

Aberfeldy Village Masterplan

Energy Assessment Report
Updated Planning Issue

Issue P8 – 06 November 2023









ABERFELDY VILLAGE MASTERPLAN ENERGY ASSESSMENT REPORT UPDATED PLANNING ISSUE

Quality Assurance Page

Issue	Date	Prepared By	Checked By	Approved By	Remarks
P1	21/9/2021	Mr R. Denteh	Mr R. Wilkes	Mr R. Wilkes	Draft Issue
P2	14/10/2021	Mr R. Denteh	Mr R. Wilkes	Mr R. Wilkes	Planning Issue
P3	25/8/2022	Mr R. Denteh	Mr R. Wilkes	Mr R. Wilkes	Planning Issue
P4	21/10/2022	Mr R. Denteh	Mr R. Wilkes	Mr R. Wilkes	Planning Issue
P5	21/08/2023	Mr W. Newall	Mr R. Denteh	Mr R. Wilkes	Draft Updated Planning Issue
P6	12/09/2023	Mr W. Newall	Mr R. Denteh	Mr R. Wilkes	Draft Updated Planning Issue
P7	21/09/2023	Mr W. Newall	Mr R. Denteh	Mr R. Wilkes	Updated Planning Issue
P8	06/11/2023	Mr R. Wilkes			Updated Planning Issue



Figure 1: 3D aerial sketch of the illustrative Masterplan



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1 Executive Summary

1.1 Introduction

This Energy Assessment Report has been prepared by Meinhardt (UK) Ltd and is submitted in support of an updated hybrid planning application to the Mayor of London for the Aberfeldy Village Masterplan seeking detailed planning permission for Phase A and Outline planning permission for future phases, comprising:

Outline planning permission (all matters reserved) for the demolition of all existing structures and redevelopment to include a number of buildings (up to 100m AOD) and up to 140,591 (GEA) of floorspace comprising the following mix of uses: Residential (Class C3); Retail, workspace, food and drink uses (Class E); Car and cycle parking; Formation of new pedestrian route through the conversion and repurposing of the Abbott Road vehicular underpass for pedestrians and cyclists connecting to Jolly's Green; Landscaping including open spaces and public realm; and New means of access, associated infrastructure and highway works.

In Full, for residential (Class C3), retail, food and drink uses and a temporary marketing suite (Class E and Sui Generis), together with access, car and cycle parking, associated landscaping and new public realm, and open space. This application is accompanied by an Environmental Statement.

The purpose of this Energy Assessment report is to demonstrate how the climate change mitigation measures proposed for the Aberfeldy Village Masterplan address the relevant local, regional and national planning policies. It also demonstrates that energy is an integral part of the proposed development's design.

This report supersedes the Energy Assessment Report Revision P4 dated 21st October 2022 previously submitted in support of the Hybrid Application (LBTH Ref: PA/21/02377/A1 and GLA Ref: 2023/0300/S3) and should therefore be read on a standalone basis.

Following a resolution to refuse planning permission by the SDC in February 2023, and the subsequent direction that the Mayor of London will act as the local planning authority for the purposes of determining the planning application, further amendments have been made to the design of the scheme to accommodate second staircases in all buildings over 18m in height.

For the sake of completeness only it should be noted that the above referenced amendments follow previous amendments to the Hybrid Application, made prior to its consideration by the LBTH SDC, the assessments of which were set out within previous revisions of this Energy Assessment Report. In summary the previously assessed charges were: the incorporation of Jolly's Green within the red line boundary, the removal of the previously proposed Block A3 and associated increase in open space and play space, an increase in the number of affordable rented family homes, and the inclusion of second staircases in Plots F & I.

Further information is set out within the accompanying Covering Letter (as prepared by DP9 Ltd, dated November 2023) and the updated Planning Statement (as prepared by DP9 Ltd, dated November 2023).

This Energy Assessment Report has been updated to reflect the revised Building Regulations 2021 and GLA planning policy introduced since submission of the application to LBTH. Refer to Section 4.

In response to the revised Building Regulations 2021 and updated planning policy, a number of improvements have been made to the scheme to lower energy usage and carbon dioxide emissions including the following;-

- Waste water heat recovery included to residential dwellings in the detailed part of the application;
- Triple glazing included to retail and office space in the detailed part of the application (Blocks F and H);
- Improved air tightness to retail and office space in the detailed part of the application (Blocks F and H);
- Reduced thermal bridging;

- · Higher efficiency residential MVHR unit included;
- Lower carbon of heat from the existing heat network achieved (through a higher CHP fraction);
- Additional photovoltaic panels included;
- Efficiency of all photovoltaic panels increased; and
- Efficiency of Block I heat pumps increased.

Using the latest Part L 2021 methodology, this report demonstrates the following improvements since the previous submission (Revision P4 dated 21st October 2022) to LBTH;-

- 34% lower residential fabric energy demand (efficiency) for the detailed part of the application;
- 8% lower total annual carbon dioxide emissions for the detailed part of the application; and
- 47.5% lower total annual carbon dioxide emissions for the outline part of the application.

1.2 Carbon Reduction Policy and Targets

National Policy

The UK Government has made a commitment to bring all greenhouse gas emissions in the UK to net zero by 2050. Further commitments have been made to reducing economy-wide greenhouse gas emissions by at least 68% by 2030 and by 78% by 2035, compared to 1990 levels.

Building Regulations

An updated Building Regulations Part L Conservation of Fuel and Power and a new Part O Overheating were introduced in June 2022. The updated Part L is expected to deliver a 30% improvement on 2013 standards for domestic buildings.

Further consultation is expected on the new Future Homes Standard and Future Buildings Standard which are intended to be introduced in 2025.

London Plan (2021)

Major development should be net zero-carbon, with a minimum on-site reduction of at least 35 per cent beyond Building Regulations Part L 2013 requirements.

Residential development should achieve 10 per cent, and non-residential development should achieve 15 per cent reduction through energy efficiency measures.

Where the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided, either through a cash in lieu contribution to the borough's carbon offset fund, or off-site provided that an alternative proposal is identified, and delivery is certain.

Carbon emissions from any other part of the development i.e. unregulated emissions, should be calculated and minimised.

Energy Assessment Guidance (2022)

Updated planning guidance has been published by the GLA (in June 2022) which explains how London Plan policies apply now that Part L 2021 has taken effect.

Residential developments are expected to be able to exceed the 35 per cent minimum improvement over Building Regulations Part L 2021 requirements and should aim to achieve at least a 50 per cent improvement.

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1.3 Detailed Part of the Application (Phase A)

1.3.1 Carbon Reduction Strategy

The energy strategy for the detailed part of the application follows the London Plan's updated energy hierarchy approach of 'Be Lean', 'Be Clean', 'Be Green', and 'Be Seen' as detailed in policy SI2.

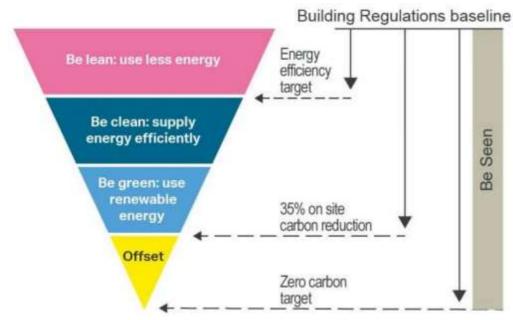


Figure 2: The energy hierarchy and associated targets

The proposed development has been assessed using Elmhurst Design SAP10.2 modelling software and IES dynamic thermal modelling software (SBEM) to demonstrate compliance with Part L 2021.

1.3.2 Carbon Reductions

Domestic Carbon Emissions and Savings (Detailed part of the application)

The expected carbon dioxide emissions at each stage of the hierarchy are shown in the graph below for the residential element of the detailed part of the application.

The graph below demonstrates that the residential element of the detailed part of the application achieves an overall on-site reduction of 28% in regulated carbon dioxide emissions over Part L 2021. It is not possible to meet the London Plan target of 35% due to the carbon content of heat delivered to Blocks F & H by the existing heat network.

In accordance with GLA Energy Assessment Guidance 2022 (see Section 1.3.4 below) Blocks F and H must prioritise a connection to the existing heat network which is currently fed from gas fired CHP and boilers. The heat network operator EON has provided a decarbonisation plan to the GLA which will see the carbon content of heat delivered by the existing network lowered considerably over the forthcoming years.

Energy demand in the residential areas has been significantly reduced, exceeding the GLA target of 10%, achieving a reduction of 15% in regulated carbon emissions over Part L 2021 at the 'Be Lean' stage of the hierarchy, through passive design and energy efficiency measures alone.

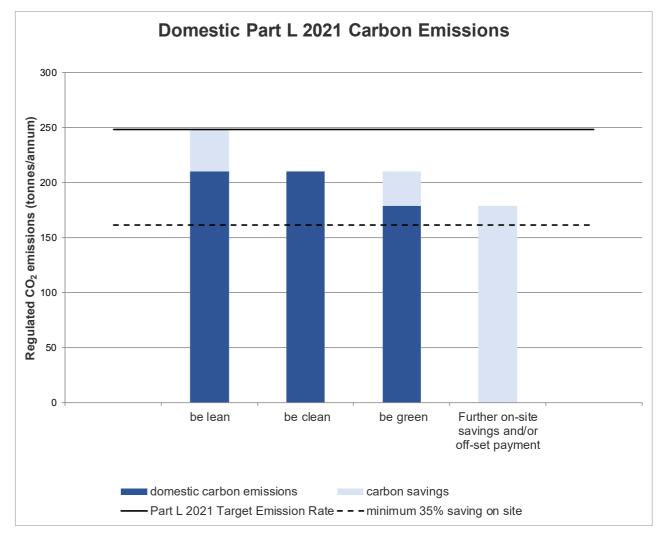


Figure 3: Domestic energy hierarchy and targets for the detailed part of the application

The tables below detail the carbon dioxide emissions and savings expected at each stage of the energy hierarchy for the domestic elements.

	_	carbon dioxide emissions for domestic buildings (Tonnes CO ₂ per annum)			
	Block F and H (Existing heat network)	Blocks I and J (Heat pumps)	Total domestic emissions for detailed part of the application		
Baseline: Part L 2021	180.8	67.4	248.2		
Be Lean	157.1	52.8	209.8		
Be Clean	157.1	52.8	209.8		
Be Green	163.5	15.6	179.1		

Table 1: Carbon dioxide emissions after each stage of the energy hierarchy for domestic elements of the detailed part of the application



	Regulated domestic carbon dioxide savings						
	Block F and H (Existing heat network)		Block I and J (Heat pumps)		Total for detailed part of the application		
	Tonnes CO ₂ per	%	Tonnes CO ₂ per	%	Tonnes CO ₂ per annum	%	
Be lean	23.8	13%	14.6	22%	38.4	15%	
Be clean	0	0%	0.0	0%	0	0%	
Be green	-6.4	-4%	37.2	55%	30.7	12%	
Cumulative on site	17.3	10%	51.8	77%	69.1	28%	
Carbon shortfall	163.5		15.6		179.1		
		Tonnes	s CO ₂				
Cumulative savings for off-set payment					5,37	73	
Cash-in-lieu contribution					£510,	397	

Table 2: Regulated carbon dioxide savings from each stage of the energy hierarchy for domestic elements of the detailed part of the application

Non-Domestic Carbon Emissions and Savings

The expected carbon dioxide emissions at each stage of the hierarchy are shown in the graph below for the non-residential element of the detailed part of the application.

The graph below demonstrates that the non-residential element of the detailed part of the application achieves an overall reduction of 30% in regulated carbon dioxide emissions over Part L 2021.

The non-residential elements of the detailed part of the application are primarily located within Blocks F and H, and as with the residential above, it is not possible to meet the London Plan target of 35% due to the carbon content of heat delivered by the existing heat network.

Energy demand in the non-residential areas has been significantly reduced, exceeding the GLA target of 15%, achieving a reduction of 25% in regulated carbon emissions over Part L 2021 at the 'Be Lean' stage of the hierarchy, through passive design and energy efficiency measures alone.

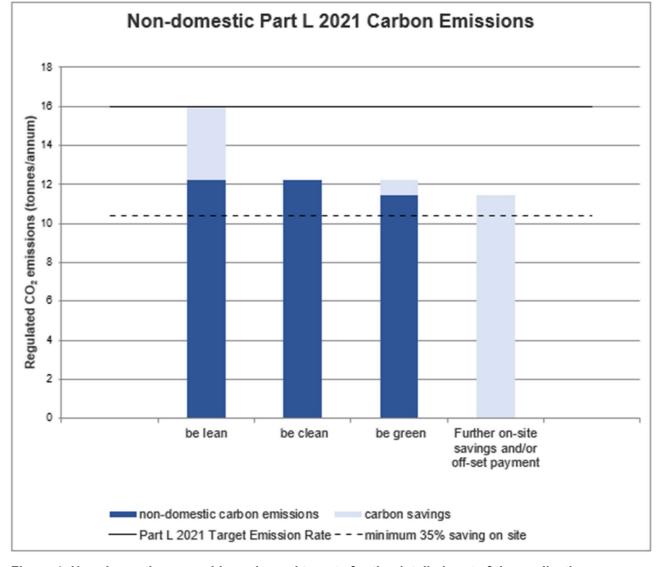


Figure 4: Non-domestic energy hierarchy and targets for the detailed part of the application

The tables below detail the carbon dioxide emissions and savings expected at each stage of the energy hierarchy for the non-domestic elements.

	Regulated carbon dioxide emissions for non-domestic buildings (Tonnes CO ₂ per annum)
Baseline: Part L 2021	16.1
Be Lean	12.0
Be Clean	12.0
Be Green	11.2

Table 3: Carbon dioxide emissions after each stage of the energy hierarchy for non-domestic elements of the detailed part of the application

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	Regulated non-domestic carbon dioxide savings		
	Tonnes CO₂ per annum	%	
Be lean	4.1	25%	
Be clean	0.0	0%	
Be green	0.8	5%	
Cumulative on site savings	4.8	30%	
Carbon shortfall	11.2	-	
	Tonne	s CO ₂	
Cumulative savings for off-set payment	33	7	
Cash-in-lieu contribution	£32,058		

Table 4: Regulated carbon dioxide savings from each stage of the energy hierarchy for non-domestic elements of the detailed part of the application

Total Carbon Emissions and Savings

The table below details the overall carbon dioxide emissions and savings expected at each stage of the energy hierarchy for the detailed part of the application.

	Total regulated emissions (Tonnes CO₂/year)	CO ₂ savings (Tonnes CO ₂ /year)	Percentage saving (%)
Part L 2021 baseline	264.3		
Be Lean	221.9	42.4	16%
Be Clean	221.9	0.0	0%
Be Green	190.3	31.5	12%
Cumulative on site savings	-	74.0	28%
		CO ₂ savings off-set (Tonnes CO ₂)	
Off-set		5,710.0	

Table 5: Total regulated carbon dioxide emissions and savings for the detailed part of the application

The table above demonstrates that the detailed part of the application as a whole achieves an on-site reduction of 28% in regulated carbon dioxide emissions over Part L 2021.

The table above demonstrates that the total regulated carbon dioxide emissions (using Part L 2021) for the detailed part of the application (190.3 Tonnes/year) are 8% lower than the 206.6 Tonnes/year calculated for the previous submission to LBTH.

1.3.3 Demand Reduction (Be Lean)

Energy demand will be significantly reduced beyond Part L requirements, achieving an overall 16% reduction over Part L 2021 through passive design and energy efficiency measures alone.

The reduction will be achieved by a combination of measures, which shall include the following. Please refer to Section 6 for further details.

- Significantly improved fabric 'U' values (including the addition of triple glazing to the commercial / retail spaces since the previous submission to LBTH)
- Minimised thermal bridging (further improved since the previous submission to LBTH)
- Improved air tightness (further improved in commercial / retail spaces since the previous submission to LBTH)
- Optimised g-value of the glazing to provide a balance between minimising heat gain in summer (to reduce overheating), maximising useful heat gain in winter (to reduce heating energy) and maximising natural daylight (to reduce lighting energy)
- Waste water heat recovery (WWHR) for the residential (included since the previous submission to LBTH)
- Communal heating systems
- High efficiency ventilation systems (Residential MVHR efficiency further improved since the previous submission to LBTH)
- · Minimised heat loss from hot water systems
- Low energy lighting
- Controls systems to monitor and operate the plant and equipment as efficiently as possible.
- · Smart meters.

Fabric Energy Efficiency

The table below details the total Part L Fabric Energy Efficiency Standard (FEES) for the residential elements of the detailed part of the application.

	Part L Fabric Ene	(FEES)	
	Target Fabric Energy Efficiency (kWh/m²)	Design Fabric Energy Efficiency (kWh/m²)	Improvement (%)
Detailed part of the application	26.21	25.61	2%

Table 6: Part L Fabric Energy Efficiency Standard (FEES) for the residential elements of the detailed part of the application

Energy Use Intensity (EUI) and Space Heating Demand

The table below details the Energy Use Intensity (EUI) and space heating demand for the residential element of the detailed part of the application.



Building type	EUI (kWh/m²/yr)	Space heating demand (kWh/m²/yr)	Methodology used	Explanatory notes
Residential Blocks F and H	79.3	8.9	SAP 10.2	Heat supply from the existing heat network.
Residential Blocks I and J	34.8	14.9	SAP 10.2	Heat supply from heat pumps
Residential Detailed part of the application overall	66.8	10.6	SAP 10.2	Overall EUI is higher than the GLA target as the heat supply to Blocks F & H is from the existing heat network

Table 7: EUI and space heating demand for the residential elements of the detailed part of the application

The table above demonstrates the following:-

- EUI in Blocks F and H residential is above the GLA target of 35 kWh/m²/year as the heat supply is from the existing heat network.
- EUI in Blocks I and J residential is below the GLA target of 35 kWh/m²/year.
- Space heating demand is below the GLA target of 15 kWh/m²/year for all residential areas of the detailed part of the application.

The table below details the Energy Use Intensity (EUI) and space heating demand for the non-residential elements of the detailed part of the application.

Building type	EUI (kWh/m²/yr)	Space heating demand (kWh/m²/yr)	Methodology used	Explanatory notes
Non-residential	60.5	36.2	CIBSE TM54	Mainly commercial / retail space. Heat
Blocks F and H				supply from the existing heat network.
Non-residential	40	8.2	CIBSE TM54	Residential entrance and amenity
Block I				space only. Heat supply from heat
				pumps.
Non-residential	57.5	32.1	CIBSE TM54	
Detailed part of				
the application				
overall				

Table 8: EUI and space heating demand for the non-residential elements of the detailed part of the application

The table above demonstrates the following;-

- EUI in Blocks F and H non-residential is slightly above the GLA target of 55 kWh/m²/year as the heat supply is from the existing heat network.
- EUI in Blocks I and J non-residential is below the GLA target of 55 kWh/m²/year.
- Space heating demand in Blocks F and H non-residential is above the GLA target of 15 kWh/m²/year. A
 combination of measures have been used to minimise the heating demand, including triple glazing.
 However, small commercial and retail spaces such as these inherently have a higher form factor (when
 assessed separately from the rest of the building) and a higher glazing to wall ratio.
- Space heating demand in Blocks I non-residential is below the GLA target of 15 kWh/m²/year.

1.3.4 Heating Infrastructure (Be Clean)

Blocks F, H1/H2, and H3

The energy strategy (AV011) submitted as part of the original masterplan for the Aberfeldy Estate, proposed a site wide heat network served from a new energy centre sized to provide heat to all six phases of the original development.

Phases 1, 2, 3a and 3b of the original masterplan have been completed and are now occupied. The energy centre was constructed in Phase 3a and includes gas fired CHP and boilers with the capacity to serve a further 300 residential units. This has been confirmed by the operator of the network EON.

Blocks F, H1/H2, and H3 of the detailed part of the application comprise 206 residential units, and are located adjacent to Phase 3b within the area designated as phases 4 and 5 of the original masterplan.

A valved and capped connection to the existing site wide heat network has been provided at the north of Phase 3b onto Blair Street to facilitate the connection and extension to Blocks F, H1/H2, and H3 of the detailed part of the application.

GLA Energy Assessment Guidance 2022 confirms that a connection to an existing heat network must be prioritised where the CO2 emission and primary energy factors are within Part L 2021, and where the operator has agreed a decarbonisation strategy with the GLA.

Since the planning submission in October 2021, regular meetings have been held between the applicant, Meinhardt and EON (the heat network operator).

In July 2023, EON provided confirmation of the expected carbon content and primary energy factor of the heat that will be delivered to Blocks F and H using the latest SAP 10.2 carbon emission factors.

The carbon content of the heat delivered by the heat network will be 0.273 kg CO2 per kWh and the primary energy factor 1.356 kWh/kWh based on SAP10.2 carbon emission factors.

As these parameters are below the limits set out in Part L 2021 (0.350 kg CO2 per kWh for carbon content and 1.450 kWh/kWh for primary energy) and as EON have submitted a decarbonisation plan to the GLA, in accordance with GLA Energy Assessment Guidance 2022 it is therefore proposed that Blocks F and H will connect to the existing heat network.

Block I

Block I is a small block of apartments located at the very east of the application site, close to Phase 1 of the original masterplan. A future connection has not been provided to allow connection into the existing site heat network serving the original masterplan.

Due to the significant distance from the rest of the new Masterplan, and the small heating demand, it is proposed to provide heat from a block energy centre comprising air-to-water heat pumps.

The carbon reductions generated by the heat pumps are included at the Be Green stage of the hierarchy.

Block J

Block J is a row of individual terraced houses and maisonettes located at the very north of the application site.

Due to the significant distance from the rest of the new Masterplan, and the small heating demand, it is proposed to provide heat to the houses from individual air-to-water heat pumps supplemented by solar thermal, and to the maisonettes from individual MVHR heat pumps.

The carbon reductions generated by the heat pumps are included at the Be Green stage of the hierarchy.



1.3.5 Renewable Energy Systems (Be Green)

An assessment of the feasibility of including on-site renewable energy has been carried out, and the results are shown in Section 8.

Blocks F, H1/H2, and H3

It is proposed to install a total of 156 No. photovoltaic panels on the roofs with a total peak output of 59.3 kW (based on 1.72m², 22% efficient panels). The panels will generate a saving of approximately 5,248 kg CO2 per year in regulated carbon dioxide emissions.

The efficiency of each panel has been improved from 20.4% to 22% and an additional 70 No. photovoltaic panels have been included, thereby increasing the peak output from 29kW to 59.3kW since the previous submission to LBTH.

Block I

As stated above, air-to-water heat pumps are appropriate as the main heat source for Block I. The heat pumps are expected to provide a total saving of approximately 27,148 kg CO2 per year in regulated carbon dioxide emissions.

It is also proposed to install photovoltaic panels with a total peak output of 6.5 kW on the roof (based on 17 No., 1.72m², 22% efficient panels). The panels will generate a saving of approximately 537 kg CO2 per year in regulated carbon dioxide emissions.

The efficiency of each panel has been improved from 20.4% to 22% thereby increasing the peak output from 5.8kW to 6.5kW since the previous submission to LBTH.

Block J

As stated above, individual air-to-water heat pumps (supplemented by solar thermal) are appropriate as the main heat source for the houses in Block J.

It is proposed to use solar thermal panels in conjunction with the local heat pumps in each house as they can generate high temperature heat suitable for domestic hot water, thereby maximising the efficiency of the heat pumps (which are best operating at lower temperature). A collector of 1.1m² area will be provided on the roof of each house.

Individual MVHR heat pumps are appropriate as the main heat source for the maisonettes in Block J.

The heat pumps and solar thermal panels are expected to provide a total saving of approximately 16,044 kg CO2 per year in regulated carbon dioxide emissions.

It is also proposed to install photovoltaic panels with a total peak output of 16 kW on the roofs (based on 42 No., 1.72m², 22% efficient panels). The panels will generate a saving of approximately 1,327 kg CO2 per year in regulated carbon dioxide emissions.

1.3.6 Energy Monitoring (Be Seen)

The applicant confirms a commitment to monitor and report its energy performance post-construction in accordance with the 'Be Seen' guidance.

An updated 'planning stage' submission will be made via the GLA 'Be Seen' web-form immediately after the planning submission.

1.3.7 Carbon Offset

The remaining regulated carbon dioxide emissions (to 100%) over 30 years for the detailed part of the application (5,710 Tonnes CO₂) will off-set through a cash in lieu contribution of £542,455 (based on £95/Tonne) to the local planning authority, to be ring fenced to secure delivery of carbon dioxide savings elsewhere.

1.3.8 Unregulated Energy

The energy demand and associated carbon dioxide emissions from unregulated uses, i.e. those not covered by the Building Regulations assessments (e.g. cooking, appliances, equipment) have been estimated using the following;-

- Residential UK Government Household Electrical Survey (2014).
- Non-residential CIBSE Guide F.

An assessment has been carried out to determine how unregulated energy and carbon dioxide emissions can be reduced through the use of energy efficient appliances and equipment, controls, good management practice, etc.

It is expected that the detailed part of the application will provide a 14.5% reduction in unregulated carbon dioxide emissions over the baseline. Refer to Section 9.

1.3.9 Overheating and Cooling

The detailed part of the application has been assessed in accordance with the cooling hierarchy detailed in policy SI 4 of the London Plan, the latest GLA Energy Assessment Guidance 2022 and Building Regulations Part O, in order to reduce overheating and minimise the use of air conditioning. Refer to Section 10.

As requested in the Energy Assessment Guidance, the Good Homes Alliance (GHA) Early Stage Overheating Risk Tool has been completed and is provided in Appendix A.7.

The assessment includes dynamic thermal modelling of the redevelopment, using IES modelling software, to assess the risk of overheating. The results are summarised below.

1.3.9.1 Residential

The residential assessment includes dynamic thermal modelling on a representative sample of dwellings to assess the risk of overheating, using IES modelling software, in accordance with the guidance and data sets in CIBSE TM49 and TM59 guidance, using the current 2020s summer year (DSY 1) and the more extreme DSY 2 and DSY 3 weather data.

Building Regulations Part O requires the modelling to assume that bedroom windows are closed at night if the average 8 hour ambient noise level exceeds 40 dB. The overheating risk categories assessment provided in Annex 14 of the Environment Statement Appendix: Noise and Vibration demonstrates that for most of the detailed part of the application the ambient noise levels are below 40 dB at night (identified as negligible or low risk).

The strategy will therefore generally allow for windows to be open at night in the detailed part of the application .

The overheating risk categories assessment shows that most of Block J, and parts of Blocks F and H1/H2 are subject to ambient noise levels over 40 dB at night (identified as medium or high risk) so two overheating assessments have been completed (one with windows open at night, and one with windows closed at night) to demonstrate that the passive design has been maximised.

Natural Ventilation via Openable Windows (All Blocks)

All residential dwellings tested have been modelled with natural ventilation via openable windows/doors and increased mechanical ventilation to demonstrate that passive measures have been maximised and the façade design has been optimised. The results are summarised below;-

The CIBSE compliance criteria are met in all rooms modelled (for the 2020s DSY1 weather scenario)
without blinds through the use of natural ventilation via openable windows/doors and increased
mechanical ventilation, together with an improvement of the glazing g-value to 0.33.



 The CIBSE compliance criteria are met in a significant proportion of the rooms modelled (for the 2020s DSY2 and 3 weather scenarios) without blinds through the use of natural ventilation via openable windows/doors and increased mechanical ventilation, together with an improvement of the glazing g-value to 0.33.

The GLA Energy Assessment Guidance 2022 expects that the CIBSE compliance criteria is met for the DSY1 weather scenario. It is acknowledged that meeting the CIBSE compliance criteria is challenging for the DSY 2 & 3 weather files, although it is expected that in the majority of cases a significant proportion of spaces will be able to achieve compliance.

The assessment with natural ventilation demonstrates that the risk of overheating has been reduced as far as practical, with all available passive measures explored.

Closed Windows (Block J, Parts of Blocks F and H1/H2)

The overheating risk categories assessment (see Annex 14 of the Environment Statement Appendix: Noise and Vibration) shows that most of Block J, and parts of Blocks F and H1/H2 are subject to ambient noise levels over 40 dB at night (identified as medium or high risk) and therefore exceed the limit prescribed in Building Regulations Part O.

Additional modelling has been carried out for the appropriate sampled dwellings in Blocks J, F and H1/H2 with the windows closed at night but with the increased mechanical ventilation in operation. The results are summarised below;-

- The CIBSE compliance criteria cannot be met in all rooms modelled (for the 2020s DSY1 weather scenario) without blinds with closed windows/doors and increased mechanical ventilation.
- The CIBSE compliance criteria cannot be met in a significant proportion of the rooms modelled (for the 2020s DSY2 and 3 weather scenarios) without blinds with closed windows/doors and increased mechanical ventilation.

The MVHR heat pumps proposed for the maisonettes in Block J have the capability to lower the temperature of the supply air when in operation to assist in reducing the impact of high summer temperatures.

In the Block J houses and in the affected apartments in Blocks F and H1/H2, an additional cooling module would be fitted to the MVHR unit to provide the same functionality.

This would provide the occupants with an alternative method of sufficiently reducing the risk of overheating without opening the windows.

This is not considered as active cooling due to the following;-

- It would only 'temper' the supply air, reducing the temperature by a few degrees.
- It would have limited cooling capacity due to the size of heat pump / cooling module, and the low air volume of the residential ventilation system.
- It would not 'control' space temperature it would only be used if required by the occupant and would
 only operate when external temperature exceeds 26 °C at night and 28°C during the day to achieve
 compliance with the CIBSE overheating criteria.
- No additional fan would be required in the apartment.

Mitigation Measures

The proposed overheating mitigation measures are summarised below;-

 In residential dwellings the use of natural ventilation via openable windows/doors and increased mechanical ventilation will generally sufficiently reduce the risk of overheating.

- In Block J and parts of Blocks F and H1/H2 where the occupants may choose to keep their windows
 closed at night, an alternative method of reducing the risk of overheating will be available through the
 use of the MVHR heat pump or a MVHR cooling module.
- During extreme summer weather, residents will be encouraged to use additional measures to reduce the risk of overheating, including the following;-
 - Using portable fans to increase airflow
 - Minimising internal heat gains
 - o Keeping windows open as long as possible
- Guidance will be provided to residents on reducing the overheating risk in their home in line with the cooling hierarchy.

Non-Residential

The non-residential assessment includes dynamic thermal modelling of the non-residential space in the detailed part of the application to assess the risk of overheating, using IES modelling software, in accordance with the guidance and data sets in CIBSE TM49 and TM52 guidance, using the current 2020s summer year (DSY 1) and the more extreme DSY 2 and DSY 3 weather data.

The results of the dynamic modelling overheating assessment are summarised below;-

 The CIBSE compliance criteria cannot be met in the non-residential space (for the 2020s DSY1, 2 and 3 weather scenarios) without blinds through the use of natural ventilation via openable windows/doors and increased mechanical ventilation.

The proposed overheating mitigation measures are summarised below;-

For the retail, commercial, marketing suite and other appropriate areas active cooling is proposed.

1.4 Outline Part of the Application (Phases B, C and D)

1.4.1 Carbon Reduction Strategy

The energy strategy for the outline part of the application follows the London Plan's updated energy hierarchy approach of 'Be Lean', 'Be Clean', 'Be Green', and 'Be Seen' as detailed in policy SI2.

The carbon emissions from the residential element of the outline part of the application have been estimated using the SAP calculation results from Block I of the detailed part of the application. These have been adjusted to reflect the proposed energy strategy for the outline part of the application (using a combination of air-to-water and water-to-water heat pumps) and then increased to reflect the maximum number of dwellings and the mix of dwelling types in the proposed outline development.

The carbon emissions from the non-residential element of the outline part of the application have been estimated using the SBEM calculation results from Blocks F and H of the detailed part of the application. These have been adjusted to reflect the proposed energy strategy for the outline part of the application (using heat pumps) and then increased pro-rata to reflect the maximum non-residential area in the proposed outline development.

1.4.2 Carbon Reductions

Domestic Carbon Emissions and Savings

The expected carbon dioxide emissions at each stage of the hierarchy are shown in the graph below for the residential element of the outline part of the application.

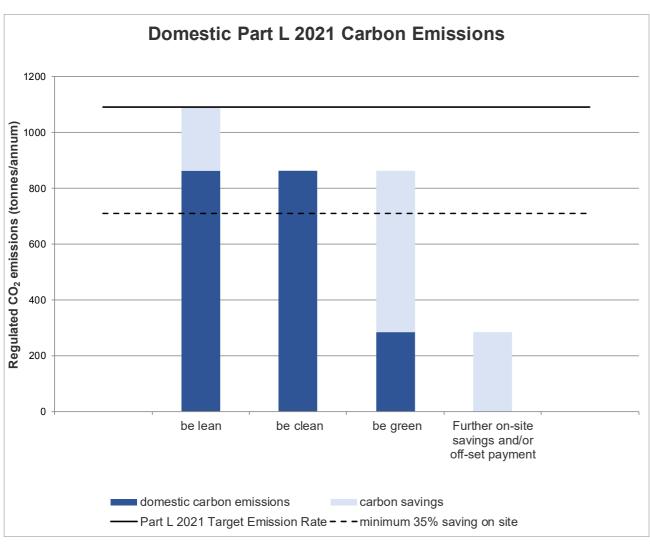


Figure 5: Domestic energy hierarchy and targets for the outline part of the application

The graph above demonstrates that the residential element of the outline part of the application is expected to significantly exceed the London Plan minimum target of 35% and GLA benchmark target of 50%, achieving an overall on-site reduction of around 74% in regulated carbon dioxide emissions over Part L 2021.

Energy demand in the residential areas will be significantly reduced, expected to exceed the GLA target of 10%, achieving a reduction of around 21% in regulated carbon emissions over Part L 2021 at the 'Be Lean' stage of the hierarchy, through passive design and energy efficiency measures alone.

The tables below detail the carbon dioxide emissions and savings expected at each stage of the energy hierarchy for the domestic elements.

	Regulated carbon dioxide emissions for domestic buildings (Tonnes CO ₂ per annum)
Baseline: Part L 2021 Compliant	1,103.5
Be Lean	871.2
Be Clean	871.2
Be Green	286.0



Table 9: Carbon dioxide emissions after each stage of the energy hierarchy for domestic elements of the outline part of the application

	Regulated domestic ca	rbon dioxide savings	
	Tonnes CO ₂ per annum	%	
Be lean	232.3	21%	
Be clean	0.0	0%	
Be green	585.2	53%	
Cumulative on site savings	817.5	74%	
Carbon shortfall	286.0	-	
	Tonnes	s CO ₂	
Cumulative savings for off-set payment	8,58	31	
Cash-in-lieu contribution	815,201		

Table 10: Regulated carbon dioxide savings from each stage of the energy hierarchy for domestic elements of the outline part of the application

Non-Domestic Carbon Emissions and Savings

The expected carbon dioxide emissions at each stage of the hierarchy are shown in the graph below for the non-residential element of the outline part of the application.



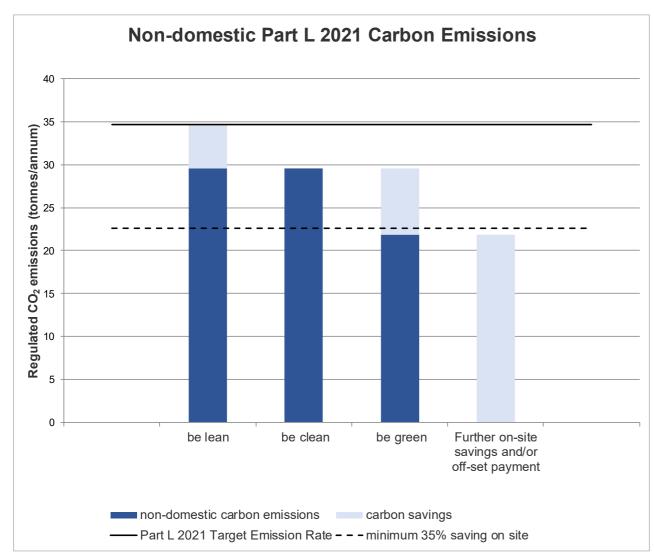


Figure 6: Non-domestic energy hierarchy and targets for the outline part of the application

The graph above demonstrates that the non-residential element of the outline part of the application is expected to exceed the London Plan minimum target of 35%, achieving an overall on-site reduction of around 37% in regulated carbon dioxide emissions over Part L 2021.

Energy demand in the non-residential areas will be significantly reduced, expected to meet the GLA target, achieving a reduction of around 15% in regulated carbon emissions over Part L 2021 at the 'Be Lean' stage of the hierarchy, through passive design and energy efficiency measures alone.

The tables below detail the carbon dioxide emissions and savings expected at each stage of the energy hierarchy for the non-domestic elements.

	Regulated carbon dioxide emissions for non-domestic buildings (Tonnes CO ₂ per annum)
Baseline: Part L 2021 Compliant	35.3
Be Lean	30.1
Be Clean	30.1
Be Green	22.2

Table 11: Carbon dioxide emissions after each stage of the energy hierarchy for non-domestic elements of the outline part of the application

	Regulated domestic carbon dioxide savings		
	Tonnes CO ₂ per annum	%	
Be lean	5.1	15%	
Be clean	0.0	0%	
Be green	8.0	23%	
Cumulative on site savings	13.1	37%	
Carbon shortfall	22.2 -		
	Tonnes CO ₂		
Cumulative savings for off-set payment	665		
Cash-in-lieu contribution	63,150		

Table 12: Regulated carbon dioxide savings from each stage of the energy hierarchy for nondomestic elements of the outline part of the application

Total Carbon Emissions and Savings

The table below details the overall carbon dioxide emissions and savings expected at each stage of the energy hierarchy for the outline part of the application. These are calculated using SAP 10 carbon emission factors.

The table below demonstrates that the outline part of the application as a whole is expected to achieve an on-site reduction of 73% in regulated carbon dioxide emissions over Part L 2021.

	Total regulated emissions (Tonnes CO₂/year)	CO₂ savings (Tonnes CO₂/year)	Percentage saving (%)	
Part L 2021 baseline	1,138.7			
Be Lean	901.4	237.4	21%	
Be Clean	901.4	0.0	0%	
Be Green	308.2	593.2	52%	



Cumulative	-	830.5	73%
		CO ₂ savings off-set (Tonnes CO ₂)	
Off-set		9,245.8	

Table 13: Total regulated carbon dioxide emissions and savings for the outline part of the application

The table above demonstrates that the outline part of the application as a whole achieves an on-site reduction of 73% in regulated carbon dioxide emissions over Part L 2021.

The table above demonstrates that the total regulated carbon dioxide emissions (using Part L 2021) for the outline part of the application (308.2 Tonnes/year) are 47.5% lower than the 587.0 Tonnes/year calculated for the previous submission to LBTH.

1.4.3 Demand Reduction (Be Lean)

As detailed above, energy demand will be significantly reduced beyond Part L requirements, achieving a 21% reduction in overall carbon emissions over Part L 2021 for the outline part of the application, through passive design and energy efficiency measures alone.

The reduction is expected to be achieved by a combination of measures, which shall include the following;

- Significantly improved fabric 'U' values (including the addition of triple glazing to the commercial / retail spaces since the previous submission to LBTH);
- Minimised cold bridging (further improved since the previous submission to LBTH);
- Improved air tightness (further improved in commercial / retail spaces since the previous submission to LBTH);
- Optimised g-value of the glazing to provide a balance between minimising heat gain in summer (to reduce overheating), maximising useful heat gain in winter (to reduce heating energy) and maximising natural daylight (to reduce lighting energy);
- Waste Water Heat Recovery (WWHR) for the residential (included since the previous submission to LBTH);
- Communal heating system to the outline development blocks;
- High efficiency ventilation systems (Residential MVHR efficiency further improved since the previous submission to LBTH);
- Minimised heat loss from heating and hot water systems;
- Low energy lighting;
- Controls systems to monitor and operate the plant and equipment as efficiently as possible; and
- Smart meters.

1.4.4 Heating Infrastructure (Be Clean)

The existing site heat network serving the original masterplan does not have capacity to serve the whole of the new Masterplan. Investigations have confirmed that there are no other district heating networks in the vicinity of this site and none planned for the near future.

It is therefore proposed to provide a new site heat network serving the heat demand of the outline part of the application (Phases B, C and D).

EON have identified potential sources of waste heat from data centres to the south of the outline part of the application, and are currently developing plans for a low temperature network that could potentially serve the outline part of the application in the future, and also be used to de-carbonise the existing heat network serving the original masterplan area.

It is therefore proposed that the site heat network serving the outline part of the application will be a low temperature network compatible with the future network being developed by EON.

As EON's plans are at an early stage, this assessment is based on the primary network for the outline part of the application being fed from central air-to-water heat pumps which will generate low temperature heat at around 20-30°C for distribution around the development.

When available, waste heat from the EON district network could directly serve the primary network to further de-carbonise the network.

Each block will be provided with its own water-to-water heat pumps and thermal store which is used to raise the temperature to around 55°C for distribution within the block. Heat interface units will be provided per dwelling, providing instantaneous heating and hot water.

An annual heating (and cooling) load profile assessment has been carried out for the development in conjunction with a heat pump manufacturer, with demand calculated hourly using the London TRY weather data, and the results are provided in Appendix A.6. This has been used to confirm the system seasonal efficiency.

The carbon reductions generated by the heat pumps are included at the Be Green stage of the hierarchy.

1.4.5 Renewable Energy Systems (Be Green)

As stated above, air-to-water and water-to-water heat pumps are appropriate as the main heat source for the outline part of the application. The heat pumps are expected to provide a total saving of approximately 649,474 kg CO2 per year in regulated carbon dioxide emissions.

It is also proposed that photovoltaic panels will be installed on the roofs of the residential blocks in the outline part of the application.

Although the exact numbers cannot be determined at this stage, it is expected that a minimum of 420 No. photovoltaic panels will be installed on the roofs, based on a pro-rata increase from Block I. The panels will have a total peak output of 159.6 kW (based on 1.72m², 22% efficient panels). The panels will generate a saving of approximately 13,287 kg CO2 per year in regulated carbon dioxide emissions.

In accordance with GLA Energy Assessment Guidance 2022, PV provision will be maximised when the design for the Reserved Matters application(s) is developed.

1.4.6 Energy Monitoring (Be Seen)

The applicant confirms a commitment to monitor and report its energy performance post-construction in accordance with the 'Be Seen' guidance.

1.4.7 Carbon Offset

The remaining regulated carbon dioxide emissions (to 100%) over 30 years for the outline part of the application (around 9,245.8 Tonnes CO₂) will off-set through a cash in lieu contribution of approximately £878,350 (based on £95/Tonne) to the local planning authority, to be ring fenced to secure delivery of carbon dioxide savings elsewhere.



1.4.8 Overheating and Cooling

An initial early stage assessment has been carried out for the outline part of the application in accordance with the cooling hierarchy detailed in policy SI 4 of the London Plan and the latest Energy Assessment Guidance, in order to reduce overheating and minimise the use of air conditioning.

Residential

Although dynamic thermal modelling is not a requirement for the outline part of the application, as part of the early stage design modelling has been carried out on a sample of apartments to assess the risk of overheating, using IES modelling software, in accordance with the guidance and data sets in CIBSE TM49 and TM59 guidance, using the current 2020s summer year (DSY 1) and the more extreme DSY 2 and DSY 3.

This modelling has been completed for a sample of west facing apartments at differing levels between the 2nd and 20th floor with both recessed and projecting balconies.

The results of this early stage dynamic modelling overheating assessment are summarised below;-

- The CIBSE compliance criteria are met in almost all rooms modelled (for the 2020s DSY1 weather scenario) for both recessed and projecting balconies, without blinds through the use of natural ventilation via openable windows/doors and increased mechanical ventilation, together with an improvement of the glazing g-value to 0.33.
- The CIBSE compliance criteria are met in a significant proportion of the rooms modelled (for the 2020s DSY2 and 3 weather scenarios) without blinds through the use of natural ventilation via openable windows/doors and increased mechanical ventilation, together with an improvement of the glazing gvalue to 0.33.

The results demonstrate that the outline design provides a suitable reduction in the risk of overheating at this stage of design.

As the design is developed for the later Reserved Matters application(s), further work will be done to explore all available passive measures with the aim of reducing the risk further.

Non-Residential

The design of the outline part of the application is not sufficiently progressed to allow dynamic thermal modelling for the non-residential areas.

As the design is developed for the later Reserved Matters application(s), an assessment will be carried out to reduce overheating and minimise the use of air conditioning in the non-residential areas.

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2 Introduction

2.1 This Application

This Energy Assessment Report has been prepared by Meinhardt (UK) Ltd and is submitted in support of an updated hybrid planning application to the Mayor of London for the Aberfeldy Village Masterplan seeking detailed planning permission for Phase A and Outline planning permission for future phases, comprising:

Outline planning permission (all matters reserved) for the demolition of all existing structures and redevelopment to include a number of buildings (up to 100m AOD) and up to 140,591 (GEA) of floorspace comprising the following mix of uses: Residential (Class C3); Retail, workspace, food and drink uses (Class E); Car and cycle parking; Formation of new pedestrian route through the conversion and repurposing of the Abbott Road vehicular underpass for pedestrians and cyclists connecting to Jolly's Green; Landscaping including open spaces and public realm; and New means of access, associated infrastructure and highway works.

In Full, for residential (Class C3), retail, food and drink uses and a temporary marketing suite (Class E and Sui Generis), together with access, car and cycle parking, associated landscaping and new public realm, and open space. This application is accompanied by an Environmental Statement.

2.2 Extant Outline Planning Permission

An Outline Permission (ref: PA/11/02716/P0) was granted in June 2012 and the following has been delivered to date:

- Phases 1, 2, 3a and 3b built out
- 901 new homes
- 29% affordable homes by habitable room or 9.18% affordable homes by habitable room on the uplift
- New larger Community Centre with improved facilities
- Larger modern Health Centre
- New retail floorspace
- New energy centre
- New and enhanced high quality open space including play-space and a linear park
- Heights: 2 to 10 storeys
- Parking ratio: 0.2 spaces

2.3 This Energy Assessment

The purpose of this Energy Assessment report is to demonstrate how the climate change mitigation measures proposed for the Aberfeldy Village Masterplan address the relevant local, regional and national planning policies. It also demonstrates that energy is an integral part of the proposed development's design.

This report supersedes the Energy Assessment Report Revision P4 dated 21st October 2022 previously submitted in support of the Hybrid Application (LBTH Ref: PA/21/02377/A1 and GLA Ref: 2023/0300/S3) and should therefore be read on a standalone basis.

Following a resolution to refuse planning permission by the SDC in February 2023, and the subsequent direction that the Mayor of London will act as the local planning authority for the purposes of determining the planning application, further amendments have been made to the design of the scheme to accommodate second staircases in all buildings over 18m in height.

For the sake of completeness only it should be noted that the above referenced amendments follow previous amendments to the Hybrid Application, made prior to its consideration by the LBTH SDC, the assessments of which were set out within previous revisions of this Energy Assessment Report. In summary the previously assessed charges were: the incorporation of Jolly's Green within the red line

boundary, the removal of the previously proposed Block A3 and associated increase in open space and play space, an increase in the number of affordable rented family homes, and the inclusion of second staircases in Plots F & I.

Further information is set out within the accompanying Covering Letter (as prepared by DP9 Ltd, dated November 2023) and the updated Planning Statement (as prepared by DP9 Ltd, dated November 2023).

This Energy Assessment Report has been updated to reflect the revised Building Regulations 2021 and GLA planning policy introduced since submission of the application to LBTH. Refer to Section 4.

In response to the revised Building Regulations 2021 and updated planning policy, a number of improvements have been made to the scheme to lower energy usage and carbon dioxide emissions.

2.4 Other Documents

Cost Consultant:

Flood Risk Consultant:

This report should be read in conjunction with the other documents which form part of the hybrid planning application.

2.5 Project Team

Client: EcoWorld and Poplar HARCA

Planning Consultant: DP9

Masterplan Architect: Levitt Bernstein

Phase A Architect: Morris and Company

Structural, Civils, MEP, and Energy: Meinhardt (UK) Ltd

Access Consultant: Lord Consultants

Air Quality and Acoustics Consultant: Entran
Arboriculture Consultant: Arbeco

Archaeology Consultant: Thames Valley Archaeology Services

Circle

Parmabrook

Communications and PR: Lowick

Cycling Consultant: Cycling Score

Daylight and Sunlight Consultant: GIA

Ecology and Sustainability Consultant: Greengage

Education Consultant: Quod
EIA Consultant: Trium

Fire Consultant: Elementa

Heritage Consultant: KM Heritage
Landscape Architect: LDA Design

Legal: Pinsent Masons

Play and Recreation: ZCD Architects

Principal Designer: Baily Garner

Retail and Commercial Consultant: AND



Rights of Light Consultant: Anstey Horne

Socio-Economic Consultant: Hatch

Townscape Consultant: Peter Stewart Consultancy

Transport Consultant: Velocity

Viability Consultant: DS2

Visual Impact Assessment: Miller Hare

Visualisation: Black Point Design

Wind Consultant: RWDI

MEINHARDT

3 Scheme Overview

3.1 Site and Surroundings

The Site is located in Poplar, within the administrative boundary of the London Borough of Tower Hamlets. The Site is 9.08 hectares in total and comprises:

- Abbott Road;
- Aberfeldy Street;
- Balmore Close;
- Blairegowrie House;
- Heather House;
- Jura House;
- Tartan House;
- Thistle House;
- Kilbrennan House;
- Blairgowrie House;
- Nos. 33-35 Findhorn Street;
- 2a Ettrick Street;
- · Lochnager Street;
- · Aberfeldy Neighbourhood Centre;
- Nairn Street Estate; and
- Leven Road Open Space, Jolly's Green and Braithwaite Park.



Figure 7: Aerial view of the existing site

3.2 Proposed Development

An outline planning approval was granted for the Aberfeldy Estate masterplan in 2012. Phases 1, 2, 3a and 3b of the original masterplan have been completed on site and are now occupied.

The New Aberfeldy Masterplan includes the residual phases of the original masterplan (phase 4-6), the Nairn Street Estate to the north, Abbott Road, the properties and land around Balmore Close and the existing green space along Abbott Road: Millennium Green, Jolly's Green, Braithwaite Park and the Leven Road green amenity space.

The proposed scheme will include the phased demolition of all existing buildings and structures, site preparation works and the construction of a new mixed use redevelopment, including the following;-

- Residential
- Retail
- Workspace/ employment space
- · Resident facilities
- Temporary marketing suite

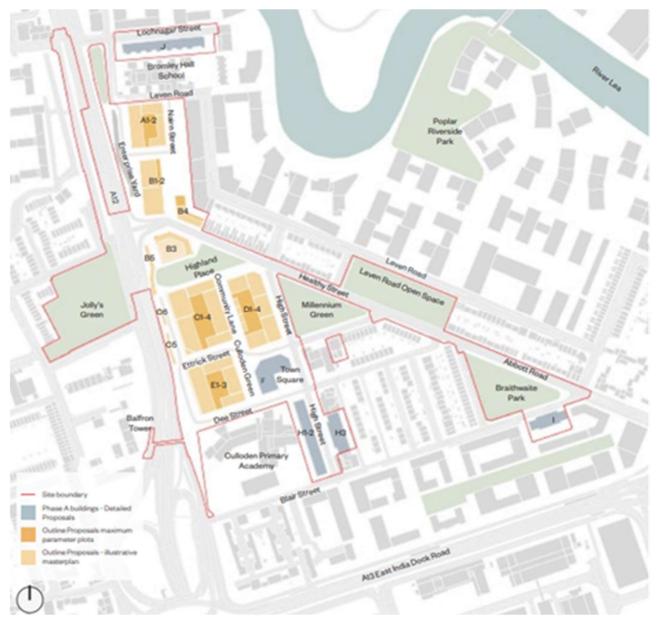


Figure 8: Plan view of the illustrative Aberfeldy Village Masterplan



The detailed part of the application comprises Phase A of the proposed development located in the areas shown in grey below, and includes Blocks F, H1/H2, H3, I and J.

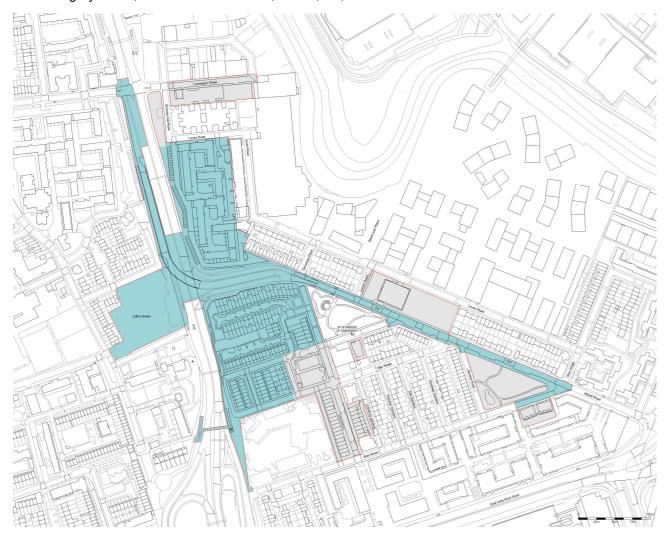


Figure 9: Detailed part of the application Phase A location plan

The remainder of the Aberfeldy Village Masterplan forms the outline part of the application and is expected to be constructed in a further three phases (B, C and D) as shown on Figure 8 above.

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Planning Policy 4

4.1 **National**

National Planning Policy Framework (2023) 4.1.1



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

The current version was issued in September 2023.

4.1.2 **Building Regulations**



The Building Regulations set out the statutory standards that developments are to meet. These standards cover measures including energy efficiency, water efficiency, sound resistance and ventilation.

Part L of the Building Regulations covers energy efficiency requirements.

The current version of Part L was issued in 2021 (with minor amendments in 2023).

4.2 Regional

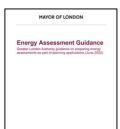
4.2.1 The London Plan (2021)



The London Plan 2021 is the Spatial Development Strategy for Greater London. It sets out a framework for how London will develop over the next 20-25 years and the Mayor's vision for Good Growth.

The Plan is part of the statutory development plan for London, meaning that the policies in the Plan should inform decisions on planning applications across the capital. Borough's Local Plans must be in 'general conformity' with the London Plan, ensuring that the planning system for London operates in a joined-up way and reflects the overall strategy for how London can develop sustainably.

4.2.2 **Energy Assessment Guidance (2022)**



This guidance document explains how to prepare an energy assessment to accompany strategic planning applications referred to the Mayor.

The purpose of an energy assessment is to demonstrate that the proposed climate change mitigation measures comply with London Plan energy policies, including the energy hierarchy.

An updated version was published in June 2022 which explains how London Plan policies apply now that Part L 2021 has taken effect.

4.2.3 'Be Seen' Energy Monitoring Guidance (2021)



This guidance explains the process that needs to be followed to comply with the 'Be Seen' post-construction monitoring requirement of Policy SI 2 of the new London Plan.

The collected data will help the GLA and local authorities better understand how London Plan policies are being applied to new developments, it will provide useful insights to the performance gap and will drive improved building performance.

4.2.4 Carbon Offset Funds (2022)



This guidance document provides further detail for London's LPAs on setting up carbon offset funds and identifying suitable projects to best utilise that funding. It aims to encourage a consistent approach across London but one that allows for flexibility according to an LPA's local context and priorities

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5 Establishing Energy Demand and Emissions

5.1 Carbon Reduction Targets

5.1.1 National Policy

The UK Government has made a commitment to bring all greenhouse gas emissions in the UK to net zero by 2050. Further commitments have been made to reducing economy-wide greenhouse gas emissions by at least 68% by 2030 and by 78% by 2035, compared to 1990 levels.

5.1.2 Building Regulations

An updated Building Regulations Part L Conservation of Fuel and Power and a new Part O Overheating were introduced in June 2022. The updated Part L is expected to deliver a 30% improvement on 2013 standards for domestic buildings.

Further consultation is expected on the new Future Homes Standard and Future Buildings Standard which are intended to be introduced in 2025.

5.1.3 London Plan (2021)

Major development should be net zero-carbon, with a minimum on-site reduction of at least 35 per cent beyond Building Regulations Part L 2013 requirements.

Residential development should achieve 10 per cent, and non-residential development should achieve 15 per cent reduction through energy efficiency measures.

Where the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided, either through a cash in lieu contribution to the borough's carbon offset fund, or off-site provided that an alternative proposal is identified and delivery is certain.

Carbon emissions from any other part of the development i.e. unregulated emissions, should be calculated and minimised.

5.1.4 Energy Assessment Guidance (2022)

Updated planning guidance has been published by the GLA (in June 2022) which explains how London Plan policies apply now that Part L 2021 has taken effect.

Residential developments are expected to be able to exceed the 35 per cent minimum improvement over Building Regulations Part L 2021 requirements and should aim to achieve at least a 50 per cent improvement.

5.2 Detailed Part of the Application

5.2.1 Residential

5.2.1.1 Methodology

Building Regulations Part L1 2021 SAP calculations have been undertaken, using Elmhurst Design SAP10.2 software for a sample of residential dwellings in each block.

The calculations include apartments at the lowest level, intermediate and top floors.

The results of the residential SAP calculations (Compliance and TER/DER worksheets) are provided in Appendix A.1 for the 'Be Lean' stage of the hierarchy and in Appendix A.2 and for the 'Be Green' stage.

5.2.1.2 Baseline Emissions

In accordance with GLA Energy Assessment Guidance 2022, to determine the CO₂ emissions baseline the Target Emission Rate (TER) has been used from the final proposed building specification ie the 'Be Green' stage of the hierarchy.

The SAP 10.2 TER includes an area of photovoltaic panels in accordance with the dwelling floor area and the number of storeys in the block (for flats).

The GLA Carbon Emissions Reporting spreadsheet also includes the carbon savings generated by the notional PV panels for the actual building, at both the 'Be Lean' and 'Be Clean' stages of the hierarchy (but not at the 'Be Green' stage) to ensure that passive design and energy efficiency savings are suitably demonstrated.

Blocks F and H

As the final proposed building specification includes a connection to an existing heat network, SAP 10.2 calculates the TER using a heat network with the same carbon emission and primary energy factors as used in calculating the DER for the actual building.

Blocks I and J

As the final proposed building specification includes heat pumps, SAP 10.2 calculates the TER using a gas fired boiler with an efficiency of 89.5% for space heating and hot water.

5.2.2 Commercial

5.2.2.1 Methodology

Building Regulations Part L2 2021 modelling has been undertaken for the commercial area using IES dynamic thermal modelling software (SBEM) in line with the relevant National Calculation Methodology (NCM) guidance.

The BRUKL output sheets are provided in Appendix A.3 for the 'Be Lean' stage of the hierarchy and in Appendix A.4 and for the 'Be Green' stage.

5.2.2.2 Baseline Emissions

In accordance with GLA Energy Assessment Guidance 2022, to determine the CO₂ emissions baseline the Target Emission Rate (TER) has been used from the final proposed building specification ie the 'Be Green' stage of the hierarchy.

The SBEM TER normally includes an area of photovoltaic panels in accordance with the building area and arrangement, but for this development it is proposed to supply 100% of the space heating and hot water demand from heat pumps so the area of PV in the TER is reduced to zero.

The GLA Carbon Emissions Reporting spreadsheet also includes the carbon savings generated by the notional PV panels for the actual building, at both the 'Be Lean' and 'Be Clean' stages of the hierarchy (but not at the 'Be Green' stage)

Blocks F and H

As the final proposed building specification includes a connection to an existing heat network, SBEM calculates the TER using a heat network with the same carbon emission and primary energy factors as used in calculating the BER for the actual building.

Blocks I

As the final proposed building specification includes heat pumps, SBEM calculates the TER using a heat pump with a seasonal efficiency of 2.64 for space heating and 2.86 for hot water.



5.3 Outline Part of the Application

5.3.1 Residential

The carbon emissions from the residential element of the outline part of the application have been estimated using the SAP calculation results from Block I of the detailed part of the application.

These have been adjusted to reflect the proposed energy strategy for the outline part of the application (using a combination of air-to-water and water-to-water heat pumps) and then increased to reflect the maximum number of dwellings and the mix of dwelling types in the proposed outline development.

5.3.2 Non-Residential

The carbon emissions from the non-residential element of the outline part of the application have been estimated using the SBEM calculation results from Blocks F and H of the detailed part of the application.

These have been adjusted to reflect the proposed energy strategy for the outline part of the application (using heat pumps) and then increased pro-rata to reflect the maximum non-residential area in the proposed outline development.

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6 Demand Reduction (Be Lean)

6.1 Detailed Part of the Application

Energy demand will be significantly reduced beyond Part L requirements, achieving a 16% reduction in overall carbon emissions over Part L 2021 for the detailed part of the application, through passive design and energy efficiency measures alone.

The demand reduction will be achieved by a combination of the measures including those detailed below;-

6.1.1 Building Fabric Insulation

The thermal performance of the building fabric will be significantly improved over Part L 2021 minimum requirements as below;-

Fabric Element	Blocks F, H and I Residential 'U' Values (W/m² K)	Block J Residential 'U' Values (W/m² K)	Non-Residential 'U' Values (W/m² K)	
External Walls	0.14	0.13	0.14	
Floor	0.10	0.08	0.10	
Roof	0.10	0.10	0.10	
Windows	1.3	0.80	0.8 (Block F and H retail and Office areas), 1.40	

Table 14: Proposed fabric 'U' values for the detailed part of the application

The window U value has been further improved in the commercial / retail space, from 1.4 W/m² K used in the previous submission to LBTH, through the incorporation of triple glazing.

6.1.2 Cold Bridging

Thermal bridging will be minimised to reduce the loss of heat and to prevent the development of cold spots which can lead to mould.

At this early stage of design, detailed construction joint drawings are not available, so each junction type has been assessed and a target improved psi-value has been set as detailed below.

These targets have been benchmarked against calculations from other similar junctions and reputable sources such as the LABC, to ensure they are deliverable.

At the appropriate stages of design and construction, the thermal bridges will be demonstrated to the Building Control Body in accordance with the requirements of Building Regulations Part L 2021.

Residential

The target improved psi-values have been set using the reference values detailed in Table R2 of the SAP 10.2 Procedure, except for window junctions (E2, E3 and E4) which have used an improved psi value of 0.03. The y-value is calculated individually for each dwelling in the SAP software using the measured junction lengths.

Commercial

IES VE software calculates thermal bridge heat losses for the actual building using default y-values that are 25% of the construction element 'U' values, in accordance with the NCM Modelling Guide.

The target improved y-values have been set at 10% of the construction element 'U' values, in accordance with the notional building in the NCM Modelling Guide.

6.1.3 Air Tightness

The target air permeability has been set at $2.5 \text{ m}^3/(\text{h m}^2)$ in non-residential areas and $3 \text{ m}^3/(\text{h m}^2)$ in the residential dwellings, as compared to the Part L minimum requirement of $8 \text{ m}^3/(\text{h m}^2)$ to reduce heat loss in winter.

The air permeability has been further improved in the commercial / retail space from 3 m³/(h m²) used in the previous submission to LBTH.

6.1.4 Natural Daylight

Natural daylight has been maximised wherever possible in the residential accommodation by arranging the living rooms and bedrooms as shallow spaces on the perimeter, by providing dual aspect glazing where possible, and by ensuring ceiling voids are as small as possible (particularly at the perimeter) to maintain the maximum floor to ceiling heights.

Increased floor to ceiling heights with full height glazing are generally provided to the ground floor commercial units and residential entrances.

6.1.5 Solar Gain

The size and g-value of the glazing has been optimised using the SAP calculations, SBEM calculations and the dynamic thermal modelling for the overheating assessment, in order to provide a balance between minimising summer heat gain to prevent overheating, maximising winter heat gain to reduce heating loads, and maximising natural daylight to reduce lighting energy.

This has resulted in the g-value of the glazing being set as detailed below;-.

Space type	Glazing g-value
Blocks F, H and I	0.33
Block J	0.50
Non-residential	0.33

Table 15: Glazing g-values for the detailed part of the application

6.1.6 Shading

Balconies are provided to most of the proposed development which will provide a shading effect to the residential apartments to minimise peak solar gain.

6.1.7 Waste Water Heat Recovery (WWHR)

WWHR will be included for the showers in the residential dwellings, based on a utilisation factor of 0.902. This has been included since the previous submission to LBTH.

6.1.8 Heating Systems

In Section 7.9 entitled "Heating and hot water assumptions" the GLA Energy Assessment Guidance 2022 states "For the purposes of demonstrating CO2 emission improvements in the 'be lean' stage of the energy hierarchy, applicants should use the notional building system type and performance values specified in the Part L 2021 baseline as determined by the final proposed building specification".



Blocks F and H - Residential and Non-Residential

In SAP 10.2 and SBEM where a connection to an existing heat network is proposed as the final specification, the notional building uses a heat network with the same carbon emission and primary energy factors as used in calculating the DER/BER for the actual building.

In July 2023, EON confirmed that the carbon content of the heat delivered by the heat network will be 0.273 kg CO2 per kWh and the primary energy factor 1.356 kWh/kWh based on SAP10.2 carbon emission factors, so this has also been used for the actual building in the Block F and H non-residential SBEM calculations at 'Be Lean' stage.

The residential SAP calculations for Blocks F and H use the following input parameters at 'Be Lean' stage to reflect the confirmed carbon content of the heat network:-

Input parameter	Value
CHP heat efficiency	49.9%
CHP electrical efficiency	32.0%
CHP fraction	55.8%
Boiler efficiency	93.9%
Boiler fraction	44.2%
Distribution loss factor	1.25

Table 16: SAP heating system input parameters for Blocks F and H

Blocks I and J - Residential

In SAP 10.2 where heat pumps are proposed as the final specification, the notional building uses a gas fired boiler with an efficiency of 89.5% for space heating and hot water, so this has also been assumed for the actual building at 'Be Lean' stage for Blocks I and J residential dwellings.

Block I - Non-Residential

In SBEM where heat pumps are proposed as the final specification, the notional building uses a heat pump with a seasonal efficiency of 2.64 for space heating and 2.86 for hot water, so this has also been assumed for the actual building at 'Be Lean' stage for Block I non-residential areas.

6.1.9 Pipework Heat Losses

The site heating systems will be designed to minimise heat losses in accordance with the recommendations of CIBSE CP1, including measures such as minimising pipework lengths and installing high level of insulation (in excess of British Standards).

6.1.10 Cooling

Residential

Active mechanical cooling is not proposed for the residential dwellings.

The use of natural ventilation via openable windows/doors and increased mechanical ventilation will generally sufficiently reduce the risk of overheating.

In Block J, where the occupants may choose to keep their windows closed at night, an alternative method of reducing the risk of overheating will be available through the use of the MVHR heat pump or a MVHR cooling module.

Non-Residential

For the retail units, marketing suite, and other appropriate areas active cooling is proposed via cooling only split or multi-split heat pump systems which will achieve a seasonal efficiency of 3.92.

6.1.11 Ventilation Systems

Residential

Ventilation to the residential apartments to provide fresh air and extract moisture/pollutants in accordance with Building Regulations Part F will be via individual Mechanical Ventilation with Heat Recovery (MHVR) units. Each unit will achieve a Specific Fan Power of up to 0.47 W/(I/s) and a heat recovery efficiency of up to 91%, depending on the number of wet rooms.

This has been further improved from 0.52 W/(l/s) and 90% efficiency used in the previous submission to LBTH, through the selection of an alternative newer model.

The communal corridors shall have a dual purpose mechanical extract system that can operate to assist the natural ventilation when necessary in maintaining air movement in corridors and prevent stagnant air and odour build up in winter.

Non-Residential

It is expected that the retail units, marketing suite, and other appropriate areas will be provided with local commercial MVHR units that will achieve a Specific Fan Power of less than 1.1 W/(I/s) and a heat recovery efficiency of at least 85%.

6.1.12 Lighting

Energy efficient LED lighting will be used throughout the proposed development. Occupancy and daylight sensors will be used where appropriate.

6.1.13 Smart Controls / Metering

It is expected that residential apartments will be provided with an individual, programmable, zoned, control system, together with smart energy meters.

This will allow the display of energy use within individual units, assisting occupants to understand the way in which they consume energy and how much it costs, and encouraging them to turn off non-essential equipment or run some equipment at a lower capacity during times of peak demand.

A central Building Management System (BMS) will be provided to operate the 'Landlord' plant and systems in the most energy efficient manner.

6.1.14 Appliances

Where appliances are provided by the developer they will be of an energy efficient type, which generally generate less heat and can help minimise the build-up of heat within the buildings. Where appliances are not provided by the developer, owners/tenants will be encouraged to supply energy efficient equipment.

6.2 Outline Part of the Application

Detailed energy assessments will be carried out as part of the Reserved Matters application(s) to determine the most appropriate demand reduction measures.



The below sections outline the measures incorporated in the outline part of the application, which should form the minimum standards expected to be achieved for all areas within the masterplan.

6.2.1 Building Fabric Insulation

The thermal performance of the building fabric should achieve at least the following;-

Fabric Element	Residential 'U' Values (W/m² K)	Non-Residential 'U' Values (W/m² K)
External Walls	0.14	0.14
Floor	0.10	0.10
Roof	0.10	0.10
Windows	1.30	0.8 in retail and office areas, 1.40 elsewhere

Table 17: Proposed maximum fabric 'U' values for the outline part of the application

The window U value has been further improved in the commercial / retail space, from 1.4 W/m² K used in the previous submission to LBTH, through the incorporation of triple glazing.

6.2.2 Cold Bridging

Cold bridging should be minimised to prevent the loss of heat and to prevent the development of cold spots, which can lead to mould. Suitable construction details should be developed to ensure insulation continuity and to meet the air tightness targets detailed below.

6.2.3 Air Tightness

The target air permeability should be set at a maximum of $2.5 \text{ m}^3/(\text{h m}^2)$ in non-residential areas and $3 \text{ m}^3/(\text{h m}^2)$ in the residential dwellings.

The air permeability has been further improved in the commercial / retail space from 3 m³/(h m²) used in the previous submission to LBTH.

6.2.4 Daylight and Solar Gain

The size and g-value of the glazing should be optimised using SAP calculations, SBEM calculations and dynamic overheating modelling, in order to provide a balance between minimising summer heat gain to prevent overheating, maximising winter heat gain to reduce heating loads, and maximising natural daylight to reduce lighting energy.

6.2.5 Shading

External shading should be considered as appropriate to reduce peak solar gain.

6.2.6 Waste Water Heat Recovery (WWHR)

WWHR should be included for the showers in the residential dwellings, with a minimum utilisation factor of 0.902. This has been included since the previous submission to LBTH.

6.2.7 Heating and Hot Water System

Residential

In SAP 10.2 where heat pumps are proposed as the final specification, the notional building uses a gas fired boiler with an efficiency of 89.5% for space heating and hot water, so this should also be assumed for the actual building at 'Be Lean' stage.

Non-Residential

In SBEM where heat pumps are proposed as the final specification, the notional building uses a heat pump with a seasonal efficiency of 2.64 for space heating and 2.86 for hot water, so this should also be assumed for the actual building at 'Be Lean' stage.

6.2.8 Pipework Heat Losses

The site heating systems should be designed to minimise heat losses in accordance with the recommendations of CIBSE CP1, including measures such as minimising pipework lengths and installing high level of insulation (in excess of British Standards).

6.2.9 Cooling

Residential

Active mechanical cooling should not be proposed for the residential dwellings.

The use of natural ventilation via openable windows/doors and increased mechanical ventilation should generally sufficiently reduce the risk of overheating.

Where the occupants may choose to keep their windows closed at night due to higher external noise levels, an alternative method of reducing the risk of overheating should be made available through the use of MVHR heat pumps or a MVHR cooling module.

Non-Residential

For the workspace and retail units cooling is expected to be provided via VRF, split or multi-split heat pump systems which should achieve a seasonal efficiency of at least 3.92.

6.2.10 Ventilation Systems

Residential

Ventilation to the residential apartments should be via individual Mechanical Ventilation with Heat Recovery (MHVR) units. Each unit should achieve a Specific Fan Power of up to 0.47 W/(I/s) and a heat recovery efficiency of up to 91%, depending on the number of wet rooms.

This has been further improved from 0.52 W/(l/s) and 90% efficiency used in the previous submission to LBTH, through the selection of an alternative newer model.

The communal corridors shall have a dual purpose mechanical extract system that can operate to assist the natural ventilation when necessary in maintaining air movement in corridors and prevent stagnant air and odour build up in winter.

Non-Residential

It is expected that the workspace and retail units will be provided with local commercial MVHR units that should achieve a Specific Fan Power of less than 1.1 W/(I/s) and a heat recovery efficiency of at least 85%.

6.2.11 Lighting

Energy efficient LED lighting should be used throughout the proposed development. Occupancy and daylight sensors should be used where appropriate.

6.2.12 Smart Controls / Metering

It is expected that residential apartments will be provided with an individual, programmable, zoned, control system, together with smart energy meters.



A central Building Management System (BMS) should be provided to operate the 'Landlord' plant and systems in the most energy efficient manner.

6.2.13 Appliances

Where appliances are provided by the developer they should be of an energy efficient type, and where they are not provided by the developer, owners/tenants will be encouraged to supply energy efficient equipment.

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Heating Infrastructure (Be Clean)

7.1 **Detailed Part of the Application**

7.1.1 Blocks F, H1/H2, and H3

Overview

The energy strategy (AV011) submitted as part of the original masterplan for the Aberfeldy Estate, proposed a site wide heat network served from a new energy centre sized to provide heat to all six phases of the development.

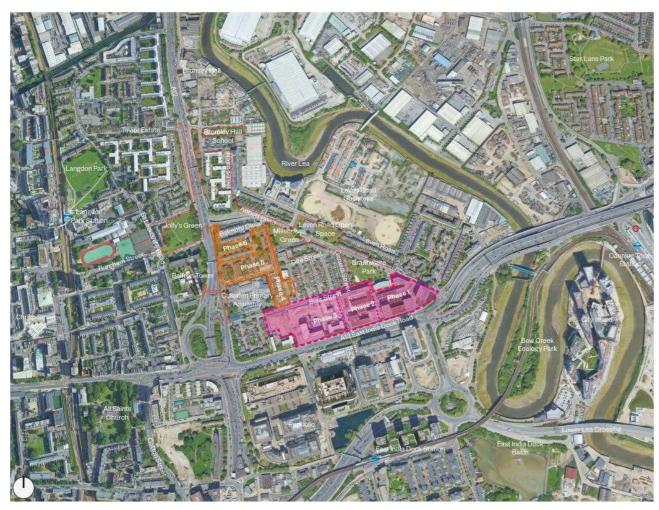


Figure 10: Aerial view of the original masterplan phases and the new masterplan boundary

Phases 1, 2, 3a and 3b of the original masterplan have been completed on site and are now occupied. The energy centre was constructed in Phase 3a and includes gas fired CHP and boilers with the capacity to serve a further 300 residential units. This has been confirmed by the operator of the network Eon.

Blocks F, H1/H2, and H3 of the detailed part of the application comprise 206 residential units, and are located adjacent to Phase 3b within the area designated as phases 4 and 5 of the original masterplan.

A valved and capped connection to the existing site wide heat network has been provided at the north of Phase 3b onto Blair Street to facilitate the connection and extension to Blocks F, H1/H2, and H3 of the detailed part of the application.

GLA Energy Assessment Guidance 2022 confirms that a connection to an existing heat network must be prioritised where the CO2 emission and primary energy factors are within Part L 2021, and where the operator has agreed a decarbonisation strategy with the GLA.

Since the planning submission in October 2021, regular meetings have been held between the applicant, Meinhardt and EON (the heat network operator).

In July 2023, EON provided confirmation of the expected carbon content and primary energy factor of the heat that will be delivered to Blocks F and H using the latest SAP 10.2 carbon emission factors. The carbon content of the heat delivered by the heat network will be 0.273 kg CO2 per kWh and the primary energy factor 1.356 kWh/kWh based on SAP10.2 carbon emission factors.

As these parameters are below the limits set out in Part L 2021 (0.350 kg CO2 per kWh for carbon content and 1.450 kWh/kWh for primary energy) and as EON have submitted a decarbonisation plan to the GLA, in accordance with GLA policy it is therefore proposed that Blocks F and H will connect to the existing heat network.

Connection to the Network

The primary pipework will be extended from the valved and capped connection in Blair Street to heat substations in Blocks F and H3, which will act as a hydraulic break between the primary network and the secondary heating system that distributes heat throughout the building.

Each substation will consist of two equally sized heat exchangers providing 60% of the heat demand. The substation will operate with both heat exchangers operating in parallel at all times unless a fault in one requires isolation.

Existing Energy Centre

The existing energy centre has been constructed on the ground floor level of Block H and includes a low NOx gas fired "base thermal" load Combined Heat and Power CHP unit operating in conjunction with a supplementary gas fired boiler plant and thermal storage.

The CHP unit has the following specification;-

Heat output 357kW 49.9% gross efficiency Electrical output 229kW 32.0% gross efficiency

716kW Gas input (gross)

The gas fired boilers have a total output of 5020 kW and a gross seasonal efficiency of 93.9%. The centralised thermal storage vessels have a total capacity of approximately 40,000 litres at 85°C storage temperature.

In July 2023, EON confirmed the CHP fraction at 55.8%, which is improved from 51% used in the previous submission to LBTH.

For the SAP calculations a distribution loss factor of 1.25 has been used to reflect the carbon content of 0.273 kg CO2 per kWh confirmed by EON.

7.1.2 **Block I**

Block I is a small block of apartments located at the very east of the application site, close to Phase 1 of the original masterplan. A future connection has not been provided to allow connection into the existing site heat network serving the original masterplan.

Due to the significant distance from the rest of the new Masterplan, and the small heating demand, it is proposed to provide heat from a block energy centre comprising air-to-water heat pumps and water-to-water heat pumps.

A load assessment has been carried out for Block I by a heat pump manufacturer, which confirms a seasonal efficiency of 310% is achievable for the block heat pumps with appropriate thermal storage. This is improved from the 257% used in the previous submission to LBTH. Please refer to Appendix A.5.

For the SAP calculations a distribution loss factor of 1.1 has been used, as it is a small building wide system.

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The carbon reductions generated by the heat pumps are included at the Be Green stage of the hierarchy.

7.1.3 Block J

Block J is a row of individual terraced houses and maisonettes located at the very north of the application site.

Due to the distance from the rest of the new Masterplan, and the small heating demand, it is proposed to provide heat to the houses from individual air-to-water heat pumps supplemented by solar thermal, and to the maisonettes from individual MVHR heat pumps.

