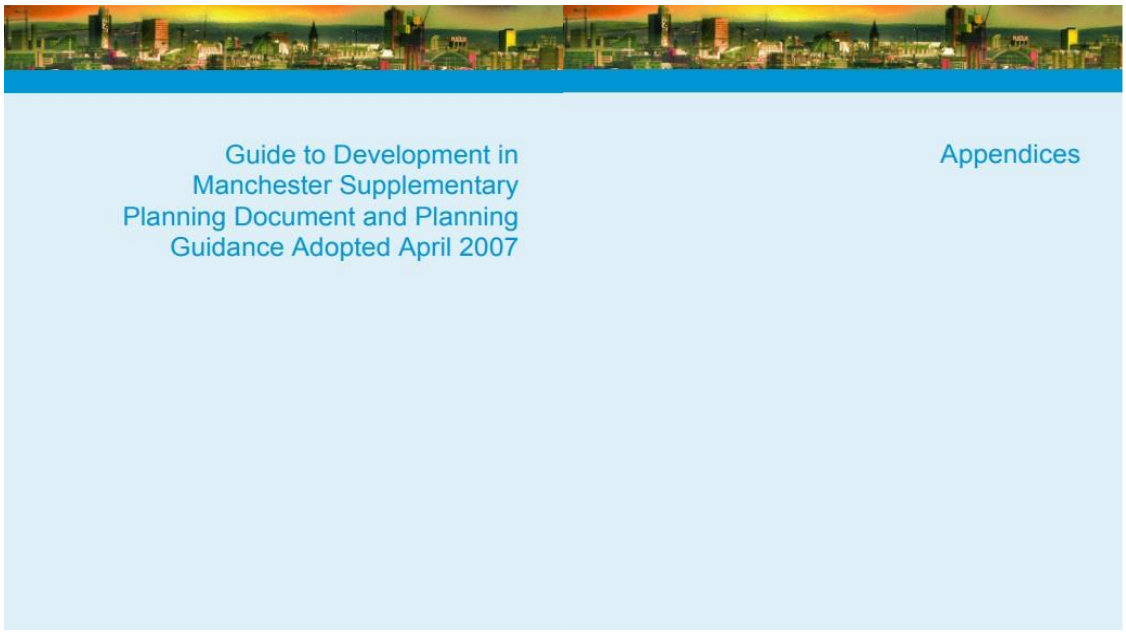


Figure 2.10: Manchester City Council – Guide to Development in Manchester SPD (2007)

2.57 The document sets out the City Council's stance on a wide range of issues, demonstrating, where applicable, links to the Manchester Unitary Development Plan. The guide states developers should aim to reduce CO_2 emissions by at least 25% more than the requirements of the Building Regulations 2006, as well as ensuring that at least 20% of final site energy demand to be met by on-site renewable energy technologies.

3. BASELINE: TARGET ENERGY AND CO_2 EMISSIONS

3.1 The baseline energy demand and CO_2 emissions due to end-uses by Building Regulations have been calculated using the National Calculation Methodology (NCM) SAP, and the NCM ApacheSim Dynamic Simulation Modelling (DSM) 2021 which are the Government's adopted methodologies for calculating the energy performance of domestic and commercial buildings within the UK respectively.

Baseline Energy and Carbon Dioxide Emissions (TER)

3.2 The SAP and DSM calculations have been performed to inform this Energy and Sustainable Design Statement and to produce the most accurate estimate of the site carbon dioxide emissions.

3.3 The baseline regulated energy and CO_2 emissions are equivalent to the Building Regulations Approved Document Part L worst allowable Target Emissions Rate (TER) calculated within the SAP and DSM assessment of the Proposed Development.

3.4 **Table 3.1** and **3.2** shows the baseline energy demand and carbon emissions of the Proposed Development. Refer to **Appendix 1-3** for the SAP/DSM compliance documents.

Table 3.1: Baseline Energy Demand (TER)

BASELINE (TER): ENERGY DEMAND							
	Energy Demand (kWh/year)						
	Heating	Hot Water	Aux	Lighting	Cooling	PV	Total
Apartments	382,933.84	733,484.90	24,596.00	51,031.84	0.00	-142,039.18	1,050,007.39
Retail	2,730.97	1,671.81	10,446.20	17,154.20	2,616.74	0.00	34,619.92
Transient	26,032.51	271,930.90	3,949.20	73,906.53	967.15	-17,489.33	359,296.97
Total	411,697.31	1,007,087.61	38,991.41	142,092.57	3,583.89	-159,528.52	**1,443,924.28**

Table 3.2: Baseline Carbon Dioxide Emissions (TER)

BASELINE (TER): CARBON DIOXIDE EMISSIONS	
	Carbon Dioxide Emissions (Tonnes/CO_2/year)
Apartments	226.82
Retail	4.69
Transient	49.16
Total	**280.67**

3.5 **Table 3.3** shows the baseline unregulated energy demand and carbon emissions of the Proposed Development.

Table 3.3: Baseline Unregulated Energy Demand and Carbon Dioxide Emissions (TER)

BASELINE (TER): UNREGULATED ENERGY DEMAND & CARBON DIOXIDE EMISSIONS		
	Energy Demand (kWh/year)	CO_2 Emissions (Tonnes/CO_2/year)
Proposed Development	956,981.09	130.15

4. PROPOSED SUSTAINABLE ENERGY STRATEGY

4.1 The design of the Proposed Development has been developed to reduce its annual energy consumption, provide energy in an environmentally friendly way, and to minimise its annual CO_2 footprint.

4.2 To achieve this, the Proposed Development will adopt an energy hierarchy approach (**Figure 4.1**) to meet the MCC's Adopted Core Strategy Development Plan (2012) Policies EN4 and EN 6 and the City Council's Places for Everyone Plan Policies JP-S1, JP-S2, JP-S3, JP-S6 and JP-P1 objectives for carbon emissions and energy reduction:

i. Use Less Energy; then
ii. Supply Energy Efficiently; and finally
iii. Use Renewable Energy.

Figure 4.1: Energy Hierarchy

4.3 Energy saving measures following the Fabric First Approach is encouraged. This will reduce energy demand and consequently the energy bills by investing in improving the building fabric's thermal properties and using efficient building services. The Fabric First approach provides protection against fluctuations in both gas and electricity supply tariffs by inherently reducing energy consumption and expands the number of suitable energy generation and delivery options.

4.4 Further improvements in building services, over and above the minimum requirements to comply with Building Regulations Part L, can reduce energy demand further. This includes identifying the Proposed Development Site heat demand, investigating existing/planned decentralised energy and heat network, and the potential for a new heat district network as part of the Proposed Development.

4.5 Finally, the use of on-site renewable technologies will be assessed. The use of the energy hierarchy will help to reduce the size of any on-site renewable technologies required by ensuring that energy consumption and CO_2 emissions is driven out of the scheme by the Fabric First approach.

5. BE LEAN: ENERGY EFFICIENT DESIGN MEASURES

5.1 Energy demand and CO_2 reduction has been considered in three stages: layout and orientation; building fabric; and building services. The proposals to reduce energy at each of these stages are described within this section.

Layout and Orientation Analysis

5.2 The opportunities for orientation and layout of the Proposed Development have been maximised. The development plan has been designed to enable passive solar gain and availability of natural light to be maximised into each habitable room with majority the provided with either a north-east, north-west, south-east and/or south-west glazed opening as possible.

Building Fabric Analysis

5.3 In order to reduce the demand for heating energy, it is proposed to construct the Development with a highly thermal efficient building envelope.

5.4 To meet Building Regulations Approved Document Part L 2021 and MCC's Policy PfE JP-S2 requirements, the Proposed Development fabric elements making up the envelope shall therefore be specified to exceed the minimum standards set in Part L to ensure energy consumption via space heating is reduced.

5.5 **Table 5.1** shows the proposed level of performance in comparison with the worst allowable standards for each element.

Table 5.1: Proposed Fabric Specification

PROPOSED FABRIC SPECIFICATION				
Element	Proposed U-values	Part L 2021 Worst Allowable U-values: Residential	Part L 2021 Worst Allowable U-values: Commercial	Percentage Improvement (%)
External Wall	0.15 W/m².K	0.26 W/m².K	0.26 W/m².K	42.31 %
External Roof	0.11 W/m².K	0.16 W/m².K	0.18 W/m².K	31.25% / 38.89%
Ground Floor	0.11 W/m².K	0.18 W/m².K	0.18 W/m².K	38.89 %
Glazed Element Windows/Doors	1.20 W/m².K	1.60 W/m².K	1.60 W/m².K	25.00 %
Air Permeability	3.00 m³/(hr.m²)	8.00 m³/(hr.m²)	8.00 m³/(hr.m²)	62.50 %

5.6 Light and Solar Transmittance (g-values) are factors that measure the amount of light and solar energy that pass through glazed openings. They are important as they affect the control of solar gains and availability of natural light into the building.

5.7 **Table 5.2** shows the proposed light and solar transmittance values recommended for the Proposed Development.

Table 5.2: Proposed Light and Solar Transmittance Specification

PROPOSED GLAZING SPECIFICATION			
Element	Description/ Notes	Proposed Solar Transmittance	Proposed Light Transmittance
Glazing	Proposed glazing spec	0.40	0.70
Glazing (Commercial)	Proposed glazing spec	0.27	0.31

5.8 In addition to the Proposed Development improved envelope u-values, a key area of construction which could result in a significant reduction in heating demand are junction details where two elements of the development envelop meet (thermal bridging).

5.9 As such, for the SAP model, the Proposed Development will be designed to make use of best practice design (such as construction joint details calculated by a suitably competent person following the guidance detailed in BR 497 and Paper 1/06 or from a reputable non-government database containing independently assessed thermal junction details).

5.10 For the DSM model, the non-repeating thermal bridge [Psi (Ψ)] heat losses for each element (including windows etc) are automatically allowed for by adding 25% to the standard area weighted average U-values.

5.11 Reputable non-government database includes Local Authority Building Control's (LABC), Recognized Construction Details, or similar Construction Details Library to minimise thermal bridging, energy losses, and reducing CO_2 emissions to ensure a y-value between 0.014 and 0.087 is achieved.

Building Services Analysis

5.12 The following services are proposed for the Development in order to reduce energy consumption and CO_2 emissions through energy efficient equipment and services strategy.

Space Heating and / or Cooling

5.13 Space heating to the Proposed Development's residential apartments is provided via 100% efficient Electric Panel Heaters (EPH) with a programmer and room thermostat controls.

5.14 Space heating / cooling to the Proposed Development (commercial elements including retail units and amenity space) is proposed to be served by Air Source Heat Pump (ASHPs) via Variable Refrigerant Flow (VRF) system with a minimum seasonal efficiency of 340% in heating mode and 510% in cooling mode – refer to chapter 7 for further details.

5.15 Space heating / cooling to the Proposed Development (non-residential elements including comms rooms) is provided via a DX split system with a minimum seasonal efficiency of 340% in heating mode and 510% in cooling mode.

5.16 Space heating to the residential communal corridors and circulation areas, as well as all commercial transient areas of the Proposed Development are provided via 100% efficient Electric Panel Heaters (EPH).

5.17 In order to further reduce the energy demand, the space heating and cooling system would be provided with BMS controls.

Domestic Hot Water

5.18 Domestic Hot Water to the Proposed Development's apartments is proposed to be heated via ASHP with a hot water storage cylinder. The ASHP has a minimum efficiency of 320%. For the one and two bed dwellings the cylinders have been assumed to have a storage capacity of 111 litres and loss of 1.03 kwh/day, for three bed dwellings the cylinders have been assumed to have a storage capacity of 143 litres and loss of 1.27 kwh/day, and for four bed dwellings the cylinders have been assumed to have a storage capacity of 164 litres and loss of 1.42 kwh/day.

5.19 The cylinders are assumed to be located in a dedicated heated space with a cylinder stat. The apartments are also expected to utilise low flow fixtures and fittings to reduce water demand for both domestic hot water and potable water.

5.20 Domestic Hot Water to the Proposed Development's non-residential areas such retail units etc is proposed to be heated via Electric Instantaneous Domestic Hot Water with a seasonal efficiency of 100%.

Ventilation:

5.21 All of the Proposed Development's apartments will have mechanical ventilation to circulate fresh air rather than relying on airflow through openable windows to maintain operative temperatures and reduce the risk of overheating, in line with the Noise and CIBSE TM59 Assessment Reports.

5.22 Ventilation to the apartments with one wet room is provided via mechanical ventilation with 93% efficient heat recovery. Such mechanical ventilation with heat recovery (MVHR) system can significantly reduce the winter heat demand by pre-heating supply air with extract air. The system shall therefore be selected to have a specific fan power (SFP) of no greater than 0.39 W/(l/s).

5.23 Ventilation to the apartments with two wet rooms are provided via mechanical ventilation with 92% efficient heat recovery. Such MVHR system can significantly reduce the winter heat demand by pre-heating supply air with extract air. The system shall therefore be selected to have a SFP of no greater than 0.46 W/(l/s).

5.24 Ventilation to the apartments with three wet rooms are provided via mechanical ventilation with 91% efficient heat recovery. Such MVHR system can significantly reduce

the winter heat demand by pre-heating supply air with extract air. The system shall therefore be selected to have a SFP of no greater than 0.55 W/(l/s).

5.25 Ventilation to the Proposed Development's commercial areas including retail units and amenity areas is provided via mechanical ventilation with 85.00% efficient heat recovery. Such MVHR system can significantly reduce the winter heat demand by pre-heating supply air with extract air. The system shall therefore be selected to have a SFP of no greater than 1.50 W/(l/s).

5.26 Extract ventilation is provided to WCs and is selected to have a SFP of no greater than 0.3 W/(l/s) with an extract rate of 6 l/s per WC.

Lighting:

5.27 All areas within the Proposed Development's apartments are proposed to be served by energy efficient LED lightings.

5.28 It is proposed that 100% of the domestic internal lighting shall be dedicated high energy efficient LED, with a minimum lighting efficacy of 80 lm/W to reduce electricity consumption.

5.29 Lighting to retail units is proposed to be served by LED lighting with efficacy of no less than 120 lumens per circuit Watt.

5.30 Lighting to transient areas such as WCs and circulation is proposed to be served by LED lighting with efficacy of no less than 110 lumens per circuit Watt.

5.31 Lighting to remaining areas including lifts, stores, plant areas etc is proposed to be served by LED lighting with efficacy of no less than 95 lumens per circuit Watt.

5.32 It is proposed that lighting to the commercial areas with glazing shall be provided with photoelectric dimming. This is to ensure that artificial lightings shall not be fully utilised when there is sufficient natural light.

5.33 It is also proposed that passive infra-red (PIR) sensors to provide auto on-off control shall be installed to all commercial zones except lifts. This is to ensure that artificial lightings shall not be utilised when spaces are unoccupied.

Metering:

5.34 It is proposed that all Proposed Development's services shall be fitted with metering which will communicate meaningful information, enabling the building occupier to address and adjust the system to satisfy the requirements of Building Regulations.

Power Factor Correction:

5.35 A power factor correction device can adjust the wavelength of the electricity supply to ensure that minimal electrical energy is wasted within the building. However, no power factor correction system has been assumed/proposed for the Proposed Development.

6. BE CLEAN: SUPPLYING ENERGY EFFICIENTLY

6.1 The next stage in the energy hierarchy is exploiting local energy resources (such as secondary heat) and suppling energy efficiently and cleanly to reduce CO_2 emissions.

Heat Network

6.2 The growth of decentralised energy generation is a core component of decarbonising the energy supply. District heat networks are an important part of a sustainable and flexible energy system of which each building is a part, & which enables a more circular approach to energy use by storing, using, and reusing energy sources. This supports a more effective and efficient use of energy by reducing primary energy demand and minimising the amount of energy that is ultimately wasted within the system.

6.3 Heat networks (**Figure 6.1**) offer an efficient and competitive solution for heating buildings in areas with high heat density and provide the added benefit of enabling the use of secondary energy or waste heat sources. This allows useful, lower quality energy to be used and re-used within the system to meet lower quality energy demands, such as space heating and hot water, saving high quality energy sources and capacity to meet high quality energy demand. The inherent thermal storage capacity of heat networks helps to manage demand, supports balancing and the flexibility of the electricity network and the integration of renewable energy into the grid mix.

Figure 6.1: Image of District Heating Network Pipework

6.4 By providing a system-level alternative to building-level solutions, heat networks help manage demand through their inherent storage provision whilst protecting existing capacity in the local electricity network to accommodate additional development and the integration of increasing volumes of renewable energy into the grid mix.

Existing Heat Network

6.5 A desktop study was undertaken to investigate whether an existing distribution network was in place close to the site. However, there are no existing district heating networks within 500m of the site; therefore, connection to an existing network is not feasible. As such, connection to an existing heat network is not proposed or recommended. Instead, an energy strategy utilising on-site renewable technologies (Air Source Heat Pump - ASHP and Solar PV), as detailed in Chapter 7, has been proposed.

7. BE GREEN: PROPOSALS FOR RENEWABLE ENERGY GENERATION

Low and Zero Carbon Feasibility Study

7.1 The next stage in the energy hierarchy is investigating opportunities for producing, storing, and using renewable energy on-site. Generating low carbon energy onsite can reduce reliance on fossil fuels and minimises energy lost through transmission, contributing to security of supply and better connections between energy demand and generation.

7.2 An initial renewable energy options assessment has been undertaken using the Renewable Energy Sources Estimation Tool (RESET) – **Figure 7.1** which accompanies the CIBSE TM38 'Renewable Energy for Buildings' guidance document. This toolkit is intended for use at the earliest stages of design, when ideas are being considered and the outline direction of the design is developed, to identify the most promising renewable technology options for a given development or building. This is the key stage for some of the most important decisions relating to overall appearance, orientation, building mass and ventilation strategy, which can also influence decisions about renewable energy sources.

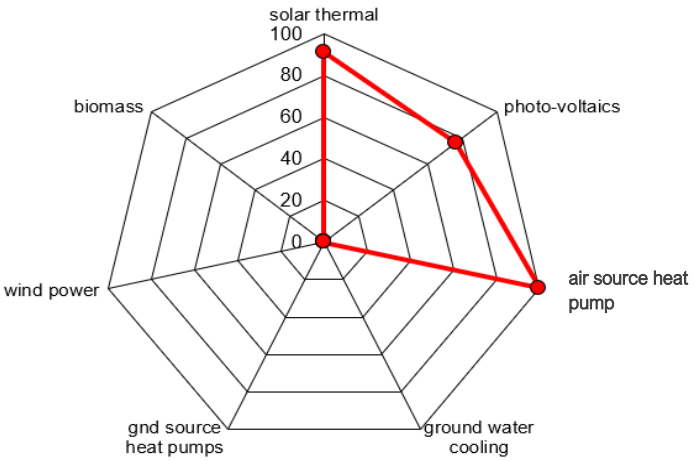


Figure 7.1: Initial Renewable Energy Feasibility

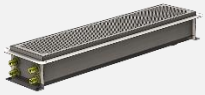
7.3 The initial assessment has been undertaken to judge the feasibility of renewable energy technologies from the outset, enabling viable technologies to be promoted and others to be ruled out from further consideration. The initial assessment demonstrates that Solar Thermal; Photovoltaic (PV) Panels and ASHP are all feasible technologies for the Proposed Development.

7.4 A further detailed review (**Table 7.1**) of potential low carbon renewable energy technologies has also been carried out to determine potential technologies which could be incorporated into the Proposed Development. The detailed assessment further demonstrates that the renewable technology with high opportunity is ASHP, Solar PV and WWHRs. Technologies such as Solar Thermal, GSHP, WSHP, Wind Turbine etc have been discounted at this stage based on a balanced consideration of the policy requirements, financial viability, and technical feasibility.

Table 7.1: Renewable Energy Feasibility Matrix

TECHNOLOGY	FEASIBILITY SUMMARY TABLE MATRIX								
LZC technologies	Description	Noise Issue	Visual Impact	Internal Space	External Space	Capital Cost	Maintenance Issue	Site Feasibility	
Solar PV Panels	Solar PV are solar cell systems that convert sunlight directly into electricity. They should be installed within 45° of due south ideally at a 30-35° angle.	🟢	🟡	🟢	🟡	🟡	🟢	There is suitable shade free roof space available with sufficient electricity demand. This technology is considered suitable for the Proposed Development.	✓
Solar Thermal Collector	Solar Thermal are devices that uses energy from the sun to warm water for storage in a hot water cylinder. They should also be installed within 45° of due south ideally at a 30-35° angle.	🟢	🟡	🟢	🟡	🟡	🟡	Whilst this technology can be considered suitable for the Proposed Development Solar PV is preferable due to its versatility, cost effectiveness, and scalability for a wide range of applications.	✗
Ground Source Heat Pump	Ground Source Heat Pumps (GSHP) work by absorbing natural heat from the ground and transferring the heat into buildings to provide heating, cooling, and domestic hot water.	🟡	🟢	🟡	🔴	🔴	🟡	Large area of land required for pipework which is subject to a full ground survey to determine geology. More beneficial to large scale development proposal with significant cooling requirement.	✗
Air Source Heat Pump	Air Source Heat Pump (ASHP) extracts heat from the outside air and transfer the heat into buildings to provide heating, cooling, and domestic hot water.	🟡	🟡	🟡	🟡	🟡	🟡	ASHP can provide simultaneous heating and DHW at a very high efficiency. There is suitable external space available. This technology is considered suitable for the Proposed Development.	✓

Water Source Heat Pump	Water Source Heat Pump (WSHP) uses submerged pipework to absorb energy from water sources such as lakes, ponds, rivers, aquifers, mine water etc to provide heating and hot water into buildings.	🔴	🟡	🟡	🔴	🔴	🔴	There are no potential enough water sources (such as lakes, ponds, rivers, aquifers, mine water) on or nearby the Site. Hence, this technology is not considered feasible.	⊗
Geothermal Energy Plant	Geothermal energy is the heat that comes from the sub-surface of the earth. It is a reliable and constant source of low-carbon, renewable heat. The heat is then used to heat buildings and to generate electricity.	🔴	🟢	🟡	🔴	🔴	🔴	Large area of land required for pipework which is subject to a full ground survey to determine geology. More beneficial to large scale development proposal subsidised by the Government. Hence, this technology is not considered feasible.	⊗
Wind Turbine	A wind turbine turns wind energy into electricity using the aerodynamic force from the rotor blades. The electricity generated is then used to power building electricity demands including appliances.	🔴	🔴	🟢	🔴	🔴	🟡	Provided the average wind speed in the area of the Site is 4.6m/s at 10m hub height (≥5.0m/s required for further investigation); this technology is therefore not considered feasible for this scheme.	⊗
Hydro, Wave & Tidal Power	Hydropower – also known as hydroelectric power or hydroelectricity – harnesses energy from the natural flow of moving water, which can then be used to generate electricity to power building electricity demands.	🔴	🔴	🟡	🔴	🔴	🔴	The Site is not located within a reasonable distance to a coastal location or water source. Hence, this technology is not considered feasible.	⊗

Biomass Heating	Biomass is a renewable energy source, generated from burning wood, plants and other organic matter, such as manure or waste. It releases carbon dioxide when burned, but considerably less than fossil fuels.	🟡	🔴	🔴	🟡	🔴	🔴	Biomass heating is not considered feasible for this development due to issues with fuel storage, access for delivery vehicles and Air Quality Management Area for Nitrogen Oxides (NOx).	⊗
Wastewater Heat Recovery (WWHRs) 	WWHR works by recovering from outgoing waste warm water to pre-heat the fresh cold mains water coming into the home. This means that the water heater requires less energy to heat the cold water up.	🟢	🟢	🟢	🟢	🟢	🟢	The residential element of the Proposed Development is expected to have a high hot water demand and therefore, WWHRs is considered feasible.	✓
Transpired Solar Collectors	Transpired Solar Collector is a highly efficient solar air heating system that harnesses the sun's energy to heat fresh, outdoor air for building. It is installed as an 'additional skin' to a building's southerly facing façade.	🟢	🔴	🟢	🔴	🟡	🟢	TSC are mostly used in industrial applications for industrial heating, cooling, and agricultural drying. Due to the ventilation equipment requirement, the Proposed Development is not expected to incorporate TSC, hence not proposed.	⊗
Hydrogen Fuel Cell	Hydrogen energy storage is a form of chemical energy storage in which electrical power is converted into hydrogen. This energy can then be released again by using the gas as fuel in a combustion engine or a fuel cell.	🟢	🟢	🟡	🟡	🔴	🔴	There is limited market available, and the Proposed Development is not expected to incorporate hydrogen fuel due to technology issues including storage, transportation, & utilisation of hydrogen energy.	⊗

Proposed Renewable Energy Technologies

7.5 From the site-specific renewable energy feasibility assessment, it was found that the potentially feasible technologies for the Proposed Development are PV, ASHP, and WWHRs.

Air Source Heat Pump

7.6 ASHPs absorb heat from the outside air. This exchange heat between the outside air and the building can be used to provide space heating and cooling.

7.7 An air-to-water heat pump is proposed to provide domestic hot water (DHW) to each individual dwelling of the Proposed Development.

7.8 Refrigerant-based heat pump system (VRF) is proposed for the Proposed Development's commercial elements including the retail units as there are no technical feasibility restraints. The efficiency of the VRF system should be no less than 340% (SCOP) in heating mode and 510% (EER/SEER) in cooling mode. The comms rooms also are expected to be heated and cooled via a DX Split System.

Wastewater Heat Recovery

7.9 WWHRs is used in baths/showers by utilising the warm water draining from the bath/shower to heat the incoming cold water before going into the wastewater system.

7.10 This means less energy is required to reach the desired temperature and saving energy in the process. The assumed recovery efficiency of the WWHR system is 54.90% at a flow rate of 8.00 litres/min, the notional recovery efficiency specification of a WWHR system as required under Part L is 36.00%.

Solar Photovoltaic (PV)

7.11 Solar PV also known as Solar panel electricity system captures the sun's energy using photovoltaic cells. These cells convert the sunlight into electricity, which can then be used to run buildings appliances and lighting.

7.12 A total of **337.51** kWp solar PV capacity is proposed. The analysis is based on an indicative panel (500W monocrystalline panel) and equates to 675.02 m^2 roof space and 675 panels which is the maximum feasible number of panels that is available to fit on the roof space of the Proposed Development.

Be Green (Renewable Energy) Results

7.13 **Table 7.2** and **Table 7.3** shows the reduction summary of regulated energy demand and CO_2 emissions due to the proposals for on-site renewable energy generation (ASHP, PV and WWHRs) for the Proposed Development and this is compared to the baseline scenario. Refer to **Appendix 1-3** for the SAP and BRUKL output. Unregulated emissions have also been included within the results to comply with MCC's PfE Plan Policy JP-S2.

Table 7.2: Be Green Energy Demand Breakdown

BE-GREEN: RENEWABLE ENERGY		
	Baseline Energy (TER) kWh/year	Proposed Energy (BER) kWh/year
Heating	411,697.31	172,322.78
Hot Water	1,007,087.61	378,415.14
Auxiliary	38,991.41	46,891.63
Lighting	142,092.57	127,015.53
Cooling	3,583.89	10,120.08
Solar PV	-159,528.52	-137,971.99
Total Regulated Energy Consumption	1,443,924.28	596,793.16
Part L 2021 Regulated Energy Reduction (%)		**58.67%**
Total Unregulated Energy Consumption	956,981.09	956,981.09
Total Energy Consumption	2,400,905.37	1,553,774.25
Total (Regulated & Unregulated) Energy Reduction (%)		**35.28%**

Table 7.3: Be Green Carbon Dioxide Emissions

BE GREEN: CARBON DIOXIDE EMISSIONS		
	Baseline Emissions (TER) Tonne/CO_2/year	Proposed Emissions (BER) Tonne/CO_2/year
Apartments	226.82	41.93
Commercial	4.69	2.41
Transient	49.16	40.30
Total Regulated emissions	280.67	84.64
Part L 2021 Regulated CO_2 Reduction (%)		**69.84%**
Total Unregulated emissions	130.15	130.15
Total Emissions	410.82	214.79
Total (Regulated & Unregulated) CO_2 Reduction (%)		**47.72%**

7.14 Thus, this ESDS proposes to reduce the Proposed Development's energy consumption and CO_2 emissions by approximately **58.67%** and **69.84%**, respectively, compared to Part L 2021 of the Building Regulations.

7.15 This complies with the national target to exceed the Part L 2021 baseline and demonstrates compliance with Manchester City Council's requirement to both adhere to the energy hierarchy that reflects national policy targets and specifically Places for Everyone Plan Policy JP-S2 which requires, as an interim measure, development should be consistent with the Part L 2022 Building Regulations.

8. OPERATIONAL ENERGY CARBON OFFSET PAYMENT

Introduction

8.1 In March 2024, Greater Manchester Combined Authority (GMCA) adopted the Places for Everyone Joint Development Plan. Policy JP-S2 (Carbon and Energy) of this plan (Clause 5a) stipulates that development should be 'net zero carbon' for regulated operational carbon emissions (unless it can be demonstrated that it is not practicable or financially viable) by 2025.

8.2 The policy further states that from 2025, 'development should also calculate and minimise carbon emissions from unregulated emissions alongside regulated emissions.' Additionally, 'any residual carbon emissions that cannot be fully mitigated on-site should be offset, in agreement with the relevant local planning authority, through a financial contribution to a carbon offset fund.'

8.3 While the GMCA Policy JP-S2 encourages carbon offsetting to achieve net-zero carbon development, it does not explicitly require considering unregulated emissions in achieving net zero but rather minimising them. Additionally, it does not specify a particular carbon offset price per tonne.

Proposed Carbon Offsetting Calculation Methodology

8.4 In calculating the carbon offset payment, the Low Energy Transformation Initiative (LETI) Energy Use Intensity (EUI) and GMCA Carbon Offsetting Study calculation methodology have been considered. This approach requires calculating the development's energy consumption (for both regulated and unregulated) and comparing it to LETI benchmark figures. Any residual energy consumption following the integration of renewable energy will then be offset using the price of £200 per tonne of CO_2, as detailed in the GMCA Carbon and Policy Implementation Study – Part 2 – Carbon Offsetting.

8.5 This study provides recommendations on how GMCA should operate a carbon offsetting approach to help deliver net-zero carbon development, including how the price of carbon should be set.

Energy Consumption Analysis

8.6 By utilising the energy consumption data detailed in section 7 and dividing by the floor area, the regulated and unregulated energy consumption for the residential element is 20.25 and 34.14 kWh/m²/year, respectively, making a total of 54.39 kWh/m²/year. This preliminary figure exceeds LETI's recommendation of a maximum of 35.00 kWh/m²/year.

8.7 The regulated and unregulated energy consumption for the non-residential element, including the retail units, is 65.51 and 52.82 kWh/m²/year, respectively, making a total of 118.34 kWh/m²/year.

8.8 While LETI doesn't provide a specific Energy Use Intensity (EUI) target for retail buildings, the commercial building target for offices has been used as a reference, which has a target EUI of 55.00 kWh/m²/year or lower.

8.9 The residual energy consumption of the development is therefore calculated to be.

i. Residential: 54.39 kWh/m²/year – 35.00 kWh/m²/year = 19.39 kWh/m²/year.
ii. Non-residential: 118.34 kWh/m²/year – 55.00 kWh/m²/year = 63.34 kWh/m²/year

Solar PV Integration

8.10 With the integration of 337.51 kWp of solar PV, which equates to 19.55 kWh/m²/year energy generation and covers approximately 40% of the available roof space area, the resultant energy consumption is

i. Residential: 19.39 kWh/m²/year – 5.37 kWh/m²/year = 14.02 kWh/m²/year
ii. Non-residential: 63.34 kWh/m²/year – 14.18 kWh/m²/year = 49.16 kWh/m²/year

Carbon Emissions and Offset Payments

8.11 To offset the residual energy consumption and the resultant carbon emissions, the energy consumption is multiplied by the appropriate floor area and then by the carbon factor using the carbon factor of 0.136 kgCO_2/kWh.

8.12 For the residential element:

i. Residual Energy: 276,545.05 kWh/year
ii. Carbon Emissions: 276,545.05 kWh/year x 0.136 = 37.61 tonnes of CO_2
iii. Offset Payment: 37.61 tonnes x £200 = £7,522.03

8.13 For the non-residential element:

i. Residual Energy: 447,182.89 kWh/year
ii. Carbon Emissions: 447,182.89 kWh/year x 0.136 = 60.82 tonnes of CO_2
iii. Offset Payment: 60.82 tonnes x £200 = £12,163.37

8.14 The total offset payment to the council amounts to **£19,685.40**, based on the solar PV allowance covering approximately 40% of the available roof space area.

8.15 As required by the Places for Everyone Joint Development Plan, **Table 8.1** below details the space heat requirement, hot water energy demand, and renewable energy installation. This is compared to Table 5.1 of the Development Plan, which outlines the Best Practice Thresholds for Reducing Energy Demand and Onsite Renewable Energy Generation within residential developments.

Table 8.1: Energy Demand and Renewable Energy Generation Breakdown

ENERGY DEMAND AND RENEWABLE ENERGY GENERATION BREAKDOWN			
	Space Heat Demand	Hot Water Energy Demand	Renewable Energy Generation
2025 – Onwards	15.00 kWh/m²	20% energy reduction	40% roof area for PV
Proposed Development	5.93 kWh/m²	18% energy reduction	40% roof area for PV

9. SUSTAINABLE DESIGN AND CONSTRUCTION MEASURES

Adapting to Climate Change

9.1 One of the critical challenges facing the UK and new development is the need to mitigate and adapt to a changing climate. The Government has demonstrated a commitment to tackling climate change, setting an ambitious long-term goal of achieving net-zero carbon emissions by 2050. This target aligns with the global efforts to limit global warming and its adverse effects on the environment and communities.

9.2 Climate change is projected to cause warmer temperatures in the UK, with wetter winters, drier summers, and increased frequency of extreme weather events. Adapting to this changing climate will significantly impact the design, construction, location, cost, and operation of all new buildings in the coming decades. The NPPF has recognised the importance of addressing climate change by including adaptation and mitigation as one of its core planning principles. Consequently, the planning process also proactively require measures to ensure that new developments are resilient and sustainable in the face of climate change.

9.3 MCC's applicable PfE policies to this chapter include JP-S1 (Sustainable Development), JP-S2 (Carbon and Energy), JP-S3 (Heat and Energy Networks), JP-S4 (Flood Risk and the Water Environment), JP-S6 (Resource Efficiency) and JP-P1 (Sustainable Places). The following section outlines the key sustainability measures (**Figure 9.1**), climate change mitigation and adaptation measures considered appropriate for this development based on the latest national guidance that include but is not limited to:

Figure 9.1: Chorlton Precinct Redevelopment, Manchester Sustainability Measures

Overheating

9.4 Increasing summer temperatures increase the risk of overheating in new development, particularly in development with high standards of fabric efficiency and glazing.

9.5 To minimise the risk of overheating, the Proposed Development's apartments will utilise appropriate overheating mitigation measures including glazing with low g-value and mechanical ventilation in line with the Noise Assessment Report by e3p.

9.6 An overheating assessment in accordance with CIBSE TM59/Part O has also been carried out to assess the risk of overheating and to ensure compliance (**Appendix 4**).

Water Efficiency

9.7 Potable water is an increasingly important natural resource and with majority of the UK classes being in an area of moderate or severe water stress, the conservation of water is becoming a more significant sustainability metric.

9.8 Water usage on the Proposed Development construction site will be identified and where water is being wasted, behaviours and/or technologies will be introduced to reduce water wastage. The Proposed Development Site will aim to reduce water consumption during occupation through a range of water efficiency measures such as:

i. Water metering to enable the monitoring of water consumption; and
ii. Dual flush WC, low flow fittings, fixtures, and appliances (if applicable)

9.9 An indicative water efficiency calculation (**Appendix 5**) has been carried out to establish the predicted water consumption for the residential element of the Proposed Development. This shows an estimated water consumption of **108.12** and **108.34 litres/person/day** (l/p/d). These calculations consider flats with bath and shower and shower only respectively. The results exceed the requirements set by both MCC's PfE Plan Policy JP-S4 requirements and Part G of the Building Regulations, which mandates a maximum consumption of 125 l/p/d. MCC's PfE Plan Policy JP-S4 also encourages setting a tighter water efficiency standard of 110 l/p/d.

Material

9.10 The use of materials is relevant to both the construction and operational phases of development. The aim of the Proposed Development is to minimise its overall environmental impact through the specification of sustainable materials that can be recycled at the end of their lifetime.

9.11 Using sustainable building materials and products promotes conservation of dwindling non-renewable resources. In addition, integrating sustainable building materials (including the use of recycled materials) into Proposed Development can help reduce the environmental impacts associated with the extraction, transport, processing, fabrication, installation, reuse, recycling, and disposal of these source materials.

9.12 All timber and timber-based products used on the project shall be Legally harvested and traded timber. The use of products with responsible sourcing certifications such as FSC and BES 6001 shall be actively encouraged.

9.13 All materials shall also be responsibly sourced and where practical and feasible, materials shall be sourced from local suppliers, reducing the environmental impacts and CO_2 emissions associated with transportation to the site. Scope for increased recycling will be incorporated wherever feasible by specifying recycled materials and materials with a high recycled content.

Energy and Carbon Emission Reduction

9.14 Developing energy efficient, low carbon buildings is a key objective of national/local policy, enforced through progressive changes to the Building Regulations which require the achievement of a target carbon performance for compliance.

9.15 Building performance is determined by a variety of factors including the efficiency of heating, DHW, ventilation (**Figure 9.2**), and lighting systems as well as building fabric performance, plant efficiencies, air permeability and the avoidance of overheating.

9.16 The Proposed Development is proposed to be compliant with Part L (2021) of the Building Regulations. This performance standards will be achieved from a combination of passive design, energy efficiency and renewable technologies (ASHP, WWHRs and Solar PV).

Figure 9.2: Example Image of Wall Mounted MVHR units

9.17 The all-electric, combustion-free operational energy strategy for on-site regulated energy demand recommended for the scheme will not only help to continuously reduce the Development's operational emissions in line with the ongoing decarbonisation of the UK electricity grid but will also ensure that there will be no adverse effect on local air quality from local combustion.

9.18 The integration of a highly thermal efficient building envelope with ASHP and Solar PV will ensure potential residents are protected against the high energy prices. Essentially, the fabric first approach provides protection against fluctuations in both gas and electricity supply tariffs by inherently reducing energy consumption and expands the number of suitable energy generation and delivery options.

Sustainable Transport

9.19 The site is located within Chorlton district centre in a proximity to a number of public transport facilities (tram, bus etc.). Local bus routes operate near the site and provide services/linked services throughout Manchester. In addition, sustainable transport solutions (such as cycling) shall be encouraged to occupants.

9.20 Dedicated Electric Vehicle (EV) chargers will be considered in accordance with Part S of the Building Regulations / local planning requirements.

Waste and Recycling

9.21 The Proposed Development will ensure the minimisation of waste and maximisation of recycling of any waste generated during demolition, construction, and operation of the site.

Construction Waste Management

9.22 The Proposed Development will ensure consideration is given to sustainable waste management options in accordance with the principles of the waste hierarchy.

9.23 A Demolition Management Plan (DMP) has been prepared for the demolition phase along with audit.

9.24 A Construction Environmental Management Plan (CEMP) has been developed to ensure the use of measures to minimise waste during the construction phases of the Development, including the use of a scheme for recycling/disposing of waste arising from and construction works.

9.25 The reduction, reuse and recycling of construction waste is to be prioritised through measures such as avoidance of over-ordering, supervision of deliveries, use of secure materials storage facilities and reuse of materials onsite where feasible. In addition, the Proposed Development will be registered with the CCS Scheme.

Operational Waste Management

9.26 In accordance with the principles of the waste hierarchy the Proposed Development Site will make provision for the storage of non-recyclable waste and recyclable waste including dedicated storage to encourage the recycling of waste materials.

9.27 Full consideration will be given to the Council's waste management infrastructure and services to ensure that occupants of the Proposed Development have the necessary infrastructure to participate in any kerbside recycling services (if required).

9.28 The proposed strategy is also expected to adopt a 'zero waste' strategy, see waste and servicing strategy set out in the Design and Access Statement. This strategy involves exploring material re-use, the use of on-site fabric to reduce new materials, and on-site recycling.

Pollution

9.29 The Proposed Development will not result in a significant increase in pollution (into the air, soil, or any water body) by virtue of the emissions of fumes, particles, effluent, smell, heat, light, noise, or noxious substances.

9.30 During the DMP and CEMP phases, all potential areas of concern have been managed including waste reduction strategies, noise and dust pollution, and construction traffic.

9.31 All external lighting will also be energy efficient, and it is anticipated that suitable controls such as daylight detection and time-switches will be installed to minimise inappropriate use.

Responsible Construction

9.32 In the first instance, the Principal Contractor shall register with the CCS and shall seek to achieve satisfactory CCS score in all categories.

9.33 This shall ensure the Proposed Development construction sites shall be managed in an environmentally, socially considerate, responsible, and accountable manner. This is also a national scheme to raise standards in the industry and waste management is also a key consideration.

9.34 The Principal Contractor shall have an appropriate environmental management system (EMS) covering their main operations. The EMS could either third party certified to ISO 14001/EMAS or equivalent.

9.35 During the construction phase, all areas of concern will be managed, including waste reduction strategies, noise and dust pollution, construction traffic and protection of any and all ecology features identified on the site.

9.36 All waste materials during the construction phase will be managed in accordance with a Project Waste Management Plan and in accordance with all applicable waste legislation and the recommendations of the local authority.

9.37 The Proposed Development itself will not have any adverse effect on the Development area and pollution resulting from the construction of the site will be carefully managed.

Flooding

9.38 The Proposed Development Site lies within Flood Zone 1 of the Environment Agency's Risk Flood Map, which is defined as having a low probability of flooding.

9.39 The Flood Zones shown on the Environment Agency's Flood Map for Planning (Rivers and Sea) do not take account of the possible impacts of climate change and consequent changes in the future probability of flooding.

9.40 Reference should therefore be made to the Strategic Flood Risk Assessment when considering location and potential future flood risks to developments and land uses.

10. CONCLUSION

10.1 This ESDS has been produced to accompany a detailed planning application for a residential-led redevelopment (the 'Proposed Development') of the Chorlton Precinct site in Manchester (the 'Site'), in accordance with Manchester City Council's (MCC) Core Strategy (2012) Policies EN4 and EN6, the City's Places for Everyone Plan (PfE) Document Policies JP-S1, JP-S2, JP-S3, JP-S4, JP-S6, JP-P1 and following the guidance detailed in chapter 4 of the City Council's Guide to Development in Manchester SPD (2007) and Manchester Climate Change Framework 2020-2025.

10.2 This ESDS sets a framework for the Energy and Sustainable Design Strategy for the Development Site and outlines the site's approach to energy efficiency, renewable energy generation, sustainable design/construction incorporating climate change resilience and carbon management measures. It summarises the key planning policy which is pertinent at the time of writing and is aimed at satisfying both energy and sustainable design related requirements.

10.3 The Proposed Development will adopt the use of an energy hierarchy and a holistic approach to sustainability to meet National best practice guidance and Manchester City Council's objectives for energy consumption reduction, CO_2 emissions reduction and sustainable design and construction. The energy hierarchy aims to reduce energy demand and CO2 emissions through passive design measures and a 'fabric first' approach before seeking to reduce the remaining demand by the cleanest means possible. This includes exploiting local energy resources, and finally exploring the opportunities for producing, storing, using renewable energy on-site.

ENERGY SUMMARY

10.4 The Proposed Development envelope and services will exceed the minimum standards set in Building Regulations Part L 2021, ensuring reduced energy consumption for space heating and cooling. Passive design strategies have been integral to the Proposed Development to reduce energy demand and associated CO2 emissions. This includes insulated building fabric with high thermal performance (low U-values) and low airtightness.

10.5 Heating to the residential element of the Proposed Development is expected to be served via Electric Panel Heaters. Domestic hot water is expected to be met via an Air Source Heat Pump, while ventilation will be via mechanical ventilation with heat recovery (MVHR). All lighting will be 100% energy-efficient LED lighting.

10.6 The non-residential elements (ground floor commercial units and amenity areas) are expected to be heated and cooled via an Air Source Heat Pump (Variable Refrigerant System) and MVHR for ventilation. The comms rooms are also expected to be cooled via a DX Split System. Transient zones are expected to be heated via Electric Panel Heaters, with an Instantaneous Electric Water Heater proposed for domestic hot water. All lighting will be 100% energy-efficient LED lighting.

10.7 Additionally, a site-wide **337.51 kWp** PV system (equivalent to 675 panels) based on 500W panels with an efficiency of 20.10% is proposed to contribute towards the development's electricity demands.

10.8 This complies with the national target to exceed the Part L 2021 baseline and demonstrates compliance with Manchester City Council's requirement to adhere to the energy hierarchy that reflects national policy targets. Specifically, it aligns with the Places for Everyone Plan Policy JP-S2, which requires, as an interim measure, that development should be consistent with the Part L 2022 Building Regulations.

10.9 In line with the Places for Everyone Joint Development Plan, the total offset payment to the council amounts to £19,685.40, following the incorporation of renewable energy technologies in the form of an Air Source Heat Pump and solar PV, covering approximately 40% of the available roof space area.

10.10 The Proposed Development's space heat requirement and hot water energy demand reduction equate to 5.93 kWh/m² and approximately 18%, respectively. This represents a significant reduction in energy demand, in line with the Places for Everyone Joint Development Plan.

SUSTAINABLE DESIGN SUMMARY

10.11 In addition to the CO_2 emissions savings opportunities identified above, the Proposed Development Site shall register with the CCS and shall seek to achieve satisfactory CCS score in all categories, including but not limited to:

i. Material: The aim of the Proposed Development will be for its overall environmental impact to be minimised through the specification of sustainable materials. This will include using sustainable building materials and products & ensuring all timber and timber-based products used on the project are legally harvested & traded timber.

ii. Water: The Proposed Development aims to reduce water consumption by implementing various water efficiency measures, such as dual flush WCs, water meters, and low-flow fittings and fixtures. Indicative water efficiency calculations have been performed, achieving an estimated consumption of 108.12 and 108.34 l/p/d. This result exceeds the requirements set by MCC's PfE Plan Policy JP-S4 which encourages a water efficiency standard of 110 l/p/d and Part G of the Building Regulations, which mandates a maximum consumption of 125 l/p/d.

iii. Sustainable Transport: The Proposed Development will ensure the principles of sustainable transport hierarchy have been met by prioritising sustainable modes of transport (walking, cycling and public transport) ahead of cars wherever feasible. As well as providing the infrastructure requirement for EV charging points.

10.12 This Energy and Sustainable Design Statement presents a vision for the Proposed Development, Manchester to deliver a secure, sustainable, low carbon design driven by innovative technologies, enabling the Proposed Development to achieve any National and Local carbon / energy reduction targets whilst reducing its reliance on the UK National Grid.

11. APPENDICES

APPENDIX 1: SAP Compliance Reports: Apartments

Full SAP Calculation Printout

Property Reference	1F_Block E1_2Bed 3P	**Issued on Date**	27/03/2025
Assessment Reference	Option 1_EPH+ASHP_P08	**Prop Type Ref**	North West
Property	Chorlton-cum-Hardy, Manchester, Greater Manchester, M21 9AQ		

SAP Rating	94 A	**DER**	1.76	**TER**	10.73
Environmental	99 A	**% DER < TER**			83.60
CO_2 Emissions (t/year)	0.09	**DFEE**	17.82	**TFEE**	18.85
Compliance Check	See BREL	**% DFEE < TFEE**			5.46
% DPER < TPER	68.54	**DPER**	18.10	**TPER**	57.54

Assessor Details	Mr. Leon Maddison	**Assessor ID**	AY03-0001
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)	
Main dwelling						
Ground floor	61.0400 (1b)	x	2.4000 (2b)	=	146.4960	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	146.4960	(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) =	74.4000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2906	0.2874	0.2842	0.2682	0.2651	0.2491	0.2491	0.2459	0.2555	0.2651	0.2714	0.2778	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Glazing			15.3600	1.1450	17.5878			(27)
External Wall 1	39.4600	15.3600	24.1000	0.1500	3.6150	60.0000	1445.9999	(29a)
Total net area of external elements Aum(A, m2)			39.4600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		21.2028			(33)
Main dwelling								
Party Wall-between flats			29.9600	0.0000	0.0000	180.0000	5392.7998	(32)
Party Wall-between circ			12.5000	0.0000	0.0000	180.0000	2250.0000	(32)
Party Floor 1			61.0400			80.0000	4883.2000	(32d)
Party Ceiling 1			61.0400			100.0000	6104.0000	(32b)
Internal Wall 1			101.8800			9.0000	916.9200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 20992.9198	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	343.9207	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E4 Jamb	19.2000	0.0180	0.3456	
E7 Party floor between dwellings (in blocks of flats)	32.8800	0.0360	1.1837	
E16 Corner (normal)	2.4000	0.0400	0.0960	
E18 Party wall between dwellings	12.0000	0.0320	0.3840	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	32.8800	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 2.0093 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 23.2121 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	14.0469	13.8928	13.7387	12.9682	12.8141	12.0436	12.0436	11.8895	12.3518	12.8141	13.1223	13.4305	(38)
Heat transfer coeff	37.2589	37.1048	36.9507	36.1803	36.0262	35.2557	35.2557	35.1016	35.5639	36.0262	36.3344	36.6425	(39)

Average = Sum(39)m / 12 = 36.1417

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6104	0.6079	0.6054	0.5927	0.5902	0.5776	0.5776	0.5751	0.5826	0.5902	0.5953	0.6003	(40)
HLP (average)												0.5921	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0109 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	57.9355	57.0648	55.7961	53.3686	51.5772	49.5794	48.4439	49.7030	51.0833	53.2282	55.7079	57.7135	(42a)
Hot water usage for baths	25.0374	24.6655	24.1419	23.1764	22.4535	21.6519	21.2189	21.7388	22.3050	23.1627	24.1481	24.9527	(42b)
Hot water usage for other uses	35.2234	33.9426	32.6617	31.3809	30.1000	28.8192	28.8192	30.1000	31.3809	32.6617	33.9426	35.2234	(42c)

Average daily hot water use (litres/day) 108.6494 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	118.1963	115.6729	112.5997	107.9259	104.1307	100.0505	98.4820	101.5419	104.7691	109.0527	113.7985	117.8896	(44)
Energy conte	187.1940	164.7167	173.0616	147.7452	140.1800	123.0237	119.1054	125.7301	129.1908	147.9835	162.1269	184.5867	(45)

Energy content (annual) Total = Sum(45)m = 1804.6445

Distribution loss (46)m = 0.15 x (45)m	28.0791	24.7075	25.9592	22.1618	21.0270	18.4536	17.8658	18.8595	19.3786	22.1975	24.3190	27.6880	(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	214.1454	189.0599	200.0130	173.8272	167.1314	149.1057	146.0568	152.6815	155.2728	174.9349	188.2089	211.5381	(62)
WWHRS	-40.6792	-35.9770	-37.6730	-31.1947	-29.0724	-24.8774	-23.3186	-24.7970	-25.7392	-30.3436	-34.3757	-39.9258	(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	173.4662	153.0829	162.3399	142.6324	138.0590	124.2283	122.7382	127.8844	129.5336	144.5913	153.8332	171.6123	(64)

Total per year (kWh/year) = Sum(64)m = 1744.0018 (64)
12Total per year (kWh/year) 1744 (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	62.2420	54.7683	57.5430	49.1253	46.6098	40.9054	39.6025	41.8052	42.9559	49.2045	53.9072	61.3751	(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	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	88.5509	98.0385	88.5509	91.5026	88.5509	91.5026	88.5509	88.5509	91.5026	88.5509	91.5026	88.5509	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.5620	177.3838	172.7930	163.0196	150.6825	139.0874	131.3411	129.5193	134.1102	143.8835	156.2206	167.8158	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	(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)	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	(71)
Water heating gains (Table 5)	83.6586	81.5004	77.3427	68.2295	62.6476	56.8130	53.2292	56.1899	59.6610	66.1351	74.8711	82.4934	(72)
Total internal gains	400.9347	410.0859	391.8498	375.9150	355.0442	340.5662	326.2844	327.4233	338.4370	351.7327	375.7575	392.0232	(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	7.6800	36.7938	0.4000	0.7000	0.7700	54.8312	(77)
Southwest	7.6800	36.7938	0.4000	0.7000	0.7700	54.8312	(79)

Solar gains	109.6623	186.7955	255.5818	316.6782	354.7060	352.1410	339.5015	311.1310	276.7410	206.4489	131.3502	93.8481	(83)
Total gains	510.5971	596.8815	647.4316	692.5932	709.7503	692.7072	665.7859	638.5543	615.1780	558.1816	507.1077	485.8713	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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)													
tau	156.5092	157.1592	157.8146	161.1754	161.8648	165.4022	165.4022	166.1283	163.9688	161.8648	160.4918	159.1420	
alpha	11.4339	11.4773	11.5210	11.7450	11.7910	12.0268	12.0268	12.0752	11.9313	11.7910	11.6995	11.6095	
util living area	0.9795	0.9202	0.8098	0.6310	0.4720	0.3257	0.2330	0.2529	0.3989	0.6692	0.9194	0.9858	(86)
MIT	20.8212	20.9295	20.9831	20.9989	21.0000	21.0000	21.0000	21.0000	21.0000	20.9983	20.9430	20.7995	(87)
Th 2	20.4206	20.4229	20.4252	20.4365	20.4388	20.4502	20.4502	20.4525	20.4457	20.4388	20.4343	20.4297	(88)
util rest of house	0.9730	0.9025	0.7825	0.6020	0.4436	0.2977	0.2039	0.2228	0.3668	0.6339	0.8986	0.9810	(89)
MIT 2	20.2255	20.3527	20.4103	20.4357	20.4388	20.4502	20.4502	20.4525	20.4457	20.4377	20.3800	20.2074	(90)
Living area fraction										fLA = Living area / (4) =		0.4895	(91)
MIT	20.5171	20.6351	20.6907	20.7114	20.7135	20.7193	20.7193	20.7205	20.7170	20.7121	20.6556	20.4973	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5171	20.6351	20.6907	20.7114	20.7135	20.7193	20.7193	20.7205	20.7170	20.7121	20.6556	20.4973	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9742	0.9093	0.7953	0.6162	0.4575	0.3114	0.2181	0.2375	0.3825	0.6512	0.9071	0.9816	(94)
Useful gains	497.4348	542.7522	514.8979	426.7753	324.7043	215.7415	145.2303	151.6567	235.3251	363.4712	460.0169	476.9497	(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	604.2305	583.8470	524.3562	427.3401	324.7217	215.7417	145.2303	151.6567	235.3266	364.3011	492.5332	597.1734	(97)
Space heating kWh	79.4560	27.6157	7.0370	0.4067	0.0130	0.0000	0.0000	0.0000	0.0000	0.6174	23.4118	89.4464	(98a)
Space heating requirement - total per year (kWh/year)												228.0040	
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	79.4560	27.6157	7.0370	0.4067	0.0130	0.0000	0.0000	0.0000	0.0000	0.6174	23.4118	89.4464	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												228.0040	
Space heating per m2											(98c) / (4) =	3.7353	(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	79.4560	27.6157	7.0370	0.4067	0.0130	0.0000	0.0000	0.0000	0.0000	0.6174	23.4118	89.4464	(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)	79.4560	27.6157	7.0370	0.4067	0.0130	0.0000	0.0000	0.0000	0.0000	0.6174	23.4118	89.4464	(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	173.4662	153.0829	162.3399	142.6324	138.0590	124.2283	122.7382	127.8844	129.5336	144.5913	153.8332	171.6123	(64)
Efficiency of water heater												346.7343	(216)
(217)m	346.7343	346.7343	346.7343	346.7343	346.7343	346.7343	346.7343	346.7343	346.7343	346.7343	346.7343	346.7343	(217)
Fuel for water heating, kWh/month	50.0286	44.1499	46.8197	41.1359	39.8169	35.8281	35.3983	36.8825	37.3582	41.7009	44.3663	49.4939	(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	8.2879	7.4859	8.2879	8.0206	8.2879	8.0206	8.2879	8.2879	8.0206	8.2879	8.0206	8.2879	(231)
Lighting	20.6812	16.5912	14.9386	10.9446	8.4539	6.9069	7.7120	10.0243	13.0206	17.0837	19.2960	21.2560	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-7.9418	-13.6381	-24.2131	-32.7858	-39.9149	-38.9500	-38.1729	-33.4600	-25.8549	-17.2671	-9.3326	-6.5208	(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												228.0040	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												346.7343	
Water heating fuel used												502.9793	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.5460)													
mechanical ventilation fans (SFP = 0.5460)												97.5839	(230a)
Total electricity for the above, kWh/year												97.5839	(231)
Electricity for lighting (calculated in Appendix L)												166.9092	(232)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-288.0521	(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	707.4243	(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	228.0040	0.1610	36.7053	(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)	502.9793	0.1409	70.8756	(264)
Space and water heating			107.5809	(265)
Pumps, fans and electric keep-hot	97.5839	0.1387	13.5361	(267)
Energy for lighting	166.9092	0.1443	24.0901	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-288.0521	0.1311	-37.7718	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-37.7718	(269)
Total CO2, kg/year			107.4353	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.7600	(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	228.0040	1.5957	363.8321	(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)	502.9793	1.5210	765.0516	(278)
Space and water heating			1128.8837	(279)
Pumps, fans and electric keep-hot	97.5839	1.5128	147.6250	(281)
Energy for lighting	166.9092	1.5338	256.0108	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-288.0521	1.4844	-427.5930	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-427.5930	(283)
Total Primary energy kWh/year			1104.9265	(286)
Dwelling Primary energy Rate (DPER)			18.1000	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	61.0400	(1b) x	2.4000	(2b) =	146.4960	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		146.4960	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1365	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3865	(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) =	0.3285	(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													

	0.4189	0.4107	0.4025	0.3614	0.3532	0.3121	0.3121	0.3039	0.3285	0.3532	0.3696	0.3860	(22b)
Effective ac	0.5877	0.5843	0.5810	0.5653	0.5624	0.5487	0.5487	0.5462	0.5540	0.5624	0.5683	0.5745	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
TER Opening Type			15.2600	1.1450	17.4733			(27)
External Wall 1	39.4600	15.2600	24.2000	0.1800	4.3560			(29a)
Total net area of external elements Aum(A, m2)			39.4600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		21.8293			(33)
Main dwelling								
Party Wall-between flats			29.9600	0.0000	0.0000			(32)
Party Wall-between circ			12.5000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 323.9207 (35)

List of Thermal Bridges

Kl Element	Length	Psi-value	Total
E4 Jamb	19.2000	0.0500	0.9600
E7 Party floor between dwellings (in blocks of flats)	32.8800	0.0700	2.3016
E16 Corner (normal)	2.4000	0.0900	0.2160
E18 Party wall between dwellings	12.0000	0.0600	0.7200
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	32.8800	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.1976 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 26.0269 (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	28.4133	28.2486	28.0872	27.3289	27.1870	26.5266	26.5266	26.4043	26.7810	27.1870	27.4740	27.7741	(38)
Heat transfer coeff													
	54.4402	54.2755	54.1141	53.3558	53.2139	52.5535	52.5535	52.4312	52.8079	53.2139	53.5009	53.8010	(39)
Average = Sum(39)m / 12 =												53.3551	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8919	0.8892	0.8865	0.8741	0.8718	0.8610	0.8610	0.8590	0.8651	0.8718	0.8765	0.8814	(40)
HLP (average)												0.8741	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0109 (42)

Hot water usage for mixer showers													
	57.9355	57.0648	55.7961	53.3686	51.5772	49.5794	48.4439	49.7030	51.0833	53.2282	55.7079	57.7135	(42a)
Hot water usage for baths													
	25.0374	24.6655	24.1419	23.1764	22.4535	21.6519	21.2189	21.7388	22.3050	23.1627	24.1481	24.9527	(42b)
Hot water usage for other uses													
	35.2234	33.9426	32.6617	31.3809	30.1000	28.8192	28.8192	30.1000	31.3809	32.6617	33.9426	35.2234	(42c)
Average daily hot water use (litres/day)												108.6494	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	118.1963	115.6729	112.5997	107.9259	104.1307	100.0505	98.4820	101.5419	104.7691	109.0527	113.7985	117.8896	(44)
Energy conte	187.1940	164.7167	173.0616	147.7452	140.1800	123.0237	119.1054	125.7301	129.1908	147.9835	162.1269	184.5867	(45)
Energy content (annual)										Total = Sum(45)m =		1804.6445	
Distribution loss (46)m = 0.15 x (45)m													
	28.0791	24.7075	25.9592	22.1618	21.0270	18.4536	17.8658	18.8595	19.3786	22.1975	24.3190	27.6880	(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													
	233.7889	206.8024	219.6565	192.8370	186.7749	168.1156	165.7003	172.3250	174.2826	194.5784	207.2187	231.1816	(62)
WWHRS	-26.4857	-23.4241	-24.5284	-20.3105	-18.9287	-16.1974	-15.1825	-16.1450	-16.7584	-19.7563	-22.3815	-25.9952	(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													
	207.3032	183.3783	195.1281	172.5265	167.8462	151.9182	150.5178	156.1799	157.5242	174.8221	184.8372	205.1864	(64)
										Total per year (kWh/year) = Sum(64)m =		2107.1681	(64)
12Total per year (kWh/year)												2107	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	99.5179	88.4369	94.8189	85.1987	83.8858	76.9789	76.8785	79.0812	79.0294	86.4804	89.9807	98.6510	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	88.5509	98.0385	88.5509	91.5026	88.5509	91.5026	88.5509	88.5509	91.5026	88.5509	91.5026	88.5509	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	175.5620	177.3838	172.7930	163.0196	150.6825	139.0874	131.3411	129.5193	134.1102	143.8835	156.2206	167.8158	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	(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)													
	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	(71)
Water heating gains (Table 5)													
	133.7606	131.6025	127.4447	118.3316	112.7497	106.9151	103.3313	106.2919	109.7631	116.2372	124.9731	132.5954	(72)
Total internal gains													

	454.0368	463.1880	444.9518	429.0170	408.1463	390.6683	376.3865	377.5253	388.5390	404.8348	428.8596	445.1253	(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	7.6300	36.7938	0.6300	0.7000	0.7700	85.7969	(77)
Southwest	7.6300	36.7938	0.6300	0.7000	0.7700	85.7969	(79)