Houses

Each system will comprise of an inverter driven outdoor unit and a wall mounted indoor unit, together with a hot water storage vessel.

It is proposed to use solar thermal panels in conjunction with the local heat pumps in each house as they can generate high temperature heat suitable for domestic hot water, thereby maximising the efficiency of the heat pumps (which are best operating at lower temperature).

When selected in the SAP Database, the proposed unit for the houses (Mitsubishi Ecodan PUZ-WMA5VAA) achieves a space heating efficiency of up to 100%, and a domestic hot water efficiency of 267%.

The carbon reductions generated by the heat pumps are included at the Be Green stage of the hierarchy.

Maisonettes

Each individual MVHR heat pump comprises an electric heat pump, hot water vessel and MVHR unit with counterflow heat exchanger.

The unit provides the following;-

- Supply and extract ventilation to the dwelling, with heat recovery via the integral counterflow heat exchanger
- Domestic hot water via the integral hot water storage vessel
- · Space heating via the ventilation supply air
- · Cooling (tempering) of the ventilation supply air

It is proposed to use the Nilan Compact P heat pump for the maisonettes, which is a Passivhaus Certified product. However, when selected in the SAP Database, the Elmhurst software is unable to calculate, so a seasonal efficiency of 310% has been assumed.

The carbon reductions generated by the heat pumps are included at the Be Green stage of the hierarchy.

7.2 Outline Part of the Application

The existing site heat network serving the original masterplan does not have capacity to serve the whole of the new Masterplan. Investigations have confirmed that there are no other district heating networks in the vicinity of this site and none planned for the near future.

It is therefore proposed to provide a new site heat network serving the heat demand of the outline part of the application (Phases B, C and D).

EON have identified potential sources of waste heat from data centres to the south of the outline part of the application, and are currently developing plans for a low temperature network that could potentially serve the outline part of the application in the future, and also be used to de-carbonise the existing heat network serving the original masterplan area.

It is therefore proposed that the site heat network serving the outline part of the application will be a low temperature network compatible with the future network being developed by EON.

As EON's plans are at an early stage, this assessment is based on the primary network for the outline part of the application being fed from central air-to-water heat pumps which will generate low temperature heat at around 20-30°C for distribution around the development.

When available, waste heat from the EON district network could directly serve the primary network to further de-carbonise the network.

Each block will be provided with its own water-to-water heat pumps and thermal store which is used to raise the temperature to around 55°C for distribution within the block. Heat interface units will be provided per dwelling, providing instantaneous heating and hot water.

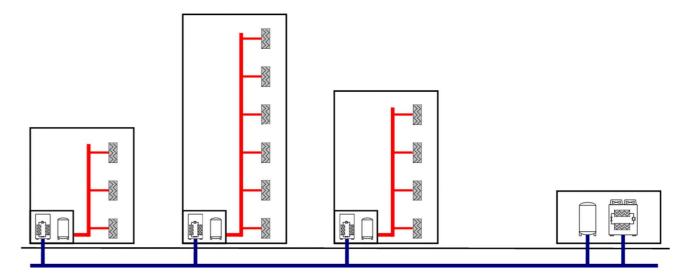


Figure 11: Diagrammatic of the proposed heat pump arrangement for the outline part of the application

An annual heating (and cooling) load profile assessment has been carried out for the development in conjunction with a heat pump manufacturer, with demand calculated hourly using the London TRY weather data, and the results are provided in Appendix A.6. This has been used to confirm the system seasonal efficiency.

The load profile assessment demonstrates an overall seasonal efficiency of 257% for the combination of the central and block heat pumps (in heating mode). For the SAP calculations a distribution loss factor of 1.2 has been assumed.

The site heat network within the development will be designed in accordance with CIBSE CP1 Heat Networks: Code of Practice.

The development has been arranged into several blocks, with the cores located centrally in each block to minimise lateral pipe runs and hence heat losses.

The system will operate with a variable volume and maximum temperature to satisfy the requirements of the tertiary system, which delivers the heat demand to the occupied spaces.

A high level of insulation (in excess of British Standards) will be provided to all parts of the systems, in accordance with the recommendations of CIBSE CP1.

The site heat network will have the following provisions to allow connection to either a future district heating network or a waste heat source (such as the data centre);-

- Space for future district heating interfacing heat exchanger, pumps, controls etc;
- Provision to allow future district heating connecting pipework to be routed through from outside; and
- Spare ways on local electrical distribution boards for future electrical supplies to pumps, controls etc.



8 Renewable Energy (Be Green)

8.1 Detailed Part of the Application

An appraisal of potential on-site renewable energy systems has been undertaken for the development with the following technologies considered:

- Biomass boilers;
- Photovoltaics (PVs);
- Solar thermal;
- Ground source heat pumps;
- Air source heat pumps; and
- Wind Turbines.

8.1.1 Biomass Boilers

Biomass boilers could provide a proportion of the space heating and hot water load, but would compete with the existing CHP serving the base load of the detailed part of the application.

Biomass boilers are better operating as the lead heat source (and not as top up) as they are not suited to operating with variable load.

Biomass boilers would also adversely impact on local air quality due to their emissions, and vehicular delivery of fuel would be required resulting in increased traffic movements.

Biomass boilers are therefore not proposed for the development.

8.1.2 Photovoltaics (PVs)

An assessment has been carried out and it has been determined that photovoltaic panels are appropriate for the detailed part of the application as detailed below.

Blocks F, H1/H2, and H3

It is proposed to install a total of 156 No. photovoltaic panels on the roofs with a total peak output of 59.3 kW (based on 1.72m², 22% efficient panels). The panels will generate a saving of approximately 5,248 kg CO2 per year in regulated carbon dioxide emissions.

The efficiency of each panel has been improved from 20.4% to 22% and an additional 70 No. photovoltaic panels have been included, thereby increasing the peak output from 29kW to 59.3kW since the previous submission to LBTH.

Block I

It is proposed to install photovoltaic panels with a total peak output of 6.5 kW on the roof (based on 17 No., 1.72m², 22% efficient panels). The panels will generate a saving of approximately 537 kg CO2 per year in regulated carbon dioxide emissions.

The efficiency of each panel has been improved from 20.4% to 22% thereby increasing the peak output from 5.8kW to 6.5kW since the previous submission to LBTH.

Block J

It is proposed to install photovoltaic panels with a total peak output of 16 kW on the roofs (based on 42 No., 1.72m², 22% efficient panels). The panels will generate a saving of approximately 1,327 kg CO2 per year in regulated carbon dioxide emissions.

Photovoltaics are therefore proposed for the development.

8.1.3 Solar Thermal

Blocks F, H1/H2, H3 and I

A solar thermal system could provide a proportion of the hot water load but would compete with the site heat network or air-to-water heat pumps serving the base load of the development. Greater carbon reductions are achieved by installing photovoltaics in the limited roof space available.

Solar thermal is therefore not proposed for Blocks F, H and I.

Block J

It is proposed to use solar thermal panels in conjunction with the local heat pumps in each house in Block J as they can generate high temperature heat suitable for domestic hot water, thereby maximising the efficiency of the heat pumps (which are best operating at lower temperature). A collector of 1.1 m² area will be provided on the roof of each dwelling.

The carbon savings generated by the solar thermal panels are reflected in the increased heat pump efficiency and are not reported separately.

Solar thermal is therefore proposed for Block J.

8.1.4 Ground Source Heat Pumps

The overall cooling load is low, resulting in a poor balance between heating and cooling demand, which would adversely impact on the potential yield from any ground source system.

Ground source heat pumps are therefore not proposed for the development.

8.1.5 Air / Water Source Heat Pumps

As described above, heat pumps are proposed for the detailed part of the application as detailed below.

Block I

Air-to-water heat pumps are appropriate as the main heat source for Block I. The heat pumps are expected to provide a total saving of approximately 27,148 kg CO2 per year in regulated carbon dioxide emissions.

Block J

Individual air-to-water heat pumps (supplemented by solar thermal) are appropriate as the main heat source for the houses in Block J.

Individual MVHR heat pumps are appropriate as the main heat source for the maisonettes in Block J.

The heat pumps and solar thermal panels are expected to provide a total saving of approximately 16,044 kg CO2 per year in regulated carbon dioxide emissions.

Air source heat pumps are therefore proposed for the development.

8.1.6 Wind Turbines

Wind turbines would be a complimentary technology to the proposed site heat network. However, they would have significant architectural and townscape implications, together with potential noise.

Wind turbines are therefore not proposed for the development.



8.2 **Outline Part of the Application**

8.2.1 **Biomass Boilers**

Biomass boilers are not appropriate for the outline part of the application due to their adverse impact on local air quality.

Biomass boilers are therefore not proposed for the development.

8.2.2 **Photovoltaics (PVs)**

It is proposed that photovoltaic panels will be installed on the roofs of the residential blocks in the outline part of the application.

Although the exact numbers cannot be determined at this stage, it is expected that a minimum of 420 No. photovoltaic panels will be installed on the roofs, based on a pro-rata increase from Block I. The panels will have a total peak output of 159.6 kW (based on 1.72m², 22% efficient panels). The panels will generate a saving of approximately 13,287 kg CO2 per year in regulated carbon dioxide emissions.

In accordance with GLA Energy Assessment Guidance 2022, PV provision will be maximised when the design for the Reserved Matters application(s) is developed.

Photovoltaics are therefore proposed for the development.

8.2.3 **Solar Thermal**

Solar thermal systems could provide a proportion of the hot water load, but would compete with the air-to-water heat pumps and potential waste heat source serving the base load of the development. Greater carbon reductions are achieved by installing photovoltaics in the limited roof space available.

Solar thermal is therefore not proposed for most of the development.

8.2.4 **Ground Source Heat Pumps**

The overall cooling load is low, resulting in a poor balance between heating and cooling demand, which would adversely impact on the potential yield from any ground source system.

Ground source heat pumps are therefore not proposed for the development.

8.2.5 **Air / Water Source Heat Pumps**

As stated above, air-to-water and water-to-water heat pumps are appropriate as the main heat source for the outline part of the application. The heat pumps are expected to provide a total saving of approximately 649,474 kg CO2 per year in regulated carbon dioxide emissions.

Air source heat pumps are therefore proposed for the development.

8.2.6 **Wind Turbines**

Wind turbines would be a complimentary technology to the proposed site heat network. However, they would have significant architectural and townscape implications, together with potential noise.

Wind turbines are therefore not proposed for the development.

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9 Unregulated Energy

9.1 Detailed Part of the Application

This section outlines how non-regulated energy and carbon dioxide emissions will be reduced through the use of energy efficient appliances and equipment, controls, good management practice, etc.

9.1.1 Baseline

The energy demand and associated carbon dioxide emissions from unregulated uses, i.e. those not covered by the Building Regulations assessments (e.g. cooking and appliances), have been estimated using the UK Government Household Electrical Survey (2014) for the residential elements and using data from CIBSE Guide F for non-residential.

The table below details the breakdown of baseline unregulated energy demand and associated CO₂ emissions for the detailed part of the application.

	Residential		Non-Residential	
Energy Use	Total Energy Demand (kWh/year)	Total Carbon Dioxide Emissions (kg CO₂/year)	Total Energy Demand (kWh/year)	Total Carbon Dioxide Emissions (kg CO ₂ /year)
Residential cooking (electric)	101,936	13,863		
Residential appliances/equipment	174,621	23,748		
Non-residential cooking (electric)			3,862	525
Non-residential appliances/equipment			69,049	9,390
Total (Unregulated)	276,557	37,612	72,910	9,916

Table 18: Baseline unregulated energy demand and CO2 emissions for detailed part of the application

9.1.2 Demand Reduction (Be Lean)

An assessment has been carried out to determine how unregulated energy and carbon dioxide emissions can be reduced through the use of energy efficient appliances and equipment, controls, good management practice, etc.

The table below details the breakdown of unregulated energy demand and associated CO₂ emissions following demand reduction for the detailed part of the application.

	Residential		Non-Residential	
Energy Use	Total Energy Demand (kWh/year)	Total Carbon Dioxide Emissions (kg CO₂/year)	Total Energy Demand (kWh/year)	Total Carbon Dioxide Emissions (kg CO₂/year)
Residential cooking (electric)	82,262	11,188		
Residential appliances/equipment	142,086	19,324		
Non-residential cooking (electric)			3,439	468
Non-residential appliances/equipment			58,885	8,009
Total (Unregulated)	224,348	30,511	62,323	8,476

Table 19: Unregulated energy demand and CO2 emissions after demand reduction for detailed part of the application

It is expected that the detailed part of the application will provide a 14.5% reduction in unregulated carbon dioxide emissions over the baseline.

It is expected that the energy demand reduction will be achieved by a combination of measures including those detailed below.

9.1.2.1 Residential Cooking

The baseline energy demand and associated carbon dioxide emissions from BREDEM are assumed to be based on the use of appliances with a good standard of energy efficiency commonly available in the commercial market, such as 'A' rated electric ovens and 'D' rated cooker hood extract units.

More efficient appliances are easily available, and provision of 'A+' rated oven and a 'C' rated cooker hood extract units will be encouraged.

9.1.2.2 Residential Appliances/Equipment

The baseline energy demand and associated carbon dioxide emissions from BREDEM are assumed to be based on the use of appliances with a good standard of energy efficiency commonly available in the commercial market, such as 'A+' rated fridge/freezers, 'A++' rated washing machines, 'A+' rated dishwashers and 'A' rated televisions.

More efficient appliances are easily available, and purchasers/tenants will be encouraged to reduce energy demand by providing an 'A++' rated fridge/freezer, an 'A+++' rated washing machine, an 'A++' rated dishwasher and an 'A+' rated television.

Further reductions in unregulated energy can be achieved by owners/tenants of residential properties as detailed below. The potential savings are difficult to quantify as they are operational items. A reduction has not been included in this assessment, but owners/tenants will be encouraged to operate appliances as suggested.

Washing Machine and Dryer

Wash full loads rather than just a few items.

Use a temperature setting of 40°C or even 30°C where possible.

Reduce dryer use by using an outdoor line in summer and a drying rack in winter.



Use tumble dryer balls to reduce drying time.

Dishwasher

Fill the dishwasher before using.

Use the economy setting if available.

Kettle

Only boil the amount you need each time.

Oven

Limit the number of times the oven door is opened while cooking.

Hob

Use the smallest pot possible each time.

Use a lid.

Use stacked steamers.

General Appliances

Do not leave appliances on standby.

9.1.2.3 Non-residential Equipment/Small Power

Tenants will be encouraged to reduce energy demand and associated carbon dioxide emissions to achieve the CIBSE good practice benchmarks.

It is expected that the energy demand reduction will be achieved by a combination of measures including those detailed below.

Retail Space

- Optimisation of refrigeration storage temperatures.
- Specification of refrigeration equipment to include (where possible) automatic defrost, self-closing doors, fan assistance (with auto shut-off and energy efficient fans), high performance insulation, and door open alarms.
- Energy efficient glass and dishwashers to be used.
- Energy efficient desktop PCs, laptops, screens etc to be used.
- Energy efficient sound systems to be used.
- Encourage staff to switch off equipment when not in use.
- Energy efficient TVs, white goods and other equipment to be used.

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10 Overheating and Cooling

10.1 Detailed Part of the Application

10.1.1 Cooling Hierarchy

The detailed part of the application has been assessed in accordance with the cooling hierarchy detailed in policy SI 4 of the London Plan, the latest GLA Energy Assessment Guidance 2022 and Building Regulations Part O, in order to reduce overheating and minimise the use of air conditioning.

10.1.1.1 Reduce the amount of heat entering a building through orientation, shading, high albedo materials, fenestration, insulation and the provision of green infrastructure

The heat entering the building will be reduced by a combination of measures including the following: -

- Significantly improved fabric 'U' values
- Improved air tightness
- Optimisation of glazing g-value
- Optimisation of glazing area
- External shading via projecting balconies and deep reveals
- Internal blinds

10.1.1.2 Minimise internal heat generation through energy efficient design

Internal heat generation will be minimised by a combination of measures including the following: -

- · Minimising cold bridging
- Minimising heat loss from heating and hot water systems through reducing pipe lengths, pipework arrangements and high levels of insulation
- Low energy lighting
- Energy efficient desktop PCs, laptops, screens
- · Energy efficient appliances

10.1.1.3 Manage the heat within the building through exposed internal thermal mass and high ceilings

- Floor to floor heights have been maximised in the proposed development.
- Purge ventilation can be achieved in residential dwellings through open windows
- · Building structure is concrete providing thermal mass to absorb excess heat

10.1.1.4 Provide passive ventilation

Passive ventilation will be maximised by a combination of measures including the following: -

- Residential dwellings are designed with shallow floorplates
- Dual aspect dwellings where possible
- All residential dwellings are provided with natural ventilation via openable windows

10.1.1.5 Mechanical ventilation

Mechanical ventilation will assist in mitigating through the following measures;-

- Mechanical ventilation with high efficiency heat recovery (MVHR) will provide fresh air and extract moisture/pollutants in accordance with Building Regulations Part F.
- MVHR will have a bypass for summer mode operation
- MVHR will have a boost mode to increase ventilation rate and assist in reducing the risk of overheating when needed
- Dynamic modelling demonstrates that the risk of overheating is suitably reduced in residential dwellings through the use of natural ventilation via open windows and mechanical ventilation
- Dynamic modelling demonstrates that the risk of overheating cannot be suitably reduced through the use of mechanical ventilation alone, where windows need to remain closed at night due to higher external noise levels. This will be mitigated by temperaing the fresh air supply using the MVHR heat pump or additional cooling module.
- Dynamic modelling demonstrates that the risk of overheating cannot be suitably reduced in the commercial space through the use of natural ventilation via open windows and mechanical ventilation

10.1.1.6 Active Cooling Systems

- The use of active cooling has been minimised through the incorporation of the above passive measures
- It is proposed to provide active cooling to the retail, commercial and marketing spaces only. High efficiency air source heat pumps will be used.
- The module fitted to the MVHR units in the apartments affected by higher external noise levels is not considered as active cooling due to the following;-
 - It would only 'temper' the supply air, reducing the temperature by a few degrees.
 - It would have limited cooling capacity due to the size of heat pump / cooling module, and the low air volume of the residential ventilation system.
 - o It would not 'control' space temperature it would only be used if required by the occupant and would only operate when external temperature exceeds 26 °C at night and 28°C during the day to achieve compliance with the CIBSE overheating criteria.
 - o No additional fan would be required in the apartment.

10.1.2 Early Stage Overheating Risk Tool

As requested in the Energy Assessment Guidance, the Good Homes Alliance (GHA) Early Stage Overheating Risk Tool has been completed and is provided in Appendix A.7.

10.1.3 Overheating Risk Assessment Methodology

10.1.3.1 Domestic

The residential assessment includes dynamic thermal modelling on a representative sample of dwellings to assess the risk of overheating, using IES modelling software, in accordance with the guidance and data sets in CIBSE TM49 and TM59 guidance.

The Chartered Institution of Building Services Engineers (CIBSE) has produced guidance on assessing and mitigating overheating risk in new developments. TM 59 Design Methodology for the Assessment of Overheating Risk in Homes should be used for residential developments.

For compliance with CIBSE TM 59, the modelled apartments must pass both of the following two criteria:

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- a) For living rooms, kitchens and bedrooms: the number of hours during which ΔT is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3% of occupied hours. (CIBSE TM52 Criterion 1: Hours of exceedance).
- b) For bedrooms only: to guarantee comfort during the sleeping hours the operative temperature in the bedroom from 10 pm to 7 am shall not exceed 26°C for more than 1% of annual hours. (Note: 1% of the annual hours between 22:00 and 07:00 for bedrooms is 32 hours, so 33 or more hours above 26°C will be recorded as a fail).

Criteria 2 and 3 of CIBSE TM52 may fail to be met, but both (a) and (b) above must be passed for all relevant rooms.

Building Regulations Part O requires the modelling to assume that bedroom windows are closed at night if the average 8 hour ambient noise level exceeds 40 dB. The overheating risk categories assessment provided in Annex 14 of the Environment Statement Appendix: Noise and Vibration demonstrates that for most of the detailed part of the application the ambient noise levels are below 40 dB at night (identified as negligible or low risk).

The strategy will therefore generally allow for windows to be open at night in the detailed part of the application.

The overheating risk categories assessment shows that most of Block J, and parts of Blocks F and H1/H2 are subject to ambient noise levels over 40 dB at night (identified as medium or high risk) so two overheating assessments have been completed (one with windows open at night, and one with windows closed at night) to demonstrate that the passive design has been maximised.

10.1.3.2 Non-Domestic

The non-residential assessment includes dynamic thermal modelling of the non-residential space in the detailed part of the application to assess the risk of overheating, using IES modelling software, in accordance with the guidance and data sets in CIBSE TM49 and TM52 guidance.

A room or building that fails any two of the three criteria is classed as overheating.

- The first criterion sets a limit for the number of hours that the operative temperature can exceed the threshold comfort temperature (upper limit of the range of comfort temperature) by 1 K or more during the occupied hours of a typical non-heating season (1 May to 30 September).
- The second criterion deals with the severity of overheating within any one day, which can be as
 important as its frequency, the level of which is a function of both temperature rise and its duration. This
 criterion sets a daily limit for acceptability.
- The third criterion sets an absolute maximum daily temperature for a room, beyond which the level of overheating is unacceptable.

10.1.3.3 Weather Data

The weather file used for the assessment is as per TM59: DSY1 (Design Summer Year) for the site location, for the 2020s, high emissions, 50% percentile scenario.

The London Heathrow weather data set has been used which is the most representative for the site location.

It is expected that the CIBSE compliance criteria are met for the DSY1 weather scenario.

Additional testing has been undertaken for the residential apartments using the 2020 versions of the following more extreme design weather years;-

- DSY2 2003: a year with a very intense single warm spell.
- DSY3 1976: a year with a prolonged period of sustained warmth.

It is acknowledged in the GLA Energy Assessment Guidance 2022 that meeting the CIBSE compliance criteria is challenging for the DSY 2 & 3 weather files, and compliance is therefore not expected.

10.1.4 Summary of Overheating Modelling Results

10.1.4.1 Domestic

Natural Ventilation via Openable Windows (All Blocks)

All residential dwellings tested have been modelled with natural ventilation via openable windows/doors and increased mechanical ventilation to demonstrate that passive measures have been maximised and the façade design has been optimised. The results are summarised below;-

- The CIBSE compliance criteria are met in all rooms modelled (for the 2020s DSY1 weather scenario)
 without blinds through the use of natural ventilation via openable windows/doors and increased
 mechanical ventilation, together with an improvement of the glazing g-value to 0.33.
- The CIBSE compliance criteria are met in a significant proportion of the rooms modelled (for the 2020s DSY2 and 3 weather scenarios) without blinds through the use of natural ventilation via openable windows/doors and increased mechanical ventilation, together with an improvement of the glazing gvalue to 0.33.

The GLA Energy Assessment Guidance 2022 expects that the CIBSE compliance criteria is met for the DSY1 weather scenario. It is acknowledged that meeting the CIBSE compliance criteria is challenging for the DSY 2 & 3 weather files, although it is expected that in the majority of cases a significant proportion of spaces will be able to achieve compliance.

The assessment with natural ventilation demonstrates that the risk of overheating has been reduced as far as practical, with all available passive measures explored.

Closed Windows (Block J, Parts of Blocks F and H1/H2)

The overheating risk categories assessment (see Annex 14 of the Environment Statement Appendix: Noise and Vibration) shows that most of Block J, and parts of Blocks F and H1/H2 are subject to ambient noise levels over 40 dB at night (identified as medium or high risk) and therefore exceed the limit prescribed in Building Regulations Part O.

Additional modelling has been carried out for the appropriate sampled dwellings in Blocks J, F and H1/H2 with the windows closed at night but with the increased mechanical ventilation in operation. The results are summarised below:-

- The CIBSE compliance criteria cannot be met in all rooms modelled (for the 2020s DSY1 weather scenario) without blinds with closed windows/doors and increased mechanical ventilation.
- The CIBSE compliance criteria cannot be met in a significant proportion of the rooms modelled (for the 2020s DSY2 and 3 weather scenarios) without blinds with closed windows/doors and increased mechanical ventilation.

The MVHR heat pumps proposed for the maisonettes in Block J have the capability to lower the temperature of the supply air when in operation to assist in reducing the impact of high summer temperatures.

In the Block J houses and in the affected apartments in Blocks F and H1/H2, an additional cooling module would be fitted to the MVHR unit to provide the same functionality.

This would provide the occupants with an alternative method of sufficiently reducing the risk of overheating without opening the windows.

This is not considered as active cooling due to the following;-

It would only 'temper' the supply air, reducing the temperature by a few degrees.



- It would have limited cooling capacity due to the size of heat pump / cooling module, and the low air volume of the residential ventilation system.
- It would not 'control' space temperature it would only be used if required by the occupant and would only operate when external temperature exceeds 26 °C at night and 28°C during the day to achieve compliance with the CIBSE overheating criteria.
- No additional fan would be required in the apartment.

10.1.4.2 Non-Residential

The non-residential assessment includes dynamic thermal modelling of the non-residential space in the detailed part of the application to assess the risk of overheating, using IES modelling software, in accordance with the guidance and data sets in CIBSE TM49 and TM52 guidance, using the current 2020s summer year (DSY 1) and the more extreme DSY 2 and DSY 3 weather data.

The results of the dynamic modelling overheating assessment are summarised below;-

 The CIBSE compliance criteria cannot be met in the non-residential space (for the 2020s DSY1, 2 and 3 weather scenarios) without blinds through the use of natural ventilation via openable windows/doors and increased mechanical ventilation.

The proposed overheating mitigation measures are summarised below;-

For the retail, commercial, marketing suite and other appropriate areas active cooling is proposed.

10.1.5 Overheating Mitigation Measures

The proposed overheating mitigation measures are summarised below;-

- In residential dwellings the use of natural ventilation via openable windows/doors and increased mechanical ventilation will generally sufficiently reduce the risk of overheating.
- In Block J and parts of Blocks F and H1/H2, where the occupants may choose to keep their windows closed at night, an alternative method of reducing the risk of overheating will be available through the use of the MVHR heat pump or a MVHR cooling module.
- During extreme summer weather, residents will be encouraged to use additional measures to reduce the risk of overheating, including the following;
 - o Using portable fans to increase airflow
 - Minimising internal heat gains
 - Keeping windows open as long as possible
- Guidance will be provided to residents on reducing the overheating risk in their home in line with the cooling hierarchy.

10.2 Outline Part of the Application

Residential

Although dynamic thermal modelling is not a requirement for the outline part of the application, as part of the early stage design modelling has been carried out on a sample of apartments to assess the risk of overheating, using IES modelling software, in accordance with the guidance and data sets in CIBSE TM49 and TM59 guidance, using the current 2020s summer year (DSY 1) and the more extreme DSY 2 and DSY 3.

This modelling has been completed for a sample of west facing apartments at differing levels between the 2nd and 20th floor with both recessed and projecting balconies.

The results of this early stage dynamic modelling overheating assessment are summarised below;-

- The CIBSE compliance criteria are met in almost all rooms modelled (for the 2020s DSY1 weather scenario) for both recessed and projecting balconies, without blinds through the use of natural ventilation via openable windows/doors and increased mechanical ventilation, together with an improvement of the glazing g-value to 0.33.
- The CIBSE compliance criteria are met in a significant proportion of the rooms modelled (for the 2020s DSY2 and 3 weather scenarios) without blinds through the use of natural ventilation via openable windows/doors and increased mechanical ventilation, together with an improvement of the glazing g-value to 0.33.

The results demonstrate that the outline design provides a suitable reduction in the risk of overheating at this stage of design.

As the design is developed for the later Reserved Matters application(s), further work will be done to explore all available passive measures with the aim of reducing the risk further.

Non-Residential

The design of the outline part of the application is not sufficiently progressed to allow dynamic thermal modelling for the non-residential areas.

As the design is developed for the later Reserved Matters application(s), an assessment will be carried out to reduce overheating and minimise the use of air conditioning in the non-residential areas.



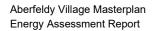
Appendix A.1 – SAP Calculations (Be Lean)



Appendix A.2 - SAP Calculations (Be Green)



Appendix A.3 – BRUKL Reports (Be Lean)





Appendix A.4 - BRUKL Reports (Be Green)



Appendix A.5 – Block I Heat Pump Selection

Mitsubishi Electric takes no design responsibility or liability for the system, components, equipment selections or control strategy - it is your responsibility to check the suitability of the proposed equipment selections

Commercial Heating **Heat Pump Selection**

Version 2.10



Aberfeldy Block I PRO-33606 Ryan Grant

Energy Consumption

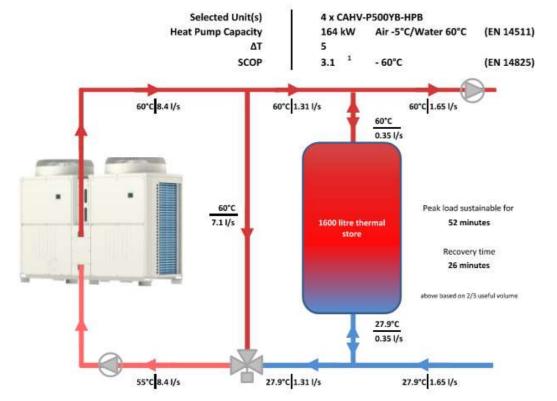
57.6%

Less primary energy compared to a condensing gas boiler1

CO2 Production

79.3%

Less CO2 produced compared to a condensing gas boiler2



- 1) Gas boiler based on 99% efficiency and the heat pump SCOP based on tested value, not project specific value
- 2) Natural gas carbon factor based on 0.21 kgCO2/kWh and electricity carbon factor based on 0.136 kgCO2/kWh

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Mitsubishi Electric takes no design responsibility or liability for the system, components, equipment selections or control strategy – it is your responsibility to check the suitability of the proposed equipment selections

Calculation Reference Points

Primary (Central Plant)				
HTG HWS				
Flow (°C)	60	60		
Ret (°C)	37	20		
ΔΤ	23	40		

	Secondary (Distribution)				
HTG HWS					
Flow (°C)	60	60			
Ret (°C)	37	20			
ΔΤ	23	40			

Tertiary (Apartment)						
	HTG HWS					
Flow (°C)	55	50				
Ret (°C)	35	10				
ΔΤ	20	40				

Same as primary unless separated by PHEX

Schedule of Accommodation

Туре	No.	no. bathrooms	Heat Loss (kW)	Summated flow to all outlets, \(\Sigma gf	DHW Load (kW)	∑qfpeak {l/s}
1B2P	22	1	1.79	0.24	40	5.34
2B3P	2	2	2.73	0.34	56	0.68
2B4P	24	2	2.73	0.34	56	8.16
2B4P	2	3	2.73	0.44	72	0.88
-	-		-			-
	-			-		
-	-		-	-		
-	-	-		-		
	-			-		
Total	50					15.05

	HTG	HWS
Flow (°C)	55	50
Ret (°C)	35	10
ΔΤ	20	40

Commercial/Communal

Area (m2)	W/m2	Heat Loss (kW)
	•	٠

Hot Water (kW)

DHW flow rates are either given by the customer or derived from Summated Flow Rates in Table 5, Section 4.4.2, CIBSE Design Guide, Heat Networks, Sept 2021

These values can be used to calculate flow rates for network pipes. However these values are not necessarily suitable for the sizing of HIUs. See section 5.4.5 of CIBSE Design Guide, Heat Networks, Sept 2021

DHW

Undiversified DHW 2490 kW **DHW Diversity Factor**

0.0588

based on: $qd = 2qm + \theta(\sum qf-2qm) + Av(qm.\theta).v(\sum qf-2qm) = 0.885$

Diversified DHW: 147 kW where: $\sum qf = 15.05$, qm = 0.1, A = 3.1, $\theta = 0.015$ diversity factor = $qd/\sum q_{fpeak}$

DS439 (Dansk Standard, 2009)

Heating

Undiversified Heating 116 kW Heating Diversity Factor

0.6276

based on: 0.62 + 0.38 / number of dwellings [Varme Stabi (Heat Stability) (Lauritsen,

2015)], or given by the customer 73 kW

Estimated total diversified peak demand: 220 kW

Diversified Heating:

Instantaneous hot water loads typically experience peaks during busy periods, such as early morning or evening, when multiple occupants are taking showers and baths that coincide. However, these peaks may only last for short periods (maybe minutes or even seconds), with loads dropping to much lower levels once the peak is over. Hence, it is not usually appropriate to size central heat sources to cope with these high but short-lived demands. A central thermal store can be used to cope with the peaks, while heat sources are sized such that they refill the store within a reasonable time period. (CIBSE Design Guide, Heat Networks, Sept 2021, Section 3.4.4)

Thermal Store volume: 1594 litres based on: $Vp = tp \times qmts \times 3/2$

Where Vp is the volume required to cope with 20 minutes peak hot water load (litres), tp is the estimated period at peak load (s), qmts is the maximum possible flow from the thermal store to the network (I/s), assuming 2/3 useful volume in the thermal store.

17/03/2022

The installed peak output capacity of heat sources can usually be lower than the peak heat demand for the network, the difference being made up by the heat output available from the thermal store. The central heat sources should be sized to provide sufficient capacity to reheat the store within a reasonable time (i.e. before the next peak load condition occurs). Although it depends on the circumstances, it would be unusual to assume more than 1 hour between each peak load occurrence. (CIBSE Design Guide, Heat Networks, Sept 2021, Section 3.6)

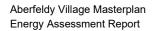
Heat Source required: 133 kW based on: Peak heating demand + 60 minutes recovery of thermal store

3) Full calculations can be provided upon request

Ryan Grant Project Specification Engineer - Central Plant

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Appendix A.6 – Heating Load Profile Assessment



Energy Summary

Heating Energy	Residential	3,205,411	kWh
	Commercial	462,824	kWh
cooling Energy	Residential	190,920	kWh
DHW Energy	Residential	2,563,721	kWh
Δ:	9 8 A		

Total Heating Energy	3,668,234 kWh
Total DHW Energy	2,563,721 kWh
Total Heating & DHW Energy	6,231,955 kWh
Total Cooling Energy	190,920 kWh

	Water Source Heat Pump (WSHP)	2000,0000 000	3 120 12 19 27 12	50 J
WSHP Delivered Heating Energy	6,231,955 kWh	Model	EW-HT /06:	17
WSHP Consumed Energy	1,546,391 kWh	Condenser temps inlet/outlet.	50/60	*C
WSHP SCOP	4.03	Evaporator temps inlet/outlet	25/18	3,0
WSHP Heat Absorbed from Loop	4,685,565 kWh	WSHP Capacity	176	4kW
		Total no.	32	
		Total output capacity	5544.8	100

WCC Delivered Cooling Energy	190,920 kWh	Model	NX-W /0122-0	302
WCC Consumed Energy	29,453 kWh	Condenser temps inlet/outlet	25/31	*0
WCC SEER	6.48	Evaporator temps inlet/outlet	18/12	3,0
WCC Heat Rejected to Loop	220,374 kWh	WCC Capacity	46.4 to 117.6	kW
		Total no.	12	Т
		Total output capacity	1035	100

Heat Recovered in Loop due to simultaneous loads	7B,17	1 kWh
Heat Recovered in primary thermal store due to deadband contro	TO DO	kWh

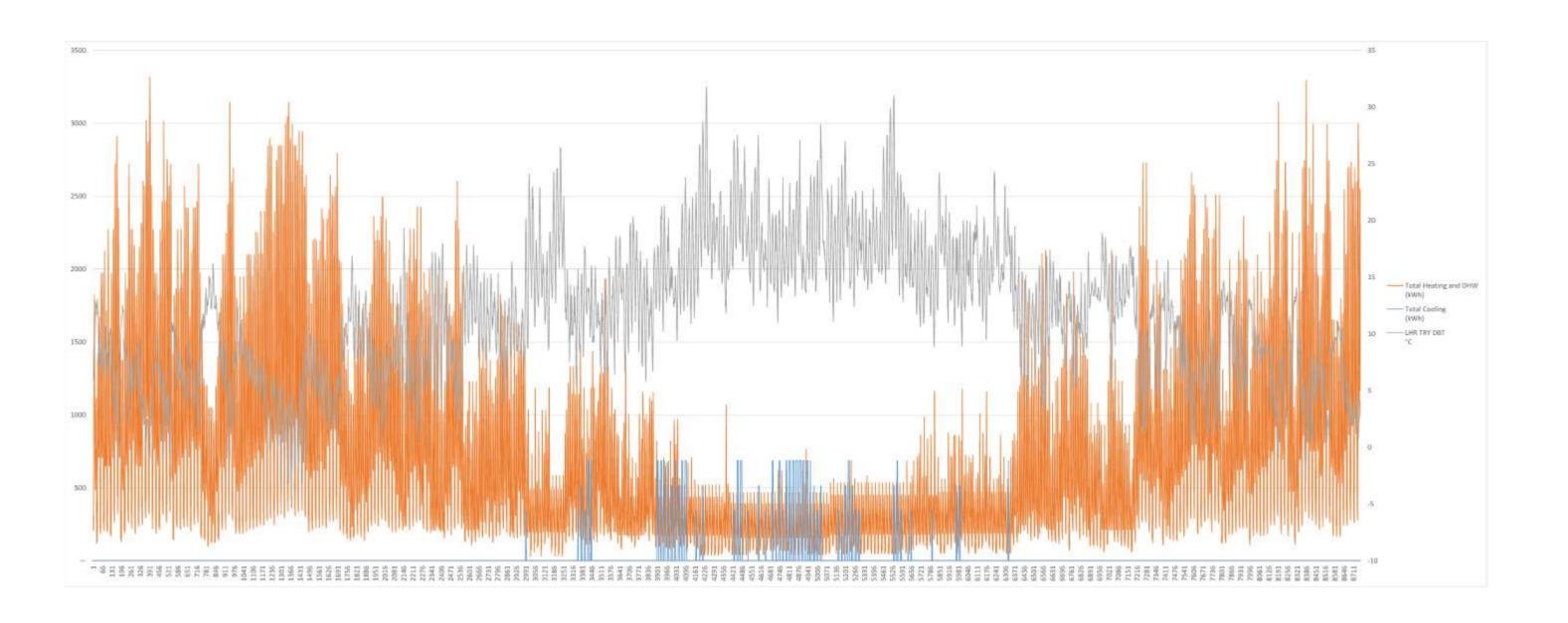
£		ASHP	***************************************		
ASHP Delivered Heating Energy	4,607,394	kWh:	Model	NX2-N-G06 /A //	808
ASHP Delivered Cooling Energy	142,203	kWh:	Condenser temps inlet/outlet	19/25	3.0
ASHP Consumed Energy for Heating	881,291	kWh:	Evaporator temps inlet/outlet	21/15	°°C
ASHP Consumed Energy for Cooling	30,430	kWfr	Heating Capacity ⊗ -5°C	599.5	kW
ASHP SCOP	5.23		no, of in heating mode		
ASHP SEER	4.67		ASHP Total Heating Capacity	3597	kW.
Children Control	1000		Copling Capacity @+36°C	971.9	kW.
			no. of in cooling mode	2	
			ASHP Yotal Cooling Capacity	1943.8	kW
			Total on units		

Combined Plant Efficiency	2 N 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Total Cooling SEER	3.19
Total Heating SCOP	2.57

	"Spincing at N+1		5 1 4 10 - 37 30 6 5 5 5 6 5 6 5 6 6 6 6 6 6 6 6 6 6 6		22 50 800000000	No. (0) (0) (0) (1) (1) (1) (1) (1) (1) (1) (1) (1) (1
	4 x EW-HT 0612	5 x EW-HT 0612	5 x EW-HT 0612	8 x EW-HT 0612	5 x EW-HT 0612	5 x EW-HT 0612
	WISHERSEC, STAGE (1909) DOND, LIEPHSEVAP	WSI-P SEC STAGE (60:50 DOMD) ISH'S EVAP.	WISHPISED STAGE (SIGN COND.) (25-18 EVAP.)	WSHP SEC, STAGE (FERE COND. (#518 EVAP	WSHP SEC STAGE (605) DOND IEHREVAR	WSHP SET: STAGE 6456 CORD, 195-16 DVAP
Output per unit	176.4 kW	176,4 kW	176.4 kW	176.4 kW	176.4 kW	176.4 kW
Total output	705.6 kW	882 kW	882 kW	1411.2 kW	882 kW	882 kW
Load to serve	427 kW	629 kW	637 KW	1145 kW	567 kW	567 kW
Thermal Store volume	3000 litres	5000 litres	4000 litres	9000 litres	4000 litres	4000 litres

	2 x NX-W 0182	2 x NX-W 0302	2 x NX-W 0252	2 NX-W 0302	2 x NX-W 0202	2 x NX-W 0122
	WOC SEC. STARE I 12/15 EVAP. I 25/31 COND.	WCC SEC. STABE 12:18 EVAF. 25:31 CDAD	WCC SEC, STACE 12/16 EVAP, 25/31 COMb.	WCC SEC. 87AGE Taits EVAP 125GF COND	WGC SEC. STARE 12/18 EVAP 125/01 COND.	WCC SEC STAGE: 12/18/EVAP - 25/31 DOND.
Output per unit	68.3 kW	117.6 kW	88.3 kW	117.6 kW	79.3 kW	46.4 kW
Total output	136.6 kW	235,2 kW	176.6 kW	235.2 kW	158.6 kW	92.8 kW
Load to serve	102.7 kW	164.1 kW	134.0 KW	173.1 kW	107.2 kW	4.5 kW
						*low load, suggest alternative system







Appendix A.7 – Early Stage Overheating Risk Tool

EARLY STAGE OVERHEATING RISK TOOL Version 1.0, July 2019

This tool provides guidance on how to assess overheating risk in residential schemes at the early stages of design. It is specifically a pre-detail design assessment intended to help identify factors that could contribute to or mitigate the likelihood of overheating.

The questions can be answered for an overall scheme or for individual units, Score zero wherever the question does not apply. Additional information is provided in the accompanying guidance, with examples of scoring and advice on next steps.



Y FACTORS INCREAS	ING THE LIKELIHOOD OF O	/ERHEA	TING	KEY FACTORS REDUCING THE LIKELIHOOD OF OVER	RHEA	TIN
eographical and	local context					
#1 Where is the	South east	4		#8 Do the site surroundings feature significant		N.
scheme in the UK?	Northern England, Scotland & N	11 0	4	blue/green infrastructure?		
See guidance for map	Rest of England and Wales	2		Proximity to green spaces and large water bodies has beneficial effects on local temperatures; as guidance, this	1	0
#2 Is the site likely to	Central London (see guidance)	3		would require at least 50% of surroundings within a 100m radius to be blue/green, or a rural context		
see an Urban Heat sland effect?	Grtr London, Manchester, B'han	m 2	3			
See guidance for details	Other cities, towns & dense sub urban areas	1				
ite characteristic	es es					
3 Does the site have	Day - reasons to keep all	8		#9 Are immediate surrounding surfaces in majority		
parriers to windows	Day - barriers some of the		4	pale in colour, or blue/green? Lighter surfaces reflect more heat and absorb less so their	1	0
Noise/Acoustic risks Poor air quality/smells e.g	time, or for some windows	4		temperatures remain lower; consider horizontal and vertical surfaces within 10m of the scheme	Ö	
ear factory or car park or ery busy road	Night - reasons to keep all windows closed	8		#10 Does the site have existing tall trees or buildings		
Security risks/crime Adjacent to heat rejection	The state of the s	K	4	that will shade solar-exposed glazed areas?	1	0
lant	to open, but other windows are likely to stay closed	4		Shading onto east, south and west facing areas can reduce solar gains, but may also reduce daylight levels	•	U
gains from surrounding are dwellings may be similarly examples 5 Does the scheme ha e. with hot pipework opera	risk e.g. dwelling size, heat eas; other dense and enclosed affected - see guidance for eve community heating? ting during summer, especially in eat gains and higher temperatures	3	3	AND a means for secure and quiet night ventilation? Thermal mass can help slow down temperature rises, but it can also cause properties to be slower to cool, so needs to be used with care - see guidance #12 Do floor-to-ceiling heights allow ceiling fans, now or in the future? Higher ceilings increase stratification and air movement, and offer the potential for ceiling fans >2.8m	2	0
olar heat gains a 6 What is the estimate atio for the dwellings? as a proportion of the faca reas i.e. orientations facin mything in between). High illow higher heat gains into	de on solar-exposed geast, south, west, and er proportions of glazing	7	4	#13 Is there useful external shading? Shading should apply to solar exposed (E/S/W) glazing. It may include shading devices, balconies above, facade articulation etc. See guidance on "full" and "part". Scoring depends on glazing proportions as per #6 >50% 4 >35% 2	9 Part 2 2 1	1
7 Are the dwellings sir	ngle aspect?			#14 Do windows & openings Openings compared	to	_
ingle aspect dwellings hav	ve all openings	1 3		support effective ventilation? Part F purge rales	iv.	
n the same facade. This re otential for ventilation	oddoo iiio		3	secure openings will	00%	3
	Dual aspect	0		- see quidance	3	
				Convert and the Manager	na F	
OTAL SCORE 24	= Sum of contribut	- 2	28	minus Sum of mitigatin		4
OTAL SCORE 24		- 2		minus		4

Incorporate design changes to reduce risk factors and increase mitigation factors AND Carry out a detailed assessment (e.g. dynamic modelling against CIBSE TM59)

Seek design changes to reduce risk factors and/or increase mitigation factors AND Carry out a detailed assessment (e.g. dynamic modelling against CIBSE TM59)

Ensure the mitigating measures are retained. and that risk factors do not increase (e.g. in planning conditions)



Appendix A.8 - Overheating Assessment

MEINHARDT

A.8 Overheating Assessment

As requested in the Energy Assessment Guidance, the Good Homes Alliance (GHA) Early Stage Overheating Risk Tool has been completed and is provided in Appendix A.7.

Detailed Part of the Application

The detailed part of the application has been assessed in accordance with the cooling hierarchy detailed in policy SI 4 of the London Plan, the latest GLA Energy Assessment Guidance 2022 and Building Regulations Part O, in order to reduce overheating and minimise the use of air conditioning.

The assessment includes dynamic thermal modelling of both the domestic and non-domestic elements of the proposed development to assess the risk of overheating, using IES modelling software, in accordance with the guidance and data sets in CIBSE TM49, TM52 and TM59.

Outline Part of the Application

An initial early stage assessment has also been carried out for the outline part of the application.

Although dynamic thermal modelling is not a requirement for the outline part of the application, as part of the early stage design modelling has been carried out on a sample of residential apartments to assess the risk of overheating, using IES modelling software, in accordance with the guidance and data sets in CIBSE TM49 and TM59 guidance, using the current 2020s summer year (DSY 1) and the more extreme DSY 2 and DSY 3.

This modelling has been completed for apartments with both recessed and projecting balconies.

A.8.1 Overheating Risk Assessment Methodology

Domestic (Apartments)

The Chartered Institution of Building Services Engineers (CIBSE) has produced guidance on assessing and mitigating overheating risk in new developments. TM 59 Design Methodology for the Assessment of Overheating Risk in Homes should be used for residential developments.

For compliance with CIBSE TM 59, the modelled apartments must pass both of the following two criteria:

- a) For living rooms, kitchens and bedrooms: the number of hours during which ΔT is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3% of occupied hours. (CIBSE TM52 Criterion 1: Hours of exceedance).
- b) For bedrooms only: to guarantee comfort during the sleeping hours the operative temperature in the bedroom from 10 pm to 7 am shall not exceed 26°C for more than 1% of annual hours. (Note: 1% of the annual hours between 22:00 and 07:00 for bedrooms is 32 hours, so 33 or more hours above 26°C will be recorded as a fail).

Criteria 2 and 3 of CIBSE TM52 may fail to be met, but both (a) and (b) above must be passed for all relevant rooms.

Building Regulations Part O requires the modelling to assume that bedroom windows are closed at night if the average 8 hour ambient noise level exceeds 40 dB.

Non-Domestic

The non-domestic overheating risk assessment has been made against the three criteria outlined in CIBSE TM52. A room or building that fails any two of the three criteria is classed as overheating.

• The first criterion sets a limit for the number of hours that the operative temperature can exceed the threshold comfort temperature (upper limit of the range of comfort temperature) by 1 K or more during the occupied hours of a typical non-heating season (1 May to 30 September).

- The second criterion deals with the severity of overheating within any one day, which can be as important as its frequency, the level of which is a function of both temperature rise and its duration. This criterion sets a daily limit for acceptability.
- The third criterion sets an absolute maximum daily temperature for a room, beyond which the level of overheating is unacceptable.

Weather Data

The weather file used for the assessment is as per TM59: DSY1 (Design Summer Year) for the site location, for the 2020s, high emissions, 50% percentile scenario.

The London Heathrow weather data set has been used which is the most representative for the site location.

It is expected that the CIBSE compliance criteria are met for the DSY1 weather scenario.

Additional testing has been undertaken for the residential apartments using the 2020 versions of the following more extreme design weather years;-

- DSY2 2003: a year with a very intense single warm spell.
- DSY3 1976: a year with a prolonged period of sustained warmth.

It is acknowledged in the GLA Energy Assessment Guidance 2022 that meeting the CIBSE compliance criteria is challenging for the DSY 2 & 3 weather files, and compliance is therefore not expected.

A.8.2 Domestic Model Input Data

This section summarises the input assumptions that have been used in the dynamic thermal modelling. The modelling has been carried out in accordance with CIBSE TM59: Design methodology for the assessment of overheating risk in home.

Fabric Performance

Refer to Section 6.

Solar Gain

For the residential apartments the size and g-value of the glazing has been optimised using the dynamic thermal modelling, in order to provide a balance between minimising summer heat gain to prevent overheating, maximising winter heat gain to reduce heating loads, and maximising natural daylight to reduce lighting energy. This has resulted in the g-value of the residential glazing being set at 0.33.

Blinds and Shading Devices

Internal blinds have not been included in the dwellings.

The balconies have been modelled to provide external shading for the apartments.

Mechanical Ventilation

Individual Mechanical Ventilation with Heat Recovery (MHVR) units are proposed to provide fresh air and extract ventilation for the residential dwellings.

These units will be equipped with a summer bypass mode and a boost mode that will enable the unit to achieve an increased total flow rate of up to 75l/s in the summer condition, exceeding the minimum ventilation requirement of Part F of the Building Regulations.

Natural Ventilation

A typical apartment has balcony doors which can be fully opened and side hung opening windows elsewhere to allow natural ventilation when required.

Window opening methodology is in accordance with Building Regulations Part O.

The overheating risk categories assessment provided in Annex 14 of the Environment Statement Appendix: Noise and Vibration demonstrates that for most of the detailed part of the application the ambient noise levels are below 40 dB at night (identified as negligible or low risk).

The strategy will therefore generally allow for windows to be open at night in the detailed part of the application .

The overheating risk categories assessment shows that most of Block J, and parts of Blocks F and H1/H2 are subject to ambient noise levels over 40 dB at night (identified as medium or high risk) so two overheating assessments have been completed (one with windows open at night, and one with windows closed at night) to demonstrate that the passive design has been maximised.

Infiltration

The target air permeability for the development is 3m³/hr.m²@50Pa. An average infiltration air change of 0.25ACH has been assumed in the dynamic thermal modelling in accordance with Table 4.24 in CIBSE Guide A.

Air Speed Assumptions

Operative air speed in the apartments has been set at 0.1m/s and assumed elevated air speed of 0.8m/s used in the thermal modelling calculation in accordance with CIBSE TM59.

Thermal Comfort Category

This is a new build development, therefore Cat II building was selected as Normal Expectations.

Internal Gains

A thermal template has been created for each of the spaces within the sample apartments taking into account the internal gains. The internal heat gains consist of occupancy gains, equipment gains and lighting gains. CIBSE TM59 has been used in developing the internal gains profile.

Occupancy Gains

Occupancy heat gains and profiles were assumed in accordance with Table 2 in CIBSE TM59.

Occupancy gain has been set at 75 W/person sensible, 55 W/person latent.

Room Type	Profile/ Gain
Single Bedroom	1 person at 70% gains from 11pm -8am 1 person at full gains from 8am to 11pm
Double Bedroom	2 person at 70% gains from 11pm -8am 2 person at full gains from 8am to 9am and from 10pm to 11pm 1 person at full gains in the bedroom from 9am to 10pm
1 Bedroom (Living room/ kitchen)	1 person from 9am -10am, room is unoccupied for the rest the day
2 Bedroom (Living room/ kitchen)	2 person from 9am -10am, room is unoccupied for the rest the day
3 Bedroom (Living room/ kitchen)	3 person from 9am -10am, room is unoccupied for the rest the day

Table 20: Occupancy Gains



Equipment Gains

Equipment heat gains and profiles were assumed in accordance with Table 2 in CISBE TM59.

Room Type	Profile/ Gain
Living Room/ Kitchen	Peak load of 450W from 6pm-8pm 200W from 8pm- 10pm 110W from 9am to 6pm and from 10pm to 12pm Base load of 85W for the rest of the day
Single Bedroom	Peak load of 80W from 8am to 11pm Base load of 10W during the sleeping hours
Double Bedroom	Peak load of 80W from 8am to 11pm Base load of 10W during the sleeping hours

Table 21: Equipment Gains

Lighting Gains

Lighting gains of 2 W/m² have been assumed for each flat for the period of 6pm –11pm in accordance with CIBSE TM59. Lighting Gains of 8W/m² have been assumed for the communal corridors.

A.8.3 Detailed Part of the Application Overheating Modelling Results

Domestic Dwellings

The results of the dynamic modelling overheating assessment are provided in Appendix A.8, and summarised below;-

Block	Windows	DSY1	DSY2 & 3
Block F	Open	100%	30%
Block H	Open	100%	47%
Block I	Open	100%	52%
Block J	Open	100%	48%
Block F	Closed (at night)	84%	38%
Block H	Closed (at night)	56%	19%
Block J	Closed (at night)	50%	19%

Table 22: TM59 Overheating Assessment results (Part O Compliant)

The results of the assessment of criteria (a) and (b) for the sample residential dwellings in the detailed part of the application are shown below.



2020	DSY1		DS	SY2	DSY3		
Block F windows openable at night	Criteria a	Criteria b	Criteria a	Criteria a Criteria b		Criteria b	
Room Name	= < 3.0	< 33	= < 3.0	< 33	= < 3.0	< 33	
Dbl Bedroom L01.10	1.1	15	3.1	50	2.9	35	
Dbl Bedroom L01.10	1.1	15	3.1	50	2.9	35	
Dbl Bedroom L01.11	0.5	17	2.2	64	1.7	46	
LDK L01.11	0.8	N/A	3.7	N/A	3	N/A	
Dbl Bedroom L01.09	1.3	19	3.1	58	3.2	46	
Dbl Bedroom L01.09	1.5	20	3.2	60	3.2	48	
Dbl Bedroom L01.08	0.5	15	2	56	1.8	42	
LDK L01.008	1.1	N/A	3.9	N/A	3.4	N/A	
LDK L01.01	0.8	N/A	3.8	N/A	3.1	N/A	
Dbl Bedroom L01.01	0.4	17	2	65	1.7	44	
Dbl Bedroom L01.02	0.6	19	2.7	66	2.2	47	
LDK L01.02	1	N/A	4	N/A	3.4	N/A	
Dbl Bedroom L01.03	1.3	18	3.3	49	2.6	39	
LDK L01.03	1.8	N/A	4.8	N/A	4.7	N/A	
Dbl Bedroom L01.03	0.9	18	3	49	2.6	39	
Dbl Bedroom L01.04	0.8	18	2.6	56	2.3	39	
Dbl Bedroom L01.04	1	18	2.9	55	2.8	42	
LDK L01.04	1.4	N/A	4.6	N/A	4.1	N/A	
Dbl Bedroom L01.05	0.8	19	2.7	52	2.6	42	
LDK L01.05	1.6	N/A	4.5	N/A	4.3	N/A	
Dbl Bedroom L01.07	1.1	15	2.6	46	2.7	33	
LDK L01.07	1.3	N/A	4.2	N/A	3.9	N/A	
LDK L01.12	0.5	N/A	2.5	N/A	1.7	N/A	
Dbl Bedroom L01.06	0.5	17	2.2	67	2	47	
LDK L01.06	0.9	N/A	3.7	N/A	3.1	N/A	
LDK L01.09	2.4	N/A	5.2	N/A	5.4	N/A	
LDK L01.10	1.9	N/A	5.3	N/A	4.9	N/A	
LDK L08.01	1.3	N/A	4.9	N/A	4.3	N/A	
Dbl Bedroom L08.01	0.6	17	2.7	68	2.1	48	
Dbl Bedroom L08.02	0.9	21	3.1	69	2.7	52	
LDK L08.02	1.6	N/A	5	N/A	4.4	N/A	
Dbl Bedroom L08.03	1.4	18	3.2	53	3.1	42	
LDK L08.03	1.8	N/A	5	N/A	4.7	N/A	
Dbl Bedroom L08.03	1.3	18	3.1	53	3.1	42	
Dbl Bedroom L08.04	1	18	2.8	53	2.6	41	
Dbl Bedroom L08.04	1.2	N/A	2.9	N/A	2.9	N/A	
LDK L08.04	1.7	N/A	4.6	N/A	4.4	N/A	
Dbl Bedroom L08.05	1	19	2.8	50	2.8	44	
LDK L08.05	1.7	N/A	4.8	N/A	4.5	N/A	
Single Bedroom L08.06	1.1	15	2.8	48	2.8	41	
Dbl Bedroom L08.06	1.2	15	2.9	45	3	38	
Single Bedroom L08.06	1.3	15	3.1	48	2.8	41	
LDK L08.06	2.4	N/A	5.6	N/A	5.7	N/A	

2020	DS	SY1	DSY2		DSY3	
Block F rooms with windows closed at night	Criteria a	Criteria b	Criteria a	Criteria b	Criteria a	Criteria b
Room Name	= < 3.0	< 33	= < 3.0	< 33	= < 3.0	< 33
Dbl Bedroom L01.10	1.1	20	1.9	43	3	55
Dbl Bedroom L01.10	1.1	20	1.9	43	3	55
Dbl Bedroom L01.09	0.5	35	2.1	69	3.3	98
Dbl Bedroom L01.09	0.8	35	2	68	3.3	99
Dbl Bedroom L01.08	1.3	23	1.3	59	1.9	78
LDK L01.008	1.5	N/A	2.8	N/A	4.3	N/A
LDK L01.01	0.5	N/A	2.6	N/A	3.4	N/A
Dbl Bedroom L01.01	1.1	23	1.4	59	1.7	77
Dbl Bedroom L01.02	0.8	25	1.5	63	2.1	84
LDK L01.02	0.4	N/A	2.6	N/A	3.5	N/A
Dbl Bedroom L01.03	0.6	28	2	62	2.8	79
Dbl Bedroom L01.03	1	28	1.8	62	2.8	79
LDK L01.07	1.3	N/A	2.8	N/A	4.3	N/A
LDK L01.09	1.8	N/A	3.9	N/A	6	N/A
LDK L01.10	0.9	N/A	3.7	N/A	5.3	N/A
LDK L08.01	0.8	N/A	3	N/A	5.1	N/A
Dbl Bedroom L08.01	1	36	1.5	74	2.3	107
Dbl Bedroom L08.02	1.4	42	1.8	81	3	115
LDK L08.02	0.8	N/A	3.1	N/A	5.1	N/A
Dbl Bedroom L08.03	1.6	39	2.1	75	3.4	107
Dbl Bedroom L08.03	1.1	39	2.2	75	3.4	107
Single Bedroom L08.06	1.3	26	2	58	3.1	87
LDK L08.06	0.5	N/A	3.8	N/A	6.1	N/A

2020	DSY1		DSY2		DSY3	
Block H windows openable at night	Criteria a	Criteria b	Criteria a	Criteria b	Criteria a	Criteria b
Room Name	= < 3.0	< 33	= < 3.0	< 33	= < 3.0	< 33
BH2 L02.05 Living room	2	N/A	3.3	N/A	2.7	N/A
BH2 L02.05 Kitchen	1.7	N/A	3.3	N/A	2.8	N/A
BH2 L02.04 Living room	1.9	N/A	3.2	N/A	2.5	N/A
BH2 L02.04 Kitchen	1.7	N/A	3.2	N/A	2.9	N/A
BH2 L02.03 LivingRm	0.9	N/A	2.3	N/A	2.7	N/A
BH2 L02.01 Dbl Bedroom	1.4	21	2	35	2.9	52
BH2 L02.01 DBI Bedroom	1.7	21	2	35	2.7	52
BH2 L02.02 Kitchen	2.4	N/A	3.7	N/A	2.5	N/A
BH2 L02.02 LivingRM	1.4	N/A	2.9	N/A	2.5	N/A
BH2 L02.02 F2 DBLBD2	0.8	N/A	1.8	N/A	1.8	N/A
BH2 L02.02 F2 SNGLBD	0.9	N/A	1.8	N/A	1.8	N/A
BH2 L02.02 DBLBD1	0.8	N/A	1.7	N/A	2.4	N/A
BH2 L02.03 Kitchen	0.9	N/A	2.6	N/A	2.5	N/A
BH2 L01.01 DBLBED2	1.4	24	2.1	36	2.7	56
BH2 L01.01 DBLBED1	1.6	24	2.2	38	2.6	56
BH2 L01.02 Kitchen diner	2.6	N/A	3.9	N/A	2.5	N/A



BH2 L01.02 Living room	1.7	N/A	3.2	N/A	2.5	N/A
BH2 L01.02 Dbl Bedroom	0.9	24	1.8	36	2.8	54
BH2 L01.01 Single Bed	1.2	23	1.9	30	2.5	50
BH2 L01.02 Dbl Bedroom	0.8	24	1.8	36	2.5	54
BH2 L03.01 Dbl Bedroom	1.3	24	2	36	2.4	57
BH2 L03.01 Dbl Bedroom	1.5	24	2	36	1.7	57
BH2 L03.01 Living/Dining	2	N/A	3.4	N/A	1.7	N/A
BH2 L03.02 Kitchen	2.6	N/A	3.9	N/A	2.4	N/A
BH2 L03.02 Kitchen	1.7	N/A	3.9	N/A	2.5	N/A
BH2 L03.02 Dbl Bedroom	1	24	1.9	36	2.8	55
BH2 L03.02 Single Bedroom	1.3	23	1.9	30	2.6	50
BH2 L03.02 Dbl Bedroom	0.8	24	1.9	36	2.6	55
BH2 L02.06 Kitchen	2.2	N/A	3.4	N/A	2.6	N/A
BH2 L02.06 Living room	2.6	N/A	3.9	N/A	2.6	N/A
BH2 L01.03 Twin Single Bed	0.9	15	1.6	25	5	41
BH2 L01.03 Dbl Bedroom	1.1	16	1.8	28	4.7	38
BH2 L01.03 Single Bedroom	1.1	20	1.9	31	4.9	48
BH2 L01.03 Dbl Bedroom	0.7	16	1.8	28	4.6	38
BH2 L01.04 Dbl Bedrrom	1.4	17	2.1	30	3.3	44
BH2 L01.04 Dbl Bedroom	1.4	20	2.1	32	3.2	48
BH2 L01.04 Single Bedroom BH2 L01.04 Dbl Bedroom	1.3	18 20	1.9	24	3.3 5.4	41 48
BH2 L01.05 Dbl Bedroom	1.1	17	2.1	32	4.3	45
BH2 L01.05 Single Bedroom	1.3	17	2.1	26	3.3	39
BH2 L01.05 Single Bedroom	1.3	17	2	26	3.2	39
BH2 L01.05 Dbl Bedroom	1.2	17	2.1	30	3.4	45
BH2 L01.06 Twin Single	0.5	23	1.3	33	5.7	48
Bedroom BH2 L01.06 Twin Single	0.5	23	1.3	33	5.7	40
Bedroom	0.5	23	1.3	33	4.7	48
BH2 L01.06 Dbl Bedroom	0.8	24	1.7	41	3	62
BH2 L01.06 Single Bedroom	0.6	39	1.7	56	3.1	75
BH2 L01.01 Living/Kitchen	2.3	N/A	3.5	N/A	3.3	N/A
BH1 L01.01 DBLBED2	1.3	25	2.2	35	4.9	58
BH1 L01.01 DBLBED1	1.5	25	2.3	35	5.8	58
BH1 L01.02 Living room	1.7	N/A	3.1	N/A	4.8	N/A
BH1 L01.02 Dbl Bedroom	1	24	1.8	36	3.2	53
BH1 L01.01 Single Bed	1.1	22	1.9	34	5.2	48
BH1 L01.02 Dbl Bedroom	0.8	24	1.8	36	5.6	53
BH1 L01.03 Twin Single Bed	0.9	15	1.6	24	2.8	41
BH1 L01.03 Dbl Bedroom	1	16	1.7	28	2.9	38
BH1 L01.03 Single Bedroom	1.1	20	1.9	32	3.2	48
BH1 L01.03 Dbl Bedroom BH1 L01.04 Dbl Bedrrom	0.7 1.4	16 17	1.7 2.1	28	3.2	38
BH1 L01.04 Dbl Bedrrom BH1 L01.04 Dbl Bedroom	1.4	20	2.1	31 32	2.9	46 48
BH1 L01.04 Single Bedroom	1.4	18	1.9	24	3.2	40
BH1 L01.04 Single Bedroom	1.3	20	2.2	32	2.9	48
BH1 L01.05 Dbl Bedroom	0.9	26	1.7	43	2.9	66
DITT LOT.00 DDI DEGIOOIII	0.5	20	1.7	70	2.0	00

BH1 L01.05 Single Bedroom	0.8	20	1.7	33	2.9	51
BH1 L01.05 Single Bedroom	0.7	20	1.7	33	5.4	51
BH1 L01.05 Dbl Bedroom	0.7	26	1.7	43	3.3	66
BH1 L01.06 Twin Single Bedroom	0.5	19	1.3	28	3.4	44
BH1 L01.06 Twin Single Bedroom	0.5	19	1.3	28	5.5	44
BH1 L01.06 Dbl Bedroom	0.8	23	1.7	38	4.4	55
BH1 L01.06 Single Bedroom	0.9	20	1.8	33	2.8	50
BH1 L01.01 Living/Kitchen	2	N/A	3.4	N/A	2.7	N/A
BH2 L02.01 Living/Kitchen	2.3	N/A	3.7	N/A	2.9	N/A
BH1 L02.05 Living room	1.9	N/A	3.2	N/A	3.2	N/A
BH1 L02.05 Kitchen	1.7	N/A	3.1	N/A	3.2	N/A
BH1 L02.04 Living room	1.9	N/A	3.2	N/A	3	N/A
BH1 L02.04 Kitchen	1.7	N/A	3.1	N/A	2.9	N/A
BH1 L02.03 LivingRm	0.9	N/A	2.3	N/A	5.1	N/A
BH1 L02.01 Dbl Bedroom	1.3	21	2.1	30	5.1	54
BH1 L02.01 DBI Bedroom	1.6	21	2.1	30	4.8	54
BH1 L02.02 LivingRM	1.7	N/A	3.1	N/A	4.6	N/A
BH1 L02.02 F2 DBLBD2	1	N/A	1.9	N/A	4.9	N/A
BH1 L02.02 F2 SNGLBD	1.1	N/A	1.9	N/A	4.6	N/A
BH1 L02.02 DBLBD1	0.8	N/A	1.7	N/A	3.4	N/A
BH1 L02.03 Kitchen	0.9	N/A	2.5	N/A	3.3	N/A
BH1 L02.06 Kitchen	2.2	N/A	3.4	N/A	3.4	N/A
BH1 L02.06 Living room	2.8	N/A	4	N/A	5.5	N/A
BH1 L02.01 Living/Kitchen	1.9	N/A	3.3	N/A	4.4	N/A
BH2 L03.03 Kitchen	1.1	N/A	2.6	N/A	2.9	N/A
BH2 L03.03 Single Bedroom	0.9	16	1.7	25	3.3	38
BH2 L03.03 Dbl Bedroom	1	14	1.8	22	5.2	37
BH2 L03.03 Living room	1.2	N/A	2.6	N/A	5.8	N/A
BH2 L03.03 Dbl Bedroom	0.9	14	1.8	22	5	37
BH2 L03.04 Dbl Bedroom	1.1	22	1.9	29	3.6	46
BH2 L03.04 Living/Kitchen	1.6	N/A	3.1	N/A	2.6	N/A
BH2 L03.05 Single Bedroom	1.4	18	2	26	2.7	41
BH2 L03.05 Dbl Bedroom	1.4	20	2	27	3.8	44
BH2 L03.05 Living/Kitchen	2.6	N/A	3.9	N/A	2.8	N/A
BH1 L03.01 Dbl Bedroom	1.2	24	2.1	35	4.7	57
BH1 L03.01 Dbl Bedroom	1.4	24	2.1	35	3	57
BH1 L03.01 Living/Dining	1.6	N/A	3	N/A	3.1	N/A
BH1 L03.02 Kitchen	2.4	N/A	3.7	N/A	5.6	N/A
BH1 L03.02 Kitchen	1.8	N/A	3.7	N/A	3.1	N/A
BH1 L03.02 Dbl Bedroom	1.1	25	1.9	35	3.3	51
BH1 L03.02 Single Bedroom	1.2	24	2	33	4.8	46
BH1 L03.02 Dbl Bedroom	0.8	25	1.9	35	5.1	51
BH1 L03.03 Kitchen	1.1	N/A	2.5	N/A	4.4	N/A
BH1 L03.03 Single Bedroom	0.9	16	1.7	25	2.7	38
BH1 L03.03 Dbl Bedroom	1	14	1.8	22	2.9	37
BH1 L03.03 Living room	1.2	N/A	2.7	N/A	3.6	N/A

BH1 L03.03 Dbl Bedroom	1	14	1.8	22	2.6	37
BH1 L03.04 Dbl Bedroom	1.1	22	1.8	29	2.7	46
BH1 L03.04 Living/Kitchen	1.6	N/A	3	N/A	3.8	N/A
BH1 L03.05 Single Bedroom	1.4	18	2	26	2.8	41
BH1 L03.05 Dbl Bedroom	1.4	20	2	27	4.6	44
BH1 L03.05 Living/Kitchen	2.7	N/A	3.9	N/A	3	N/A
BH2 L03.01 Dbl Bedroom	1.5	24	2	36	3.1	57
BH2 L03.01 Dbl Bedroom	1.7	24	2	36	5.6	57
BH2 L03.01 Living/Dining	2.5	N/A	3.4	N/A	3.3	N/A
BH2 L03.02 Living	2.1	N/A	3.7	N/A	3.5	N/A
BH2 L03.02 Dbl Bedroom	1.2	24	1.9	36	5.8	55
BH2 L03.02 Single Bedroom	1.4	23	1.9	30	6.3	50
BH2 L03.02 Dbl Bedroom	1.4	24	1.9	36	5.4	55
BH2 L03.03 Kitchen	1.3	N/A	2.6	N/A	3	N/A
BH2 L03.03 Single Bedroom	1.5	16	1.7	25	3.1	38
BH2 L03.03 Dbl Bedroom	1.3	14	1.8	22	2.7	37
BH2 L03.03 Living room	1.4	N/A	2.6	N/A	4	N/A
BH2 L03.03 Dbl Bedroom	1.4	14	1.8	22	3.2	37
BH2 L03.04 Dbl Bedroom	1.1	22	1.9	29	3.1	46
	2.4	N/A	3.1	N/A	4.5	N/A
BH2 L03.04 Living/Kitchen BH1 L03.01 Dbl Bedroom	1.4	1N/A 24	2.1	35	2.9	-
BH1 L03.01 Dbl Bedroom	1.4	24	2.1	35	3.1	57 57
	2.3	N/A	3	N/A	5.3	N/A
BH1 L03.01 Living/Dining BH1 L03.02 Kitchen	2.3	N/A	3.7	N/A	3.2	N/A N/A
BH1 L03.02 Nitchen	1.2		1.9		3.2	
		25		35		51
BH1 L03.02 Single Bedroom	1.3	24	2	33	6.2	46
BH1 L03.02 Dbl Bedroom	1	25	1.9	35	3.4	51
BH1 L03.03 Kitchen	1.3	N/A	2.5	N/A	3.5	N/A
BH1 L03.03 Single Bedroom	1.5	16	1.7	25	5.5	38
BH1 L03.03 Dbl Bedroom	1.3	14	1.8	22	5.9	37
BH1 L03.03 Living room	1.4	N/A	2.7	N/A	4.7	N/A
BH1 L03.03 Dbl Bedroom	1.1	14	1.8	22	3	37
BH1 L03.04 Dbl Bedroom	1.4	22	1.8	29	3.1	46
BH1 L03.04 Living/Kitchen	2.4	N/A	3	N/A	2.7	N/A
BH1 L03.05 Single Bedroom	1.5	18	2	26	4	41
BH1 L03.05 Dbl Bedroom	1.5	20	2	27	3.2	44
BH1 L01.02 Kitchen diner	2.6	N/A	3.7	N/A	3.1	N/A
BH1 L02.02 Kitchen	2.6	N/A	3.7	N/A	4.5	N/A
BH2 L03.05 Single Bedroom	1.5	18	2	26	3.1	41
BH2 L03.05 Dbl Bedroom	1.5	20	2	27	5.3	44
BH2 L03.05 Living/Kitchen	3	N/A	3.9	N/A	3.2	N/A
BH1 L03.02 Kitchen	2.8	N/A	3.7	N/A	3.2	N/A
BH1 L03.05 Living/Kitchen	3	N/A	3.9	N/A	6.2	N/A



2020	DS	SY1	DSY2		DSY3	
Block H rooms with windows closed at night	Criteria a	Criteria b	Criteria a	Criteria b	Criteria a	Criteria b
Room Name	= < 3.0	< 33	= < 3.0	< 33	= < 3.0	< 33
BH2 L02.05 Kitchen	2.4	N/A	3.7	N/A	5.3	N/A
BH2 L02.04 Kitchen	2.5	N/A	3.7	N/A	5.3	N/A
BH2 L02.01 Dbl Bedroom	2	69	2.8	106	4.2	149
BH2 L02.01 DBI Bedroom	2	69	2.9	106	4.4	149
BH2 L01.01 DBLBED2	2.4	N/A	2.9	114	4.6	157
BH2 L01.01 DBLBED1	2.5	73	2.9	114	4.7	156
BH2 L03.01 Dbl Bedroom	1.9	71	2.9	105	4.2	153
BH2 L03.01 Dbl Bedroom	1.9	71	2.9	105	4.5	153
BH2 L03.01 Living/Dining	2.8	N/A	4.1	N/A	6.3	N/A
BH2 L02.06 Living room	3.1	N/A	4	N/A	6.1	N/A
BH2 L01.03 Dbl Bedroom	1.4	36	2.1	64	3.4	95
BH2 L01.04 Dbl Bedrrom	1.8	66	2.6	98	4	147
BH2 L01.04 Dbl Bedroom	1.8	62	2.5	95	3.9	136
BH2 L01.05 Dbl Bedroom	1.7	65	2.6	97	4	145
BH2 L01.05 Single Bedroom	1.7	58	2.5	92	3.8	133
BH2 L01.06 Dbl Bedroom	1.4	75	2.6	109	4	155
BH2 L01.06 Single Bedroom	1.7	85	3	112	4.7	161
BH2 L01.01 Living/Kitchen	3.3	N/A	4.4	N/A	6.6	N/A
BH1 L01.01 DBLBED2	2.2	72	2.8	108	4.4	158
BH1 L01.01 DBLBED1	2.2	71	2.8	107	4.3	157
BH1 L01.03 Dbl Bedroom	1.3	36	2.1	64	3.4	95
BH1 L01.04 Dbl Bedrrom	1.7	66	2.6	98	4	146
BH1 L01.04 Dbl Bedroom	1.8	63	2.5	96	3.9	138
BH1 L01.05 Dbl Bedroom	1.6	71	2.6	106	4	150
BH1 L01.05 Single Bedroom	1.3	61	2.5	96	3.7	140
BH1 L01.06 Dbl Bedroom	1.4	72	2.5	109	3.9	152
BH1 L01.06 Single Bedroom	1.5	62	2.6	101	3.9	141
BH1 L01.01 Living/Kitchen	2.9	N/A	4.1	N/A	6.3	N/A
BH2 L02.01 Living/Kitchen	3.1	N/A	4.2	N/A	6.5	N/A
BH1 L02.05 Kitchen	2.3	N/A	3.6	N/A	5.3	N/A
BH1 L02.04 Kitchen	2.5	N/A	3.7	N/A	5.3	N/A
BH1 L02.01 Dbl Bedroom	1.9	70	2.7	103	4.2	153
BH1 L02.01 DBI Bedroom	1.9	70	2.7	103	4.1	153
BH1 L02.06 Living room	3.2	N/A	4.1	N/A	6.3	N/A
BH1 L02.01 Living/Kitchen	2.8	N/A	4.1	N/A	6.1	N/A
BH2 L03.03 Single Bedroom	1.3	37	2.1	67	3.2	91
BH2 L03.03 Living room	1.4	N/A	3.1	N/A	4.6	N/A
BH2 L03.04 Living/Kitchen	2.1	N/A	3.5	N/A	5.1	N/A
BH2 L03.05 Living/Kitchen	3.1	N/A	4.2	N/A	6.4	N/A

2020	DS	Y1	DSY2		DSY3	
Block I	Criteria a	Criteria b	Criteria a	Criteria b	Criteria a	Criteria b
Room Name	= < 3.0	< 33	= < 3.0	< 33	= < 3.0	< 33
Double Bedroom 02.02	0.7	19	1.7	37	2.5	54
LDK 2bed 02.02	1.5	N/A	2.9	N/A	4.5	N/A
Double Bedroom 02.02	0.5	19	1.7	37	2.5	54
Dpuble Bedroom 02.05	0.5	23	1.5	39	2.1	60
LDK 2bed 02.05	1.6	N/A	2.9	N/A	4.3	N/A
LDK 1bed 07.02	2.4	N/A	3.6	N/A	5.8	N/A
Double Bedroom 07.03	1.3	17	2	28	3	45
LDK 2bed 07.03	2.3	N/A	3.6	N/A	5.2	N/A
Double Bedroom 07.04	1.3	14	2	21	3	38
LDK 1bed 07.04	2.2	N/A	3.8	N/A	5.6	N/A
LDK 1bed 07.01	2.1	N/A	3.6	N/A	5.4	N/A
Double Bedroom 07.01	1	17	1.8	27	2.8	42
Double Bedroom 02.01	1.1	19	1.8	29	2.8	44
Bathroom	1.9	N/A	2.9	N/A	4.5	N/A
LDK 1bed 02.01	1.7	N/A	3.1	N/A	4.7	N/A
Double Bedroom 02.06	1.1	17	1.8	27	2.8	43
LDK 1bed 02.06	1.4	N/A	3	N/A	4.6	N/A
Double Bedroom 02.05	0.7	22	1.6	38	2.5	55
Double Bedroom 07.04	1.8	14	2	21	3	38

2020	DS	Y1	DS	SY2	DSY3	
Block J windows openable at night	Criteria a	Criteria b	Criteria a	Criteria b	Criteria a	Criteria b
Room Name	= < 3.0	< 33	= < 3.0	< 33	= < 3.0	< 33
H15 Kitchen/Din	2.7	NA	4	NA	5.9	NA
GF H15 LivingRoom	0.8	NA	2.1	NA	3	NA
1F H15 SingleBed	0.9	19	1.7	35	2.5	45
2F H1 Kitchen/Din	2.2	NA	3.7	NA	5.4	NA
2F H1 LivingRoom	0.9	NA	2.6	NA	4.1	NA
3F H1 DoubleBed	0.9	19	1.9	29	2.7	39
3F H1 SingleBed	0.8	18	1.7	27	2.6	45
3F H1 DoubleBed	0.9	19	1.9	29	2.7	39
1F H15 DoubleBed	1	22	1.6	40	2.7	60
1F H15 DoubleBed	1	22	1.6	40	2.7	60
H6 Kitchen/Din	2.2	NA	3.7	NA	5.4	NA
GF H6 LivingRoom	0.7	NA	2.1	NA	2.7	NA
1F H6 SingleBed	0.7	16	1.5	27	2.6	47
1F H6 SingleBed	0.8	16	1.5	27	2.6	47
1F H6 DoubleBed	1	21	2	33	2.8	44
1F H6 DoubleBed	0.4	21	2	33	2.8	44
2F H6 DoubleBed	0.2	16	0.9	29	1.1	45
2F H6 SingleBed	0.5	16	1.4	27	2.1	43
1F H15 SingleBed	0.8	19	1.7	35	2.5	45



2020	DS	SY1	DSY2		DSY3	
Block J windows closed at night	Criteria a	Criteria b	Criteria a	Criteria b	Criteria a	Criteria b
Room Name	= < 3.0	< 33	= < 3.0	< 33	= < 3.0	< 33
H15 Kitchen/Din	3.8	NA	4.9	NA	7.1	NA
GF H15 LivingRoom	1.3	NA	3.1	NA	5.2	NA
1F H15 SingleBed	1.8	134	2.8	139	4.3	212
2F H1 Kitchen/Din	3.6	NA	5	NA	7.4	NA
2F H1 LivingRoom	2.1	NA	4.1	NA	6.5	NA
3F H1 DoubleBed	2.1	100	3.3	118	4.7	178
3F H1 SingleBed	1.9	110	3	134	4.5	196
3F H1 DoubleBed	2.1	100	3.1	118	4.7	178
1F H15 DoubleBed	1.7	80	2.5	116	4.2	168
1F H15 DoubleBed	1.7	80	2.9	116	4.3	168
H6 Kitchen/Din	3.3	NA	4.6	NA	6.9	NA
GF H6 LivingRoom	1	NA	2.7	NA	4	NA
1F H6 SingleBed	1.1	64	1.9	98	3.2	145
1F H6 SingleBed	1.1	64	2.3	98	3.6	145
1F H6 DoubleBed	1.7	75	2.7	106	3.9	152
1F H6 DoubleBed	1.7	75	2.2	106	3.5	152
2F H6 DoubleBed	1.4	104	3	127	4.7	186
2F H6 SingleBed	1.6	75	2.8	108	4.4	160
1F H15 SingleBed	1.8	134	2.6	139	3.9	212

Non-Domestic

The results of the assessment of the three criteria for the non-domestic elements of the detailed part of the application are shown below (using DSY 1).

Room Reference	Criterion 1: % Hours exceeding comfort range	Criterion 2: Maximum daily degree hours	Criterion 3: Maximum ΔT	Result
Target	< 3	< 6	< 4	
BF01 Retail	97.1	158	15	FAIL
BF02 Retail	98	159	17	FAIL
Marketing Suite 1 (2B4P)	75.9	121	14	FAIL
Marketing Suite 2 (Closing room)	9.6	17	3	FAIL
Marketing Suite 3 (BF04)	77.1	99	10	FAIL
Cafe	36.2	59	7	FAIL
BH1-01 Retail	97.2	126	14	FAIL
BH1-02 Retail	96.4	102	10	FAIL

Room Reference	Criterion 1: % Hours exceeding comfort range	Criterion 2: Maximum daily degree hours	Criterion 3: Maximum ΔT	Result
Target	< 3	< 6	< 4	
BH1-03 Retail	93.8	82	8	FAIL
BH1-04 Retail	87.0	61	6	FAIL
BH1-05 Retail	93.2	91	9	FAIL
BH1-06 Retail	92.6	81	8	FAIL
BH2-01 Retail	98.5	145	15	FAIL
BH2-02 Retail	97.3	106	11	FAIL
BH2-03 Retail	94.1	82	8	FAIL
BH2-04 Retail	83.6	53	5	FAIL
BH2-05 Retail	85.1	58	6	FAIL
BH2-06 Retail	88.9	62	6	FAIL
BH3-01 Retail	99.3	109	13	FAIL
BH3-02 Retail	86.7	76	10	FAIL
BH3-03 Retail	87.9	88	11	FAIL
BH3-04 Retail	89.6	94	12	FAIL

A.8.4 Outline Part of the Application Overheating Modelling Results

Domestic Dwellings – Recessed Balconies

The results of the assessment of criteria (a) and (b) for the sample residential dwellings in the outline part of the application using recessed balconies are shown below.

Apartment reference		Criterion (a): % Hours exceeding comfort range): Operative t) - hours in ra	•
	DSY 1	DSY 1 DSY 2 DSY 3			DSY 2	DSY 3
Target	< 3	< 3	< 3	< 33	< 33	< 33
E4.02.02 Living Kitchen	2.1	3.5	5.6	-	-	-
E4.02.02 Double Bed 1	0.4	1.2	1.6	11	21	35
E4.02.02 Double Bed 2	1.3	2.1	3.5	19	35	51
E4.08.02 Living Kitchen	2.9	3.8	6.2	-	-	-
E4.08.02 Double Bed 1	0.8	1.5	2.7	15	24	38



Apartment reference	Criterion (a): % Hours exceeding comfort range			Criterion (b): Operative temperatur		
	DSY 1	DSY 2	DSY 3	DSY 1	DSY 2	DSY 3
Target	< 3	< 3	< 3	< 33	< 33	< 33
E4.08.02 Double Bed 2	2.5	2.9	4.2	22	37	56
E1.14.06 Living Kitchen	3.7	4.8	6.9	-	-	-
E1.14.06 Double Bed 1	0.7	1.8	2.6	16	31	40
E1.14.06 Double Bed 2	2.2	2.5	3.8	19	33	47
E1.20.06 Living Kitchen	3.7	4.8	6.9	-	-	-
E1.20.06 Double Bed 1	0.8	1.8	2.7	17	30	40
E1.20.06 Double Bed 2	2.2	2.6	3.9	20	33	46
E1.02.08 Living Kitchen	1.5	3.0	4.6	-	-	-
E1.02.08 Double Bed	1.1	1.6	3	16	25	40
E1.08.08 Living Kitchen	1.9	3.3	5.1	-	-	-
E1.08.08 Double Bed	1.6	2.2	3.5	17	28	42
E1.14.08 Living Kitchen	2.1	3.4	5.5	-	-	-
E1.14.08 Double Bed	1.9	2.3	3.6	18	32	47
E1.20.08 Living Kitchen	2.2	3.5	5.6	-	-	-
E1.20.08 Double Bed	2.0	2.3	3.7	19	33	46
E1.14.02 Living Kitchen	3.3	4.2	6.7	-	-	-
E1.14.02 Double Bed 1	0.5	1.4	2.1	15	26	38
E1.14.02 Double Bed 2	0.7	1.6	2.4	17	30	45
E1.20.02 Living Kitchen	3.4	4.2	6.6	-	-	-
E1.20.02 Double Bed 1	0.5	1.4	2.2	15	27	41
E1.20.02 Double Bed 2	0.7	1.6	2.5	17	28	44

Domestic Dwellings – Projecting Balconies

The results of the assessment of criteria (a) and (b) for the sample residential dwellings in the outline part of the application using projecting balconies are shown below.

ME	MHZISDT

Apartment reference		Criterion (a): % Hours exceeding comfort range			emperature nge	
	DSY 1	DSY 2	DSY 3	DSY 1	DSY 2	DSY 3
Target	< 3	< 3	< 3	< 33	< 33	< 33
E4.02.02 Living Kitchen	2.0	3.5	5.2	-	-	-
E4.02.02 Double Bed 1	0.4	1.3	1.7	11	23	32
E4.02.02 Double Bed 2	1.0	1.7	2.9	17	33	44
E4.08.02 Living Kitchen	3.7	4.5	6.8	-	-	-
E4.08.02 Double Bed 1	1.5	2.2	3.3	17	32	41
E4.08.02 Double Bed 2	3.1	3.2	4.6	24	38	57
E1.14.06 Living Kitchen	3.7	4.7	6.8	-	-	-
E1.14.06 Double Bed 1	0.9	1.8	2.7	17	27	38
E1.14.06 Double Bed 2	2.3	2.5	4	20	34	47
E1.20.06 Living Kitchen	4.3	5.2	7.6	-	-	-
E1.20.06 Double Bed 1	1.3	2.2	3.4	17	32	42
E1.20.06 Double Bed 2	2.7	3	4.4	22	35	52
E1.02.08 Living Kitchen	1.4	2.8	4.2	-	-	-
E1.02.08 Double Bed	0.9	1.4	2.6	12	23	31
E1.08.08 Living Kitchen	1.8	3.2	4.6	-	-	-
E1.08.08 Double Bed	1.3	2.0	3	13	23	32
E1.14.08 Living Kitchen	2.2	3.6	5.5	-	-	-
E1.14.08 Double Bed	1.8	2.2	3.5	17	27	38
E1.20.08 Living Kitchen	3.4	4.1	6.5	-	-	-
E1.20.08 Double Bed	2.3	2.5	3.8	18	30	42
E1.14.02 Living Kitchen	3.2	4.1	6.6	-	-	-
E1.14.02 Double Bed 1	0.7	1.6	2.4	17	32	43
E1.14.02 Double Bed 2	0.6	1.4	2.2	16	26	39
E1.20.02 Living Kitchen	3.5	4.2	6.7	-	-	-
E1.20.02 Double Bed 1	0.9	1.8	2.7	17	33	47
E1.20.02 Double Bed 2	0.8	1.5	2.5	17	29	41



Appendix A.9 - Drawings

FOR INFORMATION

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MASTERPLAN

ECOWORLD & POPLAR HARCA

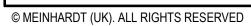
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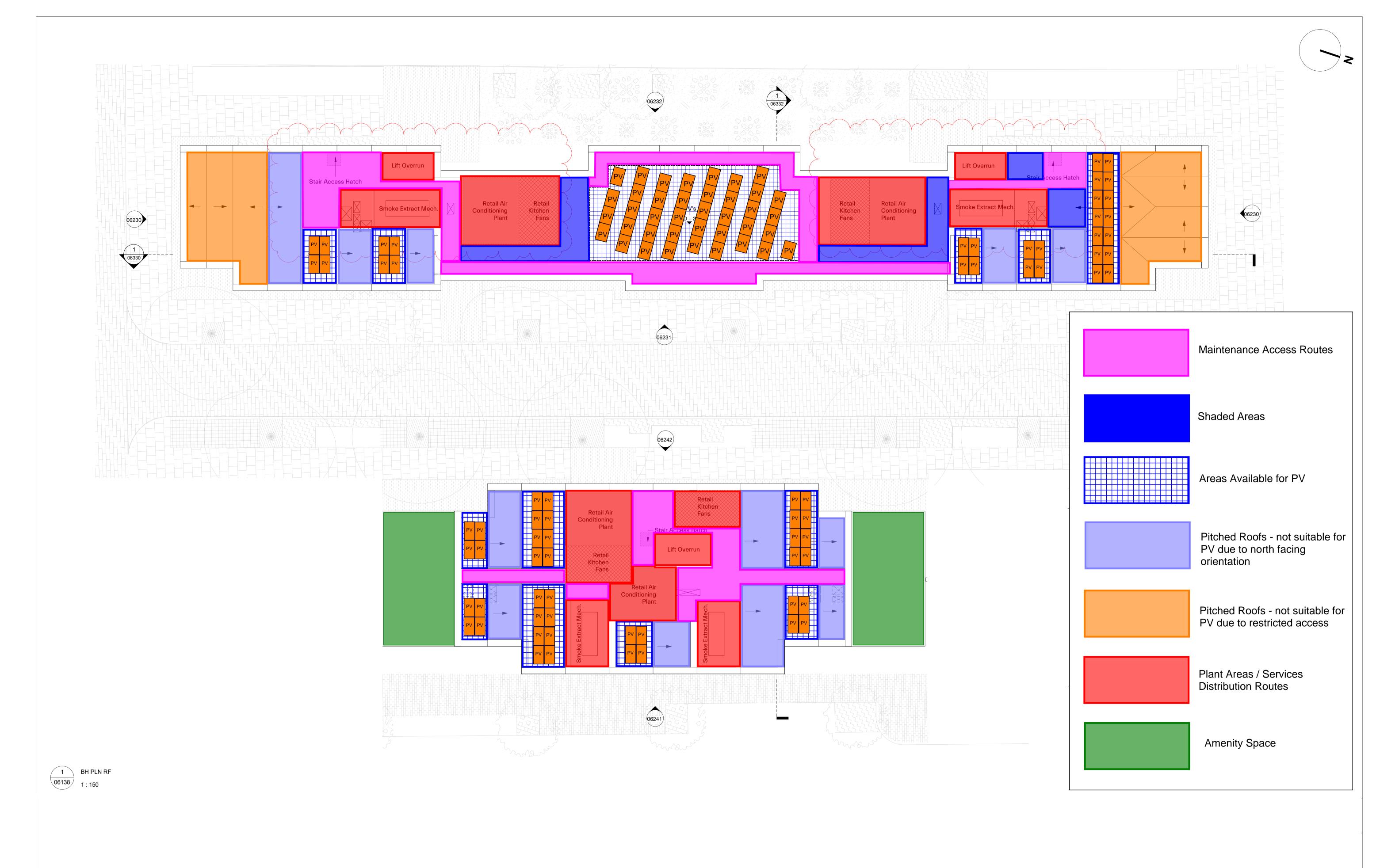
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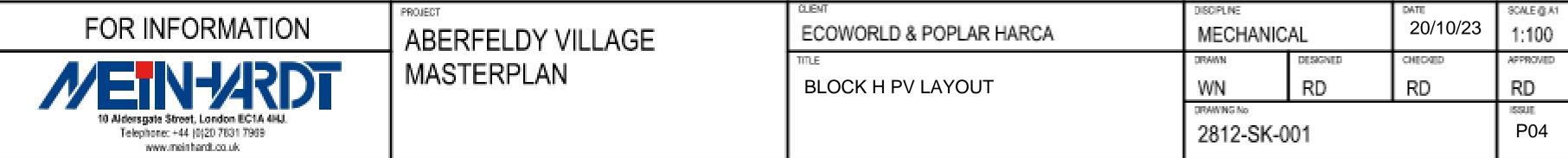
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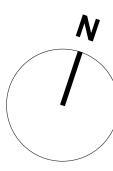
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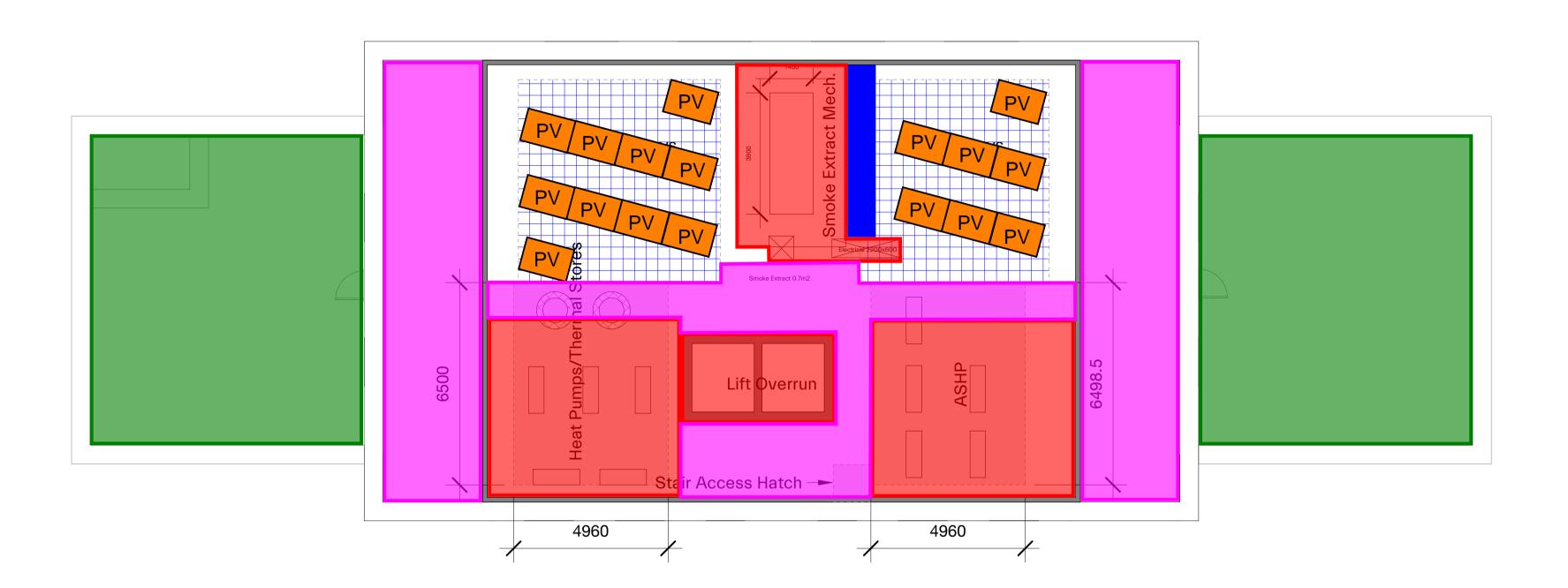
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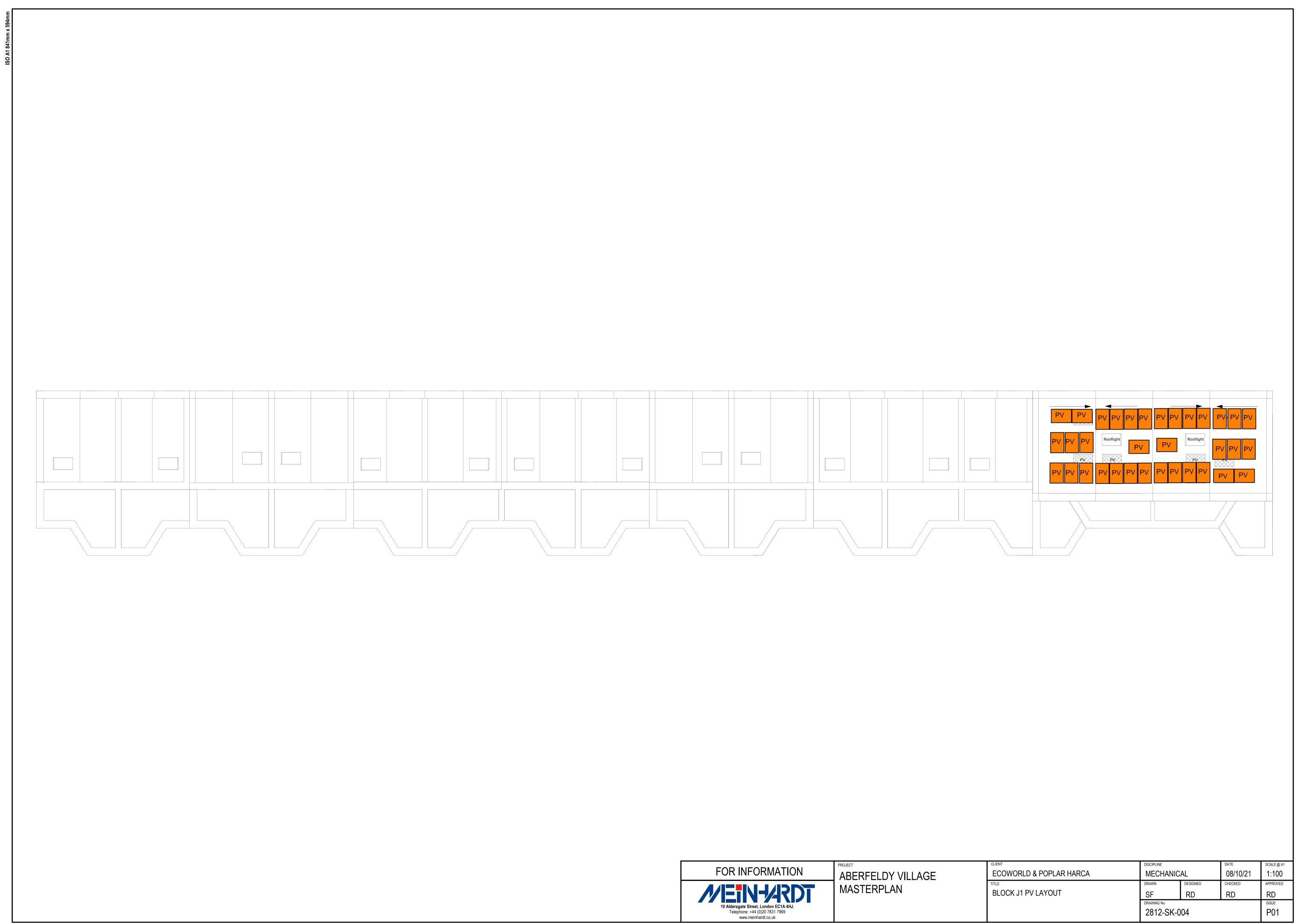






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ABERFELDY VILLAGE MASTERPLAN





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AP 10 WORKSHEET ALCULATION OF D Overall dwell round floor irst floor econd floor	FOR New E	Build (As Des MISSIONS FOR Control of the state of the st	signed) (Version 10.	.2, February	2022)		Area (m2) 61.1000 (62.1000 (39.1000 (1b) x 1c) x 1d) x	(m) 2.7300 (2.9600 (3.0200 ((2c) = (2d) =	(m3) 166.8030 183.8160 118.0820
Ventilation r	ate											13 nen hou-
umber of open comber of open fumber of chimne of flues umber of blocke umber of interm	himneys lues ys / flues attached t attached t d chimneys ittent ext	to solid fuel to other heat s	l boiler	re							0 * 80 = 0 * 20 = 0 * 10 = 0 * 20 = 0 * 35 = 0 * 20 = 0 * 10 =	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
umber of open of umber of open f umber of chimne umber of flues umber of flues umber of interm umber of passiv umber of fluele	himneys lues ys / flues attached t d chimneys ittent ext e vents ss gas fin	to solid fuel to other heat s tract fans res	l boiler ter								0 * 80 = 0 * 20 = 0 * 20 = 0 * 20 = 0 * 20 = 0 * 35 = 0 * 20 = 0 * 10 = 0 * 10 = 0 * 40 =	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
umber of open of umber of open fumber of chimme umber of flues umber of blocke umber of interm umber of fluele of fluele of the childration due ressure test ressure Test Me assured/design of illration rat	himneys lues ys / flues attached tattached to chimneys ittent ext e vents ss gas fin to chimne thod AP50 e	to solid fuel to other heat s tract fans res	l boiler ter		+(6c)+(6d)+(6e)+(6f)+(6	g)+(7a)+(7	/b)+(7c) =			0 * 80 = 0 * 20 = 0 * 10 = 0 * 20 = 0 * 35 = 0 * 20 = 0 * 10 = 0 * 10 = 0 * 40 = Air change	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 Yes Slower Door 3.0000 0.1500
umber of open of commer of open of chimme of flues umber of flues umber of blocke umber of passiv umber of fluele of fluele of the commercial of the commerc	himneys lues ys / flues attached tattached to chimneys ittent ext e vents ss gas fin to chimne thod AP50 e sheltered	to solid fuel to other heats s tract fans res	L boiler cer and fans =	(6a)+(6b)-	+(6c)+(6d)+(6e)+(6f)+(6	g)+(7a)+(7			0.0000 [0.075 x	0 * 80 = 0 * 20 = 0 * 10 = 0 * 20 = 0 * 20 = 0 * 20 = 0 * 10 = 0 * 10 = 0 * 40 = Air change / (5) =	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 Yes slower Door 3.0000 0.1500 2
umber of open of umber of open of flues umber of flues umber of flues umber of interm umber of passivumber of fluele of flues umber of fluele of f	himneys lues ys / flues attached t attached t d chimneys ittent ext e vents ss gas fir to chimne thod AP50 e sheltered e adjusted Jan 5.1000	to solid fuelto other heats stract fans res eys, flues ar d to include Feb 5.0000	L boiler cer and fans = shelter fa Mar 4.9000	(6a)+(6b)- ctor Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	(Aug 3.7000	Sep 4.0000	0.0000 [0.075 x 1) = (18) > Oct 4.3000	0 * 80 = 0 * 20 = 0 * 10 = 0 * 20 = 0 * 10 = 0 * 20 = 0 * 10 = 0 * 20 = 0 * 10 = 0 * 40 = Air change / (5) = B (19)] = (20) = Nov 4.5000	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 Yes 0.0000 0.1500 0.1500 0.1275
umber of open of umber of open of flues umber of flues umber of flues umber of blocke umber of intermumber of passivumber of fluele of flues umber of fluele	himneys lues ys / flues attached tattached tattached to chimneys ittent ext e vents ss gas fin to chimne thod AP50 e sheltered e adjusted Jan 5.1000 1.2750	to solid fuelto other heats stract fans res eys, flues and d to include Feb 5.0000 1.2500	boiler der d fans = shelter fa Mar 4.9000 1.2250	(6a)+(6b)- ctor Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	Sep 4.0000 1.0000	0.0000 [0.075 x 1) = (18) x Oct 4.3000 1.0750	0 * 80 = 0 * 20 = 0 * 10 = 0 * 20 = 0 * 10 = 0 * 20 = 0 * 10 = 0 * 10 = 0 * 10 = 0 * 40 = Air change / (5) = B (19)] = x (20) = Nov 4.5000 1.1250	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 es per hour 0.0000 Yes Slower Door 3.0000 0.1500 0.1275 Dec 4.7000 1.1750
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umber of open of umber of open of chimme mber of flues umber of flues umber of blocke umber of interm umber of passiv umber of fluele of flues umber of fluele of flue	himneys lues ys / flues attached tattached tat	to solid fuelto other heads stract fans res eys, flues are d to include Feb 5.0000 1.2500 0.1594 ilation with using Appenditionery: efficite o.4344	shelter fa Mar 4.9000 1.2250 0.1562 heat recov ix N, (23b) iency in % 0.4312	(6a)+(6b)- ctor Apr 4.4000 1.1000 0.1403 ery = (23a) x allowing for 0.4153	May 4.3000 1.0750 0.1371 Fmv (equati or in-use fa 0.4121	Jun 3.8000 0.9500 0.1211 on (N5)), o ctor (from 0.3961	Jul 3.8000 0.9500 0.1211 therwise (Table 4h) 0.3961	Aug 3.7000 0.9250 0.1179 (23b) = (23a = 0.3929	Sep 4.0000 1.0000 0.1275	0.0000 [0.075 x 1) = (18) > Oct 4.3000 1.0750 0.1371	0 * 80 = 0 * 20 = 0 * 10 = 0 * 20 = 0 * 10 = 0 * 20 = 0 * 10 = 0 * 10 = 0 * 10 = 0 * 40 = Air change / (5) = (19)] = (20) = Nov 4.5000 1.1250 0.1434	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.1500 0.1500 0.1275 Dec 4.7000 1.1750 0.1498 0.5000 45.0000

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Full SAP Calculation Printout



front door Heatloss Floor exposed floor External Wall 1 External Roof 1 External Roof 2 Total net area Fabric heat los Party Wall 1 Internal Wall 1	of externa s, W/K = S			128.0622 41.2700 19.2300	28.0900	61 1 99 41 19 251	.0000 .1000 .6800 .9722 .2700 .2300 .3422 (26)(1.0000 0.0800 0.0800 0.1300 0.1000 0.1000 30) + (32)	2.000 4.88i 0.13i 12.99i 4.12i 1.92i = 46.29i 0.000	80 110 44 64 190 70 5 30 5 36 00 180	9.0000 9.0000	6721.0000 18994.7180 371.4300 173.0700 20520.0000 2974.7700	(28b) (29a) (30) (30) (31) (33) (32)
Heat capacity C			TEA) in kl/r	n O K				(28).	(30) + (3	2) + (32a).	(32e) =		
E3 Sill E4 Jamb E5 Grou E6 Inte E20 Exp E13 Gab R5 Ridg P1 Part P4 Part E14 Flat R7 Flat E16 Cor E18 Par R4 Ridg	Bridges ent r lintels nd floor (rmediate f osed floor le (insula e (inverte y wall - G y wall - R t ceiling (ner (norma ty wall be e (vaulted	(including normal) loor withir (normal) tion at raid d) cround floor coof (insula intermediate inverted) 1) tween dwell ceiling)	other stee: n a dwelling fter level) ation at ce: e floor with	l lintels) 3 iling level; nin a dwell:	ing			16 15 40 13 13 1 12 6 20 27 9 21 5	ength	Psi-value 0.0500 0.0500 0.1600 0.1600 0.3200 0.0800 0.0800 0.1200 0.0800 0.0800 0.0400 0.0800 0.0400 0.0400 0.0400 0.0900 0.0600 0.0800	Tot 0.84 0.78 2.02 2.14 0.00 0.57 0.96 0.26 1.63 3.32 0.73 0.00 0.22 1.60 2.19	80 80 90 40 60 60 60 60 40 84 60 60 60 92 60	
Thermal bridges Point Thermal b Total fabric he	ridges	PS1) Calcul	lated using	Appendix K)				/	33) + (36) -	(36a) =	17.8606 0.0000 64.1542	
Ventilation hea		culated mor	nthlv (38)m	= 0.33 x (2	25)m x (5)				(-	33) + (30)	+ (30a) =	04.1342	(37)
(38)m	Jan 67.6784	Feb 67.1854	Mar 66.6923	Apr 64.2273	May 63.7343	Jun 61.2692	Jul 61.2692	Aug 60.7762	Sep 62.2552	Oct 63.7343	Nov 64.7203	Dec 65.7063	(38)
Heat transfer c Average = Sum(3	131.8326	131.3396	130.8465	128.3815	127.8884	125.4234	125.4234	124.9304	126.4094	127.8884	128.8745	129.8605 128.2582	
HLP	Jan 0.8123	Feb 0.8092	Mar 0.8062	Apr 0.7910	May 0.7880	Jun 0.7728	Jul 0.7728	Aug 0.7697	Sep 0.7 789	0ct 0.7880	Nov 0.7941	Dec 0.8001	(40)
HLP (average) Days in mont	31	28	31	30	31	30	31	31	30	31	30	0.7903 31	
4. Water heatin	cy for mixer 101.3610 for baths 31.8240 for other 44.8626	showers 99.8377 31.3513 uses 43.2312	97.6180 30.6858 41.5998	93.3710 29.4586 39.9685	90.2369 28.5397 38.3371	86.7417 27.5208 36.7057	84.7550 26.9704 36.7057	86.9579 27.6313 38.3371	89.3727 28.3509 39.9685	93.1255 29.4412 41.5998	97.4637 30.6937 43.2312	2.9521 100.9726 31.7164 44.8626 163.7414	(42a) (42b) (42c)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
Energy conte Energy content	178.0475 281.9837 (annual)	174.4202 248.3721	169.9036 261.1355	162.7981 222.8625	157.1137 211.5052	150.9682 185.6331	148.4312 179.5147	152.9264 189.3548	157.6921 194.4501	164.1665 222.7724 Total = S	171.3885 244.1744 um(45)m =	177.5516 278.0028 2719.7613	(45)
Distribution lo	42.2976	= 0.15 x (4 37.2558	45)m 39.1703	33.4294	31.7258	27.8450	26.9272	28.4032	29.1675	33.4159	36.6262	41.7004	(46)
Water storage 1 Store volume a) If manufact Temperature f Enter (49) or (Total storage 1	urer decla actor from 54) in (55	Table 2b	actor is kno	own (kWh/da	ay):							300.0000 2.1100 0.5400 1.1394	(48) (49)
If cylinder con	35.3214	31.9032 cated solar	35.3214 r storage	34.1820	35.3214	34.1820	35.3214	35.3214	34.1820	35.3214	34.1820	35.3214	(56)
Primary loss Combi loss Total heat requ	35.3214 23.2624 0.0000 ired for w	31.9032 21.0112 0.0000 ater heatin	35.3214 21.8667 0.0000 ng calculate			34.1820 9.9053 0.0000	35.3214 10.2355 0.0000	35.3214 11.1660 0.0000	34.1820 17.1091 0.0000	35.3214 21.8667 0.0000	34.1820 22.5120 0.0000	35.3214 23.2624 0.0000	(59) (61)
	ctor effic tor ss coeffic icient of storage v volume e rrection c to hot wat	iency ient of sys collector l colume oefficient er		272.8029 -58.9616 0.0000	257.2947 -54.9501 0.0000	229.7263 -47.0212 0.0000	225.0715 -44.0749 0.0000	235.8421 -46.8692 0.0000	245.7413 -48.6500 0.0000	279,9665 -57.3529 0.0000	300.8684 -64.9739 0.0000	336.5866 -75.4644 0.0000 0.9900 0.8000 1.0000 5.4950 9.0505 180.0000 74.2500 0.8014 205.5996 0.0000	(63a) (63b) (H1) (H2) (H8) (H10) (H11) (H12) (H14) (H15) (H16) (H24)

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Solar input Solar input	-0.0000	-0.0000	-12.5962	-26.2957	-41.9783	-40.4352	-39.6432	-30.3119	-14.3390	-0.0000	-0.0000	205.5996 -0.0000	
FGHRS Output from w/	0.0000 h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
	263.6793	233.2859	234.5211	187.5455	160.3663	142.2639	141.3534	158.6610 Total n	182.7523 er vear (kk	222.6075 h/year) = S	235.8945 um(64)m =	261.1222 2424.0530	
12Total per ye Electric showe		ar)						rocar p	er year (ki	, year ,	u(01)		(64)
Electric Showe	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	. ,
Heat gains fro	om water he	ating, kWh/	month	Tot	al Energy us	sed by inst	antaneous e	lectric sho	wer(s) (kWh	/year) = Su	m(64a)m =	0.0000	(64a)
	140.6266	124.9152	132.5780	114.0541	106.9571	96.9928	96.1341	100.1503	105.6876	119.8223	126.5432	139.3030	(65)
 5. Internal ga	ins (soo T	ahlo E and											
Metabolic gain	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
(66)m Lighting gains	147.6056 (calculat	147.6056 ed in Apper	147.6056 dix L, equa	147.6056 tion L9 or	147.6056 L9a), also s	147.6056 see Table 5		147.6056	147.6056	147.6056	147.6056	147.6056	(66)
Appliances gai	175.3892 .ns (calcul	194.1809 ated in App	175.3892 endix L, eq	181.2355 uation L13	175.3892 or L13a), all	181.2355 Lso see Tab	175.3892 ole 5	175.3892	181.2355	175.3892	181.2355	175.3892	(67)
Cooking gains	333.6109	337.0727	328.3490	309.7772	286.3337	264.3001	249.5803	246.1185	254.8422	273.4140	296.8575	318.8911	(68)
Pumps, fans	37.7606 3.0000	37.7606 3.0000	37.7606 3.0000	37.7606 3.0000	37.7606 3.0000	37.7606 0.0000	37.7606 0.0000	37.7606 0.0000	37.7606 0.0000	37.7606 3.0000	37.7606 3.0000	37.7606 3.0000	
Losses e.g. ev	aporation	(negative v	alues) (Tab	le 5)									. ,
Water heating		le 5)	-118.0845	-118.0845	-118.0845	-118.0845	-118.0845	-118.0845	-118.0845	-118.0845	-118.0845	-118.0845	
Total internal	189.0143 gains	185.8858	178.1963	158.4085	143.7595	134.7122	129.2125	134.6107	146.7883	161.0514	175.7544	187.2352	(72)
	768.2960	787.4211	752.2161	719.7029	675.7641	647.5296	621.4637	623.4001	650.1477	680.1363	724.1291	751.7971	(73)
6. Solar gains													
Bazna													
[Jan]			Д	rea m2	Solar flux Table 6a W/m2		g fic data Table 6b	Specific or Tab		Acce facto Table	or	Gains W	
North			10.9	200	10.6334		0.5000		.8000	0.77		32.1875	(74)
South Southwest			11.5		46.7521 36.7938		0.5000 0.5000	0	.8000 .8000	0.77 0.77	90	149.2954 37.2273	(78)
	210 7102	260 4212	F02 74F0	627 4120	712 4010	714 6767	606 2102	610 0246	F44 0733	407 0200	261 2621	107 (000	(02)
Solar gains Total gains	218.7102 987.0063	369.4313 1156.8523	502.7459 1254.9620	627.4120 1347.1149	713.4018 1389.1659	714.6767 1362.2063	686.2182 1307.6819	619.9246 1243.3247	544.9732 1195.1209	407.0298 1087.1661	261.2631 985.3922	187.6969 939.4940	. ,
7. Mean intern	ıal tempera	ture (heati	.ng season)										
Temperature du Utilisation fa						Γh1 (C)						21.0000	(85)
tau	Jan 104.8362	Feb 105.2298	Mar 105.6263	Apr 107.6544	May 108.0694	Jun 110.1934	Jul 110.1934	Aug 110.6283	Sep 109.3339	0ct 108.0694	Nov 107.2426	Dec 106.4283	
alpha util living ar	7.9891	8.0153	8.0418	8.1770	8.2046	8.3462	8.3462	8.3752	8.2889	8.2046	8.1495	8.0952	
acii iiving a	0.9991	0.9964	0.9875	0.9432	0.8109	0.5863	0.4218	0.4618	0.7145	0.9586	0.9965	0.9994	(86)
MIT Th 2	20.2815 20.2427	20.4311 20.2453	20.6107 20.2480	20.8323 20.2611	20.9627 20.2638	20.9976 20.2770	20.9999 20.2770	20.9997 20.2796	20.9891 20.2717	20.8292 20.2638	20.5201 20.2585	20.2639 20.2532	٠,
util rest of h	ouse 0.9987	0.9950	0.9826	0.9230	0.7617	0.5216	0.3526	0.3897	0.6461	0.9393	0.9949	0.9991	(89)
MIT 2 Living area fr	19.5830 action	19.7341	19.9132	20.1335	20.2417	20.2761	20.2769	20.2796	20.2669 fLA =	20.1364 Living are	19.8344 a / (4) =	19.5745 0.1348	
MIT Temperature ad	19.6772	19.8281	20.0072	20.2277	20.3389	20.3733	20.3744	20.3766	20.3643	20.2298	19.9268	19.6674	(92)
adjusted MIT	19.6772	19.8281	20.0072	20.2277	20.3389	20.3733	20.3744	20.3766	20.3643	20.2298	19.9268	19.6674	
8. Space heati													
Utilication	Jan	Feb	Mar a 9907	Apr	May	Jun	Jul 0 3630	Aug	Sep	0ct	Nov	Dec	(04)
Utilisation Useful gains Ext temp.	0.9984 985.3919 4.3000	0.9940 1149.8814 4.9000	0.9807 1230.6829 6.5000	0.9219 1241.9120 8.9000	0.7670 1065.5031 11.7000	0.5303 722.3705 14.6000	0.3620 473.3361 16.6000	0.3995 496.6664 16.4000	0.6550 782.8536 14.1000	0.9383 1020.0468 10.6000	0.9940 979.4669 7.1000	0.9989 938.4274 4.2000	(95)
	2027.2119	1960.6476	1767.3757	1454.2629	1104.8197	724.1128	473.3988	496.8038	791.8625	1231.5352	1653.0477	2008.6047	(97)
Space heating Space heating	775.1141		399.2995 er year (kw	152.8926 h/year)	29.2515	0.0000	0.0000	0.0000	0.0000	157.3474	484.9782	796.2120 3339.9301	
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 0.0000	(98b)
Space heating			r	, 5 - 201)								2.0000	

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Space heating Space heating		544.8349 t after sola		152.8926 tion - total	29.2515 per year	0.0000 (kWh/year)	0.0000	0.0000	0.0000	157.3474 (98c	484.9782) / (4) =	796.2120 3339.9301 20.5787	
9a. Energy re Fraction of s Fraction of s Efficiency of Efficiency of	quirements pace heat f pace heat f main space main space	- Individual rom secondar rom main sys heating sys heating sys	l heating s ry/suppleme stem(s) stem 1 (in stem 2 (in	ystems, incl ntary system %) %)	uding micr	o-CHP						0.0000 1.0000 84.5000 0.0000	(202 (206 (207
Space heating	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
	775.1141	544.8349	399.2995	152.8926	29.2515	0.0000	0.0000	0.0000	0.0000	157.3474	484.9782	796.2120	(98)
Space heating	84.5000	84.5000	84.5000	84.5000	84.5000	0.0000	0.0000	0.0000	0.0000	84.5000	84.5000	84.5000	(210
Space heating	917.2948	644.7750	472.5438	180.9380	34.6172	0.0000	0.0000	0.0000	0.0000	186.2099	573.9387	942.2627	(211
Space heating	efficiency 0.0000	(main heati 0.0000	ing system 0.0000	2) 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating	fuel (main 0.0000	heating sys	o.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating			0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Water heating													
Water heating		t 233.2859	234.5211	187.5455	160.3663	142.2639	141.3534	158.6610	182.7523	222.6075	235.8945	261.1222	(64)
Efficiency of (217)m			84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	89.5000 84.5000	(216
Fuel for wate		kWh/month	277.5397		189.7826	168.3597		187.7645	216.2749		279.1650		
Space cooling	fuel requi			221.9474			167.2822			263.4409		309.0204	
(221)m Pumps and Fa	0.0000 38.6919	0.0000 34.9475	0.0000 38.6919	0.0000 37.4438	0.0000 38.6919	0.0000 37.4438	0.0000 38.6919	0.0000 38.6919	0.0000 37.4438	0.0000 38.6919	0.0000 37.4438	0.0000 38.6919	(231
Lighting Electricity g						10.7611	12.0153	15.6180	20.2862	26.6166	30.0634	33.1170	
(233a)m lectricity g							0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
(234a)m Electricity g	0.0000 enerated by	0.0000 hydro-elect	0.0000 tric genera	0.0000 tors (Append	0.0000 lix M) (neg	0.0000 ative quant:	0.0000 ity)	0.0000	0.0000	0.0000	0.0000	0.0000	(234
(235a)m Electricity u	0.0000 sed or net	0.0000 electricity	0.0000 generated	0.0000 by micro-CHF	0.0000 (Appendix	0.0000 N) (negativ	0.0000 ve if net g	0.0000 eneration)	0.0000	0.0000	0.0000	0.0000	(235
(235c)m Electricity g	0.0000 enerated by	0.0000 PVs (Append	0.0000 dix M) (neg	0.0000 ative quanti	0.0000 ty)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235)
(233b)m Electricity g	0.0000 enerated by	0.0000 wind turbin	0.0000 nes (Append	0.0000 ix M) (negat	0.0000 ive quanti	0.0000 tv)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233l
(234b)m Electricity g	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 itv)	0.0000	0.0000	0.0000	0.0000	0.0000	(234
(235b)m Electricity u	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 eneration)	0.0000	0.0000	0.0000	0.0000	(235
(235d)m Annual totals	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235
Space heating Space heating Space heating Efficiency of Water heating Space cooling	fuel - main fuel - main fuel - secon water heat fuel used	n system 2 ondary										3952.5800 0.0000 0.0000 89.5000 2868.7018	(213 (215 (219
: lectricity f (Balanced	or pumps and WithHeatReco ventilation ating pump city for the	overy, Datab n fans (SFP e above, kWh	= 0. n/year	e factor = 1 7250) ix)	2500, SFP	= 0.7250)						0.0000 414.5660 41.0000 455.5660 260.0461	(230 (230 (231
Energy saving PV generation	/generation				I Q)							0.0000	(233
Wind generati Hydro-electri Electricity g Appendix Q -	c generation enerated - D	Micro CHP (A										0.0000 0.0000 0.0000	(235
Energy saved Energy used Total deliver	or generate	d										-0.0000 0.0000 7536.8938	(237
12a. Carbon d	ioxide emis	sions - Indi	ividual hea		including	micro-CHP							
								Energy kWh/year		ion factor kg CO2/kWh	k	Emissions g CO2/year	
Space heating Total CO2 ass			systems					3952.5800		0.2100		830.0418	(261
Water heating Space and wat	(other fue		-, - cm3					2868.7018		0.2100		602.4274	(264
	nd electric	keep-hot						455.5660		0.1387		63.1926	
Energy for li	ahtina							260.0461		0.1443		37.5327	

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EPC Dwelling Car	rbon Dioxid	e Emission	Rate (DER)										9.4500	(273)
13a. Primary ene														
Space heating -	main syste	m 1						Energy kWh/year 3952.5800		gy factor g CO2/kWh 1.1300		Prima	ary energy kWh/year 4466.4154	
Total CO2 associ Water heating (c Space and water	lated with other fuel)		systems					2868.7018		1.1300			0.0000 3241.6330 7708.0484	(473) (278)
Pumps, fans and Energy for light Total Primary er Dwelling Primary	electric k ing nergy kWh/y	ear						455.5660 260.0461		1.5128 1.5338			689.1803 398.8673 8796.0960 54.2000	(281) (282) (286)
SAP 10 WORKSHEET CALCULATION OF T	FOR New B	uild (As De SIONS	esigned)	(Version 10		2022)								
1. Overall dwell	ling charac	teristics												
Ground floor								Area (m2) 61.1000		ey height (m) 2.7300		=	Volume (m3) 166.8030	
First floor Second floor								62.1000 39.1000	(1c) x	2.9600 3.0200	(2c)	=	183.8160 118.0820	(1c) (1d)
Total floor area Dwelling volume	a TFA = (1a)+(1b)+(1c))+(1d)+(1e)	(1n)	16	2.3000		(3a)+(3b)+(3c)	+(3d)+(3e)(3n)	=	468.7010	(4) (5)
2. Ventilation r	ate													
Number of open o	chimnove										0 * 86		3 per hour	
Number of open of Number of chimne Number of flues Number of flues Number of blocke Number of intern Number of passiv Number of fluel	Flues Pys / flues attached to attached to ed chimneys mittent extore ve vents	o solid fue o other hea ract fans	el boiler	ire							0 * 20 0 * 10 0 * 20 0 * 35 0 * 20 4 * 10 0 * 40) =) =) =) =) =) =	0.0000 0.0000 0.0000 0.0000 0.0000 40.0000 0.0000	(6b) (6c) (6d) (6e) (6f) (7a) (7b)
Infiltration due	e to chimne	ys, flues a	and fans :	= (6a)+(6b)-	+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		40.000	Air ch 0 / (5)		s per hour 0.0853	
Pressure test Pressure Test Me Measured/design Infiltration rat Number of sides	AP50 e											В	Yes lower Door 5.0000 0.3353	(17)
Shelter factor Infiltration rat	ce adjusted	to include	e shelter fa	actor					(20) = 1 -	[0.075 : 1) = (18)			0.8500 0.2850	
Wind speed Wind factor Adj infilt rate	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250		Oct 4.3000 1.0750		/ 5000 1250	Dec 4.7000 1.1750	
Effective ac	0.3634 0.5660	0.3563 0.5635	0.3492 0.5610	0.3135 0.5492	0.3064 0.5469	0.2708 0.5367	0.2708 0.5367	0.2637 0.5348		0.3064 0.5469		3207 5514	0.3349 0.5561	
3. Heat losses a	and heat 10	ss naramet												
Element				Gross	Openings	Net	Area	U-value	A × 1		K-value		A x K	
TER Opaque door TER Opening Type Heatloss Floor 1 exposed floor External Wall 1		0)		m2 28.0622	m2 28.0900	26. 61. 1. 99.	m2 0000 0900 1000 6800 9722	W/m2K 1.0000 1.1450 0.1300 0.1300 0.1800	W/I 2.000 29.874 7.943 0.218 17.995	9 9 9 4 9	kJ/m2K		kJ/K	(26) (27) (28a) (28b) (29a)
External Roof 1 External Roof 2				11.2700 L9.2300			2700 2300	0.1100 0.1100	4.539 2.115					(30) (30)

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Second Company Compa	Total net area Fabric heat los								30) + (32) · 0.0000	= 64.68 0.00				(31) (33)
Start Part	Party Wall 1			> • • • • •			114	. 0000	9.0000	0.00	,00			(32)
L3 5111	List of Thermal K1 Elem	Bridges ent											al	(35)
Est incrementate falor within a dwalling 1.200	E3 Sill E4 Jamb			other seed	1111023)				15 40	.7600 .5800	0.0500 0.0500	0.78 2.02	80 90	
P1 Party will - Ground Floor 1.6360	E6 Inte E20 Exp	rmediate foor	floor within (normal)		5				13 1	.4000 .8000	0.0000 0.3200	0.00 0.57	00 60	
## Party wall 1 Interemediate (loop within a dwelling in File 1	P1 Part	y wall - 0	Ground floo		ling level)			20	.4500	0.0800	1.63	60	
As Ridge (vaulted celling) As Ridge (vaulted celling) As Pridge (sunit x Psi) calculated using Appendix X	P2 Part R7 Flat E16 Cor	y wall - 1 ceiling (ner (norma	(inverted) al)		nin a dwell	ing			21 5 17	.0000 .6500 .8800	0.0000 0.0400 0.0900	0.00 0.22 1.60	00 60 92	
### Particulation head loss calculated monthly (38) = -0.33 x (25) m. x (5) ### Blom	R4 Ridg Thermal bridges Point Thermal b	ge (vaulted (Sum(L x oridges	d ceiling)		Appendix K)				.5500	0.0800	0.52 (36a) =	40 17.8606 0.0000	
Syn				(20)	0.22 (25) (5)				((33) + (36) -	+ (36a) =	82.5460	(37)
### 169.6961 109.6995 169.3187 167.4846 167.1439 165.5525	(38)m	Jan 87.5501	Feb	Mar	Apr	May								(38)
P (average) P (ave		170.0961		169.3107	167.4846	167.1430	165.5525	165.5525	165.2579	166.1651	167.1430	167.8341		(39)
Water heating energy requirements (kbh/year)	HLP HLP (average)												1.0386	(40)
State heating energy requirements (kWh/year)	Days in mont	31	28	31	30	31	30	31	31	30	31	30		
Stribution Doss (46)m = 0.15 x (45)m 35.7304 31.4399 31.4399 33.0325 28.2004 26.7563 23.4816 22.7339 23.9985 24.6591 28.2462 30.9457 35.2328 (46)m = 1.55 35.7304 31.4399 33.0325 28.2004 26.7563 23.4816 22.7339 23.9985 24.6591 28.2462 30.9457 35.2328 (46)m = 1.55 36.9006 (47)m = 1	lot water usage overage daily had a water daily hot water	31.8240 for other 44.8626 ot water u Jan use 150.4036 238.2025	31.3513 r uses 43.2312 use (litres, Feb 147.1918	41.5998 /day) Mar 143.2805	39.9685 Apr 137.3333	38.3371 May 132.5036	36.7057 Jun 127.3114	36.7057 Jul 125.3162	38.3371 Aug 129.2106	39.9685 Sep 133.3177	41.5998 Oct 138.7687 188.3078	43.2312 Nov 144.8075 206.3049	44.8626 138.2546 Dec 150.0136 234.8850	(42) (43)
380.0000 (A) 1	istribution lo	35.7304			28.2004	26.7563	23.4816	22.7339	23.9985	24.6591				(46)
35.3664 31.9439 35.3664 34.2256 34.242 34.256 34.242 34.256 34.242 34.256 34.242 34.256 34.242 34.256 34.242 34.256 34.242 34.256 34.242 34.256 34.242 34.256 34.242 34.256 34.242 34.256 34.242 34.256 34.242 34.256 34.242 3	tore volume i) If manufact Temperature finter (49) or (urer decla actor from 54) in (59	n Table 2b	actor is kno	own (kWh/d	ay):							2.1127 0.5400	(48) (49)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 22.5120 23.2624 22.5120 23.2624 (59.0000)	_	35.3664 tains dedi	icated sola	r storage										
296.8313 262.5542 278.8457 244.7400 237.0042 213.2818 210.1879 218.6185 221.1317 246.9366 263.0424 293.5138 (62	rimary loss ombi loss	23.2624 0.0000	21.0112 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
plar input 0.0000 0.000	WHRS	296.8313 -33.7004	262.5542 -29.8049	278.8457 -31.2099	244.7400 -25.8431	237.0042 -24.0848	-20.6095	-19.3182	-20.5429	-21.3234	-25.1380	-28.4783	-33.0763	(63
263.1310 232.7493 247.6357 218.8969 212.9194 192.6722 190.8697 198.0756 199.8082 221.7986 234.5642 260.4375 (64 Total per year (kWh/year) = Sum(64)m = 2673.5583 (64 2670tal per year (kWh/year) Lectric shower(s) 0.0000	olar input GHRS	0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64 Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64 eat gains from water heating, kWh/month 126.1054 112.0558 120.1251 107.9008 106.2129 97.4410 97.2964 100.0996 100.0511 109.5154 113.9864 125.0023 (65) Internal gains (see Table 5 and 5a) etabolic gains (Table 5), Watts		263.1310		247.6357	218.8969	212.9194	192.6722	190.8697					2673.5583	(64
126.1054 112.0558 120.1251 107.9008 106.2129 97.4410 97.2964 100.0996 100.0511 109.5154 113.9864 125.0023 (65 . Internal gains (see Table 5 and 5a)	lectric shower		0.0000	0.0000										
. Internal gains (see Table 5 and 5a) tabolic gains (Table 5), Watts					107.9008	106.2129	97.4410	97.2964	100.0996	100.0511	109.5154	113.9864	125.0023	(65)
etabolic gains (Table 5), Watts														
				Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	

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(66)m	147.6056	147.6056				147.6056	147.6056	147.6056	147.6056	147.6056	147.6056	147.6056	(66)
Lighting gain	175.3892	194.1809	175.3892	181.2355	175.3892	181.2355	175.3892	175.3892	181.2355	175.3892	181.2355	175.3892	(67)
Appliances ga	ins (calcul 333.6109	ated in App 337.0727		uation L13 309.7772		lso see Tab 264.3001	ole 5 249.5803	246.1185	254.8422	273.4140	296.8575	318.8911	(68)
Cooking gains	calculate 37.7606	ed in Append 37.7606		ion L15 or 37.7606		see Table 37.7606	5 37.7606	37.7606	37.7606	37.7606	37.7606	37.7606	(69)
Pumps, fans Losses e.g. e	3.0000	3.0000 (negative)	3.0000 values) (Tab	3.0000 ale 5)	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
	-118.0845	-118.0845	-118.0845		-118.0845	-118.0845	-118.0845	-118.0845	-118.0845	-118.0845	-118.0845	-118.0845	(71)
Water heating	169.4965	166.7496	161.4585	149.8623	142.7592	135.3347	130.7748	134.5425	138.9598	147.1981	158.3145	168.0139	(72)
Total interna	748.7783	768.2849	735.4784	711.1567	674.7638	648.1520	623.0260	623.3319	642.3192	666.2829	706.6891	732.5758	(73)
6. Solar gain													
[Jan]			ı	Area m2	Solar flux Table 6a W/m2	speci	g ific data Table 6b	Specific or Tab		Acce fact Table	or	Gains W	
North			10.9		10.6334		0.6300		.7000	0.77		35.4868	
South Southwest				5200 5500 	46.7521 36.7938		0.6300 0.6300		.7000 .7000	0.77 0.77		164.5982 41.0431	
Solar gains Total gains	241.1280 989.9063	407.2980 1175.5829		691.7217 1402.8784	786.5255 1461.2893	787.9311 1436.0831	756.5555 1379.5815	683.4669 1306.7988	600.8330 1243.1522	448.7503 1115.0333	288.0426 994.7318	206.9358 939.5116	
7. Mean inter													
Temperature d Utilisation f						Th1 (C)						21.0000	(85)
tau	Jan 81.2530	Feb 81.4430	Mar	Apr 82.5200	May	Jun 83.4831	Jul 83.4831	Aug 83.6319	Sep 83.1753	Oct 82.6887	Nov 82.3482	Dec 81.9951	
alpha util living a	6.4169	6.4295	6.4420	6.5013		6.5655	6.5655	6.5755	6.5450	6.5126	6.4899	6.4663	
ucii iiving a	0.9992	0.9975	0.9924	0.9699	0.8921	0.7086	0.5242	0.5747	0.8299	0.9794	0.9977	0.9995	(86)
MIT Th 2	19.9461 20.0435	20.1119 20.0455	20.3306 20.0475	20.6200 20.0568		20.9760 20.0667	20.9970 20.0667	20.9948 20.0682	20.9344 20.0635	20.6311 20.0585	20.2353 20.0550	19.9210 20.0513	
util rest of	house 0.9989	0.9964	0.9891	0.9562	0.8466	0.6186	0.4152	0.4623	0.7524	0.9673	0.9966	0.9992	(89)
MIT 2 Living area f	18.8097 raction	19.0234	19.3033	19.6708	19.9414	20.0544	20.0659	20.0666	20.0227 fLA =	19.6905 Living are	19.1890 a / (4) =	18.7835 0.1348	
MIT Temperature a	18.9629	19.1701	19.4418	19.7988	20.0648	20.1787	20.1914	20.1918	20.1456	19.8173	19.3301	18.9369 0.0000	
adjusted MIT	18.9629	19.1701	19.4418	19.7988	20.0648	20.1787	20.1914	20.1918	20.1456	19.8173	19.3301	18.9369	(93)
8. Space heat	ing require												
Utilisation	Jan 0.9984	Feb 0.9950		Apr 0.9515	May 0.8470	Jun 0.6300	Jul 0.4300	Aug 0.4775	Sep 0.7600	0ct 0.9631	Nov 0.9953	Dec 0.9988	(94)
Useful gains Ext temp.	988.3169 4.3000	1169.7516 4.9000	1271.9530 6.5000	1334.7906 8.9000		904.7300 14.6000	593.2186 16.6000	624.0117 16.4000	944.8037 14.1000	1073.8950 10.6000	990.0543 7.1000	938.4241 4.2000	
Heat loss rat	2494.1068	2421.6330	2191.1884	1825.3767	1398.1201	923.5656	594.5677	626.6188	1004.5751	1540.6124	2052.6263	2484.0006	(97)
Space heating Space heating	1120.3077				119.3651	0.0000	0.0000	0.0000	0.0000	347.2378	765.0519	1149.9089 5380.2687	(98a)
Solar heating Solar heating	0.0000	0.0000 on - total	0.0000 per year ()	0.0000 (Wh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000	(98b)
Space heating		841.2643		353.2219	119.3651	0.0000	0.0000	0.0000	0.0000	347.2378	765.0519	1149.9089	(98c)
Space heating Space heating		nt after so	lar contribu	ution - tota	al per year	(kWh/year)				(98c) / (4) =	5380.2687 33.1501	(99)
Space medeling	•									(300	, , (.,	3374301	(33)
9a. Energy re	equirements	- Individua	al heating s	systems, in		o-CHP							
Fraction of s Fraction of s	space heat f	rom seconda	ary/suppleme									0.0000 1.0000	
Efficiency of Efficiency of	main space main space	heating synthemical heating synthesis	ystem 1 (in ystem 2 (in	%)								92.3000 0.0000	(206) (207)
Efficiency of	_		_		M	3	33	*	6	0-4	N	0.0000	(208)
Space heating			Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating			ting system		119.3651	0.0000	0.0000	0.0000	0.0000	347.2378	765.0519	1149.9089	(98)
Ĭ	92.3000	92.3000		92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)

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			93
Space heating fuel (main heating system)			
1213.7678 911.4457 740.9655 382.6890 129.3230 0.0000 pace heating efficiency (main heating system 2)	0.0000 0.0000	0.0000 376.2056	828.8753 1245.8385 (211)
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)
pace 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)
pace 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)
ater heating			
ater heating requirement 263.1310 232.7493 247.6357 218.8969 212.9194 192.6722	190.8697 198.0756	199.8082 221.7986	234.5642 260.4375 (64)
ficiency of water heater			79.8000 (216)
217)m 86.9351 86.6814 86.2152 85.1267 82.8151 79.8000 uel for water heating, kWh/month	79.8000 79.8000	79.8000 85.0607	86.5105 86.9883 (217)
302.6751 268.5112 287.2299 257.1425 257.1020 241.4439 bace cooling fuel requirement	239.1851 248.2150	250.3863 260.7533	271.1395 299.3936 (219)
221)m 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.000000			0.0000 0.0000 (221) 7.0685 7.3041 (231)
Ighting 36.4424 29.2355 26.3233 19.2856 14.8967 12.1708			34.0016 37.4553 (232)
ectricity generated by PVs (Appendix M) (negative quantity) 33a)m -56.5382 -79.3842 -113.6034 -127.0728 -136.3602 -126.9068	-125.2088 -118.4602	-106.5571 -90.3389	-61.9913 -48.9078 (233a
ectricity 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 0.0000 0.0000 0.0000		0.0000 0.0000	0.0000 0.0000 (234a
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 0.0000 0.0000 0.0000			0.0000 0.0000 (235a
235c)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000			0.0000 0.0000 (235c
ectricity generated by PVs (Appendix M) (negative quantity) :33b)m -32.9242 -69.1527 -137.2971 -206.0462 -272.3588 -273.7462	2 -270.6513 -229.3076	-168.1842 -98.9902	-43.9778 -26.0546 (233b
ectricity generated by wind turbines (Appendix M) (negative quantity)	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000 (234b
ectricity generated by hydro-electric generators (Appendix M) (negative quar	tity)		•
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 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
235d)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000			0.0000 0.0000 (235d
nual totals kWh/year Dace heating fuel - main system 1			5829.1102 (211)
pace heating fuel - main system 2 pace heating fuel - secondary			0.0000 (213) 0.0000 (215)
fficiency of water heater			79.8000
nter heating fuel used Nace cooling fuel			3183.1773 (219) 0.0000 (221)
ectricity for pumps and fans: tal electricity for the above, kWh/year ectricity for lighting (calculated in Appendix L) ergy saving/generation technologies (Appendices M ,N and Q) generation nd generation			86.0000 (231) 294.1111 (232) -3020.0206 (233) 0.0000 (234)
dro-electric generation (Appendix N) ectricity generated - Micro CHP (Appendix N) pendix Q - special features			0.0000 (235a 0.0000 (235)
nergy saved or generated nergy used			-0.0000 (236) 0.0000 (237)
otal delivered energy for all uses			6372.3780 (238)
2a. Carbon dioxide emissions - Individual heating systems including micro-CHF			
	Energy kWh/year		Emissions kg CO2/year
pace heating - main system 1 otal CO2 associated with community systems	5829.1102	0.2100	1224.1131 (261) 0.0000 (373)
ater heating (other fuel)	3183.1773	0.2100	668.4672 (264)
pace and water heating umps, fans and electric keep-hot	86.0000	0.1387	1892.5804 (265) 11.9293 (267)
nergy for lighting	294.1111	0.1443	42.4493 (268)
Energy saving/generation technologies			
V Unit electricity used in dwelling V Unit electricity exported	-1191.3297 -1828.6909		-160.4827 -230.2470
otal			-390.7298 (269)
otal CO2, kg/year PC Target Carbon Dioxide Emission Rate (TER)			1556.2292 (272) 9.5900 (273)
3a. Primary energy - Individual heating systems including micro-CHP			
	Energy	Primary energy factor	Primary energy
pace heating - main system 1	kWh/year 5829.1102		kWh/year 6586.8945 (275)
otal CO2 associated with community systems			0.0000 (473)
ater heating (other fuel) pace and water heating	3183.1773	1.1300	3596.9903 (278) 10183.8848 (279)
umps, fans and electric keep-hot	86.0000		130.1008 (281)
nergy for lighting	294.1111	1.5338	451.1175 (282)
Energy saving/generation technologies PV Unit electricity used in dwelling	-1191.3297	1.4979	-1784.4552

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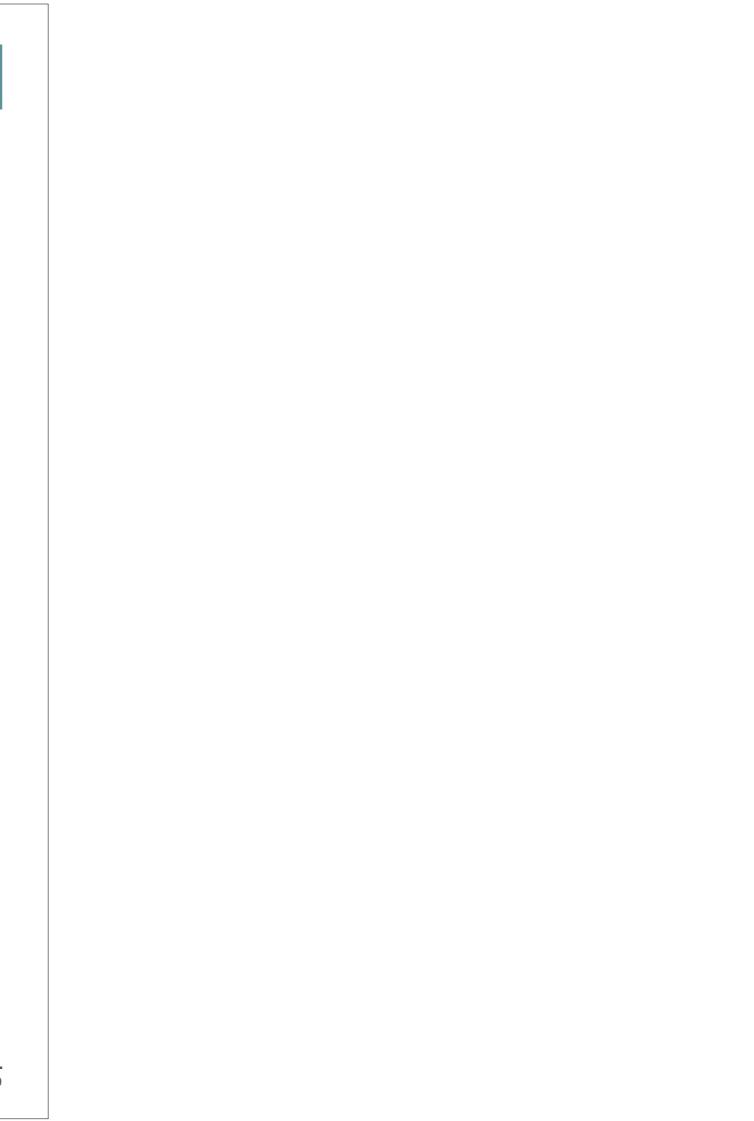
PV Unit electricity exported Total Total Primary energy kWh/year Target Primary Energy Rate (TPER)

-1828.6909

0.4622

-845.1641 -2629.6193 (283) 8135.4838 (286) 50.1300 (287)

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Property Reference		BH1 L	01-6 02 x6_Copy_	Сору					Issued (on Date	12/09	/2023	
Assessment Reference	e	BH1 L	.01 02_Copy_Copy	1			Prop	Type Ref					
Property													
SAP Rating				87	'В	DER		10.18		TER	1	1.27	
Environmental				91	В	% DE	R < TER	<u> </u>			9	0.67	
CO: Emissions (t/year)				0.	89	DFEE		27.71		TFEE	2	27.09	
Compliance Check				Se	e BREL	% DF	EE < TFEE	<u> </u>			-	2.27	
% DPER < TPER				2.	12	DPER	:	53.56		TPER	5	4.72	
Assessor Details		Mr. Dish and S	D4-b							Assessor ID		14.40.0004	
Client		Mr. Richard I	Jenten							Assessor ID		J148-0001	_
AP 10 WORKSHEET ALCULATION OF DO . Overall dwell:	FOR New B	uild (As De ISSIONS FOR	esigned) (Version 10									
								Area	Store	/ height		Volume	
round floor								(m2) 99.7000	(1b) x	(m) 2.7400	(2b) =	(m3) 273.1780	
otal floor area	TFA = (1a))+(1b)+(1c)	+(1d)+(1e).	(1n)	9	9.7000							(4
welling volume								(3	a)+(3b)+(3c)+	(3d)+(3e)	(3n) =	273.1780	(5
. Ventilation ra	ate										n	13 per hour	
umber of open cl umber of open f. umber of chimne, umber of flues a umber of blocke umber of interm. umber of passive umber of fluele	lues ys / flues attached t attached t d chimneys ittent ext	o solid fue o other hea ract fans	el boiler	re							0 * 80 = 0 * 20 = 0 * 10 = 0 * 20 = 0 * 35 = 0 * 20 = 0 * 10 = 0 * 10 = 0 * 40 =	9.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(6) (6) (6) (6) (7) (7)
nfiltration due			and fans =	(6a)+(6b)	+(6c)+(6d)+(6e)+(6f)+(6	ig)+(7a)+(7	7b)+(7c) =		0.0000		es per hour 0.0000	. (8
ressure test ressure Test Me easured/design / nfiltration rate umber of sides :	AP50 ≘										E	Yes Blower Door 3.0000 0.1500 2	(1
helter factor nfiltration rate	e adjusted	to include	shelter fa	ctor					(20) = 1 - (21)		(19)] = x (20) =	0.8500 0.1275	
ind speed ind factor	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	Sep 4.0000 1.0000	Oct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	
dj 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	(2
Balanced mechan: f mechanical ve f exhaust air he	ical venti ntilation	lation with	n heat recov	ery						0.13/1	0.1434	0.5000 0.5000	(2
balanced with	heat reco	very: effic	ciency in %	allowing f	or in-use fa	ctor (from	Table 4h)	=				72.8000	(2
fective ac	0.2986	0.2954	0.2922	0.2762	0.2731	0.2571	0.2571	0.2539	0.2635	0.2731	0.2794	0.2858	(2
			r										
. Heat losses a													
				Gross m2	Openings m2	NetA		U-value W/m2K	A x U		-value kl/m2K	A x K	
				Gross m2	Openings m2	Net#	m2	U-value W/m2K 1.2357	A x U W/K 25.2709		-value kJ/m2K	A x K kJ/K	

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Fabric heat loss Party Wall 1 Party Floor 1	s, W/K = S	um (A x U)					(26)(.4700 .7000	30) + (32) 0.0000	= 31.71 0.00	00 18	0.0000 0.0000	11964.6000 3988.0000	
Party Ceiling 1 Internal Wall 1						99	.7000 .7000 .5300			3	0.0000 5.0000	2991.0000 13239.7500	(32b)
Heat capacity Cr Thermal mass par List of Thermal	rameter (T		ΓFA) in kJ/r	m2K				(28).	(30) + (3	2) + (32a).	(32e) =	40932.8120 410.5598	
E3 Sill E4 Jamb E7 Party E8 Balco E16 Corr E18 Part E17 Corr	r lintels y floor be ony within ner (norma ty wall be ner (inver	tween dwell a dwelling l) tween dwell ted – inter	g, wall ins lings rnal area g	locks of flulation con	tinuous external a	area)		11 7 24 48 6 5	ength .4100 .9000 .9000 .5400 .6000 .4800 .4800	Psi-value	Tot 0.34 0.23 0.74 3.39 0.00 0.49 0.32	123 870 170 978 900 932 288	(22)
Thermal bridges Point Thermal be Total fabric hea	ridges	PS1) Calcul	iated using	Appendix K)				(33) + (36)	(36a) = + (36a) =	5.5461 0.0000 37.2640	
Ventilation head (38)m Heat transfer co	Jan 26.9150	culated mor Feb 26.6277	nthly (38)m Mar 26.3403	= 0.33 x () Apr 24.9036	25)m x (5) May 24.6162	Jun 23.1795	Jul 23.1795	Aug 22.8921	Sep 23.7542	Oct 24.6162	Nov 25.1909	Dec 25.7656	(38)
Average = Sum(39	64.1790	63.8917	63.6043	62.1676	61.8802	60.4435	60.4435	60.1561	61.0182	61.8802	62.4549	63.0296 62.0957	
HLP HLP (average)	Jan 0.6437	Feb 0.6408	Mar 0.6380	Apr 0.6235	May 0.6207	Jun 0.6063	Jul 0.6063	Aug 0.6034	Sep 0.6120	0ct 0.6207	Nov 0.6264	Dec 0.6322 0.6228	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	
4. Water heating													
Assumed occupand Hot water usage	for mixer											2.7367	(42)
Hot water usage	96.3954 for baths	94.9468	92.8359	88.7969	85.8163	82.4924	80.6030	82.6980	84.9945	88.5634	92.6891	96.0261	(42a)
Hot water usage	31.8642 for other	31.3910 uses	30.7246	29.4958	28.5758	27.5556	27.0045	27.6663	28.3868	29.4784	30.7325	31.7565	(42b)
Average daily ho	44.9020	43.2692	41.6364 /day)	40.0036	38.3708	36.7380	36.7380	38.3708	40.0036	41.6364	43.2692	44.9020 159.2365	
Daily hot water	Jan use	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
Energy conte		169.6069 241.5180	165.1968 253.9013	158.2964 216.6998	152.7629 205.6482	146.7859 180.4904	144.3455 174.5734	148.7350 184.1650	153.3848 189.1388	159.6782 216.6818 Total = S	166.6907 237.4815 um(45)m =	172.6846 270.3823 2644.9263	(45)
Distribution los Water storage lo	41.1368	= 0.15 X (2 36.2277	38.0852	32.5050	30.8472	27.0736	26.1860	27.6248	28.3708	32.5023	35.6222	40.5573	(46)
Store volume b) If manufact Hot water stor					av)							110.0000 0.0152	
Volume factor Temperature fa Enter (49) or (from Tabl actor from 54) in (55	e 2a Table 2b		,,	-37							1.0294 0.6000 1.0327	(52) (53)
Total storage lo	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(56)
If cylinder conf Primary loss Combi loss	32.0144 23.2624 0.0000	28.9162 21.0112 0.0000	32.0144 23.2624 0.0000	30.9817 22.5120 0.0000	32.0144 23.2624 0.0000	30.9817 22.5120 0.0000	32.0144 23.2624 0.0000	32.0144 23.2624 0.0000	30.9817 22.5120 0.0000	32.0144 23.2624 0.0000	30.9817 22.5120 0.0000	32.0144 23.2624 0.0000	(59)
WWHRS -	329.5225 -73.1216	291.4455 -64.6693	309.1781 -67.7180	270.1935 -56.0732	260.9250 -52.2582	233.9841 -44.7177	229.8502 -41.9157	239.4418 -44.5732	242.6325 -46.2667	271.9586 -54.5433	290.9751 -61.7909	325.6591 -71.7675	(63a)
PV diverter Solar input 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	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	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)
Output from w/h 2 12Total per year	256.4009	226.7761	241.4601	214.1203	208.6668	189.2664	187.9345	194.8687 Total p	196.3658 er year (kW	217.4153 h/year) = S	229.1842 um(64)m =	253.8916 2616.3507	(64)
Electric shower		0.0000	0.0000	0.0000 Tota	0.0000 al Energy (0.0000 used by inst	0.0000 antaneous e	0.0000 lectric sho	0.0000 wer(s) (kWh	0.0000 (vear) = Su	0.0000 m(64a)m =	0.0000 0.0000	
Heat gains from	water hea 135.4081	ting, kWh/n 120.2467	nonth 128.6436	114.8476	112.5995	102.8080	102.2671	105.4563	105.6836	116.2681	121.7575	134.1236	
5 Intonnal asi	ns (soc T-	hla E and s											
5. Internal gain			, a j										
	Jan 136.8366	Feb 136.8366	Mar 136.8366	Apr 136.8366	May 136.8366	Jun 136.8366	Jul 136.8366	Aug 136.8366	Sep 136.8366	Oct 136.8366	Nov 136.8366	Dec 136.8366	(66)
Lighting gains	(calculate 129.0428	d in Append 142.8689	dix L, equat 129.0428	133.3443	L9a), also 129.0428	see Table 5 133.3443	129.0428	129.0428	133.3443	129.0428	133.3443	129.0428	(67)