Solar gains	171.5937	292.2876	399.9206	495.5210	555.0249	551.0112	531.2336	486.8411	433.0295	323.0400	205.5297	146.8485	(83)
Total gains	625.6305	755.4756	844.8724	924.5380	963.1712	941.6795	907.6201	864.3664	821.5685	727.8748	634.3893	591.9737	(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	100.8860	101.1922	101.4941	102.9365	103.2109	104.5079	104.5079	104.7517	104.0045	103.2109	102.6572	102.0847	
alpha	7.7257	7.7461	7.7663	7.8624	7.8807	7.9672	7.9672	7.9834	7.9336	7.8807	7.8438	7.8056	
util living area	0.9819	0.9391	0.8506	0.6852	0.5125	0.3571	0.2548	0.2790	0.4431	0.7373	0.9440	0.9870	(86)
MIT	20.5637	20.7566	20.9022	20.9821	20.9981	20.9999	21.0000	21.0000	20.9995	20.9751	20.7852	20.5263	(87)
Th 2	20.1744	20.1767	20.1790	20.1896	20.1915	20.2008	20.2008	20.2025	20.1972	20.1915	20.1875	20.1833	(88)
util rest of house	0.9758	0.9224	0.8195	0.6435	0.4685	0.3126	0.2085	0.2307	0.3918	0.6879	0.9256	0.9824	(89)
MIT 2	19.6926	19.9254	20.0880	20.1755	20.1904	20.2008	20.2008	20.2025	20.1970	20.1730	19.9724	19.6539	(90)
Living area fraction									fLA = Living area / (4) =			0.4895	(91)
MIT	20.1190	20.3323	20.4866	20.5703	20.5858	20.5920	20.5920	20.5929	20.5899	20.5657	20.3703	20.0810	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1190	20.3323	20.4866	20.5703	20.5858	20.5920	20.5920	20.5929	20.5899	20.5657	20.3703	20.0810	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9753	0.9258	0.8317	0.6634	0.4900	0.3344	0.2311	0.2543	0.4169	0.7112	0.9302	0.9818	(94)
Useful gains	610.1884	699.4495	702.6416	613.3091	471.9612	314.8644	209.7931	219.8353	342.5212	517.6850	590.0865	581.1788	(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	861.1914	837.5949	756.8713	622.6794	472.8468	314.8983	209.7945	219.8383	342.7154	530.3116	709.9732	854.4123	(97)
Space heating kWh	186.7462	92.8337	40.3468	6.7466	0.6589	0.0000	0.0000	0.0000	0.0000	9.3941	86.3185	203.2858	(98a)
Space heating requirement - total per year (kWh/year)												626.3307	
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	186.7462	92.8337	40.3468	6.7466	0.6589	0.0000	0.0000	0.0000	0.0000	9.3941	86.3185	203.2858	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												626.3307	
Space heating per m2											(98c) / (4) =	10.2610	(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	186.7462	92.8337	40.3468	6.7466	0.6589	0.0000	0.0000	0.0000	0.0000	9.3941	86.3185	203.2858	(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)	202.3253	100.5782	43.7127	7.3094	0.7139	0.0000	0.0000	0.0000	0.0000	10.1778	93.5195	220.2446	(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	207.3032	183.3783	195.1281	172.5265	167.8462	151.9182	150.5178	156.1799	157.5242	174.8221	184.8372	205.1864	(64)
Efficiency of water heater												79.8000	(216)
(217)m	83.8263	82.6141	81.2103	80.1055	79.8316	79.8000	79.8000	79.8000	79.8000	80.2146	82.4605	84.0389	(217)
Fuel for water heating, kWh/month	247.3008	221.9696	240.2751	215.3740	210.2502	190.3737	188.6188	195.7142	197.3988	217.9430	224.1524	244.1564	(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	18.3991	14.7605	13.2902	9.7369	7.5211	6.1448	6.8610	8.9182	11.5838	15.1986	17.1668	18.9105	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.6042	-17.5882	-27.1587	-32.8823	-37.5668	-35.8532	-35.4244	-32.3852	-27.4172	-21.1131	-13.1880	-9.8950	(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	-3.2916	-7.1436	-14.6169	-22.5830	-30.4861	-30.8567	-30.4874	-25.5192	-18.3280	-10.4108	-4.4562	-2.5865	(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	678.5815	(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	2593.5270	(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)	148.4915	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-502.8425	(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	3003.7575	(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	678.5815	0.2100	142.5021	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2593.5270	0.2100	544.6407	(264)
Space and water heating			687.1428	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	148.4915	0.1443	21.4319	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-302.0764	0.1331	-40.2041	
PV Unit electricity exported	-200.7661	0.1251	-25.1127	
Total			-65.3167	(269)
Total CO2, kg/year			655.1872	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.7300	(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	678.5815	1.1300	766.7971	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2593.5270	1.1300	2930.6856	(278)
Space and water heating			3697.4826	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	148.4915	1.5338	227.7612	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-302.0764	1.4918	-450.6379	
PV Unit electricity exported	-200.7661	0.4591	-92.1729	
Total			-542.8108	(283)
Total Primary energy kWh/year			3512.5338	(286)
Target Primary Energy Rate (TPER)			57.5400	(287)

Full SAP Calculation Printout

Property Reference	1F_Block F4_3Bed	**Issued on Date**	27/03/2025
Assessment Reference	Option 1_EPH+ASHP_P08	**Prop Type Ref**	North West
Property	Chorlton-cum-Hardy, Manchester, Greater Manchester, M21 9AQ		

SAP Rating	94 A	**DER**	1.77	**TER**	9.55
Environmental	99 A	**% DER < TER**			81.47
CO_2 Emissions (t/year)	0.1	**DFEE**	17.54	**TFEE**	18.79
Compliance Check	See BREL	**% DFEE < TFEE**			6.65
% DPER < TPER	63.71	**DPER**	18.25	**TPER**	50.28

Assessor Details	Mr. Leon Maddison	**Assessor ID**	AY03-0001
Client			

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	70.5700 (1b)	x	2.4000 (2b)	=	169.3680	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.5700					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	169.3680	(5)

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2. Ventilation rate

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			m3 per hour	
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		0 * 10 =	0.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		0.0000 / (5) =	0.0000	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			3.0000	(17)
Infiltration rate			0.1500	(18)
Number of sides sheltered			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) =	73.6000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2946	0.2914	0.2882	0.2722	0.2691	0.2531	0.2531	0.2499	0.2595	0.2691	0.2754	0.2818	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Glazing			15.3600	1.1450	17.5878			(27)
External Wall 1	40.9300	15.3600	25.5700	0.1500	3.8355	60.0000	1534.2000	(29a)
Total net area of external elements Aum(A, m2)			40.9300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		21.4233			(33)
Main dwelling								
Party Wall-between flats			34.2800	0.0000	0.0000	180.0000	6170.3998	(32)
Party Wall-between circ			6.6500	0.0000	0.0000	180.0000	1197.0000	(32)
Party Floor 1			70.5700			80.0000	5645.6000	(32d)
Party Ceiling 1			70.5700			100.0000	7057.0000	(32b)
Internal Wall 1			114.1200			9.0000	1027.0800	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 22631.2798	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	320.6926	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E4 Jamb	19.2000	0.0180	0.3456	
E7 Party floor between dwellings (in blocks of flats)	34.1100	0.0360	1.2280	
E16 Corner (normal)	2.4000	0.0400	0.0960	
E18 Party wall between dwellings	9.6000	0.0320	0.3072	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	34.1100	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.9768 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 23.4000 (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	16.4635	16.2854	16.1072	15.2164	15.0383	14.1475	14.1475	13.9694	14.5038	15.0383	15.3946	15.7509	(38)
Heat transfer coeff	39.8636	39.6854	39.5073	38.6165	38.4383	37.5476	37.5476	37.3694	37.9039	38.4383	38.7946	39.1510	(39)
Average = Sum(39)m / 12 =												38.5720	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5649	0.5624	0.5598	0.5472	0.5447	0.5321	0.5321	0.5295	0.5371	0.5447	0.5497	0.5548	(40)
HLP (average)												0.5466	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2599 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
62.1105	61.1771	59.8169	57.2145	55.2940	53.1523	51.9349	53.2848	54.7645	57.0640	59.7223	61.8725	(42a)

Hot water usage for baths

26.8328	26.4343	25.8731	24.8384	24.0636	23.2045	22.7404	23.2977	23.9044	24.8237	25.8797	26.7420	(42b)

Hot water usage for other uses

37.7735	36.3999	35.0263	33.6527	32.2791	30.9056	30.9056	32.2791	33.6527	35.0263	36.3999	37.7735	(42c)

Average daily hot water use (litres/day) 116.4815 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	126.7167	124.0112	120.7163	115.7056	111.6368	107.2623	105.5809	108.8616	112.3216	116.9141	122.0019	126.3880	(44)
Energy conte	200.6883	176.5903	185.5365	158.3952	150.2845	131.8916	127.6910	134.7934	138.5038	158.6513	173.8141	197.8931	(45)
Energy content (annual)											Total = Sum(45)m =	1934.7330	
Distribution loss (46)m = 0.15 x (45)m	30.1032	26.4885	27.8305	23.7593	22.5427	19.7837	19.1536	20.2190	20.7756	23.7977	26.0721	29.6840	(46)
Water storage loss:													
Store volume												269.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7700	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.9558	(55)
Total storage loss	29.6298	26.7624	29.6298	28.6740	29.6298	28.6740	29.6298	29.6298	28.6740	29.6298	28.6740	29.6298	(56)
If cylinder contains dedicated solar storage	29.6298	26.7624	29.6298	28.6740	29.6298	28.6740	29.6298	29.6298	28.6740	29.6298	28.6740	29.6298	(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	230.3181	203.3527	215.1663	187.0692	179.9143	160.5656	157.3208	164.4232	167.1778	188.2811	202.4881	227.5229	(62)
WWHRS	-43.6106	-38.5696	-40.3878	-33.4427	-31.1674	-26.6702	-24.9991	-26.5840	-27.5940	-32.5303	-36.8529	-42.8030	(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	186.7074	164.7831	174.7784	153.6265	148.7469	133.8954	132.3217	137.8392	139.5838	155.7508	165.6353	184.7199	(64)
										Total per year (kWh/year) = Sum(64)m =		1878.3883	(64)
12Total per year (kWh/year)												1878	(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	66.7288	58.7163	61.6909	52.6664	49.9696	43.8539	42.4573	44.8188	46.0525	52.7515	57.7932	65.7994	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	112.9942	112.9942	112.9942	112.9942	112.9942	112.9942	112.9942	112.9942	112.9942	112.9942	112.9942	112.9942	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	100.2566	110.9984	100.2566	103.5985	100.2566	103.5985	100.2566	100.2566	103.5985	100.2566	103.5985	100.2566	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	198.6237	200.6848	195.4909	184.4338	170.4761	157.3578	148.5940	146.5329	151.7268	162.7840	176.7417	189.8599	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2994	34.2994	34.2994	34.2994	34.2994	34.2994	34.2994	34.2994	34.2994	34.2994	34.2994	34.2994	(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)	-90.3953	-90.3953	-90.3953	-90.3953	-90.3953	-90.3953	-90.3953	-90.3953	-90.3953	-90.3953	-90.3953	-90.3953	(71)
Water heating gains (Table 5)	89.6893	87.3754	82.9178	73.1478	67.1634	60.9083	57.0662	60.2403	63.9618	70.9026	80.2683	88.4401	(72)
Total internal gains	445.4679	455.9568	435.5636	418.0783	394.7943	378.7628	362.8150	363.9281	376.1853	390.8414	417.5067	435.4549	(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	
South	7.6800	46.7521	0.4000	0.7000	0.7700	69.6712	(78)
West	7.6800	19.6403	0.4000	0.7000	0.7700	29.2685	(80)

Solar gains	98.9397	171.3588	239.6389	301.7926	339.7178	337.2657	325.2125	297.4052	261.4974	191.0095	119.0785	84.2713	(83)
Total gains	544.4075	627.3156	675.2025	719.8709	734.5122	716.0285	688.0276	661.3333	637.6828	581.8510	536.5852	519.7262	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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)													
tau	157.6995	158.4075	159.1218	162.7923	163.5468	167.4267	167.4267	168.2249	165.8529	163.5468	162.0447	160.5700	
alpha	11.5133	11.5605	11.6081	11.8528	11.9031	12.1618	12.1618	12.2150	12.0569	11.9031	11.8030	11.7047	
util living area	0.9804	0.9286	0.8266	0.6477	0.4866	0.3356	0.2401	0.2599	0.4101	0.6846	0.9242	0.9860	(86)
MIT	20.8205	20.9232	20.9799	20.9987	21.0000	21.0000	21.0000	21.0000	21.0000	20.9980	20.9409	20.8021	(87)
Th 2	20.4617	20.4640	20.4663	20.4777	20.4800	20.4915	20.4915	20.4938	20.4869	20.4800	20.4755	20.4709	(88)
util rest of house	0.9746	0.9131	0.8016	0.6202	0.4595	0.3089	0.2124	0.2313	0.3796	0.6513	0.9055	0.9816	(89)
MIT 2	20.2633	20.3856	20.4479	20.4767	20.4800	20.4915	20.4915	20.4938	20.4869	20.4786	20.4177	20.2491	(90)
Living area fraction										fLA = Living area / (4) =		0.3385	(91)
MIT	20.4520	20.5676	20.6280	20.6534	20.6560	20.6637	20.6637	20.6652	20.6606	20.6544	20.5948	20.4363	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.4520	20.5676	20.6280	20.6534	20.6560	20.6637	20.6637	20.6652	20.6606	20.6544	20.5948	20.4363	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9745	0.9162	0.8094	0.6295	0.4687	0.3180	0.2218	0.2410	0.3900	0.6625	0.9100	0.9813	(94)
Useful gains	530.5245	574.7717	546.4850	453.1647	344.2326	227.6756	152.5806	159.3874	248.6710	385.4751	488.3145	509.9954	(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	643.8752	621.7760	558.1600	453.8749	344.2547	227.6757	152.5806	159.3874	248.6728	386.4759	523.5270	635.6673	(97)
Space heating kWh	84.3329	31.5869	8.6862	0.5113	0.0165	0.0000	0.0000	0.0000	0.0000	0.7446	25.3530	93.4999	(98a)
Space heating requirement - total per year (kWh/year)												244.7313	
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	84.3329	31.5869	8.6862	0.5113	0.0165	0.0000	0.0000	0.0000	0.0000	0.7446	25.3530	93.4999	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												244.7313	
Space heating per m2											(98c) / (4) =	3.4679	(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	84.3329	31.5869	8.6862	0.5113	0.0165	0.0000	0.0000	0.0000	0.0000	0.7446	25.3530	93.4999	(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)	84.3329	31.5869	8.6862	0.5113	0.0165	0.0000	0.0000	0.0000	0.0000	0.7446	25.3530	93.4999	(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	186.7074	164.7831	174.7784	153.6265	148.7469	133.8954	132.3217	137.8392	139.5838	155.7508	165.6353	184.7199	(64)
Efficiency of water heater												337.6948	(216)
(217)m	337.6948	337.6948	337.6948	337.6948	337.6948	337.6948	337.6948	337.6948	337.6948	337.6948	337.6948	337.6948	(217)
Fuel for water heating, kWh/month	55.2888	48.7965	51.7563	45.4927	44.0477	39.6498	39.1838	40.8177	41.3343	46.1218	49.0488	54.7002	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	11.3018	10.2080	11.3018	10.9372	11.3018	10.9372	11.3018	11.3018	10.9372	11.3018	10.9372	11.3018	(231)
Lighting	23.3560	18.7371	16.8707	12.3602	9.5473	7.8003	8.7094	11.3208	14.7046	19.2933	21.7917	24.0052	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-8.0085	-13.8410	-24.7312	-33.6992	-41.2307	-40.3142	-39.5023	-34.5122	-26.5296	-17.5920	-9.4419	-6.5675	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	244.7313	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	337.6948	
Water heating fuel used	556.2384	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.6440)		
mechanical ventilation fans (SFP = 0.6440)	133.0691	(230a)
Total electricity for the above, kWh/year	133.0691	(231)
Electricity for lighting (calculated in Appendix L)	188.4966	(232)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-295.9702	(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	826.5652	(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	244.7313	0.1609	39.3745	(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)	556.2384	0.1409	78.3748	(264)
Space and water heating			117.7493	(265)
Pumps, fans and electric keep-hot	133.0691	0.1387	18.4583	(267)
Energy for lighting	188.4966	0.1443	27.2059	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-295.9702	0.1310	-38.7784	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-38.7784	(269)
Total CO2, kg/year			124.6351	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.7700	(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	244.7313	1.5954	390.4398	(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)	556.2384	1.5210	846.0398	(278)
Space and water heating			1236.4796	(279)
Pumps, fans and electric keep-hot	133.0691	1.5128	201.3069	(281)
Energy for lighting	188.4966	1.5338	289.1223	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-295.9702	1.4840	-439.2277	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-439.2277	(283)
Total Primary energy kWh/year			1287.6810	(286)
Dwelling Primary energy Rate (DPER)			18.2500	(287)

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

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling							
Ground floor		70.5700	(1b) x	2.4000	(2b) =	169.3680	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.5700						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		169.3680	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1771	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4271	(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) =	0.3631	(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													

	0.4629	0.4538	0.4447	0.3994	0.3903	0.3449	0.3449	0.3358	0.3631	0.3903	0.4084	0.4266	(22b)
Effective ac	0.6071	0.6030	0.5989	0.5797	0.5762	0.5595	0.5595	0.5564	0.5659	0.5762	0.5834	0.5910	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
TER Opening Type			15.3600	1.1450	17.5878			(27)
External Wall 1	40.9300	15.3600	25.5700	0.1800	4.6026			(29a)
Total net area of external elements Aum(A, m2)			40.9300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	22.1904			(33)
Main dwelling								
Party Wall-between flats			34.2800	0.0000	0.0000			(32)
Party Wall-between circ			6.6500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 300.6926 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E4 Jamb	19.2000	0.0500	0.9600
E7 Party floor between dwellings (in blocks of flats)	34.1100	0.0700	2.3877
E16 Corner (normal)	2.4000	0.0900	0.2160
E18 Party wall between dwellings	9.6000	0.0600	0.5760
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	34.1100	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.1397 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 26.3301 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	33.9339	33.7013	33.4734	32.4029	32.2026	31.2702	31.2702	31.0975	31.6293	32.2026	32.6078	33.0314	(38)
Heat transfer coeff	60.2639	60.0314	59.8035	58.7330	58.5327	57.6002	57.6002	57.4276	57.9594	58.5327	58.9379	59.3615	(39)
Average = Sum(39)m / 12 =												58.7320	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8540	0.8507	0.8474	0.8323	0.8294	0.8162	0.8162	0.8138	0.8213	0.8294	0.8352	0.8412	(40)
HLP (average)												0.8323	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2599 (42)

Hot water usage for mixer showers	62.1105	61.1771	59.8169	57.2145	55.2940	53.1523	51.9349	53.2848	54.7645	57.0640	59.7223	61.8725	(42a)
Hot water usage for baths	26.8328	26.4343	25.8731	24.8384	24.0636	23.2045	22.7404	23.2977	23.9044	24.8237	25.8797	26.7420	(42b)
Hot water usage for other uses	37.7735	36.3999	35.0263	33.6527	32.2791	30.9056	30.9056	32.2791	33.6527	35.0263	36.3999	37.7735	(42c)
Average daily hot water use (litres/day)												116.4815	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	126.7167	124.0112	120.7163	115.7056	111.6368	107.2623	105.5809	108.8616	112.3216	116.9141	122.0019	126.3880	(44)
Energy conte	200.6883	176.5903	185.5365	158.3952	150.2845	131.8916	127.6910	134.7934	138.5038	158.6513	173.8141	197.8931	(45)
Energy content (annual)										Total = Sum(45)m =		1934.7330	
Distribution loss (46)m = 0.15 x (45)m	30.1032	26.4885	27.8305	23.7593	22.5427	19.7837	19.1536	20.2190	20.7756	23.7977	26.0721	29.6840	(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	247.2832	218.6760	232.1314	203.4870	196.8794	176.9834	174.2859	181.3883	183.5956	205.2462	218.9060	244.4880	(62)
WWHRS	-28.3943	-25.1122	-26.2960	-21.7741	-20.2927	-17.3646	-16.2766	-17.3085	-17.9661	-21.1801	-23.9944	-27.8685	(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	218.8888	193.5639	205.8353	181.7129	176.5867	159.6188	158.0093	164.0798	165.6295	184.0661	194.9115	216.6195	(64)
										Total per year (kWh/year) = Sum(64)m =		2219.5223	(64)
12Total per year (kWh/year)												2220	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	104.0048	92.3848	98.9668	88.7399	87.2455	79.9274	79.7332	82.0947	82.1260	90.0275	93.8667	103.0754	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	112.9942	112.9942	112.9942	112.9942	112.9942	112.9942	112.9942	112.9942	112.9942	112.9942	112.9942	112.9942	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	100.2566	110.9984	100.2566	103.5985	100.2566	103.5985	100.2566	100.2566	103.5985	100.2566	103.5985	100.2566	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	198.6237	200.6848	195.4909	184.4338	170.4761	157.3578	148.5940	146.5329	151.7268	162.7840	176.7417	189.8599	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2994	34.2994	34.2994	34.2994	34.2994	34.2994	34.2994	34.2994	34.2994	34.2994	34.2994	34.2994	(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)	-90.3953	-90.3953	-90.3953	-90.3953	-90.3953	-90.3953	-90.3953	-90.3953	-90.3953	-90.3953	-90.3953	-90.3953	(71)
Water heating gains (Table 5)	139.7914	137.4775	133.0199	123.2498	117.2655	111.0103	107.1682	110.3424	114.0639	121.0047	130.3704	138.5422	(72)
Total internal gains													

	498.5699	509.0589	488.6656	471.1803	447.8964	428.8648	412.9171	414.0301	426.2874	443.9435	470.6088	488.5569	(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	
South	7.6800	46.7521	0.6300	0.7000	0.7700	109.7321	(78)
West	7.6800	19.6403	0.6300	0.7000	0.7700	46.0978	(80)

Solar gains	155.8300	269.8901	377.4313	475.3234	535.0556	531.1934	512.2097	468.4132	411.8585	300.8400	187.5486	132.7273	(83)
Total gains	654.3999	778.9490	866.0969	946.5037	982.9520	960.0583	925.1268	882.4433	838.1458	744.7835	658.1573	621.2842	(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	97.8099	98.1888	98.5630	100.3595	100.7029	102.3331	102.3331	102.6408	101.6990	100.7029	100.0106	99.2969	
alpha	7.5207	7.5459	7.5709	7.6906	7.7135	7.8222	7.8222	7.8427	7.7799	7.7135	7.6674	7.6198	
util living area													
	0.9859	0.9547	0.8839	0.7283	0.5512	0.3838	0.2739	0.2993	0.4764	0.7793	0.9568	0.9896	(86)
MIT	20.5040	20.6939	20.8603	20.9706	20.9965	20.9998	21.0000	21.0000	20.9991	20.9609	20.7390	20.4738	(87)
Th 2	20.2068	20.2096	20.2124	20.2255	20.2279	20.2393	20.2393	20.2414	20.2349	20.2279	20.2230	20.2178	(88)
util rest of house													
	0.9813	0.9422	0.8578	0.6882	0.5065	0.3383	0.2266	0.2500	0.4239	0.7332	0.9426	0.9861	(89)
MIT 2	19.6493	19.8833	20.0764	20.2011	20.2256	20.2392	20.2393	20.2414	20.2344	20.1969	19.9524	19.6207	(90)
Living area fraction										fLA = Living area / (4) =		0.3385	(91)
MIT	19.9387	20.1577	20.3418	20.4616	20.4865	20.4967	20.4968	20.4982	20.4933	20.4556	20.2187	19.9095	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9387	20.1577	20.3418	20.4616	20.4865	20.4967	20.4968	20.4982	20.4933	20.4556	20.2187	19.9095	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9794	0.9412	0.8624	0.7007	0.5215	0.3537	0.2426	0.2667	0.4417	0.7473	0.9425	0.9844	(94)
Useful gains	640.9249	733.1751	746.9077	663.2429	512.6355	339.5871	224.4549	235.3448	370.1905	556.5527	620.3127	611.5994	(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													
	942.4475	915.9409	827.7872	679.0485	514.2994	339.6519	224.4576	235.3502	370.5518	576.8727	773.1898	932.5398	(97)
Space heating kWh													
	224.3328	122.8186	60.1743	11.3800	1.2380	0.0000	0.0000	0.0000	0.0000	15.1181	110.0715	238.7796	(98a)
Space heating requirement - total per year (kWh/year)												783.9130	
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													
	224.3328	122.8186	60.1743	11.3800	1.2380	0.0000	0.0000	0.0000	0.0000	15.1181	110.0715	238.7796	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												783.9130	
Space heating per m2											(98c) / (4) =	11.1083	(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													
	224.3328	122.8186	60.1743	11.3800	1.2380	0.0000	0.0000	0.0000	0.0000	15.1181	110.0715	238.7796	(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)													
	243.0475	133.0646	65.1943	12.3294	1.3412	0.0000	0.0000	0.0000	0.0000	16.3793	119.2540	258.6995	(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													
	218.8888	193.5639	205.8353	181.7129	176.5867	159.6188	158.0093	164.0798	165.6295	184.0661	194.9115	216.6195	(64)
Efficiency of water heater												79.8000	(216)
(217)m	84.1149	83.0683	81.6725	80.2795	79.8563	79.8000	79.8000	79.8000	79.8000	80.4186	82.8298	84.2787	(217)
Fuel for water heating, kWh/month													
	260.2259	233.0178	252.0253	226.3503	221.1305	200.0235	198.0067	205.6138	207.5558	228.8849	235.3157	257.0275	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	20.8313	16.7117	15.0470	11.0241	8.5153	6.9571	7.7680	10.0971	13.1151	17.2077	19.4361	21.4103	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-18.9063	-28.0105	-42.2888	-50.0225	-56.1179	-53.1810	-52.5334	-48.5109	-41.7995	-33.1082	-21.2618	-16.1914	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-6.9257	-14.8792	-30.1582	-46.1649	-61.8989	-62.5067	-61.7704	-51.9064	-37.5315	-21.5602	-9.3365	-5.4538	(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	849.3098	(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	2725.1778	(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)	168.1208	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-872.0248	(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	2956.5837	(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	849.3098	0.2100	178.3551	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2725.1778	0.2100	572.2873	(264)
Space and water heating			750.6424	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	168.1208	0.1443	24.2650	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-461.9322	0.1336	-61.6925	
PV Unit electricity exported	-410.0926	0.1253	-51.4023	
Total			-113.0948	(269)
Total CO2, kg/year			673.7419	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.5500	(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	849.3098	1.1300	959.7201	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2725.1778	1.1300	3079.4509	(278)
Space and water heating			4039.1710	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	168.1208	1.5338	257.8693	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-461.9322	1.4935	-689.9101	
PV Unit electricity exported	-410.0926	0.4601	-188.6710	
Total			-878.5811	(283)
Total Primary energy kWh/year			3548.5600	(286)
Target Primary Energy Rate (TPER)			50.2800	(287)

Full SAP Calculation Printout

Property Reference	2F_Block B11_2Bed 4P	**Issued on Date**	27/03/2025
Assessment Reference	Option 1_EPH+ASHP_P08	**Prop Type Ref**	North West
Property	Chorlton-cum-Hardy, Manchester, Greater Manchester, M21 9AQ		

SAP Rating	93 A	**DER**	1.95	**TER**	10.40
Environmental	99 A	**% DER < TER**			81.25
CO_2 Emissions (t/year)	0.11	**DFEE**	21.33	**TFEE**	23.07
Compliance Check	See BREL	**% DFEE < TFEE**			7.53
% DPER < TPER	64.66	**DPER**	19.90	**TPER**	56.31

Assessor Details	Mr. Leon Maddison	**Assessor ID**	AY03-0001
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)	
Main dwelling						
Ground floor	72.0200	(1b)	x 2.4000	(2b) =	172.8480	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	172.8480	(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) =												74.4000	(23c)
Effective ac	0.2906	0.2874	0.2842	0.2682	0.2651	0.2491	0.2491	0.2459	0.2555	0.2651	0.2714	0.2778	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Glazing			18.7200	1.1450	21.4351			(27)
External Wall 1	42.8600	18.7200	24.1400	0.1500	3.6210	60.0000	1448.4000	(29a)
Total net area of external elements Aum(A, m2)			42.8600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.0561			(33)
Main dwelling								
Party Wall-between flats			16.3200	0.0000	0.0000	180.0000	2937.5999	(32)
Party Wall-between circ			28.6800	0.0000	0.0000	180.0000	5162.4001	(32)
Party Floor 1			72.0200			80.0000	5761.6000	(32d)
Party Ceiling 1			72.0200			100.0000	7202.0000	(32b)
Internal Wall 1			116.5400			9.0000	1048.8600	(32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		23560.8600	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							327.1433	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E4 Jamb	28.8000	0.0180	0.5184	
E7 Party floor between dwellings (in blocks of flats)	35.7200	0.0360	1.2859	
E16 Corner (normal)	9.6000	0.0400	0.3840	
E18 Party wall between dwellings	12.0000	0.0320	0.3840	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	37.5000	0.0000	0.0000	
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0820	-0.3936	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			2.1787	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	27.2348	(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	16.5736	16.3918	16.2100	15.3009	15.1191	14.2101	14.2101	14.0282	14.5737	15.1191	15.4828	15.8464	(38)
Heat transfer coeff	43.8085	43.6267	43.4448	42.5358	42.3540	41.4449	41.4449	41.2631	41.8085	42.3540	42.7176	43.0812	(39)
Average = Sum(39)m / 12 =												42.4903	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6083	0.6058	0.6032	0.5906	0.5881	0.5755	0.5755	0.5729	0.5805	0.5881	0.5931	0.5982	(40)
HLP (average)												0.5900	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2941	(42)
Hot water usage for mixer showers	80.5042	79.2944	77.5314	74.1584	71.6691	68.8931	67.3152	69.0649	70.9827	73.9633	77.4088	80.1958	(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses	38.1244	36.7380	35.3517	33.9654	32.5790	31.1927	31.1927	32.5790	33.9654	35.3517	36.7380	38.1244	(42c)
Average daily hot water use (litres/day)												108.8807	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	118.6286	116.0324	112.8831	108.1237	104.2481	100.0858	98.5079	101.6439	104.9481	109.3150	114.1469	118.3202	(44)
Energy conte	187.8787	165.2286	173.4972	148.0160	140.3380	123.0672	119.1368	125.8563	129.4115	148.3394	162.6232	185.2608	(45)
Energy content (annual)										Total = Sum(45)m =		1808.6537	
Distribution loss (46)m = 0.15 x (45)m	28.1818	24.7843	26.0246	22.2024	21.0507	18.4601	17.8705	18.8785	19.4117	22.2509	24.3935	27.7891	(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	214.8301	189.5718	200.4486	174.0980	167.2894	149.1492	146.0882	152.8077	155.4935	175.2908	188.7052	212.2122	(62)
WWHRS	-56.5257	-49.9918	-52.3485	-43.3467	-40.3975	-34.5685	-32.4024	-34.4567	-35.7659	-42.1640	-47.7667	-55.4789	(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	158.3044	139.5800	148.1000	130.7513	126.8919	114.5807	113.6858	118.3510	119.7277	133.1268	140.9385	156.7332	(64)
										Total per year (kWh/year) = Sum(64)m =		1600.7714	(64)
12Total per year (kWh/year)												1601	(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	62.4697	54.9385	57.6878	49.2153	46.6624	40.9198	39.6130	41.8472	43.0293	49.3229	54.0722	61.5992	(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	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	101.8681	112.7826	101.8681	105.2637	101.8681	105.2637	101.8681	101.8681	105.2637	101.8681	105.2637	101.8681	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	201.9649	204.0607	198.7794	187.5363	173.3438	160.0048	151.0936	148.9978	154.2791	165.5223	179.7148	193.0537	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	(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)	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	(71)
Water heating gains (Table 5)	83.9646	81.7538	77.5374	68.3546	62.7183	56.8331	53.2433	56.2463	59.7630	66.2942	75.1003	82.7946	(72)
Total internal gains	445.2099	456.0092	435.5972	418.5668	395.3424	379.5139	363.6172	364.5245	376.7180	391.0968	417.4910	435.1287	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.0800	11.2829	0.4000	0.7000	0.7700	22.0686	(75)
Southeast	8.6400	36.7938	0.4000	0.7000	0.7700	61.6851	(77)

Solar gains	83.7536	149.9937	224.6985	311.0479	378.1879	388.5559	369.1565	317.0639	254.2858	171.0248	101.6525	70.8119	(83)
Total gains	528.9635	606.0029	660.2957	729.6148	773.5303	768.0698	732.7738	681.5884	631.0039	562.1216	519.1435	505.9405	(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	149.3931	150.0157	150.6435	153.8630	154.5235	157.9129	157.9129	158.6087	156.5395	154.5235	153.2082	151.9150	
alpha	10.9595	11.0010	11.0429	11.2575	11.3016	11.5275	11.5275	11.5739	11.4360	11.3016	11.2139	11.1277	
util living area	0.9919	0.9674	0.8937	0.7013	0.5091	0.3453	0.2489	0.2785	0.4571	0.7723	0.9654	0.9943	(86)
MIT	20.7311	20.8490	20.9482	20.9961	20.9999	21.0000	21.0000	21.0000	21.0000	20.9917	20.8794	20.7127	(87)
Th 2	20.4226	20.4248	20.4271	20.4385	20.4407	20.4521	20.4521	20.4544	20.4476	20.4407	20.4362	20.4316	(88)
util rest of house	0.9891	0.9580	0.8715	0.6701	0.4785	0.3158	0.2179	0.2455	0.4206	0.7348	0.9539	0.9923	(89)
MIT 2	20.1172	20.2634	20.3776	20.4353	20.4407	20.4521	20.4521	20.4544	20.4476	20.4344	20.3116	20.1022	(90)
Living area fraction										fLA = Living area / (4) =		0.4250	(91)
MIT	20.3781	20.5123	20.6201	20.6737	20.6783	20.6850	20.6850	20.6863	20.6823	20.6713	20.5530	20.3617	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3781	20.5123	20.6201	20.6737	20.6783	20.6850	20.6850	20.6863	20.6823	20.6713	20.5530	20.3617	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9888	0.9596	0.8793	0.6832	0.4915	0.3283	0.2310	0.2595	0.4361	0.7505	0.9565	0.9920	(94)
Useful gains	523.0613	581.4914	580.5961	498.5075	380.2048	252.1911	169.3018	176.8659	275.1864	421.8533	496.5691	501.8964	(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	704.3573	681.1118	613.4472	500.8015	380.2681	252.1916	169.3019	176.8659	275.1981	426.5587	574.6776	696.2646	(97)
Space heating kWh	134.8842	66.9449	24.4412	1.6517	0.0471	0.0000	0.0000	0.0000	0.0000	3.5008	56.2381	144.6099	(98a)
Space heating requirement - total per year (kWh/year)												432.3179	
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	134.8842	66.9449	24.4412	1.6517	0.0471	0.0000	0.0000	0.0000	0.0000	3.5008	56.2381	144.6099	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												432.3179	
Space heating per m2											(98c) / (4) =	6.0027	(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	134.8842	66.9449	24.4412	1.6517	0.0471	0.0000	0.0000	0.0000	0.0000	3.5008	56.2381	144.6099	(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)	134.8842	66.9449	24.4412	1.6517	0.0471	0.0000	0.0000	0.0000	0.0000	3.5008	56.2381	144.6099	(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	158.3044	139.5800	148.1000	130.7513	126.8919	114.5807	113.6858	118.3510	119.7277	133.1268	140.9385	156.7332	(64)
Efficiency of water heater												346.6611	(216)
(217)m	346.6611	346.6611	346.6611	346.6611	346.6611	346.6611	346.6611	346.6611	346.6611	346.6611	346.6611	346.6611	(217)
Fuel for water heating, kWh/month	45.6655	40.2641	42.7219	37.7173	36.6040	33.0527	32.7945	34.1403	34.5374	38.4026	40.6560	45.2122	(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	9.7788	8.8325	9.7788	9.4634	9.7788	9.4634	9.7788	9.7788	9.4634	9.7788	9.4634	9.7788	(231)
Lighting	24.7950	19.8915	17.9101	13.1217	10.1356	8.2808	9.2460	12.0183	15.6106	20.4819	23.1343	25.4841	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-8.0694	-13.9819	-24.8561	-33.5955	-41.0276	-40.0993	-39.2974	-34.3453	-26.4274	-17.5711	-9.5124	-6.6129	(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												432.3179	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												346.6611	
Water heating fuel used												461.7684	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.5460)													
mechanical ventilation fans (SFP = 0.5460)												115.1375	(230a)
Total electricity for the above, kWh/year												115.1375	(231)

Electricity for lighting (calculated in Appendix L)	200.1099	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-295.3962	(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	913.9374	(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	432.3179	0.1601	69.2187	(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)	461.7684	0.1408	65.0227	(264)
Space and water heating			134.2414	(265)
Pumps, fans and electric keep-hot	115.1375	0.1387	15.9710	(267)
Energy for lighting	200.1099	0.1443	28.8820	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-295.3962	0.1311	-38.7239	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-38.7239	(269)
Total CO2, kg/year			140.3705	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.9500	(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	432.3179	1.5925	688.4871	(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)	461.7684	1.5207	702.1963	(278)
Space and water heating			1390.6833	(279)
Pumps, fans and electric keep-hot	115.1375	1.5128	174.1800	(281)
Energy for lighting	200.1099	1.5338	306.9352	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-295.3962	1.4843	-438.4537	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-438.4537	(283)
Total Primary energy kWh/year			1433.3449	(286)
Dwelling Primary energy Rate (DPER)			19.9000	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	72.0200	(1b) x	2.4000	(2b) =	172.8480	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 72.0200						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		172.8480	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1736	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4236	(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) =	0.3600	(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													
	0.4590	0.4500	0.4410	0.3960	0.3870	0.3420	0.3420	0.3330	0.3600	0.3870	0.4050	0.4230	(22b)
Effective ac	0.6054	0.6013	0.5973	0.5784	0.5749	0.5585	0.5585	0.5555	0.5648	0.5749	0.5820	0.5895	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opening Type			18.0000	1.1450	20.6107			(27)
External Wall 1	42.8600	18.0000	24.8600	0.1800	4.4748			(29a)
Total net area of external elements Aum(A, m2)			42.8600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.0855			(33)
Main dwelling								
Party Wall-between flats			16.3200	0.0000	0.0000			(32)
Party Wall-between circ			28.6800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 307.1433 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E4 Jamb	28.8000	0.0500	1.4400
E7 Party floor between dwellings (in blocks of flats)	35.7200	0.0700	2.5004
E16 Corner (normal)	9.6000	0.0900	0.8640
E18 Party wall between dwellings	12.0000	0.0600	0.7200
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	37.5000	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0900	-0.4320

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.0924 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 30.1779 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	34.5295	34.2961	34.0674	32.9930	32.7920	31.8563	31.8563	31.6830	32.2167	32.7920	33.1986	33.6238	(38)
Heat transfer coeff	64.7074	64.4740	64.2453	63.1709	62.9699	62.0341	62.0341	61.8609	62.3946	62.9699	63.3765	63.8017	(39)
Average = Sum(39)m / 12 =												63.1699	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8985	0.8952	0.8920	0.8771	0.8743	0.8613	0.8613	0.8589	0.8664	0.8743	0.8800	0.8859	(40)
HLP (average)												0.8771	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2941 (42)

Hot water usage for mixer showers													
	80.5042	79.2944	77.5314	74.1584	71.6691	68.8931	67.3152	69.0649	70.9827	73.9633	77.4088	80.1958	(42a)
Hot water usage for baths													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses													
	38.1244	36.7380	35.3517	33.9654	32.5790	31.1927	31.1927	32.5790	33.9654	35.3517	36.7380	38.1244	(42c)
Average daily hot water use (litres/day)												108.8807	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	118.6286	116.0324	112.8831	108.1237	104.2481	100.0858	98.5079	101.6439	104.9481	109.3150	114.1469	118.3202	(44)
Energy conte	187.8787	165.2286	173.4972	148.0160	140.3380	123.0672	119.1368	125.8563	129.4115	148.3394	162.6232	185.2608	(45)
Energy content (annual)										Total = Sum(45)m =		1808.6537	
Distribution loss (46)m = 0.15 x (45)m													
	28.1818	24.7843	26.0246	22.2024	21.0507	18.4601	17.8705	18.8785	19.4117	22.2509	24.3935	27.7891	(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													
	234.4736	207.3144	220.0921	193.1078	186.9329	168.1590	165.7317	172.4512	174.5034	194.9343	207.7150	231.8557	(62)
WWHRS	-36.8032	-32.5490	-34.0835	-28.2224	-26.3023	-22.5071	-21.0968	-22.4343	-23.2867	-27.4524	-31.1003	-36.1216	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	197.6704	174.7653	186.0086	164.8854	160.6306	145.6519	144.6349	150.0169	151.2167	167.4819	176.6147	195.7340	(64)
										Total per year (kWh/year) = Sum(64)m =		2015.3115	(64)
12Total per year (kWh/year)												2015	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	99.7456	88.6071	94.9637	85.2888	83.9383	76.9933	76.8889	79.1232	79.1028	86.5988	90.1457	98.8751	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	101.8681	112.7826	101.8681	105.2637	101.8681	105.2637	101.8681	101.8681	105.2637	101.8681	105.2637	101.8681	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	201.9649	204.0607	198.7794	187.5363	173.3438	160.0048	151.0936	148.9978	154.2791	165.5223	179.7148	193.0537	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	(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)													
	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	(71)
Water heating gains (Table 5)													

	134.0667	131.8558	127.6394	118.4566	112.8203	106.9351	103.3453	106.3483	109.8650	116.3962	125.2023	132.8967	(72)
Total internal gains	498.3119	509.1113	488.6992	471.6689	448.4444	429.6159	413.7193	414.6265	426.8201	444.1989	470.5931	488.2307	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	9.6900	11.2829	0.6300	0.7000	0.7700	33.4132	(75)
Southeast	8.3100	36.7938	0.6300	0.7000	0.7700	93.4432	(77)

Solar gains	126.8564	227.1819	340.3199	471.0852	572.7560	588.4527	559.0753	480.1913	385.1263	259.0329	153.9659	107.2548	(83)
Total gains	625.1684	736.2932	829.0191	942.7540	1021.2004	1018.0686	972.7945	894.8179	811.9463	703.2317	624.5590	595.4856	(84)

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7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	94.9594	95.3031	95.6424	97.2690	97.5795	99.0515	99.0515	99.3289	98.4793	97.5795	96.9534	96.3074	
alpha	7.3306	7.3535	7.3762	7.4846	7.5053	7.6034	7.6034	7.6219	7.5653	7.5053	7.4636	7.4205	
util living area	0.9923	0.9753	0.9253	0.7724	0.5697	0.3898	0.2806	0.3180	0.5282	0.8487	0.9764	0.9943	(86)
MIT	20.3963	20.5802	20.7841	20.9524	20.9949	20.9998	21.0000	21.0000	20.9978	20.9236	20.6433	20.3695	(87)
Th 2	20.1688	20.1716	20.1743	20.1870	20.1894	20.2005	20.2005	20.2025	20.1962	20.1894	20.1845	20.1795	(88)
util rest of house	0.9895	0.9674	0.9045	0.7312	0.5215	0.3412	0.2296	0.2629	0.4677	0.8054	0.9673	0.9922	(89)
MIT 2	19.4818	19.7130	19.9576	20.1470	20.1860	20.2004	20.2005	20.2025	20.1951	20.1261	19.8045	19.4566	(90)
Living area fraction									fLA = Living area / (4) =			0.4250	(91)
MIT	19.8705	20.0816	20.3088	20.4893	20.5298	20.5401	20.5403	20.5415	20.5363	20.4650	20.1610	19.8446	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8705	20.0816	20.3088	20.4893	20.5298	20.5401	20.5403	20.5415	20.5363	20.4650	20.1610	19.8446	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9883	0.9663	0.9082	0.7470	0.5419	0.3618	0.2513	0.2863	0.4934	0.8210	0.9670	0.9912	(94)
Useful gains	617.8554	711.5142	752.9459	704.1940	553.3541	368.3869	244.4271	256.1806	400.5981	577.3755	603.9260	590.2174	(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	1007.5271	978.8166	887.1529	732.1050	556.0116	368.4905	244.4321	256.1939	401.5875	621.2006	827.7637	998.1521	(97)
Space heating kWh	289.9158	179.6272	99.8500	20.0960	1.9772	0.0000	0.0000	0.0000	0.0000	32.6059	161.1631	303.5034	(98a)
Space heating requirement - total per year (kWh/year)												1088.7386	
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	289.9158	179.6272	99.8500	20.0960	1.9772	0.0000	0.0000	0.0000	0.0000	32.6059	161.1631	303.5034	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1088.7386	
Space heating per m2										(98c) / (4) =		15.1172	(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	289.9158	179.6272	99.8500	20.0960	1.9772	0.0000	0.0000	0.0000	0.0000	32.6059	161.1631	303.5034	(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)	314.1016	194.6123	108.1799	21.7724	2.1421	0.0000	0.0000	0.0000	0.0000	35.3260	174.6079	328.8228	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	197.6704	174.7653	186.0086	164.8854	160.6306	145.6519	144.6349	150.0169	151.2167	167.4819	176.6147	195.7340	(64)
Efficiency of water heater												79.8000	(216)
(217)m	84.9174	84.1214	82.7288	80.6884	79.8985	79.8000	79.8000	79.8000	79.8000	81.1401	83.8550	85.0397	(217)
Fuel for water heating, kWh/month	232.7798	207.7537	224.8416	204.3482	201.0434	182.5212	181.2468	187.9911	189.4946	206.4108	210.6192	230.1678	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	21.1662	16.9803	15.2889	11.2013	8.6522	7.0689	7.8928	10.2594	13.3259	17.4843	19.7485	21.7545	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-9.5284	-14.6702	-23.0038	-28.2921	-32.7127	-31.3557	-30.9755	-28.1263	-23.5359	-17.7867	-10.9048	-8.1002	(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	-2.1885	-4.7836	-9.8565	-15.3363	-20.8170	-21.1175	-20.8700	-17.4206	-12.4468	-7.0096	-2.9740	-1.7176 (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	1179.5651	(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	2459.2181	(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)	170.8232	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-395.5299	(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	3500.0765	(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	1179.5651	0.2100	247.7087	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2459.2181	0.2100	516.4358	(264)
Space and water heating			764.1445	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	170.8232	0.1443	24.6551	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-258.9921	0.1328	-34.3922	
PV Unit electricity exported	-136.5378	0.1249	-17.0506	
Total			-51.4428	(269)
Total CO2, kg/year			749.2860	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.4000	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1179.5651	1.1300	1332.9085	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2459.2181	1.1300	2778.9165	(278)
Space and water heating			4111.8250	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	170.8232	1.5338	262.0143	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-258.9921	1.4907	-386.0730	
PV Unit electricity exported	-136.5378	0.4583	-62.5805	
Total			-448.6535	(283)
Total Primary energy kWh/year			4055.2866	(286)
Target Primary Energy Rate (TPER)			56.3100	(287)

Full SAP Calculation Printout

Property Reference	2F_Block E6_2Bed 3P	**Issued on Date**	27/03/2025
Assessment Reference	Option 1_EPH+ASHP_P08	**Prop Type Ref**	North West
Property	Chorlton-cum-Hardy, Manchester, Greater Manchester, M21 9AQ		

SAP Rating	93 A	**DER**	2.29	**TER**	12.18
Environmental	98 A	**% DER < TER**			81.20
CO_2 Emissions (t/year)	0.1	**DFEE**	23.05	**TFEE**	25.89
Compliance Check	See BREL	**% DFEE < TFEE**			10.97
% DPER < TPER	64.22	**DPER**	23.38	**TPER**	65.34

Assessor Details	Mr. Leon Maddison	**Assessor ID**	AY03-0001
Client			

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	61.0400 (1b)	x	2.4000 (2b)	=	146.4960	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	146.4960	(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) =	74.4000	(23c)

Effective ac	0.2906	0.2874	0.2842	0.2682	0.2651	0.2491	0.2491	0.2459	0.2555	0.2651	0.2714	0.2778	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Glazing			15.3600	1.1450	17.5878			(27)
External Wall 1	39.4600	15.3600	24.1000	0.1500	3.6150	60.0000	1445.9999	(29a)
Total net area of external elements Aum(A, m2)			39.4600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		21.2028			(33)
Main dwelling								
Party Wall-between flats			29.9600	0.0000	0.0000	180.0000	5392.7998	(32)
Party Wall-between circ			12.5000	0.0000	0.0000	180.0000	2250.0000	(32)
Party Floor 1			61.0400			80.0000	4883.2000	(32d)
Party Ceiling 1			61.0400			100.0000	6104.0000	(32b)
Internal Wall 1			101.8800			9.0000	916.9200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 20992.9198	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	343.9207	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E4 Jamb	19.2000	0.0180	0.3456	
E7 Party floor between dwellings (in blocks of flats)	32.8800	0.0360	1.1837	
E16 Corner (normal)	2.4000	0.0400	0.0960	
E18 Party wall between dwellings	12.0000	0.0320	0.3840	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	32.8800	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 2.0093 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 23.2121 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	14.0469	13.8928	13.7387	12.9682	12.8141	12.0436	12.0436	11.8895	12.3518	12.8141	13.1223	13.4305	(38)
Heat transfer coeff	37.2589	37.1048	36.9507	36.1803	36.0262	35.2557	35.2557	35.1016	35.5639	36.0262	36.3344	36.6425	(39)

Average = Sum(39)m / 12 = 36.1417

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6104	0.6079	0.6054	0.5927	0.5902	0.5776	0.5776	0.5751	0.5826	0.5902	0.5953	0.6003	(40)
HLP (average)												0.5921	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0109 (42)
Hot water usage for mixer showers

57.9355	57.0648	55.7961	53.3686	51.5772	49.5794	48.4439	49.7030	51.0833	53.2282	55.7079	57.7135	(42a)

Hot water usage for baths

25.0374	24.6655	24.1419	23.1764	22.4535	21.6519	21.2189	21.7388	22.3050	23.1627	24.1481	24.9527	(42b)

Hot water usage for other uses

35.2234	33.9426	32.6617	31.3809	30.1000	28.8192	28.8192	30.1000	31.3809	32.6617	33.9426	35.2234	(42c)

Average daily hot water use (litres/day) 108.6494 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	118.1963	115.6729	112.5997	107.9259	104.1307	100.0505	98.4820	101.5419	104.7691	109.0527	113.7985	117.8896	(44)
Energy conte	187.1940	164.7167	173.0616	147.7452	140.1800	123.0237	119.1054	125.7301	129.1908	147.9835	162.1269	184.5867	(45)

Energy content (annual) Total = Sum(45)m = 1804.6445
Distribution loss (46)m = 0.15 x (45)m

28.0791	24.7075	25.9592	22.1618	21.0270	18.4536	17.8658	18.8595	19.3786	22.1975	24.3190	27.6880	(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

214.1454	189.0599	200.0130	173.8272	167.1314	149.1057	146.0568	152.6815	155.2728	174.9349	188.2089	211.5381	(62)
WWHRS -40.6792	-35.9770	-37.6730	-31.1947	-29.0724	-24.8774	-23.3186	-24.7970	-25.7392	-30.3436	-34.3757	-39.9258	(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

173.4662	153.0829	162.3399	142.6324	138.0590	124.2283	122.7382	127.8844	129.5336	144.5913	153.8332	171.6123	(64)

Total per year (kWh/year) = Sum(64)m = 1744.0018 (64)
12Total per year (kWh/year) 1744 (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

62.2420	54.7683	57.5430	49.1253	46.6098	40.9054	39.6025	41.8052	42.9559	49.2045	53.9072	61.3751	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	88.5509	98.0385	88.5509	91.5026	88.5509	91.5026	88.5509	88.5509	91.5026	88.5509	91.5026	88.5509	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.5620	177.3838	172.7930	163.0196	150.6825	139.0874	131.3411	129.5193	134.1102	143.8835	156.2206	167.8158	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	(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)	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	(71)
Water heating gains (Table 5)	83.6586	81.5004	77.3427	68.2295	62.6476	56.8130	53.2292	56.1899	59.6610	66.1351	74.8711	82.4934	(72)
Total internal gains	400.9347	410.0859	391.8498	375.9150	355.0442	340.5662	326.2844	327.4233	338.4370	351.7327	375.7575	392.0232	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.6800	11.2829	0.4000	0.7000	0.7700	16.8141	(75)
Northwest	7.6800	11.2829	0.4000	0.7000	0.7700	16.8141	(81)

Solar gains	33.6283	68.4514	123.3276	202.5393	272.2526	290.2501	271.5230	216.4613	150.2766	83.6530	42.3131	27.4626	(83)
Total gains	434.5630	478.5373	515.1773	578.4543	627.2968	630.8163	597.8074	543.8846	488.7136	435.3857	418.0706	419.4858	(84)

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7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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)													
tau	156.5092	157.1592	157.8146	161.1754	161.8648	165.4022	165.4022	166.1283	163.9688	161.8648	160.4918	159.1420	
alpha	11.4339	11.4773	11.5210	11.7450	11.7910	12.0268	12.0268	12.0752	11.9313	11.7910	11.6995	11.6095	
util living area	0.9950	0.9834	0.9369	0.7496	0.5340	0.3577	0.2595	0.2969	0.5020	0.8366	0.9792	0.9963	(86)
MIT	20.7219	20.8141	20.9221	20.9939	20.9999	21.0000	21.0000	21.0000	21.0000	20.9847	20.8595	20.7099	(87)
Th 2	20.4206	20.4229	20.4252	20.4365	20.4388	20.4502	20.4502	20.4525	20.4457	20.4388	20.4343	20.4297	(88)
util rest of house	0.9930	0.9776	0.9196	0.7172	0.5018	0.3270	0.2271	0.2615	0.4618	0.7997	0.9711	0.9948	(89)
MIT 2	20.1028	20.2195	20.3484	20.4317	20.4387	20.4502	20.4502	20.4525	20.4456	20.4270	20.2864	20.0957	(90)
Living area fraction										fLA = Living area / (4) =		0.4897	(91)
MIT	20.4059	20.5107	20.6294	20.7070	20.7135	20.7194	20.7194	20.7206	20.7171	20.7001	20.5670	20.3965	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.4059	20.5107	20.6294	20.7070	20.7135	20.7194	20.7194	20.7206	20.7171	20.7001	20.5670	20.3965	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9930	0.9786	0.9261	0.7329	0.5175	0.3420	0.2429	0.2788	0.4815	0.8173	0.9733	0.9947	(94)
Useful gains	431.5150	468.2988	477.1170	423.9373	324.6555	215.7445	145.2335	151.6599	235.3088	355.8555	406.8984	417.2680	(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	600.0892	579.2323	522.0900	427.1807	324.7220	215.7448	145.2335	151.6599	235.3287	363.8670	489.3164	593.4810	(97)
Space heating kWh	125.4192	74.5473	33.4599	2.3352	0.0495	0.0000	0.0000	0.0000	0.0000	5.9605	59.3410	131.1025	(98a)
Space heating requirement - total per year (kWh/year)												432.2151	
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	125.4192	74.5473	33.4599	2.3352	0.0495	0.0000	0.0000	0.0000	0.0000	5.9605	59.3410	131.1025	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												432.2151	
Space heating per m2											(98c) / (4) =	7.0809	(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	125.4192	74.5473	33.4599	2.3352	0.0495	0.0000	0.0000	0.0000	0.0000	5.9605	59.3410	131.1025	(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)	125.4192	74.5473	33.4599	2.3352	0.0495	0.0000	0.0000	0.0000	0.0000	5.9605	59.3410	131.1025	(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	173.4662	153.0829	162.3399	142.6324	138.0590	124.2283	122.7382	127.8844	129.5336	144.5913	153.8332	171.6123	(64)
Efficiency of water heater												346.7343	(216)
(217)m	346.7343	346.7343	346.7343	346.7343	346.7343	346.7343	346.7343	346.7343	346.7343	346.7343	346.7343	346.7343	(217)
Fuel for water heating, kWh/month	50.0286	44.1499	46.8197	41.1359	39.8169	35.8281	35.3983	36.8825	37.3582	41.7009	44.3663	49.4939	(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	8.2879	7.4859	8.2879	8.0206	8.2879	8.0206	8.2879	8.2879	8.0206	8.2879	8.0206	8.2879	(231)
Lighting	20.6812	16.5912	14.9386	10.9446	8.4539	6.9069	7.7120	10.0243	13.0206	17.0837	19.2960	21.2560	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-8.0142	-13.8876	-24.5885	-32.8443	-39.9166	-38.9500	-38.1729	-33.4600	-25.8549	-17.3263	-9.4456	-6.5692	(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	432.2151	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	346.7343	
Water heating fuel used	502.9793	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.5460)		
mechanical ventilation fans (SFP = 0.5460)	97.5839	(230a)
Total electricity for the above, kWh/year	97.5839	(231)
Electricity for lighting (calculated in Appendix L)	166.9092	(232)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-289.0302	(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	910.6573	(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	432.2151	0.1596	68.9716	(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)	502.9793	0.1409	70.8756	(264)
Space and water heating			139.8471	(265)
Pumps, fans and electric keep-hot	97.5839	0.1387	13.5361	(267)
Energy for lighting	166.9092	0.1443	24.0901	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-289.0302	0.1312	-37.9226	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-37.9226	(269)
Total CO2, kg/year			139.5508	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.2900	(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	432.2151	1.5906	687.4933	(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)	502.9793	1.5210	765.0516	(278)
Space and water heating			1452.5449	(279)
Pumps, fans and electric keep-hot	97.5839	1.5128	147.6250	(281)
Energy for lighting	166.9092	1.5338	256.0108	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-289.0302	1.4847	-429.1298	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-429.1298	(283)
Total Primary energy kWh/year			1427.0509	(286)
Dwelling Primary energy Rate (DPER)			23.3800	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	61.0400	(1b) x	2.4000	(2b) =	146.4960	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		146.4960	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1365	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3865	(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) =	0.3285	(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													

	0.4189	0.4107	0.4025	0.3614	0.3532	0.3121	0.3121	0.3039	0.3285	0.3532	0.3696	0.3860	(22b)
Effective ac	0.5877	0.5843	0.5810	0.5653	0.5624	0.5487	0.5487	0.5462	0.5540	0.5624	0.5683	0.5745	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
TER Opening Type			15.2600	1.1450	17.4733			(27)
External Wall 1	39.4600	15.2600	24.2000	0.1800	4.3560			(29a)
Total net area of external elements Aum(A, m2)			39.4600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		21.8293			(33)
Main dwelling								
Party Wall-between flats			29.9600	0.0000	0.0000			(32)
Party Wall-between circ			12.5000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 323.9207 (35)

List of Thermal Bridges

Kl Element	Length	Psi-value	Total
E4 Jamb	19.2000	0.0500	0.9600
E7 Party floor between dwellings (in blocks of flats)	32.8800	0.0700	2.3016
E16 Corner (normal)	2.4000	0.0900	0.2160
E18 Party wall between dwellings	12.0000	0.0600	0.7200
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	32.8800	0.0000	0.0000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.1976 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 26.0269 (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	28.4133	28.2486	28.0872	27.3289	27.1870	26.5266	26.5266	26.4043	26.7810	27.1870	27.4740	27.7741	(38)
Heat transfer coeff													
	54.4402	54.2755	54.1141	53.3558	53.2139	52.5535	52.5535	52.4312	52.8079	53.2139	53.5009	53.8010	(39)
Average = Sum(39)m / 12 =												53.3551	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8919	0.8892	0.8865	0.8741	0.8718	0.8610	0.8610	0.8590	0.8651	0.8718	0.8765	0.8814	(40)
HLP (average)												0.8741	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0109 (42)

Hot water usage for mixer showers													
	57.9355	57.0648	55.7961	53.3686	51.5772	49.5794	48.4439	49.7030	51.0833	53.2282	55.7079	57.7135	(42a)
Hot water usage for baths													
	25.0374	24.6655	24.1419	23.1764	22.4535	21.6519	21.2189	21.7388	22.3050	23.1627	24.1481	24.9527	(42b)
Hot water usage for other uses													
	35.2234	33.9426	32.6617	31.3809	30.1000	28.8192	28.8192	30.1000	31.3809	32.6617	33.9426	35.2234	(42c)
Average daily hot water use (litres/day)												108.6494	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	118.1963	115.6729	112.5997	107.9259	104.1307	100.0505	98.4820	101.5419	104.7691	109.0527	113.7985	117.8896	(44)
Energy conte	187.1940	164.7167	173.0616	147.7452	140.1800	123.0237	119.1054	125.7301	129.1908	147.9835	162.1269	184.5867	(45)
Energy content (annual)										Total = Sum(45)m =		1804.6445	
Distribution loss (46)m = 0.15 x (45)m													
	28.0791	24.7075	25.9592	22.1618	21.0270	18.4536	17.8658	18.8595	19.3786	22.1975	24.3190	27.6880	(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													
	233.7889	206.8024	219.6565	192.8370	186.7749	168.1156	165.7003	172.3250	174.2826	194.5784	207.2187	231.1816	(62)
WWHRS	-26.4857	-23.4241	-24.5284	-20.3105	-18.9287	-16.1974	-15.1825	-16.1450	-16.7584	-19.7563	-22.3815	-25.9952	(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													
	207.3032	183.3783	195.1281	172.5265	167.8462	151.9182	150.5178	156.1799	157.5242	174.8221	184.8372	205.1864	(64)
										Total per year (kWh/year) = Sum(64)m =		2107.1681	(64)
12Total per year (kWh/year)												2107	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	99.5179	88.4369	94.8189	85.1987	83.8858	76.9789	76.8785	79.0812	79.0294	86.4804	89.9807	98.6510	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	88.5509	98.0385	88.5509	91.5026	88.5509	91.5026	88.5509	88.5509	91.5026	88.5509	91.5026	88.5509	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	175.5620	177.3838	172.7930	163.0196	150.6825	139.0874	131.3411	129.5193	134.1102	143.8835	156.2206	167.8158	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	(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)													
	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	(71)
Water heating gains (Table 5)													
	133.7606	131.6025	127.4447	118.3316	112.7497	106.9151	103.3313	106.2919	109.7631	116.2372	124.9731	132.5954	(72)
Total internal gains													

	454.0368	463.1880	444.9518	429.0170	408.1463	390.6683	376.3865	377.5253	388.5390	404.8348	428.8596	445.1253 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.6300	11.2829	0.6300	0.7000	0.7700	26.3099	(75)
Northwest	7.6300	11.2829	0.6300	0.7000	0.7700	26.3099	(81)

Solar gains	52.6197	107.1090	192.9764	316.9226	426.0062	454.1677	424.8645	338.7069	235.1447	130.8957	66.2092	42.9719 (83)
Total gains	506.6565	570.2970	637.9282	745.9396	834.1525	844.8359	801.2510	716.2323	623.6837	535.7305	495.0688	488.0972 (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	100.8860	101.1922	101.4941	102.9365	103.2109	104.5079	104.5079	104.7517	104.0045	103.2109	102.6572	102.0847	
alpha	7.7257	7.7461	7.7663	7.8624	7.8807	7.9672	7.9672	7.9834	7.9336	7.8807	7.8438	7.8056	
util living area	0.9951	0.9869	0.9552	0.8137	0.5893	0.3980	0.2886	0.3367	0.5808	0.9013	0.9859	0.9962	(86)
MIT	20.4007	20.5396	20.7404	20.9427	20.9951	20.9998	21.0000	21.0000	20.9968	20.8952	20.6209	20.3810	(87)
Th 2	20.1744	20.1767	20.1790	20.1896	20.1915	20.2008	20.2008	20.2025	20.1972	20.1915	20.1875	20.1833	(88)
util rest of house	0.9933	0.9821	0.9402	0.7735	0.5397	0.3484	0.2362	0.2784	0.5149	0.8648	0.9797	0.9948	(89)
MIT 2	19.4890	19.6656	19.9121	20.1412	20.1884	20.2007	20.2008	20.2025	20.1957	20.1018	19.7780	19.4713	(90)
Living area fraction									fLA = Living area / (4) =			0.4897	(91)
MIT	19.9354	20.0936	20.3177	20.5337	20.5834	20.5920	20.5921	20.5930	20.5880	20.4903	20.1907	19.9168	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9354	20.0936	20.3177	20.5337	20.5834	20.5920	20.5921	20.5930	20.5880	20.4903	20.1907	19.9168	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9926	0.9815	0.9431	0.7912	0.5639	0.3726	0.2618	0.3069	0.5472	0.8794	0.9798	0.9942	(94)
Useful gains	502.8902	559.7720	601.6161	590.1563	470.3737	314.8252	209.7976	219.8319	341.2769	471.0997	485.0535	485.2445	(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	851.1962	824.6393	747.7321	620.7228	472.7206	314.9012	209.8011	219.8441	342.6157	526.3019	700.3665	845.5771	(97)
Space heating kWh	259.1396	177.9908	108.7103	22.0079	1.7461	0.0000	0.0000	0.0000	0.0000	41.0705	155.0253	268.0875	(98a)
Space heating requirement - total per year (kWh/year)												1033.7779	
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	259.1396	177.9908	108.7103	22.0079	1.7461	0.0000	0.0000	0.0000	0.0000	41.0705	155.0253	268.0875	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1033.7779	
Space heating per m2											(98c) / (4) =	16.9361	(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	259.1396	177.9908	108.7103	22.0079	1.7461	0.0000	0.0000	0.0000	0.0000	41.0705	155.0253	268.0875	(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)	280.7580	192.8394	117.7793	23.8439	1.8917	0.0000	0.0000	0.0000	0.0000	44.4967	167.9581	290.4523	(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	207.3032	183.3783	195.1281	172.5265	167.8462	151.9182	150.5178	156.1799	157.5242	174.8221	184.8372	205.1864	(64)
Efficiency of water heater												79.8000	(216)
(217)m	84.5614	83.9929	82.8026	80.7256	79.8834	79.8000	79.8000	79.8000	79.8000	81.3688	83.6680	84.6604	(217)
Fuel for water heating, kWh/month	245.1510	218.3258	235.6544	213.7197	210.1141	190.3737	188.6188	195.7142	197.3988	214.8514	220.9174	242.3640	(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	18.3991	14.7605	13.2902	9.7369	7.5211	6.1448	6.8610	8.9182	11.5838	15.1986	17.1668	18.9105	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.6042	-17.5882	-27.1587	-32.8823	-37.5668	-35.8532	-35.4244	-32.3852	-27.4172	-21.1131	-13.1880	-9.8950	(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	-3.2916	-7.1436	-14.6169	-22.5830	-30.4861	-30.8567	-30.4874	-25.5192	-18.3280	-10.4108	-4.4562	-2.5865	(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	1120.0194	(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	2573.2033	(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)	148.4915	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-502.8425	(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	3424.8718	(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	1120.0194	0.2100	235.2041	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2573.2033	0.2100	540.3727	(264)
Space and water heating			775.5768	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	148.4915	0.1443	21.4319	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-302.0764	0.1331	-40.2041	
PV Unit electricity exported	-200.7661	0.1251	-25.1127	
Total			-65.3167	(269)
Total CO2, kg/year			743.6212	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.1800	(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	1120.0194	1.1300	1265.6220	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2573.2033	1.1300	2907.7198	(278)
Space and water heating			4173.3418	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	148.4915	1.5338	227.7612	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-302.0764	1.4918	-450.6379	
PV Unit electricity exported	-200.7661	0.4591	-92.1729	
Total			-542.8108	(283)
Total Primary energy kWh/year			3988.3929	(286)
Target Primary Energy Rate (TPER)			65.3400	(287)

Full SAP Calculation Printout

Property Reference	2F_Block F2_1Bed	**Issued on Date**	27/03/2025
Assessment Reference	Option 1_EPH+ASHP_P08	**Prop Type Ref**	North West
Property	Chorlton-cum-Hardy, Manchester, Greater Manchester, M21 9AQ		

SAP Rating	95 A	**DER**	1.67	**TER**	12.01
Environmental	99 A	**% DER < TER**			86.09
CO_2 Emissions (t/year)	0.07	**DFEE**	17.80	**TFEE**	21.34
Compliance Check	See BREL	**% DFEE < TFEE**			16.56
% DPER < TPER	73.04	**DPER**	17.23	**TPER**	63.91

Assessor Details	Mr. Leon Maddison	**Assessor ID**	AY03-0001
Client			

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	50.5000	(1b)	x 2.4000	(2b) =	121.2000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	121.2000	(5)

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2. Ventilation rate

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

	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		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) =	74.4000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2906	0.2874	0.2842	0.2682	0.2651	0.2491	0.2491	0.2459	0.2555	0.2651	0.2714	0.2778	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Glazing			7.6800	1.1450	8.7939			(27)
External Wall 1	34.1200	7.6800	26.4400	0.1500	3.9660	60.0000	1586.3999	(29a)
Total net area of external elements Aum(A, m2)			34.1200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		12.7599			(33)
Main dwelling								
Party Wall-between flats			17.3400	0.0000	0.0000	180.0000	3121.2000	(32)
Party Wall-between circ			16.7800	0.0000	0.0000	180.0000	3020.4001	(32)
Party Floor 1			50.5000			80.0000	4040.0000	(32d)
Party Ceiling 1			50.5000			100.0000	5050.0000	(32b)
Internal Wall 1			82.2600			9.0000	740.3400	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	17558.3401 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		347.6899 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E4 Jamb	9.6000	0.0180	0.1728	
E7 Party floor between dwellings (in blocks of flats)	28.4300	0.0360	1.0235	
E16 Corner (normal)	2.4000	0.0400	0.0960	
E18 Party wall between dwellings	7.2000	0.0320	0.2304	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	28.4300	0.0000	0.0000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.5227 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 14.2826 (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	11.6213	11.4939	11.3664	10.7289	10.6014	9.9640	9.9640	9.8365	10.2190	10.6014	10.8564	11.1114	(38)
Heat transfer coeff	25.9039	25.7764	25.6489	25.0115	24.8840	24.2466	24.2466	24.1191	24.5016	24.8840	25.1390	25.3940	(39)
Average = Sum(39)m / 12 =												24.9796	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5129	0.5104	0.5079	0.4953	0.4928	0.4801	0.4801	0.4776	0.4852	0.4928	0.4978	0.5029	(40)
HLP (average)												0.4946	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.7048 (42)
Hot water usage for mixer showers

52.8039	52.0103	50.8540	48.6415	47.0088	45.1880	44.1530	45.3006	46.5586	48.5136	50.7736	52.6016	(42a)

Hot water usage for baths

22.8306	22.4916	22.0141	21.1337	20.4745	19.7435	19.3487	19.8228	20.3391	21.1212	22.0197	22.7534	(42b)

Hot water usage for other uses

32.0892	30.9223	29.7554	28.5885	27.4216	26.2548	26.2548	27.4216	28.5885	29.7554	30.9223	32.0892	(42c)

Average daily hot water use (litres/day) 99.0230 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.7237	105.4242	102.6235	98.3638	94.9049	91.1863	89.7565	92.5451	95.4862	99.3902	103.7156	107.4442	(44)
Energy conte	170.6080	150.1226	157.7285	134.6551	127.7603	112.1242	108.5527	114.5902	117.7440	134.8716	147.7619	168.2316	(45)
Energy content (annual)										Total = Sum(45)m =		1644.7506	
Distribution loss (46)m = 0.15 x (45)m	25.5912	22.5184	23.6593	20.1983	19.1640	16.8186	16.2829	17.1885	17.6616	20.2307	22.1643	25.2347	(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

197.5594	174.4658	184.6799	160.7371	154.7117	138.2062	135.5041	141.5416	143.8260	161.8230	173.8439	195.1830	(62)
WWHRS -37.0760	-32.7904	-34.3362	-28.4317	-26.4973	-22.6739	-21.2532	-22.6007	-23.4593	-27.6560	-31.3309	-36.3894	(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													
160.4833	141.6755	150.3437	132.3054	128.2144	115.5322	114.2509	118.9409	120.3667	134.1670	142.5130	158.7936	(64)
									Total per year (kWh/year) = Sum(64)m =		1617.5866	(64)
12Total per year (kWh/year)												1618	(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

56.7271	49.9158	52.4447	44.7728	42.4803	37.2813	36.0938	38.1012	39.1499	44.8448	49.1308	55.9370	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	78.9681	87.4290	78.9681	81.6004	78.9681	81.6004	78.9681	78.9681	81.6004	78.9681	81.6004	78.9681	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	148.5325	150.0738	146.1898	137.9211	127.4834	117.6735	111.1198	109.5785	113.4626	121.7312	132.1689	141.9788	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	(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)	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	(71)
Water heating gains (Table 5)	76.2462	74.2794	70.4902	62.1845	57.0972	51.7796	48.5131	51.2113	54.3748	60.2753	68.2373	75.1842	(72)
Total internal gains	352.3192	360.3547	344.2206	330.2784	312.1212	299.6259	287.1736	288.3305	298.0103	309.5471	330.5790	344.7036	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6800	10.6334	0.4000	0.7000	0.7700	15.8462	(74)

Solar gains	15.8462	30.2828	51.4579	82.6547	111.3434	119.1964	111.2851	88.2905	61.8691	36.0478	19.5483	13.2101	(83)
Total gains	368.1654	390.6375	395.6785	412.9331	423.4646	418.8223	398.4586	376.6210	359.8794	345.5949	350.1273	357.9137	(84)

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7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	188.2850	189.2162	190.1567	195.0030	196.0020	201.1549	201.1549	202.2181	199.0615	196.0020	194.0140	192.0660	
alpha	13.5523	13.6144	13.6771	14.0002	14.0668	14.4103	14.4103	14.4812	14.2708	14.0668	13.9343	13.8044	
util living area	0.9815	0.9561	0.8994	0.7304	0.5464	0.3705	0.2677	0.2946	0.4698	0.7456	0.9321	0.9846	(86)
MIT	20.8732	20.9261	20.9714	20.9981	21.0000	21.0000	21.0000	21.0000	21.0000	20.9980	20.9588	20.8677	(87)
Th 2	20.5090	20.5113	20.5136	20.5252	20.5275	20.5391	20.5391	20.5414	20.5344	20.5275	20.5228	20.5182	(88)
util rest of house	0.9757	0.9445	0.8788	0.7026	0.5187	0.3438	0.2397	0.2652	0.4381	0.7130	0.9145	0.9796	(89)
MIT 2	20.3704	20.4349	20.4868	20.5237	20.5275	20.5391	20.5391	20.5414	20.5344	20.5260	20.4834	20.3724	(90)
Living area fraction										fLA = Living area / (4) =		0.4455	(91)
MIT	20.5944	20.6538	20.7028	20.7351	20.7380	20.7444	20.7444	20.7457	20.7419	20.7363	20.6952	20.5931	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5944	20.6538	20.7028	20.7351	20.7380	20.7444	20.7444	20.7457	20.7419	20.7363	20.6952	20.5931	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9768	0.9481	0.8871	0.7149	0.5311	0.3557	0.2522	0.2783	0.4522	0.7275	0.9212	0.9805	(94)
Useful gains	359.6181	370.3773	351.0086	295.2146	224.8868	148.9816	100.4885	104.8150	162.7349	251.4131	322.5342	350.9330	(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	422.0900	406.0756	364.2856	296.0131	224.9012	148.9816	100.4885	104.8150	162.7360	252.2322	341.7698	416.2856	(97)
Space heating kWh	46.4791	23.9892	9.8781	0.5749	0.0107	0.0000	0.0000	0.0000	0.0000	0.6094	13.8496	48.6223	(98a)
Space heating requirement - total per year (kWh/year)												144.0134	
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	46.4791	23.9892	9.8781	0.5749	0.0107	0.0000	0.0000	0.0000	0.0000	0.6094	13.8496	48.6223	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												144.0134	
Space heating per m2											(98c) / (4) =	2.8518	(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	46.4791	23.9892	9.8781	0.5749	0.0107	0.0000	0.0000	0.0000	0.0000	0.6094	13.8496	48.6223	(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)	46.4791	23.9892	9.8781	0.5749	0.0107	0.0000	0.0000	0.0000	0.0000	0.6094	13.8496	48.6223	(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	160.4833	141.6755	150.3437	132.3054	128.2144	115.5322	114.2509	118.9409	120.3667	134.1670	142.5130	158.7936	(64)
Efficiency of water heater												349.4100	(216)
(217)m	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	(217)
Fuel for water heating, kWh/month	45.9298	40.5471	43.0279	37.8654	36.6945	33.0649	32.6982	34.0405	34.4486	38.3982	40.7868	45.4462	(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	6.8568	6.1933	6.8568	6.6357	6.8568	6.6357	6.8568	6.8568	6.6357	6.8568	6.6357	6.8568	(231)
Lighting	18.4061	14.7661	13.2952	9.7406	7.5239	6.1471	6.8636	8.9216	11.5882	15.2044	17.1733	18.9177	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-7.7990	-13.3880	-23.6507	-31.6727	-38.3140	-37.3042	-36.5784	-32.1989	-25.0411	-16.8722	-9.1661	-6.4050	(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	144.0134 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	349.4100
Water heating fuel used	462.9480 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.5460)	
mechanical ventilation fans (SFP = 0.5460)	80.7337 (230a)
Total electricity for the above, kWh/year	80.7337 (231)
Electricity for lighting (calculated in Appendix L)	148.5477 (232)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-278.3900	(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	557.8528	(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	144.0134	0.1605	23.1090	(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)	462.9480	0.1409	65.2170	(264)
Space and water heating			88.3260	(265)
Pumps, fans and electric keep-hot	80.7337	0.1387	11.1988	(267)
Energy for lighting	148.5477	0.1443	21.4400	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-278.3900	0.1313	-36.5392	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-36.5392	(269)
Total CO2, kg/year			84.4256	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.6700	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	144.0134	1.5939	229.5432	(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)	462.9480	1.5209	704.0961	(278)
Space and water heating			933.6393	(279)
Pumps, fans and electric keep-hot	80.7337	1.5128	122.1340	(281)
Energy for lighting	148.5477	1.5338	227.8474	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-278.3900	1.4849	-413.3798	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-413.3798	(283)
Total Primary energy kWh/year			870.2409	(286)
Dwelling Primary energy Rate (DPER)			17.2300	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	50.5000	(1b)	x 2.4000	(2b) =	121.2000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		121.2000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1650	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4150	(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) =	0.3528	(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	0.4498	0.4410	0.4321	0.3880	0.3792	0.3351	0.3351	0.3263	0.3528	0.3792	0.3969	0.4145	(22b)

Effective ac	0.6011	0.5972	0.5934	0.5753	0.5719	0.5562	0.5562	0.5532	0.5622	0.5719	0.5787	0.5859 (25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opening Type			7.6800	1.1450	8.7939			(27)
External Wall 1	34.1200	7.6800	26.4400	0.1800	4.7592			(29a)
Total net area of external elements Aum(A, m2)			34.1200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	13.5531			(33)
Main dwelling								
Party Wall-between flats			17.3400	0.0000	0.0000			(32)
Party Wall-between circ			16.7800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K			327.6899 (35)
List of Thermal Bridges			
K1 Element	Length	Psi-value	Total
E4 Jamb	9.6000	0.0500	0.4800
E7 Party floor between dwellings (in blocks of flats)	28.4300	0.0700	1.9901
E16 Corner (normal)	2.4000	0.0900	0.2160
E18 Party wall between dwellings	7.2000	0.0600	0.4320
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	28.4300	0.0000	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			3.1181 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	16.6712 (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	24.0435	23.8864	23.7325	23.0092	22.8739	22.2440	22.2440	22.1273	22.4866	22.8739	23.1476	23.4338	(38)
Heat transfer coeff	40.7147	40.5576	40.4036	39.6804	39.5451	38.9152	38.9152	38.7985	39.1578	39.5451	39.8188	40.1050	(39)
Average = Sum(39)m / 12 =												39.6798	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8062	0.8031	0.8001	0.7858	0.7831	0.7706	0.7706	0.7683	0.7754	0.7831	0.7885	0.7942	(40)
HLP (average)												0.7857	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.7048 (42)
Hot water usage for mixer showers	52.8039	52.0103	50.8540	48.6415	47.0088	45.1880	44.1530	45.3006	46.5586	48.5136	50.7736	52.6016 (42a)
Hot water usage for baths	22.8306	22.4916	22.0141	21.1337	20.4745	19.7435	19.3487	19.8228	20.3391	21.1212	22.0197	22.7534 (42b)
Hot water usage for other uses	32.0892	30.9223	29.7554	28.5885	27.4216	26.2548	26.2548	27.4216	28.5885	29.7554	30.9223	32.0892 (42c)
Average daily hot water use (litres/day)												99.0230 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	107.7237	105.4242	102.6235	98.3638	94.9049	91.1863	89.7565	92.5451	95.4862	99.3902	103.7156	107.4442	(44)
Energy conte	170.6080	150.1226	157.7285	134.6551	127.7603	112.1242	108.5527	114.5902	117.7440	134.8716	147.7619	168.2316	(45)
Energy content (annual)										Total = Sum(45)m =		1644.7506	
Distribution loss (46)m = 0.15 x (45)m	25.5912	22.5184	23.6593	20.1983	19.1640	16.8186	16.2829	17.1885	17.6616	20.2307	22.1643	25.2347	(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	217.2029	192.2083	204.3234	179.7469	174.3552	157.2160	155.1476	161.1851	162.8359	181.4665	192.8537	214.8265	(62)
WWHRS	-24.1397	-21.3494	-22.3558	-18.5115	-17.2521	-14.7627	-13.8377	-14.7150	-15.2741	-18.0064	-20.3991	-23.6927	(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	193.0631	170.8590	181.9675	161.2354	157.1031	142.4533	141.3099	146.4701	147.5618	163.4601	172.4546	191.1338	(64)
										Total per year (kWh/year) = Sum(64)m =		1969.0717	(64)
12Total per year (kWh/year)												1969	(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	94.0031	83.5843	89.7206	80.8463	79.7562	73.3548	73.3697	75.3772	75.2234	82.1207	85.2043	93.2129	(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	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	78.9681	87.4290	78.9681	81.6004	78.9681	81.6004	78.9681	78.9681	81.6004	78.9681	81.6004	78.9681	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	148.5325	150.0738	146.1898	137.9211	127.4834	117.6735	111.1198	109.5785	113.4626	121.7312	132.1689	141.9788	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	(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)	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	(71)
Water heating gains (Table 5)	126.3482	124.3815	120.5923	112.2865	107.1992	101.8816	98.6152	101.3134	104.4769	110.3773	118.3393	125.2862	(72)
Total internal gains	405.4213	413.4567	397.3226	383.3805	365.2232	349.7280	337.2756	338.4325	348.1123	362.6491	383.6811	397.8056	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.6800	10.6334	0.6300	0.7000	0.7700	24.9577	(74)

Solar gains	24.9577	47.6955	81.0463	130.1811	175.3659	187.7343	175.2740	139.0576	97.4439	56.7752	30.7886	20.8060 (83)
Total gains	430.3790	461.1522	478.3689	513.5616	540.5891	537.4623	512.5496	477.4901	445.5562	419.4244	414.4696	418.6116 (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	112.9017	113.3390	113.7709	115.8446	116.2410	118.1226	118.1226	118.4778	117.3907	116.2410	115.4419	114.6181	
alpha	8.5268	8.5559	8.5847	8.7230	8.7494	8.8748	8.8748	8.8985	8.8260	8.7494	8.6961	8.6412	
util living area	0.9925	0.9845	0.9624	0.8645	0.6727	0.4631	0.3341	0.3737	0.6035	0.8884	0.9784	0.9937	(86)
MIT	20.5464	20.6428	20.7747	20.9349	20.9925	20.9997	21.0000	21.0000	20.9977	20.9304	20.7338	20.5366	(87)
Th 2	20.2479	20.2506	20.2533	20.2657	20.2680	20.2789	20.2789	20.2809	20.2747	20.2680	20.2633	20.2584	(88)
util rest of house	0.9897	0.9789	0.9496	0.8301	0.6228	0.4111	0.2793	0.3153	0.5415	0.8512	0.9697	0.9914	(89)
MIT 2	19.7336	19.8564	20.0195	20.2087	20.2631	20.2788	20.2789	20.2809	20.2735	20.2096	19.9811	19.7302	(90)
Living area fraction										fLA = Living area / (4) =		0.4455	(91)
MIT	20.0958	20.2068	20.3559	20.5323	20.5881	20.6000	20.6002	20.6013	20.5962	20.5307	20.3165	20.0895	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0958	20.2068	20.3559	20.5323	20.5881	20.6000	20.6002	20.6013	20.5962	20.5307	20.3165	20.0895	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9890	0.9785	0.9515	0.8432	0.6448	0.4343	0.3037	0.3414	0.5692	0.8655	0.9705	0.9908	(94)
Useful gains	425.6414	451.2548	455.1879	433.0517	348.5929	233.4100	155.6644	162.9956	253.5971	363.0142	402.2245	414.7403	(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	643.1202	620.8058	559.8309	461.5729	351.4801	233.4908	155.6672	163.0031	254.3756	392.7120	526.2644	637.2475	(97)
Space heating kWh	161.8042	113.9382	77.8544	20.5352	2.1481	0.0000	0.0000	0.0000	0.0000	22.0952	89.3087	165.5453	(98a)
Space heating requirement - total per year (kWh/year)												653.2294	
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	161.8042	113.9382	77.8544	20.5352	2.1481	0.0000	0.0000	0.0000	0.0000	22.0952	89.3087	165.5453	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												653.2294	
Space heating per m2											(98c) / (4) =	12.9352	(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	161.8042	113.9382	77.8544	20.5352	2.1481	0.0000	0.0000	0.0000	0.0000	22.0952	89.3087	165.5453	(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)	175.3025	123.4434	84.3493	22.2484	2.3273	0.0000	0.0000	0.0000	0.0000	23.9384	96.7592	179.3557	(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	193.0631	170.8590	181.9675	161.2354	157.1031	142.4533	141.3099	146.4701	147.5618	163.4601	172.4546	191.1338	(64)
Efficiency of water heater												79.8000	(216)
(217)m	83.6664	83.1724	82.2994	80.7243	79.9092	79.8000	79.8000	79.8000	79.8000	80.7748	82.6583	83.7391	(217)
Fuel for water heating, kWh/month	230.7535	205.4274	221.1044	199.7359	196.6019	178.5129	177.0801	183.5465	184.9145	202.3651	208.6357	228.2492	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	16.4080	13.1631	11.8519	8.6832	6.7072	5.4798	6.1185	7.9531	10.3303	13.5539	15.3091	16.8641	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-13.6831	-20.3538	-30.8558	-36.6633	-41.2914	-39.2099	-38.7570	-35.7271	-30.6724	-24.1532	-15.4242	-11.7108	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-4.8024	-10.3381	-20.9874	-32.1685	-43.1616	-43.5764	-43.0390	-36.1316	-26.0970	-14.9676	-6.4720	-3.7786	(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	707.7242	(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	2416.9271	(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)	132.4221	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-624.0223	(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	2719.0511	(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	707.7242	0.2100	148.6221	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2416.9271	0.2100	507.5547	(264)
Space and water heating			656.1768	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	132.4221	0.1443	19.1126	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-338.5020	0.1335	-45.1746	
PV Unit electricity exported	-285.5202	0.1253	-35.7812	
Total			-80.9559	(269)
Total CO2, kg/year			606.2628	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.0100	(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	707.7242	1.1300	799.7283	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2416.9271	1.1300	2731.1276	(278)
Space and water heating			3530.8559	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	132.4221	1.5338	203.1135	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-338.5020	1.4932	-505.4380	
PV Unit electricity exported	-285.5202	0.4600	-131.3341	
Total			-636.7721	(283)
Total Primary energy kWh/year			3227.2981	(286)
Target Primary Energy Rate (TPER)			63.9100	(287)

Full SAP Calculation Printout

Property Reference	3F_Block B11_2Bed 4P	**Issued on Date**	27/03/2025
Assessment Reference	Option 1_EPH+ASHP_P08	**Prop Type Ref**	North West
Property	Chorlton-cum-Hardy, Manchester, Greater Manchester, M21 9AQ		

SAP Rating	94 A	**DER**	1.94	**TER**	10.38
Environmental	99 A	**% DER < TER**			81.31
CO_2 Emissions (t/year)	0.11	**DFEE**	21.28	**TFEE**	22.97
Compliance Check	See BREL	**% DFEE < TFEE**			7.38
% DPER < TPER	64.71	**DPER**	19.83	**TPER**	56.19

Assessor Details	Mr. Leon Maddison	**Assessor ID**	AY03-0001
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)	
Main dwelling						
Ground floor	72.0200 (1b)	x	2.4000 (2b)	=	172.8480	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	172.8480	(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) =		74.4000 (23c)

Effective ac	0.2906	0.2874	0.2842	0.2682	0.2651	0.2491	0.2491	0.2459	0.2555	0.2651	0.2714	0.2778	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Glazing			18.7200	1.1450	21.4351			(27)
External Wall 1	42.8600	18.7200	24.1400	0.1500	3.6210	60.0000	1448.4000	(29a)
Total net area of external elements Aum(A, m2)			42.8600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.0561			(33)
Main dwelling								
Party Wall-between flats			16.3200	0.0000	0.0000	180.0000	2937.5999	(32)
Party Wall-between circ			28.6800	0.0000	0.0000	180.0000	5162.4001	(32)
Party Floor 1			72.0200			80.0000	5761.6000	(32d)
Party Ceiling 1			72.0200			100.0000	7202.0000	(32b)
Internal Wall 1			116.5400			9.0000	1048.8600	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	23560.8600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		327.1433 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E4 Jamb	28.8000	0.0180	0.5184	
E7 Party floor between dwellings (in blocks of flats)	35.7200	0.0360	1.2859	
E16 Corner (normal)	9.6000	0.0400	0.3840	
E18 Party wall between dwellings	9.6000	0.0320	0.3072	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	37.5000	0.0000	0.0000	
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0820	-0.3936	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			2.1019	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	27.1580	(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	16.5736	16.3918	16.2100	15.3009	15.1191	14.2101	14.2101	14.0282	14.5737	15.1191	15.4828	15.8464	(38)
Heat transfer coeff	43.7317	43.5499	43.3680	42.4590	42.2772	41.3681	41.3681	41.1863	41.7317	42.2772	42.6408	43.0044	(39)
Average = Sum(39)m / 12 =												42.4135	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6072	0.6047	0.6022	0.5895	0.5870	0.5744	0.5744	0.5719	0.5794	0.5870	0.5921	0.5971	(40)
HLP (average)												0.5889	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2941	(42)
Hot water usage for mixer showers	80.5042	79.2944	77.5314	74.1584	71.6691	68.8931	67.3152	69.0649	70.9827	73.9633	77.4088	80.1958	(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses	38.1244	36.7380	35.3517	33.9654	32.5790	31.1927	31.1927	32.5790	33.9654	35.3517	36.7380	38.1244	(42c)
Average daily hot water use (litres/day)												108.8807	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	118.6286	116.0324	112.8831	108.1237	104.2481	100.0858	98.5079	101.6439	104.9481	109.3150	114.1469	118.3202	(44)
Energy conte	187.8787	165.2286	173.4972	148.0160	140.3380	123.0672	119.1368	125.8563	129.4115	148.3394	162.6232	185.2608	(45)
Energy content (annual)										Total = Sum(45)m =		1808.6537	
Distribution loss (46)m = 0.15 x (45)m	28.1818	24.7843	26.0246	22.2024	21.0507	18.4601	17.8705	18.8785	19.4117	22.2509	24.3935	27.7891	(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	214.8301	189.5718	200.4486	174.0980	167.2894	149.1492	146.0882	152.8077	155.4935	175.2908	188.7052	212.2122	(62)
WWHRS	-56.5257	-49.9918	-52.3485	-43.3467	-40.3975	-34.5685	-32.4024	-34.4567	-35.7659	-42.1640	-47.7667	-55.4789	(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	158.3044	139.5800	148.1000	130.7513	126.8919	114.5807	113.6858	118.3510	119.7277	133.1268	140.9385	156.7332	(64)
										Total per year (kWh/year) = Sum(64)m =		1600.7714	(64)
12Total per year (kWh/year)												1601	(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	62.4697	54.9385	57.6878	49.2153	46.6624	40.9198	39.6130	41.8472	43.0293	49.3229	54.0722	61.5992	(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	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	101.8681	112.7826	101.8681	105.2637	101.8681	105.2637	101.8681	101.8681	105.2637	101.8681	105.2637	101.8681	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	201.9649	204.0607	198.7794	187.5363	173.3438	160.0048	151.0936	148.9978	154.2791	165.5223	179.7148	193.0537	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	(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)	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	(71)
Water heating gains (Table 5)	83.9646	81.7538	77.5374	68.3546	62.7183	56.8331	53.2433	56.2463	59.7630	66.2942	75.1003	82.7946	(72)
Total internal gains	445.2099	456.0092	435.5972	418.5668	395.3424	379.5139	363.6172	364.5245	376.7180	391.0968	417.4910	435.1287	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.0800	11.2829	0.4000	0.7000	0.7700	22.0686	(75)
Southeast	8.6400	36.7938	0.4000	0.7000	0.7700	61.6851	(77)

Solar gains	83.7536	149.9937	224.6985	311.0479	378.1879	388.5559	369.1565	317.0639	254.2858	171.0248	101.6525	70.8119	(83)
Total gains	528.9635	606.0029	660.2957	729.6148	773.5303	768.0698	732.7738	681.5884	631.0039	562.1216	519.1435	505.9405	(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	149.6555	150.2802	150.9103	154.1414	154.8042	158.2061	158.2061	158.9045	156.8276	154.8042	153.4841	152.1863	
alpha	10.9770	11.0187	11.0607	11.2761	11.3203	11.5471	11.5471	11.5936	11.4552	11.3203	11.2323	11.1458	
util living area	0.9918	0.9671	0.8929	0.7001	0.5082	0.3447	0.2484	0.2780	0.4563	0.7711	0.9651	0.9943	(86)
MIT	20.7327	20.8503	20.9490	20.9962	20.9999	21.0000	21.0000	21.0000	21.0000	20.9919	20.8805	20.7143	(87)
Th 2	20.4235	20.4258	20.4281	20.4394	20.4417	20.4531	20.4531	20.4554	20.4485	20.4417	20.4371	20.4326	(88)
util rest of house	0.9890	0.9576	0.8706	0.6690	0.4777	0.3152	0.2175	0.2451	0.4199	0.7337	0.9534	0.9922	(89)
MIT 2	20.1200	20.2659	20.3793	20.4364	20.4416	20.4531	20.4531	20.4554	20.4485	20.4355	20.3139	20.1050	(90)
Living area fraction										fLA = Living area / (4) =		0.4250	(91)
MIT	20.3804	20.5143	20.6214	20.6743	20.6789	20.6855	20.6855	20.6869	20.6829	20.6720	20.5547	20.3640	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3804	20.5143	20.6214	20.6743	20.6789	20.6855	20.6855	20.6869	20.6829	20.6720	20.5547	20.3640	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9887	0.9592	0.8785	0.6821	0.4907	0.3278	0.2306	0.2590	0.4353	0.7493	0.9561	0.9919	(94)
Useful gains	523.0122	581.2829	580.0459	497.6870	379.5409	251.7468	169.0111	176.5596	274.7044	421.2126	496.3701	501.8622	(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	703.2224	679.9994	612.4187	499.9244	379.6021	251.7472	169.0111	176.5596	274.7157	425.8152	573.7194	695.1232	(97)
Space heating kWh	134.0764	66.3375	24.0853	1.6110	0.0455	0.0000	0.0000	0.0000	0.0000	3.4243	55.6915	143.7862	(98a)

Space heating requirement - total per year (kWh/year) 429.0578

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	134.0764	66.3375	24.0853	1.6110	0.0455	0.0000	0.0000	0.0000	0.0000	3.4243	55.6915	143.7862	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 429.0578

Space heating per m2 (98c) / (4) = 5.9575 (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	134.0764	66.3375	24.0853	1.6110	0.0455	0.0000	0.0000	0.0000	0.0000	3.4243	55.6915	143.7862	(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)	134.0764	66.3375	24.0853	1.6110	0.0455	0.0000	0.0000	0.0000	0.0000	3.4243	55.6915	143.7862	(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	158.3044	139.5800	148.1000	130.7513	126.8919	114.5807	113.6858	118.3510	119.7277	133.1268	140.9385	156.7332	(64)
Efficiency of water heater												346.6611	(216)
(217)m	346.6611	346.6611	346.6611	346.6611	346.6611	346.6611	346.6611	346.6611	346.6611	346.6611	346.6611	346.6611	(217)
Fuel for water heating, kWh/month	45.6655	40.2641	42.7219	37.7173	36.6040	33.0527	32.7945	34.1403	34.5374	38.4026	40.6560	45.2122	(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	9.7788	8.8325	9.7788	9.4634	9.7788	9.4634	9.7788	9.7788	9.4634	9.7788	9.4634	9.7788	(231)
Lighting	24.7950	19.8915	17.9101	13.1217	10.1356	8.2808	9.2460	12.0183	15.6106	20.4819	23.1343	25.4841	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-8.0683	-13.9792	-24.8517	-33.5944	-41.0276	-40.0993	-39.2974	-34.3453	-26.4274	-17.5704	-9.5110	-6.6121	(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 1 429.0578 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 346.6611
Water heating fuel used 461.7684 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.5460)
mechanical ventilation fans (SFP = 0.5460) 115.1375 (230a)
Total electricity for the above, kWh/year 115.1375 (231)

Electricity for lighting (calculated in Appendix L)	200.1099	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-295.3841	(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	910.6895	(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	429.0578	0.1601	68.7022	(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)	461.7684	0.1408	65.0227	(264)
Space and water heating			133.7248	(265)
Pumps, fans and electric keep-hot	115.1375	0.1387	15.9710	(267)
Energy for lighting	200.1099	0.1443	28.8820	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-295.3841	0.1311	-38.7220	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-38.7220	(269)
Total CO2, kg/year			139.8559	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.9400	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	429.0578	1.5926	683.3149	(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)	461.7684	1.5207	702.1963	(278)
Space and water heating			1385.5112	(279)
Pumps, fans and electric keep-hot	115.1375	1.5128	174.1800	(281)
Energy for lighting	200.1099	1.5338	306.9352	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-295.3841	1.4843	-438.4346	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-438.4346	(283)
Total Primary energy kWh/year			1428.1918	(286)
Dwelling Primary energy Rate (DPER)			19.8300	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	72.0200	(1b) x	2.4000	(2b) =	172.8480	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 72.0200						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	172.8480	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1736	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4236	(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) =	0.3600	(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													
	0.4590	0.4500	0.4410	0.3960	0.3870	0.3420	0.3420	0.3330	0.3600	0.3870	0.4050	0.4230	(22b)
Effective ac	0.6054	0.6013	0.5973	0.5784	0.5749	0.5585	0.5585	0.5555	0.5648	0.5749	0.5820	0.5895	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opening Type			18.0000	1.1450	20.6107			(27)
External Wall 1	42.8600	18.0000	24.8600	0.1800	4.4748			(29a)
Total net area of external elements Aum(A, m2)			42.8600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.0855			(33)
Main dwelling								
Party Wall-between flats			16.3200	0.0000	0.0000			(32)
Party Wall-between circ			28.6800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 307.1433 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E4 Jamb	28.8000	0.0500	1.4400
E7 Party floor between dwellings (in blocks of flats)	35.7200	0.0700	2.5004
E16 Corner (normal)	9.6000	0.0900	0.8640
E18 Party wall between dwellings	9.6000	0.0600	0.5760
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	37.5000	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0900	-0.4320

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.9484 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 30.0339 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	34.5295	34.2961	34.0674	32.9930	32.7920	31.8563	31.8563	31.6830	32.2167	32.7920	33.1986	33.6238	(38)
Heat transfer coeff													
	64.5634	64.3300	64.1013	63.0269	62.8259	61.8901	61.8901	61.7169	62.2506	62.8259	63.2325	63.6577	(39)
Average = Sum(39)m / 12 =												63.0259	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8965	0.8932	0.8900	0.8751	0.8723	0.8593	0.8593	0.8569	0.8644	0.8723	0.8780	0.8839	(40)
HLP (average)												0.8751	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2941 (42)

Hot water usage for mixer showers												
	80.5042	79.2944	77.5314	74.1584	71.6691	68.8931	67.3152	69.0649	70.9827	73.9633	77.4088	80.1958 (42a)
Hot water usage for baths												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Hot water usage for other uses												
	38.1244	36.7380	35.3517	33.9654	32.5790	31.1927	31.1927	32.5790	33.9654	35.3517	36.7380	38.1244 (42c)
Average daily hot water use (litres/day)												108.8807 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	118.6286	116.0324	112.8831	108.1237	104.2481	100.0858	98.5079	101.6439	104.9481	109.3150	114.1469	118.3202	(44)
Energy conte	187.8787	165.2286	173.4972	148.0160	140.3380	123.0672	119.1368	125.8563	129.4115	148.3394	162.6232	185.2608	(45)
Energy content (annual)										Total = Sum(45)m =		1808.6537	
Distribution loss (46)m = 0.15 x (45)m													
	28.1818	24.7843	26.0246	22.2024	21.0507	18.4601	17.8705	18.8785	19.4117	22.2509	24.3935	27.7891	(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													
	234.4736	207.3144	220.0921	193.1078	186.9329	168.1590	165.7317	172.4512	174.5034	194.9343	207.7150	231.8557	(62)
WWHRS	-36.8032	-32.5490	-34.0835	-28.2224	-26.3023	-22.5071	-21.0968	-22.4343	-23.2867	-27.4524	-31.1003	-36.1216	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	197.6704	174.7653	186.0086	164.8854	160.6306	145.6519	144.6349	150.0169	151.2167	167.4819	176.6147	195.7340	(64)
										Total per year (kWh/year) = Sum(64)m =		2015.3115	(64)
12Total per year (kWh/year)												2015	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	99.7456	88.6071	94.9637	85.2888	83.9383	76.9933	76.8889	79.1232	79.1028	86.5988	90.1457	98.8751	(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	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	101.8681	112.7826	101.8681	105.2637	101.8681	105.2637	101.8681	101.8681	105.2637	101.8681	105.2637	101.8681	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	201.9649	204.0607	198.7794	187.5363	173.3438	160.0048	151.0936	148.9978	154.2791	165.5223	179.7148	193.0537	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	(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)													
	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	(71)
Water heating gains (Table 5)													

	134.0667	131.8558	127.6394	118.4566	112.8203	106.9351	103.3453	106.3483	109.8650	116.3962	125.2023	132.8967	(72)
Total internal gains	498.3119	509.1113	488.6992	471.6689	448.4444	429.6159	413.7193	414.6265	426.8201	444.1989	470.5931	488.2307	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	9.6900	11.2829	0.6300	0.7000	0.7700	33.4132	(75)
Southeast	8.3100	36.7938	0.6300	0.7000	0.7700	93.4432	(77)

Solar gains	126.8564	227.1819	340.3199	471.0852	572.7560	588.4527	559.0753	480.1913	385.1263	259.0329	153.9659	107.2548	(83)
Total gains	625.1684	736.2932	829.0191	942.7540	1021.2004	1018.0686	972.7945	894.8179	811.9463	703.2317	624.5590	595.4856	(84)

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7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	95.1712	95.5164	95.8573	97.4913	97.8032	99.2819	99.2819	99.5607	98.7071	97.8032	97.1742	96.5253	
alpha	7.3447	7.3678	7.3905	7.4994	7.5202	7.6188	7.6188	7.6374	7.5805	7.5202	7.4783	7.4350	
util living area	0.9922	0.9752	0.9248	0.7712	0.5684	0.3889	0.2799	0.3172	0.5270	0.8477	0.9762	0.9943	(86)
MIT	20.3993	20.5830	20.7862	20.9532	20.9950	20.9998	21.0000	21.0000	20.9979	20.9246	20.6457	20.3724	(87)
Th 2	20.1705	20.1733	20.1760	20.1887	20.1911	20.2022	20.2022	20.2043	20.1979	20.1911	20.1863	20.1812	(88)
util rest of house	0.9895	0.9671	0.9039	0.7300	0.5205	0.3405	0.2292	0.2624	0.4667	0.8044	0.9671	0.9922	(89)
MIT 2	19.4869	19.7178	19.9615	20.1494	20.1878	20.2021	20.2022	20.2042	20.1968	20.1287	19.8089	19.4618	(90)
Living area fraction									fLA = Living area / (4) =			0.4250	(91)
MIT	19.8747	20.0855	20.3120	20.4910	20.5309	20.5411	20.5413	20.5424	20.5373	20.4670	20.1646	19.8488	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8747	20.0855	20.3120	20.4910	20.5309	20.5411	20.5413	20.5424	20.5373	20.4670	20.1646	19.8488	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9882	0.9662	0.9077	0.7458	0.5408	0.3611	0.2507	0.2857	0.4923	0.8201	0.9668	0.9911	(94)
Useful gains	617.8214	711.3707	752.4891	703.1142	552.2165	367.5961	243.9208	255.6456	399.7615	576.7012	603.8023	590.1938	(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	1005.5539	976.8833	885.3657	730.5448	554.8081	367.6964	243.9257	255.6584	400.7245	619.9033	826.1050	996.1669	(97)
Space heating kWh	288.4730	178.4245	98.8602	19.7500	1.9282	0.0000	0.0000	0.0000	0.0000	32.1424	160.0580	302.0440	(98a)
Space heating requirement - total per year (kWh/year)												1081.6802	
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	288.4730	178.4245	98.8602	19.7500	1.9282	0.0000	0.0000	0.0000	0.0000	32.1424	160.0580	302.0440	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1081.6802	
Space heating per m2										(98c) / (4) =		15.0192	(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	288.4730	178.4245	98.8602	19.7500	1.9282	0.0000	0.0000	0.0000	0.0000	32.1424	160.0580	302.0440	(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)	312.5384	193.3093	107.1075	21.3977	2.0890	0.0000	0.0000	0.0000	0.0000	34.8238	173.4106	327.2416	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	197.6704	174.7653	186.0086	164.8854	160.6306	145.6519	144.6349	150.0169	151.2167	167.4819	176.6147	195.7340	(64)
Efficiency of water heater												79.8000	(216)
(217)m	84.9063	84.1063	82.7091	80.6746	79.8960	79.8000	79.8000	79.8000	79.8000	81.1239	83.8397	85.0292	(217)
Fuel for water heating, kWh/month	232.8100	207.7910	224.8950	204.3832	201.0495	182.5212	181.2468	187.9911	189.4946	206.4521	210.6577	230.1964	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	21.1662	16.9803	15.2889	11.2013	8.6522	7.0689	7.8928	10.2594	13.3259	17.4843	19.7485	21.7545	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-9.5284	-14.6702	-23.0038	-28.2921	-32.7127	-31.3557	-30.9755	-28.1263	-23.5359	-17.7867	-10.9048	-8.1002	(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	-2.1885	-4.7836	-9.8565	-15.3363	-20.8170	-21.1175	-20.8700	-17.4206	-12.4468	-7.0096	-2.9740	-1.7176 (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	1171.9179	(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	2459.4885	(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)	170.8232	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-395.5299	(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	3492.6997	(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	1171.9179	0.2100	246.1028	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2459.4885	0.2100	516.4926	(264)
Space and water heating			762.5953	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	170.8232	0.1443	24.6551	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-258.9921	0.1328	-34.3922	
PV Unit electricity exported	-136.5378	0.1249	-17.0506	
Total			-51.4428	(269)
Total CO2, kg/year			747.7369	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.3800	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1171.9179	1.1300	1324.2672	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2459.4885	1.1300	2779.2220	(278)
Space and water heating			4103.4892	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	170.8232	1.5338	262.0143	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-258.9921	1.4907	-386.0730	
PV Unit electricity exported	-136.5378	0.4583	-62.5805	
Total			-448.6535	(283)
Total Primary energy kWh/year			4046.9508	(286)
Target Primary Energy Rate (TPER)			56.1900	(287)

Full SAP Calculation Printout

Property Reference	3F_Block B14_1Bed	**Issued on Date**	27/03/2025
Assessment Reference	Option 1_EPH+ASHP_P08	**Prop Type Ref**	North West
Property	Chorlton-cum-Hardy, Manchester, Greater Manchester, M21 9AQ		

SAP Rating	96 A	**DER**	1.38	**TER**	10.25
Environmental	99 A	**% DER < TER**			86.54
CO_2 Emissions (t/year)	0.07	**DFEE**	15.63	**TFEE**	16.86
Compliance Check	See BREL	**% DFEE < TFEE**			7.27
% DPER < TPER	74.61	**DPER**	14.15	**TPER**	55.72

Assessor Details	Mr. Leon Maddison	**Assessor ID**	AY03-0001
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)	
Main dwelling						
Ground floor	56.9600	(1b)	x 2.4000	(2b) =	136.7040	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.9600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	136.7040	(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) =	74.4000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2906	0.2874	0.2842	0.2682	0.2651	0.2491	0.2491	0.2459	0.2555	0.2651	0.2714	0.2778	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Glazing			12.9600	1.1450	14.8397			(27)
External Wall 1	22.7400	12.9600	9.7800	0.1500	1.4670	60.0000	586.8000	(29a)
Total net area of external elements Aum(A, m2)			22.7400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.3067			(33)
Main dwelling								
Party Wall-between flats			32.6400	0.0000	0.0000	180.0000	5875.1999	(32)
Party Wall-between circ			18.2400	0.0000	0.0000	180.0000	3283.2000	(32)
Party Floor 1			56.9600			80.0000	4556.8000	(32d)
Party Ceiling 1			56.9600			100.0000	5696.0000	(32b)
Internal Wall 1			90.8300			9.0000	817.4700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 20815.4699	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	365.4401	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E4 Jamb	19.2000	0.0180	0.3456	
E7 Party floor between dwellings (in blocks of flats)	18.9500	0.0360	0.6822	
E16 Corner (normal)	4.8000	0.0400	0.1920	
E18 Party wall between dwellings	9.6000	0.0320	0.3072	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	42.4000	0.0000	0.0000	
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0820	-0.1968	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.3302 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 17.6369 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	13.1079	12.9642	12.8204	12.1014	11.9576	11.2386	11.2386	11.0948	11.5262	11.9576	12.2452	12.5328	(38)
Heat transfer coeff	30.7448	30.6010	30.4573	29.7383	29.5945	28.8755	28.8755	28.7317	29.1631	29.5945	29.8821	30.1697	(39)
Average = Sum(39)m / 12 =												29.7023	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5398	0.5372	0.5347	0.5221	0.5196	0.5069	0.5069	0.5044	0.5120	0.5196	0.5246	0.5297	(40)
HLP (average)												0.5215	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.8945 (42)
Hot water usage for mixer showers

71.8677	70.7877	69.2139	66.2026	63.9804	61.5023	60.0937	61.6556	63.3677	66.0285	69.1044	71.5924	(42a)

Hot water usage for baths

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

Hot water usage for other uses

34.0317	32.7942	31.5567	30.3191	29.0816	27.8441	27.8441	29.0816	30.3191	31.5567	32.7942	34.0317	(42c)

Average daily hot water use (litres/day) 97.1975 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.8994	103.5819	100.7705	96.5218	93.0621	89.3464	87.9378	90.7372	93.6869	97.5852	101.8986	105.6241	(44)
Energy conte	167.7188	147.4992	154.8805	132.1335	125.2794	109.8618	106.3531	112.3516	115.5253	132.4222	145.1732	165.3817	(45)
Energy content (annual)										Total = Sum(45)m =		1614.5805	
Distribution loss (46)m = 0.15 x (45)m	25.1578	22.1249	23.2321	19.8200	18.7919	16.4793	15.9530	16.8527	17.3288	19.8633	21.7760	24.8073	(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	194.6702	171.8424	181.8319	158.2155	152.2308	135.9438	133.3045	139.3030	141.6073	159.3736	171.2552	192.3331	(62)
WWHRS	-50.4616	-44.6287	-46.7326	-38.6964	-36.0637	-30.8599	-28.9263	-30.7602	-31.9289	-37.6406	-42.6423	-49.5272	(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	144.2085	127.2137	135.0994	119.5191	116.1672	105.0839	104.3782	108.5428	109.6784	121.7329	128.6130	142.8060	(64)
									Total per year (kWh/year) = Sum(64)m =			1463.0431	(64)
12Total per year (kWh/year)												1463	(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	55.7665	49.0435	51.4978	43.9344	41.6554	36.5290	35.3624	37.3569	38.4122	44.0304	48.2701	54.9894	(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	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	83.3175	92.2444	83.3175	86.0948	83.3175	86.0948	83.3175	83.3175	86.0948	83.3175	86.0948	83.3175	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	165.2203	166.9348	162.6144	153.4167	141.8064	130.8942	123.6043	121.8898	126.2102	135.4079	147.0182	157.9303	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	(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)	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	(71)
Water heating gains (Table 5)	74.9550	72.9814	69.2175	61.0200	55.9885	50.7348	47.5301	50.2109	53.3502	59.1806	67.0418	73.9105	(72)
Total internal gains	374.9105	383.5782	366.5670	351.9492	332.5300	319.1415	305.8696	306.8359	317.0729	329.3237	351.5725	366.5761	(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	
Southwest	10.0800	36.7938	0.4000	0.7000	0.7700	71.9659	(79)
Northwest	2.8800	11.2829	0.4000	0.7000	0.7700	6.3053	(81)

Solar gains	78.2712	135.4192	190.8495	245.7962	283.8232	285.5144	273.7084	244.7662	209.7882	151.1670	94.1323	66.7371	(83)
Total gains	453.1817	518.9974	557.4165	597.7454	616.3532	604.6559	579.5780	551.6022	526.8611	480.4907	445.7048	433.3131	(84)

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7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	188.0665	188.9502	189.8423	194.4321	195.3768	200.2415	200.2415	201.2437	198.2669	195.3768	193.4965	191.6520	
alpha	13.5378	13.5967	13.6562	13.9621	14.0251	14.3494	14.3494	14.4162	14.2178	14.0251	13.8998	13.7768	
util living area	0.9741	0.9047	0.7852	0.6018	0.4465	0.3056	0.2192	0.2396	0.3819	0.6401	0.8953	0.9814	(86)
MIT	20.8920	20.9653	20.9941	20.9998	21.0000	21.0000	21.0000	21.0000	21.0000	20.9997	20.9755	20.8774	(87)
Th 2	20.4845	20.4868	20.4891	20.5006	20.5029	20.5145	20.5145	20.5168	20.5099	20.5029	20.4983	20.4937	(88)
util rest of house	0.9661	0.8857	0.7597	0.5770	0.4227	0.2824	0.1950	0.2144	0.3548	0.6097	0.8725	0.9753	(89)
MIT 2	20.3694	20.4535	20.4841	20.5005	20.5029	20.5145	20.5145	20.5168	20.5099	20.5027	20.4761	20.3607	(90)
Living area fraction										fLA = Living area / (4) =		0.5381	(91)
MIT	20.6506	20.7289	20.7585	20.7692	20.7704	20.7757	20.7757	20.7768	20.7736	20.7701	20.7448	20.6387	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6506	20.7289	20.7585	20.7692	20.7704	20.7757	20.7757	20.7768	20.7736	20.7701	20.7448	20.6387	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9689	0.8949	0.7732	0.5903	0.4355	0.2949	0.2080	0.2280	0.3694	0.6261	0.8840	0.9772	(94)
Useful gains	439.0962	464.4737	431.0181	352.8765	268.4324	178.3274	120.5764	125.7530	194.6227	300.8204	394.0201	423.4536	(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	502.6966	484.3801	434.2750	352.9689	268.4337	178.3274	120.5764	125.7530	194.6228	300.9797	407.7353	495.9509	(97)
Space heating kWh	47.3187	13.3771	2.4231	0.0666	0.0010	0.0000	0.0000	0.0000	0.0000	0.1185	9.8750	53.9380	(98a)
Space heating requirement - total per year (kWh/year)												127.1179	
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	47.3187	13.3771	2.4231	0.0666	0.0010	0.0000	0.0000	0.0000	0.0000	0.1185	9.8750	53.9380	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												127.1179	
Space heating per m2										(98c) / (4) =		2.2317	(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	47.3187	13.3771	2.4231	0.0666	0.0010	0.0000	0.0000	0.0000	0.0000	0.1185	9.8750	53.9380	(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)	47.3187	13.3771	2.4231	0.0666	0.0010	0.0000	0.0000	0.0000	0.0000	0.1185	9.8750	53.9380	(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	144.2085	127.2137	135.0994	119.5191	116.1672	105.0839	104.3782	108.5428	109.6784	121.7329	128.6130	142.8060	(64)
Efficiency of water heater												349.4100	(216)
(217)m	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	(217)
Fuel for water heating, kWh/month	41.2720	36.4081	38.6650	34.2060	33.2467	30.0747	29.8727	31.0646	31.3896	34.8396	36.8086	40.8706	(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	7.7340	6.9855	7.7340	7.4845	7.7340	7.4845	7.7340	7.7340	7.4845	7.7340	7.4845	7.7340	(231)
Lighting	20.0349	16.0727	14.4717	10.6026	8.1897	6.6911	7.4710	9.7110	12.6137	16.5498	18.6930	20.5917	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-7.8385	-13.4211	-23.8065	-32.1856	-39.0718	-38.0895	-37.3468	-32.7982	-25.4276	-17.0521	-9.2115	-6.4409	(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	127.1179	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	349.4100	
Water heating fuel used	418.7181	(219)
Space cooling fuel	0.0000	(221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.5460)

mechanical ventilation fans (SFP = 0.5460) 91.0613 (230a)

Total electricity for the above, kWh/year 91.0613 (231)

Electricity for lighting (calculated in Appendix L)	161.6929	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-282.6902	(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	515.9001	(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	127.1179	0.1615	20.5328	(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)	418.7181	0.1408	58.9402	(264)
Space and water heating			79.4730	(265)
Pumps, fans and electric keep-hot	91.0613	0.1387	12.6313	(267)
Energy for lighting	161.6929	0.1443	23.3373	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-282.6902	0.1312	-37.0792	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-37.0792	(269)
Total CO2, kg/year			78.3624	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.3800	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	127.1179	1.5977	203.0970	(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)	418.7181	1.5205	636.6545	(278)
Space and water heating			839.7515	(279)
Pumps, fans and electric keep-hot	91.0613	1.5128	137.7575	(281)
Energy for lighting	161.6929	1.5338	248.0100	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-282.6902	1.4846	-419.6730	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-419.6730	(283)
Total Primary energy kWh/year			805.8459	(286)
Dwelling Primary energy Rate (DPER)			14.1500	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	56.9600	(1b) x	2.4000	(2b) =	136.7040	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.9600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		136.7040	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1463	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3963	(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) =	0.3369	(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													
	0.4295	0.4211	0.4126	0.3705	0.3621	0.3200	0.3200	0.3116	0.3369	0.3621	0.3790	0.3958	(22b)
Effective ac	0.5922	0.5887	0.5851	0.5687	0.5656	0.5512	0.5512	0.5485	0.5567	0.5656	0.5718	0.5783	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opening Type			12.9600	1.1450	14.8397			(27)
External Wall 1	22.7400	12.9600	9.7800	0.1800	1.7604			(29a)
Total net area of external elements Aum(A, m2)			22.7400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	16.6001			(33)
Main dwelling								
Party Wall-between flats			32.6400	0.0000	0.0000			(32)
Party Wall-between circ			18.2400	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K			345.4401 (35)
List of Thermal Bridges			
K1 Element	Length	Psi-value	Total
E4 Jamb	19.2000	0.0500	0.9600
E7 Party floor between dwellings (in blocks of flats)	18.9500	0.0700	1.3265
E16 Corner (normal)	4.8000	0.0900	0.4320
E18 Party wall between dwellings	9.6000	0.0600	0.5760
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	42.4000	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			3.0785 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	19.6786 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	26.7169	26.5554	26.3970	25.6532	25.5140	24.8661	24.8661	24.7461	25.1157	25.5140	25.7955	26.0899	(38)
Heat transfer coeff	46.3955	46.2340	46.0756	45.3317	45.1926	44.5447	44.5447	44.4247	44.7943	45.1926	45.4741	45.7685	(39)
Average = Sum(39)m / 12 =												45.3311	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8145	0.8117	0.8089	0.7959	0.7934	0.7820	0.7820	0.7799	0.7864	0.7934	0.7984	0.8035	(40)
HLP (average)												0.7958	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy											1.8945	(42)
Hot water usage for mixer showers												
	71.8677	70.7877	69.2139	66.2026	63.9804	61.5023	60.0937	61.6556	63.3677	66.0285	69.1044	71.5924	(42a)
Hot water usage for baths												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses												
	34.0317	32.7942	31.5567	30.3191	29.0816	27.8441	27.8441	29.0816	30.3191	31.5567	32.7942	34.0317	(42c)
Average daily hot water use (litres/day)												97.1975	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	105.8994	103.5819	100.7705	96.5218	93.0621	89.3464	87.9378	90.7372	93.6869	97.5852	101.8986	105.6241	(44)
Energy conte	167.7188	147.4992	154.8805	132.1335	125.2794	109.8618	106.3531	112.3516	115.5253	132.4222	145.1732	165.3817	(45)
Energy content (annual)										Total = Sum(45)m =		1614.5805	
Distribution loss (46)m = 0.15 x (45)m													
	25.1578	22.1249	23.2321	19.8200	18.7919	16.4793	15.9530	16.8527	17.3288	19.8633	21.7760	24.8073	(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													
	214.3137	189.5849	201.4755	177.2254	171.8743	154.9536	152.9480	158.9465	160.6171	179.0171	190.2651	211.9767	(62)
WWHRS	-32.8549	-29.0572	-30.4270	-25.1947	-23.4806	-20.0925	-18.8335	-20.0276	-20.7885	-24.5073	-27.7638	-32.2465	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	181.4588	160.5278	171.0485	152.0306	148.3937	134.8611	134.1145	138.9189	139.8286	154.5098	162.5012	179.7302	(64)
										Total per year (kWh/year) = Sum(64)m =		1857.9237	(64)
12Total per year (kWh/year)												1858	(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													
	93.0424	82.7121	88.7737	80.0079	78.9313	72.6025	72.6383	74.6328	74.4856	81.3063	84.3436	92.2654	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	83.3175	92.2444	83.3175	86.0948	83.3175	86.0948	83.3175	83.3175	86.0948	83.3175	86.0948	83.3175	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	165.2203	166.9348	162.6144	153.4167	141.8064	130.8942	123.6043	121.8898	126.2102	135.4079	147.0182	157.9303	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	(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)													
	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	(71)
Water heating gains (Table 5)													

	125.0570	123.0834	119.3195	111.1220	106.0905	100.8368	97.6322	100.3129	103.4523	109.2827	117.1439	124.0126	(72)
Total internal gains													
	428.0125	436.6803	419.6691	405.0512	385.6321	369.2436	355.9717	356.9380	367.1750	382.4257	404.6746	419.6781	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	10.0800	36.7938	0.6300	0.7000	0.7700	113.3463	(79)
Northwest	2.8800	11.2829	0.6300	0.7000	0.7700	9.9309	(81)

Solar gains	123.2772	213.2852	300.5879	387.1290	447.0215	449.6852	431.0907	385.5068	330.4164	238.0880	148.2583	105.1109	(83)
Total gains	551.2897	649.9655	720.2570	792.1803	832.6536	818.9287	787.0624	742.4448	697.5913	620.5138	552.9329	524.7890	(84)

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7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	117.8051	118.2168	118.6231	120.5696	120.9409	122.6999	122.6999	123.0313	122.0163	120.9409	120.1921	119.4192	
alpha	8.8537	8.8811	8.9082	9.0380	9.0627	9.1800	9.1800	9.2021	9.1344	9.0627	9.0128	8.9613	
util living area													
	0.9853	0.9485	0.8621	0.6845	0.5043	0.3481	0.2490	0.2752	0.4429	0.7417	0.9492	0.9894	(86)
MIT	20.6487	20.8059	20.9284	20.9905	20.9994	21.0000	21.0000	21.0000	20.9998	20.9851	20.8369	20.6207	(87)
Th 2	20.2408	20.2432	20.2456	20.2569	20.2590	20.2689	20.2689	20.2708	20.2651	20.2590	20.2548	20.2503	(88)
util rest of house													
	0.9800	0.9334	0.8325	0.6452	0.4643	0.3084	0.2076	0.2316	0.3958	0.6946	0.9317	0.9855	(89)
MIT 2	19.8528	20.0433	20.1799	20.2497	20.2587	20.2689	20.2689	20.2708	20.2651	20.2483	20.0928	19.8264	(90)
Living area fraction									fLA = Living area / (4) =			0.5381	(91)
MIT	20.2811	20.4537	20.5827	20.6483	20.6572	20.6623	20.6623	20.6632	20.6604	20.6448	20.4932	20.2538	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2811	20.4537	20.5827	20.6483	20.6572	20.6623	20.6623	20.6632	20.6604	20.6448	20.4932	20.2538	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9803	0.9380	0.8462	0.6661	0.4858	0.3297	0.2299	0.2551	0.4212	0.7195	0.9378	0.9855	(94)
Useful gains	540.4502	609.6562	609.4886	527.6574	404.4983	270.0367	180.9545	189.3893	293.8068	446.4547	518.5529	517.1735	(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													
	741.4501	719.1074	648.8672	532.5716	404.8001	270.0435	180.9547	189.3898	293.8701	453.9491	609.0439	734.7566	(97)
Space heating kWh													
	149.5439	73.5512	29.2977	3.5382	0.2245	0.0000	0.0000	0.0000	0.0000	5.5759	65.1535	161.8819	(98a)
Space heating requirement - total per year (kWh/year)												488.7669	
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													
	149.5439	73.5512	29.2977	3.5382	0.2245	0.0000	0.0000	0.0000	0.0000	5.5759	65.1535	161.8819	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												488.7669	
Space heating per m2											(98c) / (4) =	8.5809	(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													
	149.5439	73.5512	29.2977	3.5382	0.2245	0.0000	0.0000	0.0000	0.0000	5.5759	65.1535	161.8819	(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)													
	162.0194	79.6871	31.7418	3.8334	0.2433	0.0000	0.0000	0.0000	0.0000	6.0410	70.5889	175.3866	(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													
	181.4588	160.5278	171.0485	152.0306	148.3937	134.8611	134.1145	138.9189	139.8286	154.5098	162.5012	179.7302	(64)
Efficiency of water heater												79.8000	(216)
(217)m	83.6294	82.4249	81.0005	79.9844	79.8122	79.8000	79.8000	79.8000	79.8000	80.0827	82.1838	83.8260	(217)
Fuel for water heating, kWh/month													
	216.9798	194.7563	211.1696	190.0754	185.9286	168.9989	168.0633	174.0839	175.2238	192.9377	197.7290	214.4086	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	17.3117	13.8881	12.5047	9.1615	7.0766	5.7816	6.4555	8.3911	10.8992	14.3004	16.1522	17.7929	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-7.5749	-11.6846	-18.3582	-22.6274	-26.2121	-25.1490	-24.8501	-22.5437	-18.8306	-14.1917	-8.6783	-6.4376	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													

(233b)m	-1.6918	-3.7012	-7.6307	-11.8779	-16.1240	-16.3516	-16.1541	-13.4789	-9.6278	-5.4195	-2.2983	-1.3272 (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	529.5416	(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	2290.3549	(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)	139.7157	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-312.8212	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2732.7910	(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	529.5416	0.2100	111.2037	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2290.3549	0.2100	480.9745	(264)
Space and water heating			592.1783	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	139.7157	0.1443	20.1653	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-207.1382	0.1327	-27.4971	
PV Unit electricity exported	-105.6830	0.1249	-13.1973	
Total			-40.6944	(269)
Total CO2, kg/year			583.5784	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.2500	(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	529.5416	1.1300	598.3820	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2290.3549	1.1300	2588.1010	(278)
Space and water heating			3186.4830	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	139.7157	1.5338	214.3005	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-207.1382	1.4905	-308.7407	
PV Unit electricity exported	-105.6830	0.4583	-48.4380	
Total			-357.1787	(283)
Total Primary energy kWh/year			3173.7057	(286)
Target Primary Energy Rate (TPER)			55.7200	(287)

Full SAP Calculation Printout

Property Reference	4F_Block C3_1Bed	**Issued on Date**	27/03/2025
Assessment Reference	Option 1_EPH+ASHP_P08	**Prop Type Ref**	North West
Property	Chorlton-cum-Hardy, Manchester, Greater Manchester, M21 9AQ		

SAP Rating	95 A	**DER**	1.57	**TER**	10.82
Environmental	99 A	**% DER < TER**			85.49
CO_2 Emissions (t/year)	0.07	**DFEE**	18.12	**TFEE**	20.22
Compliance Check	See BREL	**% DFEE < TFEE**			10.38
% DPER < TPER	72.54	**DPER**	16.10	**TPER**	58.63

Assessor Details	Mr. Leon Maddison	**Assessor ID**	AY03-0001
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)	
Main dwelling						
Ground floor	56.9600 (1b)	x	2.4000 (2b)	=	136.7040	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.9600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	136.7040	(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) =	74.4000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2906	0.2874	0.2842	0.2682	0.2651	0.2491	0.2491	0.2459	0.2555	0.2651	0.2714	0.2778	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Glazing			12.9600	1.1450	14.8397			(27)
External Wall 1	22.7400	12.9600	9.7800	0.1500	1.4670	60.0000	586.8000	(29a)
Total net area of external elements Aum(A, m2)			22.7400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.3067			(33)
Main dwelling								
Party Wall-between flats			32.6400	0.0000	0.0000	180.0000	5875.1999	(32)
Party Wall-between circ			18.2400	0.0000	0.0000	180.0000	3283.2000	(32)
Party Floor 1			56.9600			80.0000	4556.8000	(32d)
Party Ceiling 1			56.9600			100.0000	5696.0000	(32b)
Internal Wall 1			90.8300			9.0000	817.4700	(32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		20815.4699	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							365.4401	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E4 Jamb	19.2000	0.0180	0.3456	
E7 Party floor between dwellings (in blocks of flats)	18.9500	0.0360	0.6822	
E16 Corner (normal)	4.8000	0.0400	0.1920	
E18 Party wall between dwellings	9.6000	0.0320	0.3072	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	42.4000	0.0000	0.0000	
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0820	-0.1968	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.3302 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 17.6369 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	13.1079	12.9642	12.8204	12.1014	11.9576	11.2386	11.2386	11.0948	11.5262	11.9576	12.2452	12.5328	(38)
Heat transfer coeff	30.7448	30.6010	30.4573	29.7383	29.5945	28.8755	28.8755	28.7317	29.1631	29.5945	29.8821	30.1697	(39)
Average = Sum(39)m / 12 =												29.7023	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5398	0.5372	0.5347	0.5221	0.5196	0.5069	0.5069	0.5044	0.5120	0.5196	0.5246	0.5297	(40)
HLP (average)												0.5215	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.8945 (42)
Hot water usage for mixer showers