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Appliances ga	ins (calcula 255.8419	ated in App 258.4967	endix L, eq 251.8066	uation L13 237.5642	or L13a), a 219.5856	lso see Tab 202.6883	ole 5 191.3999	188.7451	195.4352	209.6776	227.6562	244.5534	(68)
Cooking gains								36.6837	36.6837	36.6837	36.6837	36.6837	
Pumps, fans Losses e.g. e	0.0000 vaporation (0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Water heating	-109.4693 gains (Tabl	-109.4693 le 5)	-109.4693	-109.4693	-109.4693	-109.4693	-109.4693	-109.4693	-109.4693	-109.4693	-109.4693	-109.4693	(71)
Total interna	182.0002 l gains	178.9385	172.9081	159.5106	151.3434	142.7889	137.4558	141.7424	146.7828	156.2744	169.1077	180.2736	(72)
	630.9358	644.3551	617.8085	594.4700	564.0228	542.8725	521.9495	523.5813	539.6132	559.0458	594.1591	617.9208	(73)
6. Solar gain	s												
[Jan]			Α	rea	Solar flux	:	g		FF	Acce	ss	Gains	
				m2	Table 6a W/m2	or	ific data Table 6b	Specific or Tab		fact Table		W	
North East			5.3 15.1	500 000	10.6334 19.6403		0.3300 0.3300		.8000 .8000	0.77 0.77		10.4079 54.2577	
Solar gains Total gains	64.6656 695.6014	126.0296 770.3847	208.5948 826.4033	309.2189 903.6889	385.5583 949.5812	398.1139 940.9864	377.5791 899.5286	319.5391 843.1203	243.9320 783.5452	149.6200 708.6658	80.4925 674.6515	53.2954 671.2163	
rotal gains	03310021	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	02011033	20210003	J.J.J.	7.073001	03373200	0.572205	70313132	70010030	07110323	0,112103	(0.)
7. Mean inter			ng season)										
Temperature du Utilisation f	uring heatir actor for ga	ng periods ains for li	in the livi ving area,	ng area fro ni1,m (see	om Table 9, Table 9a)	Th1 (C)			-			21.0000	(85)
tau alpha	Jan 177.1642 12.8109	Feb 177.9610 12.8641	Mar 178.7650 12.9177	Apr 182.8964 13.1931	May 183.7457 13.2497	Jun 188.1134 13.5409	Jul 188.1134 13.5409	Aug 189.0119 13.6008	Sep 186.3416 13.4228	0ct 183.7457 13.2497	Nov 182.0549 13.1370	Dec 180.3950 13.0263	
util living a	rea 0.9986	0.9938	0.9678	0.8190	0.6057	0.4111	0.2957	0.3282	0.5373	0.8770	0.9916	0.9990	(86)
MIT Th 2 util rest of	20.7135 20.3908 house	20.8001 20.3934	20.9069 20.3960	20.9908 20.4089	20.9998 20.4114	21.0000 20.4244	21.0000 20.4244	21.0000 20.4270	21.0000 20.4192	20.9832 20.4114	20.8484 20.4063	20.7046 20.4011	
MIT 2	0.9979 20.1337	0.9909 20.2213	0.9551 20.3241	0.7839 20.4034	0.5676 20.4113	0.3741 20.4244	0.2570 20.4244	0.2873 20.4270	0.4921 20.4192	0.8389 20.4018	0.9872 20.2806	0.9985 20.1342	(90)
Living area for MIT Temperature ac	20.2585	20.3459	20.4495	20.5299	20.5380	20.5483	20.5483	20.5503	20.5442	Living are 20.5270	20.4028	0.2152 20.2570 0.0000	(92)
adjusted MIT	20.2585	20.3459	20.4495	20.5299	20.5380	20.5483	20.5483	20.5503	20.5442	20.5270	20.4028	20.2570	(93)
8. Space heat:	ing requiren	 nent											
	8												
Utilisation	Jan 0.9977	Feb 0.9906	Mar 0.9564	Apr 0.7913	May 0.5758	Jun 0.3821	Jul 0.2653	Aug 0.2961	Sep 0.5018	Oct 0.8468	Nov 0.9871	Dec 0.9984	(94)
Useful gains Ext temp.	694.0232 4.3000	763. 1 636 4.9000	790.355 1 6.5000	715.0463 8.9000	546.7422 11.7000	359.5340 14.6000	238.6475 16.6000	249.6666 16.4000	393.1943 14.1000	600.1224 10.6000	665.9682 7.1000	670.1388 4.2000	
Heat loss rate Space heating	1024.1993	986.8614	887.2510	723.0007	546.8973	359.5345	238.6475	249.6666	393.2131	614.2830	830.8277	1012.0636	(97)
Space heating Solar heating	245.6510 requirement		72.0905 er year (kW	5.7272 h/year)	0.1154	0.0000	0.0000	0.0000	0.0000	10.5355	118.6988	254.3920 857.5354	
Solar heating Space heating	0.0000 contributio	0.0000 on - total	0.0000 per year (k	0.0000 Wh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000	
Space heating	245.6510 requirement	150.3250 after sol	72.0905 ar contribu	5.7272 tion - tota	0.1154 al per year	0.0000 (kWh/year)	0.0000	0.0000	0.0000	10.5355	118.6988	254.3920 857.5354	
Space heating	per m2									(98c) / (4) =	8.6012	(99)
9b. Energy re													
Fraction of sp	pace heat fr	om seconda	ry/suppleme		em (Table 11							0.0000	
Fraction of specification of he Fraction of he	eat from con	nmunity Com	bined Heat		Space and Wa	ter							(302) (303a) (303b)
Factor for con	ntrol and ch	narging met	hod (Table	4c(3)) for		ng						1.0500	
Distribution :	loss factor	(Table 12c) for commu	nity heatir								1.2500	(306)
Space heating Space heating	:	• •	J	, - «=) /s								2.0000	,/
Space heat fro	245.6510 om Combined	150.3250 Heat and P				0.0000	0.0000	0.0000	0.0000	10.5355	118.6988	254.3920	
307a Space heat fro					0.0845	0.0000	0.0000	0.0000	0.0000	7.7159	86.9321	186.3104	
307b	142.5083	87.2073	41.8215	3.3225	0.0669	0.0000	0.0000	0.0000	0.0000	6.1119	68.8602	147.5792	

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pace heating requirement 322.4169 197.3015 94.6188 7.5170 0.1514 0.0000 0.000 fficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	0.0000	13.8278	155.7922	333.8895 0.0000	
pace heating fuel for secondary/supplementary system 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(30
ter heating nual water heating requirement						
256.4009 226.7761 241.4601 214.1203 208.6668 189.2664 187.934 ter heat from Combined Heat and Power = $(64) \times 0.56 \times 1.05 \times 1.25$	5 194.8687	196.3658	217.4153	229.1842	253.8916	(64
0a 187.7816 166.0852 176.8394 156.8163 152.8223 138.6140 137.638	5 142.7169	143.8134	159.2295	167.8488	185.9439	
ter heat from Boilers = (64) x 0.44 x 1.05 x 1.25 0b 148.7446 131.5585 140.0771 124.2165 121.0528 109.7982 109.025	5 113.0482	113.9167	126.1281	132.9555	147.2889	
ter heating fuel 336.5261 297.6437 316.9164 281.0329 273.8752 248.4121 246.664		257.7302	285.3576	300.8043	333.2327	(31
oling System Energy Efficiency Ratio					0.0000	(31
ace coolin 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.000 mps and Fa 16.6296 15.0203 16.6296 16.0932 16.6296 16.0932 16.629		0.0000 16.0932	0.0000 16.6296	0.0000 16.0932	0.0000 16.6296	
thing 23.7070 19.0187 17.1242 12.5459 9.6908 7.9175 8.840		14.9256	19.5832	22.1192	24.3659	
ectricity generated by PVs (Appendix M) (negative quantity) 83a)m	0.0000	0.0000	0.0000	0.0000	0.0000	(33
ectricity generated by wind turbines (Appendix M) (negative quantity) 34a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(33
ectricity generated by hydro-electric generators (Appendix M) (negative quantity)						·
85a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(33
33b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 ectricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	(33
34b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(33
ectricity generated by hydro-electric generators (Appendix M) (negative quantity) 35b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.000	0.0000	0.0000	0.0000	0.0000	0.0000	(33
nual totals kWh/year ace heating fuel - community heating					1125.5152	(30
ace heating fuel - secondary					0.0000	(36
ter heating fuel - community heating Ficiency of water heater					3433.9603 0.0000	
ectricity used for heat distribution ace cooling fuel					11.2552 0.0000	
•					0.0000	()2
ectricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5875)						
mechanical ventilation fans (SFP = 0.5875)					195.8003	
tal electricity for the above, kWh/year ectricity for lighting (calculated in Appendix L)					195.8003 191.3292	
ergy saving/generation technologies (Appendices M ,N and Q)						
generation					0.0000	•
nd generation dro-electric generation (Appendix N)					0.0000 0.0000	
ectricity generated - Micro CHP (Appendix N) pendix Q - special features					0.0000	(33
ergy saved or generated					-0.0000	
ergy used tal delivered energy for all uses					0.0000 4946.6050	
o. Carbon dioxide emissions - Community heating scheme						
	Energy		ion factor		Emissions	
ectrical efficiency of CHP unit	kWh/year		kg CO2/kWh	K	g CO2/year 32.0000	(36
at efficiency of CHP unit ace heating from Combined Heat and Power	1258.5921		0.2100		49.9000 264.3043	
ess credit emissions for electricity	-402.7495		0.3480		-140.1568	
er heating from Combined Heat and Power ess credit emissions for electricity	3839.9796 -1228.7935		0.2100 0.3480		806.3957 -427.6201	
ficiency of heat source Boilers					93.9000	(36
ace and Water heating from Boilers ectrical energy for heat distribution (space & water)	2146.2068 11.2552		0.2100 0.0000		111.2570 6.6265	
erall CO2 factor for heat network					0.2106	(38
tal CO2 associated with community systems ace and water heating					960.2531 960.2531	•
mps, fans and electric keep-hot ergy for lighting	195.8003 191.3292		0.1387 0.1443		27.1599 27.6147	
tal CO2, kg/year	131.3232		0.1443		1015.0277	(38
Dwelling Carbon Dioxide Emission Rate (DER)					10.1800	(38
o. Primary energy - Community heating scheme						
		Primary ene	rgy factor	Prim	ary energy	
	kWh/year		kg CO2/kWh		kWh/year 32.0000	(10
ectrical efficiency of CHP unit					49.9000	(46
at efficiency of CHP unit			1.1300		1422.2091	
at efficiency of CHP unit ace heating from Combined Heat and Power	1258.5921		2 1/100		-865 5000	
at efficiency of CHP unit ace heating from Combined Heat and Power ess credit emissions for electricity ter heating from Combined Heat and Power	1258.5921 -402.7495 3839.9796		2.1490 1.1300		-865.5086 4339.1770	
ectrical efficiency of CHP unit at efficiency of CHP unit ace heating from Combined Heat and Power ess credit emissions for electricity ter heating from Combined Heat and Power ess credit emissions for electricity ficiency of heat source Boilers	-402.7495				4339.1770 -2640.6772	(46 (46
at efficiency of CHP unit ace heating from Combined Heat and Power ess credit emissions for electricity ter heating from Combined Heat and Power	-402.7495 3839.9796		1.1300		4339.1770	(46 (46 (46

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Overall CO2 fact Total CO2 associ Space and water Pumps, fans and Energy for light Total Primary en Dwelling Primary	ated with heating electric l ing hergy kWh/y	community s keep-hot year	systems					195.8003 191.3292			1.5128 1.5338		1.0419 4750.5173 4750.5173 296.2067 293.4672 5340.1912 53.5600	(473) (476) (478) (479) (483)
SAP 10 WORKSHEET CALCULATION OF T	FOR New I	Build (As De SSIONS	esigned)	(Version 10		2022)								
1. Overall dwell	ing charac	cteristics												
Ground floor								Area (m2) 99.7000		Storey x	height (m) 2.7400	(2b) =	Volume (m3) 273.1780	
Total floor area Dwelling volume	1 TFA = (1a	a)+(1b)+(1c))+(1d)+(1e)	(1n)	99	9.7000				(3c)+()(3n) =	273.1780	(4) (5)
2. Ventilation r	ate													
												m3	per hour	
Number of open of Number of open f Number of chimne Number of flues Number of flues Number of interm Number of passiv Number of fluele	Flues Pys / flues attached from the chimneys attached chimneys attached chimneys attached chimneys attached chimneys attached chimneys attached chimneys	to solid fue to other hea s tract fans	el boiler	ire								0 * 80 = 0 * 20 = 0 * 10 = 0 * 20 = 0 * 35 = 0 * 20 = 3 * 10 = 0 * 10 = 0 * 40 =	9.0000 9.0000 9.0000 9.0000 9.0000 30.0000 9.0000 9.0000	(6b) (6c) (6d) (6e) (6f) (7a) (7b)
Infiltration due Pressure test		eys, flues a	and fans	= (6a)+(6b)	+(6c)+(6d)+(6e)+(6f)	+(6g)+(7a)+(7b)+(7c) =			30.0006	Air changes 0 / (5) =	0.1098 Yes	(8)
Pressure Test Me Measured/design Infiltration rat Number of sides	AP50 :e											BÌ	ower Door 5.0000 0.3598 2	(17)
Shelter factor Infiltration rat	e adjusted	d to includ∈	shelter f	actor					(20) =			x (19)] = x (20) =	0.8500 0.3058	
Wind speed Wind factor	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500		Aug 3.7000 0.9250			Oct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	
Adj infilt rate Effective ac	0.3900 0.5760	0.3823 0.5731	0.3747 0.5702	0.3364 0.5566	0.3288 0.5540	0.2906 0.5422		0.2829 0.5400			0.3288 0.5540	0.3441 0.5592	0.3594 0.5646	
3. Heat losses a														
		oss paramete		Gross	Openings		etArea	U-value		AxU	k	(-value	Α×Κ	
TER Opening Type External Wall 1				m2 66.4998	20.4500	20	m2 0.4500 6.0498	W/m2K 1.1450 0.1800	23	W/K .4160 .2890		kJ/m2K	kJ/K	(27) (29a)
Total net area of Fabric heat loss Party Wall 1			nulli(A, MZ)				6.4998 (26)(6.4700	30) + (32) 0.0000		.7050 .0000				(31) (33) (32)
Thermal mass par		MP = Cm / TF	A) in kJ/m	2K									420.5598	
E3 Sill E4 Jamb E7 Party E8 Balco E16 Corn	ent lintels floor be ony within ner (norma	(including c tween dwelli a dwelling, 1) tween dwelli	ings (in bl , wall insu	ocks of fla				1 2 4	Length 1.4100 7.9000 4.9000 8.5400 6.6000 5.4800 5.4800		-value 0.0500 0.0500 0.0500 0.0700 0.0000 0.0900 0.0600	Tota 0.576 0.395 1.245 3.397 0.006 0.495 0.328	95 60 78 90 82	
	er (inver (Sum(L x I	ted – interr	nal area gr		external are	a)			2.7400		0.0900	-0.246 (36a) =		

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Full SAP Calculation Printout



										>	. \	
	Compare Comp											
	Jan	Feb	Mar	Apr `	May				•			
(38)m Heat transfer coe	Section Sect											
	Note Insert Proceeding Proceding Proceeding Proceding Proceding Proceding Proceeding Proceeding Proceding Proceeding Proceding Proceding Procedi											
I LP												
ILP (average)												0.8833
ays in mone	31	20	31	30	31	30	31	31	30	31	30	31
. Water heating	energy r	equirement:	s (kWh/year)								
ssumed occupancy												2.7367
7	an heat base. Calculared sombly (18) = 0.11 x (2) ps (4) 3.0.											
	heat loss calculated monthly (38) = 0.33 x (25) m x (5) 23m											
4	On heat loss calculated monthly (18) = 0.11 x (23)											
	Tries head loss calculated monthly (18) = -0.33 x (25) m x (5)											
•												
nergy content (a	nnual)			178.7904	169.6352	148.8738	144.1327	152.1501	156.3386			
	Preneries coeff 88.8172 89.5511 89.2902 88.8648 87.8356 86.7683 86.7683 86.5767 87.1794 87.8356 88.2994 88.7682 (39) 88.637 20											
tore volume	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Dec Transfer Coeff Sep											
Hot water stora Volume factor f	ge loss rom Tabl	factor from e 2a			lay)							0.0000
nter (49) or (54	Section Part Loss Calculated monthly (18) m = 0.33 x (23) m x (5) Sun Sul Aug Sun Oct Nov Dec Transfer Coeff Sul S											
	Company Comp											
rimary loss Combi loss		Second Company Californ Cal										
		Feb Nar Apr Apr Nay Jun 3ul Aug Sep Oct Nov Dec Side 19 15 15 16 16 16 16 16 16 16 16 16 16 16 16 16										
		Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 51.616.2 51.4615 51.621 49.2967 94.88.796 48.8796 48.8796 48.8796 48.8796 48.9796 49.2967 9.36195 58.955 (38) 2 .99.5511 89.2992 88.0648 87.8356 86.7683 86.7683 86.5767 87.1794 87.8356 88.2994 88.7642 (39) 28.6577 87.1794 87.8356 88.2994 88.7642 (39) 28.6577 89.2992 88.0648 87.8356 88.2994 88.7642 (39) 28.6577 89.2992 88.0648 87.8356 88.2994 88.7642 (39) 28.6577 89.2992 88.0648 87.8356 88.2994 88.7642 (39) 28.6577 89.2992 88.0649 88.7642 (39) 28.6587 89.299 88.06577 89.2992 88.0649 88.7642 (39) 28.0648 89.2992 89.8956 89.8833 8.8818 89.8793 89.8792 89.8857 89.2992 89.8956 89.8833 89.8818 89.8793 89.8792 89.8857										
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
GHRS Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
			224.3853	197.4133	191.3702	172.4739	170.4010					2411.6677
lectric shower(s		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
leat gains from w	Same Feb Mar											
				94.0078	92.1157	84.0605	83.6361	86.3019	86.5426	95.2562	99.7951	109.9843
		ble 5 and !	5a)									
Netabolic gains (Table 5)											
(66)m 13												
ighting gains (d	alculate	d in Appen	dix L, equa	tion L9 or	L9a), also			129 6372				
Appliances gains	Trick heat last calculated anothal (18) in 18 (28) in 1											
ooking gains (ca	Company Comp											
umps, fans	Section Part Dec Color											
	2-71 2-72											
Water heating gai	Election hosts are calculated methy (2019 m. 20.5 (2019 m. 6) 5 methods are selected methy (2019 m. 20.5 (2019 m.											
otal internal ga												
5. Solar gains												
			_									

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					W/m2	or 	Table 6b	or Tab		Table			
North East 			5.3 15.1	500 000 	10.6334 19.6403		0.6300 0.6300		.7000 .7000	0.77 0.77		17.3859 90.6350	
Solar gains Total gains	108.0209 706.7893	210.5267 823.2275	348.4481 935.5373	516.5362 1082.6761	644.0577 1181.1429	665.0312 1182.4797	630.7288 1128.2310	533.7755 1032.2059	407.4774 921.1200	249.9334 781.3318	134.4590 698.7288	89.0276 675.0976	
 7. Mean inter	nal tempera	 ture (heati	ng season)										
Temperature d Utilisation f				ng area fro								21.0000	(85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
tau alpha	129.6763 9.6451	130.0617 9.6708	130.4418 9.6961	132.2568 9.8171	132.6020 9.8401	134.2330 9.9489	134.2330 9.9489	134.5395 9.9693	133.6000 9.9067	132.6020 9.8401	131.9055 9.7937	131.1851 9.7457	
util living a	o.9996	0.9981	0.9877	0.9002	0.6858	0.4695	0.3384	0.3858	0.6497	0.9619	0.9983	0.9998	(86)
MIT	20.4290	20.5536	20.7331	20.9344	20.9951	20.9999	21.0000	21.0000	20.9978	20.8832	20.6180	20.4115	(87)
Th 2 util rest of	20.1668	20.1690	20.1713	20.1817	20.1837	20.1928	20.1928	20.1945	20.1893	20.1837	20.1797	20.1756	
4IT 2	0.9994 19.5030	0.9970	0.9812 19.8915	0.8640	0.6284	0.4104 20.1928	0.2763	0.3182 20.1945	0.5753 20.1884	0.9378 20.0827	0.9971 19.7558	0.9996 19.4880	
Living area f	raction	19.6641		20.1279	20.1809		20.1928		fLA =	Living are	a / (4) =	0.2152	(91)
MIT Temperature a	19.7023 adjustment	19.8556	20.0726	20.3015	20.3562	20.3665	20.3666	20.3679	20.3626	20.2550	19.9413	19.6868 0.0000	(92)
adjusted MIT	19.7023	19.8556	20.0726	20.3015	20.3562	20.3665	20.3666	20.3679	20.3626	20.2550	19.9413	19.6868	(93)
8. Space heat													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
Utilisation	0.9992	0.9965	0.9802	0.8698	0.6407	0.4231	0.2897	0.3328 343.4990	0.5914	0.9403	0.9966	0.9995	
Jseful gains Ext temp.	706.2573 4.3000	820.3447 4.9000	917.0310 6.5000	941.6809 8.9000	756.7385 11.7000	500.2948 14.6000	326.8173 16.6000	16.4000	544.7177 14.1000	734.7038 10.6000	696.3765 7.1000	674.7622 4.2000	
Heat loss rat		1339.2865	1211.9024	1004.0709	760.3194	500.3503	326.8183	343.5029	545.9715	848.0521	1133.8825	1374.9854	(97)
Space heating	g kWh 503.7895	348.7289	219.3843	44.9208	2.6642	0.0000	0.0000	0.0000	0.0000	84.3311	315.0043	520.9661	(98a
Space heating Solar heating	kWh	t - total p	er year (kw	h/year)								2039.7892	
Solar heating		0.0000 on - total	0.0000 per year (k	0.0000 Wh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000	(98b)
Space heating	503.7895		219.3843	44.9208	2.6642	0.0000	0.0000	0.0000	0.0000	84.3311	315.0043	520.9661 2039.7892	(98c
Space heating Space heating		c arter sor	ar contribu	CION - COCA	I per year	(KWII/ year·)				(98c) / (4) =	20.4593	(99)
9b. Energy re	equirements												
Fraction of s	pace heat f	rom seconda	ry/suppleme	ntary syste	m (Table 11)						0.0000	(301
Fraction of s Fraction of h				and Power-S	pace and Wa	ter						1.0000 0.5580	
Fraction of h	neat from co	mmunity Boi	lers-Space	and Water								0.4420	(3031
Factor for ch	narging meth	od (Table 4	c(3)) for w	atèr ĥeatin	g	iig						1.0000 1.0000	(305
Distribution Efficiency of					g system							1.2500 0.0000	
Space heating Space heating	g:		, ,	, ,									`
Space neacing	503.7895	348.7289	210 38/13						0.0000	84.3311	315.0043	520.9661	
				44.9208	2.6642	0.0000	0.0000	0.0000	0.0000				(98)
	rom Combined 351.3932					0.0000	0.0000	0.0000	0.0000	58.8210	219.7155	363.3739	(98)
307a Space heat fr	351.3932 rom Boilers	243.2384 = (98) x 0.	ower = (98) 153.0206 44 x 1.00 x	x 0.56 x 1 31.3322 1.25	.00 x 1.25 1.8583	0.0000	0.0000	0.0000	0.0000	58.8210			(98)
307a Space heat fr 307b	351.3932 rom Boilers 278.3437 g requiremen	243.2384 = (98) x 0. 192.6727 t	ower = (98) 153.0206 44 x 1.00 x 121.2098	x 0.56 x 1 31.3322 1.25 24.8187	.00 x 1.25 1.8583 1.4720	0.0000 0.0000	0.0000	0.0000 0.0000	0.0000 0.0000	58.8210 46.5930	174.0399	287.8338	
307a Space heat fr 307b Space heating Efficiency of	351.3932 rom Boilers 278.3437 g requiremen 629.7368 secondary/	243.2384 = (98) x 0. 192.6727 t 435.9111 supplementa	ower = (98) 153.0206 44 x 1.00 x 121.2098 274.2304 ary heating	x 0.56 x 1 31.3322 1.25 24.8187 56.1510 system in %	.00 x 1.25 1.8583 1.4720 3.3302	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	0.0000	0.0000	58.8210			(307)
307a Space heat fr 307b Space heating Efficiency of	351.3932 rom Boilers 278.3437 g requiremen 629.7368 secondary/	243.2384 = (98) x 0. 192.6727 t 435.9111 supplementa	ower = (98) 153.0206 44 x 1.00 x 121.2098 274.2304 ary heating	x 0.56 x 1 31.3322 1.25 24.8187 56.1510 system in %	.00 x 1.25 1.8583 1.4720 3.3302	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	58.8210 46.5930	174.0399	287.8338 651.2076	(307 (308
307a Space heat fr 307b Space heating Efficiency of Space heating Water heating	351.3932 rom Boilers 278.3437 g requiremen 629.7368 s secondary/ g fuel for s 0.0000	243.2384 = (98) x 0. 192.6727 t 435.9111 supplementa econdary/su 0.0000	ower = (98) 153.0206 44 x 1.00 x 121.2098 274.2304 ry heating	x 0.56 x 1 31.3322 1.25 24.8187 56.1510 system in %	.00 x 1.25 1.8583 1.4720 3.3302 (from Tabl	0.0000 0.0000 0.0000 e 4a or App	0.0000 0.0000 0.0000 endix E)	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	58.8210 46.5930 105.4139	174.0399 393.7554	287.8338 651.2076 0.0000	(307 (308
307a Space heat fr 307b Space heating Efficiency of Space heating Water heating	351.3932 rom Boilers 278.3437 g requiremen 629.7368 secondary/ g fuel for s 0.0000 g heating req 239.1209	243.2384 = (98) x 0. 192.6727 t 435.9111 supplementa econdary/su 0.0000 uirement 211.3040	ower = (98) 153.0206 44 x 1.00 x 121.2098 274.2304 rey heating pplementary 0.0000	x 0.56 x 1 31.3322 1.25 24.8187 56.1510 system in % system 0.0000	.00 x 1.25 1.8583 1.4720 3.3302 (from Tabl 0.0000	0.0000 0.0000 0.0000 e 4a or App	0.0000 0.0000 0.0000 endix E)	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	58.8210 46.5930 105.4139	174.0399 393.7554	287.8338 651.2076 0.0000	(307 (308 (309
307a Space heat fr 307b Space heating Efficiency of Space heating Water heating Annual water Water heat fr 310a	351.3932 rom Boilers 278.3437 grequiremen 629.7368 5 secondary/ gfuel for s 0.0000 g heating req 239.1209 com Combined 166.7868	243.2384 = (98) x 0. 192.6727 t 435.9111 supplementa econdary/su 0.0000 uirement 211.3040 Heat and P 147.3845	ower = (98) 153.0206 44 x 1.00 x 121.2098 274.2304 ry heating pplementary 0.0000 224.3853 ower = (64) 156.5088	x 0.56 x 1 31.3322 1.25 24.8187 56.1510 system in % system 0.0000 197.4133 x 0.56 x 1 137.6958	.00 x 1.25 1.8583 1.4720 3.3302 (from Tabl 0.0000	0.0000 0.0000 0.0000 e 4a or App 0.0000	0.0000 0.0000 0.0000 endix E) 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	58.8210 46.5930 105.4139 0.0000	174.0399 393.7554 0.0000	287.8338 651.2076 0.0000 0.0000	(307 (308 (309
307a Space heat fr 307b Space heating Efficiency of Space heating Water heating Annual water Water heat fr 310a Water heat fr	351.3932 rom Boilers 278.3437 grequiremen 629.7368 5 secondary/ gfuel for s 0.0000 g heating req 239.1209 com Combined 166.7868	243.2384 = (98) x 0. 192.6727 t 435.9111 supplementa econdary/su 0.0000 uirement 211.3040 Heat and P 147.3845	ower = (98) 153.0206 44 x 1.00 x 121.2098 274.2304 ry heating pplementary 0.0000 224.3853 ower = (64) 156.5088	x 0.56 x 1 31.3322 1.25 24.8187 56.1510 system in % system 0.0000 197.4133 x 0.56 x 1 137.6958	.00 x 1.25 1.8583 1.4720 3.3302 (from Tabl 0.0000	0.0000 0.0000 0.0000 4a or App 0.0000	0.0000 0.0000 0.0000 endix E) 0.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	58.8210 46.5930 105.4139 0.0000	174.0399 393.7554 0.0000 212.3125	287.8338 651.2076 0.0000 0.0000	(307 (308 (309
307a Space heat fr 307b Space heating Efficiency of Space heating Water heating Annual water water heat fr 310a water heat fr 310a	351.3932 rom Boilers 278.3437 grequiremen 629.7368 5 secondary/ gfuel for s 0.0000 gheating req 239.1209 rom Combined 166.7868 rom Boilers 132.1143 gfuel	243.2384 = (98) x 0. 192.6727 t 435.9111 supplementa econdary/su 0.0000 uirement 211.3040 Heat and P 147.3845 = (64) x 0. 116.7454	Ower = (98) 153.0206 44 x 1.00 x 121.2098 274.2304 ry heating pplementary 0.0000 224.3853 Ower = (64) 156.5088 44 x 1.00 x 123.9729	x 0.56 x 1 31.3322 1.25 24.8187 56.1510 system in % system 0.0000 197.4133 x 0.56 x 1 137.6958 1.25 109.0709	.00 x 1.25 1.8583 1.4720 3.3302 (from Tabl 0.0000 191.3702 .00 x 1.25 133.4807	0.0000 0.0000 0.0000 e 4a or App 0.0000 172.4739 120.3005 95.2918	0.0000 0.0000 0.0000 endix E) 0.0000 170.4010 118.8547 94.1465	0.0000 0.0000 0.0000 0.0000 177.2535 123.6343 97.9326	0.0000 0.0000 0.0000 0.0000 179.2598 125.0337 99.0410	58.8210 46.5930 105.4139 0.0000 199.8139 139.3702 110.3972	174.0399 393.7554 0.0000 212.3125 148.0880 117.3027	287.8338 651.2076 0.0000 0.0000 236.5594 165.0002 130.6991	(307 (308) (309) (64)
307a Space heat fr 307b Space heating Efficiency of Space heating Water heating Annual water Water heat fr 310a Water heat fr 310b Water heating	351.3932 rom Boilers 278.3437 g requiremen 629.7368 s secondary/ g fuel for s 0.0000 g heating req 239.1209 rom Combined 166.7868 rom Boilers 132.1143 g fuel 298.9011 em Energy Ef	243.2384 = (98) x 0. 192.6727 t 435.9111 supplementa econdary/su 0.0000 uirement 211.3040 Heat and P 147.3845 = (64) x 0. 116.7454 264.1300 ficiency Ra	lower = (98) 153.0206 44 x 1.00 x 121.2098 274.2304 274.2304 274.2309 274.2309 274.2309 0.0000 224.3853 20wer = (64) 156.5088 44 x 1.00 x 123.9729 280.4817 tio	x 0.56 x 1 31.3322 1.25 24.8187 56.1510 system in % 5 system 0.0000 197.4133 x 0.56 x 1 137.6958 1.25 109.0709 246.7667	.00 x 1.25 1.8583 1.4720 3.3302 (from Tabl 0.0000 191.3702 .00 x 1.25 133.4807 105.7320 239.2128	0.0000 0.0000 0.0000 e 4a or App 0.0000 172.4739 120.3005 95.2918 215.5923	0.0000 0.0000 0.0000 endix E) 0.0000 170.4010 118.8547 94.1465 213.0012	0.0000 0.0000 0.0000 0.0000 177.2535 123.6343 97.9326 221.5669	0.0000 0.0000 0.0000 0.0000 179.2598 125.0337 99.0410 224.0747	58.8210 46.5930 105.4139 0.0000 199.8139 139.3702 110.3972 249.7674	174.0399 393.7554 0.0000 212.3125 148.0880 117.3027 265.3906	287.8338 651.2076 0.0000 0.0000 236.5594 165.0002 130.6991 295.6992 0.0000	(307) (308) (309) (64)
Space heat fr 307a Space heat fr 307b Space heating Efficiency of Space heating Water heating Mater heating Water heat fr 310b Water heat fr 310b Water heating Cooling Syste Space coolin Pumps and Fa Lighting	351.3932 rom Boilers 278.3437 requiremen 629.7368 secondary/ g fuel for s 0.0000 g heating req 239.1209 rom Combined 166.7868 rom Boilers 132.1143 g fuel 298.9011	243.2384 = (98) x 0. 192.6727 t 435.9111 supplementa econdary/su 0.0000 uirement 211.3040 Heat and P 147.3845 = (64) x 0. 116.7454 264.1300	ower = (98) 153.0206 44 x 1.00 x 121.2098 274.2304 ry heating pplementary 0.0000 224.3853 ower = (64) 156.5088 44 x 1.00 x 123.9729 280.4817	x 0.56 x 1 31.3322 1.25 24.8187 56.1510 system in % system 0.0000 197.4133 x 0.56 x 1 137.6958 1.25 109.0709	.00 x 1.25 1.8583 1.4720 3.3302 (from Tabl 0.0000 191.3702 .00 x 1.25 133.4807	0.0000 0.0000 0.0000 e 4a or App 0.0000 172.4739 120.3005 95.2918	0.0000 0.0000 0.0000 endix E) 0.0000 170.4010 118.8547 94.1465	0.0000 0.0000 0.0000 0.0000 177.2535 123.6343 97.9326	0.0000 0.0000 0.0000 0.0000 179.2598 125.0337 99.0410	58.8210 46.5930 105.4139 0.0000 199.8139 139.3702 110.3972	174.0399 393.7554 0.0000 212.3125 148.0880 117.3027	287.8338 651.2076 0.0000 0.0000 236.5594 165.0002 130.6991 295.6992	(307) (308) (309) (64) (310) (314) (315) (331)

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(333a)m -14.4370 -22.0056 -34.1563 -41.5519 -47.6106 -45.4456 -44.86	-40.9265	-34.5465	-26.4648	-16.4377	-12.2948	(333a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (334a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (335a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335a)
Electricity generated by PVs (Appendix M) (negative quantity)						
(333b)m -3.8106 -8.2913 -17.0196 -26.3940 -35.7554 -36.2752 -35.88 Electricity generated by wind turbines (Appendix M) (negative quantity)	311 -30.0073	-21.4921	-12.1525	-5.1767	-2.9952	(3330)
(334b)m 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.000	0.0000	0.0000	0.0000	0.0000	0.0000	(334b)
(335b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00	0.0000	0.0000	0.0000	0.0000	0.0000	(335b)
Space heating fuel - community heating					2549.7365	. ,
Space heating fuel - secondary Water heating fuel - community heating					0.0000 3014.5846	(310)
Efficiency of water heater Electricity used for heat distribution					0.0000 25.4974	
Space cooling fuel					0.0000	(321)
Electricity for pumps and fans: Total electricity for the above, kWh/year					0.0000	(331)
Electricity for lighting (calculated in Appendix L)					217.3894	
Energy saving/generation technologies (Appendices M ,N and Q) PV generation					-615.9903	(333)
Wind generation					0.0000	(334)
Hydro-electric generation (Appendix N) Electricity generated - Micro CHP (Appendix N)					0.0000 0.0000	• •
Appendix Q - special features Energy saved or generated					-0.0000	(336)
Energy used Total delivered energy for all uses					0.0000 5165.7202	(337)
•						
12b. Carbon dioxide emissions - Community heating scheme						
	Energy kWh/year		ion factor kg CO2/kWh	k	Emissions g CO2/year	
Electrical efficiency of CHP unit Heat efficiency of CHP unit					32.0000 49.9000	
Space heating from Combined Heat and Power	2851.2084		0.2100		598.7538	(363)
less credit emissions for electricity Water heating from Combined Heat and Power	-912.3867 3371.0184		0.3480 0.2100		-317.5106 707.9139	1 1
less credit emissions for electricity	-1078.7259		0.3480		-375.3966	(366)
Efficiency of heat source Boilers Space and Water heating from Boilers	2619.2012		0.2100		93.9000 252.0410	
Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network	25.4974		0.0000		8.2743 0.2106	
Total CO2 associated with community systems					1172.0670	(373)
Space and water heating Pumps, fans and electric keep-hot	0.0000		0.0000		1172.0670 0.0000	1 1
Energy for lighting	217.3894		0.1443		31.3760	(379)
Energy saving/generation technologies	200 7204		0.4220		50 6435	
PV Unit electricity used in dwelling PV Unit electricity exported	-380.7394 -235.2509		0.1330 0.1249		-50.6435 -29.3944	
Total Total CO2, kg/year					-80.0379 1123.4051	
EPC Target Carbon Dioxide Emission Rate (TER)					11.2700	
13b. Primary energy - Community heating scheme						
	Energy	Primary ene		Prim	ary energy	
Electrical efficiency of CHP unit	kWh/year	ı	kg CO2/kWh		kWh/year 32.0000	(461)
Heat efficiency of CHP unit	2051 2004		1 1200		49.9000	
Space heating from Combined Heat and Power less credit emissions for electricity	2851.2084 -912.3867		1.1300 2.1490		3221.8654 -1960.7190	(464)
Water heating from Combined Heat and Power less credit emissions for electricity	33 71.0184 -1078.7259		1.1300 2.1490		3809.2508 -2318.1820	
Efficiency of heat source Boilers					93.9000	(467b
	2619.2012 25.4974		1.1300 0.0000		1356.2209 86.2550	1 1
Space and Water heating from Boilers Electrical energy for heat distribution (space & water)					1.0420 5798.1677	(486)
Space and Water heating from Boilers Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network					5798.1677	(476)
Space and Water heating from Boilers Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems Space and water heating	_					(478)
Space and Water heating from Boilers Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems	0.0000 217.3894		0.0000 1.5338		0.0000 333.4391	
Space and Water heating from Boilers Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems Space and water heating Pumps, fans and electric keep-hot						
Space and Water heating from Boilers Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems Space and water heating Pumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies PV Unit electricity used in dwelling	217.3894 -380.7394		1.5338 1.4915		333.4391 -567.8750	
Space and Water heating from Boilers Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems Space and water heating Pumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies	217.3894		1.5338		333.4391	(479) (480)

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Property Reference		BH1+2	L03-6 03 x8_Co	рру					Issued o	on Date	12/09/	2023	
Assessment Reference		BH1+2	L03-6 03 x8_Co	ру			Prop	Type Ref					
Property													
SAP Rating				88	B	DER		9.20		TER	1	0.63	
Environmental				92	? A	% DE	R < TER				1:	3.45	
CO: Emissions (t/year)				0.	92	DFEE		26.92		TFEE	2	6.50	
Compliance Check					e BREL		E < TFEE					1.55	
% DPER < TPER				5.	12	DPER		48.98		TPER	5	1.62	
Assessor Details		Mr. Richard D	enteh							Assessor ID	U	1148-0001	
Client													
AP 10 WORKSHEET ALCULATION OF DW	FOR New Bu	uild (As De	signed)	(Version 10									
. Overall dwelli													
nound Clas								Area (m2)	_	height (m)	(2h)	Volume (m3)	
round floor otal floor area	TFA = (1a))+(1b)+(1c)	+(1d)+(1e)	(1n)	11	5.1000		115.1000	(1b) x	2.7400	(2b) =	315.3740	(1b) (4)
welling volume								(3	a)+(3b)+(3c)+((3d)+(3e)	(3n) =	315.3740	(5)
. Ventilation ra	te										m	3 per hour	
umber of open ch umber of open fl umber of chimney umber of flues a umber of flues a umber of blocked umber of intermi umber of passive umber of flueles	ues s / flues ttached to ttached to chimneys ttent extr	o solid fue o other hea ract fans	l boiler	ire							0 * 80 = 0 * 20 = 0 * 10 = 0 * 20 = 0 * 35 = 0 * 20 = 0 * 10 = 0 * 10 = 0 * 40 =	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(6b) (6c) (6d) (6e) (6f) (7a) (7b)
nfiltration due ressure test ressure Test Met easured/design A	hod P50	ys, flues a	nd fans =	= (6a)+(6b)·	+(6c)+(6d)+(6e)+(6f)+(6	g)+(7a)+(7	7b)+(7c) =		0.0000) / (5) =	Yes lower Door 3.0000	(8)
nfiltration rate umber of sides s												0.1500 2	(18) (19)
nelter factor nfiltration rate	adjusted	to include	shelter fa	actor					(20) = 1 - (21)		x (19)] = x (20) =	0.8500 0.1275	
ind speed ind factor	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	Sep 4.0000 1.0000	Oct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	
j 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 mechani F mechanical ven F exhaust air he	cal ventil tilation at pump us	lation with sing Append	heat recovix N, (23b)	very) = (23a) x	Fmv (equati	on (N5)), c	therwise ((23b) = (23				0.5000 0.5000	(23a (23b
f balanced with	0.2986	0.2954	0.2922	0.2762	0.2731	0.2571	0.2571	0.2539	0.2635	0.2731	0.2794	72.8000 0.2858	
. Heat losses an			r										
			r	Gross m2	Openings m2	NetA	 rea m2	U-value W/m2K 1.2357	A x U W/K 21.8726		(-value kJ/m2K	А x К kJ/K	

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Total net area Fabric heat los Party Wall 1 Party Floor 1 Party Ceiling : Internal Wall :	ss, W/K = S L		Aum(A, m2)			65 115 115	.4724 (26)(.1000 .1000 .1000 .0000	30) + (32) : 0.0000	= 30.67 0.00	000 18 4 3	0.0000 0.0000	11718.0000 4604.0000 3453.0000 14550.0000	(32d (32b
Heat capacity (Thermal mass pa List of Therma	arameter (1		ΓFA) in kJ/n	m2K				(28).	(30) + (3	2) + (32a).	(32e) =	43154.7560 374.9327	
E3 Sil: E4 Jamb E7 Part E8 Bald E16 Con E18 Par	er lintels by floor be cony withir ener (norma ety wall be ener (inver	n a dwelling al) etween dwell eted – inter	lings (in b g, wall ins lings rnal area g	locks of flulation con	tinuous external a	rea)		11 7 27 48 3 5	ength .0400 .3400 .8800 .5200 .4600 .4800 .9600	Psi-value 0.0300 0.0300 0.0300 0.0300 0.0700 0.0000 0.0900 0.0600 0.0000	Tot 0.33 0.22 0.83 3.39 0.00 0.49 0.65	12 02 64 64 00 32 76) (36)
Point Thermal I Total fabric h	oridges	,	S		,				(33) + (36)	(36a) = + (36a) =	0.0000 36.6138)
Ventilation hea						מעוד	71	Δυσ	Son	Oc+	Nov	Doc	
(38)m	Jan 31.0724	Feb 30.7407	Mar 30.4090	Apr 28.7503	May 28.4185	Jun 26.7599	Jul 26.7599	Aug 26.4281	Sep 27.4233	0ct 28.4185	Nov 29.0820	Dec 29.7455	(38)
Heat transfer (Average = Sum()	67.6862	67.3544	67.0227	65.3640	65.0323	63.3736	63.3736	63.0419	64.0371	65.0323	65.6958	66.3592 65.2811	
HLP	Jan 0.5881	Feb 0.5852	Mar 0.5823	Apr 0.5679	May 0.5650	Jun 0.5506	Jul 0.5506	Aug 0.5477	Sep 0.5564	0ct 0.5650	Nov 0.5708	Dec 0.5765	
HLP (average) Days in mont	31	28	31	30	31	30	31	31	30	31	30	0.5672 31	
4. Water heating a comment of the co	ncy e for mixer				87.9813	84.5735		84.7843	87.1388	90.7977	95.0275	2.8422	
Hot water usage		5					82.6365					98.4487	
Hot water usage	46.0391	44.3649	31.4966 42.6908	30.2370 41.0166	29.2938	28.2479 37.6683	27.6830 37.6683	28.3614 39.3425	29.1000 41.0166	30.2191 42.6908	31.5047 44.3649	32.5544 46.0391 163.2547	. (420
Average daily i	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	(43)
Daily hot water Energy conte Energy content	177.5313 281.1661	173.8868 247.6125	169.3653 260.3082	162.2908 222.1679	156.6176 210.8374	150.4898 185.0448	147.9879 178.9786	152.4883 188.8123	157.2554 193.9117	163.7076 222.1497 Total = S	170.8971 243.4742 um(45)m =	177.0422 277.2053 2711.6688	(45)
Distribution lo	42.1749	= 0.15 x (4 37.1419	45)m 39.0462	33.3252	31.6256	27.7567	26.8468	28.3218	29.0868	33.3225	36.5211	41.5808	(46)
b) If manufaction Hot water sto	orage loss	factor from			ay)							0.0152	(51)
Volume factor Temperature Enter (49) or Total storage	factor from (54) in (55	n Table 2b										1.0294 0.6000 1.0327	(53)
If cylinder co	32.0144	28.9162 icated solar	32.0144 r storage	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(56)
Primary loss Combi loss	32.0144 23.2624 0.0000	28.9162 21.0112 0.0000	32.0144 23.2624 0.0000	30.9817 22.5120 0.0000	32.0144 23.2624 0.0000	30.9817 22.5120 0.0000	32.0144 23.2624 0.0000	32.0144 23.2624 0.0000	30.9817 22.5120 0.0000	32.0144 23.2624 0.0000	30.9817 22.5120 0.0000	32.0144 23.2624 0.0000	(59)
Total heat requ	336.4430 -74.9664	297.5400 -66.3009	315.5850 -69.4264	275.6616 -57.4878	266. 114 2 -53.5766	238.5385 -45.8459	234.2554	244.0891 -45.6977	247.4054 -47.4339	277.4265 -55.9193	296.9679 -63.3498	332.4821 -73.5781	. (63a
PV diverter Solar input 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	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	(630
Output from w/l 12Total per yea	261.4766	231.2391 ar)	246.1586	218.1738	212.5376	192.6926	191.2822	198.3914 Total p	199.9715 er year (kW	221.5072 h/year) = S	233.6181 um(64)m =	258.9040 2665.9526 2666	
Electric shower		0.0000	0.0000	0.0000 Tota	0.0000 al Energy u	0.0000 sed by inst	0.0000 antaneous e	0.0000 lectric sho	0.0000 wer(s) (kWh	0.0000 /year) = Su	0.0000 m(64a)m =	0.0000 0.0000	(64a
Heat gains from		ating, kWh/m 122.2731	nonth 130.7739	116.6658	114.3249	104.3223		107.0015			123.7501	136.3922	
E Intonnal ga													
5. Internal ga													
Metabolic gains													

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												,	
	144.1344		144.1344	148.9388	144.1344	148.9388	144.1344	144.1344	148.9388	144.1344	148.9388	144.1344	(67)
Appliances ga	278.6893	281.5813	274.2937	258.7794	239.1953	220.7890	208.4925	205.6006	212.8882	228.4025	247.9866	266.3928	(68)
Cooking gains	37.2111	37.2111	37.2111	37.2111	37.2111	37.2111	37.2111	37.2111	37.2111	37.2111	37.2111	37.2111	
Pumps, fans Losses e.g. e					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	` '
Water heating	gains (Tab	le 5)			-113.6887			-113.6887	-113.6887	-113.6887	-113.6887	-113.6887	(71)
Total interna	185.0930 l gains	181.9540	175.7714	162.0358	153.6625	144.8921	139.4245	143.8193	148.9869	158.7180	171.8752	183.3229	(72)
	673.5499	688.7459	659.8327	635.3873	602.6254	580.2533	557.6846	559.1875	576.4472	596.8881	634.4338	659.4833	(73)
6. Solar gain													
[Jan]				rea m2	Solar flux Table 6a W/m2	Spec:	g ific data Table 6b	Specific or Tab		Acce fact Table	or	Gains W	
East			17.7		19.6403		0.3300	e	.8000	0.77	'00	63.6001	. (76)
									220 2005	147 6202	70 2010	F2 2016	(02)
Solar gains Total gains	63.6001 737.1500	124.4153 813.1611	204.8942 864.7269	298.8260 934.2133	366.2225 968.8479	374.8939 955.1472	356.9143 914.5989	306.5841 865.7716	238.3005 814.7476	147.6292 744.5173	79.3018 713.7357	52.3016 711.7849	
7. Mean inter	nal tempera	ture (heati	ng season)										
Temperature d Utilisation f	luring heati	ng periods	in the livi	ng area fro	om Table 9,							21.0000	(85)
tau	Jan 177.1031	Feb 177.9754	Mar 178.8563	Apr 183.3949	May 184.3304	Jun 189.1549	Jul 189.1549	Aug 190.1502	Sep 187.1951	Oct 184.3304	Nov 182.4688	Dec 180.6445	į
alpha util living a	12.8069 irea	12.8650	12.9238	13.2263	13.2887	13.6103	13.6103	13.6767	13.4797	13.2887	13.1646	13.0430	I
	0.9985	0.9937	0.9697	0.8308	0.6238	0.4246	0.3049	0.3350	0.5423	0.8773	0.9912	0.9990	(86)
MIT Th 2	20.7159 20.4408	20.8008 20.4434	20.9039 20.4460	20.9893 20.4590	20.9997 20.4616	21.0000 20.4747	21.0000 20.4747	21.0000 20.4773	21.0000 20.4694	20.9833 20.4616	20.8514 20.4564	20.7086 20.4512	
util rest of	0.9979	0.9911	0.9586	0.7989	0.5879	0.3898	0.2685	0.2969	0.5006	0.8427	0.9870	0.9985	
MIT 2 Living area f		20.2696	20.3697	20.4524	20.4614	20.4747	20.4747	20.4773		20.4516 Living are		20.1858 0.3090	(91)
MIT Temperature a	20.3481 djustment	20.4338	20.5348	20.6183	20.6278	20.6370	20.6370	20.6388	20.6334	20.6159	20.4921	20.3474 0.0000	
adjusted MIT	20.3481	20.4338	20.5348	20.6183	20.6278	20.6370	20.6370	20.6388	20.6334	20.6159	20.4921	20.3474	(93)
8. Space heat													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
Utilisation Useful gains	0.9977 735.4891	0.9910 805.8636	0.9606 830.6459	0.8085 755.3479	0.5990 580.3362	0.4006 382.5866		0.3087 267.2234	0.5135 418.3530	0.8531 635.1644	0.9873 704.6892	0.9984 710.6299	
Ext temp. Heat loss rat	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Space heating	1086.2358	1046.2705	940.6484	765.9553	580.5944	382.5875	255.8402	267.2234	418.3786	651.3554	879.8064	1071.5279	(97)
Space heating	260.9555 requiremen	161.5535 t - total p	81.8418 er year (kW	7.6374 h/year)	0.1921	0.0000	0.0000	0.0000	0.0000	12.0461	126.0844	268.5081 918.8189	
Solar heating Solar heating	0.0000	0.0000 on - total	0.0000 per year (k	0.0000 Wh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000	
Space heating		161.5535	81.8418	7.6374	0.1921	0.0000	0.0000	0.0000	0.0000	12.0461	126.0844	268.5081	(98c)
Space heating Space heating		t after sol	ar contribu	tion - tota	al per year	(kWh/year)				(980	:) / (4) =	918.8189 7.9828	
9b. Energy re													
Fraction of s Fraction of s				ntary syste	em (Table 11	.)						0.0000 1.0000	
Fraction of h Fraction of h					Space and Wa	ter						0.5580 0.4420	
Factor for co Factor for ch						ng						1.0500 1.0500	
Distribution Efficiency of	loss factor	(Table 12c) for commu	nity heatir								1.2500	(306)
Space heating Space heating	:		,	<i>y</i> ,									(
Space heat fr	260.9555	161.5535	81.8418 ower = (98)	7.6374 x 0.56 x 1	0.1921 1.05 x 1.25	0.0000	0.0000	0.0000	0.0000	12.0461	126.0844	268.5081	(98)
307a Space heat fr	191.1173	118.3177	59.9389	5.5934	0.1407	0.0000	0.0000	0.0000	0.0000	8.8223	92.3411	196.6486	j
307b	151.3868	93.7212	47.4785	4.4306	0.1114	0.0000	0.0000	0.0000	0.0000	6.9883	73.1447	155.7683	i

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Full SAP Calculation Printout



pace heating requirement 342.5041 212.0389 107.4174 10.0240 0.2521 0.0000 0.0000	0.0000	0.0000	15.8106	165.4858	352.4169	(30
fficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) pace heating fuel for secondary/supplementary system					0.0000	(30
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(30
ater heating						
nnual water heating requirement						
261.4766 231.2391 246.1586 218.1738 212.5376 192.6926 191.2822 eter heat from Combined Heat and Power = (64) x 0.56 x 1.05 x 1.25	198.3914	199.9715	221.5072	233.6181	258.9040	(64
l0a 191.4989 169.3537 180.2804 159.7850 155.6572 141.1232 140.0903	145.2969	146.4541	162.2263	171.0960	189.6148	
ter heat from Boilers = (64) x 0.44 x 1.05 x 1.25 0b 151.6891 134.1476 142.8027 126.5681 123.2984 111.7858 110.9676	115.0918	116.0084	128.5018	135.5277	150.1967	
eter heating fuel	113.0318	110.0004	120.5010	133.3277	150.1507	
343.1880 303.5013 323.0831 286.3531 278.9556 252.9090 251.0578 poling System Energy Efficiency Ratio	260.3888	262.4625	290.7281	306.6237	339.8115 0.0000	
ace coolin 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Imps and Fa 22.8746 20.6609 22.8746 22.1367 22.8746 22.1367 22.8746 ghting 26.4795 21.2429 19.1269 14.0132 10.8242 8.8434 9.8742		22.1367 16.6712	22.8746 21.8735	22.1367 24.7060	22.8746 27.2155	
ectricity generated by PVs (Appendix M) (negative quantity)					27.2133	().
33a)m	0.0000	0.0000	0.0000	0.0000	0.0000	(33
34a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(33
ectricity generated by hydro-electric generators (Appendix M) (negative quantity) 35a)m	0.0000	0.0000	0.0000	0.0000	0.0000	(33
ectricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	().
33b)m	0.0000	0.0000	0.0000	0.0000	0.0000	(33
34b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(33
ectricity generated by hydro-electric generators (Appendix M) (negative quantity) 35b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0 0000	(3:
nual totals kWh/year	0.0000	0.0000	3.0000	0.0000	0.0000	
ace heating fuel - community heating					1205.9498	•
pace heating fuel - secondary ster heating fuel - community heating					3499.0627	•
ficiency of water heater					0.0000	
Lectricity used for heat distribution bace cooling fuel					12.0595 0.0000	
acthicity for nume and fance						
Lectricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)						
mechanical ventilation fans (SFP = 0.7000)					269.3294	
rtal electricity for the above, kWh/year ectricity for lighting (calculated in Appendix L)					269.3294 213.7051	
						`
nergy saving/generation technologies (Appendices M ,N and Q) V generation					0.0000	(33
ind generation					0.0000	
ydro-electric generation (Appendix N) lectricity generated - Micro CHP (Appendix N)					0.0000 0.0000	
ppendix Q - special features						
nergy saved or generated nergy used					-0.0000 0.0000	
otal delivered energy for all uses					5188.0470	
					3100.0470	
					3188.0470	
					3188.0470	
2b. Carbon dioxide emissions - Community heating scheme	Energy		ion factor		Emissions	
b. Carbon dioxide emissions - Community heating scheme			ion factor kg CO2/kWh	k		(36
eb. Carbon dioxide emissions - Community heating scheme ectrical efficiency of CHP unit eat efficiency of CHP unit	Energy kWh/year		kg CO2/kWh	k	Emissions g CO2/year 32.0000 49.9000	(36
th. Carbon dioxide emissions - Community heating scheme	Energy kWh/year		0.2100	k	Emissions g CO2/year 32.0000 49.9000 283.1928	(36
ectrical efficiency of CHP unit that end the stand Power that emissions for electricity there heating from Combined Heat and Power	Energy kWh/year		kg CO2/kWh	k	Emissions g CO2/year 32.0000 49.9000	(36 (36
the Carbon dioxide emissions - Community heating scheme detrical efficiency of CHP unit that efficiency of CHP unit hace heating from Combined Heat and Power there heating from Combined Heat and Power there heating from Combined Heat and Power these scredit emissions for electricity there heating from Combined Heat and Power these scredit emissions for electricity	Energy kWh/year 1348.5370 -431.5318		0.2100 0.3480	k	Emissions g CO2/year 32.0000 49.9000 283.1928 -150.1731 821.6837 -435.7271	(36 (36 (36 (36
ectrical efficiency of CHP unit hat efficiency of CHP unit hat efficiency of CHP unit hace heating from Combined Heat and Power heats credit emissions for electricity ter heating from Combined Heat and Power heating from Combined Heat had been heating scheme	Energy kWh/year 1348.5370 -431.5318 3912.7796		0.2100 0.3480 0.2100	k	Emissions g CO2/year 32.0000 49.9000 283.1928 -150.1731 821.6837	(36 (36 (36 (36 (36
the Carbon dioxide emissions - Community heating scheme detrical efficiency of CHP unit teat efficiency of CHP unit teat efficiency of CHP unit teace heating from Combined Heat and Power tess credit emissions for electricity ter heating from Combined Heat and Power tess credit emissions for electricity ficiency of heat source Boilers tess credit emissions for electricity ficiency of heat source Boilers tess credit emissions for electricity ficiency of heat source Boilers tess credit emergy for heat distribution (space & water)	Energy kWh/year 1348.5370 -431.5318 3912.7796 -1252.0895		0.2100 0.3480 0.2100 0.3480	k	Emissions g CO2/year 32.0000 49.9000 283.1928 -150.1731 821.6837 -435.7271 93.9000 119.2079 6.8457	(36) (36) (36) (36) (36) (36) (37)
Dectrical efficiency of CHP unit Deat efficiency of CHP unit Deat efficiency of CHP unit Deat entaing from Combined Heat and Power Dess credit emissions for electricity Destre heating from Combined Heat and Power Dess credit emissions for electricity Dess credit emissions for electricity Dess credit emissions for electricity Description of heat source Boilers Deace and Water heating from Boilers Dectrical energy for heat distribution (space & water) Description of the destroy of the entry of th	Energy kWh/year 1348.5370 -431.5318 3912.7796 -1252.0895 2214.7130		0.2100 0.3480 0.2100 0.3480 0.2100	k	Emissions g CO2/year 32.0000 49.9000 283.1928 -150.1731 821.6837 -435.7271 93.9000 119.2079 6.8457 0.2106	(36) (36) (36) (36) (36) (36) (36) (36)
Lectrical efficiency of CHP unit Lectrical efficiency of CHP unit Leat efficiency of CHP unit Leat efficiency of CHP unit Leat efficiency of CHP unit Less credit emissions for electricity Leter heating from Combined Heat and Power Less credit emissions for electricity Leter heating from Combined Heat and Power Less credit emissions for electricity Leter heating from Boilers Lectrical of heat source Boilers Lectrical energy for heat distribution (space & water) Lectrical energy for heat network Lectrical energy	Energy kWh/year 1348.5370 -431.5318 3912.7796 -1252.0895 2214.7130		0.2100 0.3480 0.2100 0.3480 0.2100	k	Emissions g CO2/year 32.0000 49.9000 283.1928 -150.1731 821.6837 -435.7271 93.9000 119.2079 6.8457	(36) (36) (36) (36) (36) (37) (37) (37)
dectrical efficiency of CHP unit teat efficiency of CHP unit teace heating from Combined Heat and Power tess credit emissions for electricity ter heating from Combined Heat and Power tess credit emissions for electricity fficiency of heat source Boilers teace and Water heating from Boilers tectrical energy for heat distribution (space & water) terall CO2 factor for heat network teal CO2 associated with community systems teace and water heating temps, fans and electric keep-hot	Energy kWh/year 1348.5370 -431.5318 3912.7796 -1252.0895 2214.7130 12.0595		0.2100 0.3488 0.2100 0.3480 0.2100 0.3480 0.2100 0.0000	k	Emissions g CO2/year 32.0000 49.9000 283.1928 -150.1731 821.6837 -435.7271 93.9000 119.2079 6.8457 0.2106 990.9117 37.3593	(36) (36) (36) (36) (36) (36) (37) (37) (37) (37) (37) (37) (37) (37
ectrical efficiency of CHP unit at efficiency of CHP unit ace heating from Combined Heat and Power ess credit emissions for electricity ter heating from Combined Heat and Power ess credit emissions for electricity ficiency of heat source Boilers ace and Water heating from Boilers ectrical energy for heat distribution (space & water) erall CO2 factor for heat network tal CO2 associated with community systems ace and water heating mps, fans and electric keep-hot ergy for lighting	Energy kWh/year 1348.5370 -431.5318 3912.7796 -1252.0895 2214.7130 12.0595		0.2100 0.3480 0.2100 0.3480 0.2100 0.3480	k	Emissions g C02/year 32.0000 49.9000 283.1928 -150.1731 821.6837 -435.7271 93.9000 119.2079 6.8457 0.2106 990.9117	(36) (36) (36) (36) (36) (37) (37) (37) (37) (37) (37) (37) (37
b. Carbon dioxide emissions - Community heating scheme ectrical efficiency of CHP unit at efficiency of CHP unit ace heating from Combined Heat and Power ess credit emissions for electricity ter heating from Combined Heat and Power ess credit emissions for electricity ficiency of heat source Boilers ace and Water heating from Boilers ectrical energy for heat distribution (space & water) erall CO2 factor for heat network tal CO2 associated with community systems ace and water heating mps, fans and electric keep-hot ergy for lighting tal CO2, kg/year	Energy kWh/year 1348.5370 -431.5318 3912.7796 -1252.0895 2214.7130 12.0595		0.2100 0.3488 0.2100 0.3480 0.2100 0.3480 0.2100 0.0000	k	Emissions g CO2/year 32.0000 49.9000 283.1928 -150.1731 821.6837 -435.7271 93.9000 119.2079 6.8457 0.2106 990.9117 990.9117 37.3593 30.8443	(36) (36) (36) (36) (36) (37) (37) (37) (37) (37) (37) (37) (37
ectrical efficiency of CHP unit at efficiency of CHP unit ace heating from Combined Heat and Power ess credit emissions for electricity ter heating from Combined Heat and Power ess credit emissions for electricity ficiency of heat source Boilers ace and Water heating from Boilers ectrical energy for heat distribution (space & water) erall CO2 factor for heat network tal CO2 associated with community systems ace and water heating mps, fans and electric keep-hot ergy for lighting tal CO2, kg/year C Dwelling Carbon Dioxide Emission Rate (DER)	Energy kWh/year 1348.5370 -431.5318 3912.7796 -1252.0895 2214.7130 12.0595 269.3294 213.7051		0.2100 0.3480 0.2100 0.3480 0.2100 0.3480 0.2100 0.0000	k	Emissions g C02/year 32.0000 49.9000 283.1928 -150.1731 821.6837 -435.7271 93.9000 119.2079 6.8457 0.2106 990.9117 990.9117 37.3593 30.8443 1059.1153	(36) (36) (36) (36) (36) (37) (37) (37) (37) (37) (37) (37) (37
ectrical efficiency of CHP unit at efficiency of CHP unit ace heating from Combined Heat and Power ess credit emissions for electricity ter heating from Combined Heat and Power ess credit emissions for electricity ficiency of heat source Boilers ace and Water heating from Boilers ectrical energy for heat distribution (space & water) erall CO2 factor for heat network tal CO2 associated with community systems ace and water heating mps, fans and electric keep-hot ergy for lighting tal CO2, kg/year C Dwelling Carbon Dioxide Emission Rate (DER)	Energy kWh/year 1348.5370 -431.5318 3912.7796 -1252.0895 2214.7130 12.0595 269.3294 213.7051		0.2100 0.3480 0.2100 0.3480 0.2100 0.3480 0.2100 0.0000		Emissions g CO2/year 32.0000 49.9000 283.1928 -150.1731 821.6837 -435.7271 93.9000 119.2079 6.8457 0.2106 990.9117 97.3593 30.8843 1059.1153 9.2000	(36) (36) (36) (36) (36) (37) (37) (37) (37) (37) (37) (37) (37
Lectrical efficiency of CHP unit hat efficiency of CHP unit hat efficiency of CHP unit hace heating from Combined Heat and Power hess credit emissions for electricity her heating from Combined Heat and Power hess credit emissions for electricity her heating from Combined Heat and Power hess credit emissions for electricity her heating from Boilers hace and Water heating from Boilers hace and Water heating from Boilers heat CO2 factor for heat distribution (space & water) herall CO2 associated with community systems hace and water heating himps, fans and electric keep-hot hergy for lighting hal CO2, kg/year C Dwelling Carbon Dioxide Emission Rate (DER)	Energy kWh/year 1348.5370 -431.5318 3912.7796 -1252.0895 2214.7130 12.0595 269.3294 213.7051	Primary ene	0.2100 0.3480 0.2100 0.3480 0.2100 0.0000 0.1387 0.1387 0.1443		Emissions g CO2/year 32.0000 49.9000 283.1928 -150.1731 821.6837 -435.7271 93.9000 119.2079 6.8457 0.2106 990.9117 37.3593 30.8443 1059.1153 9.2000	(36) (36) (36) (36) (36) (37) (37) (37) (37) (37) (37) (37) (37
Lectrical efficiency of CHP unit cat end to the source desired the source desir	Energy kWh/year 1348.5370 -431.5318 3912.7796 -1252.0895 2214.7130 12.0595 269.3294 213.7051	Primary ene	0.2100 0.3480 0.2100 0.3480 0.2100 0.3480 0.2100 0.0000		Emissions g CO2/year 32.0000 49.9000 283.1928 -150.1731 821.6837 -435.7271 93.9000 119.2079 6.8457 0.2106 990.9117 97.3593 30.8843 1059.1153 9.2000	(36 (36 (36 (36 (37 (37 (37 (37 (37 (38 (38 (38 (38 (38 (38 (38 (38 (38 (38
Lectrical efficiency of CHP unit cat end to electricity cater heating from Combined Heat and Power cless credit emissions for electricity cater heating from Combined Heat and Power cless credit emissions for electricity cater heating from Boilers caterical energy for heat distribution (space & water) cerall CO2 factor for heat network cotal CO2 associated with community systems cater and water heating cater of lighting cat	Energy kWh/year 1348.5370 -431.5318 3912.7796 -1252.0895 2214.7130 12.0595 269.3294 213.7051	Primary ene	0.2100 0.3488 0.2100 0.3480 0.2100 0.0000 0.1387 0.1443		Emissions g CO2/year 32.0000 49.9000 283.1928 -150.1731 821.6837 -435.7271 93.9000 119.2079 6.8457 0.2106 990.9117 37.3593 30.8443 1059.1153 9.2000 ary energy kWh/year 32.0000	(36) (36) (36) (36) (37) (37) (37) (38) (38)
Lectrical efficiency of CHP unit cat efficiency of CHP unit cat efficiency of CHP unit cat efficiency of CHP unit cace heating from Combined Heat and Power Less credit emissions for electricity cater heating from Combined Heat and Power Less credit emissions for electricity cacer and water heating from Boilers cace and Water heating from Boilers cacer and water heating from Boilers cacer and water heating from Heat instribution (space & water) cacer and water heating caps, fans and electric keep-hot cacer and water heating cater for lighting cacer for lighting carbon Dioxide Emission Rate (DER) Dec. Dwelling Carbon Dioxide Emission Rate (DER) Lectrical efficiency of CHP unit cacer heating from Combined Heat and Power	Energy kWh/year 1348.5370 -431.5318 3912.7796 -1252.0895 2214.7130 12.0595 269.3294 213.7051	Primary ene	0.2100 0.3480 0.2100 0.3480 0.2100 0.3480 0.2100 0.0000 0.1387 0.1443		Emissions g CO2/year 32.0000 49.9000 283.1928 -150.1731 821.6837 -435.7271 93.9000 119.2079 6.8457 0.2106 990.9117 37.3593 30.8443 1059.1153 9.2000 ary energy kWh/year 32.0000 49.9000 1523.8468	(36) (36) (36) (36) (37) (37) (37) (38) (38) (38) (46) (46) (46)
Lectrical efficiency of CHP unit cat end to electricity cater heating from Combined Heat and Power cless credit emissions for electricity cater heating from Combined Heat and Power cless credit emissions for electricity cater heating from Boilers caterical energy for heat distribution (space & water) cerall CO2 factor for heat network cotal CO2 associated with community systems cater and water heating cater of lighting cat	Energy kWh/year 1348.5370 -431.5318 3912.7796 -1252.0895 2214.7130 12.0595 269.3294 213.7051	Primary ene	0.2100 0.3488 0.2100 0.3480 0.2100 0.0000 0.1387 0.1443		Emissions g CO2/year 32.0000 49.9000 283.1928 -150.1731 821.6837 -435.7271 93.9000 119.2079 6.8457 0.2106 990.9117 37.3593 30.8443 1059.1153 9.2000 ary energy kWh/year 32.0000	(36) (36) (36) (36) (37) (37) (37) (38) (38) (46) (46) (46)
Lectrical efficiency of CHP unit hat efficiency of CHP unit hat efficiency of CHP unit hace heating from Combined Heat and Power hess credit emissions for electricity hater heating from Combined Heat and Power hess credit emissions for electricity fficiency of heat source Boilers hace and Water heating from Boilers heactrical energy for heat distribution (space & water) herall CO2 factor for heat network hotal CO2 associated with community systems hace and water heating hmps, fans and electric keep-hot hergy for lighting hatal CO2, kg/year her Dec Dwelling Carbon Dioxide Emission Rate (DER) ABb. Primary energy - Community heating scheme Hectrical efficiency of CHP unit hat efficiency o	Energy kWh/year 1348.5370 -431.5318 3912.7796 -1252.0895 2214.7130 12.0595 269.3294 213.7051	Primary ene	0.2100 0.3480 0.2100 0.3480 0.2100 0.3480 0.2140 0.0000 0.1387 0.1443	Prim	Emissions g CO2/year 32.0000 49.9000 283.1928 -150.1731 821.6837 -435.7271 93.9000 119.2079 6.8457 0.2106 990.9117 37.3593 30.8443 1059.1153 9.20000 ary energy kWh/year 32.0000 49.9000 1523.8468 -927.3619 4421.4409 -2690.7402	(36) (36) (36) (36) (37) (37) (37) (37) (37) (38) (40) (40) (40) (40) (40) (40) (40) (40
the Carbon dioxide emissions - Community heating scheme descrical efficiency of CHP unit the process of the community of the	Energy kWh/year 1348.5370 -431.5318 3912.7796 -1252.0895 2214.7130 12.0595 269.3294 213.7051 Energy kWh/year 1348.5370 -431.5318 3912.7796	Primary ene	0.2100 0.3480 0.2100 0.3480 0.2100 0.3480 0.2100 0.0000 0.1387 0.1443	Prim	Emissions g CO2/year 32.0000 49.9000 283.1928 -150.1731 821.6837 -435.7271 93.9000 119.2079 6.8457 0.2106 990.9117 37.3593 30.8443 1059.1153 9.2000 ary energy kWh/year 32.0000 49.9000 1523.8468 9927.3619 4421.4409	(36) (36) (36) (36) (37) (37) (37) (37) (37) (37) (38) (46) (46) (46) (46) (46) (46) (46) (46

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Overall CO2 fact Total CO2 associ Space and water Pumps, fans and Energy for light Total Primary en Dwelling Primary	ated with heating electric ing ergy kWh/y	community s keep-hot year	systems					269.3294 213.7051		1.5128 1.5338		1.0419 4902.1811 4902.1811 407.4415 327.7881 5637.4107 48.9800	(473) (476) (478) (479) (483)
SAP 10 WORKSHEET CALCULATION OF TA	ARGET EMIS	SSIONS `		· 	.2, February								
1. Overall dwell:	ing chara	rtanistics											
Ground floor Total floor area Dwelling volume)+(1d)+(1 e).	(1n)	11!	5.1000		Area (m2) 115.1000		y height (m) 2.7400 (3d)+(3e)	(2b) =	Volume (m3) 315.3740 315.3740	(1b) (4)
2. Ventilation r	ate												
Number of open cl Number of open f Number of chimne Number of flues Number of flues Number of blocke Number of interm Number of passiv Number of fluele	lues ys / flues attached f attached f d chimneys ittent exf e vents	to solid fue to other hea s tract fans	el boiler	ire							0 * 80 = 0 * 20 = 0 * 10 = 0 * 20 = 0 * 35 = 0 * 20 = 4 * 10 = 0 * 40 = 0 * 40 =	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 40.0000 0.0000	(6a) (6b) (6c) (6d) (6e) (6e) (7a) (7b)
Infiltration due Pressure test Pressure Test Me Measured/design / Infiltration rat Number of sides :	thod AP50 e	eys, flues a	and fans =	= (6a)+(6b)	+(6c)+(6d)+(6e)+(6f)+	+(6g)+(7a)+(7b)+(7c) =		40.000	Air changes 0 / (5) = Bl	0.1268 Yes ower Door 5.0000 0.3768	(8)
Shelter factor Infiltration rate	e adjuste	d to include	e shelter fa	actor					(20) = 1 - (21		x (19)] = x (20) =	0.8500 0.3203	
Wind speed Wind factor	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250		Oct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	
Adj infilt rate Effective ac	0.4084 0.5834	0.4004 0.5802	0.3924 0.5770	0.3523 0.5621	0.3443 0.5593	0.3043 0.5463	0.3043 0.5463	0.2963 0.5439		0.3443 0.5593	0.3603 0.5649	0.3764 0.5708	
3. Heat losses a													
Element TER Opaque door TER Opening Type External Wall 1 Total net area o Fabric heat loss Party Wall 1	(Uw = 1.2	20) l elements A		Gross m2 66.4724	Openings m2 20.0000	2 17 46 66	etArea m2 2.3000 7.7000 5.4724 6.4724 (25)(U-value W/m2K 1.0000 1.1450 0.1800 30) + (32) 0.0000	A x U W/K 2.3000 20.2672 8.3650 = 30.9322 0.0000		K-value kJ/m2K	A x K kJ/K	
E3 Sill E4 Jamb E7 Party E8 Balco E16 Corn E18 Part	Bridges nt lintels floor bef ny within er (normal y wall bef er (inver	(including of tween dwelling, a dwelling, l) tween dwelli ted – interr	other steel ings (in blo , wall insul ings nal area gre	lintels) ocks of fla lation cont	inuous external are	a)		1 2 4 1	1.0400 7.3400 7.8800 8.5200 3.4600 5.4800 0.9600	i-value 0.0500 0.0500 0.0500 0.0700 0.0700 0.0000 0.0900 0.0600 -0.0900	Tota 0.552 0.367 1.394 3.396 0.000 0.493 0.657 -0.246	0 0 10 14 10 12 16	

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Point Thermal b Total fabric he									(33) + (36)	(36a) = + (36a) =	0.0000 37.5458 (37)
Ventilation hea	at loss cal Jan 60.7157	culated mo Feb 60.3786	nthly (38)m Mar 60.0483	= 0.33 x (Apr 58.4967	25)m x (5) May 58.2064	Jun 56.8550	Jul 56.8550	Aug 56.6048	Sep 57.3755	0ct 58.2064	Nov 58.7937	Dec 59.4076 (38)
Heat transfer o Average = Sum(3	oeff 98.2615	97.9245	97.5941	96.0425	95.7522	94.4008	94.4008	94.1506	94.9214	95.7522	96.3395	96.9535 (39) 96.0411
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec
HLP (average) Days in mont	0.8537 31	0.8508 28	0.8479 31	0.8344 30	0.8319 31	0.8202	0.8202	0.8180	0.8247 30	0.8319	0.8370 30	0.8423 (40) 0.8344 31
4. Water heatir												2 8422 (42
Assumed occupar Hot water usage	for mixer											2.8422 (42)
Hot water usage			69.2203	66.2088	63.9864	61.5080	60.0993	61.6613	63.3736	66.0347	69.1109	71.5991 (42
Hot water usage	31.0316 for other	30.5707 uses	29.9217	28.7251	27.8291	26.8355	26.2989	26.9433	27.6450	28.7082	29.9294	30.9267 (42b
Average daily h	43.7371	42.1467	40.5563 /day)	38.9658	37.3754	35.7849	35.7849	37.3754	38.9658	40.5563	42.1467	43.7371 (426 134.7980 (43)
Daily hot water		Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec
	146.6432 232.2469 (annual)	143.5117 204.3588	139.6983 214.7111	133.8998 183.3021	129.1909 173.9158	124.1285 152.6305	122.1831 147.7699	125.9801 155.9896	129.9845 160.2839	135.2991 183.5996 Total = S	141.1870 201.1468 um(45)m =	146.2629 (44 229.0123 (45 2238.9673
Distribution lo	34.8370	= 0.15 x (30.6538	45)m 32.2067	27.4953	26.0874	22.8946	22.1655	23.3984	24.0426	27.5399	30.1720	34.3518 (46)
Water storage 1 Store volume												0.0000 (47)
b) If manufac Hot water sto Volume factor Temperature f Enter (49) or (orage loss from Tabl actor from [54] in (55	factor from Le 2a n Table 2b			ay)							1.4400 (51 0.0000 (52 1.0000 (53 1.4400 (55
Total storage l	44.6400	40.3200	44.6400	43.2000	44.6400	43.2000	44.6400	44.6400	43.2000	44.6400	43.2000	44.6400 (56
If cylinder cor Primary loss	44.6400 0.0000	40.3200 0.0000	44.6400 0.0000	43.2000 0.0000	44.6400 0.0000	43.2000 0.0000	44.6400 0.0000	44.6400 0.0000	43.2000 0.0000	44.6400 0.0000	43.2000 0.0000	44.6400 (57) 0.0000 (59)
Combi loss Total heat requ	0.0000 uired for w 276.8869	0.0000 water heati 244.6788	0.0000 ng calculate 259.3511	0.0000 ed for each 226.5021	0.0000 month 218.5558	0.0000	0.0000	0.0000 200.6296	0.0000 203.4839	0.0000 228.2396	0.0000 244.3468	0.0000 (61) 273.6523 (62)
WWHRS PV diverter Solar input	-32.8580 -0.0000 0.0000	-29.0599 -0.0000 0.0000	-30.4298 -0.0000 0.0000	-25.1971 -0.0000 0.0000	-23.4828 -0.0000 0.0000	-20.0944 -0.0000 0.0000	-18.8353 -0.0000 0.0000	-20.0294 -0.0000 0.0000	-20.7904 -0.0000 0.0000	-24.5096 -0.0000 0.0000	-27.7664 -0.0000 0.0000	-32.2495 (63) -0.0000 (63) 0.0000 (63)
FGHRS Output from w/h	0.0000 1 244.0289	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (630
12Total per yea		215.6189 ar)	228.9213	201.3050	195.0750	175.7361	173.5746	180.6002 Total p	182.6934 er year (kW	203.7300 h/year) = S	216.5803 um(64)m =	241.4028 (64) 2459.2646 (64) 2459 (64)
Electric shower		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64
Heat gains from	ı water hea	nting, kWh/	month	Tot	al Energy u	sed by inst	antaneous e	lectric sho	wer(s) (kWh	/year) = Su	m(64a)m =	0.0000 (64
		100.2053		95.5079	93.5390	85.3096	84.8455	87.5786	87.8544	96.7589	101.4413	111.8586 (65)
5. Internal gai	ns (see Ta	ble 5 and	5a)									
Metabolic gains	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec
Lighting gains	(calculate							142.1108	142.1108	142.1108	142.1108	142.1108 (66
Appliances gair	ns (calcula	ated in App		uation L13	or L13a), a	lso see Tab		147.8272	152.7548	147.8272	152.7548	147.8272 (67)
Cooking gains (278.6893 calculated		274.2937 ix L, equati				208.4925 5	205.6006	212.8882	228.4025	247.9866	266.3928 (68)
Pumps, fans Losses e.g. eva	37.2111 0.0000	37.2111 0.0000	37.2111 0.0000	37.2111 0.0000	37.2111 0.0000	37.2111 0.0000	37.2111 0.0000	37.2111 0.0000	37.2111 0.0000	37.2111 0.0000	37.2111 0.0000	37.2111 (69 0.0000 (70
-	113.6887	-113.6887	-113.6887		-113.6887	-113.6887	-113.6887	-113.6887	-113.6887	-113.6887	-113.6887	-113.6887 (71
	151.7932	le 5) 149.1150	143.9563	132.6499	125.7245	118.4856	114.0396	117.7131	122.0200	130.0523	140.8907	150.3476 (72
Total internal	gains 643.9429	659.9953	631.7104	609.8173	578.3802	557.6627	535.9926	536.7741	553.2962	571.9152	607.2653	630.2008 (73
6. Solar gains												
[Jan]			Αr	rea	Solar flux		g		FF	Acce	ss	Gains



				m2	Table 6a W/m2		fic data Table 6b	Specific or Tab		facto Table 6		W	
East			17.7	000	19.6403		0.6300	0	.7000	0.77	90	106.2411	(76)
Solar gains Total gains	106.2411 750.1840	207.8301 867.8254	342.2665 973.9769	499.1753 1108.9926	611.7581 1190.1382	626.2432 1183.9059	596.2091 1132.2017	512.1348 1048.9089	398.0701 951.3663	246.6079 818.5231	132.4701 739.7354	87.3675 717.5683	
 7. Mean inter	rnal tempera	 ture (heati	 ng season)										
Temperature d	during heati	ng periods	in the livi	ng area fro	m Table 9, 1							21.0000	(85)
Utilisation f	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
tau alpha	125.2490 9.3499	125.6801 9.3787	126.1055 9.4070	128.1428 9.5429	128.5313 9.5688	130.3713 9.6914	130.3713 9.6914	130.7178 9.7145	129.6563 9.6438	128.5313 9.5688	127.7478 9.5165	126.9388 9.4626	
util living a	0.9996	0.9983	0.9905	0.9249	0.7359	0.5099	0.3668	0.4129	0.6825	0.9688	0.9984	0.9998	(86)
MIT Th 2 util rest of	20.3955 20.2070	20.5180 20.2095	20.6942 20.2120	20.9072 20.2236	20.9900 20.2258	20.9997 20.2359	21.0000 20.2359	21.0000 20.2378	20.9961 20.2320	20.8620 20.2258	20.5916 20.2214	20.3807 20.2168	
MIT 2	0.9995 19.4990	0.9975 19.6578	0.9858 19.8826	0.8961 20.1417	0.6800 20.2196	0.4493 20.2358	0.3032 20.2359	0.3445 20.2378	0.6097 20.2303	0.9497 20.0998	0.9975 19.7622	0.9996 19.4882	
nin 2 Living area f MIT		19.9236	20.1334	20.1417	20.4577	20.2338	20.2339	20.2378		Living area 20.3353		0.3090 19.7640	(91)
mii Temperature a adjusted MIT	adjustment	19.9236	20.1334	20.3783	20.4577	20.4719	20.4720	20.4733	20.4669	20.3353	20.0185	0.0000 19.7640	
aujusteu mii	19.7700	19.9230	20.1334	20.3783	20.43//	20.4/19	20.4720	20.4733	20.4009	20.3333	20.0183	13.7040	(33)
8. Space heat	ing require	 ment											
Utilisation	Jan 0.9993	Feb 0.9971	Mar 0.9852	Apr 0.9024	May 0.6971	Jun 0.4680	Jul 0.3228	Aug 0.3656	Sep 0.6323	0ct 0.9530	Nov 0.9971	Dec 0.9995	(94)
Useful gains Ext temp.	749.6700 4.3000	865.2946 4.9000	959.5413 6.5000	1000.7868 8.9000	829.6584 11.7000	554.1198 14.6000	365.5179 16.6000	383.4907 16.4000	601.5628 14.1000	780.0193 10.6000	737.6030 7.1000	717.2364 4.2000	
Heat loss rat	e W	1471.1783			838.5668	554.3085	365.5222	383.5046	604.3582			1508.9874	
Space heating		407.1538	276.0231	73.1633	6.6278	0.0000	0.0000	0.0000	0.0000	113.2055	365.0123	589.0628	. ,
Space heating Solar heating	g requiremen											2403.8932	(
Solar heating	0.0000 contributi	0.0000 on - total	0.0000 per year (k	0.0000 Wh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000	(98b)
Space heating	573.6445		276.0231	73.1633	6.6278	0.0000	0.0000	0.0000	0.0000	113.2055	365.0123	589.0628 2403.8932	(98c)
Space heating Space heating		c arter sor	ar contribu	icion - toca	i per year ((KWII/ year [*])				(98c)	/ (4) =	20.8853	(99)
9b. Energy re	equirements												
Fraction of s Fraction of s Fraction of h	pace heat f	rom communi	ty system									0.0000 1.0000 0.5580	(302)
Fraction of h	neat from co	mmunitý Boi	lers-Space	and Water								0.4420	(303b
Factor for co	narging meth	od (Table 4	c(3)) for w	ater heatin	g	ig						1.0000	(305
Distribution Efficiency of	secondary/				g system							1.2500 0.0000	
Space heating Space heating	requiremen												
	573.6445 rom Combined		276.0231 ower = (98)		6.6278 .00 x 1.25	0.0000	0.0000	0.0000	0.0000	113.2055	365.0123	589.0628	(98)
Space heat fr	400.1171		192.5261 44 x 1.00 x	51.0314 1.25	4.6229	0.0000	0.0000	0.0000	0.0000	78.9608	254.5961	410.8713	
307a	rom Boilers			40.4227	3.6619	0.0000	0.0000	0.0000	0.0000	62.5460	201.6693	325.4572	
307a Space heat fr 307b	316.9386	224.9525	152.5028	40.4227	3.0013								
307a Space heat fr 307b Space heating	316.9386 g requiremen 717.0557	224.9525 t 508.9423	345.0289	91.4541	8.2848	0.0000 4 4a or App	0.0000 endix E)	0.0000	0.0000	141.5069	456.2654	736.3285 0.0000	(307)
307a Space heat fr 307b Space heating Efficiency of	316.9386 requiremen 717.0557 secondary/	224.9525 t 508.9423 supplementa	345.0289 ry heating	91.4541 system in %	8.2848			0.0000	0.0000	141.5069 0.0000	456.2654 0.0000		(307) (308)
307a Space heat fr 307b Space heating Efficiency of Space heating Water heating	316.9386 g requiremen 717.0557 secondary/ g fuel for s 0.0000	224.9525 t 508.9423 supplementa econdary/su 0.0000	345.0289 ry heating pplementary	91.4541 system in %	8.2848 (from Table	4a or App	endix E)					0.0000	(307) (308)
307a Space heat fr 307b Space heating Efficiency of Space heating Water heating Annual water	316.9386 g requiremen 717.0557 s secondary/ g fuel for s 0.0000 g heating req 244.0289	224.9525 t 508.9423 supplementa econdary/su 0.0000 uirement 215.6189	345.0289 ry heating pplementary 0.0000 228.9213	91.4541 system in % system 0.0000	8.2848 (from Table 0.0000	4a or App	endix E)					0.0000	(307) (308) (309)
307a Space heat fr 307b Space heating Efficiency of Space heating Water heating Annual water Water heat fr 310a	316.9386 g requiremen 717.0557 s secondary/ g fuel for s 0.0000 g heating req 244.0289 rom Combined 170.2102	224.9525 t 508.9423 supplementa econdary/su 0.0000 uirement 215.6189 Heat and P 150.3942	345.0289 ry heating pplementary 0.0000 228.9213 ower = (64) 159.6726	91.4541 system in % system 0.0000 201.3050 x 0.56 x 1 140.4102	8.2848 (from Table 0.0000	9 4a or App 0.0000	endix E) 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(307) (308) (309)
307a Space heat fr 307b Space heating Efficiency of Space heating Water heating Water heating Water heat fr 310a 310a 310b	316.9386 g requiremen 717.0557 secondary/ g fuel for s 0.0000 g heating req 244.0289 com Combined 170.2102 com Boilers 134.8260	224.9525 t 508.9423 supplementa econdary/su 0.0000 uirement 215.6189 Heat and P 150.3942	345.0289 ry heating pplementary 0.0000 228.9213 ower = (64) 159.6726	91.4541 system in % system 0.0000 201.3050 x 0.56 x 1 140.4102	8.2848 (from Table 0.0000 195.0730 .00 x 1.25	0.0000 175.7361	0.0000 173.5746	0.0000	0.0000 182.6934	0.0000 203.7300	0.0000 216.5803	0.0000 0.0000 241.4028	(307) (308) (309)
307a Space heat fr 307b Space heating Efficiency of Space heating Water heating Annual water Water heat fr 310a Water heat fr 310b Water heating	316.9386 g requiremen 717.0557 s econdary/ g fuel for s 0.0000 g heating req 244.0289 own Combined 170.2102 room Boilers 134.8260 g fuel 305.0362	224.9525 t 508.9423 supplementa econdary/su 0.0000 uirement 215.6189 Heat and P 150.3942 = (64) x 0. 119.1294 269.5236	345.0289 ry heating pplementary 0.0000 228.9213 ower = (64) 159.6726 44 x 1.00 x 126.4790 286.1516	91.4541 system in % system 0.0000 201.3050 x 0.56 x 1 140.4102	8.2848 (from Table 0.0000 195.0730 .00 x 1.25 136.0634	0.0000 175.7361 122.5759	0.0000 173.5746 121.0683	0.0000 180.6002 125.9686	0.0000 182.6934 127.4287	0.0000 203.7300 142.1017	0.0000 216.5803 151.0648	0.0000 0.0000 241.4028 168.3785 133.3751 301.7535	(307) (308) (309) (64)
Space heat fr 307a Space heat fr 307b Space heating Efficiency of Space heating Water heating Annual water Water heat fr 310a Water heat fr 310b Water heating Cooling Syste Space coolin	316.9386 g requiremen 717.0557 s econdary/ g fuel for s 0.0000 g heating req 244.0289 own Combined 170.2102 room Boilers 134.8260 g fuel 305.0362	224.9525 t 508.9423 supplementa econdary/su 0.0000 uirement 215.6189 Heat and P 150.3942 = (64) x 0. 119.1294 269.5236	345.0289 ry heating pplementary 0.0000 228.9213 ower = (64) 159.6726 44 x 1.00 x 126.4790 286.1516	91,4541 system in % system 0.0000 201.3050 x 0.56 x 1 140.4102 11.25	8.2848 (from Table 0.0000 195.0730 .00 x 1.25 136.0634 107.7778	2 4a or App 0.0000 175.7361 122.5759 97.0942	0.0000 173.5746 121.0683 95.9000	0.0000 180.6002 125.9686 99.7816	0.0000 182.6934 127.4287 100.9381	0.0000 203.7300 142.1017 112.5608	0.0000 216.5803 151.0648 119.6606	0.0000 0.0000 241.4028 168.3785 133.3751	(307) (308) (309) (64)

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(333a)m -16.5497 -25.1592 -38.9454 -47.2409 -54.0009 -51.4934	-50.8305	-46.4351	-39.2880	-30.2018	-18.8204	-14.1011	(333a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (334a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quant:		0.0000	0.0000	0.0000	0.0000	0.0000	(3344)
(335a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335a)
(333b)m -4.5164 -9.8175 -20.1352 -31.2002 -42.2420 -42.8502	-42.3845	-35.4554	-25.4066	-14.3804	-6.1326	- 3.5507	(333b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (334b)m 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(334b)
Electricity generated by hydro-electric generators (Appendix M) (negative quant		0.0000	0.0000	0.0000	0.0000		
(335b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 Annual totals kWh/year	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335b)
Space heating fuel - community heating Space heating fuel - secondary						3004.8665 0.0000	
Water heating fuel - community heating						3074.0807	(310)
Efficiency of water heater Electricity used for heat distribution						0.0000 30.0487	
Space cooling fuel						0.0000	
Electricity for pumps and fans:						0.0000	(224)
Total electricity for the above, kWh/year Electricity for lighting (calculated in Appendix L)						0.0000 247.8922	
Energy saving/generation technologies (Appendices M ,N and Q)							
PV generation Wind generation						-711.1382 0.0000	
Hydro-electric generation (Appendix N)						0.0000	(335a)
Electricity generated - Micro CHP (Appendix N) Appendix Q - special features						0.0000	(335)
Energy saved or generated						-0.0000	
Energy used Total delivered energy for all uses						0.0000 5615.7012	
12b. Carbon dioxide emissions - Community heating scheme							
		Energy kWh/year		ion factor kg CO2/kWh	k	Emissions g CO2/year	
Electrical efficiency of CHP unit		KWII, yeur		(g CO2/ KWII	K	32.0000	(361)
Heat efficiency of CHP unit Space heating from Combined Heat and Power		3360.1513		0.2100		49.9000 705.6318	1 1
less credit emissions for electricity	-	-1075.2484		0.3480		-374.1864	
Water heating from Combined Heat and Power		3437.5492		0.2100		721.8853	
less credit emissions for electricity Efficiency of heat source Boilers	-	-1100.0157		0.3480		-382.8055 93.9000	1 1
Space and Water heating from Boilers		2861.4426		0.2100		297.0306	(368)
Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network		30.0487		0.0000		9.0652 0.2106	
Total CO2 associated with community systems						1280.4933	
Space and water heating		0.0000		0.0000		1280.4933	
Pumps, fans and electric keep-hot Energy for lighting		0.0000 247.8922		0.0000 0.1443		0.0000 35.7785	
Energy saving/generation technologies							
PV Unit electricity used in dwelling		-433.0666		0.1331		-57.6284	
PV Unit electricity exported Total		-278.0717		0.1250		-34.7510 -92.3794	
Total CO2, kg/year						1223.8924	(383)
EPC Target Carbon Dioxide Emission Rate (TER)						10.6300	(384)
13b. Primary energy - Community heating scheme							
			rimary ene	rgv factor	Prim	ary energy	
Flactrical afficiency of CHD unit		kWh/year		kg CO2/kWh		kWh/year	
Electrical efficiency of CHP unit						32.0000 49.9000	
Heat efficiency of CHP unit		3360.1513		1.1300		3796.9709	
Space heating from Combined Heat and Power		-1075.2484		2.1490		-2310.7088 3884.4305	
Space heating from Combined Heat and Power less credit emissions for electricity		3437.5492		1.1300			· · /
Space heating from Combined Heat and Power less credit emissions for electricity Water heating from Combined Heat and Power less credit emissions for electricity				2.1490		-2363.9338	
Space heating from Combined Heat and Power less credit emissions for electricity Water heating from Combined Heat and Power less credit emissions for electricity Efficiency of heat source Boilers		3437.5492 -1100.0157		2.1490		93.9000	(467b)
Space heating from Combined Heat and Power less credit emissions for electricity Water heating from Combined Heat and Power less credit emissions for electricity Efficiency of heat source Boilers Space and Water heating from Boilers		3437.5492					(467b (468)
Space heating from Combined Heat and Power Less credit emissions for electricity Water heating from Combined Heat and Power Less credit emissions for electricity Efficiency of heat source Boilers Space and Water heating from Boilers Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network		3437.5492 -1100.0157 2861.4426		2.1490 1.1300		93.9000 1598.3073 94.3294 1.0420	(467b) (468) (472) (486)
Space heating from Combined Heat and Power less credit emissions for electricity Water heating from Combined Heat and Power less credit emissions for electricity Efficiency of heat source Boilers Space and Water heating from Boilers Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems		3437.5492 -1100.0157 2861.4426		2.1490 1.1300		93.9000 1598.3073 94.3294	(467b) (468) (472) (486) (473)
Space heating from Combined Heat and Power less credit emissions for electricity Water heating from Combined Heat and Power less credit emissions for electricity Efficiency of heat source Boilers Space and Water heating from Boilers Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems Space and water heating Pumps, fans and electric keep-hot		3437.5492 -1100.0157 2861.4426 30.0487 0.0000		2.1490 1.1300 0.0000		93.9000 1598.3073 94.3294 1.0420 6334.5185 6334.5185	(467b) (468) (472) (486) (473) (476) (478)
Space heating from Combined Heat and Power less credit emissions for electricity Water heating from Combined Heat and Power less credit emissions for electricity Efficiency of heat source Boilers Space and Water heating from Boilers Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems Space and water heating Pumps, fans and electric keep-hot		3437.5492 -1100.0157 2861.4426 30.0487		2.1490 1.1300 0.0000		93.9000 1598.3073 94.3294 1.0420 6334.5185 6334.5185	(467b) (468) (472) (486) (473) (476) (478)
Space heating from Combined Heat and Power less credit emissions for electricity Water heating from Combined Heat and Power less credit emissions for electricity Efficiency of heat source Boilers Space and Water heating from Boilers Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems Space and water heating Pumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies		3437.5492 -1100.0157 2861.4426 30.0487 0.0000 247.8922		2.1490 1.1300 0.0000 0.0000 1.5338		93.9000 1598.3073 94.3294 1.0420 6334.5185 6334.5185 0.0000 380.2254	(467b) (468) (472) (486) (473) (476) (478) (479)
Space heating from Combined Heat and Power less credit emissions for electricity Water heating from Combined Heat and Power less credit emissions for electricity Efficiency of heat source Boilers Space and Water heating from Boilers Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems Space and water heating Pumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies PV Unit electricity used in dwelling		3437.5492 -1100.0157 2861.4426 30.0487 0.0000		2.1490 1.1300 0.0000		93.9000 1598.3073 94.3294 1.0420 6334.5185 6334.5185	(467b) (468) (472) (486) (473) (476) (476) (478) (479)
Water heating from Combined Heat and Power less credit emissions for electricity Efficiency of heat source Boilers Space and Water heating from Boilers Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems Space and water heating Pumps, fans and electric keep-hot Energy for lighting		3437.5492 -1100.0157 2861.4426 30.0487 0.0000 247.8922 -433.0666		2.1490 1.1300 0.0000 0.0000 1.5338		93.9000 1598.3073 94.3294 1.0420 6334.5185 6334.5185 0.0000 380.2254	(467b) (468) (472) (486) (473) (476) (478) (479)



Property Reference		L	_01-6.04 SO x6_Copy	/_Copy					Issued	on Date	12/09	/2023	
Assessment Reference	:е	L	_00.04 SO_Copy_Cop	ру			Prop	Type Ref					
						DER		40.00		TER		2.42	
SAP Rating Environmental				87	2A		R < TER	10.20		IER		2.48 8.27	
CO: Emissions (t/year	1			0.		DFEE		27.44		TFEE		27.80	
Compliance Check	<i>1</i>				ee BREL		EE < TFEE	27.44				.28	
% DPER < TPER					3.69	DPER		58.53		TPER		57.82	
Assessor Details Client		Mr. Rich	hard Denteh							Assessor ID	ا	J148-0001	
SAP 10 WORKSHEET CALCULATION OF D 1. Overall dwell Ground floor	ing charact	ISSIONS	FOR REGULATIO	DNS COMPLIAN	CE			Area (m2) 72.0000		y height (m) 2.7400	(2b) =	Volume (m3) 197.2800	(1b)
Total floor area Dwelling volume 2. Ventilation r)+(1b)+	(1c)+(1d)+(1e))(1n)	7.	2.0000		(3	ia)+(3b)+(3c)+	(3d)+(3e)	(3n) =	197.2800	(4)
Number of open of Number of open f Number of chimne Number of flues Number of blocke Number of interm Number of passiv Number of fluels	lues ys / flues attached to attached to d chimneys ittent extr e vents	o solid o other ract fan	fuel boiler heater	fire							0 * 80 = 0 * 20 = 0 * 10 = 0 * 20 = 0 * 35 = 0 * 20 = 0 * 10 = 0 * 10 = 0 * 40 =	9.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(6a) (6b) (6c) (6d) (6e) (6e) (6f) (7a)
Infiltration due Pressure test Pressure Test Me Measured/design Infiltration rat Number of sides	to chimney thod AP50		es and fans	= (6a)+(6b)·	+(6c)+(6d)+(0	6e)+(6f)+(6	ōg)+(7a)+(7	/b)+(7c) =		0.0000	Air change / (5) =	es per hour 0.0000 Yes Blower Door 3.0000 0.1500	(8) (8) (17)
Shelter factor Infiltration rat	e adjusted	to inc	lude shelter d	factor					(20) = 1 - (21		(19)] = x (20) =	0.8500 0.1275	
Wind speed Wind factor Adj infilt rate	Jan 5.1000 1.2750 0.1626	Feb 5.0000 1.2500 0.1594	1.22504 0.1562	Apr 4.4000 1.1000 0.1403	May 4.3000 1.0750 0.1371	Jun 3.8000 0.9500 0.1211	Jul 3.8000 0.9500 0.1211	Aug 3.7000 0.9250 0.1179	Sep 4.0000 1.0000 0.1275	0ct 4.3000 1.0750 0.1371	Nov 4.5000 1.1250 0.1434	Dec 4.7000 1.1750 0.1498	(22a)
Balanced mechan If mechanical ve If exhaust air h If balanced with	ntilation eat pump us	sing App	pendix N, (23	o) = (23a) x					a)			0.5000 0.5000 72.8000	(23b)
Effective ac	0.2986	0.2954	4 0.2922	0.2762	0.2731	0.2571	0.2571	0.2539	0.2635	0.2731	0.2794	0.2858	(25)
3. Heat losses a	nd heat los	ss parar	meter						_				
Element				Gross m2	Openings m2	Net	Area m2	U-value W/m2K	A x U W/K		-value kJ/m2K	A x K kJ/K	
window (Uw = 1.3 External Wall 1 Total net area o		element	ts Aum(A, m2)	47.8404	14.8000	33.6	3000 3404 3404	1.2357 0.1400	18.2890 4.6257	1	0.0000	6277.6760	(27)

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Fabric heat lo Party Wall 1 Party Floor 1 Party Ceiling Internal Wall	1	um (A x U)				72 72	(26)(.2000 .0000 .0000 .3600	30) + (32) = 0.0000	= 22.91 0.00	00 18 4 3	0.0000 0.0000 0.0000 5.0000	10476.0000 2880.0000 2160.0000 8877.0000	(32d) (32b)
Heat capacity Thermal mass p List of Therma	arameter (T l Bridges		ΓFA) in kJ/m	n2K						2) + (32a).		425.9816	
E3 Sil E4 Jam E7 Par	er lintels l b ty floor be	tween dwell	other steel		ats)			7 5 17 34	.5700 .9900 .1000 .9200	Psi-value 0.0300 0.0300 0.0300 0.0700	Tot 0.22 0.17 0.51 2.44	271 797 130 144	
E16 Co E8 Bal	rner (inver	l) a dwelling ted – inter	g, wall insu rnal area gr	reater than	external a	rea)		2 5	.4800 .7400 .8000 .7400	0.0600 0.0900 0.0000 -0.0900	0.32 0.24 0.00 -0.24	166 900	(36)
Point Thermal Total fabric h	bridges	rsi) caicui	tateu using	аррепитх к	,				(33) + (36)	(36a) = + (36a) =	0.0000 26.6076	
entilation he 38)m	at loss cal Jan 19.4371	culated mor Feb 19.2296	nthly (38)m Mar 19.0221	= 0.33 x () Apr 17.9845	25)m x (5) May 17.7770	Jun 16.7395	Jul 16.7395	Aug 16.5319	Sep 17.1545	0ct 17.7770	Nov 18.1921	Dec 18.6071	(38)
leat transfer verage = Sum(46.0448	45.8373	45.6297	44.5922	44.3847	43.3471	43.3471	43.1396	43.7621	44.3847	44.7997	45.2147 44.5403	(39)
HLP HLP (average) Days in mont	Jan 0.6395 31	Feb 0.6366 28	Mar 0.6337	Apr 0.6193	May 0.6165	Jun 0.6020 30	Jul 0.6020 31	Aug 0.5992 31	Sep 0.6078	Oct 0.6165	Nov 0.6222 30	Dec 0.6280 0.6186 31	(40)
. Water heati)									
ssumed occupa	ncy											2.2937	(42)
ot water usag ot water usag	86.1812	84.8860	82.9988	79.3878	76.7230	73.7513	72.0621	73.9351	75.9883	79.1790	82.8675	85.8510	(42 <i>a</i>
ot water usag	27.0765	26.6744 uses	26.1081	25.0640	24.2822	23.4152	22.9470	23.5093	24.1216	25.0492	26.1148	26.9849	(42b
verage daily	38.1196	36.7335	35.3473 /day)	33.9611	32.5749	31.1888	31.1888	32.5749	33.9611	35.3473	36.7335	38.1196 139.2145	
aily hot wate	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
nergy conte nergy content	151.3773 239.7446 (annual)	148.2938 211.1684	144.4541 222.0206	138.4129 189.4803	133.5801 179.8245	128.3553 157.8278	126.1979 152.6254	130.0194 160.9911	134.0709 165.3229	139.5755 189.4026 Total = S	145.7158 207.5988 um(45)m =	150.9555 236.3599 2312.3670	٠,
istribution later storage	35.9617	31.6753	33.3031	28.4221	26.9737	23.6742	22.8938	24.1487	24.7984	28.4104	31.1398	35.4540	(46)
tore volume) If manufac Temperature nter (49) or otal storage	turer decla factor from (54) in (55	Table 2b	actor is kno	own (kWh/d	ay):							180.0000 1.5200 0.5400 0.8208	(48) (49)
f cvlinder co	25.4448	22.9824 cated solar	25.4448 r storage	24.6240	25.4448	24.6240	25.4448	25.4448	24.6240	25.4448	24.6240	25.4448	(56)
rimary loss ombi loss	25.4448 23.2624 0.0000	22.9824 21.0112 0.0000	25.4448 23.2624 0.0000	24.6240 22.5120 0.0000	25.4448 23.2624 0.0000	24.6240 22.5120 0.0000	25.4448 23.2624 0.0000	25.4448 23.2624 0.0000	24.6240 22.5120 0.0000	25.4448 23.2624 0.0000	24.6240 22.5120 0.0000	25.4448 23.2624 0.0000	(59)
otal heat req WHRS V diverter olar input	uired for w 288.4518 -65.3735 0.0000 0.0000	ater heatir 255.1620 -57.8168 0.0000 0.0000	ng calculate 270.7278 -60.5425 0.0000 0.0000	ed for each 236.6163 -50.1315 0.0000 0.0000	month 228.5317 -46.7208 0.0000 0.0000	204.9638 -39.9793 0.0000 0.0000	201.3326 -37.4742 0.0000 0.0000	209.6983 -39.8501 0.0000 0.0000	212.4589 -41.3641 0.0000 0.0000	238.1098 -48.7638 0.0000 0.0000	254.7348 -55.2434 0.0000 0.0000	285.0671 -64.1628 0.0000 0.0000	(63a (63b
GHRS Output from w/	0.0000 h 223.0783	0.0000 197.3452	0.0000 210.1853	0.0000 186.4848	0.0000	0.0000 164.9845	0.0000 163.8584	0.0000	0.0000 171.0947	0.0000	0.0000 199.4914	0.0000 220.9042	,
2Total per ye lectric showe		r)						Total pe	er year (kW	h/year) = S	um(64)m =	2278.4321 2278	
	0.0000	0.0000	0.0000	0.0000 Tot	0.0000 al Energy u	0.0000 sed by insta	0.0000 antaneous e	0.0000 lectric show	0.0000 wer(s) (kWh	0.0000 /year) = Su	0.0000 m(64a)m =	0.0000 0.0000	
eat gains fro	m water hea 118.6808	ting, kWh/n 105.4084	nonth 112.7876	100.7110	98.7574	90.1866	89.7137	92.4953	92.6787	101.9421	106.7354	117.5554	(65)
. Internal ga		ble 5 and 5	5a)										
etabolic gain	Jan	, Watts Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
(66)m	114.6842			114.6842	114.6842	114.6842 see Table 5	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	(66)
ighting gains	101.8450	112.7570	101.8450	105.2399	101.8450	105.2399	101.8450	101.8450	105.2399	101.8450	105.2399	101.8450	(07)



Cooking gains	(calculated	d in Appendi 34.4684	x L, equat 34.4684	ion L15 or L 34.4684	.15a), also 34.4684	see Table 34.4684	5 34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	(60)
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	
Losses e.g. e	vaporation -91.7474	(negative va -91.7474	lues) (Tab -91.7474	le 5) -91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	(71)
Water heating	gains (Tab 159.5172	le 5) 156.8577	151.5962	139.8764	132.7385	125.2591	120.5830	124.3217	128.7204	137.0190	148.2436	158.0046	(72)
Total interna	l gains												
	520.6867	531.0345	509.5810	490.0153	465.2933	447.8728	430.8926	432.5361	445.6097	461.7541	490.5628	510.2649	(73)
6 Solan gain													
6. Solar gain													
[Jan]			А	rea	Solar flux		g		FF	Acce	ss	Gains	
				m2	Table 6a W/m2		fic data Table 6b	Specific or Tab		facto Table		W	
North			11.6		10.6334		0.3300		. 8000	0.77	20	22.6639	(74)
West			3.1		19.6403		0.3300		.8000	0.77		11.3187	
Solar gains Total gains	33.9826 554.6693	65.4536 596.4881	110.0617 619.6427	171.3974 661.4127	224.4236 689.7169	237.1985 685.0714	222.6836 653.5763	180.8387 613.3747	130.8975 576.5071	77.8302 539.5842	42.0719 532.6347	28.2017 538.4665	
Ü													. ,
7. Mean inter		ture (heatin	g season)										
Temperature d		ng periods i										21.0000	(85)
Utilisation f	actor for ga	ains for liv Feb	ing area, Mar	ni1,m (see l Apr	Γable 9a) May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
tau alpha	185.0293 13.3353	185.8670 13.3911	186.7123 13.4475	191.0567 13.7371	191.9500 13.7967	196.5445 14.1030	196.5445 14.1030	197.4900 14.1660	194.6806 13.9787	191.9500 13.7967	190.1717 13.6781	188.4261 13.5617	
util living a	rea												(05)
	0.9964	0.9884	0.9571	0.8061	0.5983	0.4050	0.2918	0.3235	0.5237	0.8395	0.9810	0.9972	(86)
MIT Th 2	20.7800 20.3946	20.8489 20.3971	20.9302 20.3997	20.9935 20.4126	20.9999 20.4152	21.0000 20.4282	21.0000 20.4282	21.0000 20.4308	21.0000 20.4230	20.9912 20.4152	20.8979 20.4100	20.7732 20.4049	
util rest of	house 0. 9946	0.9832	0.9411	0.7707	0.5608	0.3688	0.2539	0.2835	0.4800	0.7989	0.9718	0.9959	
MIT 2	20.2019	20.2711	20.3477	20.4089	20.4152	20.4282	20.4282	20.4308	20.4230	20.4105	20.3299	20.2047	(90)
Living area f MIT	20.4203	20.4894	20.5677	20.6298	20.6360	20.6442	20.6442	20.6458	+LA = 20.6410	Living area	a / (4) = 20.5444	0.3778 20.4195	1 1
Temperature a adjusted MIT	djustment 20.4203	20.4894	20.5677	20.6298	20.6360	20.6442	20.6442	20.6458	20.6410	20.6299	20.5444	0.0000 20.4195	(93)
-													
8. Space heat		ment											
Utilisation	Jan 0.9947	Feb 0.9841	Mar 0.9460	Apr 0.7840	May 0.5749	Jun 0.3824	Jul 0.2682	Aug 0.2986	Sep 0.4965	0ct 0.8142	Nov 0.9742	Dec 0.9959	(94)
Useful gains	551.7436	587.0079	586.1776	518.5598	396.5416	261.9978	175.3038	183.1621	286.2379	439.3526	518.9097	536.2733	(95)
Ext temp. Heat loss rat	e W	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Space heating	742.2551 kWh	714.5743	641.9076	523.0557	396.6232	261.9980	175.3038	183.1621	286.2460	445.1743	602.3064	733.3596	(97)
Space heating	141.7405	85.7246 t - total pe	41.4631 r vear (kW	3.2370 h/vear)	0.0607	0.0000	0.0000	0.0000	0.0000	4.3314	60.0456	146.6322 483.2351	(98a)
Solar heating		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(00h)
Solar heating	contributi				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(300)
Space heating	kWh 141.7405	85.7246	41.4631	3.2370	0.0607	0.0000	0.0000	0.0000	0.0000	4.3314	60.0456	146.6322	(98c)
Space heating Space heating		t after sola	r contribu	tion - total	l per year	(kWh/year)				(98c) / (4) =	483.2351 6.7116	(99)
	F									(, , (-,		()
9a. Energy re		- Individual											
Fraction of s		rom secondar										0.0000	(201)
Fraction of s	pace heat f	rom main sys	tem(s)		•	•						1.0000	(202)
Efficiency of Efficiency of	main space	heating sys	tem 2 (in	%)								84.5000 0.0000	(207)
Efficiency of	secondary/	supplementar	y heating	system, %								0.0000	(208)
Space heating	Jan requiremen	Feb t	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
	141.7405	85.7246	41.4631	3.2370	0.0607	0.0000	0.0000	0.0000	0.0000	4.3314	60.0456	146.6322	(98)
Space heating	84.5000	84.5000	84.5000	1) 84.5000	84.5000	0.0000	0.0000	0.0000	0.0000	84.5000	84.5000	84.5000	(210)
Space heating	fuel (main 167.7403	heating sys	tem) 49.0688	3.8308	0.0718	0.0000	0.0000	0.0000	0.0000	5.1259	71.0599	173.5292	(211)
Space heating					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Space heating	fuel (main	heating sys	tem 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)

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pace heating fuel (secondary) 0.0000 0.0000	0.0000 0.000	0 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215
ater heating ater heating requirement									
223.0783 197.3452 fficiency of water heater	210.1853 186.484	8 181.8109	164.9845	163.8584	169.8482	171.0947	189.3460	199.4914	220.9042 (64) 89.5000 (216
217)m 84.5000 84.5000	84.5000 84.500	0 84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000 (217
uel for water heating, kWh/month 263.9980 233.5446	248.7401 220.692	1 215.1609	195.2479	193.9153	201.0038	202.4790	224.0781	236.0845	261.4251 (219
pace cooling fuel requirement 221)m 0.0000 0.0000	0.0000 0.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221
umps and Fa 16.2581 14.6847 ighting 18.7104 15.0102	16.2581 15.733 13.5150 9.901		15.7336 6.2488	16.2581 6.9771	16.2581 9.0691	15.7336 11.7798	16.2581 15.4557	15.7336 17.4572	16.2581 (231 19.2304 (232
lectricity generated by PVs (Append 233a)m 0.0000 0.0000		ntity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233
lectricity generated by wind turbin		gative quanti		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234
lectricity generated by hydro-elect	ric generators (App	endix M) (neg	gative quant	ity)					
235a)m 0.0000 0.0000 lectricity used or net electricity		CHP (Appendix		0.0000 ve if net g		0.0000	0.0000	0.0000	0.0000 (235
235c)m 0.0000 0.0000 Lectricity generated by PVs (Append	0.0000 0.000 ix M) (negative qua		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235
233b)m 0.0000 0.0000 Lectricity generated by wind turbin	0.0000 0.000 es (Appendix M) (ne		0.0000 tv)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233
234b)m 0.0000 0.0000 lectricity generated by hydro-elect	0.0000 0.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234
235b)m 0.0000 0.0000	0.0000 0.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235
lectricity used or net electricity 235d)m 0.0000 0.0000	0.0000 0.000		0.0000	ve if net g 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235
nnual totals kWh/year Dace heating fuel - main system 1									571.8759 (211
pace heating fuel - main system 2 pace heating fuel - secondary									0.0000 (213 0.0000 (215
fficiency of water heater ater heating fuel used									89.5000 ` 2696.3693 (219
pace cooling fuel									0.0000 (221
lectricity for pumps and fans:									
(BalancedWithHeatRecovery, Datab mechanical ventilation fans (SFP		= 1.2500, SFP	9 = 0.6250)						150.4260 (236
central heating pump otal electricity for the above, kWh	/vear								41.0000 (236 191.4260 (231
lectricity for lighting (calculated									151.0036 (232
nergy saving/generation technologie / generation	s (Appendices M ,N	and Q)							0.0000 (233
ind generation	•••								0.0000 (234
ydro-electric generation (Appendix lectricity generated - Micro CHP (A									0.0000 (235 0.0000 (235
ppendix Q - special features nergy saved or generated									-0.0000 (236
nergy used otal delivered energy for all uses									0.0000 (237 3610.6748 (238
2a. Carbon dioxide emissions - Indi	vidual heating syst	ems including							
					Energy		ion factor		Emissions
pace heating - main system 1					kWh/year 571.8759		kg CO2/kWh 0.2100	K	g CO2/year 120.0939 (261
otal CO2 associated with community ater heating (other fuel)	systems				2696.3693		0.2100		0.0000 (373 566.2376 (264
pace and water heating umps, fans and electric keep-hot					191.4260		0.1387		686.3315 (265 26.5531 (267
nergy for lighting					151.0036		0.1443		21.7945 (268
otal CO2, kg/year PC Dwelling Carbon Dioxide Emission	Rate (DER)								734.6791 (272 10.2000 (273
Ba. Primary energy - Individual hea	ting systems includ	ing micro-CHP	•						
						Primary ene	rgy factor kg CO2/kWh	Prim	ary energy kWh/year
pace heating - main system 1	cystoms				571.8759		1.1300		646.2198 (275
otal CO2 associated with community ater heating (other fuel)	systems				2696.3693		1.1300		0.0000 (473 3046.8973 (278
pace and water heating umps, fans and electric keep-hot					191.4260		1.5128		3693.1171 (279 289.5893 (281
nergy for lighting otal Primary energy kWh/year					151.0036		1.5338		231.6144 (282 4214.3207 (286
welling Primary energy Rate (DPER)									58.5300 (287
I TO MOUVEHIEF LOW MEM BRITTH (AS D	restRuca) (AGL210U	10.2, reprud	ny 2022)						



		SSIONS											
1. Overall dwe													
Ground floor								Area (m2) 72.0000		ey height (m) 2.7400	(2b) =	Volume (m3) 197.2800	(1b)
Total floor are Dwelling volum		a)+(1b)+(1c))+(1d)+(1e)	(1n)	7	2.0000		(3a)+(3b)+(3c)	+(3d)+(3e))(3n) =	197.2800	(4) (5)
2. Ventilation													
											m3	per hour	
Number of open Number of open Number of chim Number of flue Number of bloc Number of inte Number of pass Number of flue	flues neys / flues s attached s attached ked chimney rmittent ex ive vents	to solid fuo to other hea s tract fans	el boiler	ire							0 * 80 = 0 * 20 = 0 * 10 = 0 * 20 = 0 * 35 = 0 * 20 = 3 * 10 = 0 * 10 = 0 * 40 =	0.0000 0.0000 0.0000 0.0000 0.0000 30.0000 0.0000	(6b) (6c) (6d) (6e) (6e) (6f) (7a)
Infiltration de Pressure test Pressure Test Pressure Test Pressured/design infiltration relumber of side	Method n AP50 ate		and fans	= (6a)+(6b)	+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7	7b)+(7c) =		30.0000	Air changes 3 / (5) = Blo	0.1521 Yes ower Door 5.0000 0.4021	(8)
Shelter factor Infiltration r	ate adjuste	d to include	e shelter f	actor					(20) = 1 - (2		x (19)] = x (20) =	0.8500 0.3418	
Wind speed Wind factor Adj infilt rat	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250		Oct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	
Effective ac	0.4357 0.5949	0.4272 0.5912	0.4187 0.5876	0.3759 0.5707	0.3674 0.5675	0.3247 0.5527	0.3247 0.5527	0.3161 0.5500		0.3674 0.5675	0.3845 0.5739	0.4016 0.5806	
3. Heat losses	and heat l	oss parameto	 er										
Element TER Opening Ty	ne (llw - 1 :	20)		Gross m2	Openings m2		Area m2 8000	U-value W/m2K 1.1450	A x W/ 16.946	K	<-value kJ/m2K	A x K kJ/K	
External Wall Total net area Fabric heat lo Party Wall 1	1 of externa	l elements /		47.8404	14.8000	33. 47.	0404 8404	0.1800 30) + (32) 0.0000	5.947	8			(29a) (31) (33) (32)
Thermal mass p		MP = Cm / TI	FA) in kJ/m	n2K								435.9816	
List of Therma K1 Ele E2 Oth E3 Sil E4 Jam	ment er lintels l	(including o	other steel	lintels)					Length P 7.5700 5.9900 7.1000	si-value 0.0500 0.0500 0.0500	Total 0.3785 0.2995 0.8550	;	
E18 Pa E16 Co E8 Bal	rty wall be rner (norma cony within	tween dwell: l) a dwelling	ings , wall insu	ocks of fla	·	2)			4.9200 5.4800 2.7400 5.8000 2.7400	0.0700 0.0600 0.0900 0.0000 -0.0900	2.4444 0.3288 0.2466 0.0000 -0.2466	3 5	
Thermal bridge Point Thermal Total fabric h	s (Sum(L x l bridges					a)					(36a) = + (36a) =	4.3062 0.0000 27.2000	
Ventilation he	at loss cal Jan 38.7317	culated mon [.] Feb 38.4917	thly (38)m Mar 38.2565	= 0.33 x (2 Apr 37.1515	5)m x (5) May 36.9448	Jun 35.9824	Jul 35.9824	Aug 35.8042	Sep 36.3531	0ct 36.9448	Nov 37.3630	Dec 37.8002	(38)
Heat transfer Average = Sum(65.9317	65.6918	65.4565	64.3516	64.1448	63.1825	63.1825	63.0043	63.5532	64.1448	64.5631	65.0003 64.3506	
HLP	Jan 0.9157	Feb 0.9124	Mar 0.9091	Apr 0.8938	May 0.8909	Jun 0.8775	Jul 0.8775	Aug 0.8751	Sep 0.8827	Oct 0.8909	Nov 0.8967	Dec 0.9028	
HLP (average) Days in mont	31	28	31	30	31	30	31	31	30	31	30	0.8938 31	

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Full SAP Calculation Printout



. Water heat:	ing energy r	requirement	s (kWh/year	`)									
ssumed occupa	ancy											2.2937	(42)
ot water usag	62.6772	61.7353	60.3627	57.7366	55.7986	53.6373	52.4088	53.7710	55.2642	57.5847	60.2673	62.4371	(42a
ot water usag	27.0765	26.6744	26.1081	25.0640	24.2822	23.4152	22.9470	23.5093	24.1216	25.0492	26.1148	26.9849	(42b
verage daily	38.1196	36.7335	35.3473 /day)	33.9611	32.5749	31.1888	31.1888	32.5749	33.9611	35.3473	36.7335	38.1196 117.5446	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
aily hot wate	127.8733	125.1431	121.8181	116.7617	112.6557	108.2413	106.5446	109.8552	113.3469	117.9812	123.1155	127.5416	(44)
nergy conte nergy content istribution :	(annual)	178.2021 = 0.15 x (187.2299	159.8409	151.6562	133.0953	128.8565	136.0237	139.7680	160.0994 Total = S	175.4006 um(45)m =	199.6994 1952.3920	(45)
ater storage	30.3780	26.7303	28.0845	23.9761	22.7484	19.9643	19.3285	20.4036	20.9652	24.0149	26.3101	29.9549	(46)
tore volume) If manufac Temperature nter (49) or	factor from	n Table 2b	actor is kn	nown (kWh/	day):							180.0000 1.5520 0.5400 0.8381	(48) (49)
otal storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
f cylinder co	25.9803	23.4661	25.9803	25.1422		25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	
rimary loss ombi loss otal heat re	23.2624 0.0000	21.0112 0.0000	23.2624 0.0000	22.5120 0.0000	0.0000	22.5120 0.0000	23.2624 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	
otal neat rec WHRS	251.7627 -28.6534	222.6793 -25.3413	236.4725 -26.5360	207.4951 -21.9728	200.8989	180.7495 -17.5231	178.0991 -16.4251	185.2664 -17.4664	187.4222 -18.1300	209.3420 -21.3733	223.0548 -24.2134	248.9420 -28.1228	
V 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
olar input GHRS utput from w,	0.0000 0.0000 /h	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000		0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	
2Total per ye	223.1093	197.3380 ar)	209.9366	185.5223	180.4210	163.2265	161.6740	167.8000 Total pe	169.2922 er year (kW	187.9687 h/year) = S	198.8415 um(64)m =	220.8192 2265.9493 2266	(64)
ectric showe	er(s) 0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
eat gains fro	om water hea	ating, kWh/ 94.8340	month 101.6481	91.2705	tal Energy us 89.8198	82.3776	82.2389	84.6220	84.5962	/year) = Su 92.6272	96.4441	0.0000 105.7942	
opliances ga	Jan 114.6842 (calculate 102.2951 ins (calculate 201.9192 (calculated 34.4684 3.0000 /aporation (-91.7474	Feb 114.6842 ed in Appen 113.2553 ted in App 204.0145 d in Append 34.4684 3.0000 (negative v. -91.7474	102.2951 endix L, eq 198.7344 ix L, equat 34.4684 3.0000	105.7050 quation L13 187.4938 ion L15 or 34.4684 3.0000	L9a), also s 102.2951 or L13a), al 173.3045 L15a), also 34.4684 3.0000	105.7050 lso see Tab 159.9686	151.0594	Aug 114.6842 102.2951 148.9641 34.4684 0.0000 -91.7474	Sep 114.6842 105.7050 154.2442 34.4684 0.0000 -91.7474	0ct 114.6842 102.2951 165.4848 34.4684 3.0000	Nov 114.6842 105.7050 179.6741 34.4684 3.0000	Dec 114.6842 102.2951 193.0100 34.4684 3.0000 -91.7474	(67) (68) (69) (70)
otal interna	143.4571	141.1220	136.6237	126.7645	120.7256	114.4133	110.5362	113.7393	117.4948	124.4989	133.9501	142.1965	(72)
	508.0767	518.7971	498.0586	480.3686	456.7305	437.4921	421.2960	422.4038	434.8492	452.6841	479.7344	497.9068	(73)
. Solar gain	5												
Jan]				rea m2	Solar flux Table 6a W/m2		g fic data Table 6b	Specific or Tabi		Acce fact Table	or	Gains W	
orth est			11.6	500 .500	10.6334 19.6403		0.6300 0.6300		.7000 .7000	0.77 0.77		37.8590 18.9073	- : :
olar gains otal gains	56.7663 564.8430	109.3373 628.1344	183.8531 681.9117	286.3115 766.6801		396.2294 833.7215	371.9829 793.2788	302.0828 724.4866	218.6582 653.5074	130.0117 582.6958	70.2792 550.0136	47.1096 545.0165	
					031.0199				333.3074	502.0930	330.0130	5,5,0103	(04
					om Table 9, 1							21.0000	(85
tilisation f						Jun	Jul	Aug	Sep	0ct	Nov	Dec	
au	132.2524	132.7356	133.2126	135.4999		138.0071	138.0071	138.3975	137.2022	135.9366	135.0561	134.1476	



		0.0400	9.8808	10.0333	10.0624	10.2005	10.2005	10 2265	10 1460	10.0624	10.0037		
lpha	9.8168	9.8490	2.0000	10.0333	10.0024		10.2003	10.2265	10.1468	10.0024	10.003/	9.9432	
til living a	nea 0.9993	0.9976	0.9890	0.9162	0.7100	0.4849	0.3504	0.4000	0.6671	0.9582	0.9971	0.9995	(86)
IT	20.4830	20.5846	20.7351	20.9264	20.9941	20.9999	21.0000	21.0000	20.9975	20.8949	20.6630	20.4720	(87)
h 2 til rest of h	20.1542 house	20.1570	20.1598	20.1728	20.1752	20.1866	20.1866	20.1888	20.1822	20.1752	20.1703	20.1651	(88)
IT 2	0.9989	0.9962 19.6914	0.9828	0.8822	0.6505	0.4233	0.2857	0.3295	0.5903 20.1813	0.9316 20.0868	0.9951 19.8029	0.9992	
iving area f			19.8827	20.1120	20.1720	20.1866	20.1866	20.1887	fLA =	Living area	(4) =	19.5546 0.3778	(91)
IT emperature ad	19.9084 diustment	20.0288	20.2047	20.4197	20.4826	20.4938	20.4939	20.4952	20.4896	20.3921	20.1278	19.9011 0.0000	(92)
djusted MIT	19.9084	20.0288	20.2047	20.4197	20.4826	20.4938	20.4939	20.4952	20.4896	20.3921	20.1278	19.9011	(93)
. Space heat:													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
cilisation seful gains	0.9987 564.1361	0.9960 625.5974	0.9832 670.4449	0.8933 684.8796	0.6730 559.6967	0.4466 372.3318	0.3101 246.0255	0.3561 258.0118	0.6195 404.8458	0.9398 547.5963	0.9950 547.2713	0.9991 544.5195	•
t 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	
at loss rate	1029.0870	993.8388	897.0630	741.3085	563.3554	372.3872	246.0266	258.0161	406.0825	628.1106	841.1175	1020.5787	(97
ace heating	kWh 345.9235	247.4582	168.6039	40.6288	2.7220	0.0000	0.0000	0.0000	0.0000	59.9027	211.5693	354.1880	(98
oace heating olar heating	requirement kWh	- total pe	er year (kWl	h/year)								1430.9965	•
lar heating ace heating	0.0000 contributio kWh	0.0000 n - total	0.0000 per year (kl	0.0000 Wh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98
_	345.9235		168.6039	40.6288	2.7220	0.0000	0.0000	0.0000	0.0000	59.9027	211.5693	354.1880	(98
ace heating	requirement per m2	arter sol	ar contribu	tion - total	per year	(KWN/year)				(98c)	/ (4) =	1430.9965 19.8750	(99
	quirements -												
													,_
action of sp	pace heat fr	om secondai	ry/suppleme≀	ntary system	ı (Table 11)						0.0000 1.0000	
eaction of sm	nace heat fr	om main sv	stem(s)										
				%)								92.3000	
raction of sp fficiency of fficiency of	main space main space	heating sys heating sys	stem 1 (in S stem 2 (in S	%)								92.3000 0.0000	(20
ficiency of ficiency of	main space main space secondary/s	heating sys heating sys upplementa	stem 1 (in S stem 2 (in S ry heating	%) system, %								92.3000 0.0000 0.0000	(20
ficiency of ficiency of ficiency of	main space main space secondary/s Jan requirement	heating sys heating sys upplementar	stem 1 (in S stem 2 (in S	%)	May	Jun	Jul	Aug	Sep	Oct	Nov	92.3000 0.0000	(20
ficiency of ficiency of ficiency of ace heating	main space main space secondary/s Jan requirement 345.9235	heating sy: heating sy: upplemental Feb 247.4582	stem 1 (in S stem 2 (in S ry heating S Mar 168.6039	%) system, % Apr 40.6288	May 2.7220	Jun 0.0000	Jul 0.0000	Aug 0.0000	Sep 0.0000	Oct 59.9027	Nov 211.5693	92.3000 0.0000 0.0000	(26)
ficiency of ficiency of ficiency of ace heating	main space main space secondary/s Jan requirement 345.9235 efficiency 92.3000	heating system the system of t	stem 1 (in 5 stem 2 (in 5 ry heating s	%) system, % Apr 40.6288	-			_				92.3000 0.0000 0.0000 Dec	(26)
ficiency of ficiency of ficiency of ace heating ace heating	main space main space secondary/s Jan requirement 345.9235 efficiency 92.3000 fuel (main 374.7817	heating symplemental Feb 247.4582 (main heat: 92.3000 heating symplemental)	Mar 168.6039 ing system 92.3000 stem) 182.6695	%) system, % Apr 40.6288 1) 92.3000 44.0182	2.7220	0.0000	0.0000	0.0000	0.0000	59.9027	211.5693	92.3000 0.0000 0.0000 Dec 354.1880	(26)
ficiency of ficiency of ficiency of ace heating ace heating ace heating	main space main space secondary/s Jan requirement 345.9235 efficiency 92.3000 fuel (main 374.7817	heating symplemental Feb 247.4582 (main heat: 92.3000 heating symplemental)	Mar 168.6039 ing system 92.3000 stem) 182.6695	%) system, % Apr 40.6288 1) 92.3000 44.0182	2.7220	0.0000 0.0000	0.0000	0.0000	0.0000	59.9027 92.3000	211.5693 92.3000	92.3000 0.0000 0.0000 Dec 354.1880 92.3000	(20 (20 (20 (20 (20 (20)
ficiency of ficiency of ficiency of ace heating ace heating ace heating ace heating	main space main space secondary/s Jan requirement 345.9235 efficiency 92.3000 fuel (main 374.7817 efficiency 0.0000 fuel (main	heating symplemental Feb 247.4582 (main heat: 92.3000 heating symplemental feb. 1021 (main heat: 0.0000 heating symplemental feb. 1021	stem 1 (in 5 stem 2 (in 5 ry heating : Mar 168.6039 ing system : 92.3000 stem) 182.6695 ing system : 0.0000 stem 2)	%) system, % Apr 40.6288 1) 92.3000 44.0182 2) 0.0000	2.7220 92.3000 2.9491 0.0000	9.00009.00009.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	59.9027 92.3000 64.9000 0.0000	211.5693 92.3000 229.2192 0.0000	92.3000 0.0000 0.0000 Dec 354.1880 92.3000 383.7357 0.0000	(2 (2 (2 (2 (2 (2 (2
ficiency of ficiency of ficiency of ace heating ace heating ace heating ace heating ace heating ace heating	main space main space main space secondary/s Jan requirement 345.9235 efficiency 92.3000 fuel (main 374.7817 efficiency 0.0000 fuel (main 0.0000	heating symbol heating symplemental Feb 247.4582 (main heat: 92.3000 heating symplements) (main heat: 0.0000 heating symplementing symplements) (main deat: 0.0000)	Mar 168.6039 ing system: 92.3000 stem) 182.6695 ing system: 0.0000	%) system, % Apr 40.6288 1) 92.3000 44.0182	2.7220 92.3000 2.9491	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	59.9027 92.3000 64.9000	211.5693 92.3000 229.2192	92.3000 0.0000 0.0000 Dec 354.1880 92.3000 383.7357 0.0000	(2) (2) (2) (2) (2) (2)
ficiency of ficiency of ficiency of ficiency of ace heating	main space main space secondary/s Jan requirement 345.9235 efficiency 92.3000 fuel (main 374.7817 efficiency 9.0000 fuel (main 0.0000 fuel (secon 0.0000	heating sy: heating sy: upplemental Feb 247.4582 (main heat: 92.3000 heating sy: 268.1021 (main heat: 0.0000 heating sy: 0.0000 dary)	Mar 168.6039 ing system: 92.3000 stem) 182.6695 ing system: 0.0000 stem 2) 0.0000	%) system, % Apr 40.6288 1) 92.3000 44.0182 2) 0.0000 0.0000	2.7220 92.3000 2.9491 0.0000 0.0000	e.0000e.0000e.0000e.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	59.9027 92.3000 64.9000 0.0000	211.5693 92.3000 229.2192 0.0000 0.0000	92.3000 0.0000 0.0000 Dec 354.1880 92.3000 383.7357 0.0000	(2 (2 (2 (2 (2 (2 (2 (2
ficiency of ficiency of ficiency of ficiency of ace heating	main space main space secondary/s Jan requirement 345.9235 efficiency 92.3000 fuel (main 374.7817 efficiency 0.0000 fuel (main 0.0000 fuel (secon 0.0000 requirement	heating symbol heatin	stem 1 (in stem 2 (in	%) system, % Apr 40.6288 1) 92.3000 44.0182 2) 0.0000 0.0000	2.7220 92.3000 2.9491 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	59.9027 92.3000 64.9000 0.0000 0.0000	211.5693 92.3000 229.2192 0.0000 0.0000	92.3000 0.0000 0.0000 Dec 354.1880 92.3000 383.7357 0.0000 0.0000	(2) (2) (2) (2) (2) (2) (2) (2)
ficiency of ficiency of ficiency of ficiency of ace heating ficiency of ficiency of	main space main space main space secondary/s Jan requirement 345.9235 efficiency 92.3000 fuel (main 374.7817 efficiency 0.0000 fuel (secon 0.0000 requirement 223.1093 water heate	heating symbol heatin	Mar 168.6039 ing system 92.3000 stem) 182.6695 ing system 0.0000 stem 2) 0.0000 209.9366	%) system, % Apr 40.6288 1) 92.3000 44.0182 2) 0.0000 0.0000 185.5223	2.7220 92.3000 2.9491 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	59.9027 92.3000 64.9000 0.0000 0.0000 187.9687	211.5693 92.3000 229.2192 0.0000 0.0000 0.0000	92.3000 0.0000 0.0000 Dec 354.1880 92.3000 383.7357 0.0000 0.0000	(2 (2 (2 (2 (2 (2 (2 (2
ficiency of ficiency of ficiency of ficiency of ace heating ace heating ace heating ace heating ace heating ace heating ficiency of 17)m	main space main space main space secondary/s Jan requirement 345.9235 efficiency 92.3000 fuel (main 374.7817 efficiency 0.0000 fuel (main 0.0000 fuel (secon 0.0000) requirement 223.1093 water heate 85.0395 rheating, ki	heating symbol heating symplemental Feb 247.4582 (main heat: 92.3000 heating symbol heating symb	Mar 168.6039 ing system: 92.3000 stem) 182.6695 ing system: 0.0000 stem) 0.0000 209.9366 83.5727	%) system, % Apr 40.6288 1) 92.3000 44.0182 2) 0.0000 0.0000 185.5223 81.2800	2.7220 92.3000 2.9491 0.0000 0.0000 180.4210 79.9204	0.0000 0.0000 0.0000 0.0000 0.0000 163.2265 79.8000	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 161.6740 79.8000	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 167.8000 79.8000	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 169.2922 79.8000	59.9027 92.3000 64.9000 0.0000 0.0000 187.9687 81.8037	211.5693 92.3000 229.2192 0.0000 0.0000 198.8415 84.1992	92.3000 0.0000 0.0000 Dec 354.1880 92.3000 383.7357 0.0000 0.0000 220.8192 79.8000 85.1136	(2) (2) (2) (2) (2) (2) (2) (2) (2)
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Full SAP Calculation Printout



Space cooling fuel			0.0000 (2	.21)
Electricity for pumps and fans:				
Total electricity for the above, kWh/year			86.0000 (2	31)
Electricity for lighting (calculated in Appendix L)			171.5393 (2	.32)
Energy saving/generation technologies (Appendices M ,N and Q)				
PV generation			-323.5255 (2	
Wind generation			0.0000 (2	,
Hydro-electric generation (Appendix N)			0.0000 (2	
Electricity generated - Micro CHP (Appendix N) Appendix Q - special features			0.0000 (2	35)
Energy saved or generated			-0.0000 (2	36)
Energy used			0.0000 (2	,
Total delivered energy for all uses			4240.2418 (2	
12a. Carbon dioxide emissions - Individual heating systems including micro-C	THP	Emission factor	Emissions	
	kWh/year	kg CO2/kWh	kg CO2/year	
Space heating - main system 1	1550.3754	0.2100	325.5788 (2	
Total CO2 associated with community systems			0.0000 (3	
Water heating (other fuel)	2755.8526	0.2100	578.7291 (2	,
Space and water heating Pumps, fans and electric keep-hot	86.0000	0.1387	904.3079 (2 11.9293 (2	
Energy for lighting	171.5393	0.1443	24.7584 (2	
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-220.6887	0.1326	-29,2744	
PV Unit electricity exported	-102.8368	0.1248	-12.8326	
Total			-42.1069 (2	69)
Total CO2, kg/year			898.8886 (2	72)
EPC Target Carbon Dioxide Emission Rate (TER)			12.4800 (2	73)
13a. Primary energy - Individual heating systems including micro-CHP				
13a. Primary energy - Individual heating systems including micro-CHP		imary energy factor	Primary energy	
		imary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	Energy Pr			75)
Space heating - main system 1 Total CO2 associated with community systems	Energy Pr kWh/year 1550.3754	kg CO2/kWh 1.1300	kWh/year 1751.9242 (2 0.0000 (4	73)
Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel)	Energy Pr kWh/year	kg CO2/kWh	kWh/year 1751.9242 (2 0.0000 (4 3114.1135 (2	73) 78)
Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Space and water heating	Energy Pr kWh/year 1550.3754 2755.8526	kg CO2/kWh 1.1300 1.1300	kWh/year 1751.9242 (2 0.0000 (4 3114.1135 (2 4866.0377 (2	73) 78) 79)
Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Space and water heating Pumps, fans and electric keep-hot	Energy Pr kWh/year 1550.3754 2755.8526 86.0000	kg CO2/kWh 1.1300 1.1300 1.5128	kWh/year 1751.9242 (2 0.0000 (4 3114.1135 (2 4866.9377 (2 130.1008 (2	73) 278) 279) 281)
Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Space and water heating Pumps, fans and electric keep-hot	Energy Pr kWh/year 1550.3754 2755.8526	kg CO2/kWh 1.1300 1.1300	kWh/year 1751.9242 (2 0.0000 (4 3114.1135 (2 4866.0377 (2	73) 278) 279) 281)
Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel)	Energy Pr kWh/year 1550.3754 2755.8526 86.0000	kg CO2/kWh 1.1300 1.1300 1.5128	kWh/year 1751.9242 (2 0.0000 (4 3114.1135 (2 4866.9377 (2 130.1008 (2	73) 278) 279) 281)
Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Space and water heating Pumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies PV Unit electricity used in dwelling	Energy Pr kWh/year 1550.3754 2755.8526 86.0000 171.5393	kg CO2/kWh 1.1300 1.1300 1.5128 1.5338	kWh/year 1751.9242 (2 0.0000 (4 3114.1135 (2 4866.3377 (2 130.1008 (2 263.1127 (2	73) 278) 279) 281)
Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Space and water heating Pumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported	Energy Pr kWh/year 1550.3754 2755.8526 86.0000 171.5393	kg CO2/kWh 1.1300 1.1300 1.5128 1.5338	kWh/year 1751.9242 (2 0.0000 (4 3114.1135 (2 4866.9377 (2 130.1008 (2 263.1127 (2	173) 178) 179) 181) 182)
Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Space and water heating Pumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total	Energy Pr kWh/year 1550.3754 2755.8526 86.0000 171.5393	kg CO2/kWh 1.1300 1.1300 1.5128 1.5338	kWh/year 1751.9242 (2 0.0000 (4 3114.1135 (2 4866.0377 (2 130.1008 (2 263.1127 (2 -328.8571 -47.0988 -375.9559 (2	(73) (78) (79) (81) (82)
Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Space and water heating Pumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported	Energy Pr kWh/year 1550.3754 2755.8526 86.0000 171.5393	kg CO2/kWh 1.1300 1.1300 1.5128 1.5338	kWh/year 1751.9242 (2 0.0000 (4 3114.1135 (2 4866.9377 (2 130.1008 (2 263.1127 (2	(73) (78) (79) (81) (82) (83) (86)



Property Reference		L02	2.02 x1_Copy_Copy	/_Сору					Issue	d on Date	12/0	09/2023	
Assessment Referen	се	L02	2.02 x1_Copy_Copy	_Copy			Prop	Type Ref					
Property													
SAP Rating				8	7 B	DER		9.11		TER		10.15	
Environmental				9-	1 B	% DE	R < TER					10.25	
CO: Emissions (t/yea	r)			0.	97	DFEE		23.27		TFEE		30.66	
Compliance Check				S	ee BREL	% DF	EE < TFEE					24.11	
% DPER < TPER				1.	59	DPER		53.03		TPER		53.88	
Assessor Details		Mr. Richar	rd Denteh							Assessor I	D	U148-0001	
Client													
SAP 10 WORKSHEE CALCULATION OF I	DWELLING EMI	SSIONS F	OR REGULATIC	NS COMPLIAN	CE	2022)		Area (m2) 61.9000 61.8000	(1b) x	ey height (m) 2.5000 2.9500 +(3d)+(3e	(2b) = (2c) =	Volume (m3) 154.7500 182.3100 337.0600	(1b) - (1c) - (4)
2. Ventilation	rate											m3 per hour	
Number of open of Number of open of Number of chimmon Number of flues Number of block Number of intern Number of passi Number of flueld	flues eys / flues attached to attached to ed chimneys mittent extr ve vents	solid for solid for solid fact fans	uel boiler meater	ire							0 * 80 = 0 * 20 = 0 * 10 = 0 * 20 = 0 * 35 = 0 * 20 = 0 * 10 = 0 * 10 = 0 * 40 =	0.0000	(6b) (6c) (6d) (6e) (6e) (6f) (7a) (7b)
Infiltration due Pressure test Pressure Test M Measured/design Infiltration rat Number of sides	ethod AP50 te	s, flues	and fans	= (6a)+(6b)	+(6c)+(6d)+((6e)+(6f)+(6	ig)+(7a)+(7	7b)+(7c) =		0.000	Air chang 0 / (5) =	ges per hour 0.0000 Yes Blower Door 3.0000 0.1500	(8)
Shelter factor Infiltration ra	te adjusted	to inclu	ıde shelter f	actor					(20) = 1 - (2		x (19)] = x (20) =	0.9250 0.1388	
Wind speed Wind factor Adj infilt rate	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	1.0000	0ct 4.3000 1.0750	1.1256	1.1750	(22a)
Balanced mechar If mechanical vo If exhaust air M If balanced with	entilation neat pump us	ing Appe	endix N, (23b	i) = (23a) x						0.1492	0.1561	0.1630 0.5000 0.5000 43.0000	(23a) (23b)
Effective ac	0.4619	0.4584	0.4550	0.4376	0.4342	0.4168	0.4168	0.4133	0.4238	0.4342	0.4411	0.4480	(25)
3. Heat losses a	and heat los	s parame											
Element				Gross m2	Openings m2	NetA	rea m2	U-value W/m2K	A x W/		K-value kJ/m2K	A x K kJ/K	
window (Uw = 0.8 External Wall 1	30)		1	.27.4340	23.5000	23.5 103.9	000	0.7752 0.1300	18.217 13.511	1	90.0000	19747.4600	(27)

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External Roof 1		al elements	Διιm(Δ m2)	8.0000			.0000 .4340	0.1000	0.800	90	9.0000	72.0000	(30) (31)
Fabric heat los Party Wall 1 Party Floor 1			7.u(7.)2)			67		30) + (32) 0.0000	= 32.528 0.000	90 18	9.0000 9.0000	12114.0000 2476.0000	(33) (32) (32d)
Party Ceiling 1 Internal Wall 1 Internal Floor	1					221	.8000 .5800 .8000				0.0000 9.0000 8.0000	1614.0000 1994.2200 1112.4000	(32c)
Heat capacity (Thermal mass pa List of Therma	arameter (1		TFA) in kJ/r	m2K				(28).	(30) + (32	2) + (32a).	(32e) =	39130.0800 316.3305	
K1 Eler	ment er lintels	(including	other stee	l lintels)				17	ength F .1500 .5700	9si-value 0.0500 0.0500	Tot 0.85 0.77	75	
E16 Cor	ermediate f rner (norma		n a dwelling lings	g				23 16	.5200 .5000 .2000 .8000	0.0500 0.0000 0.0900 0.0600	1.67 0.00 1.45 0.64	900 80	
E24 Eav E14 Fla	ves (insula at roof	ation at ce	lings (in bi	- inverted)			4	.1000 .1000 .1000	0.0700 0.1500 0.0800	2.52 0.61 0.64	.50 180	(26)
Thermal bridges Point Thermal b Total fabric he	bridges	PSI) Calcu	iated using	Appendix K)				(3	33) + (36)	(36a) = + (36a) =	9.2080 0.0000 41.7365	
Ventilation head	Jan 51.3777	lculated mo Feb 50.9919	nthly (38)m Mar 50.6061	= 0.33 x (Apr 48.6769	25)m x (5) May 48.2911	Jun 46.3620	Jul 46.3620	Aug 45.9761	Sep 47.1336	0ct 48.2911	Nov 49.0628	Dec 49.8344	(38)
Heat transfer of Average = Sum(93.1142	92.7284	92.3426	90.4134	90.0276	88.0984	88.0984	87.7126	88.8701	90.0276	90.7992	91.5709 90.3170	(39)
HLP HLP (average)	Jan 0.7527	Feb 0.7496	Mar 0.7465	Apr 0.7309	May 0.7278	Jun 0.7122	Jul 0.7122	Aug 0.7091	Sep 0.7184	0ct 0.7278	Nov 0.7340	Dec 0.7403 0.7301	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	
4. Water heatin	ng energy r	requirement	s (kWh/year))									
Assumed occupar Hot water usage		showers										2.8765	(42)
Hot water usage	99.6188 e for baths	98.1217	95.9402	91.7662	88.6859	85.2508	83.2983	85.4634	87.8366	91.5249	95.7885	99.2371	(42a)
Hot water usage	31.2791 e for other	30.8146 uses	30.1604	28.9542	28.0511	27.0496	26.5087	27.1583	27.8655	28.9372	30.1682	31.1734	(42b)
Average daily h	44.0887 hot water ι	42.4855 use (litres	40.8823 /day)	39.2790	37.6758	36.0726	36.0726	37.6758	39.2790	40.8823	42.4855	44.0887 160.9265	
Daily hot water	Jan r use	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
Energy conte Energy content		171.4218 244.1024	166.9829 256.6465	159.9995 219.0313	154.4128 207.8694	148.3730 182.4420	145.8796 176.4287	150.2974 186.0996	154.9812 191.1073	161.3443 218.9427 Total = S	168.4422 239.9767 um(45)m =	174.4992 273.2236 2673.0063	
Distribution lo	41.5704	= 0.15 x (36.6154	45)m 38.4970	32.8547	31.1804	27.3663	26.4643	27.9149	28.6661	32.8414	35.9965	40.9835	(46)
Store volume a) If manufact Temperature tenter (49) or (factor from (54) in (55	n Table 2b	actor is kno	own (kWh/d	ay):							180.0000 1.5500 0.5400 0.8370	(48) (49)
Total storage I	25.9470	23.4360	25.9470	25.1100	25.9470	25.1100	25.9470	25.9470	25.1100	25.9470	25.1100	25.9470	(56)
If cylinder com Primary loss Combi loss	25.9470 23.2624 0.0000	23.4360 21.0112 0.0000	25.9470 23.2624 0.0000	25.1100 22.5120 0.0000	25.9470 23.2624 0.0000	25.1100 22.5120 0.0000	25.9470 23.2624 0.0000	25.9470 23.2624 0.0000	25.1100 22.5120 0.0000	25.9470 23.2624 0.0000	25.1100 22.5120 0.0000	25.9470 23.2624 0.0000	(59)
Total heat requ	uired for w 326.3455	water heati 288.5496	ng calculate 305.8559	ed for each 266.6533	month 257.0788	230.0640	225.6381	235.3090	238.7293	268.1521	287.5987	322.4330	
WWHRS PV diverter	-75.5667 0.0000	-66.8318 0.0000	-69.9824 0.0000	-57.9482 0.0000	-54.0057 0.0000	-46.2130 0.0000	-43.3174 0.0000	-46.0637 0.0000	-47.8138 0.0000	-56.3672 0.0000	-63.8572 0.0000	-74.1673 0.0000	(63a)
Solar input 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	(63c)
Output from w/h		221.7177	235.8734	208.7051	203.0731	183.8509	182.3208	189.2453	190.9155	211.7849	223.7416	248.2657	` '
12Total per yea Electric shower	r(s)								er year (kWh				(64)
	0.0000	0.0000	0.0000	0.0000 Tot	0.0000 al Energy u	0.0000 sed by inst	0.0000 antaneous e	0.0000 lectric sho	0.0000 wer(s) (kWh/	0.0000 'year) = Su	0.0000 m(64a)m =	0.0000 0.0000	
Heat gains from	m water hea 131.5153	ating, kWh/ 116.7218	month 124.7025	110.9255	108.4841	98.7596	98.0301	101.2456	101.6408	112.1660	117.8899	130.2144	(65)
5. Internal ga													
Metabolic gains													
(66)m	Jan 143.8273	Feb 143.8273	Mar 143.8273	Apr 143.8273	May 143.8273	Jun 143.8273	Jul 143.8273	Aug 143.8273	Sep 143.8273	0ct 143.8273	Nov 143.8273	Dec 143.8273	(66)



Lighting gains	calculate				L9a), also: 148.1891	see Table 5	148.1891	148.1891	153.1287	148.1891	153.1287	148.1891	(67)
Appliances ga								213.9117	221.4939	237.6353	258.0111	277.1614	
Cooking gains								37.3827	37.3827	37.3827	37.3827	37.3827	. ,
Pumps, fans Losses e.g. e	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	
Water heating	-115.0619	-115.0619			-115.0619	-115.0619	-115.0619	-115.0619	-115.0619	-115.0619	-115.0619	-115.0619	(71)
otal interna	176.7678	173.6932	167.6108	154.0632	145.8119	137.1660	131.7608	136.0828	141.1678	150.7607	163.7359	175.0193	(72)
otal interna.	684.0601	699.8716	670.3298	645.5803	612.0137	586.1571	563.0187	564.3318	581.9385	605.7333	644.0239	669.5180	(73)
. Solar gain:	5												
Jan]				rea m2	Solar flux Table 6a W/m2	Speci	g fic data Table 6b	Specific		Acce facto Table	or	Gains W	
North			4.3	000	10.6334		0.5000		.8000	0.77		12.6746	(74)
Southeast South West			5.7 6.3	500 600 500	36.7938 46.7521 19.6403		0.5000 0.5000 0.5000	6	.8000 .8000	0.77 0.77 0.77	99 99	58.6457 81.6459 38.9266	(77) (78)
Solar gains	191.8928	333.9808	473.5751	610.8722	703.5031	706.1699	677.6496	607.8365	521.2642	373.8195	231.1949	163.3156	(02)
otal gains					1315.5167					979.5528	875.2188	832.8336	٠,
. Mean inter													
emperature d	uring heati	ng periods	in the livi	ng area fro								21.0000	(85)
tilisation f	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
au lpha	116.7326 8.7822	117.2183 8.8146	117.7081 8.8472	120.2196 9.0146	120.7348 9.0490	123.3786 9.2252	123.3786 9.2252	123.9214 9.2614	122.3073 9.1538	120.7348 9.0490	119.7088 8.9806	118.7000 8.9133	
til living a	rea 0.9972	0.9876	0.9541	0.8276	0.6325	0.4362	0.3124	0.3442	0.5547	0.8790	0.9882	0.9981	(86)
IT	20.4807	20.6403	20.8112	20.9586	20.9961	20.9999	21.0000	21.0000	20.9990	20.9424	20.6965	20.4601	
n 2 til rest of I		20.2972	20.2999	20.3136	20.3164	20.3301	20.3301	20.3328	20.3246	20.3164	20.3109	20.3054	
IT 2	0.9961 19.8245	0.9833 19.9837	0.9399 20.1480	0.7924 20.2858	0.5876 20.3143	0.3906 20.3300	0.2649 20.3301	0.2943 20.3328	0.5010 20.3242	0.8425 20.2785	0.9833 20.0519	0.9973 19.8136	(90)
iving area f IT emperature a	19.9696	20.1289	20.2946	20.4346	20.4650	20.4781	20.4782	20.4803	20.4734	Living area 20.4253	20.1944	0.2211 19.9566 0.0000	
djusted MIT	19.9696	20.1289	20.2946	20.4346	20.4650	20.4781	20.4782	20.4803	20.4734	20.4253	20.1944	19.9566	(93)
. Space heat:	ing require	 ment											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
tilisation Seful gains	0.9954	0.9820 1015.2501	0.9397	0.7989 1003.7726	0.5975 785.9805	0.4007 517.7875	0.2754 341.6611	0.3053 357.8924	0.5129 565.7878	0.8488 831.4015	0.9823 859.7467	0.9968 830.1955	
kt temp. eat loss rate	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
pace heating	1459.0645	1412.1518	1273.8308	1042.8813	789.0947	517.8547	341.6627	357.8966	566.4050	884.5466	1188.9620	1442.8415	(97)
pace heating pace heating olar heating	436.8041 requirement	266.7180 t - total p	147.9580 er year (kw	28.1583 h/year)	2.3170	0.0000	0.0000	0.0000	0.0000	39.5400	237.0350	455.8087 1614.3391	(98a)
olar heating pace heating	0.0000 contributi	0.0000 on - total	0.0000 per year (k	0.0000 Wh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
pace heating	436.8041	266.7180 t after sol	147.9580	28.1583	2.3170	0.0000 (kWh/vear)	0.0000	0.0000	0.0000	39.5400	237.0350	455.8087 1614.3391	(98c)
pace heating					For Joan	(, , ,				(98c) / (4) =	13.0504	(99)
a. Energy re	quirements	- Individua	l heating s	ystems, ind		o-CHP							
raction of spraction of spraction of spraction of	pace heat f pace heat f	rom seconda rom main sy	ry/suppleme stem(s)	ntary syste								0.0000 1.0000 84.5000	(202)
fficiency of fficiency of	main space	heating sy	stem 2 (in	%)								0.0000 0.0000	(207)
pace heating	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
pace neating pace heating	436.8041	266.7180	147.9580	28.1583	2.3170	0.0000	0.0000	0.0000	0.0000	39.5400	237.0350	455.8087	(98)
Pace Hearting	84.5000	84.5000	84.5000	84.5000	84.5000	0.0000	0.0000	0.0000	0.0000	84.5000	84.5000	84.5000	(210)