71.8677	70.7877	69.2139	66.2026	63.9804	61.5023	60.0937	61.6556	63.3677	66.0285	69.1044	71.5924	(42a)

Hot water usage for baths

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

Hot water usage for other uses

34.0317	32.7942	31.5567	30.3191	29.0816	27.8441	27.8441	29.0816	30.3191	31.5567	32.7942	34.0317	(42c)

Average daily hot water use (litres/day) 97.1975 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.8994	103.5819	100.7705	96.5218	93.0621	89.3464	87.9378	90.7372	93.6869	97.5852	101.8986	105.6241	(44)
Energy conte	167.7188	147.4992	154.8805	132.1335	125.2794	109.8618	106.3531	112.3516	115.5253	132.4222	145.1732	165.3817	(45)
Energy content (annual)										Total = Sum(45)m =		1614.5805	
Distribution loss (46)m = 0.15 x (45)m	25.1578	22.1249	23.2321	19.8200	18.7919	16.4793	15.9530	16.8527	17.3288	19.8633	21.7760	24.8073	(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	194.6702	171.8424	181.8319	158.2155	152.2308	135.9438	133.3045	139.3030	141.6073	159.3736	171.2552	192.3331	(62)
WWHRS	-50.4616	-44.6287	-46.7326	-38.6964	-36.0637	-30.8599	-28.9263	-30.7602	-31.9289	-37.6406	-42.6423	-49.5272	(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	144.2085	127.2137	135.0994	119.5191	116.1672	105.0839	104.3782	108.5428	109.6784	121.7329	128.6130	142.8060	(64)
									Total per year (kWh/year) = Sum(64)m =			1463.0431	(64)
12Total per year (kWh/year)												1463	(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	55.7665	49.0435	51.4978	43.9344	41.6554	36.5290	35.3624	37.3569	38.4122	44.0304	48.2701	54.9894	(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	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	83.3175	92.2444	83.3175	86.0948	83.3175	86.0948	83.3175	83.3175	86.0948	83.3175	86.0948	83.3175	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	165.2203	166.9348	162.6144	153.4167	141.8064	130.8942	123.6043	121.8898	126.2102	135.4079	147.0182	157.9303	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	(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)	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	(71)
Water heating gains (Table 5)	74.9550	72.9814	69.2175	61.0200	55.9885	50.7348	47.5301	50.2109	53.3502	59.1806	67.0418	73.9105	(72)
Total internal gains	374.9105	383.5782	366.5670	351.9492	332.5300	319.1415	305.8696	306.8359	317.0729	329.3237	351.5725	366.5761	(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	
Southwest	2.8800	36.7938	0.4000	0.7000	0.7700	20.5617	(79)
Northwest	10.0800	11.2829	0.4000	0.7000	0.7700	22.0686	(81)

Solar gains	42.6303	79.9454	128.8553	192.2936	245.1731	256.5030	241.8435	200.3898	150.5080	93.6064	52.3961	35.6188	(83)
Total gains	417.5407	463.5236	495.4223	544.2428	577.7032	575.6445	547.7131	507.2257	467.5809	422.9301	403.9686	402.1949	(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	188.0665	188.9502	189.8423	194.4321	195.3768	200.2415	200.2415	201.2437	198.2669	195.3768	193.4965	191.6520	
alpha	13.5378	13.5967	13.6562	13.9621	14.0251	14.3494	14.3494	14.4162	14.2178	14.0251	13.8998	13.7768	
util living area	0.9880	0.9562	0.8667	0.6605	0.4764	0.3210	0.2320	0.2606	0.4304	0.7254	0.9451	0.9912	(86)
MIT	20.8486	20.9257	20.9816	20.9994	21.0000	21.0000	21.0000	21.0000	21.0000	20.9985	20.9495	20.8374	(87)
Th 2	20.4845	20.4868	20.4891	20.5006	20.5029	20.5145	20.5145	20.5168	20.5099	20.5029	20.4983	20.4937	(88)
util rest of house	0.9838	0.9440	0.8428	0.6335	0.4510	0.2967	0.2064	0.2332	0.3998	0.6917	0.9286	0.9879	(89)
MIT 2	20.3173	20.4109	20.4726	20.5002	20.5029	20.5145	20.5145	20.5168	20.5099	20.5019	20.4496	20.3120	(90)
Living area fraction										fLA = Living area / (4) =		0.5381	(91)
MIT	20.6032	20.6879	20.7465	20.7688	20.7704	20.7757	20.7757	20.7768	20.7736	20.7691	20.7186	20.5947	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6032	20.6879	20.7465	20.7688	20.7704	20.7757	20.7757	20.7768	20.7736	20.7691	20.7186	20.5947	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9849	0.9491	0.8551	0.6480	0.4647	0.3098	0.2201	0.2479	0.4162	0.7098	0.9363	0.9887	(94)
Useful gains	411.2191	439.9214	423.6230	352.6647	268.4306	178.3274	120.5764	125.7530	194.6223	300.2114	378.2206	397.6321	(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	501.2383	483.1273	433.9096	352.9587	268.4337	178.3274	120.5764	125.7530	194.6228	300.9503	406.9518	494.6217	(97)
Space heating kWh	66.9743	29.0344	7.6532	0.2117	0.0023	0.0000	0.0000	0.0000	0.0000	0.5497	20.6865	72.1602	(98a)
Space heating requirement - total per year (kWh/year)												197.2724	
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	66.9743	29.0344	7.6532	0.2117	0.0023	0.0000	0.0000	0.0000	0.0000	0.5497	20.6865	72.1602	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												197.2724	
Space heating per m2											(98c) / (4) =	3.4634	(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	66.9743	29.0344	7.6532	0.2117	0.0023	0.0000	0.0000	0.0000	0.0000	0.5497	20.6865	72.1602	(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)	66.9743	29.0344	7.6532	0.2117	0.0023	0.0000	0.0000	0.0000	0.0000	0.5497	20.6865	72.1602	(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	144.2085	127.2137	135.0994	119.5191	116.1672	105.0839	104.3782	108.5428	109.6784	121.7329	128.6130	142.8060	(64)
Efficiency of water heater												349.4100	(216)
(217)m	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	(217)
Fuel for water heating, kWh/month	41.2720	36.4081	38.6650	34.2060	33.2467	30.0747	29.8727	31.0646	31.3896	34.8396	36.8086	40.8706	(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	7.7340	6.9855	7.7340	7.4845	7.7340	7.4845	7.7340	7.7340	7.4845	7.7340	7.4845	7.7340	(231)
Lighting	20.0349	16.0727	14.4717	10.6026	8.1897	6.6911	7.4710	9.7110	12.6137	16.5498	18.6930	20.5917	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-7.8790	-13.5265	-23.8945	-32.1905	-39.0719	-38.0895	-37.3468	-32.7982	-25.4276	-17.0575	-9.2543	-6.4687	(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	197.2724	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	349.4100	
Water heating fuel used	418.7181	(219)
Space cooling fuel	0.0000	(221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.5460)

mechanical ventilation fans (SFP = 0.5460) 91.0613 (230a)

Total electricity for the above, kWh/year 91.0613 (231)

Electricity for lighting (calculated in Appendix L)	161.6929	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-283.0050	(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	585.7398	(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	197.2724	0.1608	31.7244	(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)	418.7181	0.1408	58.9402	(264)
Space and water heating			90.6646	(265)
Pumps, fans and electric keep-hot	91.0613	0.1387	12.6313	(267)
Energy for lighting	161.6929	0.1443	23.3373	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-283.0050	0.1312	-37.1285	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-37.1285	(269)
Total CO2, kg/year			89.5047	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.5700	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	197.2724	1.5951	314.6737	(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)	418.7181	1.5205	636.6545	(278)
Space and water heating			951.3281	(279)
Pumps, fans and electric keep-hot	91.0613	1.5128	137.7575	(281)
Energy for lighting	161.6929	1.5338	248.0100	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-283.0050	1.4847	-420.1707	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-420.1707	(283)
Total Primary energy kWh/year			916.9250	(286)
Dwelling Primary energy Rate (DPER)			16.1000	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	56.9600	(1b) x	2.4000	(2b) =	136.7040	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.9600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		136.7040	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1463	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3963	(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) =	0.3369	(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													
	0.4295	0.4211	0.4126	0.3705	0.3621	0.3200	0.3200	0.3116	0.3369	0.3621	0.3790	0.3958	(22b)
Effective ac	0.5922	0.5887	0.5851	0.5687	0.5656	0.5512	0.5512	0.5485	0.5567	0.5656	0.5718	0.5783	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opening Type			12.9600	1.1450	14.8397			(27)
External Wall 1	22.7400	12.9600	9.7800	0.1800	1.7604			(29a)
Total net area of external elements Aum(A, m2)			22.7400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	16.6001			(33)
Main dwelling								
Party Wall-between flats			32.6400	0.0000	0.0000			(32)
Party Wall-between circ			18.2400	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K			345.4401 (35)
List of Thermal Bridges			
K1 Element	Length	Psi-value	Total
E4 Jamb	19.2000	0.0500	0.9600
E7 Party floor between dwellings (in blocks of flats)	18.9500	0.0700	1.3265
E16 Corner (normal)	4.8000	0.0900	0.4320
E18 Party wall between dwellings	9.6000	0.0600	0.5760
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	42.4000	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			3.0785 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	19.6786 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	26.7169	26.5554	26.3970	25.6532	25.5140	24.8661	24.8661	24.7461	25.1157	25.5140	25.7955	26.0899	(38)
Heat transfer coeff	46.3955	46.2340	46.0756	45.3317	45.1926	44.5447	44.5447	44.4247	44.7943	45.1926	45.4741	45.7685	(39)
Average = Sum(39)m / 12 =												45.3311	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8145	0.8117	0.8089	0.7959	0.7934	0.7820	0.7820	0.7799	0.7864	0.7934	0.7984	0.8035	(40)
HLP (average)												0.7958	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy											1.8945	(42)
Hot water usage for mixer showers												
	71.8677	70.7877	69.2139	66.2026	63.9804	61.5023	60.0937	61.6556	63.3677	66.0285	69.1044	71.5924	(42a)
Hot water usage for baths												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses												
	34.0317	32.7942	31.5567	30.3191	29.0816	27.8441	27.8441	29.0816	30.3191	31.5567	32.7942	34.0317	(42c)
Average daily hot water use (litres/day)												97.1975	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	105.8994	103.5819	100.7705	96.5218	93.0621	89.3464	87.9378	90.7372	93.6869	97.5852	101.8986	105.6241	(44)
Energy conte	167.7188	147.4992	154.8805	132.1335	125.2794	109.8618	106.3531	112.3516	115.5253	132.4222	145.1732	165.3817	(45)
Energy content (annual)										Total = Sum(45)m =		1614.5805	
Distribution loss (46)m = 0.15 x (45)m													
	25.1578	22.1249	23.2321	19.8200	18.7919	16.4793	15.9530	16.8527	17.3288	19.8633	21.7760	24.8073	(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													
	214.3137	189.5849	201.4755	177.2254	171.8743	154.9536	152.9480	158.9465	160.6171	179.0171	190.2651	211.9767	(62)
WWHRS	-32.8549	-29.0572	-30.4270	-25.1947	-23.4806	-20.0925	-18.8335	-20.0276	-20.7885	-24.5073	-27.7638	-32.2465	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	181.4588	160.5278	171.0485	152.0306	148.3937	134.8611	134.1145	138.9189	139.8286	154.5098	162.5012	179.7302	(64)
										Total per year (kWh/year) = Sum(64)m =		1857.9237	(64)
12Total per year (kWh/year)												1858	(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													
	93.0424	82.7121	88.7737	80.0079	78.9313	72.6025	72.6383	74.6328	74.4856	81.3063	84.3436	92.2654	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	83.3175	92.2444	83.3175	86.0948	83.3175	86.0948	83.3175	83.3175	86.0948	83.3175	86.0948	83.3175	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	165.2203	166.9348	162.6144	153.4167	141.8064	130.8942	123.6043	121.8898	126.2102	135.4079	147.0182	157.9303	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	(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)													
	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	(71)
Water heating gains (Table 5)													

	125.0570	123.0834	119.3195	111.1220	106.0905	100.8368	97.6322	100.3129	103.4523	109.2827	117.1439	124.0126	(72)
Total internal gains	428.0125	436.6803	419.6691	405.0512	385.6321	369.2436	355.9717	356.9380	367.1750	382.4257	404.6746	419.6781	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southwest	2.8800	36.7938	0.6300	0.7000	0.7700	32.3847	(79)
Northwest	10.0800	11.2829	0.6300	0.7000	0.7700	34.7580	(81)

Solar gains	67.1427	125.9140	202.9471	302.8624	386.1477	403.9923	380.9035	315.6139	237.0500	147.4301	82.5239	56.0996	(83)
Total gains	495.1552	562.5942	622.6162	707.9136	771.7798	773.2358	736.8752	672.5519	604.2250	529.8559	487.1985	475.7778	(84)

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7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	117.8051	118.2168	118.6231	120.5696	120.9409	122.6999	122.6999	123.0313	122.0163	120.9409	120.1921	119.4192	
alpha	8.8537	8.8811	8.9082	9.0380	9.0627	9.1800	9.1800	9.2021	9.1344	9.0627	9.0128	8.9613	
util living area	0.9931	0.9783	0.9277	0.7560	0.5436	0.3687	0.2660	0.3038	0.5110	0.8388	0.9763	0.9948	(86)
MIT	20.5706	20.7056	20.8627	20.9797	20.9988	21.0000	21.0000	21.0000	20.9995	20.9611	20.7622	20.5509	(87)
Th 2	20.2408	20.2432	20.2456	20.2569	20.2590	20.2689	20.2689	20.2708	20.2651	20.2590	20.2548	20.2503	(88)
util rest of house	0.9903	0.9706	0.9066	0.7156	0.5007	0.3266	0.2218	0.2557	0.4569	0.7946	0.9665	0.9927	(89)
MIT 2	19.7557	19.9252	20.1114	20.2409	20.2583	20.2689	20.2689	20.2708	20.2649	20.2288	20.0064	19.7389	(90)
Living area fraction									fLA = Living area / (4) =			0.5381	(91)
MIT	20.1942	20.3452	20.5157	20.6384	20.6568	20.6623	20.6623	20.6632	20.6602	20.6229	20.4131	20.1758	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1942	20.3452	20.5157	20.6384	20.6568	20.6623	20.6623	20.6632	20.6602	20.6229	20.4131	20.1758	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9901	0.9718	0.9147	0.7367	0.5238	0.3492	0.2456	0.2816	0.4860	0.8171	0.9689	0.9925	(94)
Useful gains	490.2739	546.7315	569.5006	521.5046	404.2242	270.0319	180.9543	189.3886	293.6497	432.9575	472.0479	472.1947	(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	737.4196	714.0911	645.7797	532.1236	404.7801	270.0431	180.9546	189.3897	293.8583	452.9585	605.3995	731.1895	(97)
Space heating kWh	183.8763	112.4657	56.7516	7.6456	0.4136	0.0000	0.0000	0.0000	0.0000	14.8807	96.0132	192.6922	(98a)
Space heating requirement - total per year (kWh/year)												664.7390	
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	183.8763	112.4657	56.7516	7.6456	0.4136	0.0000	0.0000	0.0000	0.0000	14.8807	96.0132	192.6922	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												664.7390	
Space heating per m2											(98c) / (4) =	11.6703	(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	183.8763	112.4657	56.7516	7.6456	0.4136	0.0000	0.0000	0.0000	0.0000	14.8807	96.0132	192.6922	(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)	199.2160	121.8480	61.4860	8.2835	0.4481	0.0000	0.0000	0.0000	0.0000	16.1221	104.0229	208.7673	(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	181.4588	160.5278	171.0485	152.0306	148.3937	134.8611	134.1145	138.9189	139.8286	154.5098	162.5012	179.7302	(64)
Efficiency of water heater												79.8000	(216)
(217)m	84.0895	83.2771	81.8671	80.1892	79.8225	79.8000	79.8000	79.8000	79.8000	80.5169	82.9213	84.2163	(217)
Fuel for water heating, kWh/month	215.7924	192.7633	208.9343	189.5900	185.9047	168.9989	168.0633	174.0839	175.2238	191.8973	195.9703	213.4151	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	17.3117	13.8881	12.5047	9.1615	7.0766	5.7816	6.4555	8.3911	10.8992	14.3004	16.1522	17.7929	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-8.4159	-12.9227	-20.2123	-24.7981	-28.6245	-27.4270	-27.1012	-24.6349	-20.6486	-15.6485	-9.6218	-7.1585	(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	-2.0092	-4.3863	-9.0252	-14.0203	-19.0036	-19.2612	-19.0285	-15.8906	-11.3671	-6.4140	-2.7268	-1.5769 (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	720.1939 (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	2280.6373 (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)	139.7157 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-351.9238 (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	2874.6231 (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	720.1939	0.2100	151.2407	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2280.6373	0.2100	478.9338	(264)
Space and water heating			630.1746	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	139.7157	0.1443	20.1653	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-227.2142	0.1328	-30.1821	
PV Unit electricity exported	-124.7096	0.1249	-15.5803	
Total			-45.7624	(269)
Total CO2, kg/year			616.5067	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.8200	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	720.1939	1.1300	813.8191	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2280.6373	1.1300	2577.1202	(278)
Space and water heating			3390.9393	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	139.7157	1.5338	214.3005	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-227.2142	1.4908	-338.7393	
PV Unit electricity exported	-124.7096	0.4585	-57.1846	
Total			-395.9239	(283)
Total Primary energy kWh/year			3339.4167	(286)
Target Primary Energy Rate (TPER)			58.6300	(287)

Full SAP Calculation Printout

Property Reference	4F_Block C6_2Bed 4P	**Issued on Date**	27/03/2025
Assessment Reference	Option 1_EPH+ASHP_P08	**Prop Type Ref**	North West
Property	Chorlton-cum-Hardy, Manchester, Greater Manchester, M21 9AQ		

SAP Rating	94 A	**DER**	1.74	**TER**	9.76
Environmental	99 A	**% DER < TER**			82.17
CO_2 Emissions (t/year)	0.1	**DFEE**	19.33	**TFEE**	20.50
Compliance Check	See BREL	**% DFEE < TFEE**			5.69
% DPER < TPER	66.09	**DPER**	17.85	**TPER**	52.65

Assessor Details	Mr. Leon Maddison	**Assessor ID**	AY03-0001
Client			

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	72.0200 (1b)	x	2.4000 (2b)	=	172.8480	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	172.8480	(5)

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2. Ventilation rate

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			m3 per hour	
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		0 * 10 =	0.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		0.0000 / (5) =	0.0000	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			3.0000	(17)
Infiltration rate			0.1500	(18)
Number of sides sheltered			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) =	74.4000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2906	0.2874	0.2842	0.2682	0.2651	0.2491	0.2491	0.2459	0.2555	0.2651	0.2714	0.2778	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Glazing			18.7200	1.1450	21.4351			(27)
External Wall 1	42.8600	18.7200	24.1400	0.1500	3.6210	60.0000	1448.4000	(29a)
Total net area of external elements Aum(A, m2)			42.8600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.0561			(33)
Main dwelling								
Party Wall-between flats			16.3200	0.0000	0.0000	180.0000	2937.5999	(32)
Party Wall-between circ			28.6800	0.0000	0.0000	180.0000	5162.4001	(32)
Party Floor 1			72.0200			80.0000	5761.6000	(32d)
Party Ceiling 1			72.0200			100.0000	7202.0000	(32b)
Internal Wall 1			116.5400			9.0000	1048.8600	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 23560.8600	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	327.1433	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E4 Jamb	28.8000	0.0180	0.5184	
E7 Party floor between dwellings (in blocks of flats)	35.7200	0.0360	1.2859	
E16 Corner (normal)	9.6000	0.0400	0.3840	
E18 Party wall between dwellings	12.0000	0.0320	0.3840	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	37.5000	0.0000	0.0000	
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0820	-0.3936	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			2.1787	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	27.2348	(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	16.5736	16.3918	16.2100	15.3009	15.1191	14.2101	14.2101	14.0282	14.5737	15.1191	15.4828	15.8464	(38)
Heat transfer coeff	43.8085	43.6267	43.4448	42.5358	42.3540	41.4449	41.4449	41.2631	41.8085	42.3540	42.7176	43.0812	(39)
Average = Sum(39)m / 12 =												42.4903	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6083	0.6058	0.6032	0.5906	0.5881	0.5755	0.5755	0.5729	0.5805	0.5881	0.5931	0.5982	(40)
HLP (average)												0.5900	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2941	(42)
Hot water usage for mixer showers	80.5042	79.2944	77.5314	74.1584	71.6691	68.8931	67.3152	69.0649	70.9827	73.9633	77.4088	80.1958	(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses	38.1244	36.7380	35.3517	33.9654	32.5790	31.1927	31.1927	32.5790	33.9654	35.3517	36.7380	38.1244	(42c)
Average daily hot water use (litres/day)												108.8807	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	118.6286	116.0324	112.8831	108.1237	104.2481	100.0858	98.5079	101.6439	104.9481	109.3150	114.1469	118.3202	(44)
Energy conte	187.8787	165.2286	173.4972	148.0160	140.3380	123.0672	119.1368	125.8563	129.4115	148.3394	162.6232	185.2608	(45)
Energy content (annual)										Total = Sum(45)m =		1808.6537	
Distribution loss (46)m = 0.15 x (45)m	28.1818	24.7843	26.0246	22.2024	21.0507	18.4601	17.8705	18.8785	19.4117	22.2509	24.3935	27.7891	(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	214.8301	189.5718	200.4486	174.0980	167.2894	149.1492	146.0882	152.8077	155.4935	175.2908	188.7052	212.2122	(62)
WWHRS	-56.5257	-49.9918	-52.3485	-43.3467	-40.3975	-34.5685	-32.4024	-34.4567	-35.7659	-42.1640	-47.7667	-55.4789	(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	158.3044	139.5800	148.1000	130.7513	126.8919	114.5807	113.6858	118.3510	119.7277	133.1268	140.9385	156.7332	(64)
										Total per year (kWh/year) = Sum(64)m =		1600.7714	(64)
12Total per year (kWh/year)												1601	(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	62.4697	54.9385	57.6878	49.2153	46.6624	40.9198	39.6130	41.8472	43.0293	49.3229	54.0722	61.5992	(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	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	101.8681	112.7826	101.8681	105.2637	101.8681	105.2637	101.8681	101.8681	105.2637	101.8681	105.2637	101.8681	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	201.9649	204.0607	198.7794	187.5363	173.3438	160.0048	151.0936	148.9978	154.2791	165.5223	179.7148	193.0537	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	(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)	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	(71)
Water heating gains (Table 5)	83.9646	81.7538	77.5374	68.3546	62.7183	56.8331	53.2433	56.2463	59.7630	66.2942	75.1003	82.7946	(72)
Total internal gains	445.2099	456.0092	435.5972	418.5668	395.3424	379.5139	363.6172	364.5245	376.7180	391.0968	417.4910	435.1287	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	2.8800	11.2829	0.4000	0.7000	0.7700	6.3053	(75)
Southeast	12.9600	36.7938	0.4000	0.7000	0.7700	92.5276	(77)
Southwest	2.8800	36.7938	0.4000	0.7000	0.7700	20.5617	(79)

Solar gains	119.3946	205.4675	286.6927	364.5506	416.8379	417.5673	401.0215	361.4404	313.5661	228.5853	143.3886	101.9301	(83)
Total gains	564.6045	661.4768	722.2898	783.1174	812.1803	797.0812	764.6387	725.9649	690.2841	619.6821	560.8796	537.0588	(84)

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7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	149.3931	150.0157	150.6435	153.8630	154.5235	157.9129	157.9129	158.6087	156.5395	154.5235	153.2082	151.9150	
alpha	10.9595	11.0010	11.0429	11.2575	11.3016	11.5275	11.5275	11.5739	11.4360	11.3016	11.2139	11.1277	
util living area	0.9860	0.9414	0.8417	0.6552	0.4849	0.3328	0.2385	0.2615	0.4179	0.7064	0.9417	0.9904	(86)
MIT	20.7727	20.8964	20.9714	20.9979	20.9999	21.0000	21.0000	21.0000	21.0000	20.9964	20.9145	20.7503	(87)
Th 2	20.4226	20.4248	20.4271	20.4385	20.4407	20.4521	20.4521	20.4544	20.4476	20.4407	20.4362	20.4316	(88)
util rest of house	0.9815	0.9271	0.8159	0.6255	0.4558	0.3043	0.2088	0.2304	0.3844	0.6701	0.9251	0.9872	(89)
MIT 2	20.1688	20.3180	20.4008	20.4369	20.4407	20.4521	20.4521	20.4544	20.4476	20.4381	20.3512	20.1492	(90)
Living area fraction										fLA = Living area / (4) =		0.4250	(91)
MIT	20.4255	20.5638	20.6433	20.6753	20.6784	20.6850	20.6850	20.6863	20.6824	20.6754	20.5906	20.4046	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.4255	20.5638	20.6433	20.6753	20.6784	20.6850	20.6850	20.6863	20.6824	20.6754	20.5906	20.4046	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9815	0.9308	0.8259	0.6381	0.4682	0.3164	0.2214	0.2436	0.3987	0.6854	0.9300	0.9870	(94)
Useful gains	554.1663	615.6825	596.5086	499.6892	380.2316	252.1913	169.3018	176.8659	275.1941	424.7531	521.6100	530.0764	(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	706.4327	683.3591	614.4530	500.8730	380.2697	252.1916	169.3019	176.8659	275.1986	426.7341	576.2877	698.1158	(97)
Space heating kWh	113.2862	45.4787	13.3507	0.8523	0.0284	0.0000	0.0000	0.0000	0.0000	1.4738	39.3679	125.0213	(98a)
Space heating requirement - total per year (kWh/year)												338.8593	
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	113.2862	45.4787	13.3507	0.8523	0.0284	0.0000	0.0000	0.0000	0.0000	1.4738	39.3679	125.0213	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												338.8593	
Space heating per m2											(98c) / (4) =	4.7051	(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	113.2862	45.4787	13.3507	0.8523	0.0284	0.0000	0.0000	0.0000	0.0000	1.4738	39.3679	125.0213	(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)	113.2862	45.4787	13.3507	0.8523	0.0284	0.0000	0.0000	0.0000	0.0000	1.4738	39.3679	125.0213	(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	158.3044	139.5800	148.1000	130.7513	126.8919	114.5807	113.6858	118.3510	119.7277	133.1268	140.9385	156.7332	(64)
Efficiency of water heater												346.6611	(216)
(217)m	346.6611	346.6611	346.6611	346.6611	346.6611	346.6611	346.6611	346.6611	346.6611	346.6611	346.6611	346.6611	(217)
Fuel for water heating, kWh/month	45.6655	40.2641	42.7219	37.7173	36.6040	33.0527	32.7945	34.1403	34.5374	38.4026	40.6560	45.2122	(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	9.7788	8.8325	9.7788	9.4634	9.7788	9.4634	9.7788	9.7788	9.4634	9.7788	9.4634	9.7788	(231)
Lighting	24.7950	19.8915	17.9101	13.1217	10.1356	8.2808	9.2460	12.0183	15.6106	20.4819	23.1343	25.4841	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-8.0410	-13.8831	-24.7168	-33.5742	-41.0269	-40.0993	-39.2974	-34.3453	-26.4274	-17.5514	-9.4669	-6.5941	(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												338.8593	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												346.6611	
Water heating fuel used												461.7684	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.5460)
mechanical ventilation fans (SFP = 0.5460) 115.1375 (230a)

Total electricity for the above, kWh/year	115.1375	(231)
Electricity for lighting (calculated in Appendix L)	200.1099	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-295.0238	(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	820.8513	(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	338.8593	0.1606	54.4340	(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)	461.7684	0.1408	65.0227	(264)
Space and water heating			119.4566	(265)
Pumps, fans and electric keep-hot	115.1375	0.1387	15.9710	(267)
Energy for lighting	200.1099	0.1443	28.8820	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-295.0238	0.1311	-38.6664	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-38.6664	(269)
Total CO2, kg/year			125.6433	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.7400	(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	338.8593	1.5945	540.2981	(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)	461.7684	1.5207	702.1963	(278)
Space and water heating			1242.4944	(279)
Pumps, fans and electric keep-hot	115.1375	1.5128	174.1800	(281)
Energy for lighting	200.1099	1.5338	306.9352	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-295.0238	1.4842	-437.8682	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-437.8682	(283)
Total Primary energy kWh/year			1285.7414	(286)
Dwelling Primary energy Rate (DPER)			17.8500	(287)

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

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling							
Ground floor		72.0200	(1b)	x 2.4000	(2b) =	172.8480	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0200						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		172.8480	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1736	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4236	(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) =	0.3600	(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	0.4590	0.4500	0.4410	0.3960	0.3870	0.3420	0.3420	0.3330	0.3600	0.3870	0.4050	0.4230	(22b)
Effective ac	0.6054	0.6013	0.5973	0.5784	0.5749	0.5585	0.5585	0.5555	0.5648	0.5749	0.5820	0.5895	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opening Type			18.0000	1.1450	20.6107			(27)
External Wall 1	42.8600	18.0000	24.8600	0.1800	4.4748			(29a)
Total net area of external elements Aum(A, m2)			42.8600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.0855			(33)
Main dwelling								
Party Wall-between flats			16.3200	0.0000	0.0000			(32)
Party Wall-between circ			28.6800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 307.1433 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E4 Jamb	28.8000	0.0500	1.4400	
E7 Party floor between dwellings (in blocks of flats)	35.7200	0.0700	2.5004	
E16 Corner (normal)	9.6000	0.0900	0.8640	
E18 Party wall between dwellings	12.0000	0.0600	0.7200	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	37.5000	0.0000	0.0000	
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0900	-0.4320	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.0924 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 30.1779 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	34.5295	34.2961	34.0674	32.9930	32.7920	31.8563	31.8563	31.6830	32.2167	32.7920	33.1986	33.6238	(38)
Heat transfer coeff	64.7074	64.4740	64.2453	63.1709	62.9699	62.0341	62.0341	61.8609	62.3946	62.9699	63.3765	63.8017	(39)

Average = Sum(39)m / 12 = 63.1699

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8985	0.8952	0.8920	0.8771	0.8743	0.8613	0.8613	0.8589	0.8664	0.8743	0.8800	0.8859	(40)
HLP (average)												0.8771	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2941 (42)

Hot water usage for mixer showers

80.5042	79.2944	77.5314	74.1584	71.6691	68.8931	67.3152	69.0649	70.9827	73.9633	77.4088	80.1958	(42a)

Hot water usage for baths

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

Hot water usage for other uses

38.1244	36.7380	35.3517	33.9654	32.5790	31.1927	31.1927	32.5790	33.9654	35.3517	36.7380	38.1244	(42c)

Average daily hot water use (litres/day) 108.8807 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	118.6286	116.0324	112.8831	108.1237	104.2481	100.0858	98.5079	101.6439	104.9481	109.3150	114.1469	118.3202	(44)
Energy conte	187.8787	165.2286	173.4972	148.0160	140.3380	123.0672	119.1368	125.8563	129.4115	148.3394	162.6232	185.2608	(45)

Energy content (annual) Total = Sum(45)m = 1808.6537

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

28.1818	24.7843	26.0246	22.2024	21.0507	18.4601	17.8705	18.8785	19.4117	22.2509	24.3935	27.7891	(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

234.4736	207.3144	220.0921	193.1078	186.9329	168.1590	165.7317	172.4512	174.5034	194.9343	207.7150	231.8557	(62)
WWHRS -36.8032	-32.5490	-34.0835	-28.2224	-26.3023	-22.5071	-21.0968	-22.4343	-23.2867	-27.4524	-31.1003	-36.1216	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

197.6704	174.7653	186.0086	164.8854	160.6306	145.6519	144.6349	150.0169	151.2167	167.4819	176.6147	195.7340	(64)

Total per year (kWh/year) = Sum(64)m = 2015.3115 (64)

12Total per year (kWh/year) 2015 (64)

Electric shower(s)

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

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

Heat gains from water heating, kWh/month

99.7456	88.6071	94.9637	85.2888	83.9383	76.9933	76.8889	79.1232	79.1028	86.5988	90.1457	98.8751	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	101.8681	112.7826	101.8681	105.2637	101.8681	105.2637	101.8681	101.8681	105.2637	101.8681	105.2637	101.8681	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	201.9649	204.0607	198.7794	187.5363	173.3438	160.0048	151.0936	148.9978	154.2791	165.5223	179.7148	193.0537	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	(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)	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	(71)

Water heating gains (Table 5)													
	134.0667	131.8558	127.6394	118.4566	112.8203	106.9351	103.3453	106.3483	109.8650	116.3962	125.2023	132.8967	(72)
Total internal gains													
	498.3119	509.1113	488.6992	471.6689	448.4444	429.6159	413.7193	414.6265	426.8201	444.1989	470.5931	488.2307	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	2.7700	11.2829	0.6300	0.7000	0.7700	9.5516	(75)
Southeast	12.4600	36.7938	0.6300	0.7000	0.7700	140.1086	(77)
Southwest	2.7700	36.7938	0.6300	0.7000	0.7700	31.1477	(79)

Solar gains	180.8079	311.1554	434.1635	552.0748	631.2625	632.3686	607.3108	547.3662	474.8617	346.1652	217.1440	154.3601	(83)
Total gains	679.1199	820.2667	922.8627	1023.7436	1079.7069	1061.9846	1021.0301	961.9927	901.6818	790.3641	687.7370	642.5908	(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	94.9594	95.3031	95.6424	97.2690	97.5795	99.0515	99.0515	99.3289	98.4793	97.5795	96.9534	96.3074	
alpha	7.3306	7.3535	7.3762	7.4846	7.5053	7.6034	7.6034	7.6219	7.5653	7.5053	7.4636	7.4205	
util living area													
	0.9874	0.9568	0.8847	0.7235	0.5399	0.3737	0.2673	0.2958	0.4765	0.7852	0.9606	0.9909	(86)
MIT	20.4622	20.6678	20.8489	20.9688	20.9964	20.9998	21.0000	21.0000	20.9989	20.9548	20.7102	20.4282	(87)
Th 2	20.1688	20.1716	20.1743	20.1870	20.1894	20.2005	20.2005	20.2025	20.1962	20.1894	20.1845	20.1795	(88)
util rest of house													
	0.9831	0.9443	0.8578	0.6817	0.4938	0.3271	0.2188	0.2445	0.4215	0.7374	0.9469	0.9877	(89)
MIT 2	19.5643	19.8179	20.0279	20.1614	20.1870	20.2004	20.2005	20.2025	20.1957	20.1538	19.8840	19.5306	(90)
Living area fraction									fLA = Living area / (4) =			0.4250	(91)
MIT	19.9459	20.1791	20.3769	20.5046	20.5310	20.5402	20.5403	20.5415	20.5370	20.4943	20.2352	19.9121	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9459	20.1791	20.3769	20.5046	20.5310	20.5402	20.5403	20.5415	20.5370	20.4943	20.2352	19.9121	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9817	0.9444	0.8649	0.6983	0.5133	0.3469	0.2394	0.2663	0.4449	0.7560	0.9478	0.9864	(94)
Useful gains	666.7004	774.6904	798.1424	714.9122	554.2283	368.4162	244.4287	256.1866	401.1457	597.5461	651.8678	633.8756	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1012.4079	985.1056	891.5229	733.0702	556.0889	368.4932	244.4323	256.1945	401.6368	623.0416	832.4605	1002.4555	(97)
Space heating kWh													
	257.2064	141.3990	69.4751	13.0737	1.3843	0.0000	0.0000	0.0000	0.0000	18.9686	130.0267	274.2235	(98a)
Space heating requirement - total per year (kWh/year)												905.7574	
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													
	257.2064	141.3990	69.4751	13.0737	1.3843	0.0000	0.0000	0.0000	0.0000	18.9686	130.0267	274.2235	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												905.7574	
Space heating per m2										(98c) / (4) =		12.5765	(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													
	257.2064	141.3990	69.4751	13.0737	1.3843	0.0000	0.0000	0.0000	0.0000	18.9686	130.0267	274.2235	(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)													
	278.6634	153.1950	75.2710	14.1644	1.4998	0.0000	0.0000	0.0000	0.0000	20.5511	140.8740	297.1002	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	197.6704	174.7653	186.0086	164.8854	160.6306	145.6519	144.6349	150.0169	151.2167	167.4819	176.6147	195.7340	(64)
Efficiency of water heater												79.8000	(216)
(217)m	84.6512	83.5889	82.0617	80.3986	79.8692	79.8000	79.8000	79.8000	79.8000	80.6314	83.3835	84.8159	(217)
Fuel for water heating, kWh/month													
	233.5116	209.0772	226.6692	205.0848	201.1172	182.5212	181.2468	187.9911	189.4946	207.7130	211.8101	230.7750	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	21.1662	16.9803	15.2889	11.2013	8.6522	7.0689	7.8928	10.2594	13.3259	17.4843	19.7485	21.7545	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-10.5828	-16.2176	-25.3131	-30.9847	-35.6944	-34.1662	-33.7516	-30.7099	-25.7896	-19.6018	-12.0857	-9.0046	(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	-2.5986	-5.6679	-11.6547	-18.0972	-24.5264	-24.8662	-24.5746	-20.5303	-14.6909	-8.2940	-3.5279	-2.0403	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	981.3190	(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	2467.0119	(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)	170.8232	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-444.9711	(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	3260.1830	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	981.3190	0.2100	206.0770	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2467.0119	0.2100	518.0725	(264)
Space and water heating			724.1495	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	170.8232	0.1443	24.6551	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-283.9021	0.1329	-37.7259	
PV Unit electricity exported	-161.0690	0.1249	-20.1233	
Total			-57.8493	(269)
Total CO2, kg/year			702.8846	(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	981.3190	1.1300	1108.8904	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2467.0119	1.1300	2787.7235	(278)
Space and water heating			3896.6139	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	170.8232	1.5338	262.0143	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-283.9021	1.4910	-423.3029	
PV Unit electricity exported	-161.0690	0.4586	-73.8588	
Total			-497.1617	(283)
Total Primary energy kWh/year			3791.5673	(286)
Target Primary Energy Rate (TPER)			52.6500	(287)

Full SAP Calculation Printout

Property Reference	5F_Block A17_3Bed	**Issued on Date**	27/03/2025
Assessment Reference	Option 1_EPH+ASHP_P08	**Prop Type Ref**	North West
Property	Chorlton-cum-Hardy, Manchester, Greater Manchester, M21 9AQ		

SAP Rating	92 A	**DER**	1.74	**TER**	7.22
Environmental	98 A	**% DER < TER**			75.90
CO_2 Emissions (t/year)	0.2	**DFEE**	18.59	**TFEE**	18.44
Compliance Check	See BREL	**% DFEE < TFEE**			-0.84
% DPER < TPER	53.82	**DPER**	17.95	**TPER**	38.86

Assessor Details	Mr. Leon Maddison	**Assessor ID**	AY03-0001
Client			

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	148.2300 (1b)	x	2.4000 (2b)	=	355.7520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	148.2300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	355.7520	(5)

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2. Ventilation rate

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			m3 per hour	
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		0 * 10 =	0.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		0.0000 / (5) =	0.0000	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			3.0000	(17)
Infiltration rate			0.1500	(18)
Number of sides sheltered			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) =												73.6000	(23c)
Effective ac	0.2946	0.2914	0.2882	0.2722	0.2691	0.2531	0.2531	0.2499	0.2595	0.2691	0.2754	0.2818	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Glazing			21.8400	1.1450	25.0076			(27)
External Wall 1	53.9500	21.8400	32.1100	0.1500	4.8165	60.0000	1926.6000	(29a)
Total net area of external elements Aum(A, m2)			53.9500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.8241			(33)
Main dwelling								
Party Wall-between flats			32.6400	0.0000	0.0000	180.0000	5875.1999	(32)
Party Wall-between circ			71.2000	0.0000	0.0000	180.0000	12815.9995	(32)
Party Floor 1			148.2300			80.0000	11858.4000	(32d)
Party Ceiling 1			148.2300			100.0000	14823.0000	(32b)
Internal Wall 1			280.5100			9.0000	2524.5901	(32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		49823.7895	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							336.1249	(35)
List of Thermal Bridges								
K1 Element					Length	Psi-value	Total	

E4 Jamb	30.6000	0.0180	0.5508	
E7 Party floor between dwellings (in blocks of flats)	44.9600	0.0360	1.6186	
E16 Corner (normal)	9.6000	0.0400	0.3840	
E18 Party wall between dwellings	14.4000	0.0320	0.4608	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	86.5300	0.0000	0.0000	
E1 Steel lintel with perforated steel base plate	7.2000	0.3400	2.4480	
E17 Corner (inverted - internal area greater than external area)	9.6000	-0.0820	-0.7872	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			4.6750	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	34.4991	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	34.5811	34.2069	33.8327	31.9616	31.5874	29.7164	29.7164	29.3422	30.4648	31.5874	32.3359	33.0843	(38)
Heat transfer coeff	69.0802	68.7060	68.3318	66.4607	66.0865	64.2155	64.2155	63.8413	64.9639	66.0865	66.8349	67.5834	(39)
Average = Sum(39)m / 12 =												66.3672	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4660	0.4635	0.4610	0.4484	0.4458	0.4332	0.4332	0.4307	0.4383	0.4458	0.4509	0.4559	(40)
HLP (average)												0.4477	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9314	(42)
Hot water usage for mixer showers	73.3696	72.2670	70.6603	67.5861	65.3175	62.7875	61.3495	62.9440	64.6920	67.4084	70.5486	73.0885	(42a)
Hot water usage for baths	31.6746	31.2041	30.5417	29.3203	28.4057	27.3916	26.8438	27.5016	28.2178	29.3030	30.5495	31.5675	(42b)
Hot water usage for other uses	44.6504	43.0267	41.4031	39.7794	38.1558	36.5321	36.5321	38.1558	39.7794	41.4031	43.0267	44.6504	(42c)
Average daily hot water use (litres/day)												137.6028	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.6945	146.4978	142.6050	136.6858	131.8790	126.7112	124.7254	128.6014	132.6892	138.1144	144.1248	149.3063	(44)
Energy conte	237.0795	208.6110	219.1786	187.1161	177.5344	155.8062	150.8446	159.2354	163.6191	187.4200	205.3322	233.7776	(45)
Energy content (annual)										Total = Sum(45)m =		2285.5547	
Distribution loss (46)m = 0.15 x (45)m	35.5619	31.2916	32.8768	28.0674	26.6302	23.3709	22.6267	23.8853	24.5429	28.1130	30.7998	35.0666	(46)
Water storage loss:													
Store volume												269.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7700	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.9558	(55)
Total storage loss	29.6298	26.7624	29.6298	28.6740	29.6298	28.6740	29.6298	29.6298	28.6740	29.6298	28.6740	29.6298	(56)
If cylinder contains dedicated solar storage	29.6298	26.7624	29.6298	28.6740	29.6298	28.6740	29.6298	29.6298	28.6740	29.6298	28.6740	29.6298	(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	266.7093	235.3734	248.8084	215.7901	207.1642	184.4802	180.4744	188.8652	192.2931	217.0498	234.0062	263.4074	(62)
WWHRS	-51.5162	-45.5613	-47.7092	-39.5051	-36.8173	-31.5049	-29.5308	-31.4030	-32.5961	-38.4273	-43.5334	-50.5622	(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	215.1931	189.8120	201.0993	176.2850	170.3469	152.9754	150.9436	157.4622	159.6969	178.6225	190.4728	212.8452	(64)
									Total per year (kWh/year) = Sum(64)m =			2155.7549	(64)
12Total per year (kWh/year)												2156	(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	78.8289	69.3632	72.8769	62.2161	59.0302	51.8056	50.1558	52.9458	54.4033	62.3171	68.2730	77.7311	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.5695	146.5695	146.5695	146.5695	146.5695	146.5695	146.5695	146.5695	146.5695	146.5695	146.5695	146.5695	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	170.5098	188.7787	170.5098	176.1935	170.5098	176.1935	170.5098	170.5098	176.1935	170.5098	176.1935	170.5098	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	318.5908	321.8967	313.5658	295.8302	273.4422	252.4006	238.3435	235.0375	243.3685	261.1041	283.4921	304.5337	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6569	37.6569	37.6569	37.6569	37.6569	37.6569	37.6569	37.6569	37.6569	37.6569	37.6569	37.6569	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.2556	-117.2556	-117.2556	-117.2556	-117.2556	-117.2556	-117.2556	-117.2556	-117.2556	-117.2556	-117.2556	-117.2556	(71)
Water heating gains (Table 5)	105.9529	103.2190	97.9528	86.4112	79.3417	71.9522	67.4137	71.1637	75.5602	83.7596	94.8236	104.4772	(72)
Total internal gains	662.0243	680.8653	648.9993	625.4058	590.2645	567.5171	543.2379	543.6819	562.0930	582.3444	621.4800	646.4916	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	2.5200	11.2829	0.4000	0.7000	0.7700	5.5171	(75)
Southeast	6.7200	36.7938	0.4000	0.7000	0.7700	47.9773	(77)
Southwest	10.0800	36.7938	0.4000	0.7000	0.7700	71.9659	(79)
Northwest	2.5200	11.2829	0.4000	0.7000	0.7700	5.5171	(81)

Solar gains	130.9775	226.7682	320.0095	412.8250	477.2926	480.3925	460.4232	411.3259	351.9950	253.2521	157.5483	111.6575	(83)
Total gains	793.0018	907.6335	969.0087	1038.2308	1067.5571	1047.9096	1003.6611	955.0078	914.0880	835.5964	779.0283	758.1491	(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	200.3460	201.4372	202.5403	208.2424	209.4215	215.5234	215.5234	216.7867	213.0404	209.4215	207.0764	204.7833	
alpha	14.3564	14.4291	14.5027	14.8828	14.9614	15.3682	15.3682	15.4524	15.2027	14.9614	14.8051	14.6522	
util living area	0.9986	0.9891	0.9454	0.7706	0.5756	0.3922	0.2815	0.3075	0.4904	0.8143	0.9873	0.9991	(86)
MIT	20.7720	20.8687	20.9529	20.9974	21.0000	21.0000	21.0000	21.0000	21.0000	20.9957	20.8990	20.7615	(87)
Th 2	20.5521	20.5544	20.5567	20.5684	20.5707	20.5824	20.5824	20.5848	20.5777	20.5707	20.5661	20.5614	(88)
util rest of house	0.9980	0.9855	0.9313	0.7445	0.5491	0.3666	0.2548	0.2797	0.4604	0.7837	0.9823	0.9987	(89)
MIT 2	20.2842	20.4079	20.5097	20.5663	20.5707	20.5824	20.5824	20.5848	20.5777	20.5674	20.4569	20.2791	(90)
Living area fraction										fLA = Living area / (4) =		0.2314	(91)
MIT	20.3971	20.5145	20.6123	20.6661	20.6700	20.6791	20.6791	20.6809	20.6754	20.6665	20.5592	20.3907	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3971	20.5145	20.6123	20.6661	20.6700	20.6791	20.6791	20.6809	20.6754	20.6665	20.5592	20.3907	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9851	0.9332	0.7504	0.5552	0.3725	0.2610	0.2862	0.4673	0.7906	0.9822	0.9986	(94)
Useful gains	791.2175	894.0869	904.2787	779.1076	592.7584	390.3692	261.9383	273.2951	427.1648	660.6624	765.1957	757.0686	(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	1111.9908	1072.8108	964.3164	781.9808	592.7981	390.3693	261.9383	273.2951	427.1670	665.2610	899.5432	1094.2248	(97)
Space heating kWh	238.6554	120.1025	44.6680	2.0687	0.0295	0.0000	0.0000	0.0000	0.0000	3.4213	96.7303	250.8442	(98a)
Space heating requirement - total per year (kWh/year)												756.5199	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	238.6554	120.1025	44.6680	2.0687	0.0295	0.0000	0.0000	0.0000	0.0000	3.4213	96.7303	250.8442	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												756.5199	
Space heating per m2										(98c) / (4) =		5.1037	(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	238.6554	120.1025	44.6680	2.0687	0.0295	0.0000	0.0000	0.0000	0.0000	3.4213	96.7303	250.8442	(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)	238.6554	120.1025	44.6680	2.0687	0.0295	0.0000	0.0000	0.0000	0.0000	3.4213	96.7303	250.8442	(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	215.1931	189.8120	201.0993	176.2850	170.3469	152.9754	150.9436	157.4622	159.6969	178.6225	190.4728	212.8452	(64)
Efficiency of water heater												336.5465	(216)
(217)m	336.5465	336.5465	336.5465	336.5465	336.5465	336.5465	336.5465	336.5465	336.5465	336.5465	336.5465	336.5465	(217)
Fuel for water heating, kWh/month	63.9416	56.3999	59.7538	52.3806	50.6162	45.4545	44.8507	46.7876	47.4517	53.0751	56.5963	63.2439	(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	23.7390	21.4417	23.7390	22.9732	23.7390	22.9732	23.7390	23.7390	22.9732	23.7390	22.9732	23.7390	(231)
Lighting	43.2789	34.7200	31.2615	22.9035	17.6913	14.4540	16.1386	20.9776	27.2478	35.7506	40.3802	44.4818	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-8.3221	-14.6595	-26.5827	-36.6826	-45.5212	-44.7602	-43.8309	-37.9232	-28.7094	-18.6443	-9.8836	-6.7969	(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	756.5199	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	336.5465	
Water heating fuel used	640.5519	(219)
Space cooling fuel	0.0000	(221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.6440)		
mechanical ventilation fans (SFP = 0.6440)	279.5072	(230a)
Total electricity for the above, kWh/year	279.5072	(231)
Electricity for lighting (calculated in Appendix L)	349.2856	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-322.3166	(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	1703.5480	(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	756.5199	0.1602	121.2103	(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)	640.5519	0.1410	90.2959	(264)
Space and water heating			211.5062	(265)
Pumps, fans and electric keep-hot	279.5072	0.1387	38.7711	(267)
Energy for lighting	349.2856	0.1443	50.4127	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-322.3166	0.1308	-42.1459	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-42.1459	(269)
Total CO2, kg/year			258.5441	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.7400	(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	756.5199	1.5930	1205.1031	(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)	640.5519	1.5212	974.4350	(278)
Space and water heating			2179.5382	(279)
Pumps, fans and electric keep-hot	279.5072	1.5128	422.8385	(281)
Energy for lighting	349.2856	1.5338	535.7459	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-322.3166	1.4830	-478.0091	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-478.0091	(283)
Total Primary energy kWh/year			2660.1136	(286)
Dwelling Primary energy Rate (DPER)			17.9500	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	148.2300	(1b) x	2.4000	(2b) =	355.7520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	148.2300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		355.7520	(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) =	0.1124	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3624	(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) =	0.3081	(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													
	0.3928	0.3851	0.3774	0.3389	0.3312	0.2927	0.2927	0.2850	0.3081	0.3312	0.3466	0.3620	(22b)
Effective ac	0.5771	0.5741	0.5712	0.5574	0.5548	0.5428	0.5428	0.5406	0.5475	0.5548	0.5601	0.5655	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opening Type			21.8400	1.1450	25.0076			(27)
External Wall 1	53.9500	21.8400	32.1100	0.1800	5.7798			(29a)
Total net area of external elements Aum(A, m2)			53.9500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.7874			(33)
Main dwelling								
Party Wall-between flats			32.6400	0.0000	0.0000			(32)
Party Wall-between circ			71.2000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 316.1249 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E4 Jamb	30.6000	0.0500	1.5300
E7 Party floor between dwellings (in blocks of flats)	44.9600	0.0700	3.1472
E16 Corner (normal)	9.6000	0.0900	0.8640
E18 Party wall between dwellings	14.4000	0.0600	0.8640
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	86.5300	0.0000	0.0000
E1 Steel lintel with perforated steel base plate	7.2000	0.0500	0.3600
E17 Corner (inverted - internal area greater than external area)	9.6000	-0.0900	-0.8640

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.9012 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 36.6886 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	67.7555	67.4038	67.0591	65.4400	65.1371	63.7269	63.7269	63.4658	64.2701	65.1371	65.7499	66.3906	(38)
Heat transfer coeff													
	104.4441	104.0925	103.7478	102.1287	101.8257	100.4156	100.4156	100.1544	100.9588	101.8257	102.4386	103.0792	(39)
Average = Sum(39)m / 12 =												102.1272	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7046	0.7022	0.6999	0.6890	0.6869	0.6774	0.6774	0.6757	0.6811	0.6869	0.6911	0.6954	(40)
HLP (average)												0.6890	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9314 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers													
	73.3696	72.2670	70.6603	67.5861	65.3175	62.7875	61.3495	62.9440	64.6920	67.4084	70.5486	73.0885	(42a)
Hot water usage for baths													
	31.6746	31.2041	30.5417	29.3203	28.4057	27.3916	26.8438	27.5016	28.2178	29.3030	30.5495	31.5675	(42b)
Hot water usage for other uses													
	44.6504	43.0267	41.4031	39.7794	38.1558	36.5321	36.5321	38.1558	39.7794	41.4031	43.0267	44.6504	(42c)
Average daily hot water use (litres/day)												137.6028	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	149.6945	146.4978	142.6050	136.6858	131.8790	126.7112	124.7254	128.6014	132.6892	138.1144	144.1248	149.3063	(44)
Energy conte	237.0795	208.6110	219.1786	187.1161	177.5344	155.8062	150.8446	159.2354	163.6191	187.4200	205.3322	233.7776	(45)
Energy content (annual)										Total = Sum(45)m =		2285.5547	
Distribution loss (46)m = 0.15 x (45)m													
	35.5619	31.2916	32.8768	28.0674	26.6302	23.3709	22.6267	23.8853	24.5429	28.1130	30.7998	35.0666	(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													
	283.6744	250.6967	265.7736	232.2079	224.1293	200.8981	197.4395	205.8303	208.7109	234.0149	250.4241	280.3725	(62)
WWHRS	-33.5415	-29.6644	-31.0628	-25.7213	-23.9713	-20.5124	-19.2271	-20.4461	-21.2229	-25.0195	-28.3440	-32.9204	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	250.1329	221.0323	234.7107	206.4867	200.1580	180.3857	178.2124	185.3842	187.4880	208.9954	222.0800	247.4521	(64)
										Total per year (kWh/year) = Sum(64)m =		2522.5183	(64)
12Total per year (kWh/year)												2523	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						0.0000	(64a)
Heat gains from water heating, kWh/month													
	116.1049	103.0317	110.1528	98.2896	96.3061	87.8790	87.4317	90.2217	90.4768	99.5931	104.3464	115.0070	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.5695	146.5695	146.5695	146.5695	146.5695	146.5695	146.5695	146.5695	146.5695	146.5695	146.5695	146.5695	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	170.5098	188.7787	170.5098	176.1935	170.5098	176.1935	170.5098	170.5098	176.1935	170.5098	176.1935	170.5098	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	318.5908	321.8967	313.5658	295.8302	273.4422	252.4006	238.3435	235.0375	243.3685	261.1041	283.4921	304.5337	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.6569	37.6569	37.6569	37.6569	37.6569	37.6569	37.6569	37.6569	37.6569	37.6569	37.6569	37.6569	(69)

Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.2556	-117.2556	-117.2556	-117.2556	-117.2556	-117.2556	-117.2556	-117.2556	-117.2556	-117.2556	-117.2556	-117.2556	(71)
Water heating gains (Table 5)	156.0549	153.3210	148.0549	136.5133	129.4437	122.0542	117.5158	121.2657	125.6622	133.8616	144.9256	154.5793	(72)
Total internal gains	715.1263	733.9673	702.1013	678.5078	643.3665	617.6191	593.3400	593.7839	612.1950	635.4464	674.5820	699.5936	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	2.5200	11.2829	0.6300	0.7000	0.7700	8.6895	(75)
Southeast	6.7200	36.7938	0.6300	0.7000	0.7700	75.5642	(77)
Southwest	10.0800	36.7938	0.6300	0.7000	0.7700	113.3463	(79)
Northwest	2.5200	11.2829	0.6300	0.7000	0.7700	8.6895	(81)

Solar gains	206.2895	357.1600	504.0149	650.1994	751.7358	756.6182	725.1666	647.8384	554.3921	398.8720	248.1385	175.8606	(83)
Total gains	921.4159	1091.1273	1206.1162	1328.7072	1395.1024	1374.2373	1318.5065	1241.6223	1166.5872	1034.3184	922.7206	875.4542	(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	124.6259	125.0469	125.4624	127.4514	127.8306	129.6257	129.6257	129.9637	128.9283	127.8306	127.0658	126.2761	
alpha	9.3084	9.3365	9.3642	9.4968	9.5220	9.6417	9.6417	9.6642	9.5952	9.5220	9.4711	9.4184	
util living area	0.9988	0.9936	0.9721	0.8687	0.6732	0.4675	0.3351	0.3710	0.5954	0.9153	0.9942	0.9992	(86)
MIT	20.4717	20.6205	20.7871	20.9476	20.9950	20.9999	21.0000	21.0000	20.9987	20.9278	20.6745	20.4497	(87)
Th 2	20.3368	20.3389	20.3409	20.3506	20.3524	20.3608	20.3608	20.3624	20.3576	20.3524	20.3487	20.3449	(88)
util rest of house	0.9983	0.9912	0.9626	0.8376	0.6286	0.4209	0.2864	0.3196	0.5409	0.8855	0.9916	0.9989	(89)
MIT 2	19.7155	19.9063	20.1145	20.3040	20.3490	20.3607	20.3608	20.3624	20.3569	20.2887	19.9841	19.6942	(90)
Living area fraction										fLA = Living area / (4) =		0.2314	(91)
MIT	19.8905	20.0716	20.2702	20.4529	20.4985	20.5086	20.5087	20.5099	20.5054	20.4366	20.1439	19.8691	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8905	20.0716	20.2702	20.4529	20.4985	20.5086	20.5087	20.5099	20.5054	20.4366	20.1439	19.8691	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9978	0.9900	0.9614	0.8428	0.6388	0.4317	0.2977	0.3315	0.5535	0.8898	0.9905	0.9986	(94)
Useful gains	919.4139	1080.2037	1159.5842	1119.8655	891.1410	593.2164	392.4937	411.6197	645.6777	920.3114	913.9748	874.1991	(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	1628.3378	1579.2467	1428.6246	1179.8853	895.9117	593.3189	392.4960	411.6261	646.6823	1001.6191	1336.1939	1615.1538	(97)
Space heating kWh	527.4394	335.3569	200.1660	43.2143	3.5494	0.0000	0.0000	0.0000	0.0000	60.4929	303.9978	551.2703	(98a)
Space heating requirement - total per year (kWh/year)												2025.4870	
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	527.4394	335.3569	200.1660	43.2143	3.5494	0.0000	0.0000	0.0000	0.0000	60.4929	303.9978	551.2703	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2025.4870	
Space heating per m2											(98c) / (4) =	13.6645	(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	527.4394	335.3569	200.1660	43.2143	3.5494	0.0000	0.0000	0.0000	0.0000	60.4929	303.9978	551.2703	(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)	571.4403	363.3336	216.8646	46.8194	3.8455	0.0000	0.0000	0.0000	0.0000	65.5395	329.3583	597.2592	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	250.1329	221.0323	234.7107	206.4867	200.1580	180.3857	178.2124	185.3842	187.4880	208.9954	222.0800	247.4521	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.6911	84.9920	83.7049	81.2247	79.9412	79.8000	79.8000	79.8000	79.8000	81.6578	84.7644	85.8020	(217)
Fuel for water heating, kWh/month	291.9006	260.0624	280.4028	254.2166	250.3817	226.0472	223.3238	232.3110	234.9473	255.9406	261.9969	288.3990	(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	35.4286	28.4221	25.5910	18.7490	14.4823	11.8322	13.2112	17.1725	22.3053	29.2658	33.0557	36.4132	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.8892	-24.3743	-38.0722	-46.6203	-53.6968	-51.3661	-50.7209	-46.1474	-38.7603	-29.4532	-18.1481	-13.5158	(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	-3.8415	-8.3852	-17.2633	-26.8483	-36.4451	-36.9970	-36.5851	-30.5519	-21.8332	-12.3029	-5.2231	-3.0170	(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	2194.4604	(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	3059.9300	(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)	285.9289	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-666.0581	(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	4960.2612	(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	2194.4604	0.2100	460.8367	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3059.9300	0.2100	642.5853	(264)
Space and water heating			1103.4220	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	285.9289	0.1443	41.2684	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-426.7645	0.1329	-56.7098	
PV Unit electricity exported	-239.2936	0.1249	-29.8818	
Total			-86.5916	(269)
Total CO2, kg/year			1070.0280	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			7.2200	(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	2194.4604	1.1300	2479.7403	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3059.9300	1.1300	3457.7209	(278)
Space and water heating			5937.4611	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	285.9289	1.5338	438.5673	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-426.7645	1.4910	-636.3126	
PV Unit electricity exported	-239.2936	0.4583	-109.6741	
Total			-745.9868	(283)
Total Primary energy kWh/year			5760.1424	(286)
Target Primary Energy Rate (TPER)			38.8600	(287)

Full SAP Calculation Printout

Property Reference	5F_Block D9_2Bed 3P	**Issued on Date**	27/03/2025
Assessment Reference	Option 1_EPH+ASHP_P08	**Prop Type Ref**	North West
Property	Chorlton-cum-Hardy, Manchester, Greater Manchester, M21 9AQ		

SAP Rating	89 B	**DER**	3.57	**TER**	13.96
Environmental	98 A	**% DER < TER**			74.43
CO_2 Emissions (t/year)	0.17	**DFEE**	31.71	**TFEE**	33.72
Compliance Check	See BREL	**% DFEE < TFEE**			5.97
% DPER < TPER	51.42	**DPER**	36.40	**TPER**	74.92

Assessor Details	Mr. Leon Maddison	**Assessor ID**	AY03-0001
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)	
Main dwelling						
Ground floor	61.0400	(1b)	x 2.4000	(2b) =	146.4960	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0400					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	146.4960	(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) =	74.4000 (23c)

Effective ac	0.2906	0.2874	0.2842	0.2682	0.2651	0.2491	0.2491	0.2459	0.2555	0.2651	0.2714	0.2778	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Glazing			15.3600	1.1450	17.5878			(27)
External Wall 1	39.4600	15.3600	24.1000	0.1500	3.6150	60.0000	1445.9999	(29a)
External Roof 1	61.0400		61.0400	0.1100	6.7144	9.0000	549.3600	(30)
Total net area of external elements Aum(A, m2)			100.5000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		27.9172			(33)
Main dwelling								
Party Wall-between flats			26.9600	0.0000	0.0000	180.0000	4852.7998	(32)
Party Wall-between circ			12.5000	0.0000	0.0000	180.0000	2250.0000	(32)
Party Floor 1			61.0400			80.0000	4883.2000	(32d)
Internal Wall 1			101.8800			9.0000	916.9200	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 14898.2798 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	244.0740 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E4 Jamb	19.2000	0.0180	0.3456	
E7 Party floor between dwellings (in blocks of flats)	16.4400	0.0360	0.5918	
E16 Corner (normal)	2.4000	0.0400	0.0960	
E18 Party wall between dwellings	12.0000	0.0320	0.3840	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.4400	0.0000	0.0000	
E14 Flat roof	16.4400	0.1600	2.6304	
P4 Party wall - Roof (insulation at ceiling level)	16.4400	0.0330	0.5425	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.5904 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 32.5075 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	14.0469	13.8928	13.7387	12.9682	12.8141	12.0436	12.0436	11.8895	12.3518	12.8141	13.1223	13.4305	(38)
Heat transfer coeff	46.5544	46.4003	46.2462	45.4757	45.3216	44.5512	44.5512	44.3971	44.8594	45.3216	45.6298	45.9380	(39)
Average = Sum(39)m / 12 =												45.4372	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7627	0.7602	0.7576	0.7450	0.7425	0.7299	0.7299	0.7273	0.7349	0.7425	0.7475	0.7526	(40)
HLP (average)												0.7444	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0109 (42)
Hot water usage for mixer showers

57.9355	57.0648	55.7961	53.3686	51.5772	49.5794	48.4439	49.7030	51.0833	53.2282	55.7079	57.7135	(42a)

Hot water usage for baths

25.0374	24.6655	24.1419	23.1764	22.4535	21.6519	21.2189	21.7388	22.3050	23.1627	24.1481	24.9527	(42b)

Hot water usage for other uses

35.2234	33.9426	32.6617	31.3809	30.1000	28.8192	28.8192	30.1000	31.3809	32.6617	33.9426	35.2234	(42c)