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pace heating fuel (main heating system)			
	.0000 0.0000	0.0000 46.792	29 280.5148 539.4185 (2
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	.0000 0.0000	0.0000 0.000	0.0000 0.0000 (2
	.0000 0.0000	0.0000 0.000	0.0000 0.0000 (2
oace heating fuel (secondary) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.	.0000 0.0000	0.0000 0.000	00 0.0000 0.0000 (2
eter heating			
ter heating requirement 250.7788 221.7177 235.8734 208.7051 203.0731 183.8509 182.	.3208 189.2453	190.9155 211.784	19 223.7416 248.2657 (6
ficiency of water heater 17)m 84.5000 84.5000 84.5000 84.5000 84.5000 84.5000 84.	.5000 84.5000	84.5000 84.500	89.5000 (2 00 84.5000 84.5000 (2
el for water heating, kWh/month	.7642 223.9590	225.9355 250.633	•
ace cooling fuel requirement	.0000 0.0000	0.0000 0.000	•
mps and Fa 36.6609 33.1131 36.6609 35.4783 36.6609 35.4783 36.	.6609 36.6609	35.4783 36.666	9 35.4783 36.6609 (2
ectricity generated by PVs (Appendix M) (negative quantity)	.1519 13.1959	17.1401 22.488	
33a)m	.0000 0.0000	0.0000 0.000	0.0000 0.0000 (2
34a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0. ectricity generated by hydro-electric generators (Appendix M) (negative quantity)	.0000 0.0000	0.0000 0.000	0.0000 0.0000 (2
	.0000 0.0000	0.0000 0.000	0.0000 0.0000 (2
35c)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.	.0000 0.0000	0.0000 0.000	00 0.0000 0.0000 (2
	.0000 0.0000	0.0000 0.000	0.0000 0.0000 (2
	.0000 0.0000	0.0000 0.000	0.0000 0.0000 (2
ctricity generated by hydro-electric generators (Appendix M) (negative quantity) 5b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.	.0000 0.0000	0.0000 0.000	00 0.0000 0.0000 (2
	net generation) .0000 0.0000	0.0000 0.000	0 0.0000 0.0000 (2
ual totals kWh/year ce heating fuel - main system 1			1910.4604 (2
ce heating fuel - main system 2			0.0000 (2
ce heating fuel - secondary iciency of water heater			0.0000 (2 89.5000
er heating fuel used ce cooling fuel			3018.0743 (2 0.0000 (2
ctricity for pumps and fans:			
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.9500) mechanical ventilation fans (SFP = 0.9500)			390.6525 (2
central heating pump tal electricity for the above, kWh/year			41.0000 (2 431.6525 (2
ectricity for lighting (calculated in Appendix L)			219.7170 (2
ergy saving/generation technologies (Appendices M ,N and Q) generation			0.0000 (2
d generation			0.0000 (2
ro-electric generation (Appendix N) ctricity generated - Micro CHP (Appendix N)			0.0000 (2 0.0000 (2
endix Q - special features rrgy saved or generated			-0.0000 (2
ergy used cal delivered energy for all uses			0.0000 (2 5579.9043 (2
			,
. Carbon dioxide emissions - Individual heating systems including micro-CHP			
and the state of t	Energy	Emission facto	or Emissions
ce heating - main system 1	kWh/year 1910.4604	kg CO2/kW 0.216	lh kg CO2/year
al CO2 associated with community systems er heating (other fuel)	3018.0743	0.216	0.0000 (3
ce and water heating			1034.9923 (2
ps, fans and electric keep-hot rgy for lighting	431.6525 219.7170	0.138 0.144	31.7120 (2
al CO2, kg/year Dwelling Carbon Dioxide Emission Rate (DER)			1126.5798 (2 9.1100 (2
. Primary energy - Individual heating systems including micro-CHP	Energy	Primary energy facto	
. Primary energy - Individual heating systems including micro-CHP		Primary energy facto kg CO2/kk 1.130	Wh kWh/year
Primary energy - Individual heating systems including micro-CHP ce heating - main system 1 al CO2 associated with community systems	Energy kWh/year	kg CO2/kW	Wh kWh/year 200 2158.8203 (2 0.0000 (4
a. Primary energy - Individual heating systems including micro-CHP ace heating - main system 1 cal CO2 associated with community systems cer heating (other fuel) ace and water heating	Energy kWh/year 1910.4604 3018.0743	kg CO2/kw 1.136 1.136	lh kWh/year 100 2158.8203 (2 0.0000 (4 00 3410.4240 (2 5569.2443 (2
a. Primary energy - Individual heating systems including micro-CHP ace heating - main system 1 al CO2 associated with community systems ter heating (other fuel)	Energy kWh/year 1910.4604	kg CO2/kW 1.130	lh kWh/year 100 2158.8203 (2 0.0000 (4 00 3410.4240 (2 5569.2443 (2 28 653.0040 (2



SAP 10 WORKSHEE	ET FOR New	Build (As D	esigned)	(Version 10	∂.2, Februar	 v 2022)							
CALCULATION OF													
1. Overall dwel	lling char	acteristics											
								Area	Store	/ height		Volume	
Ground floor First floor								(m2) 61.9000 61.8000		(m) 2.5000 2.9500		(m3) 154.7500 182.3100	(1b)
Total floor are Dwelling volume		1a)+(1b)+(1c	:)+(1d)+(1e)	(1n)	1	23.7000		(3	a)+(3b)+(3c)+	(3d)+(3e))(3n) =	337.0600	(4) (5)
2. Ventilation													
												per hour	
Number of open Number of chimm Number of flues Number of flues Number of block Number of inter Number of pass; Number of flues	flues neys / flues s attached s attached ked chimne mmittent e ive vents	to solid fu to other he ys xtract fans	el boiler	ire							0 * 80 = 0 * 20 = 0 * 10 = 0 * 20 = 0 * 35 = 0 * 20 = 4 * 10 = 0 * 10 = 0 * 40 =	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 40.0000 0.0000	(6b) (6c) (6d) (6e) (6f) (7a) (7b)
T . C'31			1 6	(5.).(51.)	. (5.) . (5.1) .	(5.).(55).	(6.).(7.).(75. \ . (7)		40.000	Air changes		
Infiltration du Pressure test Pressure Test Measured/design Infiltration ra Number of sides	Method n AP50 ate		and fans	= (6a)+(60)+(6C)+(6a)+	(be)+(bt)+	(bg)+(/a)+(/D)+(/C) =		40.0006	0 / (5) = Bl	0.1187 Yes ower Door 5.0000 0.3687	(17)
Shelter factor Infiltration ra			le shelter f	actor					(20) = 1 - (21)		((19)] = x (20) =	0.9250 0.3410	(20)
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000	(22)
Wind factor Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	` '
Effective ac	0.4348 0.5945	0.4263 0.5909	0.4178 0.5873	0.3751 0.5704	0.3666 0.5672	0.3240 0.5525	0.3240 0.5525	0.3154 0.5498	0.3410 0.5581	0.3666 0.5672	0.3837 0.5736	0.4007 0.5803	
3. Heat losses	and heat	loss paramet	er										
Element				Gross	Openings	Ne-	tArea	U-value	AxU	k	(-value	ΑxΚ	
TER Opening Typ	oe (Uw = 1	.20)		m2	m2		m2 .5000	W/m2K 1.1450	W/K 26.9084		kJ/m2K	kJ/K	
External Wall 1 External Roof 1 Total net area Fabric heat los	1 of extern			27.4340 8.0000	23.5000	8	.9340 .0000 .4340 (26)(0.1800 0.1100 30) + (32)	18.7081 0.8800 = 46.4965				(29a) (30) (31) (33)
Party Wall 1 Thermal mass pa		TMP = Cm / T	FA) in kJ/m	2K		67	.3000	0.0000	0.0000			320.6797	(32)
E3 Sill E4 Jamb E6 Inte E16 Cor E18 Par E7 Part	ment er lintels l ermediate rner (norm rty wall b ty floor b ves (insul	(including floor within al) etween dwell etween dwell ation at cei	a dwelling ings ings (in bl	ocks of fla				17 15 33 23 16 10 36	ength Ps: .1500 .5700 .5200 .5200 .5000 .2000 .8000 .1000 .1000	i-value 0.0500 0.0500 0.0500 0.0500 0.0900 0.0900 0.0600 0.0700 0.2400 0.0800	Tota 0.857 0.778 1.676 0.000 1.458 0.648 2.527 0.984 0.648	5 5 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	
Thermal bridges Point Thermal b Total fabric he	s (Sum(L x oridges	Psi) calcul	ated using	Appendix K)			· ·			(36a) = + (36a) =	9.5770 0.0000 56.0735	` ,
Ventilation hea	at loss ca Jan	lculated mon Feb	nthly (38)m Mar	= 0.33 x (2	25)m x (5) May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
(38)m Heat transfer d	66.1291 coeff 122.2027	65.7209 121.7944	65.3207 121.3942	63.4410 119.5145	63.0893 119.1628	61.4521 117.5256	61.4521 117.5256	61.1489	62.0827	63.0893 119.1628	63.8007 119.8743	64.5445 120.6180	
	177.7071	141./344	141.3944	112.0140	119.1028	11/.3230	11/.3230	11/.2224	110.1302	12.1026	117.0/43	120.0190	(25)

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												0, 10,	3)	
But	Average = Sum(3	39)m / 12 =											119.5128	;
But		Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
		0.9879	0.9846	0.9814			0.9501	0.9501			0.9633	0.9691		
		31	28	31	30	31	30	31	31	30	31	30		
Second Cologonies Cologonie														
Common C														
Truster Usage for extens usage for exten													2.8765	(4
th valer useg for other uses. It valer useg for other uses. It valer uses for other uses. It valer uses. It valer uses for other uses. It valer uses.	Hot water usage			69.7747	66.7391	64.4989	62.0006	60.5806	62.1552	63.8812	66.5636	69.6644	72.1725	(4
Ad. 6887 24.6856	Hot water usage			30.1604	28.9542	28.0511	27.0496	26.5087	27.1583	27.8655	28.9372	30.1682	31.1734	. (-
werge daily hot water use (litres/day) 20	lot water usage			40.8823	39,2790	37.6758	36.0726	36.0726	37.6758	39.2790	40.8823	42.4855		
salty but water use regry conto 147,8179 144,6613 148,8174 134,9724 130,2258 125,1228 123,1619 126,9892 131,0258 136,330 142,3180 147,4346 regry conto 241,1274 260,9959 216,4311 184,7794 173,3899 153,8331 145,9358 172,232 130,5091 321,0098 126,3180 147,4346 regry conto 241,1274 260,9959 216,4311 184,7794 173,3899 153,8331 145,9358 172,232 130,8091 187,4346 regry conto 241,1274 30,80994 32,4647 27,7156 26,2953 22,0786 22,3438 23,5899 24,2332 27,7666 30,4137 34,6270 regry conto 241,1274 30,80994 32,4647 27,7156 26,2953 22,0786 22,3438 23,5899 24,2332 27,7666 30,4137 34,6270 regry conto 241,1274 30,80994 32,4647 27,7156 26,2953 22,0786 22,3438 23,5899 24,2332 27,7666 30,4137 34,6270 regry conto 241,1274 30,80994 32,4647 27,7156 26,2953 22,0786 22,3438 23,5899 25,1422 25,8899 25,1422 25,8899 26,1422 25,1429 25,1429 26,142	Average daily H	not water u	se (litres											
147, 8179 144, 6613 248, 8174 134, 9774 133, 832,258 125,1059 126,9992 131,0579 136,0383 142,3180 147,4346	Dailv hot water		Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
Total = Sum (45) n = 2256,9027 225,9027 225,9027 22,5027 22,5027 23,5027 24,2352 27,7066 30,137 34,5276 34,5276	•	147.8179												
Sinisi 19.8994 32.467 27.7156 26.2963 23.9780 22.3490 23.5899 24.2352 27.7666 30.4137 34.6275 100.0000 1.520 100.0000 1.52	Energy content	(annual)			184.7704	173.3089	155.8551	148.9330	137.2392	101.3079				
180.0809 180.0809		35.1161	,	,	27.7156	26.2963	23.0780	22.3430	23.5859	24.2352	27.7606	30.4137	34.6270	(4
Section Company Comp	Store volume													
Total storage loss ff cylinder contains dedicated solar storage ff cylinder cyli	Temperature 1	factor from	Table 2b	actor is kn	own (kWh/d	lay):								•
Fryshinder contains dedicated solar storage 25,1422 25,9883 25,1422 25,9883 25,9883 25,9883 25,9883 25,9883 25,9883 25,9883 25,9883 25,1422 25,9883 25,9883 25,9883 25,9883 25,1422 25,9883 25,9883 25,9883 25,1422 25,9883			5)										0.8381	(
Primary loss 23,2624 21.0112 23,2624 22.5120 23.2624 22.5120 23.2624 22.5120 23.2624 22.5120 23.2624 22.5120 20.0000 1.0000 0.00	If cylinder con				25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(
Combination	Primary loss													
283,3561 256,4731 256,6737 232,4246 224,5516 201,5973 198,1963 206,819 209,2211 224,3151 256,4123 208,0895 201,3973 231,211 -29,2926 -30,6735 -25,3989 -20,2553 -18,9661 -20,1899 -2,9660 -2,0690 -0,060	Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000								•
###S	otal heat requ			•			201 5073	108 1063	206 /819	200 2221	23/ 3131	250 /123	280 0805	
V diverter	WHRS													
Giffs 0,8000 0,8	V 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	, (
utput from W/h 250.2289 221.1805 235.0002 207.0257 200.8807 181.2520 179.2101 186.2920 188.2651 209.6071 222.4235 247.5818 Total per year (kkh/year) = Sum(64)m = 2528.4376 2523 Total per year (kkh/year) = Sum(64)m = 2528.4376 2523 Total per year (kkh/year) = Sum(64)m = 2528.4376 2523 Total per year (kkh/year) = Sum(64)m = 2528.4376 2523 Total per year (kkh/year) = Sum(64)m = 2528.4376 2523 Total per year (kkh/year) = Sum(64)m = 2528.4376 2523 Total per year (kkh/year) = Sum(64)m = 2528.4376 2523 Total per year (kkh/year) = Sum(64)m = 2528.4376 2523 Total per year (kkh/year) = Sum(64)m = 2528.4376 2523 Total per year (kkh/year) = Sum(64)m = 2528.4376 2523 Total per year (kkh/year) = Sum(64)m = 2528.4376 2523 Total per year (kkh/year) = Sum(64)m = 2528.4376 2523 Total per year (kkh/year) = Sum(64)m = 2528.4376 2523 2523 Total per year (kkh/year) = Sum(64)m = 2528.4376 2523 2523 2523 2624.4376 2626 2626 2626 2626 2626 2626 2626 2626 2626 2626 2626 2626 2626 2626 2627 2627 2627 2627 2627 2627 2627 2627 2627 2627 2628 2627														
Total per year (kWh/year) = Sum(64)m = 2528.9476 2528.9476 2529 lectric shower(s) 8.08080		n												
				235.0002	207.0257	200.8807	181.2520	179.2101					2528.9476	(
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000		r(s)	•											
117.2348 104.0754 111.3575 99.5595 97.6843 89.2795 88.9212 91.6762 91.8447 100.9300 105.5404 116.1507 17.2348 104.0754 111.3575 99.5595 97.6843 89.2795 88.9212 91.6762 91.8447 100.9300 105.5404 116.1507 18.51														
Setabolic gains (Table 5), Watts Jan Feb Mar Apr	leat gains from				99.5595	97.6843	89.2795	88.9212	91.6762	91.8447	100.9300	105.5404	116.1507	(
Setabolic gains (Table 5), Watts Jan Feb Mar Apr														
Table Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Dec May May Jun Jul Aug Sep Oct Nov Dec Jul Jul Aug Sep Oct Nov Dec Jul Jul Aug Sep Oct Nov Dec Jul Jul Jul Aug Sep Oct Nov Dec Jul Jul Jul Aug Sep Oct Nov Dec Jul Ju	. Internal ga	ins (see Ta	ble 5 and	5a)										
143.8273 143	Metabolic gains			Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
148.1891					143.8273	143.8273				143.8273	143.8273	143.8273	143.8273	(
289,9549 292,9638 285,3816 269,2401 248,8644 229,7141 216,9205 213,9117 221,4939 237,6353 258,0111 277,1614 clooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 37,3827		148.1891	164.0665	148.1891	153.1287	148.1891	153.1287	148.1891	148.1891	153.1287	148.1891	153.1287	148.1891	(
37.3827 37.382	-	289.9549	292.9638	285.3816	269.2401	248.8644	229.7141	216.9205	213.9117	221.4939	237.6353	258.0111	277.1614	. (
Area Solar flux g FF Access Gains Area Solar flux g FF Access Gains Mul 2 Table 6a Specific data Specific data factor W Mul 2 or Table 6b Southeast Southe		37.3827	37.3827	37.3827	37.3827	37.3827	37.3827	37.3827						•
Solar gains Table 5 157.5737 154.8741 149.6740 138.2771 131.2962 123.9993 119.5177 123.2207 127.5620 135.6587 146.5839 156.1166 150	osses e.g. eva	aporation (negative v	alues) (Tab	le 5)									
Solar gains Solar gains Solar flux g FF Access Gains Gains Specific data S				-115.0619	-115.0619	-115.0619	-115.0619	-115.0619	-115.0619	-115.0619	-115.0619		-115.0619	(
Jan Area Solar flux g FF Access Gains Gains Area Solar flux g FF Access Gains Ga	otal internal		154.8741	149.6740	138.2771	131.2962	123.9993	119.5177	123.2207	127.5620	135.6587	146.5839	156.1166	. (
Area Solar flux g FF Access Gains		664.8660	681.0526	652.3929	629.7942	597.4979	572.9904	550.7756	551.4697	568.3328	590.6313	626.8719	650.6152	. (
Jan Area Solar flux g FF Access Gains m2 Table 6a Specific data Specific data factor W W/m2 or Table 6b or Table 6c Table 6d														
m2 Table 6a Specific data or Table 6c Table 6d W/m2 or Table 6b Or Table 6c Table 6d North 4.3000 10.6334 0.6300 0.7000 0.7700 13.9737 Noutheast 5.7500 36.7938 0.6300 0.7000 0.7700 64.6569 Nouth 6.3000 46.7521 0.6300 0.7000 0.7700 90.0146 Nest 7.1500 19.6403 0.6300 0.7000 0.7700 42.9166	-													
Acouth 4.3000 10.6334 0.6300 0.7000 0.7700 13.9737 6outheast 5.7500 36.7938 0.6300 0.7000 0.7700 64.6569 6outh 6.3000 46.7521 0.6300 0.7000 0.7700 90.0146 lest 7.1500 19.6403 0.6300 0.7000 0.7700 42.9166	[Jan]			A		Table 6a	Speci	fic data		data	fact	or		
Southeast 5.7500 36.7938 0.6300 0.7000 0.7700 64.6569 south 6.3000 46.7521 0.6300 0.7000 0.7700 90.0146 lest 7.1500 19.6403 0.6300 0.7000 0.7700 42.9166	lorth			Δ 3	 300								13.9737	
South 6.3000 46.7521 0.6300 0.7000 0.7700 90.0146 West 7.1500 19.6403 0.6300 0.7000 0.7700 42.9166														
Solar gains 211.5618 368.2138 522.1165 673.4866 775.6121 778.5523 747.1087 670.1397 574.6938 412.1360 254.8924 180.0554	√est			7.1	500 	19.6403		0.6300	0	.7000	0.77	'00	42.9166	(
	Solar gains	211.5618	368.2138	522.1165	673.4866	775.6121	778.5523	747.1087	670.1397	574.6938	412.1360	254.8924	180.0554	. (



Total gains 876.4278 1049.2664 1174.5095 1303.2808 1373.1100 1351.5427 1297.8842 1221.6094 1143.0267 1002.7673 881.7643 830.6707 (84)

. Mean intern												
emperature du tilisation fa	uring heati	ng periods	in the livi	ng area fro	m Table 9,							21.0000 (85)
au	Jan 90.1692 7.0113	Feb 90.4714	Mar 90.7697	Apr 92.1973	May 92.4694	Jun 93.7575	Jul 93.7575	Aug 94.0000	Sep 93.2571	0ct 92.4694	Nov 91.9206	Dec 91.3537
ılpha ıtil living ar		7.0314 0.9942	7.0513 0.9800	7.1465 0.9178	7.1646 0.7665	7.2505 0.5530	7.2505 0.3981	7.2667 0.4408	7.2171 0.6942	7.1646 0.9491	7.1280 0.9949	7.0902 0.9989 (86)
IIT	20.1539	20.3336	20.5574	20.8180	20.9594	20.9965	20.9997	20.9994	20.9841	20.7905	20.4257	20.1298 (87)
h 2 til rest of h		20.0962	20.0989	20.1116	20.1140	20.1251	20.1251	20.1272	20.1208	20.1140	20.1092	20.1041 (88)
IT 2 iving area fr	0.9978 19.1104	0.9919 19.3414	0.9720 19.6242	0.8891 19.9423	0.7078 20.0852	0.4792 20.1236	0.3192 20.1251	0.3575 20.1270	0.6146 20.1125 fl A =	0.9243 19.9206 Living are	0.9925 19.4700 a / (4) =	0.9985 (89) 19.0880 (90) 0.2211 (91)
IIT Emperature ad	19.3412	19.5608	19.8306	20.1359	20.2785	20.3166	20.3185	20.3199	20.3052	20.1129	19.6813	19.3184 (92) 0.0000
djusted MIT	19.3412	19.5608	19.8306	20.1359	20.2785	20.3166	20.3185	20.3199	20.3052	20.1129	19.6813	19.3184 (93)
. Space heati	ing require	ment 										
Itilisation	Jan 0.9971	Feb 0.9900	Mar 0.9690	Apr 0.8900	May 0.7192	Jun 0.4955	Jul 0.3366	Aug 0.3760	Sep 0.6319	0ct 0.9242	Nov 0.9908	Dec 0.9979 (94)
seful gains xt temp.	4.3000	1038.8253 4.9000	1138.1448 6.5000	1159.8655 8.9000	987.5866 11.7000	669.7108 14.6000	436.9051 16.6000	459.2685 16.4000	722.2318 14.1000	926.7745 10.6000	873.6772 7.1000	828.9531 (95) 4.2000 (96)
leat loss rate Space heating	1838.0693	1785.5999	1618.2514	1342.8500	1022.2387	671.8446	437.0134	459.5039	733.1824	1133.5869	1508.1742	1823.5472 (97)
pace heating	717.3621	501.8325 t - total p	357.1993 er year (kW	131.7488 Jh/year)	25.7811	0.0000	0.0000	0.0000	0.0000	153.8684	456.8378	739.9780 (98a 3084.6082
olar heating	0.0000	0.0000 on - total	0.0000 per year (k	0.0000 Wh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b 0.0000
pace heating	717.3621		357.1993		25.7811	0.0000	0.0000	0.0000	0.0000	153.8684	456.8378	739.9780 (98c
	reduirremen	t after sol	ar contribu	ition – tota	l per year	(kWh/year)						3084.6082
pace heating pace heating a. Energy req	per m2									(98c) / (4) =	24.9362 (99)
pace heating	quirements	- Individua - Individua 	ry/suppleme stem(s) stem 1 (in	entary system %) %)						(98c) / (4) =	0.0000 (201 1.0000 (202 92.3000 (206 0.0000 (207 0.0000 (208
nace heating a. Energy req raction of sp ffficiency of ffficiency of	per m2 quirements pace heat f pace heat f main space main space secondary/ Jan	- Individua - Individua - Individua - Individual - Indivi	ry/suppleme stem(s) stem 1 (in	entary system %) %)			Jul	Aug	Sep	(98c) / (4) =	0.0000 (201 1.0000 (202 92.3000 (206 0.0000 (207
raction of sp raction of sp fficiency of fficiency of fficiency of fficiency of	quirements Dace heat foace heat foace heat foace secondary/ Jan requirement 717.3621	- Individua - Individua rom seconda rom main sy heating sy supplementa Feb t 501.8325	ry/supplements tem(s) stem 1 (in stem 2 (in ry heating Mar 357.1993	mntary system %) %) system, % Apr 131.7488	m (Table 11)			Sep 0.0000			0.0000 (201 1.0000 (202 92.3000 (206 0.0000 (207 0.0000 (208
a. Energy req 	quirements Dace heat foace heat foace heat foace secondary/ Jan requirement 717.3621 efficiency 92.3000	- Individua - Individua - Individua - Individual - Indivi	ry/suppleme stem(s) sstem 1 (in sstem 2 (in ry heating Mar 357.1993 ing system 92.3000	mntary system %) %) system, % Apr 131.7488	m (Table 11) Jun	Jul	Aug		Oct	Nov	0.0000 (201 1.0000 (202 92.3000 (206 0.0000 (207 0.0000 (208
a. Energy req a. Energy req raction of sp fficiency of fficiency of fficiency of pace heating pace heating	per m2 quirements Dace heat foace heat foace heat foace heat foace near foace near foace secondary/ Jan requirement 717.3621 efficiency 92.3000 fuel (main 777.2071 efficiency	- Individua 	ry/suppleme rstem(s) rstem 1 (in rstem 2 (in ry heating Mar 357.1993 ring system 92.3000 rstem) 386.9982	%) %) system, % Apr 131.7488 1) 92.3000 142.7398	May 25.7811	Jun 0.0000	Jul 0.0000	Aug 0.0000	0.0000	Oct 153.8684 92.3000 166.7047	Nov 456.8378	0.0000 (201 1.0000 (202 92.3000 (206 0.0000 (207 0.0000 (208 Dec 739.9780 (98)
a. Energy req a. Energy req raction of sp raction of sp fficiency of fficiency of fficiency of pace heating pace heating pace heating	quirements cace heat foace heat foace heat foace heat foace near foace heat foace heat foace foa	- Individua - Individua 	mar system 357.1993 ing system 92.3000 stem) 386.9982 ing system 0.0000 stem 2)	mntary system %) %) system, % Apr 131.7488 1) 92.3000 142.7398 2) 0.0000	May 25.7811 92.3000 27.9319 0.0000	Jun 0.0000 0.0000 0.0000	Jul 0.0000 0.0000 0.0000	Aug 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	Oct 153.8684 92.3000 166.7047 0.0000	Nov 456.8378 92.3000 494.9488 0.0000	0.0000 (201 1.0000 (202 92.3000 (206 0.0000 (207 0.0000 (208 Dec 739.9780 (98) 92.3000 (210 801.7097 (211 0.0000 (212
a. Energy req	quirements Dace heat foace foace secondary/ Jan requirement 717.3621 efficiency 92.3000 fuel (main 777.2071 efficiency 0.0000 fuel (main 0.0000 fuel (seco	- Individua 	rry/suppleme rstem(s) stem 1 (in stem 2 (in ry heating Mar 357.1993 ing system 92.3000 stem) 386.9982 ing system 0.0000 stem 2) 0.0000	%) %) system, % Apr 131.7488 1) 92.3000 142.7398 2) 0.0000 0.0000	May 25.7811 92.3000 27.9319 0.0000	Jun 0.0000 0.0000 0.0000 0.0000	Jul 0.0000 0.0000 0.0000 0.0000	Aug 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	Oct 153.8684 92.3000 166.7047 0.0000 0.0000	Nov 456.8378 92.3000 494.9488 0.0000	0.0000 (201 1.0000 (202 92.3000 (206 0.0000 (207 0.0000 (208 Dec 739.9780 (98) 92.3000 (210 801.7097 (211 0.0000 (212
a. Energy req	quirements cace heat formain space main space main space secondary/ Jan requirement 717.3621 efficiency 92.3000 fuel (main 777.2071 efficiency 0.0000 fuel (main 0.0000	- Individua	mar system 357.1993 ing system 92.3000 stem) 386.9982 ing system 0.0000 stem 2)	mntary system %) %) system, % Apr 131.7488 1) 92.3000 142.7398 2) 0.0000	May 25.7811 92.3000 27.9319 0.0000	Jun 0.0000 0.0000 0.0000	Jul 0.0000 0.0000 0.0000	Aug 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	Oct 153.8684 92.3000 166.7047 0.0000	Nov 456.8378 92.3000 494.9488 0.0000	0.0000 (201 1.0000 (202 92.3000 (206 0.0000 (207 0.0000 (208 Dec 739.9780 (98) 92.3000 (210 801.7097 (211 0.0000 (212
pace heating a. Energy req raction of sp raction of sp fficiency of fficiency of fficiency of pace heating	quirements Dace heat foace foace heat (main 777.2071 efficiency 0.0000 fuel (main 0.0000 fuel (seco 0.0000)	- Individua rom seconda rom main sy heating sy supplementa Feb t 501.8325 (main heat 92.3000 heating sy 543.6972 (main heat 0.0000 heating sy 0.0000 ndary) 0.0000	rry/suppleme rstem(s) stem 1 (in stem 2 (in ry heating Mar 357.1993 ing system 92.3000 stem) 386.9982 ing system 0.0000 stem 2) 0.0000	%) %) system, % Apr 131.7488 1) 92.3000 142.7398 2) 0.0000 0.0000	May 25.7811 92.3000 27.9319 0.0000	Jun 0.0000 0.0000 0.0000 0.0000	Jul 0.0000 0.0000 0.0000 0.0000	Aug 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	Oct 153.8684 92.3000 166.7047 0.0000 0.0000	Nov 456.8378 92.3000 494.9488 0.0000	0.0000 (201 1.0000 (202 92.3000 (206 0.0000 (207 0.0000 (208 Dec 739.9780 (98) 92.3000 (210 801.7097 (211 0.0000 (212 0.0000 (213 0.0000 (215
a. Energy req a. Energy req raction of sp raction of sp fficiency of fficiency of fficiency of pace heating	per m2 quirements Dace heat foace foace foace heat foace foac	- Individua	mry/suppleme stem(s) stem 1 (in stem 2 (in ry heating Mar 357.1993 ing system 92.3000 stem) 386.9982 ing system 0.0000 stem 2) 0.0000 0.0000	mtary system %) %) system, % Apr 131.7488 1) 92.3000 142.7398 2) 0.0000 0.0000	May 25.7811 92.3000 27.9319 0.0000 0.0000	Jun 0.0000 0.0000 0.0000 0.0000 0.0000	Jul 0.0000 0.0000 0.0000 0.0000 0.0000	Aug 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	Oct 153.8684 92.3000 166.7047 0.0000 0.0000	Nov 456.8378 92.3000 494.9488 0.0000 0.0000	0.0000 (201 1.0000 (202 92.3000 (206 0.0000 (207 0.0000 (208 Dec 739.9780 (98) 92.3000 (210 801.7097 (211 0.0000 (212 0.0000 (213 0.0000 (215
a. Energy req	quirements Jace heat for main space heat for main space secondary/ Jan requirement 717.3621 efficiency 92.3000 fuel (main 777.2071 efficiency 0.0000 fuel (seco 0.0000) requiremen 250.2289 water heat 86.2834 heating, 290.0082		mry/suppleme stem(s) stem 1 (in stem 2 (in ry heating	mitary system %) %) system, % Apr 131.7488 1) 92.3000 142.7398 2) 0.0000 0.0000 0.0000	May 25.7811 92.3000 27.9319 0.0000 0.0000	Jun 0.0000 0.0000 0.0000 0.0000 0.0000	Jul 0.0000 0.0000 0.0000 0.0000 0.0000	Aug 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000	Oct 153.8684 92.3000 166.7047 0.0000 0.0000 0.0000	Nov 456.8378 92.3000 494.9488 0.0000 0.0000	0.0000 (201 1.0000 (202 92.3000 (206 0.0000 (208 Dec 739.9780 (98) 92.3000 (210 801.7097 (211 0.0000 (213 0.0000 (215 247.5818 (64) 79.8000 (216
pace heating a. Energy req a. Energy req raction of sp raction of sp raction of sp rfficiency of fficiency of fficiency of pace heating pace cooling 221)m	quirements Jace heat for main space heat for main space secondary/ Jan requirement 717.3621 efficiency 92.3000 fuel (main 777.2071 efficiency 0.0000 fuel (seco 0.0000) requiremen 250.2289 water heat 86.2834 heating, 290.0082		mar (in stem 2 (in ry heating Mar 357.1993 (ing system 92.3000 (stem) 386.9982 (ing system 0.0000 (stem) 0.0000 (235.0002 (stem) 386.9982 (ste	mtary system %) %) system, % Apr 131.7488 1) 92.3000 142.7398 2) 0.0000 0.0000 207.0257 83.0744	May 25.7811 92.3000 27.9319 0.0000 0.0000 200.8807 80.7307	Jun 0.0000 0.0000 0.0000 0.0000 0.0000 181.2520 79.8000	Jul 0.0000 0.0000 0.0000 0.0000 0.0000 179.2101 79.8000	Aug 0.0000 0.0000 0.0000 0.0000 0.0000 186.2920 79.8000	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 188.2651 79.8000	Oct 153.8684 92.3000 166.7047 0.0000 0.0000 209.6071 83.3773	Nov 456.8378 92.3000 494.9488 0.0000 0.0000 222.4235 85.6374	0.0000 (201 1.0000 (202 92.3000 (206 0.0000 (207 0.0000 (208 Dec 739.9780 (98) 92.3000 (210 801.7097 (211 0.0000 (212 0.0000 (213 0.0000 (215 247.5818 (64) 79.8000 (216 86.3583 (217
pace heating a. Energy req a. Energy req raction of sp raction of sp fficiency of fficiency of fficiency of pace heating pace cooling 221)m umps and Fa ighting lectricity ge	per m2 quirements Dace heat foace foace foace secondary/ Jan requirement 777.3621 efficiency 92.3000 fuel (main 777.2071 efficiency 0.0000 fuel (main 0.0000 fuel (main 0.0000 fuel (seco 0.0000 requirement 250.2289 water heat 86.2834 heating, 290.0082 fuel requi 0.0000 7.3041 30.7908 enerated by		mary/supplements stem(s) stem 1 (in stem 2 (in ry heating Mar 357.1993 ing system 92.3000 stem) 386.9982 ing system 0.0000 0.0000 235.0002 84.9960 276.4838 0.0000 7.3041 22.2410 dix M) (neg	mitary system %) %) system, % Apr 131.7488 1) 92.3000 142.7398 2) 0.0000 0.0000 207.0257 83.0744 249.2052 0.0000 7.0685 16.2947 gative quant	May 25.7811 92.3000 27.9319 0.0000 0.0000 200.8807 80.7307 248.8283 0.0000 7.3041 12.5865 ity)	Jun 0.0000 0.0000 0.0000 0.0000 0.0000 181.2520 79.8000 227.1328 0.0000 7.0685 10.2833	Jul 0.0000 0.0000 0.0000 0.0000 0.0000 179.2101 79.8000 224.5741 0.0000 7.3041 11.4818	Aug 0.0000 0.0000 0.0000 0.0000 0.0000 186.2920 79.8000 233.4486 0.0000 7.3041 14.9245	0.0000 0.0000 0.0000 0.0000 0.0000 188.2651 79.8000 235.9212 0.0000 7.0685 19.3854	Oct 153.8684 92.3000 166.7047 0.0000 0.0000 209.6071 83.3773 251.3960 0.0000 7.3041 25.4347	Nov 456.8378 92.3000 494.9488 0.0000 0.0000 222.4235 85.6374 259.7271 0.0000 7.0685 28.7285	0.0000 (201 1.0000 (202 92.3000 (206 0.0000 (207 0.0000 (208 Dec 739.9780 (98) 92.3000 (210 801.7097 (211 0.0000 (212 0.0000 (213 0.0000 (215 247.5818 (64) 79.8000 (216 86.3583 (217 286.6915 (219 0.0000 (221 7.3041 (231 31.6465 (232
pace heating a. Energy req a. Ener	per m2 quirements cace heat f main space main space main space secondary/ Jan requirement 717.3621 efficiency 92.3000 fuel (main 777.2071 efficiency 0.0000 fuel (main 0.0000 fuel (seco 0.0000 requirement 250.2289 water heat 86.2834 heating, 290.0082 fuel requi 0.0000 7.3041 30.7908 enerated by enerated by enerated by		mar (in year) (i	mitary system %) %) system, % Apr 131.7488 1) 92.3000 142.7398 2) 0.0000 0.0000 207.0257 83.0744 249.2052 0.0000 7.0685 16.2947 ative quant -62.1943 lix M) (nega	May 25.7811 92.3000 27.9319 0.0000 0.0000 200.8807 80.7307 248.8283 0.0000 7.3041 12.5865 ity) -70.3078 tive quanti	Jun 0.0000 0.0000 0.0000 0.0000 0.0000 181.2520 79.8000 227.1328 0.0000 7.0685 10.2833 -66.7813	Jul 0.0000 0.0000 0.0000 0.0000 0.0000 179.2101 79.8000 224.5741 0.0000 7.3041 11.4818 -65.9338	Aug 0.0000 0.0000 0.0000 0.0000 0.0000 186.2920 79.8000 233.4486 0.0000 7.3041 14.9245 -60.6102	0.0000 0.0000 0.0000 0.0000 0.0000 188.2651 79.8000 235.9212 0.0000 7.0685 19.3854	Oct 153.8684 92.3000 166.7047 0.0000 0.0000 209.6071 83.3773 251.3960 0.0000 7.3041 25.4347 -40.5555	Nov 456.8378 92.3000 494.9488 0.0000 0.0000 222.4235 85.6374 259.7271 0.0000 7.0685 28.7285 -25.7209	0.0000 (201 1.0000 (202 92.3000 (206 0.0000 (207 0.0000 (208 Dec 739.9780 (98) 92.3000 (210 801.7097 (211 0.0000 (212 0.0000 (213 0.0000 (215 247.5818 (64) 79.8000 (216 86.3583 (217 286.6915 (219 0.0000 (221 7.3041 (231 31.6465 (232 -19.4549 (233
pace heating a. Energy req caction of sp raction of sp raction of sp refficiency of efficiency of efficiency of pace heating pace obering pace heating pace heatin	quirements Quirements Quirements Quirements Quirements Quirements Quirements Quirements Quirement Qui		mar (in year) (i	### Apr 131.7488 1) 92.3000 142.7398 2) 0.0000 0.0000 207.0257 83.0744 249.2052 0.0000 7.0685 16.2947 421ve quant -62.1943 lix M) (nega 0.0000 ators (Appenitors (May 25.7811 92.3000 27.9319 0.0000 0.0000 200.8807 80.7307 248.8283 0.0000 7.3041 12.5865 ity) -70.3078 tive quanti 0.0000 dix M) (neg	Jun 0.0000 0.0000 0.0000 0.0000 0.0000 181.2520 79.8000 227.1328 0.0000 7.0685 10.2833 -66.7813 ty) 0.0000 ative quant	Jul 0.0000 0.0000 0.0000 0.0000 0.0000 179.2101 79.8000 224.5741 0.0000 7.3041 11.4818 -65.9338 0.0000 ity)	Aug 0.0000 0.0000 0.0000 0.0000 0.0000 186.2920 79.8000 233.4486 0.0000 7.3041 14.9245 -60.6102 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 188.2651 79.8000 235.9212 0.0000 7.0685 19.3854 -51.8368 0.0000	Oct 153.8684 92.3000 166.7047 0.0000 0.0000 209.6071 83.3773 251.3960 0.0000 7.3041 25.4347 -40.5555 0.0000	Nov 456.8378 92.3000 494.9488 0.0000 0.0000 222.4235 85.6374 259.7271 0.0000 7.0685 28.7285 -25.7209 0.0000	0.0000 (201 1.0000 (202 92.3000 (206 0.0000 (207 0.0000 (208 Dec 739.9780 (98) 92.3000 (210 801.7097 (211 0.0000 (212 0.0000 (213 0.0000 (215 247.5818 (64) 79.8000 (216 86.3583 (217 286.6915 (219 0.0000 (221 7.3041 (231 31.6465 (232 -19.4549 (233.00000 (234.00000)
pace heating a. Energy req a. Energy of a. Energy energy a. Energy a	per m2 quirements Dace heat f main space main space main space secondary/ Jan requirement 717.3621 efficiency 92.3000 fuel (main 777.2071 efficiency 0.0000 fuel (seco 0.0000 requirement 250.2289 water heat 86.2834 heating, 290.0082 fuel requi 0.0000 7.3041 30.7908 enerated by -22.7675 enerated by 0.0000		mar (in ry heating Mar 357.1993 ing system 92.3000 (stem 2) 0.0000 (stem 2) 0.0000 (235.0002 (84.9960 (276.4838 (0.0000 (2.2410 (dix M) (neg 5.20309) nes (Append 0.0000 (2.0000) (a.0000) (a.00	### Apr 131.7488 1) 92.3000 142.7398 2) 0.0000 0.0000 207.0257 83.0744 249.2052 0.0000 7.0685 16.2947 ative quant -62.1943 ix M) (nega 0.0000 by micro-CH	May 25.7811 92.3000 27.9319 0.0000 0.0000 200.8807 80.7307 248.8283 0.0000 7.3041 12.5865 ity) -70.3078 tive quanti 0.0000 pt (Appendix	Jun 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 181.2520 79.8000 227.1328 0.0000 227.1328 0.0000 181.2520 181.2520 181.2520 181.2520 181.2520 181.2520 181.2520 181.2520 181.2520 181.2520 181.2520 181.2520 181.2520 181.2520 181.2683	Jul 0.0000 0.0000 0.0000 0.0000 179.2101 79.8000 224.5741 0.0000 7.3041 11.4818 -65.9338 0.0000 ity) 0.0000 ve if net g	Aug 0.0000 0.0000 0.0000 0.0000 186.2920 79.8000 233.4486 0.0000 7.3041 14.9245 -60.6102 0.0000 eneration)	0.0000 0.0000 0.0000 0.0000 0.0000 188.2651 79.8000 235.9212 0.0000 7.0685 19.3854 -51.8368 0.0000	Oct 153.8684 92.3000 166.7047 0.0000 0.0000 209.6071 83.3773 251.3960 0.0000 7.3041 25.4347 -40.5555 0.0000 0.0000	Nov 456.8378 92.3000 494.9488 0.0000 0.0000 222.4235 85.6374 259.7271 0.0000 7.0685 28.7285 -25.7209 0.0000 0.0000	0.0000 (201 1.0000 (202 92.3000 (207 0.0000 (208 Dec 739.9780 (98) 92.3000 (210 801.7097 (211 0.0000 (213 0.0000 (215 247.5818 (64) 79.8000 (216 86.3583 (217 286.6915 (219 0.0000 (217 7.3041 (231 31.6465 (232 -19.4549 (233) 0.0000 (234)
pace heating a. Energy requiraction of sp inaction of sp infficiency of infficiency of inficiency of inpace heating inpace he	per m2 quirements pace heat f pace heat f pace heat f main space main space secondary/ Jan requiremen 717.3621 efficiency 92.3000 fuel (main 777.2071 efficiency 0.0000 fuel (main 0.0000 fuel (main 0.0000 fuel (seco 0.0000 requiremen 250.2289 water heat 86.2834 heating, 290.0082 fuel requi 0.0000 7.3041 30.7908 enerated by -22.7675 enerated by 0.0000 enerated by 0.0000 enerated by 0.0000		"ry/suppleme stem(s) stem 1 (in stem 2 (in ry heating	### Apr 131.7488 1) 92.3000 142.7398 2) 0.0000 0.0000 0.0000 0.0000 7.0685 16.2947 (ative quant -62.1943 lix M) (nega 0.0000 ttors (Appen 0.0000 by micro-CH 0.0000 b	May 25.7811 92.3000 27.9319 0.0000 0.0000 0.0000 200.8807 80.7307 248.8283 0.0000 7.3041 12.5865 ity) -70.3078 tive quanti 0.0000 dix M) (neg 0.0000 P (Appendix 0.0000	Jun 0.0000 0.0000 0.0000 0.0000 0.0000 181.2520 79.8000 227.1328 0.0000 7.0685 10.2833 -66.7813 ty) 0.0000 ative quant 0.0000	Jul 0.0000 0.0000 0.0000 0.0000 0.0000 179.2101 79.8000 224.5741 0.0000 7.3041 11.4818 -65.9338 0.0000 0.0000	Aug 0.0000 0.0000 0.0000 0.0000 186.2920 79.8000 233.4486 0.0000 7.3041 14.9245 -60.6102 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 188.2651 79.8000 235.9212 0.0000 7.0685 19.3854 -51.8368 0.0000	Oct 153.8684 92.3000 166.7047 0.0000 0.0000 209.6071 83.3773 251.3960 0.0000 7.3041 25.4347 -40.5555 0.0000	Nov 456.8378 92.3000 494.9488 0.0000 0.0000 222.4235 85.6374 259.7271 0.0000 7.0685 28.7285 -25.7209 0.0000	0.0000 (201 1.0000 (202 92.3000 (206 0.0000 (207 0.0000 (208 Dec 739.9780 (98) 92.3000 (210 801.7097 (211 0.0000 (212 0.0000 (213 0.0000 (215 247.5818 (64) 79.8000 (216 86.3583 (217 286.6915 (219 0.0000 (221 7.3041 (231 31.6465 (232 -19.4549 (233.00000 (234.00000)

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(234b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000		0.0000 0.0000	0.0000 0.6	0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quan (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	0.0000 0.0	9000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negat (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	0.0000 0.6	0000 (235d)
Space heating fuel - main system 1				374 (211)
Space heating fuel - main system 2 Space heating fuel - secondary				9000 (213) 9000 (215)
Efficiency of water heater			79.8	3000
Water heating fuel used Space cooling fuel				9874 (219) 9000 (221)
Electricity for pumps and fans:				
Total electricity for the above, kWh/year Electricity for lighting (calculated in Appendix L)				9000 (231) 1991 (232)
Energy saving/generation technologies (Appendices M ,N and Q) PV generation			-1010 (304 (233)
Wind generation				0000 (234)
Hydro-electric generation (Appendix N) Electricity generated - Micro CHP (Appendix N)				000 (235a)
Appendix Q - special features			0.0	0000 (235)
Energy saved or generated Energy used				0000 (236) 0000 (237)
Total delivered energy for all uses				1935 (238)
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP				
	Energy	Emission factor	Emissi	
Space heating - main system 1	kWh/year 3341.93 7 4	kg CO2/kWh 0.2100	kg CO2/y 701.8	8068 (261)
Total CO2 associated with community systems	2041 0074	0.2100		000 (373)
Water heating (other fuel) Space and water heating	3041.0874	0.2100		5283 (264) 1352 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387		293 (267)
Energy for lighting	248.4991	0.1443	35.8	3661 (268)
Energy saving/generation technologies PV Unit electricity used in dwelling	- 572.2961	0.1334	- 76.3	1180
V Unit electricity used in dwelling	-446.7343	0.1252	-55.9	
Total Total CO2, kg/year				2403 (269) 9903 (272)
EPC Target Carbon Dioxide Emission Rate (TER)				1500 (273)
13a. Primary energy - Individual heating systems including micro-CHP				
	0,	Primary energy factor	Primary end	
Space heating - main system 1	kWh/year 3341.9374	kg CO2/kWh 1.1300	kWh/y 3776.3	vear 3892 (275)
Total CO2 associated with community systems			0.0	000 (473)
Water heating (other fuel) Space and water heating	3041.0874	1.1300		1287 (278) 3180 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1	1008 (281)
Energy for lighting	248.4991	1.5338	381.1	1562 (282)
Energy saving/generation technologies	E70 2064	1 4020	OF 4	01.40
PV Unit electricity used in dwelling PV Unit electricity exported	-572.2961 -446.7343	1.4928 0.4595	-854.3 -205.2	
Fotal			-1059.5	715 (283)
Total Primary energy kWh/year Target Primary Energy Rate (TPER)				5035 (286) 8800 (287)
				, ,



Property Reference		L07-	-9.03 MA x3_Copy_0	Сору					Issue	d on Date	12/09	/2023	
Assessment Reference	•	L07-	-9.03 MA x3_Copy_0	Сору			Prop	Type Ref					
Property													
SAP Rating				87		DER		10.56		TER		2.80	
Environmental				92			R < TER					7.50	
CO₂ Emissions (t/year) Compliance Check				0.0	ee BREL	DFEE	EE < TFEE	29.07		TFEE		9.40	
% DPER < TPER					J.03	DPE		60.44		TPER		9.50	
				100				00.11					
Assessor Details Client		Mr. Richard	J Denteh							Assessor ID) [[J148-0001	
SAP 10 WORKSHEET CALCULATION OF DI	FOR New Bu	uild (As I		Version 10	.2, February	2022)		Area	Stor	ey height		Volume	
Ground floor Total floor area Dwelling volume	TFA = (1a))+(1b)+(1	c)+(1d)+(1e).	(1n)	72	2.2000		(m2) 72.2000	(1b) x 3a)+(3b)+(3c)	(m) 2.7400 +(3d)+(3e)		(m3) 197.8280 197.8280	(1b) - (4)
2. Ventilation ra	ate										n	13 per hour	
Number of open cl Number of open f. Number of chimme! Number of flues a Number of flues a Number of interm! Number of passivi Number of fluele!	lues ys / flues attached to attached to d chimneys ittent extr e vents	solid for other he	uel boiler	re							0 * 80 = 0 * 20 = 0 * 10 = 0 * 20 = 0 * 35 = 0 * 20 = 0 * 10 = 0 * 10 = 0 * 40 =	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(6b) (6c) (6d) (6e) (6e) (6f) (7a)
Infiltration due	to chimney	s, flues	and fans =	= (6a)+(6b)-	+(6c)+(6d)+(6	бе)+(б f)+(6g)+(7a)+(7	7b)+(7c) =		0.0000	Air change () / (5) =	s per hour 0.0000	
Pressure test Pressure Test Mer Measured/design / Infiltration rate Number of sides	AP50 ≘										E	Yes Blower Door 3.0000 0.1500 2	(17)
Shelter factor Infiltration rate	e adjusted	to inclu	de shelter fa	actor					(20) = 1 - (2		(19)] = x (20) =	0.8500 0.1275	
Wind speed Wind factor Adj infilt rate	Jan 5.1000 1.2750	Feb 5.0000 1.2500 0.1594	Mar 4.9000 1.2250 0.1562	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	Sep 4.0000 1.0000	Oct 4.3000 1.0750	Nov 4.5000 1.1250		(22a)
Balanced mechan: If mechanical ver If exhaust air he If balanced with	ntilation eat pump us	lation wit	th heat recov ndix N, (23b)	very) = (23a) x					0.1275 Ba)	0.1371	0.1434		(23a) (23b)
Effective ac	0.2986	0.2954	0.2922	0.2762	0.2731	0.2571	0.2571	0.2539	0.2635	0.2731	0.2794	0.2858	
3. Heat losses a		s paramet											
Element				Gross	Openings		Area	U-value	Ax		(-value	AxK	
window (Uw = 1.30 External Wall 1 Total net area o		elements		m2 56.1426	m2 15.4300	40.	m2 4300 7126 1426	W/m2K 1.2357 0.1400	W/ 19.067 5.699	5	kJ/m2K 00.0000	kJ/K 7735.3940	(27)

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Fabric heat los Party Wall 1 Party Floor 1 Party Ceiling 1	L	ин (A X U)				72 72	.0900 .2000 .2000	30) + (32) = 0.0000	= 24.76 0.00	00 18 4 3	10.0000 80.0000	10096.2000 2888.0000 2166.0000	(32 (32
Internal Wall 1		v k)				80	.8300	(20)	(20) : /2		75.0000	6062.2500	
Heat capacity (Thermal mass pa	rameter (T Bridges		ΓFA) in kJ/r	m2K							(32e) =	400.9397	
K1 Elem E2 Othe E3 Sill	er lintels	(including	other steel	l lintels)				9	ength .4800 .9000	Psi-value 0.0300 0.0300	Tot 0.28 0.23	344	
E4 Jamb E7 Part		etween dwell	lings (in bl	locks of fl	ats)				.0400 .9800	0.0300 0.0700	0.51 2.86		
E16 Cor	ner (norma		lings g, wall insu	ulation con	tinuous			5	.4800 .4800 .8400	0.0600 0.0900 0.0000	0.32 0.49 0.00	32	
	rner (inver 5 (Sum(L x oridges	ted – inter	rnal area gr	reater than	external a	rea)			.7400	-0.0900	-0.24 (36a) =	4.4766 0.0000	
Ventilation hea		culated mor	nthly (38)m	= 0.33 x (25)m x (5)				(33) + (36)	+ (36a) =	29.2439	(3/
(38)m	Jan 19.4911	Feb 19.2830	Mar 19.0749	Apr 18.0345	May 17.8264	Jun 16.7860	Jul 16.7860	Aug 16.5779	Sep 17.2021	0ct 17.8264	Nov 18.2426	Dec 18.6588	(38
Heat transfer o Average = Sum(3	48.7350	48.5269	48.3188	47.2783	47.0703	46.0298	46.0298	45.8217	46.4460	47.0703	47.4864	47.9026 47.2263	
HLP	Jan 0.6750	Feb 0.6721	Mar 0.6692	Apr 0.6548	May 0.6519	Jun 0.6375	Jul 0.6375	Aug 0.6346	Sep 0.6433	0ct 0.6519	Nov 0.6577	Dec 0.6635	(40
HLP (average) Days in mont	31	28	31	30	31	30	31	31	30	31	30	0.6541 31	,
1. Water heatir	ng energy r	requirements	s (kWh/year))									
Assumed occupar	ісу											2.2983	(42
Hot water usage Hot water usage	86.2882	84.9915	83.1019	79.4865	76.8184	73.8429	72.1517	74.0270	76.0827	79.2774	82.9705	85.9576	(4:
Hot water usage	27.1100	26.7073	26.1404	25.0950	24.3122	23.4442	22.9754	23.5384	24.1514	25.0802	26.1471	27.0183	(42
Average daily h	38.1672	36.7793	35.3914 /day)	34.0035	32.6156	31.2277	31.2277	32.6156	34.0035	35.3914	36.7793	38.1672 139.3875	
Daily hot water	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
Energy conte	151.5654 240.0425	148.4781 211.4309	144.6336 222.2965	138.5849 189.7158	133.7461 180.0480	128.5148 158.0240	126.3547 152.8151	130.1810 161.1912	134.2376 165.5283	139.7489 189.6380	145.8968 207.8568 Sum(45)m =	151.1431 236.6536 2315.2407	(45
Distribution lo		= 0.15 x (4 31.7146	45)m 33.3445	28.4574	27.0072	23.7036	22.9223	24.1787	24.8292	28.4457	31.1785	35.4980	
Water storage l Store volume a) If manufact		anod loss f	octon is kno	awa (khila /d	av).							180.0000 1.5200	
Temperature f Enter (49) or (actor from [54] in (55	n Table 2b	actor 15 km	JWII (KWII/U	ay).							0.5400 0.8208	(49
Total storage l	25.4448	22.9824	25.4448	24.6240	25.4448	24.6240	25.4448	25.4448	24.6240	25.4448	24.6240	25.4448	(56
f cylinder cor	25.4448	22.9824	25.4448	24.6240	25.4448	24.6240	25.4448	25.4448	24.6240	25.4448	24.6240	25.4448	
Primary loss Combi loss	23.2624 0.0000	21.0112 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	
Total heat requ	iired for w 288.7497	ater heatir 255.4245	ng calculate 271.0037	ed for each 236.8518	month 228.7552	205.1600	201.5223	209.8984	212.6643	238.3452	254.9928	285.3608	(62
WWHRS PV diverter	-65.4547 0.0000	-57.8887 0.0000	-60.6177 0.0000	-50.1938 0.0000	-46.7788 0.0000	-40.0290 0.0000	-37.5208 0.0000	-39.8996 0.0000	-41.4155 0.0000	-48.8244 0.0000	-55.3121 0.0000	-64.2426 0.0000	
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	(6
GHRS Output from w/h	0.0000 1 223.2950	0.0000	0.0000 210.3860	0.0000 186.6580	0.0000 181.9764	0.0000 165.1310	0.0000 164.0015	0.0000 169.9988	0.0000 171.2488	0.0000 189.5208	0.0000	0.0000 221.1182	
12Total per yea	ır (kWh/yea								er year (kW	h/year) = S		2280.5511 2281	(6
Electric shower	o.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000	
Heat gains from	n water hea 118.7799		nonth 112.8794	100.7893	98.8317	sed by insta 90.2518	89.7768	92.5618	92.7470	102.0204	106.8212	117.6531	·
													ν
5. Internal gai		ble 5 and 5	5a)										
Metabolic gains	(Table 5) Jan		Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
(66)m Lighting gains	114.9164 (calculate	114.9164 ed in Append	114.9164 dix L, equat	114.9164 tion L9 or	114.9164 L9a), also	114.9164 see Table 5	114.9164	114.9164	114.9164	114.9164	114.9164	114.9164	
Appliances gair	102.0756 ns (calcula	113.0123 ated in Appe	102.0756 endix L, equ	105.4781 uation L13	102.0756 or L13a), a	105.4781 lso see Tab	102.0756 le 5	102.0756	105.4781	102.0756	105.4781	102.0756	
-	202.3763		199.1843			160.3307	151.4014	149.3013	154.5933	165.8594	180.0808	193.4469	(69



Process Color C													
### PAIR PAIR PAIR PAIR PAIR PAIR PAIR PAIR	Pumps, fans	34.4916 0.0000	34.4916 0.0000	34.4916 0.0000	34.4916 0.0000	34.4916	34.4916	34.4916					34.4916 (69) 0.0000 (70)
1902 100-20 100	Losses e.g. ev					-91.9332	-91.9332	-91.9332	-91.9332	-91.9332	-91.9332	-91.9332	- 91.9332 (71)
\$11,1972 \$11,9911 \$10.4944 \$490.8964 \$466.897 \$448.8958 \$41,6996 \$452.2629 \$446.9516 \$45.2629 \$446.9516 \$45.2629 \$446.9516 \$45.2629 \$446.9516 \$45.2629 \$466.9516 \$45.2629 \$466.9516 \$45.2629 \$466.9516 \$45.2629 \$466.9516 \$45.2629 \$466.9516 \$45.2629 \$466.9516 \$45.2629 \$466.9516 \$46.2629 \$466.9516 \$46.2629 \$466.9516 \$46.2629 \$466.9516 \$46.2629 \$466.9516 \$46.2629 \$466.9516 \$46.2629 \$466.9516 \$46.2629 \$466.9516 \$46.2629 \$466.9516 \$46.2629 \$466.9516	Water heating			151.7196	139.9852	132.8383	125.3497	120.6677	124.4111	128.8152	137.1242	148.3628	158.1359 (72)
Company Comp	Total internal		531.9511	510.4544	490.8564	466.0857	448.6335	431.6196	433.2629	446.3616	462.5341	491.3966	511.1333 (73)
Second S													
Table 66 Specific data Specific Specif	. Solar gains												
20.05622 1.0.6693 2.0.6996 2.0.3996	[Jan]			Α		Table 6a	speci	fic data		data	facto	or	
The probability of the properties of the probability of the probabilit	East												19.1622 (74) 20.0502 (76)
7. Noon intermal temperature (heating sections in the living area from Table 9, Thi (C) Temperature during heating periods in the living area from Table 9, Thi (C) Table 11.0997 12.046 (1.479 17.033 16.479 17.09793 170.81312 174.6926 174.6926 174.6926 175.4860 17.271 179.8131 169.3340 12.3881 12.389 12.3898													32.4629 (83) 543.5961 (84)
Temperature during heating periods in the living area from Table 9, Thi (C) Tillisation factor for gains for living mrea, nil,m (see Table 90) The cau 164,9988 165,9393 166,1479 120,8979 370,8312 174,6926 175,4856 175,4856 173,1273 108,812 109,838 12,3889 11,999 11,999 11,999 12,0469 11,999 12,0469 11,998 12,0469 11,999 12,0469 11,998 12,0469 12,3886 12,3887 12,6462 12,													
1	 Temperature du	ring heatin	ng periods i	n the livi									21.0000 (85)
11-9997 12.9469 12.945 12.935 12.336 12.3387 12.662 12.6662 12.6692 12.5418 12.387 12.2887 12.2889 12.1999 12.945 12.387 12.2889 12.1999 12.945 12.387 12.2889 12.1999 12.945 12.387		Jan	Feb	Mar	Apr	May							
## 1.5 ##	alpha	11.9997											
th 2	ITII IIVING ar		0.9888	0.9596	0.8187	0.6107	0.4144	0.2984	0.3311	0.5373	0.8577	0.9834	0.9973 (86)
## 10	h 2	20.3630											20.7192 (87) 20.3732 (88)
Living area fraction		0.9948											0.9960 (89)
emperature adjustment digisted MIT 20.3611 28.4410 20.5355 20.6158 20.6261 20.6342 20.6342 20.6358 20.6310 20.6142 20.5917 20.3584 (93 distributed MIT 20.3611 28.4410 20.5355 20.6158 20.6261 20.6342 20.6342 20.6358 20.6310 20.6142 20.5917 20.3584 (93 distributed MIT 20.3611 28.4410 20.5355 20.6158 20.6261 20.6342 20.6342 20.6358 20.6310 20.6142 20.5917 20.3584 (93 distributed MIT 20.3611 20.6158 20.6158 20.6261 20.6342 20.6342 20.6358 20.6310 20.6142 20.5917 20.3584 (93 distributed MIT 20.3611 20.6158 20.6158 20.6158 20.6312 20.	iving area fr	action								fLA =	Living area	a / (4) =	0.3940 (91)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	Temperature ad	ljustment											
### Part	3. Space heati	ng requirem											
Seful gains 557,8825 598,4676 604,7666 545,7137 419,9211 277,7522 185,6938 194,0902 383,3108 468,4098 527,7887 541,3976 595; kit temp. 4,3000 4,9000 6,5000 8,9000 11,7000 14,6000 16,6000 14,1000 14,0000 7,1000 4,2000 696; kit temp. 4,3000 4,9000 6,5000 8,9000 11,7000 14,6000 16,6000 14,1000 14,0000 7,1000 4,2000 6,5000 7,4000 4,2000 6,5000 7,4000 4,2000 6,5000 7,4000 4,2000 6,5000 7,4000 7,4000 6,5000 7,4000		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec
782.7393 754.1575 678.179 553.9032 420.1559 277.7534 185.6938 194.0902 303.3410 471.3701 636.3971 774.0286 (97.5926 heating kkh 167.3233 104.6236 54.6180 5.8964 0.1747 0.0000 0.0000 0.0000 0.0000 8.1545 78.2038 173.0775 (98.5926 heating requirement - total per year (kkh/year) 0.0000 0.000	Jseful gains	557.8425	598.4676	604.7666	545.7137	0.5863 419.9211	277.7522	185.6938	0.3048 194.0902	303.3100	460.4098	527.7807	0.9960 (94) 541.3976 (95) 4.2000 (96)
167.3233 104.6236 54.6180 5.8964 0.1747 0.0000 0.0000 0.0000 0.0000 8.1545 78.2038 173.0775 (98: 592.0718	Heat loss rate		754.1575	678.1779	553.9032	420.1559	277.7534	185.6938	194.0902	303.3410	471.3701	636.3971	774.0286 (97)
0.0000 0.	pace heating	167.3233 requirement				0.1747	0.0000	0.0000	0.0000	0.0000	8.1545	78.2038	173.0775 (98a) 592.0718
167.3233 104.6236 54.6180 5.8964 0.1747 0.0000 0.0000 0.0000 8.1545 78.2038 173.0775 (98c pace heating requirement after solar contribution - total per year (kWh/year) (98c) / (4) = 8.2004 (99c) / (Solar heating	0.0000 contributio				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b) 0.0000
Pace heating per m2 (98c) / (4) = 8.2004 (99) Da. Energy requirements - Individual heating systems, including micro-CHP Traction of space heat from secondary/supplementary system (Table 11) Fraction of space heat from main system(s) Fraction of space heat from main system(s) Fraction of space heating system 1 (in %) Frictiency of main space heating system 2 (in %) Frictiency of main space heating system 2 (in %) Frictiency of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Space heating requirement 167.3233 104.6236 54.6180 5.8964 0.1747 0.0000 0.0000 0.0000 0.0000 8.1545 78.2038 173.0775 (98) Space heating efficiency (main heating system 1) 84.5000 84.5000 84.5000 84.5000 84.5000 0.0000 0.0000 0.0000 0.0000 84.5000 84.5000 84.5000 (216) Space heating fuel (main heating system 2) 198.0157 123.8149 64.6367 6.9780 0.2067 0.0000 0.0		167.3233						0.0000	0.0000	0.0000	8.1545	78.2038	173.0775 (98c)
Pas. Energy requirements - Individual heating systems, including micro-CHP Fraction of space heat from secondary/supplementary system (Table 11) Fraction of space heat from main system(s) Efficiency of main space heating system 1 (in %) Efficiency of main space heating system 2 (in %) Individual heating system 1 (in %) Efficiency of main space heating system 2 (in %) Individual heating system 1 (in %) Bat. 5000 (200 (200 (200 (200 (200 (200 (200			. arter sola	r contribu	cion - tota	i per year	(KWII/ year-)				(98c)) / (4) =	8.2004 (99)
Fraction of space heat from secondary/supplementary system (Table 11) Fraction of space heat from main system(s) Fraction of space heat from main system 1 (in %) Fraction of space heating system 1 (in %) Fraction of space heating system 1 (in %) Fraction of space heating system 2 (in %) Fraction of space heating system 3 (in %) Fraction of space heating system 2 (in %) Fraction of space heating frequirement Fraction of space heating system 2 (in %) Fraction of space heating system 2 (in %) Fraction of space heating from main system 2 (in %) Fraction of space heating from main system 2 (in %) Fraction of space heating from main system 2 (in %) Fraction of space heating from main system 2 (in %) Fraction of space heating from main system 2 (in %) Fraction of space heating from main system 2 (in %) Fraction of space heating from main system 2 (in %) Fraction of space heating from main system 2 (in %) Fraction of space heating from main system 2 (in %) Fraction of space heating from main system 2 (in %) Fraction of space heating system 2 (in %) Fraction of space													
## Praction of space heat from main system(s) ## First ciency of main space heating system 1 (in %) ## Fifticiency of main space heating system 2 (in %) ## Fifticiency of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec ## Space heating requirement 167.3233 104.6236 54.6180 5.8964 0.1747 0.0000 0.0000 0.0000 0.0000 8.1545 78.2038 173.0775 (98.5) ## Space heating efficiency (main heating system 1) 84.5000 84.5000 84.5000 84.5000 84.5000 84.5000 0.0000 0.0000 0.0000 0.0000 0.0000 84.5000 84.5000 84.5000 84.5000 84.5000 ## Space heating fuel (main heating system) 198.0157 123.8149 64.6367 6.9780 0.2067 0.0000 0.													0.0000 (201)
Space heating requirement 167.3233 104.6236 54.6180 5.8964 0.1747 0.0000 0.0000 0.0000 0.0000 8.1545 78.2038 173.0775 (98) Space heating efficiency (main heating system 1) 84.5000 84.5000 84.5000 84.5000 0.0000 0.0000 0.0000 0.0000 84.5000 84.5000 84.5000 (216) Space heating fuel (main heating system) 198.0157 123.8149 64.6367 6.9780 0.2067 0.0000 0.0000 0.0000 0.0000 9.6503 92.5489 204.8254 (216) Space heating efficiency (main heating system 2) 0.0000	raction of sp Efficiency of Efficiency of	ace heat fr main space main space	om main sys heating sys heating sys	tem(s) tem 1 (in tem 2 (in	%) %)	`							
167.3233 104.6236 54.6180 5.8964 0.1747 0.0000 0.0000 0.0000 0.0000 8.1545 78.2038 173.0775 (98) space heating efficiency (main heating system 1) 84.5000 84.5000 84.5000 84.5000 84.5000 0.0000 0.0000 0.0000 0.0000 84.5000 84.5000 84.5000 (216) space heating fuel (main heating system) 198.0157 123.8149 64.6367 6.9780 0.2067 0.0000 0.0000 0.0000 0.0000 9.6503 92.5489 204.8254 (216) space heating efficiency (main heating system 2) 0.0000 0.00	inace heating			Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec
84.5000 84.5000 84.5000 84.5000 84.5000 84.5000 0.0000 0.0000 0.0000 0.0000 84.5000 84.5000 84.5000 (216 pace heating fuel (main heating system) 198.0157 123.8149 64.6367 6.9780 0.2067 0.0000 0.0000 0.0000 0.0000 9.6503 92.5489 204.8254 (216 pace heating efficiency (main heating system 2) 0.0000		167.3233	104.6236			0.1747	0.0000	0.0000	0.0000	0.0000	8.1545	78.2038	173.0775 (98)
198.0157 123.8149 64.6367 6.9780 0.2067 0.0000 0.0000 0.0000 0.0000 9.6503 92.5489 204.8254 (21: pace heating efficiency (main heating system 2) 0.00000 0.00000 0.0000 0.0000 0.0000 0.00000 0.0000 0.00000 0.00000 0.0000		84.5000	84.5000	84.5000		84.5000	0.0000	0.0000	0.0000	0.0000	84.5000	84.5000	84.5000 (210)
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (21% Space heating fuel (main heating system 2)		198.0157	123.8149	64.6367		0.2067	0.0000	0.0000	0.0000	0.0000	9.6503	92.5489	204.8254 (211)
		0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
	space neating				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)

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Full SAP Calculation Printout



pace 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	(21
ter heating	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(
ter heating requirement 223.2950 197.5358	210.3860	186.6580	181.9764	165.1310	164.0015	169.9988	171.2488	189.5208	199.6807	221.1182	(64
ficiency of water heater	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	89.5000 84.5000	
1 for water heating, kWh/month 264.2545 233.7702	248.9776	220.8970	215.3566	195.4213	194.0846	201.1820	202.6613	224.2850	236.3086	261.6784	
ce cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
ps and Fa 16.2936 14.7168 htting 18.7528 15.0442	16.2936 13.5456	15.7680 9.9241	16.2936 7.6656	15.7680 6.2629	16.2936 6.9929	16.2936 9.0896	15.7680 11.8065	16.2936 15.4907	15.7680 17.4967	16.2936 19.2739	(2
ectricity generated by PVs (Appendicts) 0.0000 0.0000				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
ctricity generated by wind turbin 4a)m 0.0000 0.0000					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
ctricity generated by hydro-elect 5a)m 0.0000 0.0000						0.0000	0.0000	0.0000	0.0000	0.0000	
ctricity used or net electricity					ve if net g 0.0000		0.0000	0.0000	0.0000		
ctricity generated by PVs (Append	dix M) (nega	tive quanti	ity)							0.0000	
3b)m 0.0000 0.0000 ctricity generated by wind turbin					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
4b)m 0.0000 0.0000 ectricity generated by hydro-elect						0.0000	0.0000	0.0000	0.0000	0.0000	·
5b)m 0.0000 0.0000 ectricity used or net electricity					0.0000 ve if net g		0.0000	0.0000	0.0000	0.0000	·
5d)m 0.0000 0.0000 ual totals kWh/year	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	·
ce heating fuel - main system 1 ce heating fuel - main system 2										700.6767 0.0000	(2
ce heating fuel - secondary iciency of water heater										0.0000 89.5000	(2
er heating fuel used ce cooling fuel										2698.8770 0.0000	
ctricity for pumps and fans:											
(BalancedWithHeatRecovery, Datab mechanical ventilation fans (SFP		factor = 1 250)	1.2500, SFP	= 0.6250)						150.8439	(2
central heating pump al electricity for the above, kWh		•								41.0000 191.8439	
ctricity for lighting (calculated		x L)								151.3454	
rgy saving/generation technologic generation	es (Appendic	es M ,N and	d Q)							0.0000	(2
d generation ro-electric generation (Appendix	N/\									0.0000	(2
ectricity generated - Micro CHP (A										0.0000	
endix Q - special features ergy saved or generated										-0.0000	
ergy used al delivered energy for all uses										0.0000 3742.7430	
a. Carbon dioxide emissions - Indi	ividual heat	ing systems	including	micro-CHP							
						Energy		ion factor	le.	Emissions	
ce heating - main system 1						kWh/year 700.6767		kg CO2/kWh 0.2100	K)	g CO2/year 147.1421	(2
al CO2 associated with community er heating (other fuel)	systems					2698.8770		0.2100		0.0000 566.7642	(2
ce and water heating ps, fans and electric keep-hot						191.8439		0.1387		713.9063 26.6111	(2
rgy for lighting al CO2, kg/year						151.3454		0.1443		21.8438 762.3612	
Dwelling Carbon Dioxide Emission	n Rate (DER)									10.5600	(2
. Primary energy - Individual hea	ating systems	s including	g micro-CHP								
						Energy	Primary ene		Prim	ary energy	
ce heating - main system 1	aveter-					kWh/year 700.6767		kg CO2/kWh 1.1300		kWh/year 791.7646	(2
al CO2 associated with community er heating (other fuel)	systems					2698.8770		1.1300		0.0000 3049.7310	(2
ce and water heating ps, fans and electric keep-hot						191.8439		1.5128		3841.4957 290.2214	(2
						151.3454		1.5338		232.1387 4363.8557	
rgy for lighting al Primary energy kWh/year											
rgy for lighting										60.4400	(2



CALCULATION OF 1													
1. Overall dwell	ling chara	cteristics											
Ground floor Total floor area Dwelling volume					7	72.2000		Area (m2) 72.2000		ey height (m) 2.7400 +(3d)+(3e)		Volume (m3) 197.8280 197.8280	(1b)
2. Ventilation r											m3	per hour	
Number of open of Number of open f Number of chimme Number of flues Number of flues Number of intern Number of passi Number of fluele	flues eys / flue attached attached ed chimney mittent ex /e vents	to solid fu to other he s tract fans	el boiler	ire							0 * 80 = 0 * 20 = 0 * 10 = 0 * 20 = 0 * 35 = 0 * 20 = 3 * 10 = 0 * 10 = 0 * 40 =	0.0000 0.0000 0.0000 0.0000 0.0000 30.0000 0.0000	(6b) (6c) (6d) (6e) (6e) (6f) (7a)
Infiltration due Pressure test Pressure Test Me Measured/design Infiltration rat Number of sides	ethod AP50 te		and fans	= (6a)+(6b)	+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7	7b)+(7c) =		30.000	Air changes 0 / (5) = Blo	0.1516 Yes ower Door 5.0000 0.4016	(8) (17)
Shelter factor Infiltration rat	te adjuste	d to includ	e shelter f	actor					(20) = 1 -		x (19)] = x (20) =	0.8500 0.3414	
Wind speed Wind factor Adj infilt rate	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250		Oct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	
Effective ac	0.4353 0.5947	0.4267 0.5911	0.4182 0.5875	0.3755 0.5705	0.3670 0.5673	0.3243 0.5526	0.3243 0.5526	0.3158 0.5499		0.3670 0.5673	0.3841 0.5738	0.4011 0.5805	
3. Heat losses a	and heat l	oss paramet	er										
Element				Gross	Openings	Net	Area	U-value	Ах		K-value	AxK	
TER Opening Type External Wall 1 Total net area of Fabric heat loss Party Wall 1	of externa	l elements	Aum(A, m2)	m2 56.1426	m2 15.4300	15. 40. 56.	m2 4300 7126 1426 (26)(3	W/m2K 1.1450 0.1800 30) + (32) 0.0000	W/ 17.667 7.328 = 24.996 0.000	9 3 2	kJ/m2K	kJ/K	(27) (29a (31) (33) (32)
Thermal mass par		MP = Cm / T	FA) in kJ/m	12K								410.9397	(35)
E3 Sill E4 Jamb E7 Party	ent r lintels / floor be	(including tween dwell tween dwell	ings (in bl		its)			1	Length P 9.4800 7.9000 7.0400 0.9800 5.4800	si-value 0.0500 0.0500 0.0500 0.0700 0.0600	Tota: 0.4746 0.3956 0.8526 2.8686 0.3288)))	
E16 Corr E8 Balco	ner (norma ony within ner (inver (Sum(L x ridges	l) a dwelling ted – inter	, wall insu nal area gr	eater than	external are	ea)			5.4800 5.8400 2.7400	0.0900 0.0000 -0.0900	0.493; 0.0000; -0.2460 (36a) = + (36a) =)	
Ventilation heat		culated mon	thly (38)m Mar	= 0.33 x (2	15)m x (5) May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	. (-1)
(38)m Heat transfer co	38.8263 eff 68.9875	38.5862 68.7474	38.3508 68.5120	37.2451 67.4063	37.0382 67.1994	36.0752 66.2364	36.0752 66.2364	35.8969 66.0581	36.4461	37.0382 67.1994	37.4567 67.6179	37.8942 68.0554	(39)
Average = Sum(39	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	67.4053 Dec	
HLP HLP (average) Days in mont	0.9555 31	0.9522 28	0.9489 31	0.9336 30	0.9307 31	0.9174 30	0.9174 31	0.9149 31		0.9307 31	0.9365 30	0.9426 0.9336 31	,

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4. Water heati	ing energy r	equirement	s (kWh/year)									
Assumed occupa Hot water usag	•	showers 61.8120	60.4377	57.8083	55.8679	53.7039	52.4739	53.8378	55.3329	57.6563	60.3422	2.2983 62.5146	
Hot water usag			26.1404	25.0950	24.3122	23.4442	22.9754	23.5384	24.1514	25.0802	26.1471	27.0183	
Hot water usag	ge for other 38.1672		35.3914	34.0035	32.6156	31.2277	31.2277	32.6156	34.0035	35.3914	36.7793	38.1672	
Average daily	hot water u	se (litres	/day)									117.6907	(43)
Daily hot wate		Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
Energy conte Energy content		125.2986 178.4236	121.9695 187.4626	116.9068 160.0395		108.3758 133.2607	106.6770 129.0166	109.9918 136.1928	113.4877 139.9417	118.1278 160.2984 Total = S	123.2685 175.6186 um(45)m =	127.7001 199.9476 1954.8185	
Distribution Nater storage	30.4158	26.7635	28.1194	24.0059	22.7767	19.9891	19.3525	20.4289	20.9913	24.0448	26.3428	29.9921	(46)
Store volume a) If manufac Temperature Enter (49) or	turer decla factor from (54) in (55	Table 2b	actor is kn	own (kWh/	day):							180.0000 1.5520 0.5400 0.8381	(48) (49)
Total storage If cylinder co	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	
Primary loss Combi loss Total heat red	23.2624 0.0000	21.0112 0.0000	23.2624 0.0000	22.5120 0.0000 ed for each	0.0000	22.5120 0.0000	23.2624 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	
	252.0144	222.9008	236.7052	207.6937	201.0873	180.9149	178.2593	185.4355	187.5959	209.5410	223.2728	249.1902	
WWHRS PV diverter	-28.6890 -0.0000	-25.3728 -0.0000	-26.5689 -0.0000	-22.0001 -0.0000	-20.5033 -0.0000	-17.5448 -0.0000	-16.4455 -0.0000	-17.4881 -0.0000	-18.1526 -0.0000	-21.3999 -0.0000	-24.2435 -0.0000	-28.1577 -0.0000	
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 Output from w,		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
12Total per ye	223.3254 ear (kWh/vea	197.5280	210.1363	185.6936	180.5840	163.3701	161.8138	167.9473 Total p	169.4434 er year (kW	188.1412 h/year) = S	199.0294 um(64)m =	221.0325 2268.0450 2268	(64)
Electric shows		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Heat gains fro	om water hea	ting, kWh/	month	To	tal Energy us	sed by inst	antaneous e	lectric show	wer(s) (kWh	/year) = Su	m(64a)m =	0.0000	(64a)
5. Internal gander		ble 5 and , Watts Feb	5a)		May				Sep 114.9164	0ct 114.9164	Nov 114.9164	Dec 114.9164	(66)
Lighting gains					L9a), also s			102.2420	105.6501	102.2420	105.6501	102.2420	
Appliances gai	202.3763	204.4763	199.1843	187.9182	173.6968	160.3307	151.4014	149.3013	154.5933	165.8594	180.0808	193.4469	(68)
Cooking gains	(calculated 34.4916	I in Append 34.4916	ix L, equat 34.4916	ion L15 or 34.4916	L15a), also 34.4916	see Table ! 34.4916	5 34.4916	34.4916	34.4916	34.4916	34.4916	34.4916	(69)
Pumps, fans Losses e.g. ev	3.0000 aporation (3.0000 negative v	3.0000	3.0000 le 5)	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	
Water heating	-91.9332	-91.9332	-91.9332	-91.9332	-91.9332	-91.9332	- 91.9332	- 91.9332	-91.9332	-91.9332	-91.9332	-91.9332	(71)
	143.5695	141.2316	136.7277	126.8563	120.8098	114.4897	110.6077	113.8148	117.5750	124.5878	134.0508	142.3074	(72)
Total internal	508.6628	519.3794	498.6290	480.8995	457.2236	437.9454	421.7260	422.8331	435.2933	453.1642	480.2566	498.4712	(73)
6. Solar gains	5												
[Jan]				rea	Solar flux		g		FF	Acce		Gains	
				m2	Table 6a W/m2		fic data Table 6b 	Specific or Tab		fact Table		W	
North East			9.8 5.5		10.6334 19.6403		0.6300 0.6300		.7000 .7000	0.77 0.77		32.0096 33.4929	
													, ,
Solar gains Total gains	65.5025 574.1653	126.6912 646.0706	211.8470 710.4760	324.3312 805.2307		438.2049 876.1503	412.7555 834.4815	339.8012 762.6343	250.4701 685.7635	150.5614 603.7255	81.2497 561.5063	54.2277 552.6990	
7. Mean intern													
Temperature du						Γh1 (C)						21.0000	(85)
Utilisation fa tau	Jan 119.4654	Feb 119.8827	ving area, Mar 120.2947	n11,m (see Apr 122.2679	May	Jun 124.4274	Jul 124.4274	Aug 124.7633	Sep 123.7345	0ct 122.6443	Nov 121.8852	Dec 121.1016	



alpha	8.9644	8.9922	9.0196	9.1512	9.1763	9.2952	9.2952	9.3176	9.2490	9.1763	9.1257	9.0734	
util living are		0.9967	0.9857	0.9072	0.7046	0.4835	0.3492	0.3984	0.6646	0.9541	0.9963	0.9993	(86)
IT h 2 til rest of ho	20.4171 20.1206 ouse	20.5334 20.1234	20.7044 20.1261	20.9140 20.1390	20.9915 20.1414	20.9997 20.1527	21.0000 20.1527	21.0000 20.1548	20.9962 20.1484	20.8758 20.1414	20.6158 20.1366	20.4035 20.1314	
MIT 2	0.9985 19.4507	0.9950 19.6011	0.9782 19.8174	0.8718 20.0670	0.6440 20.1365	0.4197 20.1526	0.2820 20.1527	0.3252 20.1548	0.5857 20.1468	0.9266 20.0354	0.9940 19.7175	0.9989 19.4423	
iving area fra	action								fLA =	Living area	/ (4) =	0.3940	(91)
IT emperature adj	19.8315 justment	19.9685	20.1669	20.4007	20.4734	20.4864	20.4866	20.4878	20.4815	20.3666	20.0714	19.8211 0.0000	(92)
djusted MIT	19.8315	19.9685	20.1669	20.4007	20.4734	20.4864	20.4866	20.4878	20.4815	20.3666	20.0714	19.8211	(93)
3. Space heatir													
tilisation	Jan 0.9983	Feb 0.9946	Mar 0.9787	Apr 0.8835	May 0.6678	Jun 0.4449	Jul 0.3085	Aug 0.3541	Sep 0.6170	0ct 0.9350	Nov 0.9938	Dec 0.9987	(94)
	573.1706 4.3000	642.5555 4.9000	695.3108 6.5000	711.4282 8.9000	584.3402 11.7000	389.7799 14.6000	257.4305 16.6000	270.0241 16.4000	423.1020 14.1000	564.4624 10.6000	558.0180 7.1000	551.9962 4.2000	(95)
eat loss rate	W												
pace heating k	kWh	1035.9178	936.3486	775.2219	589.5694	389.8965	257.4336	270.0351	425.0536	656.3071		1063.0992	
pace heating rolar heating k		264.3395 t - total p	179.3321 er year (kWh	45.9314 n/year)	3.8905	0.0000	0.0000	0.0000	0.0000	68.3325	229.7401	380.2606 1542.5681	(98a)
olar heating o	0.0000 contributi	0.0000 on - total p	0.0000 per year (kw	0.0000 lh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000	(98b)
	370.7413		179.3321	45.9314	3.8905	0.0000	0.0000	0.0000	0.0000	68.3325	229.7401	380.2606	(98c)
pace heating r pace heating p		t after sola	ar contribut	ion - tota	l per year	(kWh/year)				(98c)	/ (4) =	1542.5681 21.3652	(99)
a. Energy requ						o-CHP							
Fraction of spa	ce heat f	rom secondai	ry/supplemen									0.0000	
Fraction of spa Efficiency of m				()								1.0000 92.3000	
Efficiency of m												0.0000	(207)
Efficiency of s	secondary/	supplementa	ry heating s	system, %								0.0000	(208)
Space heating r	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
	370.7413	264.3395	179.3321	45.9314	3.8905	0.0000	0.0000	0.0000	0.0000	68.3325	229.7401	380.2606	(98)
pace heating e	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)
pace heating f	fuel (main 401.6699	heating sys 286.3917	stem) 194.2927	49.7632	4.2150	0.0000	0.0000	0.0000	0.0000	74.0330	248.9059	411.9834	(211)
pace heating e	efficiency 0.0000	(main heat: 0.0000	ing system 2 0.0000	2) 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
pace heating f	fuel (main 0.0000	heating sys	stem 2) 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
pace heating f			0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
	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)
ater heating ater heating r													
fficiency of w	223.3254 water heat	197.5280 er	210.1363	185.6936	180.5840	163.3701	161.8138	167.9473	169.4434	188.1412	199.0294	221.0325 79.8000	
217)m wel for water	85.1882	84.7139	83.7064	81.4367	79.9709	79.8000	79.8000	79.8000	79.8000	82.0147	84.3824	85.2651	
	262.1553	233.1707	251.0398	228.0220	225.8121	204.7244	202.7742	210.4603	212.3350	229.3994	235.8659	259.2298	(219)
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	
umps and Fa ighting	7.3041 21.2439	6.5973 17.0426	7.3041 15.3450	7.0685 11.2424	7.3041 8.6840	7.0685 7.0949	7.3041 7.9218	7.3041 10.2970	7.0685 13.3748	7.3041 17.5485	7.0685 19.8210	7.3041 21.8343	
lectricity ger 233a)m	nerated by -7.9741	PVs (Append -12.3677	dix M) (nega -19.5340	tive quant: -24.2038	ity) -28.1474	-27.0385	-26.7111	-24.1766	-20.1180	-15.0681	-9.1566	-6.7694	(233a
lectricity ger 234a)m							0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
lectricity ger	nerated by	hydro-elect	tric generat	ors (Append	dix M) (neg	ative quant:	ity)						
235a)m lectricity use						0.0000 N) (negati	0.0000 ve if net g	0.0000 eneration)	0.0000	0.0000	0.0000	0.0000	(235a
235c)m lectricity ger	0.0000 nerated by	0.0000 PVs (Append	0.0000 dix M) (nega	0.0000 ntive quant:	0.0000 ity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c
233b)m lectricity ger	-1.6363 perated by	-3.5888 wind turbin	-7.4189 nes (Annendi	-11.5813	-15.7591	-16.0014 tv)	-15.8140	-13.1822	-9.3959	-5.2705	-2.2271	-1.2834	(233b
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
lectricity ger 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
lectricity use 235d)m	ed or net 0.0000	electricity 0.0000	generated b	y micro-CHF 0.0000	O.0000	N) (negativ 0.0000	ve if net go 0.0000	eneration) 0.0000	0.0000	0.0000	0.0000	0.0000	(235d
nnual totals k pace heating f	Wh/year											1671.2547	
pace heating f	fuel – mai	n system 2										0.0000	(213)
Space heating f Efficiency of w												0.0000 79.8000	(215)
Water heating f												2754.9890	(219)

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Space cooling fuel				
Floridate Consumer and Consu			0.0000	(221
Electricity for pumps and fans:				
Total electricity for the above, kWh/year			86.0000	
Electricity for lighting (calculated in Appendix L)			171.4502	(232
Energy saving/generation technologies (Appendices M ,N and Q)				
PV generation			-324.4242	
Wind generation			0.0000	
Hydro-electric generation (Appendix N) Electricity generated - Micro CHP (Appendix N)			0.0000 0.0000	
Appendix Q - special features			0.0000	(233
Energy saved or generated			-0.0000	(236
Energy used			0.0000	•
Total delivered energy for all uses			4359.2697	(238
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP				
	Energy	Emission factor	Emissions	
Space heating - main system 1	kWh/year 1671.2547	kg CO2/kWh 0.2100	kg CO2/year 350.9635	
Total CO2 associated with community systems	10/1.254/	0.2100	0.0000	
Water heating (other fuel)	2754.9890	0.2100	578.5477	
Space and water heating			929.5112	
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	
Energy for lighting	171.4502	0.1443	24.7456	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-221.2652	0.1327	-29.3509	
PV Unit electricity exported	-103.1590	0.1248	-12.8728	
Total CO2 kg/yean			-42.2238 923.9622	
Total CO2, kg/year EPC Target Carbon Dioxide Emission Rate (TER)			12.8000	
13a. Primary energy - Individual heating systems including micro-CHP				
		rimary energy factor	Primary energy	
Space heating - main system 1	kWh/year 1671.2547	kg CO2/kWh 1.1300	kWh/year 1888.5178	
Total CO2 associated with community systems	10/1.254/	1.1500	0.0000	•
Water heating (other fuel)	2754.9890	1.1300	3113.1375	
Space and water heating			5001.6553	
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	
Energy for lighting	171.4502	1.5338	262.9761	(282
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-221.2652	1.4901	- 329.7166	
	-103.1590	0.4580	-47.2465	
			276 0621	(283
Total			-376.9631	
PV Unit electricity exported Total Total Primary energy kWh/year Target Primary Energy Rate (TPER)			5017.7691 69.5000	(286)



Property Reference		LEAN	PLANNING						Issued	on Date	12/09/	2023	
Assessment Reference	,	L01tos	5 - 09 x5_Copy_Co	рру			Prop	Type Ref					_
Property													
SAP Rating				87	'В	DER		10.58		TER	11	1.66	
Environmental				91	В	% DEF	R < TER				9.	26	
CO₂ Emissions (t/year)				0.7	75	DFEE		22.43		TFEE	22	2.07	
Compliance Check				Se	e BREL		E < TFEE				-1	.66	
% DPER < TPER				3.0	02	DPER		55.78		TPER	5	7.52	
Assessor Details		Mr. Richard I	Denteh							Assessor ID	U	148-0001	
Client													
P 10 WORKSHEET LCULATION OF DW						2022)							
. Overall dwelli	ing charac	teristics						Area	Stano	, boight		Volume	
round floor otal floor area welling volume	TFA = (1a)+(1b)+(1c))+(1d)+(1e).	(1n)	7	6.3000		(m2) 76.3000		/ height (m) 2.7400 ((3d)+(3e).		(m3) 209.0620 209.0620	(4
Ventilation ra	ate										m	3 per hour	
umber of open ch umber of open fl umber of chimney umber of flues a umber of flues a umber of intermi umber of passive umber of flueles	lues /s / flues /s ttached t /s chimneys ittent ext	o solid fue o other hea ract fans	el boiler	re							0 * 80 = 0 * 20 = 0 * 10 = 0 * 20 = 0 * 35 = 0 * 20 = 0 * 10 = 0 * 10 = 0 * 40 =	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(6 (6 (6 (6 (7 (7
nfiltration due ressure test ressure Test Met easured/design A nfiltration rate umber of sides s	chod AP50	ys, flues a	and fans =	(6a)+(6b)-	+(6c)+(6d)+(6e)+(6f)+(6	g)+(7a)+(7	'b)+(7c) =			Air change / (5) = B	0.0000 Yes lower Door 3.0000 0.1500	(1
nelter factor nfiltration rate	e adjusted	to include	e shelter fa	ctor					(20) = 1 - (21)	[0.075 x) = (18) >		0.8500 0.1275	
ind speed	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	Sep 4.0000 1.0000	Oct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	
dj infilt rate Balanced mechani F mechanical ver F exhaust air he	ntilation				0.1371	0.1211 on (N5)) o	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498 0.5000 0.5000	(2
balanced with									-/			72.8000	
fective ac	0.2986	0.2954	0.2922	0.2762	0.2731	0.2571	0.2571	0.2539	0.2635	0.2731	0.2794	0.2858	(2
Heat losses ar		ss paramete	er										
ement Lazing (Uw = 1.3				Gross m2	Openings m2	NetA	m2	U-value W/m2K 1.2357	A x U W/K 15.7804		-value <j m2k<="" td=""><td>A x K kJ/K</td><td>(2</td></j>	A x K kJ/K	(2
kternal Wall 1		elements A		7.8404	12.7700	35.0 47.8	704	0.1400	4.9099	198	0.0000	6663.3760	

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Fabric heat lo Party Wall 1 Party Floor 1 Party Ceiling Internal Wall	1 1					76 76	(26)(.4400 .3000 .3000 .5200	30) + (32) : 0.0000	0.00	00 18 4 3	0.0000 0.0000 0.0000 9.0000	3139.2000 3052.0000 2289.0000 1399.6800	(32d) (32b) (32c)
E3 Sil E4 Jam E7 Par E8 Bal E16 Co E18 Pa	arameter (T l Bridges ment er lintels l b ty floor be cony within rner (norma rty wall be	(including etween dwelling al)	other stee lings (in b g, wall inso	l lintels) locks of fl ulation con	tinuous			Li 7 4 13 34 5 2	(30) + (3. ength .0000 .7400 .9400 .9200 .1400 .7400	Psi-value 0.0300 0.0300 0.0300 0.0300 0.0700 0.0900 0.0900 0.0900	Tot 0.21 0.14 0.41 2.44 0.00 0.24 0.32	216.8186 al 00 22 82 44 00 66 88	5 (35)
Thermal bridge Point Thermal Total fabric h	bridges	PS1) calcu.	lated using	Appendix K)				(33) + (36)	(36a) = + (36a) =	3.7902 0.0000 24.4805)
Ventilation he	Jan 20.5980	culated mon Feb 20.3781	nthly (38)m Mar 20.1582	= 0.33 x (Apr 19.0586	25)m x (5) May 18.8387	Jun 17.7392	Jul 17.7392	Aug 17.5193	Sep 18.1790	0ct 18.8387	Nov 19.2785	Dec 19.7183	(38)
Heat transfer Average = Sum(45.0784	44.8585	44.6386	43.5391	43.3192	42.2196	42.2196	41.9997	42.6595	43.3192	43.7590	44.1988 43.4841	
HLP HLP (average)	Jan 0.5908	Feb 0.5879	Mar 0.5850	Apr 0.5706	May 0.5677	Jun 0.5533	Jul 0.5533	Aug 0.5505	Sep 0.5591	0ct 0.5677	Nov 0.5735	Dec 0.5793 0.5699	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	
4. Water heati	ng energy r	requirements	s (kWh/year))									
Assumed occupa												2.3889	(42)
Hot water usag	e for mixer 88.3765	showers 87.0484	85.1131	81.4101	78.6775	75.6300	73.8979	75.8186	77.9240	81.1960	84.9785	88.0379	(42a
Hot water usag	e for baths 27.7631	27.3508	26.7701	25.6995	24.8979	24.0090	23.5289	24.1054	24.7332	25.6844	26.7770	27.6692	
Hot water usag	39.0948	uses 37.6732	36.2516 /day)	34.8299	33.4083	31.9867	31.9867	33.4083	34.8299	36.2516	37.6732	39.0948 142.7617	42c
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
Daily hot wate Energy conte Energy content	155.2345 245.8534	152.0724 216.5490	148.1348 227.6776	141.9396 194.3083	136.9837 184.4064	131.6257 161.8492	129.4134 156.5143	133.3323 165.0933	137.4872 169.5354	143.1320 194.2287 Total = S	149.4287 212.8886	154.8020 242.3825 2371.2867	(45)
Distribution 1	oss (46)m 36.8780	= 0.15 x (4 32.4824	45)m 34.1516	29.1462	27.6610	24.2774	23.4771	24.7640	25.4303	29.1343	31.9333	36.3574	
Store volume b) If manufa Hot water st Volume facto	cturer decl orage loss	factor from			ay)							110.0000 0.0152 1.0294	(51)
Temperature Enter (49) or Total storage	factor from (54) in (55	n Table 2b										0.6000 1.0327) (53)
If cylinder co		28.9162 cated solar 28.9162	32.0144 r storage 32.0144	30.9817 30.9817	32.0144 32.0144	30.9817 30.9817	32.0144 32.0144	32.0144 32.0144	30.9817 30.9817	32.0144 32.0144	30.9817 30.9817	32.0144	
Primary loss Combi loss Total heat req	32.0144 23.2624 0.0000 uired for w	21.0112 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	32.0144 23.2624 0.0000	(59)
WWHRS PV diverter Solar input	301.1302 -67.0388 0.0000 0.0000	266.4765 -59.2897 0.0000 0.0000	282.9544 -62.0847 0.0000 0.0000	247.8019 -51.4086 0.0000 0.0000	239.6832 -47.9110 0.0000 0.0000	215.3429 -40.9978 0.0000 0.0000	211.7911 -38.4289 0.0000 0.0000	220.3701 -40.8652 0.0000 0.0000	223.0291 -42.4179 0.0000 0.0000	249.5055 -50.0060 0.0000 0.0000	266.3823 -56.6507 0.0000 0.0000	297.6593 -65.7973 0.0000 0.0000	(63a (63b (63c
FGHRS Output from w/	0.0000 h 234.0914	0.0000 207.1868	0.0000 220.8697	0.0000	0.0000 191.7722	0.0000 174.3451	0.0000 173.3623	0.0000 179.5048	0.0000 180.6112 er year (kW	0.0000 199.4996	0.0000 209.7316	0.0000 231.8620 2399.2300	(64)
12Total per ye Electric showe		er) 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(64)
Heat gains fro	m water hea							lectric shown				0.0000 124.8136	64a
5. Internal ga		ble 5 and 9	5a)										
Metabolic gain (66)m	Jan	Feb 119.4455	Mar 119.4455	Apr 119.4455	May 119.4455	Jun 119.4455	Jul 119.4455	Aug 119.4455	Sep 119.4455	0ct 119.4455	Nov 119.4455	Dec 119.4455	(60)



Cooking gains	211.5344 (calculate	213.7294	208.1979	196.4220	181.5571	167.5861	158.2527	156.0576	161.5891	173.3650	188.2299	202.2009	(68)
Pumps, fans	34.9445	34.9445 0.0000	34.9445 0.0000	34.9445	34.9445	34.9445	34.9445 0.0000	34.9445 0.0000	34.9445 0.0000	34.9445 0.0000	34.9445 0.0000	34.9445 0.0000	
Losses e.g. ev					-95.5564	-95.5564	-95.5564	-95.5564	-95.5564	-95.5564	-95.5564	-95.5564	
Water heating			161.1885	149.1701	141.8502	134.1803	129.3850	133.2190	137.7298	146.2399	157.7506	167.7603	
Total internal		558.7326	536.2327	516.0388	490.2536	472.2131	454.4840	456.1229	469.7656	486.4512	516.4272	536.8074	
					,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	.,					22011212		(,,,
6. Solar gains													
[Jan]			А	rea m2	Solar flux Table 6a W/m2	Speci	g fic data Table 6b	Specific or Tab		Acces facto Table 6	or	Gains W	
South West			5.0 7.7		46.7521 19.6403		0.3300 0.3300		.8000 .8000	0.776 0.776		42.7669 27.9194	. ,
Solar gains Total gains	70.6863 618.3784	124.6574 683.3900	179.1652 715.3979	232.0176 748.0564	265.8449 756.0985	265.6968 737.9099	255.4843 709.9683	230.5385 686.6615	197.8107 667.5764	140.3527 626.8039	85.5055 601.9327	59.9141 596.7215	
7. Mean intern													
Temperature du Utilisation fa	ctor for g	ains for li	ving area,	ni1,m (see	Table 9a)					_		21.0000	(85)
tau alpha	Jan 101.9412 7.7961	Feb 102.4409 7.8294	Mar 102.9456 7.8630	Apr 105.5454 8.0364	May 106.0812 8.0721	Jun 108.8439 8.2563	Jul 108.8439 8.2563	Aug 109.4137 8.2942	Sep 107.7217 8.1814	0ct 106.0812 8.0721	Nov 105.0150 8.0010	Dec 103.9700 7.9313	
util living ar	rea 0.9532	0.9097	0.8381	0.6913	0.5313	0.3661	0.2617	0.2814	0.4406	0.7040	0.8935	0.9596	(86)
MIT Th 2	20.7106 20.4383	20.8218 20.4409	20.9154 20.4435	20.9827 20.4565	20.9979 20.4591	20.9999 20.4722	21.0000 20.4722	21.0000 20.4748	20.9996 20.4669	20.9835 20.4591	20.8748 20.4539	20.6982 20.4487	
util rest of h MIT 2	0.9444 20.1842	0.8954 20.2898	0.8167 20.3758	0.6633 20.4441	0.5009 20.4578	0.3360 20.4721	0.2303 20.4722	0.2492 20.4748	0.4067 20.4668	0.6713 20.4478	0.8753 20.3517	0.9519 20.1820	. ,
Living area fr MIT	action 20.3770	20.4846	20.5734	20.6413	20.6556	20.6654	20.6655	20.6671	fLA = 20.6619	Living area 20.6440	a / (4) = 20.5432	0.3662 20.3711	1 1
Temperature ad adjusted MIT	ljustment 20.3770	20.4846	20.5734	20.6413	20.6556	20.6654	20.6655	20.6671	20.6619	20.6440	20.5432	0.0000 20.3711	(93)
8. Space heati	ng require												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
Utilisation Useful gains	0.9434 583.3780	0.8966 612.6974	0.8218 587.9257	0.6729 503.3611	0.5119 387.0823	0.3470 256.0526	0.2418 171.6411	0.2610 179.2157	0.4191 279.7942	0.6826 427.8451	0.8784 528.7500	0.9507 567.3049	(95)
Ext temp. Heat loss rate		4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000 588.2614	4.2000	
Space heating	724.7238 kWh 105.1613	699 .101 6 58 . 0636	628.2154 29.9755	511.2056	387.9491 0.6449	256.0794 0.0000	0.0000	0.0000	279.9269 0.0000	435.0965 5.3950	42.8482	714.7412	
Space heating Solar heating	requiremen				0.0449	0.0000	0.0000	0.0000	0.0000	3.3530	42.0402	357.4292	(300)
Solar heating Space heating	0.0000 contributi	0.0000 on - total	0.0000 per year (ki	0.0000 Wh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000	(98b)
Space heating	105.1613	58.0636 t after sol	29.9755 ar contribu	5.6480 tion - tota	0.6449 l per year	0.0000 (kWh/year)	0.0000	0.0000	0.0000	5.3950	42.8482	109.6926 357.4292	(98c)
Space heating					, ,	,				(98c)) / (4) =	4.6845	(99)
9b. Energy req Fraction of sp												0.0000	(201)
Fraction of sp Fraction of he	ace heat f	rom communi	ty system		•	-						1.0000 0.5580	(302)
Fraction of he Factor for con	at from co	mmunity Boi	lers-Space	and Water								0.4420 1.0500	(303b
Factor for cha Distribution 1	erging meth	od (Table 4	c(3)) for w	ater heatin	g	''6						1.0500 1.2500	(305a
Efficiency of Space heating:	secondary/				g system							0.0000	
Space heating		t 58.0636	29.9755	5.6480	0.6449	0.0000	0.0000	0.0000	0.0000	5.3950	42.8482	109.6926	(98)
Space heat fro 307a						0.0000	0.0000	0.0000	0.0000	3.9512	31.3810	80.3361	(50)
Space heat fro 307b					0.3741	0.0000	0.0000	0.0000	0.0000	3.1298	24.8573	63.6354	
Space heating			_,	3.2700	0.5/41	0.0000	0.000	2.000	3.0000	J. 12.70		-5.5554	

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Full SAP Calculation Printout



				enei	99	
138.0242 76.2085 39.3429 7.4131 0.8464 0.0000 0.00 fficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0.0000	7.0810	56.2383	143.9715 0.0000	
pace heating fuel for secondary/supplementary system 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.000 0.0000 0.000	0.0000	0.0000	0.0000	0.0000	0.0000	(309
Water heating unnual water heating requirement						
234.0914 207.1868 220.8697 196.3933 191.7722 174.3451 173.36	179.5048	180.6112	199.4996	209.7316	231.8620	(64)
ater heat from Combined Heat and Power = (64) x 0.56 x 1.05 x 1.25 10a 171.4427 151.7384 161.7595 143.8336 140.4492 127.6860 126.96	131.4648	132.2752	146.1085	153.6021	169.8099	
later heat from Boilers = (64) x 0.44 x 1.05 x 1.25 10b 135.8023 120.1942 128.1320 113.9327 111.2519 101.1420 100.57	718 104.1352	104.7771	115.7347	121.6705	134.5089	
later heating fuel 307.2450 271.9327 289.8915 257.7663 251.7010 228.8279 227.53		237.0523	261.8432	275.2727	304.3188	
cooling System Energy Efficiency Ratio					0.0000	(31
pace coolin 0.00000 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.000000		0.0000 13.1022	0.0000 13.5389	0.0000 13.1022	0.0000 13.5389	
ighting 19.8435 15.9192 14.3334 10.5013 8.1115 6.6272 7.39 lectricity generated by PVs (Appendix M) (negative quantity)	9.6183	12.4932	16.3917	18.5144	20.3950	
333a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00	0.0000	0.0000	0.0000	0.0000	0.0000	(33
lectricity generated by wind turbines (Appendix M) (negative quantity) 334a)m	0.0000	0.0000	0.0000	0.0000	0.0000	(33
lectricity generated by hydro-electric generators (Appendix M) (negative quantity) 335a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00	0.0000	0.0000	0.0000	0.0000	0.0000	(33
lectricity generated by PVs (Appendix M) (negative quantity)						Ī
333b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(33
0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(33
335b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(33
nual totals kWh/year ace heating fuel - community heating					469.1258	(30
pace heating fuel - secondary ster heating fuel - community heating					0.0000 3148.9894	•
ficiency of water heater					0.0000	(3:
ectricity used for heat distribution ace cooling fuel					4.6913 0.0000	•
ectricity for pumps and fans:						•
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6250)						
mechanical ventilation fans (SFP = 0.6250) tal electricity for the above, kWh/year					159.4098 159.4098	
ectricity for lighting (calculated in Appendix L)					160.1482	
ergy saving/generation technologies (Appendices M ,N and Q)						
generation nd generation					0.0000 0.0000	
dro-electric generation (Appendix N)					0.0000	(33
ectricity generated - Micro CHP (Appendix N) pendix Q - special features					0.0000	(3:
ergy saved or generated ergy used					-0.0000 0.0000	•
tal delivered energy for all uses						() -
					3937.6732	(3:
					3937.6732	(33
					3937.6732	(33
	Energy		ion factor		Emissions	•
b. Carbon dioxide emissions - Community heating scheme			ion factor kg CO2/kWh	k	Emissions g CO2/year	•
b. Carbon dioxide emissions - Community heating scheme ectrical efficiency of CHP unit at efficiency of CHP unit	Energy kWh/year		kg CO2/kWh	k	Emissions g CO2/year 32.0000 49.9000	(36)
b. Carbon dioxide emissions - Community heating scheme ectrical efficiency of CHP unit at efficiency of CHP unit ace heating from Combined Heat and Power ess credit emissions for electricity	Energy			k	Emissions g CO2/year 32.0000	(36 (36 (36
b. Carbon dioxide emissions - Community heating scheme ectrical efficiency of CHP unit at efficiency of CHP unit ace heating from Combined Heat and Power ess credit emissions for electricity ter heating from Combined Heat and Power	Energy kWh/year 524.5936 -167.8700 3521.3148		0.2100 0.3480 0.2100	k	Emissions g CO2/year 32.0000 49.9000 110.1647 -58.4187 739.4761	(3i (3i (3i (3i
b. Carbon dioxide emissions - Community heating scheme ectrical efficiency of CHP unit at efficiency of CHP unit ace heating from Combined Heat and Power ess credit emissions for electricity ter heating from Combined Heat and Power ess credit emissions for electricity ficiency of heat source Boilers	Energy kWh/year 524.5936 -167.8700 3521.3148 -1126.8207		0.2100 0.3480 0.2100 0.3480	k	Emissions gg CO2/year 32.0000 49.9000 110.1647 -58.4187 739.4761 -392.1336 93.9000	(3) (3) (3) (3) (3)
b. Carbon dioxide emissions - Community heating scheme ectrical efficiency of CHP unit at efficiency of CHP unit ace heating from Combined Heat and Power ess credit emissions for electricity ter heating from Combined Heat and Power ess credit emissions for electricity ficiency of heat source Boilers ace and Water heating from Boilers	Energy kWh/year 524.5936 -167.8700 3521.3148 -1126.8207 1703.0958		0.2100 0.3480 0.2100 0.3480 0.2100	k	Emissions g CO2/year 32.0000 49.9000 110.1647 -58.4187 739.4761 -392.1336 46.3730	(3) (3) (3) (3) (3) (3)
b. Carbon dioxide emissions - Community heating scheme ectrical efficiency of CHP unit at efficiency of CHP unit ace heating from Combined Heat and Power ess credit emissions for electricity ter heating from Combined Heat and Power ess credit emissions for electricity ficiency of heat source Boilers ace and Water heating from Boilers ectrical energy for heat distribution (space & water) erall CO2 factor for heat network	Energy kWh/year 524.5936 -167.8700 3521.3148 -1126.8207		0.2100 0.3480 0.2100 0.3480	k	Emissions g CO2/year 32.0000 49.9000 110.1647 -58.4187 739.4761 -392.1336 93.9000 46.3730 5.1764 0.2106	(3) (3) (3) (3) (3) (3) (3) (3)
b. Carbon dioxide emissions - Community heating scheme ectrical efficiency of CHP unit at efficiency of CHP unit ace heating from Combined Heat and Power ess credit emissions for electricity ter heating from Combined Heat and Power ess credit emissions for electricity ficiency of heat source Boilers ace and Water heating from Boilers ectrical energy for heat distribution (space & water) erall CO2 factor for heat network tal CO2 associated with community systems	Energy kWh/year 524.5936 -167.8700 3521.3148 -1126.8207 1703.0958		0.2100 0.3480 0.2100 0.3480 0.2100	k	Emissions g CO2/year 32.0000 49.9000 110.1647 -58.4187 739.4761 -392.1336 93.9000 46.3730 5.1764	(36) (36) (36) (36) (36) (36) (37) (38) (38) (38)
dectrical efficiency of CHP unit that enable from Combined Heat and Power the ess credit emissions for electricity ter heating from Combined Heat and Power the ess credit emissions for electricity ficiency of heat source Boilers that eace and Water heating from Boilers the ectrical energy for heat distribution (space & water) the enable CO2 associated with community systems that CO2 associated with community systems that eace and water heating the enable control water heating t	Energy kWh/year 524.5936 -167.8700 3521.3148 -1126.8207 1703.0958 4.6913		0.2100 0.3480 0.2100 0.3480 0.2100 0.3480 0.2100 0.0000	k	Emissions g CO2/year 32.0000 49.9000 110.1647 -58.4187 739.4761 -392.1336 93.9000 46.3730 5.1764 0.2106 761.9149 22.1121	(36 (36 (36 (36 (36 (37 (37 (37 (37 (37)
ectrical efficiency of CHP unit at efficiency of CHP unit ac efficiency of CHP unit ace heating from Combined Heat and Power ess credit emissions for electricity ter heating from Combined Heat and Power ess credit emissions for electricity ficiency of heat source Boilers ace and Water heating from Boilers ectrical energy for heat distribution (space & water) erall CO2 factor for heat network tal CO2 associated with community systems ace and water heating mps, fans and electric keep-hot ergy for lighting tal CO2, kg/year	Energy kWh/year 524.5936 -167.8700 3521.3148 -1126.8207 1703.0958 4.6913		8g CO2/kWh 0.2100 0.3480 0.2100 0.3480 0.2100 0.0000	k	Emissions g C02/year 32.0000 49.9000 110.1647 -58.4187 739.4761 -392.1336 93.9000 46.3730 5.1764 0.2106 761.9149 761.9149 22.1121 33.1143	(36 (36 (36 (36 (36 (37 (37 (37 (37 (37 (37 (37 (37 (37 (37
ectrical efficiency of CHP unit that efficiency of CHP unit ace efficiency of CHP unit ace heating from Combined Heat and Power theses credit emissions for electricity the heating from Combined Heat and Power theses credit emissions for electricity ficiency of heat source Boilers that and Water heating from Boilers that and Water heating from Boilers that ace and Water heat ing from Boilers that CO2 factor for heat network that CO2 associated with community systems that CO2 associated with community systems that CO2 associated with community systems that CO2, kg/year	Energy kWh/year 524.5936 -167.8700 3521.3148 -1126.8207 1703.0958 4.6913		0.2100 0.3480 0.2100 0.3480 0.2100 0.3480 0.2100 0.0000	k	Emissions g CO2/year 32.0000 49.9000 110.1647 -58.4187 739.4761 -392.1336 93.9000 46.3739 5.1764 0.2106 761.9149 761.9149 22.1121 23.1143	(36 (36 (36 (36 (36 (37 (37 (37 (37 (37 (37 (37 (37 (37 (37
ectrical efficiency of CHP unit at efficiency of CHP unit ace heating from Combined Heat and Power ess credit emissions for electricity ter heating from Combined Heat and Power ess credit emissions for electricity ficiency of heat source Boilers ace and Water heating from Boilers ectrical energy for heat distribution (space & water) erall CO2 factor for heat network tal CO2 associated with community systems ace and water heating mps, fans and electric keep-hot ergy for lighting tal CO2, kg/year C Dwelling Carbon Dioxide Emission Rate (DER)	Energy kWh/year 524.5936 -167.8700 3521.3148 -1126.8207 1703.0958 4.6913 159.4098 160.1482		0.2100 0.3480 0.2100 0.3480 0.2100 0.3480 0.2100 0.0000	k	Emissions g C02/year 32.0000 49.9000 110.1647 -58.4187 739.4761 -392.1336 93.9000 46.3730 5.1764 0.2106 761.9149 761.9149 22.1121 33.1143	(36) (36) (36) (36) (36) (37) (37) (37) (37) (37) (37)
Lectrical efficiency of CHP unit Leat efficiency of CHP unit Leace heating from Combined Heat and Power Less credit emissions for electricity Less credit emission (space & water) Less credit emission for electricity Less credit emission (space & water) Less credit emission for electricity Less credit emission (space & water) Less credit emission for electricity Less credit emission (space & water) Less credit emission for electricity Less credit emission (space & water) Less credit emission for electricity Less credit emission (space & water) Less credit emission (space & water) Less credit emission for electricity Less credit emission (space & water) Less credit emission for electricity Less credit emission (space & water) Less credit emission for electricity	Energy kWh/year 524.5936 -167.8700 3521.3148 -1126.8207 1703.0958 4.6913 159.4098 160.1482		kg CO2/kWh 0.2100 0.3480 0.2100 0.3480 0.2100 0.0000 0.1387 0.1443		Emissions g C02/year 32.0000 49.9000 110.1647 -58.4187 739.4761 -392.1336 93.9000 46.3730 5.1764 0.2106 761.9149 761.9149 22.1121 33.1143	(36) (36) (36) (36) (36) (37) (37) (37) (38) (38)
ectrical efficiency of CHP unit at efficiency of CHP unit ace heating from Combined Heat and Power ess credit emissions for electricity ter heating from Combined Heat and Power ess credit emissions for electricity ficiency of heat source Boilers ace and Water heating from Boilers ectrical energy for heat distribution (space & water) erall CO2 factor for heat network tal CO2 associated with community systems ace and water heating mps, fans and electric keep-hot ergy for lighting tal CO2, kg/year C Dwelling Carbon Dioxide Emission Rate (DER)	Energy kWh/year 524.5936 -167.8700 3521.3148 -1126.8207 1703.0958 4.6913 159.4098 160.1482	Primary ene	kg CO2/kWh 0.2100 0.3480 0.2100 0.3480 0.2100 0.0000 0.1387 0.1443		Emissions g CO2/year 32.0000 49.9000 110.1647 -58.4187 739.4761 -392.1336 93.9000 46.3730 5.1764 0.2106 761.9149 761.9149 22.1121 23.1143 807.1413 10.5800	(3) (3) (3) (3) (3) (3) (3) (3) (3) (3)
ectrical efficiency of CHP unit at efficiency of CHP unit ace heating from Combined Heat and Power ess credit emissions for electricity ter heating from Combined Heat and Power ess credit emissions for electricity ficiency of heat source Boilers ace and Water heating from Boilers ectrical energy for heat distribution (space & water) erall CO2 factor for heat network tal CO2 associated with community systems ace and water heating mps, fans and electric keep-hot ergy for lighting tal CO2, kg/year C Dwelling Carbon Dioxide Emission Rate (DER) ectrical efficiency of CHP unit	Energy kWh/year 524.5936 -167.8700 3521.3148 -1126.8207 1703.0958 4.6913 159.4098 160.1482	Primary ene	kg CO2/kWh 0.2100 0.3480 0.2100 0.3480 0.2100 0.3480 0.1187 0.1443		Emissions g CO2/year 32.0000 49.9000 110.1647 -58.4187 739.4761 -392.1336 93.9000 46.3730 5.1764 0.2106 761.9149 22.1121 23.1143 807.1413 10.5800	(3) (3) (3) (3) (3) (3) (3) (3) (3) (4)
b. Carbon dioxide emissions - Community heating scheme ectrical efficiency of CHP unit at efficiency of CHP unit ace heating from Combined Heat and Power ess credit emissions for electricity ter heating from Combined Heat and Power ess credit emissions for electricity ficiency of heat source Boilers ace and Water heating from Boilers ectrical energy for heat distribution (space & water) erall CO2 factor for heat network tal CO2 associated with community systems ace and water heating mps, fans and electric keep-hot ergy for lighting tal CO2, kg/year C Dwelling Carbon Dioxide Emission Rate (DER) b. Primary energy - Community heating scheme ectrical efficiency of CHP unit ace heating from Combined Heat and Power	Energy kWh/year 524.5936 -167.8700 3521.3148 -1126.8207 1703.0958 4.6913 159.4098 160.1482	Primary ene	kg CO2/kWh 0.2100 0.3480 0.2100 0.3480 0.2100 0.3480 4.2100 0.0000 0.1387 0.1443		Emissions g CO2/year 32.0000 49.9000 110.1647 -58.4187 739.4761 -392.1336 93.9000 46.3730 5.1764 0.2106 761.9149 761.9149 22.1121 23.1143 807.1413 10.5800	(3) (3) (3) (3) (3) (3) (3) (3) (3) (3)
ectrical efficiency of CHP unit at efficiency of CHP unit ace heating from Combined Heat and Power ess credit emissions for electricity ter heating from Combined Heat and Power ess credit emissions for electricity ficiency of heat source Boilers ace and Water heating from Boilers ectrical energy for heat distribution (space & water) erall CO2 factor for heat network tal CO2 associated with community systems ace and water heating mps, fans and electric keep-hot ergy for lighting tal CO2, kg/year C Dwelling Carbon Dioxide Emission Rate (DER) b. Primary energy - Community heating scheme ectrical efficiency of CHP unit ace heating from Combined Heat and Power ess credit emissions for electricity ter heating from Combined Heat and Power ess credit emissions for electricity ter heating from Combined Heat and Power	Energy kWh/year 524.5936 -167.8700 3521.3148 -1126.8207 1703.0958 4.6913 159.4098 160.1482 Energy kWh/year 524.5936 -167.8700 3521.3148	Primary ene	kg CO2/kWh 0.2100 0.3480 0.2100 0.3480 0.2100 0.0000 0.1387 0.1443 rgy factor kg CO2/kWh 1.1300 2.1490 1.1300		Emissions (g CO2/year 32.0000 49.9000 110.1647 -58.4187 739.4761 -392.1336 93.9000 46.3730 5.1764 0.2166 761.9149 22.1121 23.1143 10.5800	(3i) (3i) (3i) (3i) (3i) (3i) (3i) (3i)
dectrical efficiency of CHP unit that efficiency of CMP unit the thating from Combined Heat and Power theses credit emissions for electricity ther heating from Combined Heat and Power theses credit emissions for electricity efficiency of heat source Boilers that CO2 factor for heat distribution (space & water) the that CO2 associated with community systems that CO2 associated with community systems that CO2 associated with community systems the that CO2, kg/year the that CO2, kg/year the CD welling Carbon Dioxide Emission Rate (DER) The that efficiency of CHP unit that efficiency of CMP unit that efficiency of	Energy kWh/year 524.5936 -167.8700 3521.3148 -1126.8207 1703.0958 4.6913 159.4098 160.1482	Primary ene	kg CO2/kWh 0.2100 0.3480 0.2100 0.3480 0.2100 0.0000 0.1387 0.1443	Prim	Emissions g CO2/year 32.0000 49.9000 110.1647 -58.4187 739.4761 -392.1336 93.9000 46.3730 5.1764 0.2106 761.9149 22.1121 23.1143 807.1413 10.5800	(36 (36 (36 (36 (36 (37 (37 (37 (37 (37 (37 (46 (46 (46 (46 (46 (46 (46 (46 (46 (46
Decirical efficiency of CHP unit pace heating from Combined Heat and Power less credit emissions for electricity ater heating from Combined Heat and Power less credit emissions for electricity fficiency of heat source Boilers pace and Water heating from Boilers lectrical energy for heat distribution (space & water) verall CO2 associated with community systems pace and water heating umps, fans and electric keep-hot nergy for lighting ptal CO2, kg/year PC Dwelling Carbon Dioxide Emission Rate (DER) Bib. Primary energy - Community heating scheme Lectrical efficiency of CHP unit pace heating from Combined Heat and Power less credit emissions for electricity ater heating from Combined Heat and Power less credit emissions for electricity fficiency of heat source Boilers pace and Water heating from Boilers lectrical energy for heat distribution (space & water)	Energy kWh/year 524.5936 -167.8700 3521.3148 -1126.8207 1703.0958 4.6913 159.4098 160.1482 Energy kWh/year 524.5936 -167.8700 3521.3148	Primary ene	kg CO2/kWh 0.2100 0.3480 0.2100 0.3480 0.2100 0.0000 0.1387 0.1443 rgy factor kg CO2/kWh 1.1300 2.1490 1.1300	Prim	Emissions g C02/year 32.0000 49.9000 49.9000 110.1647 -58.4187 739.4761 -392.1336 93.9000 46.3730 5.1764 0.2106 761.9149 761.9149 22.1121 23.1143 807.1413 10.5800	(36 (36 (36 (36 (36 (37 (37 (37 (37 (37 (46 (46 (46 (46 (46 (46 (46 (46 (46 (46



Total CO2 associ Space and water I Pumps, fans and Energy for light: Total Primary en Dwelling Primary	heating electric k ing ergy kWh/y	eep-hot	systems					159.4098 160.1482			.5128 .5338		ŝ	3769.4083 3769.4083 241.1551 245.6406 4256.2040 55.7800	(476) (478) (479) (483)
SAP 10 WORKSHEET CALCULATION OF TA	FOR New E	uild (As De	esigned) (Version 10	.2, February	2022)									
1. Overall dwell:															
Ground floor Total floor area Dwelling volume	TFA = (1a)+(1b)+(1c))+(1d)+(1e).	(1n)	76	5.3000		Area (m2) 76.3000			(m) .7400		=	Volume (m3) 209.0620 209.0620	(1b) (4)
2. Ventilation ra															
Number of open of Number of open fi Number of chimner Number of flues a Number of flues a Number of blocker Number of interm: Number of passivi Number of flueler	lues ys / flues attached t attached t d chimneys ittent ext e vents	o solid fue to other hea ract fans	el boiler	re								0 * 8 0 * 2 0 * 1 0 * 2 0 * 3 0 * 2 3 * 1 0 * 4	0 = 0 = 0 = 0 = 5 = 0 = 0 =	per hour 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(6a) (6b) (6c) (6d) (6e) (6e) (6f) (7a)
Infiltration due Pressure test Pressure Test Me Measured/design / Infiltration rate Number of sides	thod AP50 e	ys, flues a	and fans =	(6a)+(6b)·	+(6c)+(6d)+(6	бе)+(бf)+	·(6g)+(7a)+(7	7b)+(7c) =	:	31	9.0000	Air c	=	per hour 0.1435 Yes ower Door 5.0000 0.3935	(8)
Shelter factor Infiltration rate	e adjusted	to include	e shelter fa	ctor					(20) = 3	1 - [0				0.8500 0.3345	
Wind speed Wind factor Adj infilt rate	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250		90 4	ct .3000 .0750		v 5000 1250	Dec 4.7000 1.1750	
Effective ac	0.4265 0.5909	0.4181 0.5874	0.4097 0.5839	0.3679 0.5677	0.3596 0.5646	0.3177 0.5505	0.3177 0.5505	0.3094 0.5479			. 3596 . 5646		3763 5708	0.3930 0.5772	
3. Heat losses a	nd heat lo	ss paramete	er												
Element TER Opening Type External Wall 1 Total net area or Fabric heat loss Party Wall 1	(Uw = 1.2 f external	0) elements /	4	Gross m2 .7.8404	Openings m2 12.7700	12 35 47	etArea m2 2.7700 5.0704 7.8404 (25)(3	U-value W/m2K 1.1450 0.1800 30) + (32) 0.0000	14 6 = 20	A x U W/K .6221 .3127 .9348		(-value kJ/m2K		A x K kJ/K	
Thermal mass parallist of Thermal Miss E2 Other E3 Sill E4 Jamb E7 Party E8 Balcon E16 Corne	Bridges nt lintels (floor bet ny within er (normal y wall bet (Sum(L x F idges	including of ween dwell: a dwelling;) ween dwell:	other steel ings (in blo , wall insul	lintels) ocks of fla ation cont		-/		1	Length 7.0000 4.7400 3.9400 44.9200 5.1400 2.7400 5.4800	Psi-va 0.1 0.1 0.1 0.1	9599 9599 9599 9799 9999 9999	(36a + (36a	•	0 0 0 1 0 0	(35)

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Full SAP Calculation Printout



an]			ΙA	rea m2	Solar flux Table 6a W/m2		g fic data Table 6b	Specific or Tab		Acces facto Table	or	Gains W	
Solar gains													
	JEE: 3307	222.1032	J11.1747	772.70/1	-00.2301	771.7032	724.47/3	9100.00	0.0403	703.3202	7,2,1030	510.512/	(,
tal internal		533.1632	511.1949	492.9871	468.2507	451.4852	434.4973	435.5870	448.6483	463.9282	492.1638	510.9127	
ter heating	gains (Tabl		133.8067	123.6963	117.5034	111.0303	107.0544	110.3392	114.1904	121.3730	131.0650	139.5216	
sses e.g. ev					-95.5564	-95.5564	-95.5564	-95.5564	-95.5564	-95.5564	-95.5564	-95.5564	
mps, fans	34.9445 0.0000	34.9445 0.0000	34.9445 0.0000	34.9445 0.0000	34.9445 0.0000	34.9445 0.0000	34.9445 0.0000	34.9445 0.0000	34.9445 0.0000	34.9445 0.0000	34.9445 0.0000	34.9445 0.0000	
oking gains			ix L, equati	on L15 or				156.0576	161.5891	173.3650	188.2299	202.2009	
oliances gai	ns (calcula	ted in Appe	endix L, equ	ation L13	or L13a), al	lso see Tab	le 5						
ghting gains		d in Append		ion L9 or			110.3566	110.3566	114.0351	110.3566	114.0351	110.3566	
5)m	Jan 119.4455	Feb 119.4455	Mar 119.4455	Apr 1 1 9.4455	May 119.4455	Jun 119.4455	Jul 119.4455	Aug 119.4455	Sep 119.4455	0ct 119.4455	Nov 119.4455	Dec 119.4455	;
abolic gain		, Watts							_			_	
Internal ga	ins (see Ta												
ac gains iro	104.7658	93.0180	99.5522	89.0613	87.4226	79.9418	79.6485	82.0924	82.2171	90.3015	94.3668	103.8040)
at gains fro					al Energy us				wer(s) (kWh			0.0000	
ectric showe		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Total per ye		r)						Total p	er year (kW	n/year) = S	um(64)m =	2254.7241 2255	L
tput from w/	n 222.9373	197.0761	209.4287	184.5812	179.1609	161.7172	159.9363	166.2185	167.9377	186.9013	198.2400	220.5889)
lar input HRS	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	
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)
HRS	252.3207 -29.3833	223.0629 -25.9869	236.6406 -27.2119	207.1138 -22.5326	200.1605 -20.9995	179.6866 -17.9694	176.7798 -16.8435	184.1298 -17.9114	186.5296 -18.5919	208.8190 -21.9178	223.0702 -24.8302	249.4281 -28.8392	
ndi ioss tal heat req		ater heatin	ng calculate	d for each	month					0.0000		0.0000	
imary loss mbi 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)
cylinder co	ntains dedi 44.6400	cated solar 40.3200	r storage 44.6400	43.2000	44.6400	43.2000	44.6400	44.6400	43.2000	44.6400	43.2000	44.6400	,
tal storage	44.6400	40.3200	44.6400	43.2000	44.6400	43.2000	44.6400	44.6400	43.2000	44.6400	43.2000	44.6400)
Hot water sto /olume factor Temperature ter (49) or	orage loss from Tabl factor from (54) in (55	factor from e 2a Table 2b			ay)							1.4400 0.0000 1.0000 1.4400)
ore volume b) If manufa		ared loss t	factor is no	ot known :								0.0000	ı
stribution lo	31.1521	= 0.15 X (2 27.4114	28.8001	24.5871	23.3281	20.4730	19.8210	20.9235	21.4994	24.6269	26.9805	30.7182	:
ergy conte ergy content		182.7429	192.0006	163.9138	155.5205	136.4866	132.1398	139.4898	143.3296	164.1790 Total = S	179.8702 um(45)m =	204.7881 2002.1417	
ily hot wate	131.1318	128.3319	124.9221	119.7369	115.5262	110.9993	109.2595	112.6545	116.2352	120.9876	126.2527	130.7916	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
erage daily	39.0948	37.6732	36.2516 /day)	34.8299	33.4083	31.9867	31.9867	33.4083	34.8299	36.2516	37.6732	39.0948 120.5398	
t water usag	27.7631	27.3508 uses	26.7701	25.6995	24.8979	24.0090	23.5289	24.1054	24.7332	25.6844	26.7770	27.6692	: 1
t water usag	64.2739	63.3079	61.9004	59.2074	57.2200	55.0037	53.7439	55.1408	56.6720	59.0517	61.8025	64.0276	;
sumed occupa t water usag	ncy											2.3889	,
Water heati													
P (average) ys in mont	31	28	31	30	31	30	31	31	30	31	30	0.8441 31	
P	Jan 0.8651	Feb 0.8619	Mar 0.8588	Apr 0.8441	May 0.8413	Jun 0.8285	Jul 0.8285	Aug 0.8262	Sep 0.8335	0ct 0.8413	Nov 0.8469	Dec 0.8527	,
erage = Sum(39)m / 12 =		03.3248	64.4033	64.1935	63.2166	63.2166	63.0358	63.5929	64.1935	64.6180	65.0618 64.4023	
	66.0072	65.7636	65.5248		64 4035			63 6356					



			5.00 7.73		46.7521 19.6403		0.6300 0.6300		.7000 .7000	0.770 0.770		71.4402 46.6380	
Solar gains Total gains	118.0782 639.6171	208.2345 741.3977	299.2872 810.4821	387.5748 880.5619	444.0819 912.3326	443.8344 895.3196	426.7749 861.2722	385.1042 820.6912	330.4339 779.0821	234.4528 698.3811	142.8331 634.9969	100.0837 610.9964	
7. Mean inter	nal tempera	ture (heati											
 Temperature d Utilisation f			in the livi	ng area fro	m Table 9,							21.0000	(85)
tau alpha	Jan 72.8298 5.8553	Feb 73.0996 5.8733	Mar 73.3660 5.8911	Apr 74.6436 5.9762	May 74.8876 5.9925	Jun 76.0447 6.0696	Jul 76.0447 6.0696	Aug 76.2630 6.0842	Sep 75.5948 6.0397	0ct 74.8876 5.9925	Nov 74.3956 5.9597	Dec 73.8882 5.9259	
util living a	o.9822	0.9595	0.9134	0.7995	0.6356	0.4499	0.3227	0.3529	0.5554	0.8370	0.9593	0.9857	(86)
IIT h 2	20.2387 20.1973	20.4417 20.2000	20.6626 20.2027	20.8786 20.2153	20.9723 20.2177	20.9971 20.2287	20.9997 20.2287	20.9995 20.2307	20.9902 20.2244	20.8659 20.2177	20.5340 20.2129	20.2098 20.2079	
itil rest of	0.9777 19.3236	0.9501 19.5777	0.8948 19.8464	0.7648 20.1008	0.5878 20. 1 959	0.3965 20.2270	0.2663 20.2286	0.2941 20.2305	0.4961 20.2182	0.7992 20.0950	0.9481 19.7055	0.9820 19.2957	(90)
Living area f MIT Femperature a	19.6587	19.8941	20.1453	20.3856	20.4803	20.5090	20.5109	20.5121	+LA = 20.5009	Living area 20.3773	/ (4) = 20.0089	0.3662 19.6304 0.0000	(92
adjusted MIT	19.6587	19.8941	20.1453	20.3856	20.4803	20.5090	20.5109	20.5121	20.5009	20.3773	20.0089	19.6304	
 8. Space heat													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
Jtilisation Jseful gains Ext temp.	0.9740 622.9942 4.3000	0.9459 701.2915 4.9000	0.8933 724.0330 6.5000	0.7727 680.3683 8.9000	0.6041 551.1850 11.7000	0.4160 372.4656 14.6000	0.2870 247.1458 16.6000	0.3156 259.0489 16.4000	0.5175 403.1586 14.1000	0.8075 563.9208 10.6000	0.9447 599.9110 7.1000	0.9787 597.9703 4.2000	(95
leat loss rat	1013.7829	986.0648	894.1078	739.7100	563.6348	373.5483	247.2362	259.2087	407.0525	627.6392	834.1455	1003.9306	(97
pace heating	290.7468 requirement	191.3677 t - total pe	126.5357 er year (kWh	42.7260 n/year)	9.2627	0.0000	0.0000	0.0000	0.0000	47.4065	168.6488	302.0344 1178.7286	
Solar heating Solar heating	0.0000	0.0000 on - total i	0.0000 per vear (kl	0.0000 Wh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Space heating Space heating Space heating	kWh 290.7468 requirement	191.3677	126.5357	42.7260	9.2627 l per year	0.0000 (kWh/year)	0.0000	0.0000	0.0000	47.4065 (98c)	168.6488	302.0344 1178.7286 15.4486	•
9b. Energy re	equirements											0.0000	(20)
Praction of s Fraction of s Fraction of h Fraction of h Factor for co Factor for ch Distribution Efficiency of	equirements pace heat fi pace heat fi peat from cor neat from cor neat from del parging metho loss factor secondary/s	rom secondar rom communit munity Coml munity Boi narging metl od (Table 40 (Table 12c	ry/supplementy system bined Heat a lers-Space a hod (Table 4 c(3)) for way for commun	ntary system and Power-Spand Water 4c(3)) for ater heating nity heating	m (Table 11) pace and War space heatin	ter						0.0000 1.0000 0.5580 0.4420 1.0000 1.0000	(30) (30) (30) (30) (30)
Pb. Energy re Fraction of s Fraction of s Fraction of h Fraction of h Factor for ch Oistribution Efficiency of Space heating	equirements pace heat fi pace heat from cor leat from cor	rom secondai rom community rom community rom	ry/supplementy system bined Heat alers-Space alers-Spa	and Power-Spand Water 4c(3)) for stern heating hity heating system, %	m (Table 11) pace and War space heatin g g system 9.2627	ter			0.0000	47.4065	168.6488	1.0000 0.5580 0.4420 1.0000 1.2500	(30 (30 (30 (30 (30 (30 (20
Pb. Energy re- Fraction of s Fraction of s Fraction of h Fraction of h Fraction for co Fractor for co Fractor for co Friciency of Frace heating Frace heating Frace heat fr	equirements pace heat fi pace heat fi peat from cor leat	rom secondar rom community community Community Boi. narging metid (Table 4 (Table 12c; supplementar 191.3677 Heat and Po 133.4789	ry/supplementy system bined Heat alers-Space alers-Spa	ntary system and Power-Spand Water 4c(3)) for ster heating itty heating system, % 42.7260 x 0.56 x 1 29.8014	m (Table 11) pace and War space heatin g g system 9.2627	ter			0.0000 0.0000	47.4065 33.0660	168.6488 117.6326	1.0000 0.5580 0.4420 1.0000 1.2500 0.0000	(30 (30 (30 (30 (30 (20
Pb. Energy re Fraction of s Fraction of s Fraction of h Fraction of h Fractor for co Fractor for	equirements pace heat fi pace h	rom secondal rom community Coml munity Boi: narging meti (Table 4: (Table 12: supplemental 191.3677 Heat and Po 133.4789 = (98) x 0 105.7306	ry/supplementy system bined Heat alers-Space alers-Spa	ntary system and Power-Spand Water 4c(3)) for ster heating itty heating system, % 42.7260 x 0.56 x 1 29.8014	m (Table 11) pace and War space heatin g g system 9.2627 .00 x 1.25	0.0000	0.0000	0.0000				1.0000 0.5580 0.4420 1.0000 1.2500 0.0000	(30 (30 (30 (30 (30 (20 (98
raction of s raction of s raction of s raction of h raction of h raction for co ractor for ch distribution refficiency of pace heating race heat fr race race race race race race race rac	equirements pace heat fi space heat from core leat	rom secondai rom community munity Com munity Boi narging metl (Table 12c; supplementai 191.3677 Heat and Pr 133.4789 = (98) x 0.4 105.7306	ry/supplementy system bined Heat alers-Space alers-Spa	and Power-Spand Water 4c(3)) for a ter heating hity heating system, % 42.7260 x 0.56 x 1 29.8014 1.25 23.6061 53.4075 system in %	m (Table 11) pace and War space heating g system 9.2627 .00 x 1.25 6.4607 5.1176 11.5784	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000	0.0000	33.0660	117.6326	1.0000 0.5580 0.4420 1.0000 1.2500 0.0000 302.0344	(30 (30 (30 (30 (30 (20 (98
Pb. Energy re Fraction of s Fraction of s Fraction of h Fraction of h Fraction of h Factor for co Factor for ch Distribution Efficiency of Space heating Space heat fr 307a Space heat fr 307b Space heating Efficiency of Space heating	equirements pace heat fi space heat from con leat from leat from con leat from leat from con leat from leat from con leat from leat from con leat from	rom secondai rom community munity Com munity Boi narging metl (Table 12c; supplementai 191.3677 Heat and Pr 133.4789 = (98) x 0.4 105.7306	ry/supplementy system bined Heat alers-Space alers-Spa	and Power-Spand Water 4c(3)) for a ter heating hity heating system, % 42.7260 x 0.56 x 1 29.8014 1.25 23.6061 53.4075 system in %	m (Table 11) pace and War space heating g system 9.2627 .00 x 1.25 6.4607 5.1176 11.5784	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000	33.0660 26.1921	117.6326 93.1785	1.0000 0.5580 0.4420 1.0000 1.2500 0.0000 302.0344 210.6690 166.8740	(30) (30) (30) (30) (30) (20) (98)
Procession of securion of securion of securion of securion of securion of heaction of histribution of ficiency of space heating space heat from the securion of space heating space heat	equirements pace heat fi pace	rom secondar rom community Coml munity Coml munity Boi: narging metil rod (Table 4: (Table 12c; supplementar 191.3677 Heat and Po 133.4789 = (98) x 0 105.7306 : 239.2096 supplementar econdary/sup 0.0000	ry/supplementy system bined Heat alers-Space and bined (Table acc)) for work for community heating street 126.5357 ower = (98) 88.2586 44 x 1.00 x 69.9189 158.1696 ry heating spplementary 0.0000	ntary system and Power-Spand Water 4c(3)) for ster heating inty heating system, % 42.7260 x 0.56 x 1 29.8014 1.25 23.6061 53.4075 system in % system 0.0000	m (Table 11) pace and War space heating g system 9.2627 .00 x 1.25 6.4607 5.1176 11.5784 (from Table 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 endix E)	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	33.0660 26.1921 59.2581	117.6326 93.1785 210.8111	1.0000 0.5580 0.4420 1.0000 1.0000 0.0000 302.0344 210.6690 166.8740 377.5430 0.0000	(30 (30 (30 (30 (30 (20 (98 (30 (30
Pb. Energy re- Fraction of s Fraction of s Fraction of h Fraction of h Fraction of h Fraction for ch Fractor fo	quirements pace heat fi pace heat pac	rom secondar or community Boi. Interest of Carlotte 12c supplementar of 191.3677 Heat and Point 195.7306 Supplementar 195.7306 Supplementar 195.7306 Supplementar 197.0761 Heat and Point 197.0761	ry/supplementy system bined Heat alers-Space alers-Spa	and Power-Spand Water 4c(3)) for seter heating system, % 42.7260 x 0.56 x 1 29.8014 1.25 23.6061 53.4075 system in % 9.0000 184.5812 x 0.56 x 1 128.7454	m (Table 11) pace and War space heating g system 9.2627 .00 x 1.25 6.4607 5.1176 11.5784 (from Table 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 endix E) 0.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	33.0660 26.1921 59.2581 0.0000	117.6326 93.1785 210.8111 0.0000	1.0000 0.5580 0.4420 1.0000 1.0000 1.2500 0.0000 302.0344 210.6690 166.8740 377.5430 0.0000	(30 (30 (30 (30 (30 (20 (98 (30 (30 (30
Pb. Energy refraction of seraction of seraction of seraction of heraction of heraction of heraction for consistent of the series	equirements pace heat fi space	rom secondar or community Boi. Interest of Carlotte 12c supplementar of 191.3677 Heat and Point 195.7306 Supplementar 195.7306 Supplementar 195.7306 Supplementar 197.0761 Heat and Point 197.0761	ry/supplementy system bined Heat alers-Space alers-Spa	and Power-Spand Water 4c(3)) for seter heating system, % 42.7260 x 0.56 x 1 29.8014 1.25 23.6061 53.4075 system in % 9.0000 184.5812 x 0.56 x 1 128.7454	m (Table 11) pace and War space heating g system 9.2627 .00 x 1.25 6.4607 5.1176 11.5784 (from Table 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 endix E) 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	33.0660 26.1921 59.2581 0.0000	117.6326 93.1785 210.8111 0.0000	1.0000 0.5580 0.4420 1.0000 1.0000 302.0344 210.6690 166.8740 377.5430 0.0000	(30 (30 (30) (30) (30) (20) (98) (30) (30) (30) (30)
Pb. Energy re- Fraction of s Fraction of s Fraction of s Fraction of s Fraction of h Fractor for co Factor for ch Distribution Fficiency of Foace heating Foace heat fr Foace heating Fo	quirements pace heat fi pace heat from core leat f	rom secondar or community Boi. Instantial secondary secondarial secondarial secondarial secondary secondar	ry/supplementy system bined Heat alers-Space alers-Spa	ntary system and Power-Spand Water 4c(3)) for ster heating inty heating inty heating system, % 42.7260 x 0.56 x 1 29.8014 1.25 23.6061 53.4075 system in system 0.0000 184.5812 x 0.56 x 1 128.7454 1.25	m (Table 11) pace and War space heating g system 9.2627 .00 x 1.25 6.4607 5.1176 11.5784 (from Table 0.0000 179.1609 .00 x 1.25 124.9647	0.0000 0.0000 0.0000 0.0000 0.0000 4a or App 0.0000	0.0000 0.0000 0.0000 0.0000 endix E) 0.0000 159.9363	0.0000 0.0000 0.0000 0.0000 166.2185 115.9374	0.0000 0.0000 0.0000 0.0000 167.9377 117.1365	33.0660 26.1921 59.2581 0.0000 186.9013 130.3636	117.6326 93.1785 210.8111 0.0000 198.2400 138.2724	1.0000 0.5580 0.4420 1.0000 1.0000 1.2500 0.0000 302.0344 210.6690 166.8740 377.5430 0.0000 220.5889 153.8608 121.8754 275.7362	(30) (30) (30) (30) (30) (20) (98) (30) (30) (30) (40)
	quirements pace heat fi pace heat from core leat f	rom secondar or community Boi. Instantial secondary secondarial secondarial secondarial secondary secondar	ry/supplementy system bined Heat alers-Space alers-Spa	and Power-Signator water heating ity heating system, % 42.7260 x 0.56 x 1 29.8014 1.25 23.6061 53.4075 system in % system 0.0000 184.5812 x 0.56 x 1 128.7454 1.25 101.9811	m (Table 11) pace and War space heatin g g system 9.2627 .00 x 1.25 6.4607 5.1176 11.5784 (from Table 0.0000 179.1609 .00 x 1.25 124.9647 98.9864	0.0000 0.0000 0.0000 0.0000 4a or App 0.0000 161.7172 112.7977 89.3488	0.0000 0.0000 0.0000 0.0000 endix E) 0.0000 159.9363 111.5556 88.3648	0.0000 0.0000 0.0000 0.0000 166.2185 115.9374 91.8357	0.0000 0.0000 0.0000 0.0000 167.9377 117.1365 92.7856	33.0660 26.1921 59.2581 0.0000 186.9013 130.3636 103.2629	117.6326 93.1785 210.8111 0.0000 198.2400 138.2724 109.5276	1.0000 0.5580 0.4420 1.0000 1.0000 302.0344 210.6690 166.8740 377.5430 0.0000 220.5889 153.8608	(30) (30) (30) (30) (30) (98) (30) (30) (30) (30) (30) (30) (30) (30

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	0000 0.0000	0.0000 0.0000	0.0000 0.0	000 (334
,	0000 0.0000	0.0000 0.0000	0.0000 0.0	000 (335
,	0900 -12.5736	-8.9495 -5.0094	-2.1122 -1.2	154 (333l
Electricity generated by wind turbines (Appendix M) (negative quantity) (334b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.	0.000 0.0000	0.0000 0.0000	0.0000 0.0	000 (334l
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (335b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.	0000 0.0000	0.0000 0.0000	0.0000 0.0	000 (335l
Annual totals kWh/year Space heating fuel - community heating				` 108 (307)
Space heating fuel - secondary			0.0	000 (309)
Water heating fuel - community heating Efficiency of water heater				052 (310) 000 (311)
Electricity used for heat distribution Space cooling fuel				341 (313) 000 (321)
Electricity for pumps and fans:				
Total electricity for the above, kWh/year Electricity for lighting (calculated in Appendix L)				000 (331) 576 (332)
Energy saving/generation technologies (Appendices M ,N and Q)			214 2	766 (222)
PV generation Wind generation			0.0	766 (333) 000 (334)
Hydro-electric generation (Appendix N) Electricity generated - Micro CHP (Appendix N)				000 (335) 000 (335)
Appendix Q - special features Energy saved or generated				000 (336)
Energy used Total delivered energy for all uses				000 (337) 970 (338)
12b. Carbon dioxide emissions - Community heating scheme				
	Energy	Emission factor	Emissi	ons
Electrical efficiency of CHP unit	kWh/year	kg CO2/kWh	kg C02/y	ear 000 (361)
Heat efficiency of CHP unit			49.9	000 (362
Space heating from Combined Heat and Power less credit emissions for electricity	1647.6217 -527.2389	0.2100 0.3480		006 (363 792 (364
Water heating from Combined Heat and Power	3151.6435	0.2100		451 (365
less credit emissions for electricity	-1008.5259	0.3480	-350.9	670 (366
Efficiency of heat source Boilers Space and Water heating from Boilers	2020.2158	0.2100		000 (367) 464 (368)
Electrical energy for heat distribution (space & water)	14.7341	0.0000		922 (372
Overall CO2 factor for heat network Total CO2 associated with community systems				106 (386) 371 (373)
Space and water heating				371 (376)
Pumps, fans and electric keep-hot Energy for lighting	0.0000 185.0576	0.0000 0.1443		000 (378) 095 (379)
Energy saving/generation technologies				
PV Unit electricity used in dwelling PV Unit electricity exported	-216.0607 -98.2158	0.1326 0.1247	-28.6 -12.2	
Total	-98.2138	0.1247		964 (380)
Total CO2, kg/year EPC Target Carbon Dioxide Emission Rate (TER)				402 (383 600 (384
	Energy	Primary energy factor	Primary ene	
Electrical efficiency of CHP unit	kWh/year	kg CO2/kWh	kWh/y: 32.0	ear 000 (461
Heat efficiency of CHP unit				000 (462)
Space heating from Combined Heat and Power	1647.6217	1.1300		125 (463
less credit emissions for electricity Water heating from Combined Heat and Power	-527.2389 3151.6435	2.1490 1.1300		365 (464) 571 (465)
less credit emissions for electricity	-1008.5259	2.1490		222 (466)
Efficiency of heat source Boilers				000 (467)
,	2020.2158 14.7341	1.1300 0.0000		165 (468)
Space and Water heating from Boilers	14./341	0.0000		940 (472) 419 (486)
Space and Water heating from Boilers Electrical energy for heat distribution (space & water)			4471.8	489 (473)
Space and Water heating from Boilers Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems				489 (476) 000 (478)
Space and Water heating from Boilers Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems Space and water heating	a agaa	a aaa		UUU 14/0
Space and Water heating from Boilers Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems Space and water heating Dumps, fans and electric keep-hot	0.0000 185.0576	0.0000 1.5338		
Space and Water heating from Boilers Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems Space and water heating Pumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies	185.0576	1.5338	283.8	475 (479)
Space and Water heating from Boilers Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems Space and water heating Pumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies PV Unit electricity used in dwelling				475 (479) 478
Space and Water heating from Boilers Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems Space and water heating Pumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported	185.0576 -216.0607	1.5338	-321.9 -44.9	475 (479) 478
Space and Water heating from Boilers Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems Space and water heating Pumps, fans and electric keep-hot Energy for lighting	185.0576 -216.0607	1.5338	283.8 -321.9 -44.9 -366.9 4388.7	475 (479 478 579



Property Reference		LEAN	PLANNING						Issued	on Date	12/09	/2023	
Assessment Reference	9		01,2 x2_Copy_C	ору			Prop	Type Ref					
Property													
SAP Rating				86	В	DER		12.15		TER	1	3.34	
Environmental				91	В	% DE	R < TER				8	.92	
CO₂ Emissions (t/year))			0.6		DFEI		16.92		TFEE		1.17	
% DPER < TPER					e BREL	% DF	EE < TFEE	00.57	<u> </u>	TOFO		0.07	
		_		3.6	04	DPE	`	63.57		TPER		5.97	
Assessor Details Client		Mr. Richard I	Denteh							Assessor ID	L	J148-0001	
SAP 10 WORKSHEET CALCULATION OF DI	WELLING EM	ISSIONS FOR				2022)		Area (m2)	_	y height		Volume (m3)	
Fround floor Fotal floor area Welling volume 2. Ventilation r.)+(1b)+(1c)	+(1d)+(1e)	(1n)	5:	1.9000		51.9000	(1b) x a)+(3b)+(3c)+(2.7400 (3d)+(3e)	` ,	142.2060 142.2060	(4)
lumber of open c											0 * 80 =	0.0000	(6a
Jumber of open f Jumber of chimne; Jumber of flues Jumber of blocke; Jumber of interm Jumber of passiv Jumber of fluele	ys / flues attached to attached to d chimneys ittent exto e vents	o solid fue o other hea ract fans	el boiler	ire							0 * 20 = 0 * 10 = 0 * 20 = 0 * 35 = 0 * 20 = 0 * 10 = 0 * 10 = 0 * 40 =	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(6c (6d (6e (6f (7a (7b
nfiltration due ressure test ressure Test Me leasured/design nfiltration rat lumber of sides	thod AP50 e	ys, flues a	and fans =	= (6a)+(6b)-	+(6c)+(6d)+(5e)+(6f)+(бg)+(7а)+(7	7b)+(7c) =		0.0000	/ (5) =	es per hour 0.0000 Yes Blower Door 3.0000 0.1500	(8)
helter factor nfiltration rat	e adjusted	to include	shelter fa	actor					(20) = 1 - (21)		(19)] = x (20) =	0.7750 0.1162	
Wind speed Wind factor Adj infilt rate	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	Sep 4.0000 1.0000	0ct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	
Balanced mechan f mechanical ve f exhaust air h f balanced with	ntilation eat pump u	sing Append	lix N, (23b)) = (23a) x					0.1162	0.1250	0.1308	0.1366 0.5000 0.5000 72.8000	(23
ffective ac	0.2842	0.2813	0.2784	0.2639	0.2610	0.2464	0.2464	0.2435	0.2522	0.2610	0.2668	0.2726	(25
. Heat losses a			er										
lement lazing (Uw = 1.				Gross m2	Openings m2	7.	Area m2 7700	U-value W/m2K 1.2357	A x U W/K 9.6017		-value kJ/m2K	A x K kJ/K	(27
xternal Wall 1 xternal Roof 1				19.2348 51.9000	7.7700	11.	4648 9000	0.1400 0.1000	1.6051 5.1900		0.0000 9.0000	2178.3120 467.1000	(29

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Total net are Fabric heat l			Aum(A, m2)			71	.1348	30) + (32) =	= 16.39	68			(31) (33)
Party Wall 1		(,, ,, ,,					.5300 .9000	0.0000	0.00	00 18	0.0000	10535.4000	(32)
Party Floor 1 Internal Wall							.2000				0.0000 5.0000	2076.0000 5265.0000	
Heat capacity Thermal mass List of Therm	parameter (1		TFA) in kJ/ı	m2K				(28).	(30) + (3	2) + (32a).	(32e) =	20521.8120 395.4106	
K1 El	ement	/:1d:		1 1:-+-1-\					-	Psi-value	Tot		
E3 Si		(Including	other stee.	i iinteis)				1	.8400 .5600	0.0300 0.0300	0.11 0.04	168	
	rty floor be								.7400 .0100	0.0300 0.0700	0.23 0.49		
E18 P	lcony betwee arty wall be lat roof			ulation con	tinuous			5	.0100 .4800 .0100	0.0200 0.0600 0.0800	0.14 0.32 0.56	288	
P4 Pa Thermal bridg	rty wall - F es (Sum(L x							21	.3500	0.1200	2.56	520 4.4767	(36)
Point Thermal Total fabric									(33) + (36)	(36a) = + (36a) =	0.0000 20.8735	
Ventilation h	eat loss cal Jan	culated mo	nthly (38)m Mar	= 0.33 x (25)m x (5) May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
(38)m Heat transfer	13.3378	13.2014	13.0650	12.3831	12.2467	11.5648	11.5648	11.4284	11.8376	12.2467	12.5195	12.7923	(38)
Average = Sum	34.2113	34.0749	33.9385	33.2566	33.1202	32.4383	32.4383	32.3019	32.7111	33.1202	33.3930	33.6658 33.2225	
HLP	Jan 0.6592	Feb 0.6565	Mar 0.6539	Apr 0.6408	May 0.6382	Jun 0.6250	Jul 0.6250	Aug 0.6224	Sep 0.6303	Oct 0.6382	Nov 0.6434	Dec 0.6487	(40)
HLP (average) Days in mont	31	28	31	30	31	30	31	31	30	31	30	0.6401 31	
bays In mone	31	20	31	30	31	30	31	31	30	31	30	31	
4. Water heat			s (kWh/year)									
Assumed occup Hot water usa	ancy											1.7461	(42)
	73.5573	72.4519	70.8410	67.7590	65.4846	62.9481	61.5064	63.1051	64.8575	67.5808	70.7290	73.2755	(42a
Hot water usa	23.1283	22.7849	22.3012	21.4093	20.7415	20.0010	19.6010	20.0813	20.6043	21.3967	22.3069	23.0502	(42b
Hot water usa Average daily	32.5120	31.3298	30.1475 /day)	28.9653	27.7830	26.6007	26.6007	27.7830	28.9653	30.1475	31.3298	32.5120 118.8174	
5 13 1	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
Daily hot wat	er use 129.1977 204.6175	126.5665 180.2290	123.2897 189.4917	118.1336 161.7190	114.0091 153.4781	109.5499 134.7043	107.7082 130.2637	110.9694 137.4033	114.4270 141.0999	119.1250 161.6515	124.3657 177.1817	128.8376 201.7286	
Energy content Distribution	loss (46)m										um(45)m =	1973.5683	
Water storage	30.6926 loss:	27.0343	28.4238	24.2578	23.0217	20.2057	19.5396	20.6105	21.1650	24.2477	26.5773	30.2593	
Store volume b) If manuf	acturer decl	ared loss	factor is n	ot known :								110.0000	(47)
	torage loss or from Tabl		m Table 2 (kWh/litre/d	ay)							0.0152 1.0294	
	factor from (54) in (55	n Table 2b										0.6000 1.0327	(53)
· ·	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(56)
If cylinder c	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	
Primary loss Combi loss	23.2624 0.0000	21.0112 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	
Total heat re	quired for w 259.8943	ater heati 230.1564	244.7685	ed for each 215.2126	month 208.7549	188.1980	185.5405	192.6801	194.5936	216.9283	230.6754	257.0054	(62)
WWHRS PV diverter	-55.7975 0.0000	-49.3478 0.0000	-51.6742 0.0000	-42.7882 0.0000	-39.8771 0.0000	-34.1231 0.0000	-31.9850 0.0000	-34.0128 0.0000	-35.3051 0.0000	-41.6208 0.0000	-47.1513 0.0000	-54.7642 0.0000	
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 Output from w		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
12Total per y	204.0968 ear (kWh/yea	180.8086 ar)	193.0943	172.4244	168.8778	154.0749	153.5555	158.6672 Total p	159.2885 er year (kW	175.3075 h/year) = S	183.5241 um(64)m =	202.2412 2105.9609 2106	
Electric show		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a
Heat gains fr					-	sed by insta						0.0000	
	112.2568	99.8681	107.2274	96.5665	95.2529	87.5841	87.5341	89.9080	89.7107	97.9706	101.7079	111.2962	(65)
5. Internal g	ains (see Ta												
Metabolic gai	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
(66)m Lighting gain							87.3060	87.3060	87.3060	87.3060	87.3060	87.3060	
	79.0664	87.5378	79.0664	81.7020	79.0664	81.7020	79.0664	79.0664	81.7020	79.0664	81.7020	79.0664	(67)