Average daily hot water use (litres/day) 108.6494 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	118.1963	115.6729	112.5997	107.9259	104.1307	100.0505	98.4820	101.5419	104.7691	109.0527	113.7985	117.8896	(44)
Energy conte	187.1940	164.7167	173.0616	147.7452	140.1800	123.0237	119.1054	125.7301	129.1908	147.9835	162.1269	184.5867	(45)
Energy content (annual)										Total = Sum(45)m =		1804.6445	
Distribution loss (46)m = 0.15 x (45)m	28.0791	24.7075	25.9592	22.1618	21.0270	18.4536	17.8658	18.8595	19.3786	22.1975	24.3190	27.6880	(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

214.1454	189.0599	200.0130	173.8272	167.1314	149.1057	146.0568	152.6815	155.2728	174.9349	188.2089	211.5381	(62)
WWHRS -40.6792	-35.9770	-37.6730	-31.1947	-29.0724	-24.8774	-23.3186	-24.7970	-25.7392	-30.3436	-34.3757	-39.9258	(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	173.4662	153.0829	162.3399	142.6324	138.0590	124.2283	122.7382	127.8844	129.5336	144.5913	153.8332	171.6123	(64)
Total per year (kWh/year) = Sum(64)m =												1744.0018	(64)
12Total per year (kWh/year)												1744	(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

62.2420	54.7683	57.5430	49.1253	46.6098	40.9054	39.6025	41.8052	42.9559	49.2045	53.9072	61.3751	(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	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	88.5509	98.0385	88.5509	91.5026	88.5509	91.5026	88.5509	88.5509	91.5026	88.5509	91.5026	88.5509	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.5620	177.3838	172.7930	163.0196	150.6825	139.0874	131.3411	129.5193	134.1102	143.8835	156.2206	167.8158	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	(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)	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	(71)
Water heating gains (Table 5)	83.6586	81.5004	77.3427	68.2295	62.6476	56.8130	53.2292	56.1899	59.6610	66.1351	74.8711	82.4934	(72)
Total internal gains	400.9347	410.0859	391.8498	375.9150	355.0442	340.5662	326.2844	327.4233	338.4370	351.7327	375.7575	392.0232	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.6800	11.2829	0.4000	0.7000	0.7700	16.8141	(75)
Northwest	7.6800	11.2829	0.4000	0.7000	0.7700	16.8141	(81)

Solar gains 33.6283	68.4514	123.3276	202.5393	272.2526	290.2501	271.5230	216.4613	150.2766	83.6530	42.3131	27.4626	(83)
Total gains 434.5630	478.5373	515.1773	578.4543	627.2968	630.8163	597.8074	543.8846	488.7136	435.3857	418.0706	419.4858	(84)

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7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	88.8941	89.1893	89.4865	91.0026	91.3120	92.8912	92.8912	93.2136	92.2530	91.3120	90.6953	90.0868	
alpha	6.9263	6.9460	6.9658	7.0668	7.0875	7.1927	7.1927	7.2142	7.1502	7.0875	7.0464	7.0058	
util living area	0.9921	0.9832	0.9579	0.8531	0.6582	0.4512	0.3278	0.3753	0.6243	0.9082	0.9813	0.9936	(86)
MIT	20.3321	20.4665	20.6582	20.8901	20.9833	20.9990	20.9999	20.9998	20.9914	20.8530	20.5667	20.3141	(87)
Th 2	20.2858	20.2880	20.2902	20.3012	20.3035	20.3145	20.3145	20.3167	20.3101	20.3035	20.2990	20.2946	(88)
util rest of house	0.9898	0.9786	0.9468	0.8232	0.6133	0.4032	0.2768	0.3197	0.5656	0.8807	0.9753	0.9918	(89)
MIT 2	19.5087	19.6797	19.9188	20.1962	20.2906	20.3140	20.3145	20.3167	20.3047	20.1635	19.8163	19.4929	(90)
Living area fraction										fLA = Living area / (4) =		0.4897	(91)
MIT	19.9119	20.0650	20.2808	20.5360	20.6298	20.6494	20.6501	20.6512	20.6409	20.5011	20.1837	19.8950	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9119	20.0650	20.2808	20.5360	20.6298	20.6494	20.6501	20.6512	20.6409	20.5011	20.1837	19.8950	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9884	0.9769	0.9467	0.8337	0.6346	0.4267	0.3018	0.3469	0.5940	0.8892	0.9742	0.9905	(94)
Useful gains	429.5196	467.5049	487.7006	482.2713	398.0917	269.1676	180.4152	188.6802	290.3198	387.1335	407.2783	415.4870	(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	726.8027	703.6600	637.3117	529.1556	404.7134	269.5084	180.4381	188.7397	293.4227	448.7358	597.0090	720.9996	(97)
Space heating kWh	221.1787	158.6962	111.3107	33.7567	4.9266	0.0000	0.0000	0.0000	0.0000	45.8321	136.6061	227.3013	(98a)
Space heating requirement - total per year (kWh/year)												939.6085	
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	221.1787	158.6962	111.3107	33.7567	4.9266	0.0000	0.0000	0.0000	0.0000	45.8321	136.6061	227.3013	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												939.6085	
Space heating per m2											(98c) / (4) =	15.3933	(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	221.1787	158.6962	111.3107	33.7567	4.9266	0.0000	0.0000	0.0000	0.0000	45.8321	136.6061	227.3013	(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)	221.1787	158.6962	111.3107	33.7567	4.9266	0.0000	0.0000	0.0000	0.0000	45.8321	136.6061	227.3013	(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	173.4662	153.0829	162.3399	142.6324	138.0590	124.2283	122.7382	127.8844	129.5336	144.5913	153.8332	171.6123	(64)
Efficiency of water heater												346.7343	(216)
(217)m	346.7343	346.7343	346.7343	346.7343	346.7343	346.7343	346.7343	346.7343	346.7343	346.7343	346.7343	346.7343	(217)
Fuel for water heating, kWh/month	50.0286	44.1499	46.8197	41.1359	39.8169	35.8281	35.3983	36.8825	37.3582	41.7009	44.3663	49.4939	(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	8.2879	7.4859	8.2879	8.0206	8.2879	8.0206	8.2879	8.2879	8.0206	8.2879	8.0206	8.2879	(231)
Lighting	20.6812	16.5912	14.9386	10.9446	8.4539	6.9069	7.7120	10.0243	13.0206	17.0837	19.2960	21.2560	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-8.1336	-14.2317	-25.4840	-33.7245	-40.1377	-38.9500	-38.1729	-33.4600	-25.8549	-17.7200	-9.6364	-6.6581	(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												939.6085	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												346.7343	
Water heating fuel used												502.9793	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.5460)

mechanical ventilation fans (SFP = 0.5460) 97.5839 (230a)

Total electricity for the above, kWh/year	97.5839	(231)
Electricity for lighting (calculated in Appendix L)	166.9092	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-292.1637	(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	1414.9171	(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	939.6085	0.1574	147.8624	(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)	502.9793	0.1409	70.8756	(264)
Space and water heating			218.7380	(265)
Pumps, fans and electric keep-hot	97.5839	0.1387	13.5361	(267)
Energy for lighting	166.9092	0.1443	24.0901	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-292.1637	0.1314	-38.3860	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-38.3860	(269)
Total CO2, kg/year			217.9783	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.5700	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	939.6085	1.5826	1486.9953	(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)	502.9793	1.5210	765.0516	(278)
Space and water heating			2252.0468	(279)
Pumps, fans and electric keep-hot	97.5839	1.5128	147.6250	(281)
Energy for lighting	166.9092	1.5338	256.0108	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-292.1637	1.4854	-433.9806	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-433.9806	(283)
Total Primary energy kWh/year			2221.7021	(286)
Dwelling Primary energy Rate (DPER)			36.4000	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	61.0400	(1b)	x 2.4000	(2b) =	146.4960	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	146.4960	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1365	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3865	(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) =	0.3285	(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	0.4189	0.4107	0.4025	0.3614	0.3532	0.3121	0.3121	0.3039	0.3285	0.3532	0.3696	0.3860	(22b)
Effective ac	0.5877	0.5843	0.5810	0.5653	0.5624	0.5487	0.5487	0.5462	0.5540	0.5624	0.5683	0.5745	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
TER Opening Type			15.2600	1.1450	17.4733			(27)
External Wall 1	39.4600	15.2600	24.2000	0.1800	4.3560			(29a)
External Roof 1	61.0400		61.0400	0.1100	6.7144			(30)
Total net area of external elements Aum(A, m2)			100.5000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		28.5437			(33)
Main dwelling								
Party Wall-between flats			26.9600	0.0000	0.0000			(32)
Party Wall-between circ			12.5000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 244.0740 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E4 Jamb	19.2000	0.0500	0.9600
E7 Party floor between dwellings (in blocks of flats)	16.4400	0.0700	1.1508
E16 Corner (normal)	2.4000	0.0900	0.2160
E18 Party wall between dwellings	12.0000	0.0600	0.7200
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	16.4400	0.0000	0.0000
E14 Flat roof	16.4400	0.0800	1.3152
P4 Party wall - Roof (insulation at ceiling level)	16.4400	0.1200	1.9728

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.3348 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 34.8785 (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	28.4133	28.2486	28.0872	27.3289	27.1870	26.5266	26.5266	26.4043	26.7810	27.1870	27.4740	27.7741	(38)
Heat transfer coeff	63.2918	63.1271	62.9657	62.2074	62.0655	61.4051	61.4051	61.2828	61.6595	62.0655	62.3525	62.6526	(39)
Average = Sum(39)m / 12 =												62.2067	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0369	1.0342	1.0315	1.0191	1.0168	1.0060	1.0060	1.0040	1.0101	1.0168	1.0215	1.0264	(40)
HLP (average)												1.0191	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0109 (42)

Hot water usage for mixer showers	57.9355	57.0648	55.7961	53.3686	51.5772	49.5794	48.4439	49.7030	51.0833	53.2282	55.7079	57.7135	(42a)
Hot water usage for baths	25.0374	24.6655	24.1419	23.1764	22.4535	21.6519	21.2189	21.7388	22.3050	23.1627	24.1481	24.9527	(42b)
Hot water usage for other uses	35.2234	33.9426	32.6617	31.3809	30.1000	28.8192	28.8192	30.1000	31.3809	32.6617	33.9426	35.2234	(42c)
Average daily hot water use (litres/day)												108.6494	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	118.1963	115.6729	112.5997	107.9259	104.1307	100.0505	98.4820	101.5419	104.7691	109.0527	113.7985	117.8896	(44)
Energy conte	187.1940	164.7167	173.0616	147.7452	140.1800	123.0237	119.1054	125.7301	129.1908	147.9835	162.1269	184.5867	(45)
Energy content (annual)										Total = Sum(45)m =		1804.6445	
Distribution loss (46)m = 0.15 x (45)m	28.0791	24.7075	25.9592	22.1618	21.0270	18.4536	17.8658	18.8595	19.3786	22.1975	24.3190	27.6880	(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	233.7889	206.8024	219.6565	192.8370	186.7749	168.1156	165.7003	172.3250	174.2826	194.5784	207.2187	231.1816	(62)
WWHRS	-26.4857	-23.4241	-24.5284	-20.3105	-18.9287	-16.1974	-15.1825	-16.1450	-16.7584	-19.7563	-22.3815	-25.9952	(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	207.3032	183.3783	195.1281	172.5265	167.8462	151.9182	150.5178	156.1799	157.5242	174.8221	184.8372	205.1864	(64)
									Total per year (kWh/year) = Sum(64)m =			2107.1681	(64)
12Total per year (kWh/year)												2107	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	99.5179	88.4369	94.8189	85.1987	83.8858	76.9789	76.8785	79.0812	79.0294	86.4804	89.9807	98.6510	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	100.5441	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	88.5509	98.0385	88.5509	91.5026	88.5509	91.5026	88.5509	88.5509	91.5026	88.5509	91.5026	88.5509	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.5620	177.3838	172.7930	163.0196	150.6825	139.0874	131.3411	129.5193	134.1102	143.8835	156.2206	167.8158	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	33.0544	(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)													
	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	-80.4353	(71)
Water heating gains (Table 5)													
	133.7606	131.6025	127.4447	118.3316	112.7497	106.9151	103.3313	106.2919	109.7631	116.2372	124.9731	132.5954	(72)
Total internal gains													
	454.0368	463.1880	444.9518	429.0170	408.1463	390.6683	376.3865	377.5253	388.5390	404.8348	428.8596	445.1253	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	7.6300	11.2829	0.6300	0.7000	0.7700	26.3099	(75)
Northwest	7.6300	11.2829	0.6300	0.7000	0.7700	26.3099	(81)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	52.6197	107.1090	192.9764	316.9226	426.0062	454.1677	424.8645	338.7069	235.1447	130.8957	66.2092	42.9719	(83)
Total gains	506.6565	570.2970	637.9282	745.9396	834.1525	844.8359	801.2510	716.2323	623.6837	535.7305	495.0688	488.0972	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	65.3862	65.5568	65.7249	66.5260	66.6781	67.3953	67.3953	67.5298	67.1172	66.6781	66.3712	66.0533	
alpha	5.3591	5.3705	5.3817	5.4351	5.4452	5.4930	5.4930	5.5020	5.4745	5.4452	5.4247	5.4036	
util living area													
	0.9898	0.9798	0.9513	0.8484	0.6603	0.4614	0.3366	0.3922	0.6530	0.9118	0.9789	0.9915	(86)
MIT	19.9845	20.1631	20.4398	20.7801	20.9515	20.9942	20.9992	20.9981	20.9666	20.7119	20.2995	19.9585	(87)
Th 2	20.0527	20.0549	20.0571	20.0674	20.0694	20.0784	20.0784	20.0800	20.0749	20.0694	20.0655	20.0614	(88)
util rest of house													
	0.9868	0.9739	0.9376	0.8130	0.6040	0.3967	0.2664	0.3145	0.5767	0.8812	0.9717	0.9890	(89)
MIT 2	18.8867	19.1132	19.4571	19.8598	20.0326	20.0753	20.0781	20.0794	20.0543	19.7970	19.2952	18.8602	(90)
Living area fraction										fLA = Living area / (4) =		0.4897	(91)
MIT	19.4243	19.6273	19.9383	20.3105	20.4826	20.5253	20.5291	20.5293	20.5010	20.2450	19.7870	19.3980	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4243	19.6273	19.9383	20.3105	20.4826	20.5253	20.5291	20.5293	20.5010	20.2450	19.7870	19.3980	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9842	0.9707	0.9356	0.8229	0.6296	0.4283	0.3008	0.3526	0.6128	0.8877	0.9690	0.9866	(94)
Useful gains	498.6328	553.5757	596.8233	613.8296	525.1893	361.8069	241.0368	252.5186	382.2007	475.5495	479.7411	481.5774	(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													
	957.2418	929.6916	846.1511	709.8153	545.0966	363.8412	241.2679	253.0537	394.6833	598.6237	791.0653	952.1929	(97)
Space heating kWh													
	341.2051	252.7499	185.4999	69.1097	14.8111	0.0000	0.0000	0.0000	0.0000	91.5672	224.1534	350.1379	(98a)
Space heating requirement - total per year (kWh/year)												1529.2343	
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													
	341.2051	252.7499	185.4999	69.1097	14.8111	0.0000	0.0000	0.0000	0.0000	91.5672	224.1534	350.1379	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1529.2343	
Space heating per m2											(98c) / (4) =	25.0530	(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													
	341.2051	252.7499	185.4999	69.1097	14.8111	0.0000	0.0000	0.0000	0.0000	91.5672	224.1534	350.1379	(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)													
	369.6697	273.8352	200.9750	74.8750	16.0467	0.0000	0.0000	0.0000	0.0000	99.2061	242.8531	379.3477	(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													
	207.3032	183.3783	195.1281	172.5265	167.8462	151.9182	150.5178	156.1799	157.5242	174.8221	184.8372	205.1864	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.1697	84.7796	83.9464	82.1822	80.4612	79.8000	79.8000	79.8000	79.8000	82.6804	84.4934	85.2476	(217)
Fuel for water heating, kWh/month													
	243.4003	216.2999	232.4435	209.9317	208.6050	190.3737	188.6188	195.7142	197.3988	211.4431	218.7594	240.6947	(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	18.3991	14.7605	13.2902	9.7369	7.5211	6.1448	6.8610	8.9182	11.5838	15.1986	17.1668	18.9105	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.6042	-17.5882	-27.1587	-32.8823	-37.5668	-35.8532	-35.4244	-32.3852	-27.4172	-21.1131	-13.1880	-9.8950	(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	-3.2916	-7.1436	-14.6169	-22.5830	-30.4861	-30.8567	-30.4874	-25.5192	-18.3280	-10.4108	-4.4562	-2.5865	(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	1656.8085	(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	2553.6831	(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)	148.4915	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-502.8425	(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	3942.1406	(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	1656.8085	0.2100	347.9298	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2553.6831	0.2100	536.2735	(264)
Space and water heating			884.2032	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	148.4915	0.1443	21.4319	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-302.0764	0.1331	-40.2041	
PV Unit electricity exported	-200.7661	0.1251	-25.1127	
Total			-65.3167	(269)
Total CO2, kg/year			852.2477	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.9600	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1656.8085	1.1300	1872.1936	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2553.6831	1.1300	2885.6619	(278)
Space and water heating			4757.8556	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	148.4915	1.5338	227.7612	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-302.0764	1.4918	-450.6379	
PV Unit electricity exported	-200.7661	0.4591	-92.1729	
Total			-542.8108	(283)
Total Primary energy kWh/year			4572.9067	(286)
Target Primary Energy Rate (TPER)			74.9200	(287)

Full SAP Calculation Printout

Property Reference	6F_Block A2_2Bed 4P	**Issued on Date**	27/03/2025
Assessment Reference	Option 1_EPH+ASHP_P08	**Prop Type Ref**	North West
Property	Chorlton-cum-Hardy, Manchester, Greater Manchester, M21 9AQ		

SAP Rating	94 A	**DER**	1.66	**TER**	8.99
Environmental	99 A	**% DER < TER**			81.54
CO_2 Emissions (t/year)	0.12	**DFEE**	18.26	**TFEE**	20.12
Compliance Check	See BREL	**% DFEE < TFEE**			9.25
% DPER < TPER	64.92	**DPER**	17.12	**TPER**	48.79

Assessor Details	Mr. Leon Maddison	**Assessor ID**	AY03-0001
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)	
Main dwelling						
Ground floor	92.8600 (1b)	x	2.4000 (2b)	=	222.8640	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.8600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	222.8640	(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) =	73.6000 (23c)

Effective ac	0.2946	0.2914	0.2882	0.2722	0.2691	0.2531	0.2531	0.2499	0.2595	0.2691	0.2754	0.2818	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Glazing			15.8400	1.1450	18.1374			(27)
External Wall 1	38.0300	15.8400	22.1900	0.1500	3.3285	60.0000	1331.3999	(29a)
Total net area of external elements Aum(A, m2)			38.0300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		21.4659			(33)
Main dwelling								
Party Wall-between flats			32.6400	0.0000	0.0000	180.0000	5875.1999	(32)
Party Wall-between circ			29.0400	0.0000	0.0000	180.0000	5227.2002	(32)
Party Floor 1			92.8600			80.0000	7428.8000	(32d)
Party Ceiling 1			92.8600			100.0000	9286.0000	(32b)
Internal Wall 1			146.6600			9.0000	1319.9400	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	30468.5400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		328.1126 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E4 Jamb	23.4000	0.0180	0.4212	
E7 Party floor between dwellings (in blocks of flats)	31.7000	0.0360	1.1412	
E16 Corner (normal)	9.6000	0.0400	0.3840	
E18 Party wall between dwellings	9.6000	0.0320	0.3072	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	51.4000	0.0000	0.0000	
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0820	-0.3936	
E1 Steel lintel with perforated steel base plate	1.6000	0.3400	0.5440	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 2.4040 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 23.8699 (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	21.6636	21.4292	21.1948	20.0227	19.7882	18.6161	18.6161	18.3817	19.0850	19.7882	20.2571	20.7259	(38)
Heat transfer coeff	45.5335	45.2991	45.0647	43.8926	43.6581	42.4860	42.4860	42.2516	42.9549	43.6581	44.1270	44.5958	(39)
Average = Sum(39)m / 12 =												43.8340	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4903	0.4878	0.4853	0.4727	0.4702	0.4575	0.4575	0.4550	0.4626	0.4702	0.4752	0.4802	(40)
HLP (average)												0.4720	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6629 (42)
Hot water usage for mixer showers

88.4727	87.1432	85.2057	81.4988	78.7631	75.7123	73.9783	75.9011	78.0088	81.2844	85.0710	88.1338	(42a)

Hot water usage for baths

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

Hot water usage for other uses

41.9005	40.3769	38.8532	37.3296	35.8059	34.2823	34.2823	35.8059	37.3296	38.8532	40.3769	41.9005	(42c)

Average daily hot water use (litres/day) 119.6603 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	130.3733	127.5200	124.0589	118.8283	114.5690	109.9946	108.2605	111.7070	115.3384	120.1376	125.4479	130.0343	(44)
Energy conte	206.4794	181.5868	190.6740	162.6700	154.2319	135.2512	130.9318	138.3166	142.2238	163.0256	178.7235	203.6023	(45)
Energy content (annual)										Total = Sum(45)m =		1987.7168	
Distribution loss (46)m = 0.15 x (45)m	30.9719	27.2380	28.6011	24.4005	23.1348	20.2877	19.6398	20.7475	21.3336	24.4538	26.8085	30.5403	(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)
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)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

233.4308	205.9300	217.6254	188.7520	181.1833	161.3332	157.8832	165.2680	168.3058	189.9770	204.8055	230.5537	(62)
-62.1208	-54.9401	-57.5301	-47.6372	-44.3962	-37.9901	-35.6097	-37.8673	-39.3061	-46.3375	-52.4948	-60.9704	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

171.3100	150.9899	160.0952	141.1148	136.7871	123.3431	122.2735	127.4007	128.9997	143.6395	152.3107	169.5833	(64)

Total per year (kWh/year) = Sum(64)m = 1727.8475 (64)
12Total per year (kWh/year) 1728 (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

68.6544	60.3776	63.3991	54.0878	51.2821	44.9710	43.5348	45.9903	47.2894	54.2060	59.4256	67.6978	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.1439	133.1439	133.1439	133.1439	133.1439	133.1439	133.1439	133.1439	133.1439	133.1439	133.1439	133.1439	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	126.9783	140.5832	126.9783	131.2109	126.9783	131.2109	126.9783	126.9783	131.2109	126.9783	131.2109	126.9783	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.2421	246.7766	240.3898	226.7931	209.6297	193.4985	182.7219	180.1875	186.5742	200.1709	217.3343	233.4655	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3144	36.3144	36.3144	36.3144	36.3144	36.3144	36.3144	36.3144	36.3144	36.3144	36.3144	36.3144	(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)	-106.5151	-106.5151	-106.5151	-106.5151	-106.5151	-106.5151	-106.5151	-106.5151	-106.5151	-106.5151	-106.5151	-106.5151	(71)
Water heating gains (Table 5)	92.2774	89.8477	85.2138	75.1219	68.9276	62.4598	58.5145	61.8149	65.6797	72.8576	82.5355	90.9916	(72)
Total internal gains	526.4410	540.1506	515.5251	496.0691	468.4788	450.1124	431.1580	431.9238	446.4081	462.9500	494.0239	514.3786	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	2.8800	11.2829	0.4000	0.7000	0.7700	6.3053	(75)
Southwest	2.8800	36.7938	0.4000	0.7000	0.7700	20.5617	(79)
Northwest	10.0800	11.2829	0.4000	0.7000	0.7700	22.0686	(81)

Solar gains	48.9356	92.7800	151.9792	230.2697	296.2205	310.9249	292.7540	240.9763	178.6848	109.2914	60.3298	40.7681	(83)
Total gains	575.3766	632.9306	667.5044	726.3389	764.6993	761.0373	723.9120	672.9001	625.0929	572.2414	554.3538	555.1467	(84)

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7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	185.8736	186.8355	187.8074	192.8227	193.8581	199.2063	199.2063	200.3116	197.0320	193.8581	191.7983	189.7819	
alpha	13.3916	13.4557	13.5205	13.8548	13.9239	14.2804	14.2804	14.3541	14.1355	13.9239	13.7866	13.6521	
util living area													
	0.9941	0.9775	0.9208	0.7286	0.5309	0.3573	0.2582	0.2888	0.4741	0.7867	0.9693	0.9956	(86)
MIT	20.8070	20.8866	20.9602	20.9981	21.0000	21.0000	21.0000	21.0000	21.0000	20.9960	20.9219	20.7984	(87)
Th 2	20.5297	20.5320	20.5343	20.5459	20.5483	20.5599	20.5599	20.5622	20.5553	20.5483	20.5436	20.5390	(88)
util rest of house													
	0.9920	0.9708	0.9033	0.7022	0.5051	0.3327	0.2324	0.2613	0.4436	0.7550	0.9593	0.9941	(89)
MIT 2	20.3086	20.4088	20.4955	20.5444	20.5483	20.5599	20.5599	20.5622	20.5553	20.5453	20.4627	20.3062	(90)
Living area fraction									fLA = Living area / (4) =			0.3643	(91)
MIT	20.4901	20.5829	20.6648	20.7097	20.7128	20.7202	20.7202	20.7217	20.7173	20.7095	20.6300	20.4855	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.4901	20.5829	20.6648	20.7097	20.7128	20.7202	20.7202	20.7217	20.7173	20.7095	20.6300	20.4855	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9918	0.9716	0.9085	0.7117	0.5145	0.3417	0.2418	0.2714	0.4547	0.7664	0.9614	0.9939	(94)
Useful gains	570.6721	614.9512	606.3945	516.9620	393.4645	260.0247	175.0528	182.5998	284.2420	438.5890	532.9544	551.7415	(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													
	737.1944	710.4207	638.3331	518.3569	393.4829	260.0248	175.0528	182.5998	284.2443	441.3609	597.0373	726.2655	(97)
Space heating kWh													
	123.8926	64.1555	23.7623	1.0043	0.0136	0.0000	0.0000	0.0000	0.0000	2.0623	46.1397	129.8459	(98a)
Space heating requirement - total per year (kWh/year)												390.8761	
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													
	123.8926	64.1555	23.7623	1.0043	0.0136	0.0000	0.0000	0.0000	0.0000	2.0623	46.1397	129.8459	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												390.8761	
Space heating per m2										(98c) / (4) =		4.2093	(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													
	123.8926	64.1555	23.7623	1.0043	0.0136	0.0000	0.0000	0.0000	0.0000	2.0623	46.1397	129.8459	(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)													
	123.8926	64.1555	23.7623	1.0043	0.0136	0.0000	0.0000	0.0000	0.0000	2.0623	46.1397	129.8459	(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													
	171.3100	150.9899	160.0952	141.1148	136.7871	123.3431	122.2735	127.4007	128.9997	143.6395	152.3107	169.5833	(64)
Efficiency of water heater												343.2476	(216)
(217)m	343.2476	343.2476	343.2476	343.2476	343.2476	343.2476	343.2476	343.2476	343.2476	343.2476	343.2476	343.2476	(217)
Fuel for water heating, kWh/month													
	49.9086	43.9886	46.6413	41.1117	39.8509	35.9341	35.6225	37.1163	37.5821	41.8472	44.3734	49.4055	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	14.8715	13.4323	14.8715	14.3918	14.8715	14.3918	14.8715	14.8715	14.3918	14.8715	14.3918	14.8715	(231)
Lighting	31.5687	25.3256	22.8029	16.7063	12.9045	10.5431	11.7719	15.3015	19.8752	26.0773	29.4543	32.4461	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-8.1313	-14.1996	-25.5168	-34.8809	-42.9133	-42.0537	-41.2012	-35.8515	-27.3933	-18.0167	-9.6219	-6.6538	(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												390.8761	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												343.2476	
Water heating fuel used												503.3823	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.6440)

mechanical ventilation fans (SFP = 0.6440)	175.0998	(230a)
Total electricity for the above, kWh/year	175.0998	(231)
Electricity for lighting (calculated in Appendix L)	254.7772	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-306.4340	(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	1017.7014	(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	390.8761	0.1603	62.6529	(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)	503.3823	0.1409	70.9016	(264)
Space and water heating			133.5545	(265)
Pumps, fans and electric keep-hot	175.0998	0.1387	24.2885	(267)
Energy for lighting	254.7772	0.1443	36.7722	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-306.4340	0.1309	-40.1188	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-40.1188	(269)
Total CO2, kg/year			154.4964	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.6600	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	390.8761	1.5932	622.7518	(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)	503.3823	1.5208	765.5492	(278)
Space and water heating			1388.3010	(279)
Pumps, fans and electric keep-hot	175.0998	1.5128	264.8910	(281)
Energy for lighting	254.7772	1.5338	390.7858	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-306.4340	1.4837	-454.6414	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-454.6414	(283)
Total Primary energy kWh/year			1589.3364	(286)
Dwelling Primary energy Rate (DPER)			17.1200	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	92.8600	(1b)	x 2.4000	(2b) =	222.8640	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.8600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	222.8640	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1346	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3846	(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) =	0.3269	(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													
	0.4168	0.4086	0.4005	0.3596	0.3514	0.3106	0.3106	0.3024	0.3269	0.3514	0.3678	0.3841	(22b)
Effective ac	0.5869	0.5835	0.5802	0.5647	0.5618	0.5482	0.5482	0.5457	0.5534	0.5618	0.5676	0.5738	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opening Type			15.8400	1.1450	18.1374			(27)
External Wall 1	38.0300	15.8400	22.1900	0.1800	3.9942			(29a)
Total net area of external elements Aum(A, m2)			38.0300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	22.1316			(33)
Main dwelling								
Party Wall-between flats			32.6400	0.0000	0.0000			(32)
Party Wall-between circ			29.0400	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 308.1126 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E4 Jamb	23.4000	0.0500	1.1700
E7 Party floor between dwellings (in blocks of flats)	31.7000	0.0700	2.2190
E16 Corner (normal)	9.6000	0.0900	0.8640
E18 Party wall between dwellings	9.6000	0.0600	0.5760
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	51.4000	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0900	-0.4320
E1 Steel lintel with perforated steel base plate	1.6000	0.0500	0.0800

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.4770 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 26.6086 (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	43.1615	42.9134	42.6702	41.5280	41.3143	40.3195	40.3195	40.1353	40.7027	41.3143	41.7466	42.1986	(38)
Heat transfer coeff													
	69.7701	69.5220	69.2788	68.1366	67.9229	66.9281	66.9281	66.7439	67.3113	67.9229	68.3552	68.8072	(39)
Average = Sum(39)m / 12 =												68.1356	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7513	0.7487	0.7461	0.7338	0.7315	0.7207	0.7207	0.7188	0.7249	0.7315	0.7361	0.7410	(40)
HLP (average)												0.7337	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6629 (42)

Hot water usage for mixer showers												
88.4727	87.1432	85.2057	81.4988	78.7631	75.7123	73.9783	75.9011	78.0088	81.2844	85.0710	88.1338	(42a)
Hot water usage for baths												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses												
41.9005	40.3769	38.8532	37.3296	35.8059	34.2823	34.2823	35.8059	37.3296	38.8532	40.3769	41.9005	(42c)
Average daily hot water use (litres/day)												119.6603	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	130.3733	127.5200	124.0589	118.8283	114.5690	109.9946	108.2605	111.7070	115.3384	120.1376	125.4479	130.0343	(44)
Energy conte	206.4794	181.5868	190.6740	162.6700	154.2319	135.2512	130.9318	138.3166	142.2238	163.0256	178.7235	203.6023	(45)
Energy content (annual)										Total = Sum(45)m =		1987.7168	
Distribution loss (46)m = 0.15 x (45)m													
	30.9719	27.2380	28.6011	24.4005	23.1348	20.2877	19.6398	20.7475	21.3336	24.4538	26.8085	30.5403	(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													
	253.0743	223.6726	237.2689	207.7619	200.8268	180.3430	177.5267	184.9115	187.3156	209.6205	223.8153	250.1972	(62)
WWHRS	-40.4460	-35.7708	-37.4571	-31.0160	-28.9058	-24.7349	-23.1850	-24.6549	-25.5917	-30.1697	-34.1787	-39.6970	(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													
	212.6283	187.9017	199.8117	176.7459	171.9210	155.6082	154.3416	160.2566	161.7239	179.4508	189.6367	210.5001	(64)
									Total per year (kWh/year) = Sum(64)m =			2160.5265	(64)
12Total per year (kWh/year)												2161	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month													
	105.9303	94.0462	100.6750	90.1613	88.5580	81.0445	80.8107	83.2662	83.3629	91.4819	95.4990	104.9737	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.1439	133.1439	133.1439	133.1439	133.1439	133.1439	133.1439	133.1439	133.1439	133.1439	133.1439	133.1439	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	126.9783	140.5832	126.9783	131.2109	126.9783	131.2109	126.9783	126.9783	131.2109	126.9783	131.2109	126.9783	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.2421	246.7766	240.3898	226.7931	209.6297	193.4985	182.7219	180.1875	186.5742	200.1709	217.3343	233.4655	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3144	36.3144	36.3144	36.3144	36.3144	36.3144	36.3144	36.3144	36.3144	36.3144	36.3144	36.3144	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

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

-106.5151	-106.5151	-106.5151	-106.5151	-106.5151	-106.5151	-106.5151	-106.5151	-106.5151	-106.5151	-106.5151	-106.5151	(71)

Water heating gains (Table 5)

142.3795	139.9497	135.3159	125.2240	119.0296	112.5618	108.6166	111.9169	115.7818	122.9596	132.6375	141.0937	(72)

Total internal gains

579.5431	593.2526	568.6272	549.1712	521.5808	500.2145	481.2600	482.0259	496.5101	516.0520	547.1260	567.4807	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	2.8800	11.2829	0.6300	0.7000	0.7700	9.9309	(75)
Southwest	2.8800	36.7938	0.6300	0.7000	0.7700	32.3847	(79)
Northwest	10.0800	11.2829	0.6300	0.7000	0.7700	34.7580	(81)

Solar gains	77.0735	146.1285	239.3673	362.6748	466.5473	489.7068	461.0876	379.5376	281.4286	172.1339	95.0195	64.2097	(83)
Total gains	656.6166	739.3811	807.9945	911.8460	988.1281	989.9212	942.3476	861.5635	777.9387	688.1860	642.1455	631.6903	(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	113.9112	114.3177	114.7190	116.6421	117.0090	118.7482	118.7482	119.0760	118.0722	117.0090	116.2690	115.5053	
alpha	8.5941	8.6212	8.6479	8.7761	8.8006	8.9165	8.9165	8.9384	8.8715	8.8006	8.7513	8.7004	
util living area	0.9968	0.9903	0.9661	0.8470	0.6347	0.4326	0.3125	0.3563	0.5945	0.9093	0.9893	0.9976	(86)
MIT	20.4695	20.5977	20.7671	20.9457	20.9953	20.9999	21.0000	21.0000	20.9980	20.9159	20.6720	20.4528	(87)
Th 2	20.2957	20.2980	20.3003	20.3111	20.3131	20.3225	20.3225	20.3243	20.3189	20.3131	20.3090	20.3048	(88)
util rest of house	0.9957	0.9869	0.9550	0.8134	0.5896	0.3868	0.2644	0.3040	0.5371	0.8780	0.9848	0.9968	(89)
MIT 2	19.6795	19.8435	20.0542	20.2632	20.3099	20.3225	20.3225	20.3243	20.3179	20.2389	19.9475	19.6658	(90)
Living area fraction									fLA = Living area / (4) =			0.3643	(91)
MIT	19.9673	20.1183	20.3139	20.5119	20.5596	20.5693	20.5693	20.5704	20.5656	20.4855	20.2115	19.9525	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9673	20.1183	20.3139	20.5119	20.5596	20.5693	20.5693	20.5704	20.5656	20.4855	20.2115	19.9525	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9950	0.9858	0.9552	0.8236	0.6059	0.4035	0.2819	0.3231	0.5580	0.8866	0.9841	0.9962	(94)
Useful gains	653.3083	728.9077	771.8192	751.0407	598.7555	399.4380	265.6585	278.3442	434.0974	610.1228	631.9063	629.2743	(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	1093.1070	1058.0029	957.0132	791.1926	601.7720	399.5110	265.6609	278.3520	435.2100	671.4550	896.2373	1083.8875	(97)
Space heating kWh	327.2102	221.1520	137.7843	28.9094	2.2443	0.0000	0.0000	0.0000	0.0000	45.6311	190.3183	338.2322	(98a)
Space heating requirement - total per year (kWh/year)												1291.4818	
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	327.2102	221.1520	137.7843	28.9094	2.2443	0.0000	0.0000	0.0000	0.0000	45.6311	190.3183	338.2322	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1291.4818	
Space heating per m2											(98c) / (4) =	13.9078	(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	327.2102	221.1520	137.7843	28.9094	2.2443	0.0000	0.0000	0.0000	0.0000	45.6311	190.3183	338.2322	(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)	354.5073	239.6012	149.2788	31.3211	2.4315	0.0000	0.0000	0.0000	0.0000	49.4379	206.1954	366.4488	(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	212.6283	187.9017	199.8117	176.7459	171.9210	155.6082	154.3416	160.2566	161.7239	179.4508	189.6367	210.5001	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.0231	84.4261	83.2434	80.9534	79.9044	79.8000	79.8000	79.8000	79.8000	81.4741	84.0678	85.1174	(217)
Fuel for water heating, kWh/month	250.0829	222.5635	240.0333	218.3305	215.1585	194.9977	193.4106	200.8228	202.6616	220.2551	225.5758	247.3055	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	26.3836	21.1659	19.0575	13.9624	10.7849	8.8114	9.8384	12.7883	16.6107	21.7942	24.6165	27.1169	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-10.1822	-15.7501	-24.8082	-30.6480	-35.5531	-34.1134	-33.6946	-30.5379	-25.4727	-19.1484	-11.6764	-8.6479	(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	-2.1783	-4.7723	-9.8572	-15.3771	-20.9171	-21.2424	-20.9990	-17.5111	-12.4867	-7.0101	-2.9648	-1.7092	(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	1399.2219	(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	2631.1977	(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)	212.9307	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-417.2580	(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	3912.0923	(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	1399.2219	0.2100	293.8366	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2631.1977	0.2100	552.5515	(264)
Space and water heating			846.3881	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	212.9307	0.1443	30.7325	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-280.2329	0.1327	-37.1896	
PV Unit electricity exported	-137.0251	0.1248	-17.1005	
Total			-54.2901	(269)
Total CO2, kg/year			834.7598	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.9900	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1399.2219	1.1300	1581.1208	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2631.1977	1.1300	2973.2534	(278)
Space and water heating			4554.3742	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	212.9307	1.5338	326.6002	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-280.2329	1.4904	-417.6490	
PV Unit electricity exported	-137.0251	0.4580	-62.7630	
Total			-480.4120	(283)
Total Primary energy kWh/year			4530.6632	(286)
Target Primary Energy Rate (TPER)			48.7900	(287)

Full SAP Calculation Printout

Property Reference	6F_Block A5_1Bed	**Issued on Date**	27/03/2025
Assessment Reference	Option 1_EPH+ASHP_P08	**Prop Type Ref**	North West
Property	Chorlton-cum-Hardy, Manchester, Greater Manchester, M21 9AQ		

SAP Rating	95 A	**DER**	1.57	**TER**	11.04
Environmental	99 A	**% DER < TER**			85.78
CO_2 Emissions (t/year)	0.07	**DFEE**	18.12	**TFEE**	20.22
Compliance Check	See BREL	**% DFEE < TFEE**			10.38
% DPER < TPER	73.32	**DPER**	16.10	**TPER**	60.33

Assessor Details	Mr. Leon Maddison	**Assessor ID**	AY03-0001
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)	
Main dwelling						
Ground floor	56.9600 (1b)	x	2.4000 (2b)	=	136.7040	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.9600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	136.7040	(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) =	74.4000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2906	0.2874	0.2842	0.2682	0.2651	0.2491	0.2491	0.2459	0.2555	0.2651	0.2714	0.2778	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Glazing			12.9600	1.1450	14.8397			(27)
External Wall 1	22.7400	12.9600	9.7800	0.1500	1.4670	60.0000	586.8000	(29a)
Total net area of external elements Aum(A, m2)			22.7400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.3067			(33)
Main dwelling								
Party Wall-between flats			32.6400	0.0000	0.0000	180.0000	5875.1999	(32)
Party Wall-between circ			18.2400	0.0000	0.0000	180.0000	3283.2000	(32)
Party Floor 1			56.9600			80.0000	4556.8000	(32d)
Party Ceiling 1			56.9600			100.0000	5696.0000	(32b)
Internal Wall 1			90.8300			9.0000	817.4700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 20815.4699	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	365.4401	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E4 Jamb	19.2000	0.0180	0.3456	
E7 Party floor between dwellings (in blocks of flats)	18.9500	0.0360	0.6822	
E16 Corner (normal)	4.8000	0.0400	0.1920	
E18 Party wall between dwellings	9.6000	0.0320	0.3072	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	42.4000	0.0000	0.0000	
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0820	-0.1968	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.3302 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 17.6369 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	13.1079	12.9642	12.8204	12.1014	11.9576	11.2386	11.2386	11.0948	11.5262	11.9576	12.2452	12.5328	(38)
Heat transfer coeff	30.7448	30.6010	30.4573	29.7383	29.5945	28.8755	28.8755	28.7317	29.1631	29.5945	29.8821	30.1697	(39)

Average = Sum(39)m / 12 = 29.7023

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5398	0.5372	0.5347	0.5221	0.5196	0.5069	0.5069	0.5044	0.5120	0.5196	0.5246	0.5297	(40)
HLP (average)												0.5215	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.8945 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	71.8677	70.7877	69.2139	66.2026	63.9804	61.5023	60.0937	61.6556	63.3677	66.0285	69.1044	71.5924	(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses	34.0317	32.7942	31.5567	30.3191	29.0816	27.8441	27.8441	29.0816	30.3191	31.5567	32.7942	34.0317	(42c)

Average daily hot water use (litres/day) 97.1975 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.8994	103.5819	100.7705	96.5218	93.0621	89.3464	87.9378	90.7372	93.6869	97.5852	101.8986	105.6241	(44)
Energy conte	167.7188	147.4992	154.8805	132.1335	125.2794	109.8618	106.3531	112.3516	115.5253	132.4222	145.1732	165.3817	(45)

Energy content (annual) Total = Sum(45)m = 1614.5805

Distribution loss (46)m = 0.15 x (45)m	25.1578	22.1249	23.2321	19.8200	18.7919	16.4793	15.9530	16.8527	17.3288	19.8633	21.7760	24.8073	(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	194.6702	171.8424	181.8319	158.2155	152.2308	135.9438	133.3045	139.3030	141.6073	159.3736	171.2552	192.3331	(62)
WWHRS	-50.4616	-44.6287	-46.7326	-38.6964	-36.0637	-30.8599	-28.9263	-30.7602	-31.9289	-37.6406	-42.6423	-49.5272	(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	144.2085	127.2137	135.0994	119.5191	116.1672	105.0839	104.3782	108.5428	109.6784	121.7329	128.6130	142.8060	(64)

Total per year (kWh/year) = Sum(64)m = 1463.0431 (64)
12Total per year (kWh/year) 1463 (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	55.7665	49.0435	51.4978	43.9344	41.6554	36.5290	35.3624	37.3569	38.4122	44.0304	48.2701	54.9894	(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	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	83.3175	92.2444	83.3175	86.0948	83.3175	86.0948	83.3175	83.3175	86.0948	83.3175	86.0948	83.3175	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	165.2203	166.9348	162.6144	153.4167	141.8064	130.8942	123.6043	121.8898	126.2102	135.4079	147.0182	157.9303	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	(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)	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	(71)
Water heating gains (Table 5)	74.9550	72.9814	69.2175	61.0200	55.9885	50.7348	47.5301	50.2109	53.3502	59.1806	67.0418	73.9105	(72)
Total internal gains	374.9105	383.5782	366.5670	351.9492	332.5300	319.1415	305.8696	306.8359	317.0729	329.3237	351.5725	366.5761	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.0800	11.2829	0.4000	0.7000	0.7700	22.0686	(75)
Southeast	2.8800	36.7938	0.4000	0.7000	0.7700	20.5617	(77)

Solar gains	42.6303	79.9454	128.8553	192.2936	245.1731	256.5030	241.8435	200.3898	150.5080	93.6064	52.3961	35.6188	(83)
Total gains	417.5407	463.5236	495.4223	544.2428	577.7032	575.6445	547.7131	507.2257	467.5809	422.9301	403.9686	402.1949	(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	188.0665	188.9502	189.8423	194.4321	195.3768	200.2415	200.2415	201.2437	198.2669	195.3768	193.4965	191.6520	
alpha	13.5378	13.5967	13.6562	13.9621	14.0251	14.3494	14.3494	14.4162	14.2178	14.0251	13.8998	13.7768	
util living area	0.9880	0.9562	0.8667	0.6605	0.4764	0.3210	0.2320	0.2606	0.4304	0.7254	0.9451	0.9912	(86)
MIT	20.8486	20.9257	20.9816	20.9994	21.0000	21.0000	21.0000	21.0000	21.0000	20.9985	20.9495	20.8374	(87)
Th 2	20.4845	20.4868	20.4891	20.5006	20.5029	20.5145	20.5145	20.5168	20.5099	20.5029	20.4983	20.4937	(88)
util rest of house	0.9838	0.9440	0.8428	0.6335	0.4510	0.2967	0.2064	0.2332	0.3998	0.6917	0.9286	0.9879	(89)
MIT 2	20.3173	20.4109	20.4726	20.5002	20.5029	20.5145	20.5145	20.5168	20.5099	20.5019	20.4496	20.3120	(90)
Living area fraction										fLA = Living area / (4) =		0.5381	(91)
MIT	20.6032	20.6879	20.7465	20.7688	20.7704	20.7757	20.7757	20.7768	20.7736	20.7691	20.7186	20.5947	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6032	20.6879	20.7465	20.7688	20.7704	20.7757	20.7757	20.7768	20.7736	20.7691	20.7186	20.5947	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9849	0.9491	0.8551	0.6480	0.4647	0.3098	0.2201	0.2479	0.4162	0.7098	0.9363	0.9887	(94)
Useful gains	411.2191	439.9214	423.6230	352.6647	268.4306	178.3274	120.5764	125.7530	194.6223	300.2114	378.2206	397.6321	(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	501.2383	483.1273	433.9096	352.9587	268.4337	178.3274	120.5764	125.7530	194.6228	300.9503	406.9518	494.6217	(97)
Space heating kWh	66.9743	29.0344	7.6532	0.2117	0.0023	0.0000	0.0000	0.0000	0.0000	0.5497	20.6865	72.1602	(98a)
Space heating requirement - total per year (kWh/year)												197.2724	
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	66.9743	29.0344	7.6532	0.2117	0.0023	0.0000	0.0000	0.0000	0.0000	0.5497	20.6865	72.1602	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												197.2724	
Space heating per m2											(98c) / (4) =	3.4634	(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	66.9743	29.0344	7.6532	0.2117	0.0023	0.0000	0.0000	0.0000	0.0000	0.5497	20.6865	72.1602	(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)	66.9743	29.0344	7.6532	0.2117	0.0023	0.0000	0.0000	0.0000	0.0000	0.5497	20.6865	72.1602	(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	144.2085	127.2137	135.0994	119.5191	116.1672	105.0839	104.3782	108.5428	109.6784	121.7329	128.6130	142.8060	(64)
Efficiency of water heater												349.4100	(216)
(217)m	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	(217)
Fuel for water heating, kWh/month	41.2720	36.4081	38.6650	34.2060	33.2467	30.0747	29.8727	31.0646	31.3896	34.8396	36.8086	40.8706	(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	7.7340	6.9855	7.7340	7.4845	7.7340	7.4845	7.7340	7.7340	7.4845	7.7340	7.4845	7.7340	(231)
Lighting	20.0349	16.0727	14.4717	10.6026	8.1897	6.6911	7.4710	9.7110	12.6137	16.5498	18.6930	20.5917	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-7.8790	-13.5265	-23.8945	-32.1905	-39.0719	-38.0895	-37.3468	-32.7982	-25.4276	-17.0575	-9.2543	-6.4687	(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	197.2724	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	349.4100	
Water heating fuel used	418.7181	(219)
Space cooling fuel	0.0000	(221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.5460)

mechanical ventilation fans (SFP = 0.5460) 91.0613 (230a)

Total electricity for the above, kWh/year 91.0613 (231)

Electricity for lighting (calculated in Appendix L)	161.6929	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-283.0050	(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	585.7398	(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	197.2724	0.1608	31.7244	(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)	418.7181	0.1408	58.9402	(264)
Space and water heating			90.6646	(265)
Pumps, fans and electric keep-hot	91.0613	0.1387	12.6313	(267)
Energy for lighting	161.6929	0.1443	23.3373	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-283.0050	0.1312	-37.1285	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-37.1285	(269)
Total CO2, kg/year			89.5047	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.5700	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	197.2724	1.5951	314.6737	(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)	418.7181	1.5205	636.6545	(278)
Space and water heating			951.3281	(279)
Pumps, fans and electric keep-hot	91.0613	1.5128	137.7575	(281)
Energy for lighting	161.6929	1.5338	248.0100	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-283.0050	1.4847	-420.1707	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-420.1707	(283)
Total Primary energy kWh/year			916.9250	(286)
Dwelling Primary energy Rate (DPER)			16.1000	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	56.9600	(1b) x	2.4000	(2b) =	136.7040	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.9600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		136.7040	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1463	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3963	(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) =	0.3369	(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													
	0.4295	0.4211	0.4126	0.3705	0.3621	0.3200	0.3200	0.3116	0.3369	0.3621	0.3790	0.3958	(22b)
Effective ac	0.5922	0.5887	0.5851	0.5687	0.5656	0.5512	0.5512	0.5485	0.5567	0.5656	0.5718	0.5783	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opening Type			12.9600	1.1450	14.8397			(27)
External Wall 1	22.7400	12.9600	9.7800	0.1800	1.7604			(29a)
Total net area of external elements Aum(A, m2)			22.7400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	16.6001			(33)
Main dwelling								
Party Wall-between flats			32.6400	0.0000	0.0000			(32)
Party Wall-between circ			18.2400	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K			345.4401 (35)
List of Thermal Bridges			
K1 Element	Length	Psi-value	Total
E4 Jamb	19.2000	0.0500	0.9600
E7 Party floor between dwellings (in blocks of flats)	18.9500	0.0700	1.3265
E16 Corner (normal)	4.8000	0.0900	0.4320
E18 Party wall between dwellings	9.6000	0.0600	0.5760
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	42.4000	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			3.0785 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	19.6786 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	26.7169	26.5554	26.3970	25.6532	25.5140	24.8661	24.8661	24.7461	25.1157	25.5140	25.7955	26.0899	(38)
Heat transfer coeff	46.3955	46.2340	46.0756	45.3317	45.1926	44.5447	44.5447	44.4247	44.7943	45.1926	45.4741	45.7685	(39)
Average = Sum(39)m / 12 =												45.3311	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8145	0.8117	0.8089	0.7959	0.7934	0.7820	0.7820	0.7799	0.7864	0.7934	0.7984	0.8035	(40)
HLP (average)												0.7958	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy											1.8945	(42)
Hot water usage for mixer showers												
	71.8677	70.7877	69.2139	66.2026	63.9804	61.5023	60.0937	61.6556	63.3677	66.0285	69.1044	71.5924	(42a)
Hot water usage for baths												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses												
	34.0317	32.7942	31.5567	30.3191	29.0816	27.8441	27.8441	29.0816	30.3191	31.5567	32.7942	34.0317	(42c)
Average daily hot water use (litres/day)												97.1975	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	105.8994	103.5819	100.7705	96.5218	93.0621	89.3464	87.9378	90.7372	93.6869	97.5852	101.8986	105.6241	(44)
Energy conte	167.7188	147.4992	154.8805	132.1335	125.2794	109.8618	106.3531	112.3516	115.5253	132.4222	145.1732	165.3817	(45)
Energy content (annual)										Total = Sum(45)m =		1614.5805	
Distribution loss (46)m = 0.15 x (45)m													
	25.1578	22.1249	23.2321	19.8200	18.7919	16.4793	15.9530	16.8527	17.3288	19.8633	21.7760	24.8073	(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													
	214.3137	189.5849	201.4755	177.2254	171.8743	154.9536	152.9480	158.9465	160.6171	179.0171	190.2651	211.9767	(62)
WWHRS	-32.8549	-29.0572	-30.4270	-25.1947	-23.4806	-20.0925	-18.8335	-20.0276	-20.7885	-24.5073	-27.7638	-32.2465	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	181.4588	160.5278	171.0485	152.0306	148.3937	134.8611	134.1145	138.9189	139.8286	154.5098	162.5012	179.7302	(64)
										Total per year (kWh/year) = Sum(64)m =		1857.9237	(64)
12Total per year (kWh/year)												1858	(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													
	93.0424	82.7121	88.7737	80.0079	78.9313	72.6025	72.6383	74.6328	74.4856	81.3063	84.3436	92.2654	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	83.3175	92.2444	83.3175	86.0948	83.3175	86.0948	83.3175	83.3175	86.0948	83.3175	86.0948	83.3175	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	165.2203	166.9348	162.6144	153.4167	141.8064	130.8942	123.6043	121.8898	126.2102	135.4079	147.0182	157.9303	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	(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)													
	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	(71)
Water heating gains (Table 5)													

	125.0570	123.0834	119.3195	111.1220	106.0905	100.8368	97.6322	100.3129	103.4523	109.2827	117.1439	124.0126	(72)
Total internal gains	428.0125	436.6803	419.6691	405.0512	385.6321	369.2436	355.9717	356.9380	367.1750	382.4257	404.6746	419.6781	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.0800	11.2829	0.6300	0.7000	0.7700	34.7580	(75)
Southeast	2.8800	36.7938	0.6300	0.7000	0.7700	32.3847	(77)

Solar gains	67.1427	125.9140	202.9471	302.8624	386.1477	403.9923	380.9035	315.6139	237.0500	147.4301	82.5239	56.0996	(83)
Total gains	495.1552	562.5942	622.6162	707.9136	771.7798	773.2358	736.8752	672.5519	604.2250	529.8559	487.1985	475.7778	(84)

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7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	117.8051	118.2168	118.6231	120.5696	120.9409	122.6999	122.6999	123.0313	122.0163	120.9409	120.1921	119.4192	
alpha	8.8537	8.8811	8.9082	9.0380	9.0627	9.1800	9.1800	9.2021	9.1344	9.0627	9.0128	8.9613	
util living area	0.9931	0.9783	0.9277	0.7560	0.5436	0.3687	0.2660	0.3038	0.5110	0.8388	0.9763	0.9948	(86)
MIT	20.5706	20.7056	20.8627	20.9797	20.9988	21.0000	21.0000	21.0000	20.9995	20.9611	20.7622	20.5509	(87)
Th 2	20.2408	20.2432	20.2456	20.2569	20.2590	20.2689	20.2689	20.2708	20.2651	20.2590	20.2548	20.2503	(88)
util rest of house	0.9903	0.9706	0.9066	0.7156	0.5007	0.3266	0.2218	0.2557	0.4569	0.7946	0.9665	0.9927	(89)
MIT 2	19.7557	19.9252	20.1114	20.2409	20.2583	20.2689	20.2689	20.2708	20.2649	20.2288	20.0064	19.7389	(90)
Living area fraction									fLA = Living area / (4) =			0.5381	(91)
MIT	20.1942	20.3452	20.5157	20.6384	20.6568	20.6623	20.6623	20.6632	20.6602	20.6229	20.4131	20.1758	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1942	20.3452	20.5157	20.6384	20.6568	20.6623	20.6623	20.6632	20.6602	20.6229	20.4131	20.1758	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9901	0.9718	0.9147	0.7367	0.5238	0.3492	0.2456	0.2816	0.4860	0.8171	0.9689	0.9925	(94)
Useful gains	490.2739	546.7315	569.5006	521.5046	404.2242	270.0319	180.9543	189.3886	293.6497	432.9575	472.0479	472.1947	(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	737.4196	714.0911	645.7797	532.1236	404.7801	270.0431	180.9546	189.3897	293.8583	452.9585	605.3995	731.1895	(97)
Space heating kWh	183.8763	112.4657	56.7516	7.6456	0.4136	0.0000	0.0000	0.0000	0.0000	14.8807	96.0132	192.6922	(98a)
Space heating requirement - total per year (kWh/year)												664.7390	
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	183.8763	112.4657	56.7516	7.6456	0.4136	0.0000	0.0000	0.0000	0.0000	14.8807	96.0132	192.6922	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												664.7390	
Space heating per m2										(98c) / (4) =		11.6703	(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	183.8763	112.4657	56.7516	7.6456	0.4136	0.0000	0.0000	0.0000	0.0000	14.8807	96.0132	192.6922	(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)	199.2160	121.8480	61.4860	8.2835	0.4481	0.0000	0.0000	0.0000	0.0000	16.1221	104.0229	208.7673	(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	181.4588	160.5278	171.0485	152.0306	148.3937	134.8611	134.1145	138.9189	139.8286	154.5098	162.5012	179.7302	(64)
Efficiency of water heater												79.8000	(216)
(217)m	84.0895	83.2771	81.8671	80.1892	79.8225	79.8000	79.8000	79.8000	79.8000	80.5169	82.9213	84.2163	(217)
Fuel for water heating, kWh/month	215.7924	192.7633	208.9343	189.5900	185.9047	168.9989	168.0633	174.0839	175.2238	191.8973	195.9703	213.4151	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	17.3117	13.8881	12.5047	9.1615	7.0766	5.7816	6.4555	8.3911	10.8992	14.3004	16.1522	17.7929	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-6.3206	-9.8200	-15.5379	-19.2905	-22.4721	-21.6059	-21.3489	-19.3069	-16.0396	-11.9833	-7.2649	-5.3642	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													

(233b)m	-1.2612	-2.7684	-5.7258	-8.9411	-12.1665	-12.3492	-12.2000	-10.1661	-7.2445	-4.0622	-1.7159	-0.9888	(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	720.1939	(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	2280.6373	(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)	139.7157	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-255.9446	(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	2970.6023	(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	720.1939	0.2100	151.2407	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2280.6373	0.2100	478.9338	(264)
Space and water heating			630.1746	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	139.7157	0.1443	20.1653	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-176.3548	0.1326	-23.3863	
PV Unit electricity exported	-79.5898	0.1248	-9.9318	
Total			-33.3182	(269)
Total CO2, kg/year			628.9509	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.0400	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	720.1939	1.1300	813.8191	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2280.6373	1.1300	2577.1202	(278)
Space and water heating			3390.9393	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	139.7157	1.5338	214.3005	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-176.3548	1.4900	-262.7666	
PV Unit electricity exported	-79.5898	0.4580	-36.4523	
Total			-299.2189	(283)
Total Primary energy kWh/year			3436.1218	(286)
Target Primary Energy Rate (TPER)			60.3300	(287)

Full SAP Calculation Printout

Property Reference	6F_Block C Penthouse_2Bed 4P	**Issued on Date**	27/03/2025
Assessment Reference	Option 1_EPH+ASHP_P08	**Prop Type Ref**	North West
Property	Chorlton-cum-Hardy, Manchester, Greater Manchester, M21 9AQ		

SAP Rating	87 B	**DER**	3.10	**TER**	9.92
Environmental	97 A	**% DER < TER**			68.75
CO_2 Emissions (t/year)	0.43	**DFEE**	36.35	**TFEE**	35.11
Compliance Check	See BREL	**% DFEE < TFEE**			-3.53
% DPER < TPER	42.12	**DPER**	30.57	**TPER**	52.81

Assessor Details	Mr. Leon Maddison	**Assessor ID**	AY03-0001
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)	
Main dwelling						
Ground floor	175.1800	(1b)	x 2.4000	(2b) =	420.4320	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	175.1800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	420.4320	(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) =	73.6000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2946	0.2914	0.2882	0.2722	0.2691	0.2531	0.2531	0.2499	0.2595	0.2691	0.2754	0.2818	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Glazing			59.0400	1.1450	67.6031			(27)
External Wall 1	104.3900	59.0400	45.3500	0.1500	6.8025	60.0000	2721.0000	(29a)
External Roof 1	175.1800		175.1800	0.1100	19.2698	9.0000	1576.6200	(30)
Total net area of external elements Aum(A, m2)			279.5700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		93.6754			(33)
Main dwelling								
Party Wall-between circ			91.9200	0.0000	0.0000	180.0000	16545.5997	(32)
Party Floor 1			175.1800			80.0000	14014.4000	(32d)
Internal Wall 1			249.9600			9.0000	2249.6401	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 37107.2597	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	211.8236	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E4 Jamb	81.6000	0.0180	1.4688

E7 Party floor between dwellings (in blocks of flats)	43.4900	0.0360	1.5656	
E16 Corner (normal)	21.6000	0.0400	0.8640	
E18 Party wall between dwellings	12.0000	0.0320	0.3840	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	38.3000	0.0000	0.0000	
E17 Corner (inverted - internal area greater than external area)	19.2000	-0.0820	-1.5744	
P4 Party wall - Roof (insulation at ceiling level)	38.3000	0.0330	1.2639	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.9719 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 97.6473 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.8684	40.4261	39.9839	37.7727	37.3304	35.1192	35.1192	34.6770	36.0037	37.3304	38.2149	39.0994	(38)
Heat transfer coeff	138.5156	138.0734	137.6312	135.4200	134.9777	132.7665	132.7665	132.3243	133.6510	134.9777	135.8622	136.7467	(39)
Average = Sum(39)m / 12 =												135.3094	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7907	0.7882	0.7857	0.7730	0.7705	0.7579	0.7579	0.7554	0.7629	0.7705	0.7756	0.7806	(40)
HLP (average)												0.7724	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9695 (42)
Hot water usage for mixer showers

	74.0080	72.8958	71.2751	68.1742	65.8858	63.3338	61.8833	63.4917	65.2548	67.9949	71.1624	73.7244	(42a)

Hot water usage for baths

	31.9491	31.4746	30.8064	29.5744	28.6519	27.6290	27.0765	27.7400	28.4624	29.5569	30.8143	31.8411	(42b)

Hot water usage for other uses

	45.0403	43.4024	41.7646	40.1268	38.4890	36.8511	36.8511	38.4890	40.1268	41.7646	43.4024	45.0403	(42c)

Average daily hot water use (litres/day) 138.8004 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.9973	147.7728	143.8461	137.8754	133.0267	127.8140	125.8109	129.7206	133.8440	139.3165	145.3792	150.6058	(44)
Energy conte	239.1429	210.4265	221.0861	188.7445	179.0795	157.1622	152.1574	160.6212	165.0431	189.0511	207.1193	235.8122	(45)
Energy content (annual)										Total = Sum(45)m =		2305.4461	
Distribution loss (46)m = 0.15 x (45)m	35.8714	31.5640	33.1629	28.3117	26.8619	23.5743	22.8236	24.0932	24.7565	28.3577	31.0679	35.3718	(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	266.0943	234.7697	248.0375	214.8265	206.0309	183.2442	179.1088	187.5726	191.1251	216.0025	233.2013	262.7636	(62)
WWHRS	-51.9644	-45.9578	-48.1243	-39.8488	-37.1377	-31.7790	-29.7877	-31.6763	-32.8798	-38.7616	-43.9122	-51.0021	(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	214.1299	188.8120	199.9132	174.9777	168.8932	151.4652	149.3210	155.8964	158.2453	177.2409	189.2891	211.7615	(64)
										Total per year (kWh/year) = Sum(64)m =		2139.9454	(64)
12Total per year (kWh/year)												2140	(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	79.5150	69.9668	73.5111	62.7576	59.5439	52.2564	50.5923	53.4066	54.8768	62.8595	68.8672	78.4076	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.4732	148.4732	148.4732	148.4732	148.4732	148.4732	148.4732	148.4732	148.4732	148.4732	148.4732	148.4732	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	174.9189	193.6602	174.9189	180.7495	174.9189	180.7495	174.9189	174.9189	180.7495	174.9189	180.7495	174.9189	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	346.7963	350.3949	341.3264	322.0207	297.6506	274.7461	259.4446	255.8459	264.9144	284.2202	308.5903	331.4947	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8473	37.8473	37.8473	37.8473	37.8473	37.8473	37.8473	37.8473	37.8473	37.8473	37.8473	37.8473	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-118.7785	-118.7785	-118.7785	-118.7785	-118.7785	-118.7785	-118.7785	-118.7785	-118.7785	-118.7785	-118.7785	-118.7785	(71)
Water heating gains (Table 5)	106.8750	104.1173	98.8053	87.1633	80.0322	72.5784	68.0004	71.7830	76.2178	84.4886	95.6488	105.3865	(72)
Total internal gains	696.1321	715.7144	682.5926	657.4754	620.1436	595.6160	569.9059	570.0898	589.4237	611.1696	652.5306	679.3421	(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	
Southwest	16.8000	36.7938	0.4000	0.7000	0.7700	119.9432	(79)
Northwest	42.2400	11.2829	0.4000	0.7000	0.7700	92.4778	(81)

Solar gains	212.4210	392.5489	618.6934	903.3499	1136.6543	1183.3419	1118.0180	935.5681	715.9461	455.8492	260.0253	178.1684	(83)
Total gains	908.5531	1108.2633	1301.2860	1560.8254	1756.7979	1778.9579	1687.9238	1505.6579	1305.3698	1067.0188	912.5559	857.5105	(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	74.4145	74.6528	74.8927	76.1156	76.3650	77.6368	77.6368	77.8963	77.1231	76.3650	75.8678	75.3771	
alpha	5.9610	5.9769	5.9928	6.0744	6.0910	6.1758	6.1758	6.1931	6.1415	6.0910	6.0579	6.0251	
util living area	0.9977	0.9921	0.9718	0.8786	0.6855	0.4750	0.3458	0.4034	0.6797	0.9473	0.9937	0.9983	(86)
MIT	19.9423	20.1548	20.4496	20.7983	20.9615	20.9965	20.9996	20.9990	20.9735	20.7032	20.2593	19.9139	(87)
Th 2	20.2614	20.2636	20.2658	20.2768	20.2790	20.2900	20.2900	20.2922	20.2856	20.2790	20.2746	20.2702	(88)
util rest of house	0.9971	0.9900	0.9645	0.8530	0.6404	0.4234	0.2901	0.3418	0.6187	0.9299	0.9916	0.9979	(89)
MIT 2	19.0023	19.2750	19.6480	20.0741	20.2471	20.2878	20.2898	20.2918	20.2671	19.9744	19.4178	18.9726	(90)
Living area fraction										fLA = Living area / (4) =		0.3378	(91)
MIT	19.3198	19.5721	19.9188	20.3187	20.4884	20.5272	20.5296	20.5306	20.5057	20.2206	19.7020	19.2905	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3198	19.5721	19.9188	20.3187	20.4884	20.5272	20.5296	20.5306	20.5057	20.2206	19.7020	19.2905	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9960	0.9875	0.9603	0.8546	0.6539	0.4408	0.3089	0.3626	0.6381	0.9283	0.9896	0.9971	(94)
Useful gains	904.8750	1094.4122	1249.6697	1333.8879	1148.6886	784.0762	521.4574	545.9278	832.8950	990.4834	903.0226	854.9811	(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	2080.4729	2025.8326	1846.8430	1546.3180	1186.2390	786.9332	521.7131	546.5835	856.1267	1298.5654	1712.1411	2063.5795	(97)
Space heating kWh	874.6448	625.9146	444.2970	152.9497	27.9375	0.0000	0.0000	0.0000	0.0000	229.2131	582.5653	899.1972	(98a)
Space heating requirement - total per year (kWh/year)												3836.7190	
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	874.6448	625.9146	444.2970	152.9497	27.9375	0.0000	0.0000	0.0000	0.0000	229.2131	582.5653	899.1972	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3836.7190	
Space heating per m2											(98c) / (4) =	21.9016	(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	874.6448	625.9146	444.2970	152.9497	27.9375	0.0000	0.0000	0.0000	0.0000	229.2131	582.5653	899.1972	(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)	874.6448	625.9146	444.2970	152.9497	27.9375	0.0000	0.0000	0.0000	0.0000	229.2131	582.5653	899.1972	(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	214.1299	188.8120	199.9132	174.9777	168.8932	151.4652	149.3210	155.8964	158.2453	177.2409	189.2891	211.7615	(64)
Efficiency of water heater												337.1865	(216)
(217)m	337.1865	337.1865	337.1865	337.1865	337.1865	337.1865	337.1865	337.1865	337.1865	337.1865	337.1865	337.1865	(217)
Fuel for water heating, kWh/month	63.5049	55.9963	59.2886	51.8934	50.0890	44.9203	44.2844	46.2345	46.9311	52.5647	56.1378	62.8025	(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	28.0550	25.3400	28.0550	27.1500	28.0550	27.1500	28.0550	28.0550	27.1500	28.0550	27.1500	28.0550	(231)
Lighting	45.5914	36.5751	32.9319	24.1273	18.6366	15.2263	17.0009	22.0985	28.7037	37.6608	42.5378	46.8586	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-80.1583	-129.1111	-203.6123	-216.3445	-207.1024	-184.3413	-181.6733	-172.7487	-152.4070	-141.3732	-91.0122	-66.6384	(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												3836.7190	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												337.1865	
Water heating fuel used												634.6473	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.6440)		
mechanical ventilation fans (SFP = 0.6440)	330.3250	(230a)
Total electricity for the above, kWh/year	330.3250	(231)

Electricity for lighting (calculated in Appendix L)	367.9489	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1826.5225	(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	3343.1177	(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	3836.7190	0.1569	601.9599	(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)	634.6473	0.1410	89.4866	(264)
Space and water heating			691.4465	(265)
Pumps, fans and electric keep-hot	330.3250	0.1387	45.8202	(267)
Energy for lighting	367.9489	0.1443	53.1064	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1826.5225	0.1353	-247.2109	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-247.2109	(269)
Total CO2, kg/year			543.1622	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.1000	(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	3836.7190	1.5808	6065.1620	(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)	634.6473	1.5214	965.5394	(278)
Space and water heating			7030.7014	(279)
Pumps, fans and electric keep-hot	330.3250	1.5128	499.7157	(281)
Energy for lighting	367.9489	1.5338	564.3723	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1826.5225	1.5003	-2740.3569	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-2740.3569	(283)
Total Primary energy kWh/year			5354.4325	(286)
Dwelling Primary energy Rate (DPER)			30.5700	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	175.1800	(1b) x	2.4000	(2b) =	420.4320	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	175.1800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		420.4320	(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) =	0.0951	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3451	(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) =	0.2934	(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													
	0.3740	0.3667	0.3594	0.3227	0.3154	0.2787	0.2787	0.2714	0.2934	0.3154	0.3300	0.3447	(22b)
Effective ac	0.5700	0.5672	0.5646	0.5521	0.5497	0.5388	0.5388	0.5368	0.5430	0.5497	0.5545	0.5594	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opening Type			43.7900	1.1450	50.1412			(27)
External Wall 1	104.3900	43.7900	60.6000	0.1800	10.9080			(29a)
External Roof 1	175.1800		175.1800	0.1100	19.2698			(30)
Total net area of external elements Aum(A, m2)			279.5700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	80.3190			(33)
Main dwelling								
Party Wall-between circ			91.9200	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	211.8236	(35)
List of Thermal Bridges		

K1 Element	Length	Psi-value	Total
E4 Jamb	81.6000	0.0500	4.0800
E7 Party floor between dwellings (in blocks of flats)	43.4900	0.0700	3.0443
E16 Corner (normal)	21.6000	0.0900	1.9440
E18 Party wall between dwellings	12.0000	0.0600	0.7200
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	38.3000	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	19.2000	-0.0900	-1.7280
P4 Party wall - Roof (insulation at ceiling level)	38.3000	0.1200	4.5960

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		12.6563	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	92.9753	(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	79.0770	78.7001	78.3307	76.5956	76.2709	74.7596	74.7596	74.4798	75.3418	76.2709	76.9277	77.6143	(38)
Heat transfer coeff													
	172.0524	171.6755	171.3060	169.5709	169.2462	167.7350	167.7350	167.4551	168.3171	169.2462	169.9030	170.5896	(39)
Average = Sum(39)m / 12 =												169.5693	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9821	0.9800	0.9779	0.9680	0.9661	0.9575	0.9575	0.9559	0.9608	0.9661	0.9699	0.9738	(40)
HLP (average)												0.9680	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9695	(42)
Hot water usage for mixer showers													
	74.0080	72.8958	71.2751	68.1742	65.8858	63.3338	61.8833	63.4917	65.2548	67.9949	71.1624	73.7244	(42a)
Hot water usage for baths													
	31.9491	31.4746	30.8064	29.5744	28.6519	27.6290	27.0765	27.7400	28.4624	29.5569	30.8143	31.8411	(42b)
Hot water usage for other uses													
	45.0403	43.4024	41.7646	40.1268	38.4890	36.8511	36.8511	38.4890	40.1268	41.7646	43.4024	45.0403	(42c)
Average daily hot water use (litres/day)												138.8004	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	150.9973	147.7728	143.8461	137.8754	133.0267	127.8140	125.8109	129.7206	133.8440	139.3165	145.3792	150.6058	(44)
Energy conte	239.1429	210.4265	221.0861	188.7445	179.0795	157.1622	152.1574	160.6212	165.0431	189.0511	207.1193	235.8122	(45)
Energy content (annual)											Total = Sum(45)m =	2305.4461	
Distribution loss (46)m = 0.15 x (45)m													
	35.8714	31.5640	33.1629	28.3117	26.8619	23.5743	22.8236	24.0932	24.7565	28.3577	31.0679	35.3718	(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													
	285.7378	252.5122	267.6810	233.8364	225.6744	202.2540	198.7523	207.2161	210.1349	235.6460	252.2111	282.4071	(62)
WWHRS	-33.8334	-29.9225	-31.3331	-25.9451	-24.1799	-20.6909	-19.3944	-20.6240	-21.4076	-25.2372	-28.5907	-33.2068	(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													
	251.9044	222.5897	236.3479	207.8913	201.4945	181.5631	179.3579	186.5921	188.7273	210.4089	223.6205	249.2003	(64)
											Total per year (kWh/year) = Sum(64)m =	2539.6980	(64)
12Total per year (kWh/year)												2540	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
											Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000	(64a)
Heat gains from water heating, kWh/month													
	116.7909	103.6354	110.7871	98.8310	96.8199	88.3299	87.8682	90.6825	90.9503	100.1354	104.9406	115.6835	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.4732	148.4732	148.4732	148.4732	148.4732	148.4732	148.4732	148.4732	148.4732	148.4732	148.4732	148.4732	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	174.9189	193.6602	174.9189	180.7495	174.9189	180.7495	174.9189	174.9189	180.7495	174.9189	180.7495	174.9189	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	346.7963	350.3949	341.3264	322.0207	297.6506	274.7461	259.4446	255.8459	264.9144	284.2202	308.5903	331.4947	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.8473	37.8473	37.8473	37.8473	37.8473	37.8473	37.8473	37.8473	37.8473	37.8473	37.8473	37.8473	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-118.7785	-118.7785	-118.7785	-118.7785	-118.7785	-118.7785	-118.7785	-118.7785	-118.7785	-118.7785	-118.7785	-118.7785	(71)

Water heating gains (Table 5)													
	156.9771	154.2193	148.9073	137.2653	130.1342	122.6804	118.1025	121.8851	126.3199	134.5906	145.7509	155.4886	(72)
Total internal gains													
	749.2342	768.8164	735.6946	710.5775	673.2456	645.7180	620.0079	620.1918	639.5258	664.2717	705.6326	732.4441	(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	
Southwest	12.4600	36.7938	0.6300	0.7000	0.7700	140.1086	(79)
Northwest	31.3300	11.2829	0.6300	0.7000	0.7700	108.0325	(81)

Solar gains	248.1412	458.5602	722.7366	1055.2672	1327.8101	1382.3508	1306.0404	1092.9049	836.3454	532.5060	303.7507	208.1286	(83)
Total gains	997.3754	1227.3766	1458.4312	1765.8447	2001.0558	2028.0688	1926.0483	1713.0967	1475.8711	1196.7776	1009.3834	940.5727	(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	59.9095	60.0410	60.1705	60.7862	60.9028	61.4515	61.4515	61.5542	61.2390	60.9028	60.6674	60.4232	
alpha	4.9940	5.0027	5.0114	5.0524	5.0602	5.0968	5.0968	5.1036	5.0826	5.0602	5.0445	5.0282	
util living area													
	0.9967	0.9903	0.9701	0.8906	0.7216	0.5194	0.3814	0.4454	0.7223	0.9497	0.9921	0.9975	(86)
MIT	19.6451	19.8830	20.2285	20.6535	20.9059	20.9854	20.9975	20.9948	20.9309	20.5488	20.0167	19.6076	(87)
Th 2	20.0982	20.1000	20.1018	20.1101	20.1117	20.1189	20.1189	20.1202	20.1161	20.1117	20.1085	20.1052	(88)
util rest of house													
	0.9958	0.9877	0.9620	0.8639	0.6695	0.4519	0.3059	0.3623	0.6508	0.9314	0.9895	0.9968	(89)
MIT 2	18.5023	18.8068	19.2433	19.7618	20.0336	20.1102	20.1180	20.1181	20.0677	19.6520	18.9848	18.4594	(90)
Living area fraction										fLA = Living area / (4) =		0.3378	(91)
MIT	18.8883	19.1703	19.5761	20.0630	20.3283	20.4058	20.4151	20.4142	20.3592	19.9549	19.3333	18.8473	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8883	19.1703	19.5761	20.0630	20.3283	20.4058	20.4151	20.4142	20.3592	19.9549	19.3333	18.8473	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9940	0.9840	0.9560	0.8624	0.6827	0.4742	0.3314	0.3904	0.6716	0.9275	0.9864	0.9954	(94)
Useful gains	991.3634	1207.7724	1394.3238	1522.8056	1366.2140	961.6642	638.3615	668.7423	991.1634	1109.9688	995.6278	936.2483	(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													
	2509.9503	2449.8606	2240.0081	1892.9176	1460.3011	973.8407	639.9183	672.2022	1053.5358	1583.2823	2078.4748	2498.6703	(97)
Space heating kWh													
	1129.8287	834.6833	629.1891	266.4806	70.0008	0.0000	0.0000	0.0000	0.0000	352.1453	779.6498	1162.4420	(98a)
Space heating requirement - total per year (kWh/year)												5224.4195	
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													
	1129.8287	834.6833	629.1891	266.4806	70.0008	0.0000	0.0000	0.0000	0.0000	352.1453	779.6498	1162.4420	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5224.4195	
Space heating per m2											(98c) / (4) =	29.8232	(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													
	1129.8287	834.6833	629.1891	266.4806	70.0008	0.0000	0.0000	0.0000	0.0000	352.1453	779.6498	1162.4420	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	1224.0830	904.3156	681.6783	288.7114	75.8405	0.0000	0.0000	0.0000	0.0000	381.5225	844.6911	1259.4171	(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													
	251.9044	222.5897	236.3479	207.8913	201.4945	181.5631	179.3579	186.5921	188.7273	210.4089	223.6205	249.2003	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.0109	86.7404	86.1469	84.6177	81.9413	79.8000	79.8000	79.8000	79.8000	85.2058	86.6225	87.0665	(217)
Fuel for water heating, kWh/month													
	289.5089	256.6159	274.3544	245.6831	245.9011	227.5227	224.7592	233.8247	236.5004	246.9421	258.1552	286.2183	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	36.3447	29.1571	26.2527	19.2339	14.8568	12.1381	13.5529	17.6165	22.8821	30.0226	33.9104	37.3548	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-24.5472	-36.9706	-56.7104	-68.1549	-77.3571	-73.5734	-72.6240	-66.6012	-56.7362	-44.1072	-27.7960	-20.9527	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)

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

(233b)m	-7.5150	-16.2632	-33.2093	-51.2309	-69.1228	-70.0158	-69.2474	-58.0346	-41.7277	-23.7461	-10.1820	-5.9129 (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	5660.2595	(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	3025.9861	(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)	293.3225	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1082.3388	(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	7983.2293	(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	5660.2595	0.2100	1188.6545	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3025.9861	0.2100	635.4571	(264)
Space and water heating			1824.1116	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	293.3225	0.1443	42.3355	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-626.1309	0.1333	-83.4328	
PV Unit electricity exported	-456.2079	0.1251	-57.0720	
Total			-140.5048	(269)
Total CO2, kg/year			1737.8715	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.9200	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	5660.2595	1.1300	6396.0932	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3025.9861	1.1300	3419.3643	(278)
Space and water heating			9815.4575	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	293.3225	1.5338	449.9078	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-626.1309	1.4924	-934.4366	
PV Unit electricity exported	-456.2079	0.4592	-209.4751	
Total			-1143.9117	(283)
Total Primary energy kWh/year			9251.5544	(286)
Target Primary Energy Rate (TPER)			52.8100	(287)

Full SAP Calculation Printout

Property Reference	7F_Block A2_2Bed 4P	**Issued on Date**	27/03/2025
Assessment Reference	Option 1_EPH+ASHP_P08	**Prop Type Ref**	North West
Property	Chorlton-cum-Hardy, Manchester, Greater Manchester, M21 9AQ		

SAP Rating	94 A	**DER**	1.67	**TER**	9.01
Environmental	99 A	**% DER < TER**			81.47
CO_2 Emissions (t/year)	0.12	**DFEE**	18.31	**TFEE**	20.21
Compliance Check	See BREL	**% DFEE < TFEE**			9.39
% DPER < TPER	64.88	**DPER**	17.17	**TPER**	48.89

Assessor Details	Mr. Leon Maddison	**Assessor ID**	AY03-0001
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)	
Main dwelling						
Ground floor	92.8600 (1b)	x	2.4000 (2b)	=	222.8640	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.8600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	222.8640	(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) =												73.6000	(23c)
Effective ac	0.2946	0.2914	0.2882	0.2722	0.2691	0.2531	0.2531	0.2499	0.2595	0.2691	0.2754	0.2818	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Glazing			15.8400	1.1450	18.1374			(27)
External Wall 1	38.0300	15.8400	22.1900	0.1500	3.3285	60.0000	1331.3999	(29a)
Total net area of external elements Aum(A, m2)			38.0300					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		21.4659			(33)
Main dwelling								
Party Wall-between flats			32.6400	0.0000	0.0000	180.0000	5875.1999	(32)
Party Wall-between circ			29.0400	0.0000	0.0000	180.0000	5227.2002	(32)
Party Floor 1			92.8600			80.0000	7428.8000	(32d)
Party Ceiling 1			92.8600			100.0000	9286.0000	(32b)
Internal Wall 1			146.6600			9.0000	1319.9400	(32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		30468.5400	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							328.1126	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E4 Jamb	23.4000	0.0180	0.4212	
E7 Party floor between dwellings (in blocks of flats)	31.7000	0.0360	1.1412	
E16 Corner (normal)	9.6000	0.0400	0.3840	
E18 Party wall between dwellings	12.0000	0.0320	0.3840	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	51.4000	0.0000	0.0000	
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0820	-0.3936	
E1 Steel lintel with perforated steel base plate	1.6000	0.3400	0.5440	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 2.4808 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 23.9467 (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	21.6636	21.4292	21.1948	20.0227	19.7882	18.6161	18.6161	18.3817	19.0850	19.7882	20.2571	20.7259	(38)
Heat transfer coeff	45.6103	45.3759	45.1415	43.9694	43.7349	42.5628	42.5628	42.3284	43.0317	43.7349	44.2038	44.6726	(39)

Average = Sum(39)m / 12 = 43.9108

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4912	0.4886	0.4861	0.4735	0.4710	0.4584	0.4584	0.4558	0.4634	0.4710	0.4760	0.4811	(40)
HLP (average)												0.4729	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6629 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	88.4727	87.1432	85.2057	81.4988	78.7631	75.7123	73.9783	75.9011	78.0088	81.2844	85.0710	88.1338	(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses	41.9005	40.3769	38.8532	37.3296	35.8059	34.2823	34.2823	35.8059	37.3296	38.8532	40.3769	41.9005	(42c)

Average daily hot water use (litres/day) 119.6603 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	130.3733	127.5200	124.0589	118.8283	114.5690	109.9946	108.2605	111.7070	115.3384	120.1376	125.4479	130.0343	(44)
Energy conte	206.4794	181.5868	190.6740	162.6700	154.2319	135.2512	130.9318	138.3166	142.2238	163.0256	178.7235	203.6023	(45)

Energy content (annual) Total = Sum(45)m = 1987.7168

Distribution loss (46)m = 0.15 x (45)m	30.9719	27.2380	28.6011	24.4005	23.1348	20.2877	19.6398	20.7475	21.3336	24.4538	26.8085	30.5403	(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	233.4308	205.9300	217.6254	188.7520	181.1833	161.3332	157.8832	165.2680	168.3058	189.9770	204.8055	230.5537	(62)
WWHRS	-62.1208	-54.9401	-57.5301	-47.6372	-44.3962	-37.9901	-35.6097	-37.8673	-39.3061	-46.3375	-52.4948	-60.9704	(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	171.3100	150.9899	160.0952	141.1148	136.7871	123.3431	122.2735	127.4007	128.9997	143.6395	152.3107	169.5833	(64)

Total per year (kWh/year) = Sum(64)m = 1727.8475 (64)
12Total per year (kWh/year) 1728 (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	68.6544	60.3776	63.3991	54.0878	51.2821	44.9710	43.5348	45.9903	47.2894	54.2060	59.4256	67.6978	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.1439	133.1439	133.1439	133.1439	133.1439	133.1439	133.1439	133.1439	133.1439	133.1439	133.1439	133.1439	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	126.9783	140.5832	126.9783	131.2109	126.9783	131.2109	126.9783	126.9783	131.2109	126.9783	131.2109	126.9783	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.2421	246.7766	240.3898	226.7931	209.6297	193.4985	182.7219	180.1875	186.5742	200.1709	217.3343	233.4655	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3144	36.3144	36.3144	36.3144	36.3144	36.3144	36.3144	36.3144	36.3144	36.3144	36.3144	36.3144	(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)	-106.5151	-106.5151	-106.5151	-106.5151	-106.5151	-106.5151	-106.5151	-106.5151	-106.5151	-106.5151	-106.5151	-106.5151	(71)
Water heating gains (Table 5)	92.2774	89.8477	85.2138	75.1219	68.9276	62.4598	58.5145	61.8149	65.6797	72.8576	82.5355	90.9916	(72)
Total internal gains	526.4410	540.1506	515.5251	496.0691	468.4788	450.1124	431.1580	431.9238	446.4081	462.9500	494.0239	514.3786	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	2.8800	11.2829	0.4000	0.7000	0.7700	6.3053	(75)
Southwest	2.8800	36.7938	0.4000	0.7000	0.7700	20.5617	(79)
Northwest	10.0800	11.2829	0.4000	0.7000	0.7700	22.0686	(81)

Solar gains	48.9356	92.7800	151.9792	230.2697	296.2205	310.9249	292.7540	240.9763	178.6848	109.2914	60.3298	40.7681	(83)
Total gains	575.3766	632.9306	667.5044	726.3389	764.6993	761.0373	723.9120	672.9001	625.0929	572.2414	554.3538	555.1467	(84)

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7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	185.5606	186.5193	187.4879	192.4859	193.5177	198.8469	198.8469	199.9482	196.6804	193.5177	191.4651	189.4556	
alpha	13.3707	13.4346	13.4992	13.8324	13.9012	14.2565	14.2565	14.3299	14.1120	13.9012	13.7643	13.6304	
util living area	0.9941	0.9777	0.9215	0.7298	0.5319	0.3579	0.2587	0.2894	0.4750	0.7879	0.9696	0.9957	(86)
MIT	20.8057	20.8855	20.9596	20.9980	21.0000	21.0000	21.0000	21.0000	21.0000	20.9959	20.9210	20.7971	(87)
Th 2	20.5289	20.5312	20.5336	20.5452	20.5475	20.5592	20.5592	20.5615	20.5545	20.5475	20.5429	20.5382	(88)
util rest of house	0.9921	0.9711	0.9041	0.7033	0.5060	0.3333	0.2328	0.2618	0.4443	0.7562	0.9598	0.9941	(89)
MIT 2	20.3063	20.4068	20.4941	20.5436	20.5475	20.5592	20.5592	20.5615	20.5545	20.5444	20.4609	20.3039	(90)
Living area fraction										fLA = Living area / (4) =		0.3643	(91)
MIT	20.4883	20.5812	20.6637	20.7091	20.7123	20.7198	20.7198	20.7212	20.7168	20.7089	20.6286	20.4836	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.4883	20.5812	20.6637	20.7091	20.7123	20.7198	20.7198	20.7212	20.7168	20.7089	20.6286	20.4836	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9919	0.9719	0.9092	0.7129	0.5154	0.3423	0.2422	0.2718	0.4555	0.7676	0.9618	0.9939	(94)
Useful gains	570.7224	615.1428	606.9230	517.8048	394.1348	260.4741	175.3485	182.9112	284.7292	439.2669	533.1872	551.7794	(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	738.3517	711.5494	639.3707	519.2405	394.1538	260.4741	175.3485	182.9112	284.7316	442.1122	598.0135	727.4307	(97)
Space heating kWh	124.7162	64.7852	24.1411	1.0337	0.0142	0.0000	0.0000	0.0000	0.0000	2.1170	46.6749	130.6846	(98a)
Space heating requirement - total per year (kWh/year)												394.1670	
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	124.7162	64.7852	24.1411	1.0337	0.0142	0.0000	0.0000	0.0000	0.0000	2.1170	46.6749	130.6846	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												394.1670	
Space heating per m2											(98c) / (4) =	4.2447	(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	124.7162	64.7852	24.1411	1.0337	0.0142	0.0000	0.0000	0.0000	0.0000	2.1170	46.6749	130.6846	(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)	124.7162	64.7852	24.1411	1.0337	0.0142	0.0000	0.0000	0.0000	0.0000	2.1170	46.6749	130.6846	(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	171.3100	150.9899	160.0952	141.1148	136.7871	123.3431	122.2735	127.4007	128.9997	143.6395	152.3107	169.5833	(64)
Efficiency of water heater												343.2476	(216)
(217)m	343.2476	343.2476	343.2476	343.2476	343.2476	343.2476	343.2476	343.2476	343.2476	343.2476	343.2476	343.2476	(217)
Fuel for water heating, kWh/month	49.9086	43.9886	46.6413	41.1117	39.8509	35.9341	35.6225	37.1163	37.5821	41.8472	44.3734	49.4055	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	14.8715	13.4323	14.8715	14.3918	14.8715	14.3918	14.8715	14.8715	14.3918	14.8715	14.3918	14.8715	(231)
Lighting	31.5687	25.3256	22.8029	16.7063	12.9045	10.5431	11.7719	15.3015	19.8752	26.0773	29.4543	32.4461	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-8.1322	-14.2019	-25.5205	-34.8815	-42.9133	-42.0537	-41.2012	-35.8515	-27.3933	-18.0171	-9.6231	-6.6545	(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	394.1670	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	343.2476	
Water heating fuel used	503.3823	(219)
Space cooling fuel	0.0000	(221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.6440)

mechanical ventilation fans (SFP = 0.6440)	175.0998	(230a)
Total electricity for the above, kWh/year	175.0998	(231)
Electricity for lighting (calculated in Appendix L)	254.7772	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-306.4437	(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	1020.9825	(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	394.1670	0.1603	63.1751	(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)	503.3823	0.1409	70.9016	(264)
Space and water heating			134.0767	(265)
Pumps, fans and electric keep-hot	175.0998	0.1387	24.2885	(267)
Energy for lighting	254.7772	0.1443	36.7722	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-306.4437	0.1309	-40.1203	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-40.1203	(269)
Total CO2, kg/year			155.0171	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.6700	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	394.1670	1.5932	627.9758	(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)	503.3823	1.5208	765.5492	(278)
Space and water heating			1393.5250	(279)
Pumps, fans and electric keep-hot	175.0998	1.5128	264.8910	(281)
Energy for lighting	254.7772	1.5338	390.7858	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-306.4437	1.4837	-454.6567	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-454.6567	(283)
Total Primary energy kWh/year			1594.5450	(286)
Dwelling Primary energy Rate (DPER)			17.1700	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	92.8600	(1b)	x 2.4000	(2b) =	222.8640	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.8600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	222.8640	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1346	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3846	(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) =	0.3269	(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													
	0.4168	0.4086	0.4005	0.3596	0.3514	0.3106	0.3106	0.3024	0.3269	0.3514	0.3678	0.3841	(22b)
Effective ac	0.5869	0.5835	0.5802	0.5647	0.5618	0.5482	0.5482	0.5457	0.5534	0.5618	0.5676	0.5738	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
TER Opening Type			15.8400	1.1450	18.1374			(27)
External Wall 1	38.0300	15.8400	22.1900	0.1800	3.9942			(29a)
Total net area of external elements Aum(A, m2)			38.0300					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	22.1316			(33)
Main dwelling								
Party Wall-between flats			32.6400	0.0000	0.0000			(32)
Party Wall-between circ			29.0400	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 308.1126 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E4 Jamb	23.4000	0.0500	1.1700
E7 Party floor between dwellings (in blocks of flats)	31.7000	0.0700	2.2190
E16 Corner (normal)	9.6000	0.0900	0.8640
E18 Party wall between dwellings	12.0000	0.0600	0.7200
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	51.4000	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0900	-0.4320
E1 Steel lintel with perforated steel base plate	1.6000	0.0500	0.0800

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.6210 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 26.7526 (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	43.1615	42.9134	42.6702	41.5280	41.3143	40.3195	40.3195	40.1353	40.7027	41.3143	41.7466	42.1986	(38)
Heat transfer coeff													
	69.9141	69.6660	69.4228	68.2806	68.0669	67.0721	67.0721	66.8879	67.4553	68.0669	68.4992	68.9512	(39)
Average = Sum(39)m / 12 =												68.2796	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7529	0.7502	0.7476	0.7353	0.7330	0.7223	0.7223	0.7203	0.7264	0.7330	0.7377	0.7425	(40)
HLP (average)												0.7353	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6629 (42)

Hot water usage for mixer showers												
	88.4727	87.1432	85.2057	81.4988	78.7631	75.7123	73.9783	75.9011	78.0088	81.2844	85.0710	88.1338	(42a)
Hot water usage for baths													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses													
	41.9005	40.3769	38.8532	37.3296	35.8059	34.2823	34.2823	35.8059	37.3296	38.8532	40.3769	41.9005	(42c)
Average daily hot water use (litres/day)												119.6603	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	130.3733	127.5200	124.0589	118.8283	114.5690	109.9946	108.2605	111.7070	115.3384	120.1376	125.4479	130.0343	(44)
Energy conte	206.4794	181.5868	190.6740	162.6700	154.2319	135.2512	130.9318	138.3166	142.2238	163.0256	178.7235	203.6023	(45)
Energy content (annual)										Total = Sum(45)m =		1987.7168	
Distribution loss (46)m = 0.15 x (45)m													
	30.9719	27.2380	28.6011	24.4005	23.1348	20.2877	19.6398	20.7475	21.3336	24.4538	26.8085	30.5403	(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													
	253.0743	223.6726	237.2689	207.7619	200.8268	180.3430	177.5267	184.9115	187.3156	209.6205	223.8153	250.1972	(62)
WWHRS	-40.4460	-35.7708	-37.4571	-31.0160	-28.9058	-24.7349	-23.1850	-24.6549	-25.5917	-30.1697	-34.1787	-39.6970	(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													
	212.6283	187.9017	199.8117	176.7459	171.9210	155.6082	154.3416	160.2566	161.7239	179.4508	189.6367	210.5001	(64)
									Total per year (kWh/year) = Sum(64)m =			2160.5265	(64)
12Total per year (kWh/year)												2161	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month													
	105.9303	94.0462	100.6750	90.1613	88.5580	81.0445	80.8107	83.2662	83.3629	91.4819	95.4990	104.9737	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.1439	133.1439	133.1439	133.1439	133.1439	133.1439	133.1439	133.1439	133.1439	133.1439	133.1439	133.1439	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	126.9783	140.5832	126.9783	131.2109	126.9783	131.2109	126.9783	126.9783	131.2109	126.9783	131.2109	126.9783	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.2421	246.7766	240.3898	226.7931	209.6297	193.4985	182.7219	180.1875	186.5742	200.1709	217.3343	233.4655	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3144	36.3144	36.3144	36.3144	36.3144	36.3144	36.3144	36.3144	36.3144	36.3144	36.3144	36.3144	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

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

-106.5151	-106.5151	-106.5151	-106.5151	-106.5151	-106.5151	-106.5151	-106.5151	-106.5151	-106.5151	-106.5151	-106.5151	(71)

Water heating gains (Table 5)

142.3795	139.9497	135.3159	125.2240	119.0296	112.5618	108.6166	111.9169	115.7818	122.9596	132.6375	141.0937	(72)

Total internal gains

579.5431	593.2526	568.6272	549.1712	521.5808	500.2145	481.2600	482.0259	496.5101	516.0520	547.1260	567.4807	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	2.8800	11.2829	0.6300	0.7000	0.7700	9.9309	(75)
Southwest	2.8800	36.7938	0.6300	0.7000	0.7700	32.3847	(79)
Northwest	10.0800	11.2829	0.6300	0.7000	0.7700	34.7580	(81)

Solar gains	77.0735	146.1285	239.3673	362.6748	466.5473	489.7068	461.0876	379.5376	281.4286	172.1339	95.0195	64.2097	(83)
Total gains	656.6166	739.3811	807.9945	911.8460	988.1281	989.9212	942.3476	861.5635	777.9387	688.1860	642.1455	631.6903	(84)

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7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	113.6766	114.0814	114.4810	116.3961	116.7615	118.4933	118.4933	118.8197	117.8202	116.7615	116.0246	115.2641	
alpha	8.5784	8.6054	8.6321	8.7597	8.7841	8.8996	8.8996	8.9213	8.8547	8.7841	8.7350	8.6843	
util living area	0.9968	0.9904	0.9664	0.8480	0.6360	0.4335	0.3132	0.3571	0.5957	0.9100	0.9893	0.9976	(86)
MIT	20.4672	20.5954	20.7653	20.9449	20.9952	20.9999	21.0000	21.0000	20.9979	20.9149	20.6701	20.4505	(87)
Th 2	20.2943	20.2967	20.2990	20.3097	20.3118	20.3212	20.3212	20.3229	20.3176	20.3118	20.3077	20.3034	(88)
util rest of house	0.9957	0.9870	0.9553	0.8144	0.5907	0.3876	0.2649	0.3046	0.5381	0.8788	0.9849	0.9968	(89)
MIT 2	19.6753	19.8395	20.0508	20.2611	20.3085	20.3211	20.3212	20.3229	20.3165	20.2365	19.9439	19.6617	(90)
Living area fraction									fLA = Living area / (4) =			0.3643	(91)
MIT	19.9638	20.1149	20.3111	20.5102	20.5587	20.5684	20.5685	20.5696	20.5647	20.4837	20.2085	19.9490	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9638	20.1149	20.3111	20.5102	20.5587	20.5684	20.5685	20.5696	20.5647	20.4837	20.2085	19.9490	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9950	0.9859	0.9555	0.8247	0.6071	0.4043	0.2825	0.3237	0.5591	0.8873	0.9842	0.9962	(94)
Useful gains	653.3253	728.9744	772.0734	751.9595	599.8899	400.2366	266.1718	278.8864	434.9370	610.6381	631.9751	629.2863	(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	1095.1201	1059.9609	958.8027	792.7509	602.9825	400.3122	266.1743	278.8945	436.0800	672.7516	897.9206	1085.9144	(97)
Space heating kWh	328.6954	222.4230	138.9266	29.3698	2.3009	0.0000	0.0000	0.0000	0.0000	46.2125	191.4808	339.7313	(98a)
Space heating requirement - total per year (kWh/year)												1299.1401	
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	328.6954	222.4230	138.9266	29.3698	2.3009	0.0000	0.0000	0.0000	0.0000	46.2125	191.4808	339.7313	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1299.1401	
Space heating per m2											(98c) / (4) =	13.9903	(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	328.6954	222.4230	138.9266	29.3698	2.3009	0.0000	0.0000	0.0000	0.0000	46.2125	191.4808	339.7313	(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)	356.1163	240.9783	150.5163	31.8199	2.4929	0.0000	0.0000	0.0000	0.0000	50.0677	207.4548	368.0729	(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	212.6283	187.9017	199.8117	176.7459	171.9210	155.6082	154.3416	160.2566	161.7239	179.4508	189.6367	210.5001	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.0330	84.4390	83.2609	80.9693	79.9070	79.8000	79.8000	79.8000	79.8000	81.4914	84.0815	85.1271	(217)
Fuel for water heating, kWh/month	250.0537	222.5296	239.9826	218.2874	215.1515	194.9977	193.4106	200.8228	202.6616	220.2083	225.5391	247.2776	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	26.3836	21.1659	19.0575	13.9624	10.7849	8.8114	9.8384	12.7883	16.6107	21.7942	24.6165	27.1169	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-10.1822	-15.7501	-24.8082	-30.6480	-35.5531	-34.1134	-33.6946	-30.5379	-25.4727	-19.1484	-11.6764	-8.6479	(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	-2.1783	-4.7723	-9.8572	-15.3771	-20.9171	-21.2424	-20.9990	-17.5111	-12.4867	-7.0101	-2.9648	-1.7092	(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	1407.5191	(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	2630.9224	(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)	212.9307	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-417.2580	(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	3920.1142	(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	1407.5191	0.2100	295.5790	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2630.9224	0.2100	552.4937	(264)
Space and water heating			848.0727	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	212.9307	0.1443	30.7325	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-280.2329	0.1327	-37.1896	
PV Unit electricity exported	-137.0251	0.1248	-17.1005	
Total			-54.2901	(269)
Total CO2, kg/year			836.4444	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.0100	(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	1407.5191	1.1300	1590.4966	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2630.9224	1.1300	2972.9423	(278)
Space and water heating			4563.4389	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	212.9307	1.5338	326.6002	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-280.2329	1.4904	-417.6490	
PV Unit electricity exported	-137.0251	0.4580	-62.7630	
Total			-480.4120	(283)
Total Primary energy kWh/year			4539.7279	(286)
Target Primary Energy Rate (TPER)			48.8900	(287)

Full SAP Calculation Printout

Property Reference	7F_Block A7_1Bed	**Issued on Date**	27/03/2025
Assessment Reference	Option 1_EPH+ASHP_P08	**Prop Type Ref**	North West
Property	Chorlton-cum-Hardy, Manchester, Greater Manchester, M21 9AQ		

SAP Rating	95 A	**DER**	1.57	**TER**	11.04
Environmental	99 A	**% DER < TER**			85.78
CO_2 Emissions (t/year)	0.07	**DFEE**	18.12	**TFEE**	20.22
Compliance Check	See BREL	**% DFEE < TFEE**			10.38
% DPER < TPER	73.32	**DPER**	16.10	**TPER**	60.33

Assessor Details	Mr. Leon Maddison	**Assessor ID**	AY03-0001
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)	
Main dwelling						
Ground floor	56.9600 (1b)	x	2.4000 (2b)	=	136.7040	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.9600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	136.7040	(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) =	74.4000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2906	0.2874	0.2842	0.2682	0.2651	0.2491	0.2491	0.2459	0.2555	0.2651	0.2714	0.2778	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Glazing			12.9600	1.1450	14.8397			(27)
External Wall 1	22.7400	12.9600	9.7800	0.1500	1.4670	60.0000	586.8000	(29a)
Total net area of external elements Aum(A, m2)			22.7400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.3067			(33)
Main dwelling								
Party Wall-between flats			32.6400	0.0000	0.0000	180.0000	5875.1999	(32)
Party Wall-between circ			18.2400	0.0000	0.0000	180.0000	3283.2000	(32)
Party Floor 1			56.9600			80.0000	4556.8000	(32d)
Party Ceiling 1			56.9600			100.0000	5696.0000	(32b)
Internal Wall 1			90.8300			9.0000	817.4700	(32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		20815.4699	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							365.4401	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E4 Jamb	19.2000	0.0180	0.3456	
E7 Party floor between dwellings (in blocks of flats)	18.9500	0.0360	0.6822	
E16 Corner (normal)	4.8000	0.0400	0.1920	
E18 Party wall between dwellings	9.6000	0.0320	0.3072	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	42.4000	0.0000	0.0000	
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0820	-0.1968	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 1.3302 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 17.6369 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	13.1079	12.9642	12.8204	12.1014	11.9576	11.2386	11.2386	11.0948	11.5262	11.9576	12.2452	12.5328	(38)
Heat transfer coeff	30.7448	30.6010	30.4573	29.7383	29.5945	28.8755	28.8755	28.7317	29.1631	29.5945	29.8821	30.1697	(39)

Average = Sum(39)m / 12 = 29.7023

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5398	0.5372	0.5347	0.5221	0.5196	0.5069	0.5069	0.5044	0.5120	0.5196	0.5246	0.5297	(40)
HLP (average)												0.5215	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.8945 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	71.8677	70.7877	69.2139	66.2026	63.9804	61.5023	60.0937	61.6556	63.3677	66.0285	69.1044	71.5924	(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses	34.0317	32.7942	31.5567	30.3191	29.0816	27.8441	27.8441	29.0816	30.3191	31.5567	32.7942	34.0317	(42c)

Average daily hot water use (litres/day) 97.1975 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	105.8994	103.5819	100.7705	96.5218	93.0621	89.3464	87.9378	90.7372	93.6869	97.5852	101.8986	105.6241	(44)
Energy conte	167.7188	147.4992	154.8805	132.1335	125.2794	109.8618	106.3531	112.3516	115.5253	132.4222	145.1732	165.3817	(45)

Energy content (annual) Total = Sum(45)m = 1614.5805

Distribution loss (46)m = 0.15 x (45)m	25.1578	22.1249	23.2321	19.8200	18.7919	16.4793	15.9530	16.8527	17.3288	19.8633	21.7760	24.8073	(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	194.6702	171.8424	181.8319	158.2155	152.2308	135.9438	133.3045	139.3030	141.6073	159.3736	171.2552	192.3331	(62)
WWHRS	-50.4616	-44.6287	-46.7326	-38.6964	-36.0637	-30.8599	-28.9263	-30.7602	-31.9289	-37.6406	-42.6423	-49.5272	(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	144.2085	127.2137	135.0994	119.5191	116.1672	105.0839	104.3782	108.5428	109.6784	121.7329	128.6130	142.8060	(64)

Total per year (kWh/year) = Sum(64)m = 1463.0431 (64)
12Total per year (kWh/year) 1463 (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	55.7665	49.0435	51.4978	43.9344	41.6554	36.5290	35.3624	37.3569	38.4122	44.0304	48.2701	54.9894	(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	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	83.3175	92.2444	83.3175	86.0948	83.3175	86.0948	83.3175	83.3175	86.0948	83.3175	86.0948	83.3175	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	165.2203	166.9348	162.6144	153.4167	141.8064	130.8942	123.6043	121.8898	126.2102	135.4079	147.0182	157.9303	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	(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)	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	(71)
Water heating gains (Table 5)	74.9550	72.9814	69.2175	61.0200	55.9885	50.7348	47.5301	50.2109	53.3502	59.1806	67.0418	73.9105	(72)
Total internal gains	374.9105	383.5782	366.5670	351.9492	332.5300	319.1415	305.8696	306.8359	317.0729	329.3237	351.5725	366.5761	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.0800	11.2829	0.4000	0.7000	0.7700	22.0686	(75)
Southeast	2.8800	36.7938	0.4000	0.7000	0.7700	20.5617	(77)

Solar gains	42.6303	79.9454	128.8553	192.2936	245.1731	256.5030	241.8435	200.3898	150.5080	93.6064	52.3961	35.6188	(83)
Total gains	417.5407	463.5236	495.4223	544.2428	577.7032	575.6445	547.7131	507.2257	467.5809	422.9301	403.9686	402.1949	(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	188.0665	188.9502	189.8423	194.4321	195.3768	200.2415	200.2415	201.2437	198.2669	195.3768	193.4965	191.6520	
alpha	13.5378	13.5967	13.6562	13.9621	14.0251	14.3494	14.3494	14.4162	14.2178	14.0251	13.8998	13.7768	
util living area	0.9880	0.9562	0.8667	0.6605	0.4764	0.3210	0.2320	0.2606	0.4304	0.7254	0.9451	0.9912	(86)
MIT	20.8486	20.9257	20.9816	20.9994	21.0000	21.0000	21.0000	21.0000	21.0000	20.9985	20.9495	20.8374	(87)
Th 2	20.4845	20.4868	20.4891	20.5006	20.5029	20.5145	20.5145	20.5168	20.5099	20.5029	20.4983	20.4937	(88)
util rest of house	0.9838	0.9440	0.8428	0.6335	0.4510	0.2967	0.2064	0.2332	0.3998	0.6917	0.9286	0.9879	(89)
MIT 2	20.3173	20.4109	20.4726	20.5002	20.5029	20.5145	20.5145	20.5168	20.5099	20.5019	20.4496	20.3120	(90)
Living area fraction										fLA = Living area / (4) =		0.5381	(91)
MIT	20.6032	20.6879	20.7465	20.7688	20.7704	20.7757	20.7757	20.7768	20.7736	20.7691	20.7186	20.5947	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6032	20.6879	20.7465	20.7688	20.7704	20.7757	20.7757	20.7768	20.7736	20.7691	20.7186	20.5947	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9849	0.9491	0.8551	0.6480	0.4647	0.3098	0.2201	0.2479	0.4162	0.7098	0.9363	0.9887	(94)
Useful gains	411.2191	439.9214	423.6230	352.6647	268.4306	178.3274	120.5764	125.7530	194.6223	300.2114	378.2206	397.6321	(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	501.2383	483.1273	433.9096	352.9587	268.4337	178.3274	120.5764	125.7530	194.6228	300.9503	406.9518	494.6217	(97)
Space heating kWh	66.9743	29.0344	7.6532	0.2117	0.0023	0.0000	0.0000	0.0000	0.0000	0.5497	20.6865	72.1602	(98a)
Space heating requirement - total per year (kWh/year)												197.2724	
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	66.9743	29.0344	7.6532	0.2117	0.0023	0.0000	0.0000	0.0000	0.0000	0.5497	20.6865	72.1602	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												197.2724	
Space heating per m2											(98c) / (4) =	3.4634	(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	66.9743	29.0344	7.6532	0.2117	0.0023	0.0000	0.0000	0.0000	0.0000	0.5497	20.6865	72.1602	(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)	66.9743	29.0344	7.6532	0.2117	0.0023	0.0000	0.0000	0.0000	0.0000	0.5497	20.6865	72.1602	(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	144.2085	127.2137	135.0994	119.5191	116.1672	105.0839	104.3782	108.5428	109.6784	121.7329	128.6130	142.8060	(64)
Efficiency of water heater												349.4100	(216)
(217)m	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	(217)
Fuel for water heating, kWh/month	41.2720	36.4081	38.6650	34.2060	33.2467	30.0747	29.8727	31.0646	31.3896	34.8396	36.8086	40.8706	(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	7.7340	6.9855	7.7340	7.4845	7.7340	7.4845	7.7340	7.7340	7.4845	7.7340	7.4845	7.7340	(231)
Lighting	20.0349	16.0727	14.4717	10.6026	8.1897	6.6911	7.4710	9.7110	12.6137	16.5498	18.6930	20.5917	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-7.8790	-13.5265	-23.8945	-32.1905	-39.0719	-38.0895	-37.3468	-32.7982	-25.4276	-17.0575	-9.2543	-6.4687	(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	197.2724	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	349.4100	
Water heating fuel used	418.7181	(219)
Space cooling fuel	0.0000	(221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.5460)

mechanical ventilation fans (SFP = 0.5460) 91.0613 (230a)

Total electricity for the above, kWh/year 91.0613 (231)

Electricity for lighting (calculated in Appendix L)	161.6929	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-283.0050	(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	585.7398	(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	197.2724	0.1608	31.7244	(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)	418.7181	0.1408	58.9402	(264)
Space and water heating			90.6646	(265)
Pumps, fans and electric keep-hot	91.0613	0.1387	12.6313	(267)
Energy for lighting	161.6929	0.1443	23.3373	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-283.0050	0.1312	-37.1285	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-37.1285	(269)
Total CO2, kg/year			89.5047	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.5700	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	197.2724	1.5951	314.6737	(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)	418.7181	1.5205	636.6545	(278)
Space and water heating			951.3281	(279)
Pumps, fans and electric keep-hot	91.0613	1.5128	137.7575	(281)
Energy for lighting	161.6929	1.5338	248.0100	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-283.0050	1.4847	-420.1707	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-420.1707	(283)
Total Primary energy kWh/year			916.9250	(286)
Dwelling Primary energy Rate (DPER)			16.1000	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	56.9600	(1b) x	2.4000	(2b) =	136.7040	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	56.9600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		136.7040	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1463	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3963	(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) =	0.3369	(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													
	0.4295	0.4211	0.4126	0.3705	0.3621	0.3200	0.3200	0.3116	0.3369	0.3621	0.3790	0.3958	(22b)
Effective ac	0.5922	0.5887	0.5851	0.5687	0.5656	0.5512	0.5512	0.5485	0.5567	0.5656	0.5718	0.5783	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opening Type			12.9600	1.1450	14.8397			(27)
External Wall 1	22.7400	12.9600	9.7800	0.1800	1.7604			(29a)
Total net area of external elements Aum(A, m2)			22.7400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	16.6001			(33)
Main dwelling								
Party Wall-between flats			32.6400	0.0000	0.0000			(32)
Party Wall-between circ			18.2400	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K			345.4401 (35)
List of Thermal Bridges			
K1 Element	Length	Psi-value	Total
E4 Jamb	19.2000	0.0500	0.9600
E7 Party floor between dwellings (in blocks of flats)	18.9500	0.0700	1.3265
E16 Corner (normal)	4.8000	0.0900	0.4320
E18 Party wall between dwellings	9.6000	0.0600	0.5760
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	42.4000	0.0000	0.0000
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			3.0785 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	19.6786 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	26.7169	26.5554	26.3970	25.6532	25.5140	24.8661	24.8661	24.7461	25.1157	25.5140	25.7955	26.0899	(38)
Heat transfer coeff	46.3955	46.2340	46.0756	45.3317	45.1926	44.5447	44.5447	44.4247	44.7943	45.1926	45.4741	45.7685	(39)
Average = Sum(39)m / 12 =												45.3311	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8145	0.8117	0.8089	0.7959	0.7934	0.7820	0.7820	0.7799	0.7864	0.7934	0.7984	0.8035	(40)
HLP (average)												0.7958	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy											1.8945	(42)
Hot water usage for mixer showers												
	71.8677	70.7877	69.2139	66.2026	63.9804	61.5023	60.0937	61.6556	63.3677	66.0285	69.1044	71.5924	(42a)
Hot water usage for baths												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses												
	34.0317	32.7942	31.5567	30.3191	29.0816	27.8441	27.8441	29.0816	30.3191	31.5567	32.7942	34.0317	(42c)
Average daily hot water use (litres/day)												97.1975	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	105.8994	103.5819	100.7705	96.5218	93.0621	89.3464	87.9378	90.7372	93.6869	97.5852	101.8986	105.6241	(44)
Energy conte	167.7188	147.4992	154.8805	132.1335	125.2794	109.8618	106.3531	112.3516	115.5253	132.4222	145.1732	165.3817	(45)
Energy content (annual)										Total = Sum(45)m =		1614.5805	
Distribution loss (46)m = 0.15 x (45)m													
	25.1578	22.1249	23.2321	19.8200	18.7919	16.4793	15.9530	16.8527	17.3288	19.8633	21.7760	24.8073	(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													
	214.3137	189.5849	201.4755	177.2254	171.8743	154.9536	152.9480	158.9465	160.6171	179.0171	190.2651	211.9767	(62)
WWHRS	-32.8549	-29.0572	-30.4270	-25.1947	-23.4806	-20.0925	-18.8335	-20.0276	-20.7885	-24.5073	-27.7638	-32.2465	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	181.4588	160.5278	171.0485	152.0306	148.3937	134.8611	134.1145	138.9189	139.8286	154.5098	162.5012	179.7302	(64)
										Total per year (kWh/year) = Sum(64)m =		1857.9237	(64)
12Total per year (kWh/year)												1858	(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													
	93.0424	82.7121	88.7737	80.0079	78.9313	72.6025	72.6383	74.6328	74.4856	81.3063	84.3436	92.2654	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	94.7256	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	83.3175	92.2444	83.3175	86.0948	83.3175	86.0948	83.3175	83.3175	86.0948	83.3175	86.0948	83.3175	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	165.2203	166.9348	162.6144	153.4167	141.8064	130.8942	123.6043	121.8898	126.2102	135.4079	147.0182	157.9303	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	32.4726	(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)													
	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	-75.7805	(71)
Water heating gains (Table 5)													

	125.0570	123.0834	119.3195	111.1220	106.0905	100.8368	97.6322	100.3129	103.4523	109.2827	117.1439	124.0126	(72)
Total internal gains	428.0125	436.6803	419.6691	405.0512	385.6321	369.2436	355.9717	356.9380	367.1750	382.4257	404.6746	419.6781	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	10.0800	11.2829	0.6300	0.7000	0.7700	34.7580	(75)
Southeast	2.8800	36.7938	0.6300	0.7000	0.7700	32.3847	(77)

Solar gains	67.1427	125.9140	202.9471	302.8624	386.1477	403.9923	380.9035	315.6139	237.0500	147.4301	82.5239	56.0996	(83)
Total gains	495.1552	562.5942	622.6162	707.9136	771.7798	773.2358	736.8752	672.5519	604.2250	529.8559	487.1985	475.7778	(84)

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7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	117.8051	118.2168	118.6231	120.5696	120.9409	122.6999	122.6999	123.0313	122.0163	120.9409	120.1921	119.4192	
alpha	8.8537	8.8811	8.9082	9.0380	9.0627	9.1800	9.1800	9.2021	9.1344	9.0627	9.0128	8.9613	
util living area	0.9931	0.9783	0.9277	0.7560	0.5436	0.3687	0.2660	0.3038	0.5110	0.8388	0.9763	0.9948	(86)
MIT	20.5706	20.7056	20.8627	20.9797	20.9988	21.0000	21.0000	21.0000	20.9995	20.9611	20.7622	20.5509	(87)
Th 2	20.2408	20.2432	20.2456	20.2569	20.2590	20.2689	20.2689	20.2708	20.2651	20.2590	20.2548	20.2503	(88)
util rest of house	0.9903	0.9706	0.9066	0.7156	0.5007	0.3266	0.2218	0.2557	0.4569	0.7946	0.9665	0.9927	(89)
MIT 2	19.7557	19.9252	20.1114	20.2409	20.2583	20.2689	20.2689	20.2708	20.2649	20.2288	20.0064	19.7389	(90)
Living area fraction									fLA = Living area / (4) =			0.5381	(91)
MIT	20.1942	20.3452	20.5157	20.6384	20.6568	20.6623	20.6623	20.6632	20.6602	20.6229	20.4131	20.1758	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1942	20.3452	20.5157	20.6384	20.6568	20.6623	20.6623	20.6632	20.6602	20.6229	20.4131	20.1758	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9901	0.9718	0.9147	0.7367	0.5238	0.3492	0.2456	0.2816	0.4860	0.8171	0.9689	0.9925	(94)
Useful gains	490.2739	546.7315	569.5006	521.5046	404.2242	270.0319	180.9543	189.3886	293.6497	432.9575	472.0479	472.1947	(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	737.4196	714.0911	645.7797	532.1236	404.7801	270.0431	180.9546	189.3897	293.8583	452.9585	605.3995	731.1895	(97)
Space heating kWh	183.8763	112.4657	56.7516	7.6456	0.4136	0.0000	0.0000	0.0000	0.0000	14.8807	96.0132	192.6922	(98a)
Space heating requirement - total per year (kWh/year)												664.7390	
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	183.8763	112.4657	56.7516	7.6456	0.4136	0.0000	0.0000	0.0000	0.0000	14.8807	96.0132	192.6922	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												664.7390	
Space heating per m2										(98c) / (4) =		11.6703	(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	183.8763	112.4657	56.7516	7.6456	0.4136	0.0000	0.0000	0.0000	0.0000	14.8807	96.0132	192.6922	(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)	199.2160	121.8480	61.4860	8.2835	0.4481	0.0000	0.0000	0.0000	0.0000	16.1221	104.0229	208.7673	(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	181.4588	160.5278	171.0485	152.0306	148.3937	134.8611	134.1145	138.9189	139.8286	154.5098	162.5012	179.7302	(64)
Efficiency of water heater												79.8000	(216)
(217)m	84.0895	83.2771	81.8671	80.1892	79.8225	79.8000	79.8000	79.8000	79.8000	80.5169	82.9213	84.2163	(217)
Fuel for water heating, kWh/month	215.7924	192.7633	208.9343	189.5900	185.9047	168.9989	168.0633	174.0839	175.2238	191.8973	195.9703	213.4151	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	17.3117	13.8881	12.5047	9.1615	7.0766	5.7816	6.4555	8.3911	10.8992	14.3004	16.1522	17.7929	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-6.3206	-9.8200	-15.5379	-19.2905	-22.4721	-21.6059	-21.3489	-19.3069	-16.0396	-11.9833	-7.2649	-5.3642	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													

(233b)m	-1.2612	-2.7684	-5.7258	-8.9411	-12.1665	-12.3492	-12.2000	-10.1661	-7.2445	-4.0622	-1.7159	-0.9888	(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	720.1939	(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	2280.6373	(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)	139.7157	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-255.9446	(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	2970.6023	(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	720.1939	0.2100	151.2407	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2280.6373	0.2100	478.9338	(264)
Space and water heating			630.1746	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	139.7157	0.1443	20.1653	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-176.3548	0.1326	-23.3863	
PV Unit electricity exported	-79.5898	0.1248	-9.9318	
Total			-33.3182	(269)
Total CO2, kg/year			628.9509	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.0400	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	720.1939	1.1300	813.8191	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2280.6373	1.1300	2577.1202	(278)
Space and water heating			3390.9393	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	139.7157	1.5338	214.3005	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-176.3548	1.4900	-262.7666	
PV Unit electricity exported	-79.5898	0.4580	-36.4523	
Total			-299.2189	(283)
Total Primary energy kWh/year			3436.1218	(286)
Target Primary Energy Rate (TPER)			60.3300	(287)

Full SAP Calculation Printout

Property Reference	8F_Block A17_3Bed	**Issued on Date**	27/03/2025
Assessment Reference	Option 1_EPH+ASHP_P08	**Prop Type Ref**	North West
Property	Chorlton-cum-Hardy, Manchester, Greater Manchester, M21 9AQ		

SAP Rating	92 A	**DER**	1.74	**TER**	7.22
Environmental	98 A	**% DER < TER**			75.90
CO_2 Emissions (t/year)	0.2	**DFEE**	18.59	**TFEE**	18.44
Compliance Check	See BREL	**% DFEE < TFEE**			-0.84
% DPER < TPER	53.82	**DPER**	17.95	**TPER**	38.86

Assessor Details	Mr. Leon Maddison	**Assessor ID**	AY03-0001
Client			

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	148.2300	(1b)	x 2.4000	(2b) =	355.7520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	148.2300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	355.7520	(5)

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2. Ventilation rate

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

	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		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) =	73.6000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2946	0.2914	0.2882	0.2722	0.2691	0.2531	0.2531	0.2499	0.2595	0.2691	0.2754	0.2818	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Glazing			21.8400	1.1450	25.0076			(27)
External Wall 1	53.9500	21.8400	32.1100	0.1500	4.8165	60.0000	1926.6000	(29a)
Total net area of external elements Aum(A, m2)			53.9500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		29.8241			(33)
Main dwelling								
Party Wall-between flats			32.6400	0.0000	0.0000	180.0000	5875.1999	(32)
Party Wall-between circ			71.2000	0.0000	0.0000	180.0000	12815.9995	(32)
Party Floor 1			148.2300			80.0000	11858.4000	(32d)
Party Ceiling 1			148.2300			100.0000	14823.0000	(32b)
Internal Wall 1			280.5100			9.0000	2524.5901	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 49823.7895	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	336.1249	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E4 Jamb	30.6000	0.0180	0.5508	
E7 Party floor between dwellings (in blocks of flats)	44.9600	0.0360	1.6186	
E16 Corner (normal)	9.6000	0.0400	0.3840	
E18 Party wall between dwellings	14.4000	0.0320	0.4608	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	86.5300	0.0000	0.0000	
E1 Steel lintel with perforated steel base plate	7.2000	0.3400	2.4480	
E17 Corner (inverted - internal area greater than external area)	9.6000	-0.0820	-0.7872	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			4.6750	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	34.4991	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	34.5811	34.2069	33.8327	31.9616	31.5874	29.7164	29.7164	29.3422	30.4648	31.5874	32.3359	33.0843	(38)
Heat transfer coeff	69.0802	68.7060	68.3318	66.4607	66.0865	64.2155	64.2155	63.8413	64.9639	66.0865	66.8349	67.5834	(39)
Average = Sum(39)m / 12 =												66.3672	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.4660	0.4635	0.4610	0.4484	0.4458	0.4332	0.4332	0.4307	0.4383	0.4458	0.4509	0.4559	(40)
HLP (average)												0.4477	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9314	(42)
Hot water usage for mixer showers	73.3696	72.2670	70.6603	67.5861	65.3175	62.7875	61.3495	62.9440	64.6920	67.4084	70.5486	73.0885	(42a)
Hot water usage for baths	31.6746	31.2041	30.5417	29.3203	28.4057	27.3916	26.8438	27.5016	28.2178	29.3030	30.5495	31.5675	(42b)
Hot water usage for other uses	44.6504	43.0267	41.4031	39.7794	38.1558	36.5321	36.5321	38.1558	39.7794	41.4031	43.0267	44.6504	(42c)
Average daily hot water use (litres/day)												137.6028	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.6945	146.4978	142.6050	136.6858	131.8790	126.7112	124.7254	128.6014	132.6892	138.1144	144.1248	149.3063	(44)
Energy conte	237.0795	208.6110	219.1786	187.1161	177.5344	155.8062	150.8446	159.2354	163.6191	187.4200	205.3322	233.7776	(45)
Energy content (annual)										Total = Sum(45)m =		2285.5547	
Distribution loss (46)m = 0.15 x (45)m	35.5619	31.2916	32.8768	28.0674	26.6302	23.3709	22.6267	23.8853	24.5429	28.1130	30.7998	35.0666	(46)
Water storage loss:													
Store volume												269.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7700	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.9558	(55)
Total storage loss	29.6298	26.7624	29.6298	28.6740	29.6298	28.6740	29.6298	29.6298	28.6740	29.6298	28.6740	29.6298	(56)
If cylinder contains dedicated solar storage	29.6298	26.7624	29.6298	28.6740	29.6298	28.6740	29.6298	29.6298	28.6740	29.6298	28.6740	29.6298	(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	266.7093	235.3734	248.8084	215.7901	207.1642	184.4802	180.4744	188.8652	192.2931	217.0498	234.0062	263.4074	(62)
WWHRS	-51.5162	-45.5613	-47.7092	-39.5051	-36.8173	-31.5049	-29.5308	-31.4030	-32.5961	-38.4273	-43.5334	-50.5622	(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	215.1931	189.8120	201.0993	176.2850	170.3469	152.9754	150.9436	157.4622	159.6969	178.6225	190.4728	212.8452	(64)
									Total per year (kWh/year) = Sum(64)m =			2155.7549	(64)
12Total per year (kWh/year)												2156	(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	78.8289	69.3632	72.8769	62.2161	59.0302	51.8056	50.1558	52.9458	54.4033	62.3171	68.2730	77.7311	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.5695	146.5695	146.5695	146.5695	146.5695	146.5695	146.5695	146.5695	146.5695	146.5695	146.5695	146.5695	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	170.5098	188.7787	170.5098	176.1935	170.5098	176.1935	170.5098	170.5098	176.1935	170.5098	176.1935	170.5098	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	318.5908	321.8967	313.5658	295.8302	273.4422	252.4006	238.3435	235.0375	243.3685	261.1041	283.4921	304.5337	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6569	37.6569	37.6569	37.6569	37.6569	37.6569	37.6569	37.6569	37.6569	37.6569	37.6569	37.6569	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.2556	-117.2556	-117.2556	-117.2556	-117.2556	-117.2556	-117.2556	-117.2556	-117.2556	-117.2556	-117.2556	-117.2556	(71)
Water heating gains (Table 5)	105.9529	103.2190	97.9528	86.4112	79.3417	71.9522	67.4137	71.1637	75.5602	83.7596	94.8236	104.4772	(72)
Total internal gains	662.0243	680.8653	648.9993	625.4058	590.2645	567.5171	543.2379	543.6819	562.0930	582.3444	621.4800	646.4916	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	2.5200	11.2829	0.4000	0.7000	0.7700	5.5171	(75)
Southeast	6.7200	36.7938	0.4000	0.7000	0.7700	47.9773	(77)
Southwest	10.0800	36.7938	0.4000	0.7000	0.7700	71.9659	(79)
Northwest	2.5200	11.2829	0.4000	0.7000	0.7700	5.5171	(81)

Solar gains	130.9775	226.7682	320.0095	412.8250	477.2926	480.3925	460.4232	411.3259	351.9950	253.2521	157.5483	111.6575	(83)
Total gains	793.0018	907.6335	969.0087	1038.2308	1067.5571	1047.9096	1003.6611	955.0078	914.0880	835.5964	779.0283	758.1491	(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	200.3460	201.4372	202.5403	208.2424	209.4215	215.5234	215.5234	216.7867	213.0404	209.4215	207.0764	204.7833	
alpha	14.3564	14.4291	14.5027	14.8828	14.9614	15.3682	15.3682	15.4524	15.2027	14.9614	14.8051	14.6522	
util living area	0.9986	0.9891	0.9454	0.7706	0.5756	0.3922	0.2815	0.3075	0.4904	0.8143	0.9873	0.9991	(86)
MIT	20.7720	20.8687	20.9529	20.9974	21.0000	21.0000	21.0000	21.0000	21.0000	20.9957	20.8990	20.7615	(87)
Th 2	20.5521	20.5544	20.5567	20.5684	20.5707	20.5824	20.5824	20.5848	20.5777	20.5707	20.5661	20.5614	(88)
util rest of house	0.9980	0.9855	0.9313	0.7445	0.5491	0.3666	0.2548	0.2797	0.4604	0.7837	0.9823	0.9987	(89)
MIT 2	20.2842	20.4079	20.5097	20.5663	20.5707	20.5824	20.5824	20.5848	20.5777	20.5674	20.4569	20.2791	(90)
Living area fraction										fLA = Living area / (4) =		0.2314	(91)
MIT	20.3971	20.5145	20.6123	20.6661	20.6700	20.6791	20.6791	20.6809	20.6754	20.6665	20.5592	20.3907	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3971	20.5145	20.6123	20.6661	20.6700	20.6791	20.6791	20.6809	20.6754	20.6665	20.5592	20.3907	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9851	0.9332	0.7504	0.5552	0.3725	0.2610	0.2862	0.4673	0.7906	0.9822	0.9986	(94)
Useful gains	791.2175	894.0869	904.2787	779.1076	592.7584	390.3692	261.9383	273.2951	427.1648	660.6624	765.1957	757.0686	(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	1111.9908	1072.8108	964.3164	781.9808	592.7981	390.3693	261.9383	273.2951	427.1670	665.2610	899.5432	1094.2248	(97)
Space heating kWh	238.6554	120.1025	44.6680	2.0687	0.0295	0.0000	0.0000	0.0000	0.0000	3.4213	96.7303	250.8442	(98a)
Space heating requirement - total per year (kWh/year)												756.5199	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	238.6554	120.1025	44.6680	2.0687	0.0295	0.0000	0.0000	0.0000	0.0000	3.4213	96.7303	250.8442	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												756.5199	
Space heating per m2										(98c) / (4) =		5.1037	(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	238.6554	120.1025	44.6680	2.0687	0.0295	0.0000	0.0000	0.0000	0.0000	3.4213	96.7303	250.8442	(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)	238.6554	120.1025	44.6680	2.0687	0.0295	0.0000	0.0000	0.0000	0.0000	3.4213	96.7303	250.8442	(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	215.1931	189.8120	201.0993	176.2850	170.3469	152.9754	150.9436	157.4622	159.6969	178.6225	190.4728	212.8452	(64)
Efficiency of water heater												336.5465	(216)
(217)m	336.5465	336.5465	336.5465	336.5465	336.5465	336.5465	336.5465	336.5465	336.5465	336.5465	336.5465	336.5465	(217)
Fuel for water heating, kWh/month	63.9416	56.3999	59.7538	52.3806	50.6162	45.4545	44.8507	46.7876	47.4517	53.0751	56.5963	63.2439	(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	23.7390	21.4417	23.7390	22.9732	23.7390	22.9732	23.7390	23.7390	22.9732	23.7390	22.9732	23.7390	(231)
Lighting	43.2789	34.7200	31.2615	22.9035	17.6913	14.4540	16.1386	20.9776	27.2478	35.7506	40.3802	44.4818	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-8.3221	-14.6595	-26.5827	-36.6826	-45.5212	-44.7602	-43.8309	-37.9232	-28.7094	-18.6443	-9.8836	-6.7969	(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	756.5199	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	336.5465	
Water heating fuel used	640.5519	(219)
Space cooling fuel	0.0000	(221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.6440)		
mechanical ventilation fans (SFP = 0.6440)	279.5072	(230a)
Total electricity for the above, kWh/year	279.5072	(231)
Electricity for lighting (calculated in Appendix L)	349.2856	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-322.3166	(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	1703.5480	(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	756.5199	0.1602	121.2103	(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)	640.5519	0.1410	90.2959	(264)
Space and water heating			211.5062	(265)
Pumps, fans and electric keep-hot	279.5072	0.1387	38.7711	(267)
Energy for lighting	349.2856	0.1443	50.4127	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-322.3166	0.1308	-42.1459	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-42.1459	(269)
Total CO2, kg/year			258.5441	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.7400	(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	756.5199	1.5930	1205.1031	(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)	640.5519	1.5212	974.4350	(278)
Space and water heating			2179.5382	(279)
Pumps, fans and electric keep-hot	279.5072	1.5128	422.8385	(281)
Energy for lighting	349.2856	1.5338	535.7459	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-322.3166	1.4830	-478.0091	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-478.0091	(283)
Total Primary energy kWh/year			2660.1136	(286)
Dwelling Primary energy Rate (DPER)			17.9500	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	148.2300	(1b) x	2.4000	(2b) =	355.7520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	148.2300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		355.7520	(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) =	0.1124	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3624	(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) =	0.3081	(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													
	0.3928	0.3851	0.3774	0.3389	0.3312	0.2927	0.2927	0.2850	0.3081	0.3312	0.3466	0.3620	(22b)
Effective ac	0.5771	0.5741	0.5712	0.5574	0.5548	0.5428	0.5428	0.5406	0.5475	0.5548	0.5601	0.5655	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opening Type			21.8400	1.1450	25.0076			(27)
External Wall 1	53.9500	21.8400	32.1100	0.1800	5.7798			(29a)
Total net area of external elements Aum(A, m2)			53.9500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.7874			(33)
Main dwelling								
Party Wall-between flats			32.6400	0.0000	0.0000			(32)
Party Wall-between circ			71.2000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 316.1249 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E4 Jamb	30.6000	0.0500	1.5300
E7 Party floor between dwellings (in blocks of flats)	44.9600	0.0700	3.1472
E16 Corner (normal)	9.6000	0.0900	0.8640
E18 Party wall between dwellings	14.4000	0.0600	0.8640
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	86.5300	0.0000	0.0000
E1 Steel lintel with perforated steel base plate	7.2000	0.0500	0.3600
E17 Corner (inverted - internal area greater than external area)	9.6000	-0.0900	-0.8640

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.9012 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 36.6886 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	67.7555	67.4038	67.0591	65.4400	65.1371	63.7269	63.7269	63.4658	64.2701	65.1371	65.7499	66.3906	(38)
Heat transfer coeff													
	104.4441	104.0925	103.7478	102.1287	101.8257	100.4156	100.4156	100.1544	100.9588	101.8257	102.4386	103.0792	(39)
Average = Sum(39)m / 12 =												102.1272	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7046	0.7022	0.6999	0.6890	0.6869	0.6774	0.6774	0.6757	0.6811	0.6869	0.6911	0.6954	(40)
HLP (average)												0.6890	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9314 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers													
	73.3696	72.2670	70.6603	67.5861	65.3175	62.7875	61.3495	62.9440	64.6920	67.4084	70.5486	73.0885	(42a)
Hot water usage for baths													
	31.6746	31.2041	30.5417	29.3203	28.4057	27.3916	26.8438	27.5016	28.2178	29.3030	30.5495	31.5675	(42b)
Hot water usage for other uses													
	44.6504	43.0267	41.4031	39.7794	38.1558	36.5321	36.5321	38.1558	39.7794	41.4031	43.0267	44.6504	(42c)
Average daily hot water use (litres/day)												137.6028	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	149.6945	146.4978	142.6050	136.6858	131.8790	126.7112	124.7254	128.6014	132.6892	138.1144	144.1248	149.3063	(44)
Energy conte	237.0795	208.6110	219.1786	187.1161	177.5344	155.8062	150.8446	159.2354	163.6191	187.4200	205.3322	233.7776	(45)
Energy content (annual)										Total = Sum(45)m =		2285.5547	
Distribution loss (46)m = 0.15 x (45)m													
	35.5619	31.2916	32.8768	28.0674	26.6302	23.3709	22.6267	23.8853	24.5429	28.1130	30.7998	35.0666	(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													
	283.6744	250.6967	265.7736	232.2079	224.1293	200.8981	197.4395	205.8303	208.7109	234.0149	250.4241	280.3725	(62)
WWHRS	-33.5415	-29.6644	-31.0628	-25.7213	-23.9713	-20.5124	-19.2271	-20.4461	-21.2229	-25.0195	-28.3440	-32.9204	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	250.1329	221.0323	234.7107	206.4867	200.1580	180.3857	178.2124	185.3842	187.4880	208.9954	222.0800	247.4521	(64)
										Total per year (kWh/year) = Sum(64)m =		2522.5183	(64)
12Total per year (kWh/year)												2523	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						0.0000	(64a)
Heat gains from water heating, kWh/month													
	116.1049	103.0317	110.1528	98.2896	96.3061	87.8790	87.4317	90.2217	90.4768	99.5931	104.3464	115.0070	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.5695	146.5695	146.5695	146.5695	146.5695	146.5695	146.5695	146.5695	146.5695	146.5695	146.5695	146.5695	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	170.5098	188.7787	170.5098	176.1935	170.5098	176.1935	170.5098	170.5098	176.1935	170.5098	176.1935	170.5098	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	318.5908	321.8967	313.5658	295.8302	273.4422	252.4006	238.3435	235.0375	243.3685	261.1041	283.4921	304.5337	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.6569	37.6569	37.6569	37.6569	37.6569	37.6569	37.6569	37.6569	37.6569	37.6569	37.6569	37.6569	(69)

Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-117.2556	-117.2556	-117.2556	-117.2556	-117.2556	-117.2556	-117.2556	-117.2556	-117.2556	-117.2556	-117.2556	-117.2556	(71)
Water heating gains (Table 5)	156.0549	153.3210	148.0549	136.5133	129.4437	122.0542	117.5158	121.2657	125.6622	133.8616	144.9256	154.5793	(72)
Total internal gains	715.1263	733.9673	702.1013	678.5078	643.3665	617.6191	593.3400	593.7839	612.1950	635.4464	674.5820	699.5936	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	2.5200	11.2829	0.6300	0.7000	0.7700	8.6895	(75)
Southeast	6.7200	36.7938	0.6300	0.7000	0.7700	75.5642	(77)
Southwest	10.0800	36.7938	0.6300	0.7000	0.7700	113.3463	(79)
Northwest	2.5200	11.2829	0.6300	0.7000	0.7700	8.6895	(81)

Solar gains	206.2895	357.1600	504.0149	650.1994	751.7358	756.6182	725.1666	647.8384	554.3921	398.8720	248.1385	175.8606	(83)
Total gains	921.4159	1091.1273	1206.1162	1328.7072	1395.1024	1374.2373	1318.5065	1241.6223	1166.5872	1034.3184	922.7206	875.4542	(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	124.6259	125.0469	125.4624	127.4514	127.8306	129.6257	129.6257	129.9637	128.9283	127.8306	127.0658	126.2761	
alpha	9.3084	9.3365	9.3642	9.4968	9.5220	9.6417	9.6417	9.6642	9.5952	9.5220	9.4711	9.4184	
util living area	0.9988	0.9936	0.9721	0.8687	0.6732	0.4675	0.3351	0.3710	0.5954	0.9153	0.9942	0.9992	(86)
MIT	20.4717	20.6205	20.7871	20.9476	20.9950	20.9999	21.0000	21.0000	20.9987	20.9278	20.6745	20.4497	(87)
Th 2	20.3368	20.3389	20.3409	20.3506	20.3524	20.3608	20.3608	20.3624	20.3576	20.3524	20.3487	20.3449	(88)
util rest of house	0.9983	0.9912	0.9626	0.8376	0.6286	0.4209	0.2864	0.3196	0.5409	0.8855	0.9916	0.9989	(89)
MIT 2	19.7155	19.9063	20.1145	20.3040	20.3490	20.3607	20.3608	20.3624	20.3569	20.2887	19.9841	19.6942	(90)
Living area fraction										fLA = Living area / (4) =		0.2314	(91)
MIT	19.8905	20.0716	20.2702	20.4529	20.4985	20.5086	20.5087	20.5099	20.5054	20.4366	20.1439	19.8691	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8905	20.0716	20.2702	20.4529	20.4985	20.5086	20.5087	20.5099	20.5054	20.4366	20.1439	19.8691	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9978	0.9900	0.9614	0.8428	0.6388	0.4317	0.2977	0.3315	0.5535	0.8898	0.9905	0.9986	(94)
Useful gains	919.4139	1080.2037	1159.5842	1119.8655	891.1410	593.2164	392.4937	411.6197	645.6777	920.3114	913.9748	874.1991	(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	1628.3378	1579.2467	1428.6246	1179.8853	895.9117	593.3189	392.4960	411.6261	646.6823	1001.6191	1336.1939	1615.1538	(97)
Space heating kWh	527.4394	335.3569	200.1660	43.2143	3.5494	0.0000	0.0000	0.0000	0.0000	60.4929	303.9978	551.2703	(98a)
Space heating requirement - total per year (kWh/year)												2025.4870	
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	527.4394	335.3569	200.1660	43.2143	3.5494	0.0000	0.0000	0.0000	0.0000	60.4929	303.9978	551.2703	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2025.4870	
Space heating per m2											(98c) / (4) =	13.6645	(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	527.4394	335.3569	200.1660	43.2143	3.5494	0.0000	0.0000	0.0000	0.0000	60.4929	303.9978	551.2703	(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)	571.4403	363.3336	216.8646	46.8194	3.8455	0.0000	0.0000	0.0000	0.0000	65.5395	329.3583	597.2592	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	250.1329	221.0323	234.7107	206.4867	200.1580	180.3857	178.2124	185.3842	187.4880	208.9954	222.0800	247.4521	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.6911	84.9920	83.7049	81.2247	79.9412	79.8000	79.8000	79.8000	79.8000	81.6578	84.7644	85.8020	(217)
Fuel for water heating, kWh/month	291.9006	260.0624	280.4028	254.2166	250.3817	226.0472	223.3238	232.3110	234.9473	255.9406	261.9969	288.3990	(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	35.4286	28.4221	25.5910	18.7490	14.4823	11.8322	13.2112	17.1725	22.3053	29.2658	33.0557	36.4132	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.8892	-24.3743	-38.0722	-46.6203	-53.6968	-51.3661	-50.7209	-46.1474	-38.7603	-29.4532	-18.1481	-13.5158	(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	-3.8415	-8.3852	-17.2633	-26.8483	-36.4451	-36.9970	-36.5851	-30.5519	-21.8332	-12.3029	-5.2231	-3.0170	(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	2194.4604	(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	3059.9300	(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)	285.9289	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-666.0581	(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	4960.2612	(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	2194.4604	0.2100	460.8367	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3059.9300	0.2100	642.5853	(264)
Space and water heating			1103.4220	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	285.9289	0.1443	41.2684	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-426.7645	0.1329	-56.7098	
PV Unit electricity exported	-239.2936	0.1249	-29.8818	
Total			-86.5916	(269)
Total CO2, kg/year			1070.0280	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			7.2200	(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	2194.4604	1.1300	2479.7403	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3059.9300	1.1300	3457.7209	(278)
Space and water heating			5937.4611	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	285.9289	1.5338	438.5673	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-426.7645	1.4910	-636.3126	
PV Unit electricity exported	-239.2936	0.4583	-109.6741	
Total			-745.9868	(283)
Total Primary energy kWh/year			5760.1424	(286)
Target Primary Energy Rate (TPER)			38.8600	(287)

Full SAP Calculation Printout

Property Reference	8F_Block A18_2Bed 4P	**Issued on Date**	27/03/2025
Assessment Reference	Option 1_EPH+ASHP_P08	**Prop Type Ref**	North West
Property	Chorlton-cum-Hardy, Manchester, Greater Manchester, M21 9AQ		

SAP Rating	94 A	**DER**	1.74	**TER**	9.98
Environmental	99 A	**% DER < TER**			82.57
CO_2 Emissions (t/year)	0.1	**DFEE**	19.33	**TFEE**	20.50
Compliance Check	See BREL	**% DFEE < TFEE**			5.69
% DPER < TPER	67.14	**DPER**	17.85	**TPER**	54.33

Assessor Details	Mr. Leon Maddison	**Assessor ID**	AY03-0001
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)	
Main dwelling						
Ground floor	72.0200 (1b)	x	2.4000 (2b)	=	172.8480	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	172.8480	(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) =												74.4000	(23c)
Effective ac	0.2906	0.2874	0.2842	0.2682	0.2651	0.2491	0.2491	0.2459	0.2555	0.2651	0.2714	0.2778	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Glazing			18.7200	1.1450	21.4351			(27)
External Wall 1	42.8600	18.7200	24.1400	0.1500	3.6210	60.0000	1448.4000	(29a)
Total net area of external elements Aum(A, m2)			42.8600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.0561			(33)
Main dwelling								
Party Wall-between flats			16.3200	0.0000	0.0000	180.0000	2937.5999	(32)
Party Wall-between circ			28.6800	0.0000	0.0000	180.0000	5162.4001	(32)
Party Floor 1			72.0200			80.0000	5761.6000	(32d)
Party Ceiling 1			72.0200			100.0000	7202.0000	(32b)
Internal Wall 1			116.5400			9.0000	1048.8600	(32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		23560.8600	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							327.1433	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E4 Jamb	28.8000	0.0180	0.5184	
E7 Party floor between dwellings (in blocks of flats)	35.7200	0.0360	1.2859	
E16 Corner (normal)	9.6000	0.0400	0.3840	
E18 Party wall between dwellings	12.0000	0.0320	0.3840	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	37.5000	0.0000	0.0000	
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0820	-0.3936	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			2.1787	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	27.2348	(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	16.5736	16.3918	16.2100	15.3009	15.1191	14.2101	14.2101	14.0282	14.5737	15.1191	15.4828	15.8464	(38)
Heat transfer coeff	43.8085	43.6267	43.4448	42.5358	42.3540	41.4449	41.4449	41.2631	41.8085	42.3540	42.7176	43.0812	(39)
Average = Sum(39)m / 12 =												42.4903	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6083	0.6058	0.6032	0.5906	0.5881	0.5755	0.5755	0.5729	0.5805	0.5881	0.5931	0.5982	(40)
HLP (average)												0.5900	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2941	(42)
Hot water usage for mixer showers	80.5042	79.2944	77.5314	74.1584	71.6691	68.8931	67.3152	69.0649	70.9827	73.9633	77.4088	80.1958	(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses	38.1244	36.7380	35.3517	33.9654	32.5790	31.1927	31.1927	32.5790	33.9654	35.3517	36.7380	38.1244	(42c)
Average daily hot water use (litres/day)												108.8807	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	118.6286	116.0324	112.8831	108.1237	104.2481	100.0858	98.5079	101.6439	104.9481	109.3150	114.1469	118.3202	(44)
Energy conte	187.8787	165.2286	173.4972	148.0160	140.3380	123.0672	119.1368	125.8563	129.4115	148.3394	162.6232	185.2608	(45)
Energy content (annual)										Total = Sum(45)m =		1808.6537	
Distribution loss (46)m = 0.15 x (45)m	28.1818	24.7843	26.0246	22.2024	21.0507	18.4601	17.8705	18.8785	19.4117	22.2509	24.3935	27.7891	(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	214.8301	189.5718	200.4486	174.0980	167.2894	149.1492	146.0882	152.8077	155.4935	175.2908	188.7052	212.2122	(62)
WWHRS	-56.5257	-49.9918	-52.3485	-43.3467	-40.3975	-34.5685	-32.4024	-34.4567	-35.7659	-42.1640	-47.7667	-55.4789	(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	158.3044	139.5800	148.1000	130.7513	126.8919	114.5807	113.6858	118.3510	119.7277	133.1268	140.9385	156.7332	(64)
										Total per year (kWh/year) = Sum(64)m =		1600.7714	(64)
12Total per year (kWh/year)												1601	(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	62.4697	54.9385	57.6878	49.2153	46.6624	40.9198	39.6130	41.8472	43.0293	49.3229	54.0722	61.5992	(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	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	101.8681	112.7826	101.8681	105.2637	101.8681	105.2637	101.8681	101.8681	105.2637	101.8681	105.2637	101.8681	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	201.9649	204.0607	198.7794	187.5363	173.3438	160.0048	151.0936	148.9978	154.2791	165.5223	179.7148	193.0537	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	(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)	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	(71)
Water heating gains (Table 5)	83.9646	81.7538	77.5374	68.3546	62.7183	56.8331	53.2433	56.2463	59.7630	66.2942	75.1003	82.7946	(72)
Total internal gains	445.2099	456.0092	435.5972	418.5668	395.3424	379.5139	363.6172	364.5245	376.7180	391.0968	417.4910	435.1287	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	2.8800	11.2829	0.4000	0.7000	0.7700	6.3053	(75)
Southeast	7.2000	36.7938	0.4000	0.7000	0.7700	51.4042	(77)
Southwest	8.6400	36.7938	0.4000	0.7000	0.7700	61.6851	(79)

Solar gains	119.3946	205.4675	286.6927	364.5506	416.8379	417.5673	401.0215	361.4404	313.5661	228.5853	143.3886	101.9301	(83)
Total gains	564.6045	661.4768	722.2898	783.1174	812.1803	797.0812	764.6387	725.9649	690.2841	619.6821	560.8796	537.0588	(84)

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7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	149.3931	150.0157	150.6435	153.8630	154.5235	157.9129	157.9129	158.6087	156.5395	154.5235	153.2082	151.9150	
alpha	10.9595	11.0010	11.0429	11.2575	11.3016	11.5275	11.5275	11.5739	11.4360	11.3016	11.2139	11.1277	
util living area	0.9860	0.9414	0.8417	0.6552	0.4849	0.3328	0.2385	0.2615	0.4179	0.7064	0.9417	0.9904	(86)
MIT	20.7727	20.8964	20.9714	20.9979	20.9999	21.0000	21.0000	21.0000	21.0000	20.9964	20.9145	20.7503	(87)
Th 2	20.4226	20.4248	20.4271	20.4385	20.4407	20.4521	20.4521	20.4544	20.4476	20.4407	20.4362	20.4316	(88)
util rest of house	0.9815	0.9271	0.8159	0.6255	0.4558	0.3043	0.2088	0.2304	0.3844	0.6701	0.9251	0.9872	(89)
MIT 2	20.1688	20.3180	20.4008	20.4369	20.4407	20.4521	20.4521	20.4544	20.4476	20.4381	20.3512	20.1492	(90)
Living area fraction										fLA = Living area / (4) =		0.4250	(91)
MIT	20.4255	20.5638	20.6433	20.6753	20.6784	20.6850	20.6850	20.6863	20.6824	20.6754	20.5906	20.4046	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.4255	20.5638	20.6433	20.6753	20.6784	20.6850	20.6850	20.6863	20.6824	20.6754	20.5906	20.4046	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9815	0.9308	0.8259	0.6381	0.4682	0.3164	0.2214	0.2436	0.3987	0.6854	0.9300	0.9870	(94)
Useful gains	554.1663	615.6825	596.5086	499.6892	380.2316	252.1913	169.3018	176.8659	275.1941	424.7531	521.6100	530.0764	(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	706.4327	683.3591	614.4530	500.8730	380.2697	252.1916	169.3019	176.8659	275.1986	426.7341	576.2877	698.1158	(97)
Space heating kWh	113.2862	45.4787	13.3507	0.8523	0.0284	0.0000	0.0000	0.0000	0.0000	1.4738	39.3679	125.0213	(98a)
Space heating requirement - total per year (kWh/year)												338.8593	
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	113.2862	45.4787	13.3507	0.8523	0.0284	0.0000	0.0000	0.0000	0.0000	1.4738	39.3679	125.0213	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												338.8593	
Space heating per m2											(98c) / (4) =	4.7051	(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	113.2862	45.4787	13.3507	0.8523	0.0284	0.0000	0.0000	0.0000	0.0000	1.4738	39.3679	125.0213	(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)	113.2862	45.4787	13.3507	0.8523	0.0284	0.0000	0.0000	0.0000	0.0000	1.4738	39.3679	125.0213	(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	158.3044	139.5800	148.1000	130.7513	126.8919	114.5807	113.6858	118.3510	119.7277	133.1268	140.9385	156.7332	(64)
Efficiency of water heater												346.6611	(216)
(217)m	346.6611	346.6611	346.6611	346.6611	346.6611	346.6611	346.6611	346.6611	346.6611	346.6611	346.6611	346.6611	(217)
Fuel for water heating, kWh/month	45.6655	40.2641	42.7219	37.7173	36.6040	33.0527	32.7945	34.1403	34.5374	38.4026	40.6560	45.2122	(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	9.7788	8.8325	9.7788	9.4634	9.7788	9.4634	9.7788	9.7788	9.4634	9.7788	9.4634	9.7788	(231)
Lighting	24.7950	19.8915	17.9101	13.1217	10.1356	8.2808	9.2460	12.0183	15.6106	20.4819	23.1343	25.4841	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-8.0410	-13.8831	-24.7168	-33.5742	-41.0269	-40.0993	-39.2974	-34.3453	-26.4274	-17.5514	-9.4669	-6.5941	(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												338.8593	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												346.6611	
Water heating fuel used												461.7684	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.5460)
mechanical ventilation fans (SFP = 0.5460) 115.1375 (230a)

Total electricity for the above, kWh/year	115.1375	(231)
Electricity for lighting (calculated in Appendix L)	200.1099	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-295.0238	(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	820.8513	(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	338.8593	0.1606	54.4340	(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)	461.7684	0.1408	65.0227	(264)
Space and water heating			119.4566	(265)
Pumps, fans and electric keep-hot	115.1375	0.1387	15.9710	(267)
Energy for lighting	200.1099	0.1443	28.8820	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-295.0238	0.1311	-38.6664	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-38.6664	(269)
Total CO2, kg/year			125.6433	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.7400	(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	338.8593	1.5945	540.2981	(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)	461.7684	1.5207	702.1963	(278)
Space and water heating			1242.4944	(279)
Pumps, fans and electric keep-hot	115.1375	1.5128	174.1800	(281)
Energy for lighting	200.1099	1.5338	306.9352	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-295.0238	1.4842	-437.8682	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-437.8682	(283)
Total Primary energy kWh/year			1285.7414	(286)
Dwelling Primary energy Rate (DPER)			17.8500	(287)

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

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling							
Ground floor		72.0200	(1b)	x 2.4000	(2b) =	172.8480	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0200						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		172.8480	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1736	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4236	(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) =	0.3600	(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	0.4590	0.4500	0.4410	0.3960	0.3870	0.3420	0.3420	0.3330	0.3600	0.3870	0.4050	0.4230	(22b)
Effective ac	0.6054	0.6013	0.5973	0.5784	0.5749	0.5585	0.5585	0.5555	0.5648	0.5749	0.5820	0.5895	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opening Type			18.0000	1.1450	20.6107			(27)
External Wall 1	42.8600	18.0000	24.8600	0.1800	4.4748			(29a)
Total net area of external elements Aum(A, m2)			42.8600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	25.0855			(33)
Main dwelling								
Party Wall-between flats			16.3200	0.0000	0.0000			(32)
Party Wall-between circ			28.6800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 307.1433 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E4 Jamb	28.8000	0.0500	1.4400	
E7 Party floor between dwellings (in blocks of flats)	35.7200	0.0700	2.5004	
E16 Corner (normal)	9.6000	0.0900	0.8640	
E18 Party wall between dwellings	12.0000	0.0600	0.7200	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	37.5000	0.0000	0.0000	
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0900	-0.4320	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.0924 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 30.1779 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	34.5295	34.2961	34.0674	32.9930	32.7920	31.8563	31.8563	31.6830	32.2167	32.7920	33.1986	33.6238	(38)
Heat transfer coeff	64.7074	64.4740	64.2453	63.1709	62.9699	62.0341	62.0341	61.8609	62.3946	62.9699	63.3765	63.8017	(39)

Average = Sum(39)m / 12 = 63.1699

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8985	0.8952	0.8920	0.8771	0.8743	0.8613	0.8613	0.8589	0.8664	0.8743	0.8800	0.8859	(40)
HLP (average)												0.8771	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2941 (42)

Hot water usage for mixer showers

80.5042	79.2944	77.5314	74.1584	71.6691	68.8931	67.3152	69.0649	70.9827	73.9633	77.4088	80.1958	(42a)

Hot water usage for baths

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

Hot water usage for other uses

38.1244	36.7380	35.3517	33.9654	32.5790	31.1927	31.1927	32.5790	33.9654	35.3517	36.7380	38.1244	(42c)

Average daily hot water use (litres/day) 108.8807 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	118.6286	116.0324	112.8831	108.1237	104.2481	100.0858	98.5079	101.6439	104.9481	109.3150	114.1469	118.3202	(44)
Energy conte	187.8787	165.2286	173.4972	148.0160	140.3380	123.0672	119.1368	125.8563	129.4115	148.3394	162.6232	185.2608	(45)

Energy content (annual) Total = Sum(45)m = 1808.6537

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

28.1818	24.7843	26.0246	22.2024	21.0507	18.4601	17.8705	18.8785	19.4117	22.2509	24.3935	27.7891	(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

234.4736	207.3144	220.0921	193.1078	186.9329	168.1590	165.7317	172.4512	174.5034	194.9343	207.7150	231.8557	(62)
WWHRS -36.8032	-32.5490	-34.0835	-28.2224	-26.3023	-22.5071	-21.0968	-22.4343	-23.2867	-27.4524	-31.1003	-36.1216	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

197.6704	174.7653	186.0086	164.8854	160.6306	145.6519	144.6349	150.0169	151.2167	167.4819	176.6147	195.7340	(64)

Total per year (kWh/year) = Sum(64)m = 2015.3115 (64)

12Total per year (kWh/year) 2015 (64)

Electric shower(s)

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

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

Heat gains from water heating, kWh/month

99.7456	88.6071	94.9637	85.2888	83.9383	76.9933	76.8889	79.1232	79.1028	86.5988	90.1457	98.8751	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	114.7075	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	101.8681	112.7826	101.8681	105.2637	101.8681	105.2637	101.8681	101.8681	105.2637	101.8681	105.2637	101.8681	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	201.9649	204.0607	198.7794	187.5363	173.3438	160.0048	151.0936	148.9978	154.2791	165.5223	179.7148	193.0537	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	34.4707	(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)	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	-91.7660	(71)

Water heating gains (Table 5)													
	134.0667	131.8558	127.6394	118.4566	112.8203	106.9351	103.3453	106.3483	109.8650	116.3962	125.2023	132.8967	(72)
Total internal gains													
	498.3119	509.1113	488.6992	471.6689	448.4444	429.6159	413.7193	414.6265	426.8201	444.1989	470.5931	488.2307	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	2.7700	11.2829	0.6300	0.7000	0.7700	9.5516	(75)
Southeast	6.9200	36.7938	0.6300	0.7000	0.7700	77.8131	(77)
Southwest	8.3100	36.7938	0.6300	0.7000	0.7700	93.4432	(79)

Solar gains	180.8079	311.1554	434.1635	552.0748	631.2625	632.3686	607.3108	547.3662	474.8617	346.1652	217.1440	154.3601	(83)
Total gains	679.1199	820.2667	922.8627	1023.7436	1079.7069	1061.9846	1021.0301	961.9927	901.6818	790.3641	687.7370	642.5908	(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	94.9594	95.3031	95.6424	97.2690	97.5795	99.0515	99.0515	99.3289	98.4793	97.5795	96.9534	96.3074	
alpha	7.3306	7.3535	7.3762	7.4846	7.5053	7.6034	7.6034	7.6219	7.5653	7.5053	7.4636	7.4205	
util living area	0.9874	0.9568	0.8847	0.7235	0.5399	0.3737	0.2673	0.2958	0.4765	0.7852	0.9606	0.9909	(86)
MIT	20.4622	20.6678	20.8489	20.9688	20.9964	20.9998	21.0000	21.0000	20.9989	20.9548	20.7102	20.4282	(87)
Th 2	20.1688	20.1716	20.1743	20.1870	20.1894	20.2005	20.2005	20.2025	20.1962	20.1894	20.1845	20.1795	(88)
util rest of house	0.9831	0.9443	0.8578	0.6817	0.4938	0.3271	0.2188	0.2445	0.4215	0.7374	0.9469	0.9877	(89)
MIT 2	19.5643	19.8179	20.0279	20.1614	20.1870	20.2004	20.2005	20.2025	20.1957	20.1538	19.8840	19.5306	(90)
Living area fraction									fLA = Living area / (4) =			0.4250	(91)
MIT	19.9459	20.1791	20.3769	20.5046	20.5310	20.5402	20.5403	20.5415	20.5370	20.4943	20.2352	19.9121	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9459	20.1791	20.3769	20.5046	20.5310	20.5402	20.5403	20.5415	20.5370	20.4943	20.2352	19.9121	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9817	0.9444	0.8649	0.6983	0.5133	0.3469	0.2394	0.2663	0.4449	0.7560	0.9478	0.9864	(94)
Useful gains	666.7004	774.6904	798.1424	714.9122	554.2283	368.4162	244.4287	256.1866	401.1457	597.5461	651.8678	633.8756	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1012.4079	985.1056	891.5229	733.0702	556.0889	368.4932	244.4323	256.1945	401.6368	623.0416	832.4605	1002.4555	(97)
Space heating kWh	257.2064	141.3990	69.4751	13.0737	1.3843	0.0000	0.0000	0.0000	0.0000	18.9686	130.0267	274.2235	(98a)
Space heating requirement - total per year (kWh/year)												905.7574	
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	257.2064	141.3990	69.4751	13.0737	1.3843	0.0000	0.0000	0.0000	0.0000	18.9686	130.0267	274.2235	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												905.7574	
Space heating per m2											(98c) / (4) =	12.5765	(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	257.2064	141.3990	69.4751	13.0737	1.3843	0.0000	0.0000	0.0000	0.0000	18.9686	130.0267	274.2235	(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)	278.6634	153.1950	75.2710	14.1644	1.4998	0.0000	0.0000	0.0000	0.0000	20.5511	140.8740	297.1002	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	197.6704	174.7653	186.0086	164.8854	160.6306	145.6519	144.6349	150.0169	151.2167	167.4819	176.6147	195.7340	(64)
Efficiency of water heater												79.8000	(216)
(217)m	84.6512	83.5889	82.0617	80.3986	79.8692	79.8000	79.8000	79.8000	79.8000	80.6314	83.3835	84.8159	(217)
Fuel for water heating, kWh/month	233.5116	209.0772	226.6692	205.0848	201.1172	182.5212	181.2468	187.9911	189.4946	207.7130	211.8101	230.7750	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	21.1662	16.9803	15.2889	11.2013	8.6522	7.0689	7.8928	10.2594	13.3259	17.4843	19.7485	21.7545	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-7.9546	-12.3376	-19.4869	-24.1461	-28.0809	-26.9749	-26.6483	-24.1194	-20.0700	-15.0317	-9.1343	-6.7528	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													

(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-1.6319	-3.5791	-7.3987	-11.5498	-15.7161	-15.9577	-15.7708	-13.1463	-9.3703	-5.2562	-2.2211	-1.2799	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	981.3190	(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	2467.0119	(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)	170.8232	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-323.6153	(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	3381.5388	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	981.3190	0.2100	206.0770	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2467.0119	0.2100	518.0725	(264)
Space and water heating			724.1495	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	170.8232	0.1443	24.6551	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-220.7375	0.1327	-29.2808	
PV Unit electricity exported	-102.8779	0.1248	-12.8378	
Total			-42.1186	(269)
Total CO2, kg/year			718.6152	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.9800	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	981.3190	1.1300	1108.8904	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2467.0119	1.1300	2787.7235	(278)
Space and water heating			3896.6139	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	170.8232	1.5338	262.0143	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-220.7375	1.4901	-328.9298	
PV Unit electricity exported	-102.8779	0.4580	-47.1178	
Total			-376.0476	(283)
Total Primary energy kWh/year			3912.6814	(286)
Target Primary Energy Rate (TPER)			54.3300	(287)

Full SAP Calculation Printout

Property Reference	GF_Block D1_1Bed	**Issued on Date**	27/03/2025
Assessment Reference	Option 1_EPH+ASHP_P08	**Prop Type Ref**	North West
Property	Chorlton-cum-Hardy, Manchester, Greater Manchester, M21 9AQ		

SAP Rating	94 A	**DER**	2.17	**TER**	13.11
Environmental	99 A	**% DER < TER**			83.45
CO_2 Emissions (t/year)	0.09	**DFEE**	21.53	**TFEE**	25.59
Compliance Check	See BREL	**% DFEE < TFEE**			15.87
% DPER < TPER	68.58	**DPER**	22.18	**TPER**	70.60

Assessor Details	Mr. Leon Maddison	**Assessor ID**	AY03-0001
Client			

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	53.4900	(1b)	x 2.4000	(2b) =	128.3760	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.4900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	128.3760	(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) =	74.4000 (23c)

Effective ac	0.2906	0.2874	0.2842	0.2682	0.2651	0.2491	0.2491	0.2459	0.2555	0.2651	0.2714	0.2778	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Glazing			7.6800	1.1450	8.7939			(27)
Heatloss Floor 1			53.4900	0.1100	5.8839	110.0000	5883.9000	(28a)
External Wall 1	35.1300	7.6800	27.4500	0.1500	4.1175	60.0000	1647.0001	(29a)
Total net area of external elements Aum(A, m2)			88.6200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		18.7953			(33)
Main dwelling								
Party Wall-between flats			26.9500	0.0000	0.0000	180.0000	4851.0001	(32)
Party Wall-between circ			8.1800	0.0000	0.0000	180.0000	1472.4001	(32)
Party Ceiling 1			53.4900			100.0000	5349.0000	(32b)
Internal Wall 1			84.5300			9.0000	760.7700	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	19964.0702 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		373.2299 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E4 Jamb	9.6000	0.0180	0.1728	
E7 Party floor between dwellings (in blocks of flats)	14.6400	0.0360	0.5270	
E16 Corner (normal)	2.4000	0.0400	0.0960	
E18 Party wall between dwellings	9.6000	0.0320	0.3072	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	14.6400	0.0000	0.0000	
P1 Party wall - Ground floor	14.6400	0.0420	0.6149	
E5 Ground floor (normal)	14.6400	0.0730	1.0687	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				2.7866 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	21.5819 (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	12.3094	12.1744	12.0393	11.3642	11.2291	10.5540	10.5540	10.4189	10.8240	11.2291	11.4992	11.7693	(38)
Heat transfer coeff	33.8913	33.7563	33.6213	32.9461	32.8111	32.1359	32.1359	32.0008	32.4060	32.8111	33.0811	33.3512	(39)
Average = Sum(39)m / 12 =												32.9123	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6336	0.6311	0.6286	0.6159	0.6134	0.6008	0.6008	0.5983	0.6058	0.6134	0.6185	0.6235	(40)
HLP (average)												0.6153	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.7930	(42)
Hot water usage for mixer showers	54.2822	53.4664	52.2777	50.0033	48.3249	46.4531	45.3891	46.5689	47.8621	49.8718	52.1950	54.0742	(42a)
Hot water usage for baths	23.4663	23.1178	22.6271	21.7222	21.0446	20.2933	19.8874	20.3748	20.9054	21.7093	22.6329	23.3870	(42b)
Hot water usage for other uses	32.9921	31.7924	30.5927	29.3929	28.1932	26.9935	26.9935	28.1932	29.3929	30.5927	31.7924	32.9921	(42c)
Average daily hot water use (litres/day)												101.7961	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	110.7406	108.3766	105.4974	101.1184	97.5627	93.7398	92.2701	95.1369	98.1604	102.1738	106.6203	110.4533	(44)
Energy conte	175.3860	154.3268	162.1456	138.4260	131.3381	115.2641	111.5927	117.7993	121.0416	138.6489	151.9001	172.9431	(45)
Energy content (annual)										Total = Sum(45)m =		1690.8123	
Distribution loss (46)m = 0.15 x (45)m	26.3079	23.1490	24.3218	20.7639	19.7007	17.2896	16.7389	17.6699	18.1562	20.7973	22.7850	25.9415	(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	202.3374	178.6700	189.0970	164.5080	158.2895	141.3461	138.5441	144.7507	147.1236	165.6003	177.9821	199.8945	(62)
WWHRS	-38.1140	-33.7083	-35.2974	-29.2277	-27.2391	-23.3087	-21.8482	-23.2334	-24.1161	-28.4302	-32.2080	-37.4082	(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	164.2234	144.9617	153.7995	135.2804	131.0504	118.0374	116.6959	121.5173	123.0075	137.1700	145.7741	162.4863	(64)
									Total per year (kWh/year) = Sum(64)m =			1654.0039	(64)
12Total per year (kWh/year)												1654	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	58.3158	51.3137	53.9134	46.0267	43.6699	38.3253	37.1046	39.1683	40.2463	46.1007	50.5068	57.5036	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	89.6498	89.6498	89.6498	89.6498	89.6498	89.6498	89.6498	89.6498	89.6498	89.6498	89.6498	89.6498	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	84.1078	93.1193	84.1078	86.9113	84.1078	86.9113	84.1078	84.1078	86.9113	84.1078	86.9113	84.1078	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	156.2862	157.9079	153.8211	145.1208	134.1383	123.8163	116.9205	115.2987	119.3855	128.0858	139.0683	149.3904	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.9650	31.9650	31.9650	31.9650	31.9650	31.9650	31.9650	31.9650	31.9650	31.9650	31.9650	31.9650	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-71.7198	-71.7198	-71.7198	-71.7198	-71.7198	-71.7198	-71.7198	-71.7198	-71.7198	-71.7198	-71.7198	-71.7198	(71)
Water heating gains (Table 5)	78.3815	76.3596	72.4643	63.9259	58.6961	53.2296	49.8717	52.6455	55.8977	61.9634	70.1483	77.2898	(72)
Total internal gains	368.6704	377.2818	360.2881	345.8530	326.8371	313.8521	300.7949	301.9470	312.0895	324.0519	346.0230	360.6829	(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	7.6800	36.7938	0.4000	0.7000	0.7700	54.8312	(77)

Solar gains	54.8312	93.3978	127.7909	158.3391	177.3530	176.0705	169.7507	155.5655	138.3705	103.2244	65.6751	46.9241	(83)
Total gains	423.5015	470.6796	488.0790	504.1922	504.1901	489.9226	470.5457	457.5125	450.4600	427.2763	411.6981	407.6069	(84)

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7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	163.6281	164.2826	164.9424	168.3227	169.0154	172.5664	172.5664	173.2946	171.1283	169.0154	167.6356	166.2781	
alpha	11.9085	11.9522	11.9962	12.2215	12.2677	12.5044	12.5044	12.5530	12.4086	12.2677	12.1757	12.0852	
util living area	0.9918	0.9716	0.9225	0.7808	0.6047	0.4198	0.3005	0.3217	0.4963	0.7879	0.9645	0.9941	(86)
MIT	20.7743	20.8667	20.9423	20.9923	20.9996	21.0000	21.0000	21.0000	21.0000	20.9929	20.9027	20.7597	(87)
Th 2	20.3999	20.4021	20.4044	20.4157	20.4179	20.4293	20.4293	20.4316	20.4248	20.4179	20.4134	20.4089	(88)
util rest of house	0.9886	0.9620	0.9016	0.7466	0.5671	0.3824	0.2615	0.2820	0.4550	0.7480	0.9513	0.9917	(89)
MIT 2	20.1479	20.2622	20.3499	20.4098	20.4177	20.4293	20.4293	20.4316	20.4247	20.4129	20.3164	20.1378	(90)
Living area fraction										fLA = Living area / (4) =		0.5689	(91)
MIT	20.5042	20.6061	20.6869	20.7412	20.7487	20.7540	20.7540	20.7549	20.7520	20.7428	20.6499	20.4916	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.5042	20.6061	20.6869	20.7412	20.7487	20.7540	20.7540	20.7549	20.7520	20.7428	20.6499	20.4916	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9893	0.9656	0.9120	0.7659	0.5885	0.4037	0.2837	0.3046	0.4785	0.7705	0.9570	0.9921	(94)
Useful gains	418.9534	454.4801	445.1280	386.1467	296.7147	197.7616	133.4913	139.3619	215.5519	329.2374	394.0148	404.3752	(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	549.1825	530.1785	476.9831	390.1206	296.8990	197.7630	133.4913	139.3619	215.5639	332.7976	448.2477	543.3456	(97)
Space heating kWh	96.8905	50.8694	23.7002	2.8612	0.1371	0.0000	0.0000	0.0000	0.0000	2.6488	39.0477	103.3940	(98a)
Space heating requirement - total per year (kWh/year)												319.5488	
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	96.8905	50.8694	23.7002	2.8612	0.1371	0.0000	0.0000	0.0000	0.0000	2.6488	39.0477	103.3940	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												319.5488	
Space heating per m2											(98c) / (4) =	5.9740	(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	96.8905	50.8694	23.7002	2.8612	0.1371	0.0000	0.0000	0.0000	0.0000	2.6488	39.0477	103.3940	(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)	96.8905	50.8694	23.7002	2.8612	0.1371	0.0000	0.0000	0.0000	0.0000	2.6488	39.0477	103.3940	(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	164.2234	144.9617	153.7995	135.2804	131.0504	118.0374	116.6959	121.5173	123.0075	137.1700	145.7741	162.4863	(64)
Efficiency of water heater												348.9046	(216)
(217)m	348.9046	348.9046	348.9046	348.9046	348.9046	348.9046	348.9046	348.9046	348.9046	348.9046	348.9046	348.9046	(217)
Fuel for water heating, kWh/month	47.0683	41.5477	44.0807	38.7729	37.5605	33.8308	33.4464	34.8282	35.2553	39.3145	41.7805	46.5704	(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	7.2628	6.5600	7.2628	7.0285	7.2628	7.0285	7.2628	7.2628	7.0285	7.2628	7.0285	7.2628	(231)
Lighting	19.9100	15.9726	14.3815	10.5365	8.1387	6.6494	7.4244	9.6505	12.5351	16.4467	18.5765	20.4634	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-7.9256	-13.6328	-24.0707	-32.1074	-38.8253	-37.8209	-37.0810	-32.6012	-25.3047	-17.0277	-9.3060	-6.5057	(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												319.5488	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												348.9046	
Water heating fuel used												474.0563	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.5460)

mechanical ventilation fans (SFP = 0.5460) 85.5138 (230a)

Total electricity for the above, kWh/year 85.5138 (231)

Electricity for lighting (calculated in Appendix L)	160.6855	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-282.2091	(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	757.5952	(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	319.5488	0.1599	51.0953	(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)	474.0563	0.1409	66.7874	(264)
Space and water heating			117.8827	(265)
Pumps, fans and electric keep-hot	85.5138	0.1387	11.8618	(267)
Energy for lighting	160.6855	0.1443	23.1919	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-282.2091	0.1313	-37.0467	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-37.0467	(269)
Total CO2, kg/year			115.8897	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.1700	(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	319.5488	1.5918	508.6608	(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)	474.0563	1.5209	721.0112	(278)
Space and water heating			1229.6721	(279)
Pumps, fans and electric keep-hot	85.5138	1.5128	129.3653	(281)
Energy for lighting	160.6855	1.5338	246.4647	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-282.2091	1.4850	-419.0741	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-419.0741	(283)
Total Primary energy kWh/year			1186.4280	(286)
Dwelling Primary energy Rate (DPER)			22.1800	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	53.4900	(1b) x	2.4000	(2b) =	128.3760	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.4900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		128.3760	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1558	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4058	(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) =	0.3449	(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	0.4398	0.4312	0.4225	0.3794	0.3708	0.3277	0.3277	0.3191	0.3449	0.3708	0.3880	0.4053	(22b)
Effective ac	0.5967	0.5929	0.5893	0.5720	0.5687	0.5537	0.5537	0.5509	0.5595	0.5687	0.5753	0.5821	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opening Type			7.6800	1.1450	8.7939			(27)
Heatloss Floor 1			53.4900	0.1300	6.9537			(28a)
External Wall 1	35.1300	7.6800	27.4500	0.1800	4.9410			(29a)
Total net area of external elements Aum(A, m2)			88.6200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	20.6886			(33)
Main dwelling								
Party Wall-between flats			26.9500	0.0000	0.0000			(32)
Party Wall-between circ			8.1800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	353.2299	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E4 Jamb	9.6000	0.0500	0.4800
E7 Party floor between dwellings (in blocks of flats)	14.6400	0.0700	1.0248
E16 Corner (normal)	2.4000	0.0900	0.2160
E18 Party wall between dwellings	9.6000	0.0600	0.5760
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	14.6400	0.0000	0.0000
P1 Party wall - Ground floor	14.6400	0.0800	1.1712
E5 Ground floor (normal)	14.6400	0.1600	2.3424

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.8104	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	26.4990	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	25.2787	25.1197	24.9637	24.2313	24.0943	23.4564	23.4564	23.3383	23.7021	24.0943	24.3715	24.6613	(38)
Heat transfer coeff	51.7777	51.6187	51.4627	50.7303	50.5933	49.9554	49.9554	49.8373	50.2011	50.5933	50.8705	51.1603	(39)
Average = Sum(39)m / 12 =												50.7297	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9680	0.9650	0.9621	0.9484	0.9458	0.9339	0.9339	0.9317	0.9385	0.9458	0.9510	0.9564	(40)
HLP (average)												0.9484	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy											1.7930	(42)
Hot water usage for mixer showers												
54.2822	53.4664	52.2777	50.0033	48.3249	46.4531	45.3891	46.5689	47.8621	49.8718	52.1950	54.0742	(42a)
Hot water usage for baths												
23.4663	23.1178	22.6271	21.7222	21.0446	20.2933	19.8874	20.3748	20.9054	21.7093	22.6329	23.3870	(42b)
Hot water usage for other uses												
32.9921	31.7924	30.5927	29.3929	28.1932	26.9935	26.9935	28.1932	29.3929	30.5927	31.7924	32.9921	(42c)
Average daily hot water use (litres/day)											101.7961	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	110.7406	108.3766	105.4974	101.1184	97.5627	93.7398	92.2701	95.1369	98.1604	102.1738	106.6203	110.4533	(44)
Energy conte	175.3860	154.3268	162.1456	138.4260	131.3381	115.2641	111.5927	117.7993	121.0416	138.6489	151.9001	172.9431	(45)
Energy content (annual)										Total = Sum(45)m =		1690.8123	
Distribution loss (46)m = 0.15 x (45)m													
	26.3079	23.1490	24.3218	20.7639	19.7007	17.2896	16.7389	17.6699	18.1562	20.7973	22.7850	25.9415	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss													
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage													
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	221.9809	196.4126	208.7405	183.5179	177.9330	160.3559	158.1876	164.3942	166.1334	185.2438	196.9920	219.5380	(62)
WWHRS	-24.8155	-21.9471	-22.9817	-19.0298	-17.7351	-15.1760	-14.2251	-15.1270	-15.7017	-18.5106	-20.9702	-24.3560	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	197.1654	174.4655	185.7588	164.4881	160.1980	145.1799	143.9625	149.2673	150.4317	166.7332	176.0217	195.1820	(64)
									Total per year (kWh/year) = Sum(64)m =			2008.8541	(64)
12Total per year (kWh/year)												2009	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
					Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =							0.0000	(64a)
Heat gains from water heating, kWh/month													
	95.5918	84.9822	91.1893	82.1001	80.9458	74.3988	74.3805	76.4442	76.3198	83.3767	86.5803	94.7795	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	89.6498	89.6498	89.6498	89.6498	89.6498	89.6498	89.6498	89.6498	89.6498	89.6498	89.6498	89.6498	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	84.1078	93.1193	84.1078	86.9113	84.1078	86.9113	84.1078	84.1078	86.9113	84.1078	86.9113	84.1078	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	156.2862	157.9079	153.8211	145.1208	134.1383	123.8163	116.9205	115.2987	119.3855	128.0858	139.0683	149.3904	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.9650	31.9650	31.9650	31.9650	31.9650	31.9650	31.9650	31.9650	31.9650	31.9650	31.9650	31.9650	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													

	-71.7198	-71.7198	-71.7198	-71.7198	-71.7198	-71.7198	-71.7198	-71.7198	-71.7198	-71.7198	-71.7198	-71.7198	(71)
Water heating gains (Table 5)													
	128.4836	126.4617	122.5663	114.0280	108.7982	103.3316	99.9738	102.7476	105.9997	112.0654	120.2504	127.3918	(72)
Total internal gains													
	421.7724	430.3838	413.3901	398.9551	379.9392	363.9542	350.8970	352.0490	362.1915	377.1539	399.1250	413.7849	(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	7.6800	36.7938	0.6300	0.7000	0.7700	86.3591	(77)

Solar gains	86.3591	147.1015	201.2707	249.3841	279.3310	277.3110	267.3574	245.0157	217.9336	162.5785	103.4383	73.9054	(83)
Total gains	508.1315	577.4853	614.6608	648.3392	659.2702	641.2652	618.2544	597.0647	580.1251	539.7324	502.5633	487.6903	(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	101.3642	101.6766	101.9847	103.4570	103.7372	105.0619	105.0619	105.3109	104.5477	103.7372	103.1719	102.5875	
alpha	7.7576	7.7784	7.7990	7.8971	7.9158	8.0041	8.0041	8.0207	7.9698	7.9158	7.8781	7.8392	
util living area	0.9933	0.9813	0.9525	0.8619	0.6988	0.4976	0.3555	0.3839	0.5931	0.8762	0.9794	0.9949	(86)
MIT	20.4422	20.5901	20.7507	20.9144	20.9847	20.9990	20.9999	20.9999	20.9964	20.9172	20.6662	20.4190	(87)
Th 2	20.1101	20.1126	20.1150	20.1265	20.1287	20.1388	20.1388	20.1406	20.1349	20.1287	20.1243	20.1198	(88)
util rest of house	0.9905	0.9740	0.9354	0.8224	0.6394	0.4312	0.2859	0.3122	0.5208	0.8317	0.9701	0.9927	(89)
MIT 2	19.4831	19.6694	19.8648	20.0541	20.1190	20.1384	20.1388	20.1406	20.1333	20.0625	19.7755	19.4619	(90)
Living area fraction										fLA = Living area / (4) =		0.5689	(91)
MIT	20.0287	20.1932	20.3688	20.5435	20.6115	20.6280	20.6287	20.6294	20.6243	20.5488	20.2822	20.0064	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0287	20.1932	20.3688	20.5435	20.6115	20.6280	20.6287	20.6294	20.6243	20.5488	20.2822	20.0064	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9902	0.9748	0.9408	0.8421	0.6728	0.4690	0.3255	0.3530	0.5620	0.8545	0.9720	0.9924	(94)
Useful gains	503.1306	562.9221	578.2946	545.9929	443.5749	300.7547	201.2371	210.7520	326.0199	461.1892	488.4969	483.9733	(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	814.3971	789.4145	713.7273	590.6802	450.8620	301.1316	201.2542	210.7843	327.5266	503.3405	670.5844	808.6607	(97)
Space heating kWh	231.5822	152.2029	100.7620	32.1749	5.4216	0.0000	0.0000	0.0000	0.0000	31.3606	131.1030	241.5674	(98a)
Space heating requirement - total per year (kWh/year)												926.1746	
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	231.5822	152.2029	100.7620	32.1749	5.4216	0.0000	0.0000	0.0000	0.0000	31.3606	131.1030	241.5674	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												926.1746	
Space heating per m2											(98c) / (4) =	17.3149	(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													
	231.5822	152.2029	100.7620	32.1749	5.4216	0.0000	0.0000	0.0000	0.0000	31.3606	131.1030	241.5674	(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)													
	250.9017	164.9002	109.1679	34.8590	5.8739	0.0000	0.0000	0.0000	0.0000	33.9768	142.0401	261.7199	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	197.1654	174.4655	185.7588	164.4881	160.1980	145.1799	143.9625	149.2673	150.4317	166.7332	176.0217	195.1820	(64)
Efficiency of water heater												79.8000	(216)
(217)m	84.4215	83.7551	82.7494	81.1455	80.0656	79.8000	79.8000	79.8000	79.8000	81.1013	83.4086	84.5391	(217)
Fuel for water heating, kWh/month													
	233.5487	208.3043	224.4835	202.7076	200.0833	181.9297	180.4041	187.0517	188.5110	205.5864	211.0355	230.8779	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	17.4759	14.0198	12.6233	9.2484	7.1437	5.8365	6.5167	8.4707	11.0026	14.4360	16.3054	17.9616	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-10.2085	-15.4933	-23.9549	-29.0431	-33.2193	-31.7235	-31.3526	-28.6508	-24.2305	-18.6244	-11.6116	-8.7032	(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	-2.8448	-6.1794	-12.6536	-19.5617	-26.4162	-26.7352	-26.4067	-22.0914	-15.8565	-9.0003	-3.8502	-2.2345 (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	1003.4394	(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	2454.5237	(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)	141.0408	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-440.6462	(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	3244.3576	(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	1003.4394	0.2100	210.7223	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2454.5237	0.2100	515.4500	(264)
Space and water heating			726.1723	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	141.0408	0.1443	20.3565	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-266.8156	0.1331	-35.5030	
PV Unit electricity exported	-173.8306	0.1251	-21.7417	
Total			-57.2446	(269)
Total CO2, kg/year			701.2134	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.1100	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1003.4394	1.1300	1133.8865	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2454.5237	1.1300	2773.6118	(278)
Space and water heating			3907.4983	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	141.0408	1.5338	216.3330	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-266.8156	1.4917	-398.0052	
PV Unit electricity exported	-173.8306	0.4591	-79.8001	
Total			-477.8053	(283)
Total Primary energy kWh/year			3776.1268	(286)
Target Primary Energy Rate (TPER)			70.6000	(287)

Full SAP Calculation Printout

Property Reference	GF_Block E2_1Bed	**Issued on Date**	27/03/2025
Assessment Reference	Option 1_EPH+ASHP_P08	**Prop Type Ref**	North West
Property	Chorlton-cum-Hardy, Manchester, Greater Manchester, M21 9AQ		

SAP Rating	94 A	**DER**	2.05	**TER**	11.48
Environmental	99 A	**% DER < TER**			82.14
CO_2 Emissions (t/year)	0.1	**DFEE**	20.33	**TFEE**	22.14
Compliance Check	See BREL	**% DFEE < TFEE**			8.21
% DPER < TPER	65.86	**DPER**	21.02	**TPER**	61.56

Assessor Details	Mr. Leon Maddison	**Assessor ID**	AY03-0001
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)	
Main dwelling						
Ground floor	60.9800	(1b)	x 2.4000	(2b) =	146.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	146.3520	(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) =												74.4000	(23c)
Effective ac	0.2906	0.2874	0.2842	0.2682	0.2651	0.2491	0.2491	0.2459	0.2555	0.2651	0.2714	0.2778	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Glazing			13.4400	1.1450	15.3893			(27)
Heatloss Floor 1			53.4900	0.1100	5.8839	110.0000	5883.9000	(28a)
External Wall 1	24.2200	13.4400	10.7800	0.1500	1.6170	60.0000	646.8000	(29a)
Total net area of external elements Aum(A, m2)			77.7100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		22.8902			(33)
Main dwelling								
Party Wall-between flats			39.4800	0.0000	0.0000	180.0000	7106.3999	(32)
Party Wall-between circ			24.2200	0.0000	0.0000	180.0000	4359.5999	(32)
Party Ceiling 1			53.4900			100.0000	5349.0000	(32b)
Internal Wall 1			119.8900			9.0000	1079.0100	(32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		24424.7097	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							400.5364	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E4 Jamb	16.8000	0.0180	0.3024	
E7 Party floor between dwellings (in blocks of flats)	8.6500	0.0360	0.3114	
E18 Party wall between dwellings	11.2000	0.0320	0.3584	
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	22.7500	0.0000	0.0000	
P1 Party wall - Ground floor	22.7500	0.0420	0.9555	
E5 Ground floor (normal)	8.6500	0.0730	0.6314	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 2.5591 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 25.4494 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	14.0331	13.8791	13.7252	12.9554	12.8015	12.0318	12.0318	11.8778	12.3397	12.8015	13.1094	13.4173	(38)

Heat transfer coeff

	39.4824	39.3285	39.1745	38.4048	38.2509	37.4811	37.4811	37.3272	37.7890	38.2509	38.5588	38.8666	(39)

Average = Sum(39)m / 12 = 38.3663

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6475	0.6449	0.6424	0.6298	0.6273	0.6146	0.6146	0.6121	0.6197	0.6273	0.6323	0.6374	(40)
HLP (average)												0.6292	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0092 (42)
Hot water usage for mixer showers

	57.9073	57.0371	55.7690	53.3427	51.5522	49.5554	48.4204	49.6789	51.0584	53.2024	55.6808	57.6854	(42a)

Hot water usage for baths

	25.0253	24.6536	24.1302	23.1652	22.4426	21.6414	21.2086	21.7283	22.2942	23.1515	24.1364	24.9407	(42b)

Hot water usage for other uses

	35.2062	33.9260	32.6458	31.3656	30.0853	28.8051	28.8051	30.0853	31.3656	32.6458	33.9260	35.2062	(42c)

Average daily hot water use (litres/day) 108.5966 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	118.1388	115.6167	112.5450	107.8735	104.0801	100.0019	98.4341	101.4926	104.7182	108.9997	113.7432	117.8324	(44)
Energy conte	187.1030	164.6366	172.9775	147.6734	140.1118	122.9640	119.0475	125.6690	129.1280	147.9116	162.0481	184.4970	(45)
Energy content (annual)										Total = Sum(45)m =		1803.7676	

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

	28.0655	24.6955	25.9466	22.1510	21.0168	18.4446	17.8571	18.8503	19.3692	22.1867	24.3072	27.6745	(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

	214.0544	188.9798	199.9289	173.7554	167.0632	149.0460	145.9989	152.6204	155.2100	174.8630	188.1301	211.4484	(62)
WWHRS	-40.6594	-35.9595	-37.6547	-31.1796	-29.0583	-24.8654	-23.3073	-24.7850	-25.7267	-30.3289	-34.3590	-39.9064	(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

	173.3950	153.0203	162.2742	142.5758	138.0050	124.1806	122.6916	127.8354	129.4834	144.5341	153.7711	171.5420	(64)
									Total per year (kWh/year) = Sum(64)m =			1743.3085	(64)
12Total per year (kWh/year)												1743	(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

	62.2118	54.7417	57.5150	49.1014	46.5872	40.8855	39.5833	41.7849	42.9351	49.1806	53.8810	61.3452	(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	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	(66)

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

	88.5005	97.9827	88.5005	91.4505	88.5005	91.4505	88.5005	88.5005	91.4505	88.5005	91.4505	88.5005	(67)

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

	175.4116	177.2318	172.6449	162.8799	150.5534	138.9682	131.2286	129.4084	133.9953	143.7602	156.0868	167.6720	(68)

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

	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	(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)

	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	(71)

Water heating gains (Table 5)

	83.6179	81.4608	77.3051	68.1964	62.6172	56.7854	53.2034	56.1625	59.6320	66.1030	74.8347	82.4533	(72)

Total internal gains

	400.6681	409.8134	391.5886	375.6649	354.8091	340.3422	326.0705	327.2094	338.2158	351.5017	375.5100	391.7638	(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	13.4400	36.7938	0.4000	0.7000	0.7700	95.9545	(77)

Solar gains	95.9545	163.4461	223.6341	277.0935	310.3678	308.1234	297.0638	272.2397	242.1484	180.6428	114.9314	82.1171	(83)
Total gains	496.6226	573.2595	615.2226	652.7583	665.1769	648.4655	623.1343	599.4491	580.3642	532.1445	490.4415	473.8809	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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)													
tau	171.8396	172.5122	173.1901	176.6613	177.3722	181.0148	181.0148	181.7613	179.5400	177.3722	175.9559	174.5621	
alpha	12.4560	12.5008	12.5460	12.7774	12.8248	13.0677	13.0677	13.1174	12.9693	12.8248	12.7304	12.6375	
util living area	0.9926	0.9630	0.8839	0.7092	0.5347	0.3699	0.2647	0.2864	0.4493	0.7430	0.9610	0.9952	(86)
MIT	20.7887	20.8970	20.9692	20.9978	20.9999	21.0000	21.0000	21.0000	21.0000	20.9969	20.9178	20.7694	(87)
Th 2	20.3875	20.3897	20.3920	20.4033	20.4055	20.4168	20.4168	20.4191	20.4123	20.4055	20.4010	20.3965	(88)
util rest of house	0.9894	0.9507	0.8575	0.6753	0.5006	0.3362	0.2296	0.2503	0.4110	0.7025	0.9461	0.9930	(89)
MIT 2	20.1532	20.2851	20.3648	20.4017	20.4055	20.4168	20.4168	20.4191	20.4123	20.4035	20.3212	20.1372	(90)
Living area fraction										fLA = Living area / (4) =		0.5089	(91)
MIT	20.4766	20.5965	20.6724	20.7050	20.7080	20.7136	20.7136	20.7147	20.7114	20.7054	20.6248	20.4589	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.4766	20.5965	20.6724	20.7050	20.7080	20.7136	20.7136	20.7147	20.7114	20.7054	20.6248	20.4589	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9900	0.9552	0.8701	0.6925	0.5179	0.3534	0.2474	0.2687	0.4305	0.7230	0.9522	0.9933	(94)
Useful gains	491.6429	547.6054	535.3038	452.0453	344.5266	229.1439	154.1818	161.0555	249.8341	384.7668	466.9746	470.6983	(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	638.6904	617.3181	555.1963	453.3684	344.5627	229.1440	154.1818	161.0555	249.8366	386.5414	521.4982	631.9289	(97)
Space heating kWh	109.4033	46.8469	14.8001	0.9526	0.0268	0.0000	0.0000	0.0000	0.0000	1.3202	39.2570	119.9556	(98a)
Space heating requirement - total per year (kWh/year)												332.5626	
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	109.4033	46.8469	14.8001	0.9526	0.0268	0.0000	0.0000	0.0000	0.0000	1.3202	39.2570	119.9556	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												332.5626	
Space heating per m2											(98c) / (4) =	5.4536	(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	109.4033	46.8469	14.8001	0.9526	0.0268	0.0000	0.0000	0.0000	0.0000	1.3202	39.2570	119.9556	(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)	109.4033	46.8469	14.8001	0.9526	0.0268	0.0000	0.0000	0.0000	0.0000	1.3202	39.2570	119.9556	(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	173.3950	153.0203	162.2742	142.5758	138.0050	124.1806	122.6916	127.8354	129.4834	144.5341	153.7711	171.5420	(64)
Efficiency of water heater												346.7511	(216)
(217)m	346.7511	346.7511	346.7511	346.7511	346.7511	346.7511	346.7511	346.7511	346.7511	346.7511	346.7511	346.7511	(217)
Fuel for water heating, kWh/month	50.0056	44.1297	46.7985	41.1176	39.7994	35.8126	35.3832	36.8666	37.3419	41.6824	44.3463	49.4712	(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	8.2798	7.4785	8.2798	8.0127	8.2798	8.0127	8.2798	8.2798	8.0127	8.2798	8.0127	8.2798	(231)
Lighting	21.6179	17.3426	15.6151	11.4403	8.8368	7.2198	8.0612	10.4783	13.6103	17.8574	20.1699	22.2187	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-7.9915	-13.7498	-24.3350	-32.8120	-39.9252	-38.9584	-38.1831	-33.4724	-25.8662	-17.2818	-9.3870	-6.5578	(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	332.5626	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	346.7511	
Water heating fuel used	502.7551	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.5460)		
mechanical ventilation fans (SFP = 0.5460)	97.4880	(230a)
Total electricity for the above, kWh/year	97.4880	(231)
Electricity for lighting (calculated in Appendix L)	174.4684	(232)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-288.5202	(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	818.7538	(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	332.5626	0.1605	53.3925	(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)	502.7551	0.1409	70.8439	(264)
Space and water heating			124.2364	(265)
Pumps, fans and electric keep-hot	97.4880	0.1387	13.5228	(267)
Energy for lighting	174.4684	0.1443	25.1812	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-288.5202	0.1312	-37.8427	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-37.8427	(269)
Total CO2, kg/year			125.0977	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.0500	(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	332.5626	1.5941	530.1520	(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)	502.7551	1.5210	764.7102	(278)
Space and water heating			1294.8622	(279)
Pumps, fans and electric keep-hot	97.4880	1.5128	147.4798	(281)
Energy for lighting	174.4684	1.5338	267.6055	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-288.5202	1.4846	-428.3236	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-428.3236	(283)
Total Primary energy kWh/year			1281.6239	(286)
Dwelling Primary energy Rate (DPER)			21.0200	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	60.9800	(1b) x	2.4000	(2b) =	146.3520	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	60.9800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		146.3520	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1367	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3867	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3287	(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													

	0.4190	0.4108	0.4026	0.3615	0.3533	0.3122	0.3122	0.3040	0.3287	0.3533	0.3697	0.3862	(22b)
Effective ac	0.5878	0.5844	0.5810	0.5653	0.5624	0.5487	0.5487	0.5462	0.5540	0.5624	0.5684	0.5746	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
TER Opening Type			13.4400	1.1450	15.3893			(27)
Heatloss Floor 1			53.4900	0.1300	6.9537			(28a)
External Wall 1	24.2200	13.4400	10.7800	0.1800	1.9404			(29a)
Total net area of external elements Aum(A, m2)			77.7100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		24.2834			(33)
Main dwelling								
Party Wall-between flats			39.4800	0.0000	0.0000			(32)
Party Wall-between circ			24.2200	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 382.9929 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E4 Jamb	16.8000	0.0500	0.8400
E7 Party floor between dwellings (in blocks of flats)	8.6500	0.0700	0.6055
E18 Party wall between dwellings	11.2000	0.0600	0.6720
P3 Party wall - Intermediate floor between dwellings (in blocks of flats)	22.7500	0.0000	0.0000
P1 Party wall - Ground floor	22.7500	0.0800	1.8200
E5 Ground floor (normal)	8.6500	0.1600	1.3840

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.3215 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 29.6049 (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	28.3883	28.2237	28.0623	27.3042	27.1624	26.5021	26.5021	26.3799	26.7565	27.1624	27.4493	27.7493	(38)
Heat transfer coeff	57.9933	57.8286	57.6672	56.9091	56.7673	56.1071	56.1071	55.9848	56.3614	56.7673	57.0542	57.3542	(39)

Average = Sum(39)m / 12 = 56.9085

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9510	0.9483	0.9457	0.9332	0.9309	0.9201	0.9201	0.9181	0.9243	0.9309	0.9356	0.9405	(40)
HLP (average)												0.9332	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0092 (42)

Hot water usage for mixer showers

57.9073	57.0371	55.7690	53.3427	51.5522	49.5554	48.4204	49.6789	51.0584	53.2024	55.6808	57.6854	(42a)

Hot water usage for baths

25.0253	24.6536	24.1302	23.1652	22.4426	21.6414	21.2086	21.7283	22.2942	23.1515	24.1364	24.9407	(42b)

Hot water usage for other uses

35.2062	33.9260	32.6458	31.3656	30.0853	28.8051	28.8051	30.0853	31.3656	32.6458	33.9260	35.2062	(42c)

Average daily hot water use (litres/day) 108.5966 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	118.1388	115.6167	112.5450	107.8735	104.0801	100.0019	98.4341	101.4926	104.7182	108.9997	113.7432	117.8324	(44)
Energy conte	187.1030	164.6366	172.9775	147.6734	140.1118	122.9640	119.0475	125.6690	129.1280	147.9116	162.0481	184.4970	(45)
Energy content (annual)										Total = Sum(45)m =		1803.7676	
Distribution loss (46)m = 0.15 x (45)m	28.0655	24.6955	25.9466	22.1510	21.0168	18.4446	17.8571	18.8503	19.3692	22.1867	24.3072	27.6745	(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	233.6979	206.7224	219.5724	192.7652	186.7068	168.0558	165.6424	172.2639	174.2199	194.5065	207.1399	231.0919	(62)
WWHRS	-26.4728	-23.4128	-24.5165	-20.3006	-18.9195	-16.1895	-15.1751	-16.1372	-16.7503	-19.7468	-22.3707	-25.9826	(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	207.2251	183.3096	195.0559	172.4646	167.7873	151.8663	150.4673	156.1267	157.4696	174.7598	184.7693	205.1093	(64)
										Total per year (kWh/year) = Sum(64)m =		2106.4107	(64)
12Total per year (kWh/year)												2106	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	99.4877	88.4103	94.7909	85.1749	83.8631	76.9590	76.8592	79.0609	79.0085	86.4565	89.9545	98.6212	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	100.4602	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	88.5005	97.9827	88.5005	91.4505	88.5005	91.4505	88.5005	88.5005	91.4505	88.5005	91.4505	88.5005	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.4116	177.2318	172.6449	162.8799	150.5534	138.9682	131.2286	129.4084	133.9953	143.7602	156.0868	167.6720	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	33.0460	(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)	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	-80.3681	(71)
Water heating gains (Table 5)													

	133.7200	131.5629	127.4072	118.2984	112.7192	106.8875	103.3054	106.2646	109.7341	116.2050	124.9368	132.5553 (72)
Total internal gains	453.7701	462.9154	444.6906	428.7669	407.9112	390.4442	376.1725	377.3115	388.3179	404.6038	428.6121	444.8658 (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	13.4400	36.7938	0.6300	0.7000	0.7700	151.1284 (77)

Solar gains	151.1284	257.4276	352.2237	436.4222	488.8292	485.2943	467.8755	428.7775	381.3837	284.5123	181.0170	129.3344 (83)
Total gains	604.8985	720.3430	796.9143	865.1891	896.7404	875.7385	844.0480	806.0890	769.7016	689.1161	609.6291	574.2003 (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	111.8660	112.1845	112.4985	113.9971	114.2819	115.6267	115.6267	115.8792	115.1050	114.2819	113.7072	113.1125	
alpha	8.4577	8.4790	8.4999	8.5998	8.6188	8.7084	8.7084	8.7253	8.6737	8.6188	8.5805	8.5408	
util living area	0.9929	0.9718	0.9149	0.7702	0.5862	0.4099	0.2925	0.3195	0.5046	0.8149	0.9737	0.9951	(86)
MIT	20.5328	20.7066	20.8640	20.9717	20.9971	20.9999	21.0000	21.0000	20.9993	20.9633	20.7462	20.5013	(87)
Th 2	20.1243	20.1266	20.1289	20.1393	20.1413	20.1505	20.1505	20.1522	20.1469	20.1413	20.1373	20.1332	(88)
util rest of house	0.9898	0.9610	0.8884	0.7241	0.5332	0.3556	0.2360	0.2606	0.4426	0.7626	0.9616	0.9929	(89)
MIT 2	19.6045	19.8198	20.0018	20.1179	20.1397	20.1504	20.1505	20.1522	20.1467	20.1149	19.8799	19.5723	(90)
Living area fraction										fLA = Living area / (4) =		0.5089	(91)
MIT	20.0769	20.2710	20.4405	20.5524	20.5760	20.5827	20.5827	20.5836	20.5806	20.5466	20.3207	20.0450	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0769	20.2710	20.4405	20.5524	20.5760	20.5827	20.5827	20.5836	20.5806	20.5466	20.3207	20.0450	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9896	0.9631	0.8986	0.7467	0.5602	0.3832	0.2647	0.2906	0.4741	0.7882	0.9645	0.9926	(94)
Useful gains	598.5819	693.7443	716.1091	646.0750	502.3239	335.6213	223.4588	234.2134	364.9540	543.1648	588.0074	569.9582	(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	914.9543	888.8841	803.9092	663.1259	503.8651	335.6702	223.4603	234.2168	365.2529	564.6435	754.2984	908.7797	(97)
Space heating kWh	235.3811	131.1340	65.3232	12.2767	1.1467	0.0000	0.0000	0.0000	0.0000	15.9802	119.7296	252.0832	(98a)
Space heating requirement - total per year (kWh/year)												833.0546	
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	235.3811	131.1340	65.3232	12.2767	1.1467	0.0000	0.0000	0.0000	0.0000	15.9802	119.7296	252.0832	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												833.0546	
Space heating per m2											(98c) / (4) =	13.6611	(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	235.3811	131.1340	65.3232	12.2767	1.1467	0.0000	0.0000	0.0000	0.0000	15.9802	119.7296	252.0832	(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)	255.0174	142.0736	70.7727	13.3008	1.2423	0.0000	0.0000	0.0000	0.0000	17.3133	129.7179	273.1129	(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	207.2251	183.3096	195.0559	172.4646	167.7873	151.8663	150.4673	156.1267	157.4696	174.7598	184.7693	205.1093	(64)
Efficiency of water heater												79.8000	(216)
(217)m	84.3462	83.3218	81.8820	80.3411	79.8549	79.8000	79.8000	79.8000	79.8000	80.4834	83.1121	84.5234	(217)
Fuel for water heating, kWh/month	245.6840	220.0021	238.2158	214.6655	210.1151	190.3086	188.5556	195.6475	197.3303	217.1376	222.3132	242.6658	(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	18.3887	14.7521	13.2826	9.7314	7.5168	6.1413	6.8571	8.9131	11.5772	15.1900	17.1570	18.8997	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-11.5931	-17.5716	-27.1333	-32.8519	-37.5324	-35.8206	-35.3922	-32.3556	-27.3920	-21.0933	-13.1755	-9.8855	(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	-3.2880	-7.1359	-14.6013	-22.5589	-30.4536	-30.8238	-30.4549	-25.4919	-18.3083	-10.3996	-4.4514	-2.5837	(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	902.5510	(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	2582.6411	(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)	148.4070	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-502.3482	(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	3217.2509	(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	902.5510	0.2100	189.5357	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2582.6411	0.2100	542.3546	(264)
Space and water heating			731.8903	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	148.4070	0.1443	21.4197	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-301.7969	0.1331	-40.1668	
PV Unit electricity exported	-200.5513	0.1251	-25.0858	
Total			-65.2526	(269)
Total CO2, kg/year			699.9867	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.4800	(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	902.5510	1.1300	1019.8826	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2582.6411	1.1300	2918.3844	(278)
Space and water heating			3938.2671	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	148.4070	1.5338	227.6316	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-301.7969	1.4918	-450.2207	
PV Unit electricity exported	-200.5513	0.4591	-92.0742	
Total			-542.2949	(283)
Total Primary energy kWh/year			3753.7045	(286)
Target Primary Energy Rate (TPER)			61.5600	(287)

APPENDIX 2: DSM BRUKL Compliance Report: Non-Commercial Areas

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Chorlton Precinct_Retail

As designed

Date: Wed Mar 05 14:43:26 2025

Administrative information

Building Details

Address: Chorlton-Cum-Hardy, Manchester, M21 9AQ

Certifier details

Name: BWB

Telephone number:

Address: Whitehall Waterfront, Leeds, LS1 4AW

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.26

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.26

BRUKL compliance module version: v6.1.e.1

Foundation area [m²]: 1038.39

The CO_2 emission and primary energy rates of the building must not exceed the targets

Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	4.52	
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	2.32	
Target primary energy rate (TPER), kWh_{PE}/m^2.annum	49.23	
Building primary energy rate (BPER), kWh_{PE}/m^2.annum	24.3	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.15	0.15	00000046:Surf[2]
Floors	0.18	0.11	0.11	00000046:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.11	0.11	00000046:Surf[1]
Windows** and roof windows	1.6	1.2	1.2	00000046:Surf[4]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	-	-	No personnel doors in building
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m²K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	3

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- 001_ASHP (VRF)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.4	5.1	0	1.5	0.85
Standard value	2.5*	N/A	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

1- 007_Instantaneous Electric DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

General lighting and display lighting	**General luminaire**	**Display light source**	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
00_GF_Block ABC_Commercial Unit 2A	120	120	1.25
00_GF_Block ABC_Commercial Unit 2B	120	120	1.25
00_GF_Block ABC_Commercial Unit 2C	120	120	1.25
00_GF_Block E_Commercial Unit 1	120	120	1.25
00_GF_Block F_Commercial Unit 5	120	120	1.25
00_GF_Block F_Commercial Unit 4	120	120	1.25
00_GF_Block F_Commercial Unit 6A	120	120	1.25
00_GF_Block F_Commercial Unit 6C	120	120	1.25
00_GF_Block F_Commercial Unit 6B	120	120	1.25
00_GF_Block ABC_Commercial Unit 3A & 3B	120	120	1.25

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
00_GF_Block ABC_Commercial Unit 2A	NO (-22.2%)	NO
00_GF_Block ABC_Commercial Unit 2B	NO (-2.4%)	NO
00_GF_Block ABC_Commercial Unit 2C	NO (-25.4%)	NO
00_GF_Block E_Commercial Unit 1	N/A	N/A
00_GF_Block F_Commercial Unit 5	NO (-8.7%)	NO
00_GF_Block F_Commercial Unit 4	NO (-14.9%)	NO
00_GF_Block F_Commercial Unit 6A	NO (-70.1%)	NO
00_GF_Block F_Commercial Unit 6C	NO (-50%)	NO
00_GF_Block F_Commercial Unit 6B	NO (-40.5%)	NO
00_GF_Block ABC_Commercial Unit 3A & 3B	NO (-40.4%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	1038.4	1038.4
External area [m^2]	1305.3	1305.3
Weather	MAN	MAN
Infiltration [m^3/hm^2@ 50Pa]	3	3
Average conductance [W/K]	356.91	479.52
Average U-value [W/m^2K]	0.27	0.37
Alpha value* [%]	25	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
100	**Retail/Financial and Professional Services**
	Restaurants and Cafes/Drinking Establishments/Takeaways
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger Terminals
	Others: Emergency Services
	Others: Miscellaneous 24hr Activities
	Others: Car Parks 24 hrs
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	1.82	2.63
Cooling	2.45	2.52
Auxiliary	6.69	10.06
Lighting	14.78	16.52
Hot water	1.7	1.61
Equipment*	20.26	20.26
TOTAL**	**27.43**	**33.35**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	11.72	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*11.72*	*0*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	52.47	68.45
Primary energy [kWh_{PE}/m^2]	24.3	49.23
Total emissions [kg/m^2]	2.32	4.52

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	22	30.4	1.8	2.4	6.7	3.37	3.45	3.4	5.1
	Notional	26.4	42.1	2.6	2.5	10.1	2.78	4.63	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

APPENDIX 3: DSM BRUKL Compliance Report: Transient Areas

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Chorlton Precinct_Plant & Flat Transient Areas

As designed

Date: Tue Mar 04 14:46:43 2025

Administrative information

Building Details

Address: Chorlton-Cum-Hardy, Manchester, M21 9AQ

Certifier details

Name: BWB

Telephone number:

Address: Whitehall Waterfront, Leeds, LS1 4AW

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.26

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.26

BRUKL compliance module version: v6.1.e.1

Foundation area [m^2]: 551.56

The CO_2 emission and primary energy rates of the building must not exceed the targets

Target CO_2 emission rate (TER), $kgCO_2/m^2$annum	6.1	
Building CO_2 emission rate (BER), $kgCO_2/m^2$annum	5	
Target primary energy rate (TPER), kWh_{PE}/m^2annum	65.99	
Building primary energy rate (BPER), kWh_{PE}/m^2annum	54.09	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.15	0.15	00000056:Surf[2]
Floors	0.18	0.11	0.11	00000056:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.11	0.11	00000056:Surf[1]
Windows** and roof windows	1.6	1.2	1.2	0000005F:Surf[1]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	-	-	No personnel doors in building
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m^2K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	3

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- 002_EPH (Natural)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.67	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

2- 004_DX Split System

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.4	5.1	-	-	-
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

3- 001_ASHP (VRF)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.4	5.1	0	1.5	0.85
Standard value	2.5*	N/A	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. ^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.					

4- 003_EPH (Extract)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	-	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

1- 005_Electric DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	3.4	-
Standard value	2*	N/A
* Standard shown is for all types except absorption and gas engine heat pumps.		

2- 006_Instantaneous Electric DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

Zone-level mechanical ventilation, exhaust, and terminal units

ID	System type in the Approved Documents
A	Local supply or extract ventilation units
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter
NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.	

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
00_GF_Block ABC_Acc WC	0.3	-	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
00_GF_Block ABC_Car Park Extract Plant Room	95	-	-
00_GF_Block ABC_Central Block ABC Refuse Room & Collection	95	-	-
00_GF_Block ABC_Circulation	110	-	-
00_GF_Block ABC_Circulation	110	-	-
00_GF_Block ABC_Circulation	110	-	-
00_GF_Block ABC_Circulation	110	-	-
00_GF_Block ABC_Circulation	110	-	-
00_GF_Block ABC_Circulation	110	-	-
00_GF_Block ABC_Circulation	110	-	-
00_GF_Block ABC_Circulation	110	-	-
00_GF_Block ABC_Circulation	110	-	-
00_GF_Block ABC_Circulation	110	-	-
00_GF_Block ABC_Comms Room/Comms Intake Room	95	-	-
00_GF_Block ABC_Cycle Store	95	-	-
00_GF_Block ABC_Cycle Store	95	-	-
00_GF_Block ABC_Cycle Store	95	-	-
00_GF_Block ABC_Draught Lobby	110	-	-
00_GF_Block ABC_Entrance and Amenity Space	110	-	-
00_GF_Block ABC_Entrance Lobby	110	-	-
00_GF_Block ABC_Entrance Lobby	110	-	-
00_GF_Block ABC_Flat transient areas	110	-	-
00_GF_Block ABC_Flat transient areas	110	-	-
00_GF_Block ABC_Generator Room	95	-	-
00_GF_Block ABC_Life Safety Switch Room	95	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
00_GF_Block ABC_Lift	95	-	-
00_GF_Block ABC_Lift	95	-	-
00_GF_Block ABC_Lift	95	-	-
00_GF_Block ABC_Main LV Switchroom	95	-	-
00_GF_Block ABC_Parcel Delivery Room	95	-	-
00_GF_Block ABC_Refuse Drop Room	95	-	-
00_GF_Block ABC_Refuse Drop Room	95	-	-
00_GF_Block ABC_Refuse Drop Room	95	-	-
00_GF_Block ABC_Riser Room	95	-	-
00_GF_Block ABC_Riser Room	95	-	-
00_GF_Block ABC_Riser Room	95	-	-
00_GF_Block ABC_Riser Room	95	-	-
00_GF_Block ABC_Stairs	110	-	-
00_GF_Block ABC_Stairs	110	-	-
00_GF_Block ABC_Stairs	110	-	-
00_GF_Block ABC_Stairs	110	-	-
00_GF_Block ABC_Stairs	110	-	-
00_GF_Block ABC_Stairs	110	-	-
00_GF_Block ABC_Store	95	-	-
00_GF_Block ABC_Substation East	95	-	-
00_GF_Block D_Amenity Space	110	-	-
00_GF_Block D_Circulation	110	-	-
00_GF_Block D_Circulation	110	-	-
00_GF_Block D_Circulation	110	-	-
00_GF_Block D_Comms Room	95	-	-
00_GF_Block D_Cycle Store	95	-	-
00_GF_Block D_Domestic Water Storage & Booster	95	-	-
00_GF_Block D_Flat transient areas	110	-	-
00_GF_Block D_Generator Room	95	-	-
00_GF_Block D_Life Safety Switchroom	95	-	-
00_GF_Block D_Lift	95	-	-
00_GF_Block D_Main LV Switchroom	95	-	-
00_GF_Block D_Refuse Room	95	-	-
00_GF_Block D_Resi Sprinkler Storage & Pumpset	95	-	-
00_GF_Block D_Risers & Smoke Shaft	95	-	-
00_GF_Block D_Stairs	110	-	-
00_GF_Block D_Stairs	110	-	-
00_GF_Block D_Store	95	-	-
00_GF_Block E_Circulation	110	-	-
00_GF_Block E_Comms room	95	-	-
00_GF_Block E_Cycle Store	95	-	-
00_GF_Block E_Domestic Water Storage & Booster	95	-	-
00_GF_Block E_Entrance Lobby	110	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
00_GF_Block E_Flat transient space	110	-	-
00_GF_Block E_Generator Room	95	-	-
00_GF_Block E_Life Safety Switch Room	95	-	-
00_GF_Block E_Lift	95	-	-
00_GF_Block E_Main LV Switchroom	95	-	-
00_GF_Block E_Resi Refuse Room	95	-	-
00_GF_Block E_Resi Sprinkler Storage & Pumpsets	95	-	-
00_GF_Block E_Stairs	110	-	-
00_GF_Block E_Stairs	110	-	-
00_GF_Block F_Circulation	110	-	-
00_GF_Block F_Comms Room	95	-	-
00_GF_Block F_Cycle Store	95	-	-
00_GF_Block F_Domestic Water Storage & Booster	95	-	-
00_GF_Block F_Entrance Lobby	110	-	-
00_GF_Block F_Lift	95	-	-
00_GF_Block F_Main LV Switchroom	95	-	-
00_GF_Block F_Refuse Room	95	-	-
00_GF_Block F_Stairs	110	-	-
01_1F_Block A_Flat Amenity area	110	-	-
01_1F_Block A_Flat Circulation	110	-	-
01_1F_Block A_Flat Circulation	110	-	-
01_1F_Block A_Flat Circulation	110	-	-
01_1F_Block A_Lift	95	-	-
01_1F_Block A_Lift	95	-	-
01_1F_Block A_Stairs	110	-	-
01_1F_Block A_Stairs	110	-	-
01_1F_Block A_Stairs	110	-	-
01_1F_Block A_Store	95	-	-
01_1F_Block A_Store	95	-	-
01_1F_Block B_Flat Circulation	110	-	-
01_1F_Block B_Stairs	110	-	-
01_1F_Block C_Circulation	110	-	-
01_1F_Block C_Circulation	110	-	-
01_1F_Block C_Lift	95	-	-
01_1F_Block C_Stairs	110	-	-
01_1F_Block C_Stairs	110	-	-
01_1F_Block D_Flat Circulation	110	-	-
01_1F_Block D_Flat Circulation	110	-	-
01_1F_Block D_Lift	95	-	-
01_1F_Block D_Stairs	110	-	-
01_1F_Block D_Stairs	110	-	-
01_1F_Block D_Store/Riser	95	-	-
01_1F_Block E_Flat Circulation	110	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
01_1F_Block E_Flat Circulation	110	-	-
01_1F_Block E_Lift	95	-	-
01_1F_Block E_Stairs	110	-	-
01_1F_Block E_Stairs	110	-	-
01_1F_Block F_Flat Circulation	110	-	-
01_1F_Block F_Lift	95	-	-
01_1F_Block F_Stairs	110	-	-
01_1F_Block F_Store/Riser	95	-	-
-1_Basement_Block A/B_Circulation	110	-	-
-1_Basement_Block A/B_Circulation	110	-	-
-1_Basement_Block A/B_Circulation	110	-	-
-1_Basement_Block A/B_Circulation	110	-	-
-1_Basement_Block A/B_Circulation	110	-	-
-1_Basement_Block A/B_Commercial Sprinkler Tanks & Pumps	95	-	-
-1_Basement_Block A/B_Cycle Store	95	-	-
-1_Basement_Block A/B_Domestic Water Storage & Booster	95	-	-
-1_Basement_Block A/B_Lift	95	-	-
-1_Basement_Block A/B_Lift	95	-	-
-1_Basement_Block A/B_Resi Sprinkler Storage & Pumpsets	95	-	-
-1_Basement_Block A/B_Stairs	110	-	-
-1_Basement_Block A/B_Stairs	110	-	-
-1_Basement_Block A/B_Stairs	110	-	-
-1_Basement_Block A/B_Stairs	110	-	-
-1_Basement_Block A/B_Store	95	-	-
-1_Basement_Block A/B_Store	95	-	-
02_2F_Block A_Flat Circulation	110	-	-
02_2F_Block A_Flat Circulation	110	-	-
02_2F_Block A_Flat Circulation	110	-	-
02_2F_Block A_Lift	95	-	-
02_2F_Block A_Lift	95	-	-
02_2F_Block A_Stairs	110	-	-
02_2F_Block A_Stairs	110	-	-
02_2F_Block A_Stairs	110	-	-
02_2F_Block A_Store	95	-	-
02_2F_Block A_Store	95	-	-
02_2F_Block B_Flat Circulation	110	-	-
02_2F_Block B_Stairs	110	-	-
02_2F_Block C_Circulation	110	-	-
02_2F_Block C_Circulation	110	-	-
02_2F_Block C_Lift	95	-	-
02_2F_Block C_Stairs	110	-	-
02_2F_Block C_Stairs	110	-	-
02_2F_Block D_Flat Circulation	110	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
02_2F_Block D_Flat Circulation	110	-	-
02_2F_Block D_Lift	95	-	-
02_2F_Block D_Stairs	110	-	-
02_2F_Block D_Stairs	110	-	-
02_2F_Block D_Store/Riser	95	-	-
02_2F_Block E_Flat Circulation	110	-	-
02_2F_Block E_Flat Circulation	110	-	-
02_2F_Block E_Lift	95	-	-
02_2F_Block E_Stairs	110	-	-
02_2F_Block E_Stairs	110	-	-
02_2F_Block F_Flat Circulation	110	-	-
02_2F_Block F_Lift	95	-	-
02_2F_Block F_Stairs	110	-	-
02_2F_Block F_Store/Riser	95	-	-
03_3F_Block A_Flat Circulation	110	-	-
03_3F_Block A_Flat Circulation	110	-	-
03_3F_Block A_Flat Circulation	110	-	-
03_3F_Block A_Lift	95	-	-
03_3F_Block A_Lift	95	-	-
03_3F_Block A_Stairs	110	-	-
03_3F_Block A_Stairs	110	-	-
03_3F_Block A_Stairs	110	-	-
03_3F_Block A_Store	95	-	-
03_3F_Block A_Store	95	-	-
03_3F_Block B_Flat Circulation	110	-	-
03_3F_Block B_Stairs	110	-	-
03_3F_Block C_Circulation	110	-	-
03_3F_Block C_Circulation	110	-	-
03_3F_Block C_Lift	95	-	-
03_3F_Block C_Stairs	110	-	-
03_3F_Block C_Stairs	110	-	-
03_3F_Block D_Flat Circulation	110	-	-
03_3F_Block D_Flat Circulation	110	-	-
03_3F_Block D_Lift	95	-	-
03_3F_Block D_Stairs	110	-	-
03_3F_Block D_Stairs	110	-	-
03_3F_Block D_Store/Riser	95	-	-
03_3F_Block E_Flat Circulation	110	-	-
03_3F_Block E_Flat Circulation	110	-	-
03_3F_Block E_Lift	95	-	-
03_3F_Block E_Stairs	110	-	-
03_3F_Block E_Stairs	110	-	-
03_3F_Block F_Flat Circulation	110	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
03_3F_Block F_Lift	95	-	-
03_3F_Block F_Stairs	110	-	-
03_3F_Block F_Store/Riser	95	-	-
04_4F_Block A_Flat Circulation	110	-	-
04_4F_Block A_Flat Circulation	110	-	-
04_4F_Block A_Flat Circulation	110	-	-
04_4F_Block A_Lift	95	-	-
04_4F_Block A_Lift	95	-	-
04_4F_Block A_Stairs	110	-	-
04_4F_Block A_Stairs	110	-	-
04_4F_Block A_Stairs	110	-	-
04_4F_Block A_Store	95	-	-
04_4F_Block A_Store	95	-	-
04_4F_Block B_Flat Circulation	110	-	-
04_4F_Block B_Stairs	110	-	-
04_4F_Block C_Circulation	110	-	-
04_4F_Block C_Circulation	110	-	-
04_4F_Block C_Lift	95	-	-
04_4F_Block C_Stairs	110	-	-
04_4F_Block C_Stairs	110	-	-
04_4F_Block D_Flat Circulation	110	-	-
04_4F_Block D_Flat Circulation	110	-	-
04_4F_Block D_Lift	95	-	-
04_4F_Block D_Stairs	110	-	-
04_4F_Block D_Stairs	110	-	-
04_4F_Block D_Store/Riser	95	-	-
04_4F_Block E_Flat Circulation	110	-	-
04_4F_Block E_Flat Circulation	110	-	-
04_4F_Block E_Lift	95	-	-
04_4F_Block E_Stairs	110	-	-
04_4F_Block E_Stairs	110	-	-
05_5F_Block A_Flat Circulation	110	-	-
05_5F_Block A_Flat Circulation	110	-	-
05_5F_Block A_Flat Circulation	110	-	-
05_5F_Block A_Lift	95	-	-
05_5F_Block A_Lift	95	-	-
05_5F_Block A_Stairs	110	-	-
05_5F_Block A_Stairs	110	-	-
05_5F_Block A_Stairs	110	-	-
05_5F_Block A_Store	95	-	-
05_5F_Block A_Store	95	-	-
05_5F_Block B_Flat Circulation	110	-	-
05_5F_Block B_Stairs	110	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
05_5F_Block C_Circulation	110	-	-
05_5F_Block C_Circulation	110	-	-
05_5F_Block C_Lift	95	-	-
05_5F_Block C_Stairs	110	-	-
05_5F_Block C_Stairs	110	-	-
05_5F_Block D_Flat Circulation	110	-	-
05_5F_Block D_Flat Circulation	110	-	-
05_5F_Block D_Lift	95	-	-
05_5F_Block D_Stairs	110	-	-
05_5F_Block D_Stairs	110	-	-
05_5F_Block D_Store/Riser	95	-	-
05_5F_Block E_Flat Circulation	110	-	-
05_5F_Block E_Flat Circulation	110	-	-
05_5F_Block E_Lift	95	-	-
05_5F_Block E_Stairs	110	-	-
05_5F_Block E_Stairs	110	-	-
06_6F_Block A_Flat Circulation	110	-	-
06_6F_Block A_Flat Circulation	110	-	-
06_6F_Block A_Flat Circulation	110	-	-
06_6F_Block A_Lift	95	-	-
06_6F_Block A_Lift	95	-	-
06_6F_Block A_Stairs	110	-	-
06_6F_Block A_Stairs	110	-	-
06_6F_Block A_Stairs	110	-	-
06_6F_Block A_Store	95	-	-
06_6F_Block A_Store	95	-	-
06_6F_Block B_Flat Circulation	110	-	-
06_6F_Block B_Stairs	110	-	-
06_6F_Block C_Circulation	110	-	-
06_6F_Block C_Circulation	110	-	-
06_6F_Block C_Lift	95	-	-
06_6F_Block C_Stairs	110	-	-
06_6F_Block C_Stairs	110	-	-
07_7F_Block A_Flat Circulation	110	-	-
07_7F_Block A_Flat Circulation	110	-	-
07_7F_Block A_Flat Circulation	110	-	-
07_7F_Block A_Lift	95	-	-
07_7F_Block A_Lift	95	-	-
07_7F_Block A_Stairs	110	-	-
07_7F_Block A_Stairs	110	-	-
07_7F_Block A_Stairs	110	-	-
07_7F_Block A_Store	95	-	-
07_7F_Block A_Store	95	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
07_7F_Block B_Flat Circulation	110	-	-
07_7F_Block B_Stairs	110	-	-
08_8F_Block A_Flat Circulation	110	-	-
08_8F_Block A_Flat Circulation	110	-	-
08_8F_Block A_Flat Circulation	110	-	-
08_8F_Block A_Lift	95	-	-
08_8F_Block A_Lift	95	-	-
08_8F_Block A_Stairs	110	-	-
08_8F_Block A_Stairs	110	-	-
08_8F_Block A_Stairs	110	-	-
08_8F_Block A_Store	95	-	-
08_8F_Block A_Store	95	-	-
09_9F_Block A_Flat Circulation	110	-	-
09_9F_Block A_Flat Circulation	110	-	-
09_9F_Block A_Flat Circulation	110	-	-
09_9F_Block A_Flat Circulation	110	-	-
09_9F_Block A_Lift	95	-	-
09_9F_Block A_Lift	95	-	-
09_9F_Block A_Stairs	110	-	-
09_9F_Block A_Stairs	110	-	-
09_9F_Block A_Stairs	110	-	-
09_9F_Block A_Store	95	-	-
09_9F_Block A_Store	95	-	-
00_GF_Block ABC_Acc WC	110	-	-
00_GF_Block ABC_Commercial Refuse Room	95	-	-
00_GF_Block ABC_Office	110	-	-
00_GF_Block E_Retail Refuse Room	95	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
00_GF_Block ABC_Comms Room/Comms Intake Room	N/A	N/A
00_GF_Block ABC_Entrance and Amenity Space	NO (-35.9%)	NO
00_GF_Block D_Amenity Space	N/A	N/A
00_GF_Block D_Comms Room	N/A	N/A
00_GF_Block E_Comms room	N/A	N/A
00_GF_Block F_Comms Room	NO (-9.1%)	NO
01_1F_Block A_Flat Amenity area	N/A	N/A
00_GF_Block ABC_Office	NO (-69.1%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	8059.6	8059.6
External area [m^2]	5657.5	5657.5
Weather	MAN	MAN
Infiltration [m^3/hm^2@ 50Pa]	3	3
Average conductance [W/K]	935.62	1853.19
Average U-value [W/m^2K]	0.17	0.33
Alpha value* [%]	25.03	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
24	**Retail/Financial and Professional Services**
	Restaurants and Cafes/Drinking Establishments/Takeaways
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
76	**Residential Spaces**
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger Terminals
	Others: Emergency Services
	Others: Miscellaneous 24hr Activities
	Others: Car Parks 24 hrs
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	1.57	3.23
Cooling	0.94	0.12
Auxiliary	0.07	0.49
Lighting	6.41	9.17
Hot water	29.08	33.74
Equipment*	32.56	32.56
TOTAL**	**38.07**	**46.75**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	2.46	2.17
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*2.46*	*2.17*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	16.83	18.85
Primary energy [kWh_{PE}/m^2]	54.09	65.99
Total emissions [kg/m^2]	5	6.1

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	0.1	180	0	14.1	1.1	3.5	3.56	3.4	5.1
	Notional	12.4	30.8	1.2	1.8	3.7	2.78	4.63	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	7	0	2.3	0	0	0.84	0	1	0
	Notional	23.4	0	4.6	0	0	1.41	0	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	0	0	0	0	1.7	0.84	0	1	0
	Notional	0	0	0	0	2.2	1.41	0	----	----
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	0	0	0	0	0	3.33	3.81	3.4	5.1
	Notional	0	0	0	0	0	2.78	4.63	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

APPENDIX 4: CIBSE TM59 / PART O Overheating Results

BWB Consulting
TM59 Overheating Risk Assessment - 233048_Chorlton Precint

Project Name	Chorton Precinct
Project Number	233048
Weather Location	Manchester_DSY1_2020High50
Status	S2
Revision	P01
Guide Standard	TM59 Overheating Risk Assessment
Ventilation Strategy Tested	Natural Ventilation with MVHR
Date	11-Dec-24
IES Modeller/Consultant	Ariana Beepath MSc BASc (Hons)
Checked	Laurence Earnshaw MSc BA(Hons)

CIBSE TM59 Overheating Risk Assessment Thermal Model - (IES VE > ModelIT, SunCast, MacroFlo, & Apache) Input and Result Summary

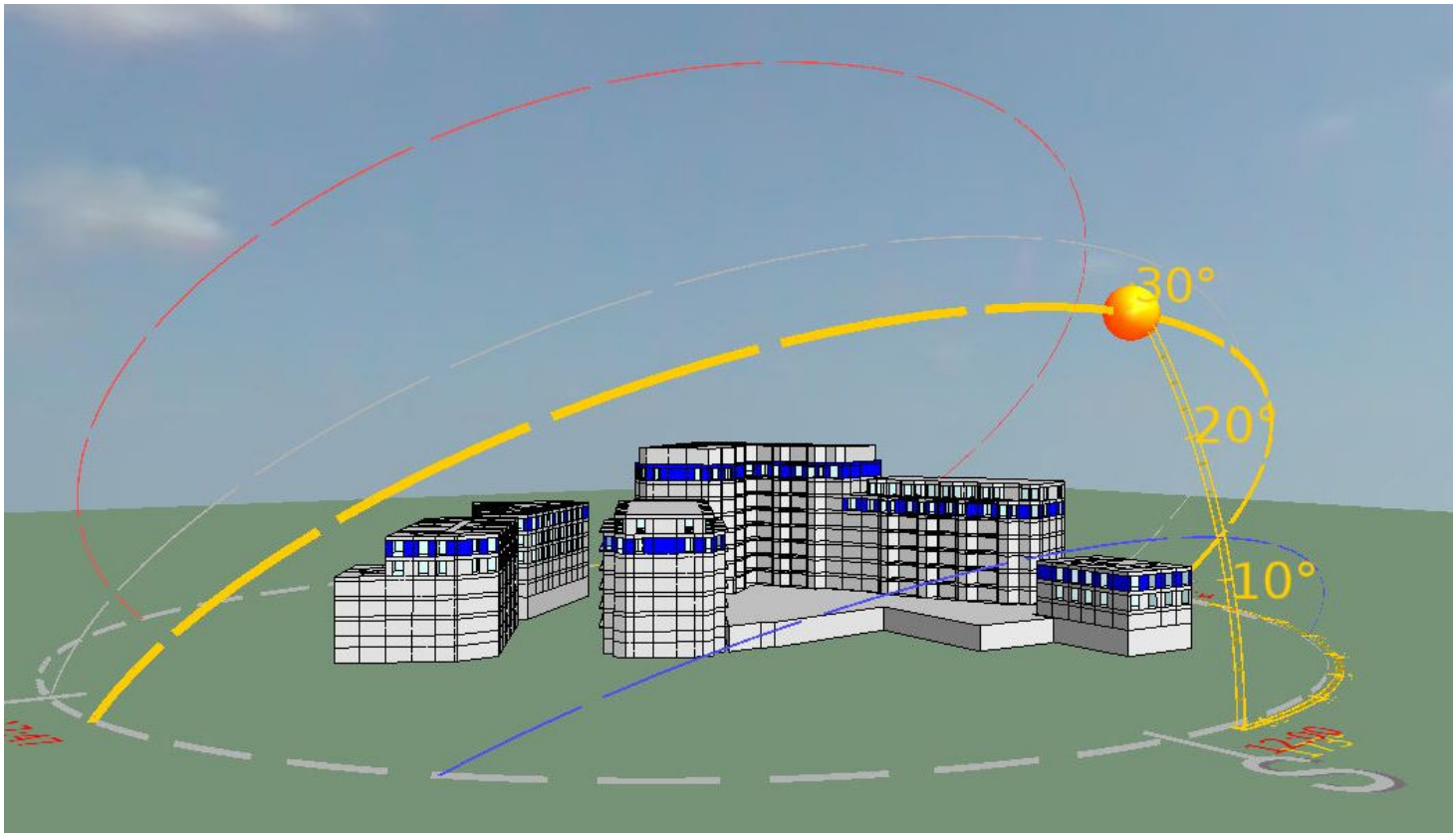
	Proposed Development Thermal Element			
	Thermal Element (U-value)		**Reference**	
External Wall U-Value	0.15		As Proposed	
Ground Floor U-value	0.11		As Proposed	
Roof U-Value	0.11		As Proposed	
Window (window & frame) U-Value	1.20		As Proposed	
Window g-Value	0.40		As Proposed	
Infiltration Rate (ach)	0.25		CIBSE Guide A Table 4.24	
	Proposed Development TM59 Internal Gains			
Occupancy Gain	75.00 W/Person Sensible and 55.00 W/Person Latent			
Double Bedroom Occupancy Level	2 people at full gains from 8am to 9am and from 10pm to 11pm;			
	1 person at full gain from 9am to 10pm			
	2 people at 70% gains from 11pm to 8am;			
Single Bedroom Occupancy Level	1 person at 70% gains from 11pm to 8am;			
	1 person at full gains from 8am to 9am andfrom 10pm to 11pm;			
Living/Kitchen Occupancy Level	1/2/3 person from 9am to 10pm; room is unoccupied for the rest of the day			
Single/Double Bedroom Equipment Level	Peak load of 80W from 8am-11pm			
	Base load of 10W during sleeping hours			
Living/Kitchen Equipment Profile	Peak load of 450 W from 6 pm to 10 pm			
	200 W from 8 pm to 10 pm			
	110 W from 9am-6pm & from 10pm-12 pm			
	Base load of 85 W for the rest of the day			
Bedroom/Living/Kitchen Lighting Profile	2.00 W/m2 (Peak Gain)			
	6pm to 11pm has been assumed to the living, kitchen and bedrooms			
	Natural Ventilation Strategy			
	Windows Opening Ventilation Strategy			
	Opening Type	Open Area (%)	Max Angle (°)	Profile
Bedroom Openable Windows	Top Hung	50.00	30.00	ADO Section 26ab
Bedroom Openable Windows	Top Hung	50.00	30.00	ADO Section 26a
Bedroom Openable Door	Side Hung	90.00	90.00	ADO Section 26ab
Living/Kitchen Openable Windows	Top Hung	50.00	30.00	ADO Section 26a
Living/Kitchen Openable Doord	Side Hung	90.00	90.00	ADO Section 26a
All Other Windows (Corridors/Stairs etc)	Top Hung	90.00	45.00	ADO Section 26c
	Mechanical Ventilation Strategy			
	MVHR - Ventilation Rate (ach)			
Bedrooms	up to 2.00			
Living/Kitchen	0.00			

	Proposed Development Shading Devices	
	Type	Included (Yes / No)
External Shading Device	Buildings	Yes - Surrounding Buildings were included as part of this assessment
Internal Shading Device	Blinds	No - Internal blinds are not included as part of this assessment

	Proposed Development TM59 Results (Natural Ventilation)		
Rooms	**TM52 (DSY1 2020s High 50)**	**CIBSE Guide A**	**Overall Compliance**
	Criteria 1 (a)	Criteria (b)	
	% Hours of Exceedance	1% annual hours above 26°C	
	Target (3.00)	Target (32.00)	
00_3F_BLK F_A1_LKD	2.00	N/A	Pass
00_3F_BLK F_A2_LKD	0.50	N/A	Pass
00_3F_BLK F_A3_LKD	0.00	N/A	Pass
00_3F_BLK F_A4_LKD	0.40	N/A	Pass
00_5F_BLK C_A1_LKD	1.80	N/A	Pass
00_5F_BLK C_A2_LKD	0.60	N/A	Pass
00_5F_BLK C_A3_LKD	0.80	N/A	Pass
00_5F_BLK C_A4 LKD	1.10	N/A	Pass
00_5F_BLK C_A5 LKD	0.20	N/A	Pass
00_5F_BLK C_A6_LKD	0.30	N/A	Pass
00_5F_BLK D_A2_LKD	1.30	N/A	Pass
00_5F_BLK D_A3_LKD	1.20	N/A	Pass
00_5F_BLK D_A4_LKD	0.20	N/A	Pass
00_5F_BLK D_A5_LKD	0.30	N/A	Pass
00_5F_BLK D_A6_LKD	0.30	N/A	Pass
00_5F_BLK D_A8_LKD	1.60	N/A	Pass
00_5F_BLK D_A9_LKD	1.10	N/A	Pass
00_5F_BLK E_A2 LKD	0.30	N/A	Pass
00_5F_BLK E_A3 LKD	0.60	N/A	Pass
00_5F_BLK E_A4 LKD	0.40	N/A	Pass
00_5F_BLK E_A5 LKD	0.00	N/A	Pass
00_5F_BLK E_A6 LKD	1.10	N/A	Pass
00_5F_BLK E_A7 LKD	0.90	N/A	Pass
00_6F_BLK B_A1 LKD	2.00	N/A	Pass
00_6F_BLK B_A2 LKD	1.10	N/A	Pass
00_6F_BLK B_A3 LKD	0.90	N/A	Pass
00_6F_BLK B_A4 LKD	1.50	N/A	Pass
00_6F_BLK B_A5 LKD	0.70	N/A	Pass
00_6F_BLK B_A6 LKD	0.20	N/A	Pass
00_6F_BLK B_A7 LKD	0.20	N/A	Pass
00_6F_BLK B_A8 LKD	0.40	N/A	Pass
00_7F_BLK A_A1 LKD	1.20	N/A	Pass
00_7F_BLK A_A2 LKD	0.40	N/A	Pass
00_7F_BLK A_A3 LKD	1.50	N/A	Pass
00_7F_BLK A_A4 LKD	0.20	N/A	Pass
00_7F_BLK A_A5 LKD	0.20	N/A	Pass
00_7F_BLK A_A6 LKD	0.20	N/A	Pass
00_7F_BLK A_A7 LKD	0.70	N/A	Pass
00_7F_BLK A_A8 LKD	0.80	N/A	Pass
00_7F_BLK A_A9 LKD	0.40	N/A	Pass
00_7F_BLK A_A10 LKD	1.60	N/A	Pass

00_3F_BLK F_A1_BED 1	1.00	3.00	Pass
00_3F_BLK F_A1_BED 2	1.10	16.00	Pass
00_3F_BLK F_A2_BED 1	1.10	15.00	Pass
00_3F_BLK F_A2_BED 2	0.90	3.00	Pass
00_3F_BLK F_A3_BED	0.00	13.00	Pass
00_3F_BLK F_A4_BED	0.40	1.00	Pass
00_5F_BLK C_A1_BED 1	0.70	3.00	Pass
00_5F_BLK C_A1_BED 2	0.70	12.00	Pass
00_5F_BLK C_A2_ BED 2	0.60	1.00	Pass
00_5F_BLK C_A2_BED 1	1.00	2.00	Pass
00_5F_BLK C_A3 BED	1.00	2.00	Pass
00_5F_BLK C_A4_BED 1	0.70	14.00	Pass
00_5F_BLK C_A4_BED 2	0.00	5.00	Pass
00_5F_BLK C_A5 BED 1	0.20	12.00	Pass
00_5F_BLK C_A5 BED 2	0.10	0.00	Pass
00_5F_BLK C_A6_BED	0.30	12.00	Pass
00_5F_BLK D_A2_BED	1.00	13.00	Pass
00_5F_BLK D_A3_BED 1	0.70	12.00	Pass
00_5F_BLK D_A3_BED 2	0.00	1.00	Pass
00_5F_BLK D_A4_BED 1	0.20	11.00	Pass
00_5F_BLK D_A4_BED 2	0.20	11.00	Pass
00_5F_BLK D_A5_BED 1	0.10	9.00	Pass
00_5F_BLK D_A5_BED 2	0.30	15.00	Pass
00_5F_BLK D_A6 BED 1	0.20	6.00	Pass
00_5F_BLK D_A6 BED 2	0.20	6.00	Pass
00_5F_BLK D_A8_BED 1	0.60	2.00	Pass
00_5F_BLK D_A8_BED 2	1.00	3.00	Pass
00_5F_BLK D_A9_BED 1	0.80	3.00	Pass
00_5F_BLK D_A9_BED 2	0.30	11.00	Pass
00_5F_BLK E_A1 BED 1	0.70	7.00	Pass
00_5F_BLK E_A1 BED 2	0.00	1.00	Pass
00_5F_BLK E_A2 BED 1	0.50	7.00	Pass
00_5F_BLK E_A2 BED 2	0.00	1.00	Pass
00_5F_BLK E_A3 BED 1	0.20	14.00	Pass
00_5F_BLK E_A3 BED 2	0.10	3.00	Pass
00_5F_BLK E_A4 BED 1	0.00	4.00	Pass
00_5F_BLK E_A4 BED 2	0.00	9.00	Pass
00_5F_BLK E_A5 BED	0.00	10.00	Pass
00_5F_BLK E_A6 BED 1	1.30	14.00	Pass
00_5F_BLK E_A6 BED 2	0.00	2.00	Pass
00_5F_BLK E_A7 BED	0.60	1.00	Pass
00_6F_BLK B_A1 BED	1.30	2.00	Pass
00_6F_BLK B_A2 BED 1	1.30	19.00	Pass
00_6F_BLK B_A2 BED 2	1.30	19.00	Pass
00_6F_BLK B_A3 BED 1	1.40	12.00	Pass
00_6F_BLK B_A3 BED 2	0.50	0.00	Pass
00_6F_BLK B_A4 BED 1	0.80	2.00	Pass
00_6F_BLK B_A4 BED 2	0.10	10.00	Pass
00_6F_BLK B_A5 BED 1	0.10	10.00	Pass
00_6F_BLK B_A5 BED 2	0.00	9.00	Pass
00_6F_BLK B_A6 BED 1	0.00	4.00	Pass
00_6F_BLK B_A6 BED 2	0.00	18.00	Pass
00_6F_BLK B_A7 BED 1	0.00	19.00	Pass
00_6F_BLK B_A7 BED 2	0.00	19.00	Pass

00_6F_BLK B_A8 BED	0.00	19.00	Pass
00_7F_BLK A_A1 BED 2	0.30	2.00	Pass
00_7F_BLK A_A1_BED 1	1.00	3.00	Pass
00_7F_BLK A_A2 BED 1	0.20	2.00	Pass
00_7F_BLK A_A2 BED 2	1.40	3.00	Pass
00_7F_BLK A_A2 BED 3	0.60	13.00	Pass
00_7F_BLK A_A3 BED 1	1.10	3.00	Pass
00_7F_BLK A_A4 BED	0.00	17.00	Pass
00_7F_BLK A_A5 BED 1	0.00	1.00	Pass
00_7F_BLK A_A5 BED 2	0.00	16.00	Pass
00_7F_BLK A_A6 BED	0.00	17.00	Pass
00_7F_BLK A_A7 BED 1	0.00	17.00	Pass
00_7F_BLK A_A7 BED 2	0.40	24.00	Pass
00_7F_BLK A_A7 BED 3	0.30	18.00	Pass
00_7F_BLK A_A8 BED 1	0.60	23.00	Pass
00_7F_BLK A_A8 BED 2	0.50	15.00	Pass
00_7F_BLK A_A9 BED 1	0.40	0.00	Pass
00_7F_BLK A_A9 BED 2	0.40	9.00	Pass
00_7F_BLK A_A10 BED 1	0.50	23.00	Pass
00_7F_BLK A_A10 BED 2	1.10	3.00	Pass



APPENDIX 5: Illustrative Water Efficiency Calculation

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Appendix 4
Illustrative Water Efficiency Calculator
Water Fixtures and Fittings Specification

Project Name	Chorlton Precinct Redevelopment, Manchester - Bath (where shower also present)
Project Number	233048
Date	11-Dec-24
Revision	P01
Status	S2
Author / Consultant	Laurence Earnshaw BA (Hons) MSc AMEI

Water Efficiency Calculator

Installation type	Unit of measure	(1) Capacity / flow rate	(2) Use Factor	(3) Fixed use (litres/person/day)	(4) Litres/person/day (1x2 +3)
WC (single flush)	Flush volume (litres)	0.00	4.42	0	0
WC (dual flush)	Full flush volume (litres)	4.50	1.46	0	6.57
	Part flush volume (litres)	3.00	2.96	0	8.88
WC's (multiple fittings)	Average effective flushing volume (litres)	0.00	4.42	0	0
Taps (excluding kitchen / utility room taps)	Flow Rate (litres/min)	4.00	1.58	1.58	7.9
Bath (where shower also present)	Capacity to overflow (litres)	185.00	0.11	0	20.35
Shower (where bath also present)	Flow rate (litres/min)	8.00	4.37	0	34.96
Bath only	Capacity to overflow (litres)	0.00	0.50	0	0
Shower only	Flow rate (litres/min)	0.00	5.60	0	0
Kitchen / Utility sink taps	Flow Rate (litres/min)	6.00	0.44	10.36	13
Washing Machine	litres/Kg (dry load)	8.17	2.10	0	17.157
Dishwasher	litres/place setting	1.25	3.60	0	4.5
Waste disposal unit	litres/use	0.00	3.08	0	0
Water softner	litres/person/day	0.00	1.00	0	0
	(5)	Total calculated use =			113.317
	(6)	Contribution from greywater =			0
	(7)	Contribution from rainwater =			0
	(8)	Normalisation factor			0.91
	(9)	Total water consumption (5-6-7)x8 =			103.12
	(10)	External water use =			5.00
	(11)	Total water consumption = (litres/person/day)			**108.12**

Building Regulations Part G - Regulation 36

The potential consumption of wholesome water by persons occupying a new dwelling must not exceed

125 litres/person/day.

Calculated above in accordance with the methadology set out in BR Part G - 2016

As set out in Policy JP-S4 (Flood Risk and the Water Environment) of the MCC Places for Everyone Plan (2024)

110 litres/person/day.

As set out in Policy JP-S4 (Flood Risk and the Water Environment) of the MCC Places for Everyone Plan (2024);
and national Building Regulations 'higher standard' for water consumption

Notes;

1 - WC (dual flush) based on Ideal Standard i.Life A 6/4 Litre Rimless Close Coupled Open Back WC + Soft Close Seat

2 - Duravit DuraStyle Basic Rimless Close Coupled Toilet (4.5/3 L Flush) + Seat

3 - Bristan Prism Eco Basin Taps (4 l/min, Chrome)
4 - Ideal Standard Studio Straight Bath 1700 X 700mm 2 Tap Hole
5 - Fixed shower head EcoVand Style Air 8 l/min
6 - Raindance Select S Hand shower 150 3jet EcoSmart 9 l/min
7 - Blanco DARAS Eco Flow (6 Litre Eco) Single Lever Galvanic Kitchen Tap - Chrome - 526361
8 - Washing machine and dishwasher figures input as mandatory figures, no information available.

BWB Consulting
Appendix 4
Illustrative Water Efficiency Calculator
Water Fixtures and Fittings Specification

Project Name	Chorlton Precinct Redevelopment, Manchester - Shower only
Project Number	233048
Date	11-Dec-24
Revision	P01
Status	S2
Author / Consultant	Laurence Earnshaw BA (Hons) MSc AMEI

Water Efficiency Calculator

Installation type	Unit of measure	(1) Capacity / flow rate	(2) Use Factor	(3) Fixed use (litres/person/day)	(4) Litres/person/day (1x2 +3)
WC (single flush)	Flush volume (litres)	0.00	4.42	0	0
WC (dual flush)	Full flush volume (litres)	6.00	1.46	0	8.76
	Part flush volume (litres)	4.00	2.96	0	11.84
WC's (multiple fittings)	Average effective flushing volume (litres)	0.00	4.42	0	0
Taps (excluding kitchen / utility room taps)	Flow Rate (litres/min)	4.00	1.58	1.58	7.9
Bath (where shower also present)	Capacity to overflow (litres)	0.00	0.11	0	0
Shower (where bath also present)	Flow rate (litres/min)	0.00	4.37	0	0
Bath only	Capacity to overflow (litres)	0.00	0.50	0	0
Shower only	Flow rate (litres/min)	9.00	5.60	0	50.4
Kitchen / Utility sink taps	Flow Rate (litres/min)	6.00	0.44	10.36	13
Washing Machine	litres/Kg (dry load)	8.17	2.10	0	17.157
Dishwasher	litres/place setting	1.25	3.60	0	4.5
Waste disposal unit	litres/use	0.00	3.08	0	0
Water softner	litres/person/day	0.00	1.00	0	0
	(5)	Total calculated use =			113.557
	(6)	Contribution from greywater =			0
	(7)	Contribution from rainwater =			0
	(8)	Normalisation factor			0.91
	(9)	Total water consumption (5-6-7)x8 =			103.34
	(10)	External water use =			5.00
	(11)	Total water consumption = (litres/person/day)			**108.34**

Building Regulations Part G - Regulation 36

The potential consumption of wholesome water by persons occupying a new dwelling must not exceed

125 litres/person/day.

Calculated above in accordance with the methadology set out in BR Part G - 2016

As set out in Policy JP-S4 (Flood Risk and the Water Environment) of the MCC Places for Everyone Plan (2024)

110 litres/person/day.

As set out in Policy JP-S4 (Flood Risk and the Water Environment) of the MCC Places for Everyone Plan (2024);
and national Building Regulations 'higher standard' for water consumption

Notes;

1 - WC (dual flush) based on Ideal Standard i.Life A 6/4 Litre Rimless Close Coupled Open Back WC + Soft Close Seat

2 - Duravit DuraStyle Basic Rimless Close Coupled Toilet (4.5/3 L Flush) + Seat

3 - Bristan Prism Eco Basin Taps (4 l/min, Chrome)
4 - Ideal Standard Studio Straight Bath 1700 X 700mm 2 Tap Hole
5 - Fixed shower head EcoVand Style Air 8 l/min
6 - Raindance Select S Hand shower 150 3jet EcoSmart 9 l/min
7 - Blanco DARAS Eco Flow (6 Litre Eco) Single Lever Galvanic Kitchen Tap - Chrome - 526361
8 - Washing machine and dishwasher figures input as mandatory figures, no information available.

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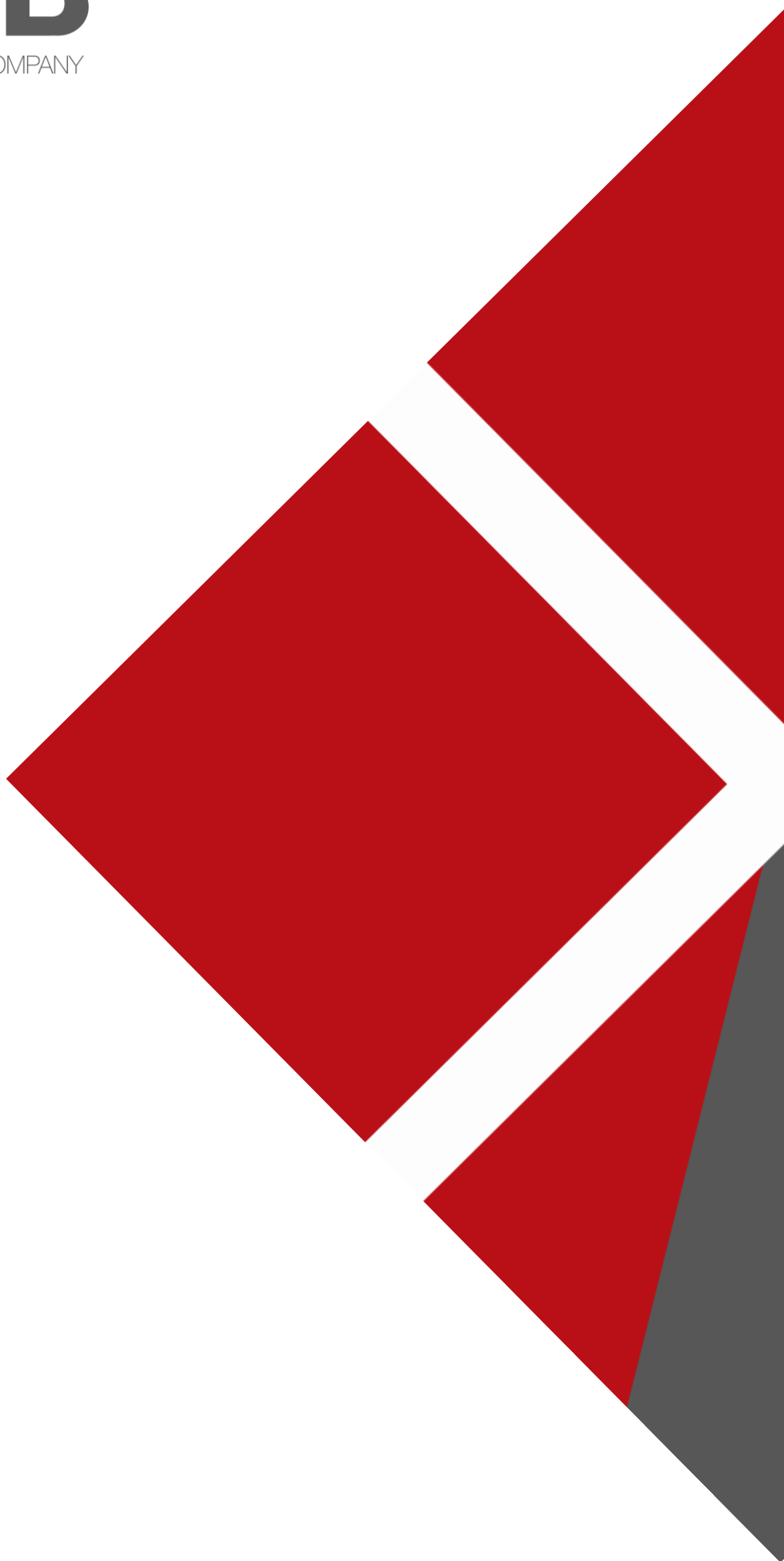

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