Appliances ga	ins (calcula 152.1665	ated in App 153.7456		uation L13 141.2955	or L13a), a 130.6025	lso see Tab 120.5525	ole 5 113.8385	112.2595	116.2386	124.7095	135.4026	145.4526	(68)
Cooking gains Pumps, fans			dix L, equat					31.7306	31.7306 0.0000	31.7306	31.7306 0.0000	31.7306 0.0000	(69)
Losses e.g. e	vaporation -69.8448	negative v -69.8448	values) (Tab -69.8448	le 5) -69.8448	-69.8448	-69.8448	-69.8448	-69.8448	-69.8448	-69.8448	-69.8448	-69.8448	
Water heating	gains (Tab. 150.8827	le 5) 148.6132	144.1229	134.1201	128.0281	121.6446	117.6534	120.8441	124.5982	131.6809	141.2609	149.5917	(72)
Total interna	l gains 431.3075	439.0884	422.1476	406.3095	386.8888	373.0909	359.7502	361.3619	371.7305	384.6486	407.5573	423.3024	(73)
6. Solar gain	s												
[Jan]			А	rea m2	Solar flux Table 6a W/m2	Speci	g ific data Table 6b	Specific or Tab		Acce fact Table	or	Gains W	
South			7.7	700	46.7521		0.7600		.8000	0.77	00	153.0589	(78)
Solar gains Total gains	153.0589 584.3664	250.6711 689.7595	319.3105 741.4581	360.8901 767.1996	376.0699 762.9587	361.9161 735.0070	353.6140 713.3642	343.4082 704.7701	333.5575 705.2880	270.3723 655.0209	181.4270 588.9843	132.2570 555.5594	
7. Mean inter													
Temperature d Utilisation f						Th1 (C) Jun	Jul	Aug	Sep	0ct	Nov	21.0000 Dec	(85)
tau alpha	166.6264 12.1084	167.2933 12.1529		171.4097 12.4273	172.1155 12.4744	175.7337 12.7156	175.7337 12.7156	176.4757 12.7650	174.2683 12.6179	172.1155 12.4744	170.7096 12.3806	169.3265 12.2884	
util living a	0.9129	0.7848	0.6622	0.5244	0.4037	0.2825	0.2001	0.2108	0.3200	0.5258	0.7789	0.9327	(86)
MIT Th 2 util rest of	20.9429 20.3770 house	20.9890 20.3794		20.9999 20.3934	21.0000 20.3958	21.0000 20.4075	21.0000 20.4075	21.0000 20.4099	21.0000 20.4028	20.9999 20.3958	20.9919 20.3911	20.9285 20.3864	
MIT 2 Living area f	0.8927 20.3343	0.7576 20.3720		0.4982 20.3934	0.3775 20.3958	0.2563 20.4075	0.1731 20.4075	0.1838 20.4099	0.2923 20.4028 fl A =	0.4953 20.3957 Living are	0.7478 20.3860	0.9155 20.3316 0.5451	(90)
MIT Temperature a	20.6661	20.7083	20.7173	20.7240	20.7251	20.7305	20.7305	20.7316	20.7283	20.7251	20.7163	20.6569	
adjusted MIT	20.6661	20.7083	20.7173	20.7240	20.7251	20.7305	20.7305	20.7316	20.7283	20.7251	20.7163	20.6569	(93)
8. Space heat	ing require	 ment											
Utilisation	Jan 0.9024	Feb 0.7721	Mar 0.6496	Apr 0.5125	May 0.3918	Jun 0.2706	Jul 0.1878	Aug 0.1985	Sep 0.3074	Oct 0.5119	Nov 0.7646	Dec 0.9235	(94)
Useful gains Ext temp. Heat loss rat	527.3587 4.3000	532.5842 4.9000	481.6196 6.5000	393.1784 8.9000	298.9128 11.7000	198.8624 14.6000	133.9858 16.6000	139.9174 16.4000	216.8200 14.1000	335.3060 10.6000	450.3420 7.1000	513.0423 4.2000	(95)
Space heating	559.9040 kWh	538.6663		393.2258	298.9143	198.8624	133.9858	139.9174	216.8201	335.3446	454.6875	554.0353	
Space heating Solar heating		4.0872 t - total p		0.0341 h/year)	0.0011	0.0000	0.0000	0.0000	0.0000	0.0287	3.1287	30.4987 62.6590	(98a)
Solar heating	0.0000 contribution	0.0000 on - total		0.0000 Wh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000	(98b)
Space heating Space heating	24.2137 requirement	4.0872 t after so		0.0341 tion - tota	0.0011 al per year	0.0000 (kWh/year)	0.0000	0.0000	0.0000	0.0287	3.1287) / (4) =	30.4987 62.6590 1.2073	
Space medeling	, pc <u>-</u>									(300	, , (.,	112073	(33)
9b. Energy re	quirements												
Fraction of s Fraction of s Fraction of h Fraction of h Factor for co Factor for ch Distribution	pace heat fi pace heat fi eat from con eat from con entrol and ch arging metho	rom seconda rom communi mmunity Com mmunity Boi harging met od (Table 4	ary/suppleme ity system mbined Heat ilers-Space thod (Table 4c(3)) for w	ntary systemand Power-Sand Water 4c(3)) forwater	em (Table 11 Space and Wa space heati) ter						0.0000 1.0000 0.5580 0.4420 1.0500 1.2500	(302) (303) (303) (305) (305)
Efficiency of Space heating Space heating	:		ary heating	system, %								0.0000	(208)
Space heat fr	24.2137	4.0872		0.0341 x 0.56 x 3	0.0011 1.05 x 1.25	0.0000	0.0000	0.0000	0.0000	0.0287	3.1287	30.4987	(98)
307a Space heat fr	17.7335	2.9934	0.4883	0.0250	0.0008	0.0000	0.0000	0.0000	0.0000	0.0210	2.2914	22.3365	
307b Space heating	14.0470	2.3711		0.0198	0.0007	0.0000	0.0000	0.0000	0.0000	0.0167	1.8151	17.6931	

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				CITCI	9)
31.7805 5.3644 0.8750 0.0448 0.0015 0.0000 0.0000 Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) Space heating fuel for secondary/supplementary system	0.0000	0.0000	0.0377	4.1065	40.0296 (307) 0.0000 (308)
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 Water heating	0.0000	0.0000	0.0000	0.0000	0.0000 (309)
Annual water heating requirement 204.0968 180.8086 193.0943 172.4244 168.8778 154.0749 153.5555	158.6672	159.2885	175.3075	183.5241	202.2412 (64)
Water heat from Combined Heat and Power = (64) x 0.56 x 1.05 x 1.25 310a 149.4754 132.4197 141.4175 126.2793 123.6819 112.8406 112.4602	116.2039	116.6589	128.3908	134.4084	148.1164
Water heat from Boilers = (64) x 0.44 x 1.05 x 1.25 310b 118.4016 104.8916 112.0189 100.0277 97.9702 89.3827 89.0814	92.0468	92.4073	101.7002	106.4669	117.3252
Water heating fuel 267.8770 237.3113 253.4363 226.3070 221.6521 202.2233 201.5416	208.2508	209.0662	230.0911	240.8753	265.4415 (310)
Cooling System Energy Efficiency Ratio Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000 (314) 0.0000 (315)
Pumps and Fa 8.6567 7.8190 8.6567 8.3775 8.6567 8.3775 8.6567 Lighting 14.5256 11.6530 10.4922 7.6871 5.9377 4.8512 5.4166	8.6567 7.0407	8.3775 9.1451	8.6567 11. 9989	8.3775 13.5527	8.6567 (331) 14.9293 (332)
Electricity generated by PVs (Appendix M) (negative quantity) (333a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (333a
(334a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000 (334a
(335a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000 (335a
(333b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000 (333b
(334b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000 (334b
(335b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 Annual totals kWh/year	0.0000	0.0000	0.0000	0.0000	0.0000 (335b
Space heating fuel - community heating Space heating fuel - secondary					82.2399 (307) 0.0000 (309)
Water heating fuel - community heating Efficiency of water heater					2764.0736 (310) 0.0000 (311)
Electricity used for heat distribution Space cooling fuel					0.8224 (313) 0.0000 (321)
Electricity for pumps and fans:					, ,
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5875) mechanical ventilation fans (SFP = 0.5875)					101.9262 (330a
Total electricity for the above, kWh/year Electricity for lighting (calculated in Appendix L)					101.9262 (331) 117.2302 (332)
Energy saving/generation technologies (Appendices M ,N and Q) PV generation Wind generation					0.0000 (333) 0.0000 (334)
Hydro-electric generation (Appendix N) Electricity generated - Micro CHP (Appendix N)					0.0000 (335a 0.0000 (335)
Appendix Q - special features Energy saved or generated Energy used					-0.0000 (336) 0.0000 (337)
Total delivered energy for all uses					3065.4699 (338)
12b. Carbon dioxide emissions - Community heating scheme					
	Energy	Emiss	ion factor		Emissions
Electrical efficiency of CHP unit	kWh/year	1	kg CO2/kWh	k	g CO2/year 32.0000 (361)
Heat efficiency of CHP unit Space heating from Combined Heat and Power	91.9637		0.2100		49.9000 (362) 19.3124 (363)
less credit emissions for electricity Water heating from Combined Heat and Power	-29.4284 3090.8879		0.3480 0.2100		-10.2411 (364) 649.0865 (365)
less credit emissions for electricity Efficiency of heat source Boilers	-989.0841		0.3480		-344.2013 (366) 93.9000 (367)
Space and Water heating from Boilers	1339.7983		0.2100 0.0000		8.1294 (368)
Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network	0.8224		0.0000		4.0176 (372) 0.2106 (386)
Total CO2 associated with community systems Space and water heating					599.3317 (373) 599.3317 (376)
Pumps, fans and electric keep-hot Energy for lighting	101.9262 117.2302		0.1387 0.1443		14.1384 (378) 16.9199 (379)
Total CO2, kg/year EPC Dwelling Carbon Dioxide Emission Rate (DER)					630.3901 (383) 12.1500 (384)
13b. Primary energy - Community heating scheme					
Electrical efficiency of CHP unit	Energy kWh/year	Primary ene	rgy factor kg CO2/kWh	Prim	ary energy kWh/year 32.0000 (461)
Heat efficiency of CHP unit	04 063=		4 4300		49.9000 (462)
Space heating from Combined Heat and Power less credit emissions for electricity	91.9637 -29.4284		1.1300 2.1490		103.9190 (463) -63.2416 (464)
Water heating from Combined Heat and Power less credit emissions for electricity	3090.8879 -989.0841		1.1300 2.1490		3492.7034 (465) -2125.5418 (466)
Efficiency of heat source Boilers Space and Water heating from Boilers	1339.7983		1.1300		93.9000 (467b 43.7439 (468)
Direct and water installing from bolier's Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network	0.8224		0.0000		43.3185 (472) 1.0417 (486)
					` '



Total CO2 assoc Space and water Pumps, fans and Energy for ligh Total Primary en Dwelling Primary	heating electric I ting nergy kWh/y y energy Ra	keep-hot /ear ate (DPER)						101.9262 117.2302			1.5128 1.5338		2	2965.1296 2965.1296 154.1939 179.8116 3299.1350 63.5700	(476) (478) (479) (483)
SAP 10 WORKSHEE CALCULATION OF	T FOR New I	Build (As De SSIONS	esigned)	(Version 10	.2, February	2022)									
1. Overall dwel		cteristics													
Ground floor Total floor are Dwelling volume		a)+(1b)+(1c))+(1d)+(1e)	(1n)	5:	1.9000		Area (m2) 51.9000	(1b)	x	y height (m) 2.7400 (3d)+(3e)			Volume (m3) 142.2060 142.2060	(1b) -
2. Ventilation	rate														
Number of open Number of chimn Number of flues Number of flues Number of inter Number of passi Number of fluel Number of fluel	flues eys / flues attached f attached f ed chimneys mittent ext ve vents	to solid fue to other hea s tract fans	el boiler	ire								0 * 80 0 * 20 0 * 10 0 * 20 0 * 35 0 * 20 2 * 10 0 * 10 0 * 40	= = = = = = =	per hour 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(6a) (6b) (6c) (6d) (6e) (6f) (7a) (7b)
Infiltration du Pressure test Pressure Test M Measured/design Infiltration ra Number of sides	e to chimno ethod AP50 te		and fans :	= (6a)+(6b)	+(6c)+(6d)+(6	5e)+(6f)	+(6g)+(7a)+(7b)+(7c) =	:		20.0000	Air cha	anges =	per hour 0.1406 Yes Ower Door 5.0000 0.3906	(8)
Shelter factor Infiltration ra	te adjusted	d to include	shelter f	actor					(20) =		[0.075 x) = (18)			0.7750 0.3027	
Wind speed Wind factor	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500		Aug 3.7000 0.9250		000	0ct 4.3000 1.0750	Nov 4.50 1.12	900	Dec 4.7000 1.1750	
Adj infilt rate Effective ac	0.3860 0.5745	0.3784 0.5716	0.3709 0.5688	0.3330 0.5555	0.3255 0.5530	0.2876 0.5414		0.2800 0.5392			0.3255 0.5530	0.34 0.5		0.3557 0.5633	. ,
3. Heat losses	and heat lo	oss paramete	er												
TER Opening Type External Wall 1 External Roof 1 Total net area of Fabric heat los: Party Wall 1	e (Uw = 1.2	20) L elements A	:	Gross m2 19.2348 51.9000	Openings m2 7.7700	1 5 7	etArea m2 7.7700 1.4648 1.9000 1.1348 (26)(8.5300	U-value W/m2K 1.1450 0.1800 0.1100 30) + (32) 0.0000	= 1	A x U W/K 8.8969 2.0637 5.7090 6.6696 0.0000		-value kJ/m2K		A x K kJ/K	
Thermal mass pal List of Thermal K1 Elem E2 Other E3 Sill E4 Jamb E7 Part; E9 Balc E18 Par E14 Flar P4 Part; Thermal bridges	Bridges ent r lintels y floor befony between ty wall beft t roof y wall - Ro (Sum(L x I	(including of tween dwelli n dwellings, tween dwelli pof (insulat	other steel ings (in bloom wall insu- ings ion at cei	lintels) ocks of fla lation cont ling level)	inuous				Length 3.8400 1.5600 7.7400 7.0100 7.0100 5.4800 7.0100 1.3500		i-value 0.0500 0.0500 0.0500 0.0500 0.0700 0.0200 0.0600 0.0800 0.1200		Total 0.1920 0.0780 0.3870 0.4907 0.1402 0.3288 0.5608 2.5620	9 9 7 2 3 3 3 9	(35)
Point Thermal b	ridges											(36a)	=	0.0000	

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(38)m 26. Heat transfer coeff Average = Sum(39)m Ja HLP 0. HLP (average) Days in mont 4. Water heating er Assumed occupancy Hot water usage for 32. Hot water usage for 32. Average daily hot water usage for 32. Daily hot water usage for 32. Parity water usage for 32. Average daily hot water usage for 32. Daily hot water usage for 32.	an .9601 f f .3692 / 12 = an .9320 31	Feb 26.8243 48.2334 Feb 0.9294 28	Mar 26.6912 48.1004 Mar 0.9268 31 5 (kWh/year) 51.5208 22.3012 30.1475 (day)	Apr 26.0662 47.4753 Apr 0.9147 30 49.2793 21.4093 28.9653	May 25.9493 47.3584 May 0.9125 31	Jun 25.4049 46.8140 Jun 0.9020 30 45.7805 20.0010 26.6007		45.8946	Sep 25.6146 47.0237 Sep 0.9060 30	Oct 25.9493 47.3584 Oct 0.9125 31	Nov 26.1859 47.5950 Nov 0.9171 30	Dec 26.4332 47.8423 47.4748 Dec 0.9218 0.9147 31	(39) (40)
(38)m 26. Heat transfer coefi Average = Sum(39)m Ja HLP 0. HLP (average) Days in mont 4. Water heating er Assumed occupancy Hot water usage for 32. Hot water usage for 32. Average daily hot water usage for 32. Daily hot water usage for 32. Paily hot water usage for 32. Daily hot water usage for 32.	.9601 f3692 / 12 = an .9320 31 31 	26.8243 48.2334 Feb 0.9294 28	26.6912 48.1004 Mar 0.9268 31 51.5208 22.3012 30.1475 (day)	26.0662 47.4753 Apr 0.9147 30 49.2793 21.4093 28.9653	25.9493 47.3584 May 0.9125 31 47.6252 20.7415	25.4049 46.8140 Jun 0.9020 30 45.7805 20.0010	25.4049 46.8140 Jul 0.9020 31	25.3041 46.7132 Aug 0.9001 31	25.6146 47.0237 Sep 0.9060 30	25.9493 47.3584 Oct 0.9125 31	26.1859 47.5950 Nov 0.9171 30	26.4332 47.8423 47.4748 Dec 0.9218 0.9147 31	(39) (40)
48. Average = Sum(39)m HLP 0. HLP (0. HLP (average) Days in mont 4. Water heating er Assumed occupancy Hot water usage for 23. Hot water usage for 32. Average daily hot w Daily hot water use 109. Energy conte 172.	.3692 / 12 = an .9320 31 31 	Feb 0.9294 28 28 29 29 29 29 29 29 29 29 29 29 29 29 29	Mar 0.9268 31 5 (kWh/year) 51.5208 22.3012 30.1475 (day)	Apr 0.9147 30 49.2793 21.4093 28.9653	May 0.9125 31 47.6252 20.7415	Jun 0.9020 30 45.7805 20.0010	Jul 0.9020 31 44.7320	Aug 0.9001 31 45.8946	Sep 0.9060 30	Oct 0.9125 31	Nov 0.9171 30	47.4748 Dec 0.9218 0.9147 31	(40)
HLP (average) Days in mont 4. Water heating er Assumed occupancy Hot water usage for 53. Hot water usage for 32. Average daily hot w Daily hot water usage 109. Energy conte 172.	.9320 31 	0.9294 28 28 quirements 52.6923 22.7849 uses 31.3298 e (litres/ Feb	0.9268 31 5 (kWh/year) 51.5208 22.3012 30.1475 (day)	9.9147 30 49.2793 21.4093 28.9653	9.9125 31 47.6252 20.7415	0.9020 30 45.7805 20.0010	0.9020 31 44.7320	0.9001 31 45.8946	0.9060 30	0.9125 31	0.9171 30	0.9218 0.9147 31	(42)
4. Water heating er Assumed occupancy Hot water usage for 53. Hot water usage for 32. Hot water usage for 32. Average daily hot w Daily hot water usage 109. Energy conte 172.	nergy re	quirements showers 52.6923 22.7849 uses 31.3298 e (litres/ Feb 106.8069	51.5208 22.3012 30.1475 (day)	49.2793 21.4093 28.9653	47.6252 20.7415	45.7805 20.0010	44.7320	45.8946				1.7461	
Assumed occupancy Hot water usage for 53. Hot water usage for 23. Hot water usage for 32. Average daily hot water usage Daily hot water usage 109. Energy conte 172.	r mixer .4962 r baths .1283 r other .5120 water us an e .1366 .8457 nual) (46)m =	showers 52.6923 22.7849 uses 31.3298 e (litres/ Feb	51.5208 22.3012 30.1475 (day)	49.2793 21.4093 28.9653	47.6252 20.7415	45.7805 20.0010	44.7320	45.8946	47.1691	49.1497	51.4393		
Hot water usage for 53. Hot water usage for 23. Hot water usage for 32. Average daily hot v Daily hot water usage for 109. Energy conte 172.	.4962 r baths .1283 r other .5120 water us an e .1366 .8457 nual) (46)m =	52.6923 22.7849 uses 31.3298 e (litres/ Feb 106.8069	22.3012 30.1475 (day) Mar	21.4093 28.9653	20.7415	20.0010			47.1691	49.1497	51.4393		
Hot water usage for 23. Hot water usage for 32. Average daily hot water use 109. Energy conte 172.	r baths .1283 r other .5120 water us an e .1366 .8457 nual) (46)m =	22.7849 uses 31.3298 e (litres/ Feb 106.8069	22.3012 30.1475 (day) Mar	21.4093 28.9653	20.7415	20.0010			47.1691	49.1497	51.4393	53.2912	(42a)
Hot water usage for 32. Average daily hot v Daily hot water use 109. Energy conte 172.	r other .5120 water us an e .1366 .8457 nual) (46)m =	uses 31.3298 e (litres/ Feb 106.8069	30.1475 ′day) Mar	28.9653			19.6010						
Average daily hot w Ja Daily hot water use 109 Energy conte 172	water us an e .1366 .8457 nual) (46)m =	e (litres/ Feb 106.8069	′day) Mar		27.7830	25 5007		20.0813	20.6043	21.3967	22.3069	23.0502	
Daily hot water use 109. Energy conte 172.	e .1366 .8457 nual) (46)m =	106.8069		Ann		20.0007	26.6007	27.7830	28.9653	30.1475	31.3298	32.5120 100.3217	
109. Energy conte 172.	.1366 .8457 nual) (46)m =			Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
Energy content (ann	. ,		103.9694 159.7971	99.6538 136.4211	96. 1 496 129.4359	92.3822 113.5947	90.9337 109.9764	93.7589 116.0931	96.7386 119.2884	100.6939 136.6406 Total = Su	105.0759 149.6999 um(45)m =	108.8534 170.4382 1666.3227	
Distribution loss 25.	. 5200	0.15 x (4 22.8137	15)m 23.9696	20.4632	19.4154	17.0392	16.4965	17.4140	17.8933	20.4961	22.4550	25.5657	(46)
Water storage loss: Store volume	:											0.0000	(47)
b) If manufacture Hot water storage Volume factor fro Temperature factor	e loss f om Table	actor from 2a			ay)							1.4400 0.0000 1.0000	(52)
Enter (49) or (54) Total storage loss												1.4400	(55)
44. If cylinder contain	.6400 ns dedic	40.3200 ated solar		43.2000	44.6400	43.2000	44.6400	44.6400	43.2000	44.6400	43.2000	44.6400	(56)
Primary loss 0.	.6400 .0000 .0000	40.3200 0.0000 0.0000	44.6400 0.0000 0.0000	43.2000 0.0000 0.0000	44.6400 0.0000 0.0000	43.2000 0.0000 0.0000	44.6400 0.0000 0.0000	44.6400 0.0000 0.0000	43.2000 0.0000 0.0000	44.6400 0.0000 0.0000	43.2000 0.0000 0.0000	44.6400 0.0000 0.0000	(59)
Total heat required 217.		ter heatir 192.4116	ng calculate 204.4371	ed for each 179.6211	month 174.0759	156.7947	154.6164	160.7331	162.4884	181.2806	192.8999	215.0782	(62)
	.4562 .0000	-21.6293 -0.0000	-22.6489 -0.0000	-18.7542 -0.0000	-17.4783 -0.0000	-14.9563 -0.0000	-14.0191 -0.0000	-14.9079 -0.0000	-15.4743 -0.0000	-18.2425 -0.0000	-20.6666 -0.0000	-24.0033 -0.0000	
	.0000 .0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	
		170.7823	181.7882	160.8669	156.5976	141.8384	140.5973	145.8252 Total pe	147.0140 er year (kWl	163.0381 n/year) = Su	172.2334 um(64)m =	191.0748 1964.6856	(64)
12Total per year (F Electric shower(s)												1965	
	.0000	0.0000	0.0000	0.0000 Tot	0.0000 al Energy u	0.0000 sed by insta	0.0000 antaneous el	0.0000 lectric show	0.0000 wer(s) (kWh,	0.0000 /year) = Sur	0.0000 n(64a)m =	0.0000 0.0000	
Heat gains from wat 93.	.1832	1ng, kwn/n 82.8265	88.8445	79.9200	78.7494	72.3302	72.2792	74.3130	74.2234	81.1450	84.3352	92.3827	(65)
5. Internal gains ((see Tab	le 5 and 5											
Metabolic gains (Ta													
	an .3060	Feb 87.3060	Mar 87.3060	Apr 87.3060	May 87.3060	Jun 87.3060	Jul 87.3060	Aug 87.3060	Sep 87.3060	0ct 87.3060	Nov 87.3060	Dec 87.3060	(66)
Lighting gains (cal							81.1655	81.1655	83.8711	81.1655	83.8711	81.1655	
Appliances gains (d		ed in Appe 153.7456	endix L, equ 149.7665	uation L13 141.2955	or L13a), a 130.6025	lso see Tabl 120.5525	le 5 113.8385	112.2595	116.2386	124.7095	135.4026	145.4526	(68)
	.7306	31.7306	31.7306	31.7306	31.7306	31.7306	31.7306	31.7306	31.7306	31.7306	31.7306	31.7306	
Losses e.g. evapora					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Water heating gains	s (Table		-69.8448	-69.8448	-69.8448	-69.8448	-69.8448	-69.8448	-69.8448	-69.8448	-69.8448	-69.8448	
Total internal gair	ns	123.2536	119.4147	111.0000	105.8460	100.4587	97.1494	99.8830	103.0880	109.0659	117.1323	124.1703	
407.	.7701	416.0529	399.5386	385.3585	366.8059	354.0741	341.3453	342.4999	352.3895	364.1328	385.5977	399.9802	(/3)
6. Solar gains													
[Jan]			Ar	rea m2	Solar flux Table 6a		g Fic data	Specific	FF data	Acces facto		Gains W	



Solar gains Total gains 7. Mean int		181.8190		700	46.7521		0.6300	0	.7000	0.778	00	111.0181	(78)
Total gains 7. Mean int			221 (051										
		597.8718	231.6051 631.1437	261.7641 647.1225	272.7744 639.5802	262.5082 616.5823	256.4865 597.8318	249.0839 591.5838	241.9389 594.3284	196.1088 560.2416	131.5943 517.1920	95.9298 495.9100	٠,
	ernal tempera	ture (heati											
	during heati	ng periods ains for li	in the livi	ng area fron ni1,m (see T	m Table 9, ⁻ Table 9a)	Th1 (C)			C	0-+	New	21.0000	(85)
tau alpha	Jan 117.8540 8.8569	Feb 118.1857 8.8790	Mar 118.5127 8.9008	Apr 120.0729 9.0049	May 120.3694 9.0246	Jun 121.7691 9.1179	Jul 121.7691 9.1179	Aug 122.0319 9.1355	Sep 121.2262 9.0817	0ct 120.3694 9.0246	Nov 119.7711 8.9847	Dec 119.1520 8.9435	
util living	0.9928	0.9756	0.9378	0.8387	0.6810	0.4856	0.3445	0.3632	0.5449	0.8333	0.9739	0.9949	(86
MIT Th 2 util rest o	20.5743 20.1404 f house	20.7188 20.1426	20.8463 20.1448	20.9538 20.1550	20.9929 20.1569	20.9997 20.1658	21.0000 20.1658	21.0000 20.1674	20.9991 20.1624	20.9626 20.1569	20.7699 20.1530	20.5480 20.1490	
MIT 2 Living area	0.9896 19.6686	0.9658 19.8480	0.9157 19.9984	0.7956 20.1186	0.6227 20.1528	0.4225 20.1657	0.2792 20.1658	0.2975 20.1674	0.4793 20.1620 fLA =	0.7822 20.1300 Living area	0.9616 19.9213	0.9925 19.6428 0.5451	(90
MIT	20.1623 adjustment	20.3227	20.4606	20.5738	20.6107	20.6203	20.6205	20.6212	20.6183	20.5838	20.3839	20.1362	(92)
adjusted MI	T 20.1623	20.3227	20.4606	20.5738	20.6107	20.6203	20.6205	20.6212	20.6183	20.5838	20.3839	20.1362	(93)
8. Space he	ating require	ment											
Utilisation Useful gain Ext temp.		Feb 0.9681 578.8096 4.9000	Mar 0.9245 583.5107 6.5000	Apr 0.8178 529.2043 8.9000	May 0.6545 418.5771 11.7000	Jun 0.4569 281.7124 14.6000	Jul 0.3148 188.2125 16.6000	Aug 0.3333 197.1823 16.4000	Sep 0.5151 306.1516 14.1000	0ct 0.8091 453.2953 10.6000	Nov 0.9654 499.2996 7.1000	Dec 0.9924 492.1567 4.2000	(95
Heat loss r		743.8880	671.5091	554.2197	421.9977	281.8340	188.2159	197.1881	306.5150	472.8179	632.2448	762.4245	
Space heati Space heati	ng kWh 188.8417 ng requiremen	110.9327 t - total p	65.4708 per year (kW	18.0111 h/year)	2.5449	0.0000	0.0000	0.0000	0.0000	14.5248	95.7206	201.0792 697.1258	
	0.0000 ng contributi	0.0000 on - total	0.0000 per year (ki	0.0000 Wh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000	
Space heati Space heati	ng kWh 188.8417 ng requiremen		65.4708 lar contribu	18.0111 tion - total	2.5449 1 per year	0.0000 (kWh/year)	0.0000	0.0000	0.0000	14.5248	95.7206	201.0792 697.1258	
Space heati	ng per m2									(98c)	/ (4) =	13.4321	(99
	requirements												
Fraction of Fraction of Fraction of Fraction of Factor for Factor for Distribution	space heat fi space heat fi heat from con heat from con control and charging methon in loss factor of secondary/	rom seconda rom communi mmunity Com mmunity Boi harging met od (Table 4 (Table 12c	ary/supplemently system bined Heat silers-Space sthod (Table 4c(3)) for was been for community.	ntary system and Power-Sp and Water 4c(3)) for s ater heating nity heating	m (Table 11) pace and War space heating) ter						0.0000 1.0000 0.5580 0.4420 1.0000 1.0000 0.0000	(303 (303 (303 (305 (305 (306
Space heati	ng requiremen 188.8417	110.9327	65.4708	18.0111	2.5449	0.0000	0.0000	0.0000	0.0000	14.5248	95.7206	201.0792	(98
307a	from Combined 131.7171	77.3755	45.6659	12.5628	.00 x 1.25 1.7751	0.0000	0.0000	0.0000	0.0000	10.1310	66.7651	140.2528	
307b	from Boilers : 104.3351 ng requiremen	61.2903	36.1726	9.9511	1.4061	0.0000	0.0000	0.0000	0.0000	8.0249	52.8856	111.0963	
Efficiency		138.6658 supplementa			3.1811 (from Table	0.0000 e 4a or App	0.0000 endix E)	0.0000	0.0000	18.1560	119.6507	251.3491 0.0000	
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(30
Water heati Annual wate	ng r heating req 193.0294	uirement 170.7823	181.7882	160.8669	156.5976	141.8384	140.5973	145.8252	147.0140	163.0381	172.2334	191.0748	(64
310a	from Combined 134.6380	Heat and P 119.1207	Power = (64) 126.7973	x 0.56 x 1. 112.2047		98.9323	98.0666	101.7131	102.5423	113.7191	120.1328	133.2747	•
Water heat	from Boilers : 106.6488	= (64) x 0. 94.3572		1.25 88.8790	86.5202	78.3657	77.6800	80.5684	81.2253	90.0785	95.1589	105.5688	
	ng fuel 241.2868	213.4779	227.2352	201.0836	195.7470	177.2980	175.7466	182.2815	183.7675	203.7976	215.2917	238.8435	
310b Water heati Cooling Sys		Ficiency Da											(21
Water heati	tem Energy Ef n 0.0000	ficiency Ra 0.0000 0.0000 13.5294	0.0000 0.0000 0.0000 12.1817	0.0000 0.0000 8.9249	0.0000 0.0000 6.8938	0.0000 0.0000 5.6323	0.0000 0.0000 6.2888	0.0000 0.0000 8.1744	0.0000 0.0000 10.6177	0.0000 0.0000 13.9310	0.0000 0.0000 15.7350	0.0000 0.0000 17.3333	(31

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Electricity generated by wind turbines (Appendix M) (negative quantity)				
	0.0000	0.0000 0.0000	0.0000 0.0000) (334a
(335a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0	0.0000	0.0000 0.0000	0.0000 0.0000) (335a
Electricity generated by PVs (Appendix M) (negative quantity) (333b)m -1.0177 -2.2370 -4.6351 -7.2537 -9.8909 -10.0537 -9.9	380 -8.2757	-5.8869 -3.2923	-1.3871 -0.7980) (333b
Electricity generated by wind turbines (Appendix M) (negative quantity) (334b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0	0.0000	0.0000 0.0000	0.0000 0.0000) (334b
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000 0.0000		` 9 (335b
Annual totals kWh/year	0.0000	0.0000		
Space heating fuel - community heating Space heating fuel - secondary				(309)
Water heating fuel - community heating Efficiency of water heater			2455.8570 0.0000	9 (310) 9 (311)
Electricity used for heat distribution Space cooling fuel				l (313) 9 (321)
Electricity for pumps and fans:			0.000	(321)
Total electricity for the above, kWh/year				(331)
Electricity for lighting (calculated in Appendix L)			136.1070) (332)
Energy saving/generation technologies (Appendices M ,N and Q) PV generation			-213.7740	(333)
Wind generation Hydro-electric generation (Appendix N)			0.0000 0.0000) (334)) (335a
Electricity generated - Micro CHP (Appendix N)				(335)
Appendix Q - special features Energy saved or generated			-0.0000	
Energy used Total delivered energy for all uses			0.0000 3249.5973	9 (337) 3 (338)
12b. Carbon dioxide emissions - Community heating scheme				
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Electrical efficiency of CHP unit	KWII/ year	kg COZ/KWII	32.0000	(361)
Heat efficiency of CHP unit Space heating from Combined Heat and Power	974.4394	0.2100	49.9000 204.6323	
less credit emissions for electricity	-311.8206	0.3480	-108.5136	1 1
Water heating from Combined Heat and Power less credit emissions for electricity	2746.2289 -878.7932	0.2100 0.3480	576.7081 -305.8200	1 1
Efficiency of heat source Boilers Space and Water heating from Boilers	1566.1883	0.2100	93.9000 86.1385	1 1
electrical energy for heat distribution (space & water) Overall CO2 factor for heat network	8.7141	0.0000	4.8395 0.2106	(372)
Total CO2 associated with community systems			700.7458	3 (373)
Space and water heating Pumps, fans and electric keep-hot	0.0000	0.0000		(378)
Energy for lighting	136.1070	0.1443	19.6444	⊦ (379)
Energy saving/generation technologies PV Unit electricity used in dwelling	-149.1078	0.1326	-19.7685	j
PV Unit electricity exported	-64.6661	0.1247	-8.0645	5
Total Total CO2, kg/year			-27.8330 692.5572	2 (383)
EPC Target Carbon Dioxide Emission Rate (TER)			13.3400	(384)
		Primary energy factor	Primary energy	,
Electrical efficiency of CHP unit	kWh/year	kg CO2/kWh	kWh/year 32.0000	•
Heat efficiency of CHP unit			49.9000	
Space heating from Combined Heat and Power less credit emissions for electricity	974.4394 -311.8206	1.1300 2.1490	1101.1166 -670.1025	
Water heating from Combined Heat and Power	2746.2289	1.1300	3103.2386	(465)
less credit emissions for electricity Efficiency of heat source Boilers	-878.7932	2.1490	-1888.5267 93.9000	
	1566.1883 8.7141	1.1300 0.0000	463.5070 51.1726	
		0.0000	1.0419) (486)
Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network			3466.6914	, (473)
Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems			3466.6914	(476)
Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems Space and water heating Pumps, fans and electric keep-hot	0.0000 136.1070	0.0000 1.5338		(478)
Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems Space and water heating Pumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies	136.1070	1.5338	0.0000 208.7654	(478) (479)
Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems Space and water heating Pumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies PV Unit electricity used in dwelling			0.0000	(478) (479)
Space and Water heating from Boilers Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems Space and water heating Pumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total Total	136.1070 -149.1078	1.5338	0.0000 208.7654 -222.1514	(478) 1 (479) 1 5 9 (480)



Blower Door Door Door Door Door Door Door Do	Property Reference	20		x2_Copy_Copy				l a	Type Bef	Issued	on Date	12/09/2	.023	_
March Marc		-0	13, 07	x2_Copy_Copy				Prop	Type Ref					=
Companies Comp														_
Commissioner Control C									3.18		TER			_
Section Sect									_					_
Department		r)							30.72		TFEE			_
March Marc									00.00		TOFO			_
### De MOMOSHIT FOR New Build (de Designed) (Version 10:2, February 2022) **Control Design Characteristics** **Overall Design Characteri	M DPER < TPER				32	.57	DPER		33.39		IPER	49	.52	_
### Description for the Bullo (As Designed) (Version 10.2, February 2022)	Assessor Details		Mr. Richard I	Denteh							Assessor ID	U1	48-0001	
mber of open chimneys mber of open flues mber of flues attached to colosed fire mber of flues attached to solid fuel boiler 0 * 20 = 0.8000 mber of flues attached to solid fuel boiler 0 * 20 = 0.8000 mber of flues attached to tother heater 0 * 25 = 0.8000 mber of flues attached to tother heater 0 * 25 = 0.8000 mber of flues attached to tother heater 0 * 25 = 0.8000 mber of flues mittent extract fans 0 * 10 = 0.8000 mber of passive vents 0 * 10 = 0.8000 mber of passive vents 0 * 40 = 0.8000 mber of pas	P 10 WORKSHEET LCULATION OF C Overall dwell ound floor rist floor cond floor tal floor area	FOR New B	uild (As De	esigned) (Version 10.	.2, February	2022)		Area (m2) 61.1000 (: 62.1000 (:	lb) x lc) x ld) x	(m) 2.7300 (2.9600 (3.0200 (2c) = 2d) =	(m3) 166.8030 183.8160 118.0820))) () ()
Air changes per hour per filtration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.00	mber of open f mber of chimne mber of flues mber of flues mber of blocke mber of intern mber of passiv	Flues Eys / flues attached to attached to ed chimneys mittent extore ve vents	o solid fue o other hea ract fans	el boiler	re							0 * 20 = 0 * 10 = 0 * 20 = 0 * 35 = 0 * 20 = 0 * 10 =	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	
Yes Blower Dost Pessure Test Method Pore ressure Test Test Test Test Test Test Test Tes	umber of fluele	ess gas fir		and fans =	(6a)+(6b)-	+(6c)+(6d)+(6e)+(6f)+(6	5g)+(7a)+(7	7b)+(7c) =			Air changes	0.0000 per hour) (
Sep	ressure test ressure Test Me easured/design nfiltration rat	ethod AP50 ce										Bì	lower Door 3.0000 0.1500) (
ind 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 ind factor 1.2750 1.2500 1.2500 1.2250 1.1000 1.0750 0.9500 0.9500 0.9250 1.0000 1.0750 1.1250 1.1750 ij 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 salanced mechanical ventilation with heat recovery femechanical ventilation fe exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 fe balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 45.0000 feective ac 0.4376 0.4344 0.4312 0.4153 0.4121 0.3961 0.3961 0.3929 0.4025 0.4121 0.4184 0.4248 Heat losses and heat loss parameter	helter factor nfiltration rat	e adjusted	to include	e shelter fa	ctor				(2					
0.1626 0.1594 0.1562 0.1403 0.1371 0.1211 0.1211 0.1179 0.1275 0.1371 0.1434 0.1498 Salanced mechanical ventilation with heat recovery f mechanical ventilation f exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 f balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 45.0000 Ffective ac 0.4376 0.4344 0.4312 0.4153 0.4121 0.3961 0.3961 0.3929 0.4025 0.4121 0.4184 0.4248 Heat losses and heat loss parameter Lement Gross Openings NetArea U-value A x U K-value A x K	ind speed ind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	
Aslanced mechanical ventilation with heat recovery if mechanical ventilation if exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) if balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = if ective ac 0.4376 0.4344 0.4312 0.4153 0.4121 0.3961 0.3961 0.3929 0.4025 0.4121 0.4184 0.4248 if elective ac 0.4376 0.4344 0.4312 0.4153 0.4121 0.3961 0.3961 0.3929 0.4025 0.4121 0.4184 0.4248 if elective ac 0.4376 0.4344 0.4312 0.4153 0.4121 0.3961 0.3961 0.3929 0.4025 0.4121 0.4184 0.4248 if elective ac 0.4376 0.4344 0.4312 0.4153 0.4121 0.3961 0.3961 0.3929 0.4025 0.4121 0.4184 0.4248 if elective ac 0.4376 0.4344 0.4312 0.4153 0.4121 0.3961 0.3961 0.3929 0.4025 0.4121 0.4184 0.4248 if elective ac 0.4376 0.4344 0.4312 0.4153 0.4121 0.3961 0.3961 0.3929 0.4025 0.4121 0.4184 0.4248 if elective ac 0.4376 0.4344 0.4312 0.4153 0.4121 0.3961 0.3961 0.3929 0.4025 0.4121 0.4184 0.4248 if elective ac 0.4376 0.4344 0.4312 0.4153 0.4121 0.3961 0.3961 0.3929 0.4025 0.4121 0.4184 0.4248 if elective ac 0.4376 0.4344 0.4312 0.4153 0.4121 0.3961 0.3961 0.3929 0.4025 0.4121 0.4184 0.4248 if elective ac 0.4376 0.4344 0.4312 0.4153 0.4121 0.3961 0.3961 0.3929 0.4025 0.4121 0.4184 0.4248 if elective ac 0.4376 0.4344 0.4312 0.4153 0.4121 0.3961 0.3961 0.3929 0.4025 0.4121 0.4184 0.4248 if elective ac 0.4376 0.4344 0.4312 0.4153 0.4121 0.3961 0.3961 0.3929 0.4025 0.4121 0.4184 0.4248	lj infilt rate	0 1626	0 1504	0 1562	0 1/02	0 1271	Q 1211	0 1211	0 1170	0 1275	0 1271	0 1/2/	0 1/05	, ,
exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 45.0000 fective ac 0.4376 0.4344 0.4312 0.4153 0.4121 0.3961 0.3961 0.3929 0.4025 0.4121 0.4184 0.4248 fective ac 0.4376 0.4344 0.4312 0.4153 0.4121 0.3961 0.3961 0.3929 0.4025 0.4121 0.4184 0.4248 feat losses and heat loss parameter from the companies of the compani	alanced mechar					0.13/1	V.1211	V.1211	0.11/	0.12/3	0.13/1	0.1434	0.1430	. (
balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 45.0000 fective ac 0.4376 0.4344 0.4312 0.4153 0.4121 0.3961 0.3961 0.3929 0.4025 0.4121 0.4184 0.4248 Heat losses and heat loss parameter ement	mechanical ve	entilation				F / ::	(NEXX	Alexander 1	(221-) (25.3					
Fective ac 0.4376 0.4344 0.4312 0.4153 0.4121 0.3961 0.3961 0.3929 0.4025 0.4121 0.4184 0.4248 Heat losses and heat loss parameter Ement Gross Openings NetArea U-value A x U K-value A x K)				
Heat losses and heat loss parameter ement Gross Openings NetArea U-value A x U K-value A x K				-	arrowing I								45.0000	. (
Heat losses and heat loss parameter	Fective ac	0.4376	0.4344	0.4312	0.4153	0.4121	0.3961	0.3961	0.3929	0.4025	0.4121	0.4184	0.4248	(
ement Gross Openings NetArea U-value A x U K-value A x K	Heat losses a	and heat lo	ss paramete	er										
												,	A II	,
ndow (Uw = 0.80) 26.0900 0.7752 20.2248	ement				Gross		Net	Area						

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front door						-	2.0000	1.0000	2.00	90			(26)
Heatloss Floor	1						1.1000	0.0800	4.88		0.0000	6721.0000	(26) (28a)
exposed floor					20.0000		1.6800	0.0800	0.13			40004 7400	(28b
external Wall 1 External Roof 1				128.0622 41.2700	28.0900		9.9722 1.2700	0.1300 0.1000	12.990 4.12		0.0000 9.0000	18994.7180 371.4300	
xternal Roof 2				19.2300			9.2300	0.1000	1.92		9.0000	173.0700	
otal net area			Aum(A, m2)			251	1.3422	20) + (22)	= 46.29	26			(31) (33)
abric heat los arty Wall 1 nternal Wall 1		Sum (A X U)					(26)(4.0000 3.5300	30) + (32) 0.0000	0.000	00 18	0.0000 9.0000	20520.0000 2974.7700	(32)
eat capacity (x k)						(28).	(30) + (3				
hermal mass pa ist of Thermal		TMP = Cm / 1	TFA) in kJ/r	m2K								306.5618	(35)
K1 Eler		(inaludina	athon atoo:	1 1:0+010\					0	Psi-value	Tot		
E3 Sill		(including	other stee.	i linteis)					.9600 .7600	0.0500 0.0500	0.84 0.78		
E4 Jamb									.5800	0.0500	2.02		
	und floor ermediate	(normaı) floor withir	n a dwelling	g					.4000 .4000	0.1600 0.0010	2.14 0.01		
E20 Exp	osed floo	r (normal)		5				1	.8000	0.3200	0.57	'60	
	ole (insul: ge (invert	ation at raf	fter level)						.0000 .5500	0.0800 0.0400	0.96 0.26		
P1 Part	ty wall -	Ground floor							.4500	0.0800	1.63		
		Roof (insula	ation at ce	iling level)				.7000	0.1200	3.32		
E14 Fla P2 Part		Intermediate	e floor with	hin a dwell	ing				.2300 .0000	0.0800 0.0000	0.73 0.00		
R7 Flat	ceiling	(inverted)							.6500	0.0400	0.22		
	rner (norm rtv wall b	aı) etween dwell	lings						.8800 .6000	0.0900 0.0600	1.60 2.19		
R4 Rid	ge (vaulte	d ceiling)							.5500	0.0800	0.52	:40	
Thermal bridges Point Thermal b		Psi) calcul	lated using	Appendix K)						(36a) =	17.8740 0.0000	
Total fabric he									(33) + (36)		64.1676	
Ventilation hea	at loss ca Jan	lculated mor Feb	nthly (38)m Mar	= 0.33 x (25)m x (5) May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
(38)m Heat transfer o	67.6784	67.1854	66.6923	64.2273	63.7343	61.2692	61.2692	60.7762	62.2552	63.7343	64.7203	65.7063	(38)
verage = Sum(:	131.8460	131.3530	130.8599	128.3949	127.9018	125.4368	125.4368	124.9438	126.4228	127.9018	128.8879	129.8739 128.2716	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
LP LP (average)	0.8124	0.8093	0.8063	0.7911	0.7881	0.7729	0.7729	0.7698	0.7789	0.7881	0.7941	0.8002 0.7903	
ays in mont	31	28	31	30	31	30	31	31	30	31	30	31	
. Water heatin)									
Assumed occupar Hot water usage		r showers										2.9521	, ,
Hot water usage			97.6180	93.3710	90.2369	86.7417	84.7550	86.9579	89.3727	93.1255	97.4637	100.9726	
lot water usage	31.8240 e for other	31.3513 r uses	30.6858	29.4586	28.5397	27.5208	26.9704	27.6313	28.3509	29.4412	30.6937	31.7164	(42b)
Average daily h	44.8626	43.2312	41.5998 /day)	39.9685	38.3371	36.7057	36.7057	38.3371	39.9685	41.5998	43.2312	44.8626 163.7414	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
aily hot water	use 178.0475	174.4202	169.9036	162.7981	157.1137	150.9682	148.4312	152.9264	157.6921	164.1665	171.3885	177.5516	(44)
nergy conte nergy content	281.9837	248.3721	261.1355	222.8625	211.5052	185.6331	179.5147	189.3548	194.4501	222.7724	244.1744 um(45)m =	278.0028 2719.7613	(45)
istribution lo	oss (46)m 42.2976	= 0.15 x (4 37.2558	45)m 39.1703	33.4294	31.7258	27.8450	26.9272	28.4032	29.1675	33.4159	36.6262	41.7004	(46)
ater storage I core volume	loss:											180.0000	(47)
a) If manufact			actor is kno	own (kWh/d	ay):							1.5200	(48)
Temperature finter (49) or (0.5400 0.8208	
otal storage		-,										0.0200	(22)
f cylindon co	25.4448	22.9824	25.4448	24.6240	25.4448	24.6240	25.4448	25.4448	24.6240	25.4448	24.6240	25.4448	(56)
f cylinder com	25.4448	22.9824	25.4448	24.6240	25.4448	24.6240	25.4448	25.4448	24.6240	25.4448	24.6240	25.4448	(57)
rimary 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	
Combi loss Total heat requ	0.0000 uired for a	0.0000 water heatir	0.0000 ng calculate	0.0000 ed for each	0.0000 month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
	330.6909	292.3657	309.8427	269.9985	260.2124	232.7691	228.2219	238.0620	241.5861	271.4796	291.3104	326.7100	
WHRS V diverter	-76.8882 0.0000	-68.0006 0.0000	-71.2063 0.0000	-58.9616 0.0000	-54.9501 0.0000	-47.0212 0.0000	-44.0749 0.0000	-46.8692 0.0000	-48.6500 0.0000	-57.3529 0.0000	-64.9739 0.0000	-75.4644 0.0000	
olar 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	
GHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
utput from w/h	າ 253.8027	224.3651	238.6364	211.0369	205.2623	185.7479	184.1470	191.1928	192.9362	214.1267	226.3365	251.2456	(64)
2Total per yea									er year (kWl			2578.8360	
lectric shower	^(s)	•											
	0.0000	0.0000	0.0000	0.0000 Tot	0.0000 al Energy us	0.0000 ed by inst	0.0000 tantaneous e	0.0000 electric sho	0.0000 wer(s) (kWh,	0.0000 /year) = Su	0.0000 m(64a)m =	0.0000 0.0000	
Heat gains from	n water he 132.7253	ating, kWh/n 117.7786	month 125.7933	111.8106	109.2912	99.4318	98.6544	101.9262	102.3635	113.0376	118.8968	131.4017	
	172.1233	11/.//00	163.1333	111.0100	107.2312	JJ.4318	J0.03 44	101.9202	102.3033	113.03/0	110.0708	T)1.401/	(03)



Metabolic gair			Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec
(66)m Lighting gains	147.6056	147.6056	147.6056	147.6056	147.6056	147.6056	147.6056	147.6056	147.6056	147.6056	147.6056	147.6056 (6
Appliances gai	175.3892 ins (calcul	194.1809 ated in App	175.3892 pendix L, eq	181.2355 Juation L13	175.3892 or L13a), a	181.2355 lso see Tab	175.3892 ele 5	175.3892	181.2355	175.3892	181.2355	175.3892 (6
ooking gains	333.6109 (calculate	337.0727 d in Append	328.3490 dix L, equat	309.7772 ion L15 or	286.3337 L15a), also	264.3001 see Table	249.5803 5	246.1185	254.8422	273.4140	296.8575	318.8911 (6
umps, fans	37.7606 0.0000	37.7606 0.0000	37.7606 0.0000	37.7606 0.0000	37.7606 0.0000	37.7606 0.0000	37.7606 0.0000	37.7606 0.0000	37.7606 0.0000	37.7606 0.0000	37.7606 0.0000	37.7606 (6 0.0000 (7
osses e.g. e\	vaporation -118.0845			ole 5) -118.0845	-118.0845	-118.0845	-118.0845	-118.0845	-118.0845	-118.0845	-118.0845	-118.0845 (7
ater heating	gains (Tab 178.3943	le 5) 175.2658	169.0771	155.2925	146.8968	138.0997	132.6000	136.9976	142.1715	151.9322	165.1344	176.6152 (7
otal internal	l gains 754.6760	773.8011	740.0969	713.5869	675.9014	650.9170	624.8512	625.7870	645.5309	668.0171	710.5091	738.1771 (7
. Solar gains	S											
[Jan]				irea	Solar flux		g	Canaifi c	FF data	Acces		Gains
				m2	Table 6a W/m2		fic data Table 6b	Specific or Tab		facto Table 0		W
lorth South			10.9 11.5		10.6334 46.7521		0.5000 0.5000		.8000 .8000	0.770 0.770		32.1875 (7 149.2954 (7
outhwest				5500	36.7938		0.5000		.8000	0.77		37.2273 (7
Solar gains Total gains	218.7102 973.3863	369.4313 1143.2323	502.7459 1242.8428	627.4120 1340.9989	713.4018 1389.3032	714.6767 1365.5937	686.2182 1311.0694	619.9246 1245.7116	544.9732 1190.5041	407.0298 1075.0469	261.2631 971.7722	187.6969 (8 925.8740 (8
emperature du	uring heati	ng periods	in the livi	ng area fro	m Table 9,							21.0000 (8
emperature du tilisation fa	uring heati actor for g Jan	ng periods ains for li Feb	in the livi iving area, Mar	ng area fro ni1,m (see Apr	m Table 9, Table 9a) May	Th1 (C) Jun	Jul	Aug	Sep	0ct	Nov	Dec
emperature du tilisation fa au lpha	uring heati actor for g Jan 104.8256 7.9884	ng periods ains for li	in the livi iving area,	ng area fro ni1,m (see	m Table 9, Table 9a)	Th1 (C)			Sep 109.3223 8.2882	Oct 108.0581 8.2039	Nov 107.2314 8.1488	
emperature du tilisation fa au lpha	uring heati actor for g Jan 104.8256 7.9884	ng periods ains for li Feb 105.2190	in the livi iving area, Mar 105.6154	ng area fro ni1,m (see Apr 107.6432	m Table 9, Table 9a) May 108.0581	Th1 (C) Jun 110.1816	Jul 110.1816	Aug 110.6164	109.3223	108.0581	107.2314	Dec 106.4173
emperature du tilisation fa au lpha til living ar iving on living	uring heati actor for g Jan 104.8256 7.9884 rea 0.9992 20.2734 19.5749	ng periods ains for li Feb 105.2190 8.0146 0.9967 20.4232 19.7262	in the livi iving area, Mar 105.6154 8.0410 0.9883 20.6040 19.9067	ng area fronil,m (see Apr 107.6432 8.1762 0.9445 20.8298 20.1313	m Table 9, Table 9a) May 108.0581 8.2039 0.8109 20.9627 20.2417	Jun 110.1816 8.3454 0.5850 20.9976 20.2760	Jul 110.1816 8.3454 0.4208 20.9999 20.2769	Aug 110.6164 8.3744 0.4610 20.9997 20.2795	109.3223 8.2882 0.7170 20.9889 20.2667	108.0581 8.2039 0.9611 20.8238 20.1316	107.2314 8.1488 0.9969 20.5122 19.8264	Dec 106.4173 8.0945 0.9994 (8 20.2558 19.5663
emperature dutilisation fa au lpha til living ar iving on living 4 / 16 4 / 9	uring heati actor for g Jan 104.8256 7.9884 rea 0.9992 20.2734 19.5749 0	ng periods ains for li Feb 105.2190 8.0146 0.9967 20.4232 19.7262	in the livi iving area, Mar 105.6154 8.0410 0.9883 20.6040 19.9067 0	ng area fro ni1,m (see Apr 107.6432 8.1762 0.9445 20.8298 20.1313 0	m Table 9, Table 9a) May 108.0581 8.2039 0.8109 20.9627 20.2417 0	Th1 (C) Jun 110.1816 8.3454 0.5850 20.9976 20.2760 0	Jul 110.1816 8.3454 0.4208 20.9999 20.2769 0	Aug 110.6164 8.3744 0.4610 20.9997 20.2795 0	109.3223 8.2882 0.7170 20.9889 20.2667 0	108.0581 8.2039 0.9611 20.8238 20.1316 0	107.2314 8.1488 0.9969 20.5122 19.8264 0	Dec 106.4173 8.0945 0.9994 (8 20.2558 19.5563 0
emperature du tilisation fa au lpha til living ar iving on living 4 / 16 4 / 9 6 / 9 IT h 2	uring heati actor for g Jan 104.8256 7.9884 rea 0.9992 20.2734 19.5749 0 3 28 20.6283 20.2426	ng periods ains for li Feb 105.2190 8.0146 0.9967 20.4232 19.7262	in the livi iving area, Mar 105.6154 8.0410 0.9883 20.6040 19.9067	ng area fronil,m (see Apr 107.6432 8.1762 0.9445 20.8298 20.1313 0	m Table 9, Table 9a) May 108.0581 8.2039 0.8109 20.9627 20.2417	Th1 (C) Jun 110.1816 8.3454 0.5850 20.9976 20.2760 0	Jul 110.1816 8.3454 0.4208 20.9999 20.2769 0	Aug 110.6164 8.3744 0.4610 20.9997 20.2795 0	109.3223 8.2882 0.7170 20.9889 20.2667 0	108.0581 8.2039 0.9611 20.8238 20.1316 0	107.2314 8.1488 0.9969 20.5122 19.8264 0	Dec 106.4173 8.0945 0.9994 (8 20.2558 19.5663 0
emperature du tilisation fa au lpha til living ar iving on living 4 / 16 4 / 9 6 / 9 IT h 2 til rest of h	uring heati actor for g Jan 104.8256 7.9884 rea 0.9992 20.2734 19.5749 0 3 28 20.6283 20.2426 nouse 0.9989	ng periods ains for li Feb 105.2190 8.0146 0.9967 20.4232 19.7262 0 0 20.4232 20.2453	in the livi iving area, Mar 105.6154 8.0410 0.9883 20.6040 19.9067 0 0 20.6040 20.2479	ng area froni1,m (see Apr 107.6432 8.1762 0.9445 20.8298 20.1313 0 0 20.8298 20.2611 0.9246	m Table 9, Table 9a) May 108.0581 8.2039 0.8109 20.9627 20.2417 0 0 20.9627 20.2637	Th1 (C) Jun 110.1816 8.3454 0.5850 20.9976 20.2760 0 20.9976 20.2769 0.5204	Jul 110.1816 8.3454 0.4208 20.9999 20.2769 0 0 20.9999 20.2769 0.3518	Aug 110.6164 8.3744 0.4610 20.9997 20.2795 0 0 20.9997 20.2796 0.3890	109.3223 8.2882 0.7170 20.9889 20.2667 0 0 20.9889 20.2716	108.0581 8.2039 0.9611 20.8238 20.1316 0 0 20.8238 20.2637 0.9427	107.2314 8.1488 0.9969 20.5122 19.8264 0 0 20.5122 20.2584 0.9954	Dec 106.4173 8.0945 0.9994 (8 20.2558 19.5663 0 10 20.3599 (8 20.2532 (8
emperature du tilisation fa au lpha til living ar iving on living 4 / 16 4 / 9 6 / 9 IT h 2 til rest of h IT 2 iving area fr	uring heati actor for g Jan 104.8256 7.9884 rea 0.9992 20.2734 19.5749 0 3 28 20.6283 20.2426 nouse 0.9989 19.9010	ng periods ains for li Feb 105.2190 8.0146 0.9967 20.4232 19.7262 0 0 20.4232 20.2453 0.9954 19.7262	in the livi iving area, Mar 105.6154 8.0410 0.9883 20.6040 19.9067 0 0 20.6040 20.2479 0.9836 19.9067	ng area fronii,m (see Apr 107.6432 8.1762 0.9445 20.8298 20.1313 0 0 20.8298 20.2611 0.9246 20.1313	m Table 9, Table 9a) May 108.0581 8.2039 0.8109 20.9627 20.2417 0 0 20.9627 20.2637	Th1 (C) Jun 110.1816 8.3454 0.5850 20.9976 20.2760 0 20.9976 20.2769 0.5204 20.2769	Jul 110.1816 8.3454 0.4208 20.9999 20.2769 0 0 20.9999 20.2769	Aug 110.6164 8.3744 0.4610 20.9997 20.2795 0 0 20.9997 20.2796 0.3890 20.2795	109.3223 8.2882 0.7170 20.9889 20.2667 0 0 20.9889 20.2716 0.6484 20.2667 fLA =	108.0581 8.2039 0.9611 20.8238 20.1316 0 0 20.8238 20.2637 0.9427 20.1316 Eliving area	107.2314 8.1488 0.9969 20.5122 19.8264 0 0 20.5122 20.2584 0.9954 19.8264 a / (4) =	Dec 106.4173 8.0945 0.9994 (8 20.2558 19.5663 0 0 20.3599 (8 20.2532 (8 0.9992 (8 19.6623 (9 0.1348 (9
emperature du tilisation fa au lpha til living ar iving on living 4 / 16 4 / 9 6 / 9 IT h 2 til rest of h IT 2 iving area fr IT emperature ac	28 20.6283 20.2426 nouse 0.9991 druction 19.9991 druction	ng periods ains for li Feb 105.2190 8.0146 0.9967 20.4232 19.7262 0 0 20.4232 20.2453 0.9954 19.7262	in the livi living area, Mar 105.6154 8.0410 0.9883 20.6040 19.9067 0 20.6040 20.2479 0.9836 19.9067	ng area fronil,m (see Apr 107.6432 8.1762 0.9445 20.8298 20.1313 0 0 20.8298 20.2611 0.9246 20.1313 20.2254	m Table 9, Table 9a) May 108.0581 8.2039 0.8109 20.9627 20.2417 0 0 20.9627 20.2637 0.7617 20.2417	Th1 (C) Jun 110.1816 8.3454 0.5850 20.9976 20.2760 0 20.9976 20.2769 0.5204 20.2760 20.3733	Jul 110.1816 8.3454 0.4208 20.9999 20.2769 0 20.9999 20.2769 0.3518 20.2769 20.3743	Aug 110.6164 8.3744 0.4610 20.9997 20.2795 0 20.9997 20.2796 0.3890 20.2795 20.3766	109.3223 8.2882 0.7170 20.9889 20.2667 0 20.9889 20.2716 0.6484 20.2667 fLA = 20.3641	108.0581 8.2039 0.9611 20.8238 20.1316 0 0 20.8238 20.2637 0.9427 20.1316 Living are: 20.2249	107.2314 8.1488 0.9969 20.5122 19.8264 0 20.5122 20.2584 0.9954 19.8264 a / (4) = 19.9189	Dec 106.4173 8.0945 0.9994 (8 20.2558 19.5663 0 10 20.3599 (8 20.2532 (8 0.9992 (8 19.6623 (9 0.1348 (9 19.7564 (9
Temperature duritilisation faraurillisation faraurillisat	20.2734 19.5749 0 3 28 20.6283 20.2426 nouse 0.9991 28 20.6283 20.2426 nouse 0.9989 19.9010 raction 19.9991	ng periods ains for li Feb 105.2190 8.0146 0.9967 20.4232 19.7262 0 0 20.4232 20.2453 0.9954 19.7262	in the livi iving area, Mar 105.6154 8.0410 0.9883 20.6040 19.9067 0 0 20.6040 20.2479 0.9836 19.9067	ng area fronii,m (see Apr 107.6432 8.1762 0.9445 20.8298 20.1313 0 0 20.8298 20.2611 0.9246 20.1313	m Table 9, Table 9a) May 108.0581 8.2039 0.8109 20.9627 20.2417 0 0 20.9627 20.2637	Th1 (C) Jun 110.1816 8.3454 0.5850 20.9976 20.2760 0 20.9976 20.2769 0.5204 20.2769	Jul 110.1816 8.3454 0.4208 20.9999 20.2769 0 0 20.9999 20.2769 0.3518 20.2769	Aug 110.6164 8.3744 0.4610 20.9997 20.2795 0 0 20.9997 20.2796 0.3890 20.2795	109.3223 8.2882 0.7170 20.9889 20.2667 0 0 20.9889 20.2716 0.6484 20.2667 fLA =	108.0581 8.2039 0.9611 20.8238 20.1316 0 0 20.8238 20.2637 0.9427 20.1316 Eliving area	107.2314 8.1488 0.9969 20.5122 19.8264 0 0 20.5122 20.2584 0.9954 19.8264 a / (4) =	Dec 106.4173 8.0945 0.9994 (8 20.2558 19.5663 0 10 20.3599 (8 20.2532 (8 0.9992 (8 19.6623 (9 0.1348 (9 19.7564 (9
iemperature du titilisation fa au ulpha itil living ar iving ion living 4 / 16 4 / 9 6 / 9 IIT h 2 itil rest of h IIT 2 iving area fr IIT emperature ac	uring heati actor for g Jan 104.8256 7.9884 rea 0.9992 20.2734 19.5749 0 3 28 20.6283 20.2426 nouse 0.9989 19.9010 raction 19.9991 djustment 19.9991	ng periods ains for li Feb 105.2190 8.0146 0.9967 20.4232 19.7262 0 0 20.4232 20.2453 0.9954 19.7262 19.8201	in the livi living area, Mar 105.6154 8.0410 0.9883 20.6040 19.9067 0 20.6040 20.2479 0.9836 19.9067	ng area fronil,m (see Apr 107.6432 8.1762 0.9445 20.8298 20.1313 0 0 20.8298 20.2611 0.9246 20.1313 20.2254	m Table 9, Table 9a) May 108.0581 8.2039 0.8109 20.9627 20.2417 0 0 20.9627 20.2637 0.7617 20.2417	Th1 (C) Jun 110.1816 8.3454 0.5850 20.9976 20.2760 0 20.9976 20.2769 0.5204 20.2760 20.3733	Jul 110.1816 8.3454 0.4208 20.9999 20.2769 0 20.9999 20.2769 0.3518 20.2769 20.3743	Aug 110.6164 8.3744 0.4610 20.9997 20.2795 0 20.9997 20.2796 0.3890 20.2795 20.3766	109.3223 8.2882 0.7170 20.9889 20.2667 0 20.9889 20.2716 0.6484 20.2667 fLA = 20.3641	108.0581 8.2039 0.9611 20.8238 20.1316 0 0 20.8238 20.2637 0.9427 20.1316 Living are: 20.2249	107.2314 8.1488 0.9969 20.5122 19.8264 0 20.5122 20.2584 0.9954 19.8264 a / (4) = 19.9189	Dec 106.4173 8.0945 0.9994 (8 20.2558 19.5663 0 10 20.3599 (8 20.2532 (8 0.9992 (8 19.6623 (9 0.1348 (9 19.7564 (9
emperature du tilisation fa au lpha til living ar iving on living 4 / 16 4 / 9 6 / 9 IT h 2 til rest of h IT 2 iving area fr IT emperature ac djusted MIT	uring heati actor for g Jan 104.8256 7.9884 rea 0.9992 20.2734 19.5749 0 3 28 20.6283 20.2426 nouse 0.9989 19.9010 raction 19.9991 justment 19.9991	ng periods ains for li Feb 105.2190 8.0146 0.9967 20.4232 19.7262 0 0 20.4232 20.2453 0.9954 19.7262 19.8201	in the livi iving area, Mar 105.6154 8.0410 0.9883 20.6040 19.9067 0 0 20.6040 20.2479 0.9836 19.9067 20.0007	ng area fronii,m (see Apr 107.6432 8.1762 0.9445 20.8298 20.1313 0 0 0 20.8298 20.2611 0.9246 20.1313 20.2254	m Table 9, Table 9a) May 108.0581 8.2039 0.8109 20.9627 20.2417 0 0 0 20.9627 20.2637 0.7617 20.2417 20.3389 20.3389	Th1 (C) Jun 110.1816 8.3454 0.5850 20.9976 20.2760 0 20.9976 20.2769 0.5204 20.2760 20.3733 20.3733	Jul 110.1816 8.3454 0.4208 20.9999 20.2769 0 20.9999 20.2769 20.3743 20.3743	Aug 110.6164 8.3744 0.4610 20.9997 20.2795 0 0 20.9997 20.2796 0.3890 20.2795 20.3766 20.3766	109.3223 8.2882 0.7170 20.9889 20.2667 0 0 20.9889 20.2716 0.6484 20.2667 fLA = 20.3641	108.0581 8.2039 0.9611 20.8238 20.1316 0 0 20.8238 20.2637 0.9427 20.1316 : Living area 20.2249	107.2314 8.1488 0.9969 20.5122 19.8264 0 0 20.5122 20.2584 0.9954 19.8264 a / (4) = 19.9189 19.9189	Dec 106.4173 8.0945 0.9994 (8 20.2558 19.5663 0 0 20.3599 (8 20.2532 (8 19.6623 (9 0.1348 (9 19.7564 (9 0.0000 19.7564 (9
emperature du tilisation fa au lpha til living ar til living ar iving on living 4 / 16 4 / 9 6 / 9 IT h 2 til rest of h IT 2 iving area fr IT emperature ac djusted MIT . Space heati	20.2734 19.5749 20.2734 19.5749 3 28 20.6283 20.2426 nouse 0.9989 19.9010 action 19.9991 djustment 19.9991	ng periods ains for li Feb 105.2190 8.0146 0.9967 20.4232 19.7262 0 20.4232 20.2453 0.9954 19.7262 19.8201	in the livi iving area, Mar 105.6154 8.0410 0.9883 20.6040 19.9067 0 20.6040 20.2479 0.9836 19.9067 20.0007	ng area fronii,m (see Apr 107.6432 8.1762 0.9445 20.8298 20.1313 0 0 20.8298 20.2611 0.9246 20.1313 20.2254 20.2254	m Table 9, Table 9a) Table 9a) May 108.0581 8.2039 0.8109 20.9627 20.2417 0 0 20.9627 20.2637 0.7617 20.2417 20.3389 20.3389	Th1 (C) Jun 110.1816 8.3454 0.5850 20.9976 20.2760 0 20.9976 20.2769 0.5204 20.2760 20.3733 20.3733	Jul 110.1816 8.3454 0.4208 20.9999 20.2769 0 20.9999 20.2769 0.3518 20.2769 20.3743	Aug 110.6164 8.3744 0.4610 20.9997 20.2795 0 0 20.9997 20.2796 0.3890 20.2795 20.3766 20.3766	109.3223 8.2882 0.7170 20.9889 20.2667 0 20.9889 20.2716 0.6484 20.2667 fLA = 20.3641 20.3641	108.0581 8.2039 0.9611 20.8238 20.1316 0 0 20.8238 20.2637 0.9427 20.1316 Living are: 20.2249 20.2249	107.2314 8.1488 0.9969 20.5122 19.8264 0 20.5122 20.2584 0.9954 19.8264 a / (4) = 19.9189 19.9189	Dec 106.4173 8.0945 0.9994 (8 20.2558 19.5663 0 0 20.3599 (8 20.2532 (8 0.9992 (8 19.6623 (9 0.1348 (9 19.7564 (9 0.0000 19.7564 (9
emperature du tilisation fa au lpha til living ar iving on living 4 / 16 4 / 9 6 / 9 IT h 2 til rest of f IT 2 irving area fr IT 2 emperature ac djusted MIT . Space heati tilisation seful gains xt temp. eat loss rate	uring heati actor for g Jan 104.8256 7.9884 rea 0.9992 20.2734 19.5749 0 3 28.20.6283 20.2426 nouse 0.9989 19.9010 raction 19.9991 djustment 19.9991 djustment 19.9991	ng periods ains for li Feb 105.2190 8.0146 0.9967 20.4232 19.7262 0 0 20.4232 20.2453 0.9954 19.7262 19.8201 19.8201	in the livi living area, Mar 105.6154 8.0410 0.9883 20.6040 19.9067 0 20.6040 20.2479 0.9836 19.9067 20.0007 20.0007	Apr 0.9235 Apr 0.9235 20.2254 Apr 0.9246 20.8298 20.1313 20.2254	m Table 9, Table 9a) Table 9a) May 108.0581 8.2039 0.8109 20.9627 20.2417 20.2637 0.7617 20.2417 20.3389 20.3389	Th1 (C) Jun 110.1816 8.3454 0.5850 20.9976 20.2760 0 0 20.9976 20.2769 20.2769 20.3733 20.3733	Jul 110.1816 8.3454 0.4208 20.9999 20.2769 0 20.9999 20.2769 20.3743 20.3743 20.3743	Aug 110.6164 8.3744 0.4610 20.9997 20.2795 0 0 20.9997 20.2796 0.3890 20.2795 20.3766 20.3766	109.3223 8.2882 0.7170 20.9889 20.2667 0 20.9889 20.2716 0.6484 20.2667 fLA = 20.3641 20.3641	108.0581 8.2039 0.9611 20.8238 20.1316 0 0 20.8238 20.2637 0.9427 20.1316 Living are: 20.2249 20.2249	107.2314 8.1488 0.9969 20.5122 19.8264 0 20.5122 20.2584 0.9954 19.8264 a/(4) = 19.9189 19.9189	Dec 106.4173 8.0945 0.9994 (8 20.2558 19.5663 0 0 20.3599 (8 20.2532 (8 0.9992 (8 19.6623 (9 0.1348 (9 19.7564 (9 0.0000 19.7564 (9
emperature du tilisation fa au lpha til living ar iving on living 4 / 16 4 / 9 6 / 9 IT h 2 til rest of h IT 2 iving area fr IT 2 iving area fr IT emperature ac djusted MIT . Space heating pace heating pace heating	uring heati actor for g Jan 104.8256 7.9884 rea 0.9992 20.2734 19.5749 0 3 20.6283 20.2426 nouse 0.9989 19.9010 raction 19.9991 djustment 19.9991 djustment 19.9991	ng periods ains for li Feb 105.2190 8.0146 0.9967 20.4232 19.7262 9.2453 0.9954 19.7262 19.8201 19.820	in the livi iving area, Mar 105.6154 8.0410 0.9883 20.6040 19.9067 0 0 20.6040 20.2479 0.9836 19.9067 20.0007 Mar 0.9817 1220.1093 6.5000 1766.7063	ng area froni1,m (see Apr 107.6432 8.1762 0.9445 20.8298 20.1313 0 0 0 20.8298 20.2611 0.9246 20.1313 20.2254 20.2254 20.2254	m Table 9, Table 9a) Table 9a) May 108.0581 8.2039 0.8109 20.9627 20.2417 20.2637 0.7617 20.2417 20.3389 20.3389	Th1 (C) Jun 110.1816 8.3454 0.5850 20.9976 20.2760 0 20.9976 20.2769 20.2769 20.3733 20.3733 20.3733	Jul 110.1816 8.3454 0.4208 20.9999 20.2769 0 20.9999 20.2769 20.3743 20.3743 Jul 0.3611 473.3802 16.6000	Aug 110.6164 8.3744 0.4610 20.9997 20.2795 0 20.9997 20.2796 20.3766 20.3766 20.3766	109.3223 8.2882 0.7170 20.9889 20.2667 0 20.9889 20.2716 0.6484 20.3641 20.3641 20.3641	108.0581 8.2039 0.9611 20.8238 20.1316 0 0 20.8238 20.2637 0.9427 20.1316 c. Living area: 20.2249 20.2249 0.2249	107.2314 8.1488 0.9969 20.5122 19.8264 0 0 20.5122 20.2584 19.8264 a/ (4) = 19.9189 19.9189 Nov 0.9945 966.4338 7.1000	Dec 106.4173 8.0945 0.9994 (8 20.2558 19.5663 0 0 20.3599 (8 20.2532 (8 19.6623 (9 0.1348 (9 19.7564 (9 0.0000 19.7564 (9 0.9990 (9 924.9670 (9 4.2000 (9
emperature de tilisation fa au lpha til living ar iving on living 4 / 16 4 / 9 6 / 9 IT h 2 til rest of h 2 til rest of h IT 2 iving area fr IT emperature ac djusted MIT	uring heati actor for g Jan 104.8256 7.9884 rea 0.9992 20.2734 19.5749 0 3 28 20.6283 20.2426 nouse 0.9989 19.9010 raction 19.9911 djustment 19.9991 djustment 19.9991	ng periods ains for li Feb 105.2190 8.0146 0.9967 20.4232 19.7262 0.20.4232 20.2453 0.9954 19.7262 19.8201 19.	in the livi iving area, Mar 105.6154 8.0410 0.9883 20.6040 19.9067 0 0 20.6040 20.2479 0.9836 19.9067 20.0007 Mar 0.9817 1220.1093 6.5000 1766.7063 406.6682 per year (kW	Apr 0.9246 20.2254 Apr 0.9246 20.1313 20.2254 20.2254 4.1275 155.3232 lh/year) 0.0000	m Table 9, Table 9a) May 108.0581 8.2039 0.8109 20.9627 20.2417 0 0 0 20.9627 20.2637 0.7617 20.2417 20.3389 20.3389 20.3389	Th1 (C) Jun 110.1816 8.3454 0.5850 20.9976 20.2760 0 20.9976 20.2769 20.2769 20.3733 20.3733 20.3733	Jul 110.1816 8.3454 0.4208 20.9999 20.2769 0 0 0.3518 20.2769 20.3743 20.3743 20.3743 40.3611 473.3802 16.6000 473.4417	Aug 110.6164 8.3744 0.4610 20.9997 20.2795 0 0 20.9997 20.2796 20.3766 20.3766 20.3766	109.3223 8.2882 0.7170 20.9889 20.2667 0 20.9889 20.2716 0.6484 20.3641 20.3641 20.3641	108.0581 8.2039 0.9611 20.8238 20.1316 0 0 20.8238 20.2637 0.9427 20.1316 5. Living area 20.2249 20.2249 0.0000 1.00000 1.000000000000000000000	107.2314 8.1488 0.9969 20.5122 19.8264 0 20.5122 20.2584 0.9954 19.8264 a / (4) = 19.9189 19.9189 19.9189	Dec 106.4173 8.0945 0.9994 (8 20.2558 19.5663 0 0 0 20.3599 (8 20.2532 (8 19.6623 (9 19.6623 (9 19.7564 (9 19.
Temperature dutilisation fa au sipha sitil living ar siving area of siving area from the siving area from siving area from siving area from siving s	uring heatil actor for g Jan 104.8256 7.9884 rea 0.9992 20.2734 19.5749 0 3 28 20.6283 20.2426 nouse 0.9989 19.9010 raction 19.9991 djustment 19.9991 djustment 19.9991 djustment 19.9991 djustment 19.9991 djustment 19.9992 vjenjens 6.988 8.988 19.9010 raction 19.9991 djustment 19.9991 djustment 19.9991 djustment 19.9991 djustment 19.9987 972.1406 4.3000 e W 2069.8586 kWh 816.7022 requiremenk kWh 0.0000 contributik kWh 816.7022	ment Feb 0.9954 19.8201 Feb 105.2190 8.0146 0.9967 20.4232 19.7262 0 0 20.4232 20.2453 0.9954 19.7262 19.8201 Feb 0.9944 1136.8460 4.9000 1959.8050 553.0285 t - total process 0.0000 on - total 553.0285	in the livi iving area, Mar 105.6154 8.0410 0.9883 20.6040 19.9067 0 0 20.6040 20.2479 0.9836 19.9067 20.0007 20.0007	Apr (9254 20.2254 20.2254 20.2254 20.0000 Wh/year) 155.3232 215, see Apr (10,000 Wh/year) 155.3232	m Table 9, Table 9a) Table 9a) May 108.0581 8.2039 0.8109 20.9627 20.2417 0 0 0 20.9627 20.2637 0.7617 20.2417 20.3389 20.3389 20.3389 20.3389 21.7600 1104.9267 29.2598	Th1 (C) Jun 110.1816 8.3454 0.5850 20.9976 20.2760 0 0 20.9976 20.2769 20.2769 20.3733 20.3733 20.3733 Jun 0.5291 722.4712 14.6000 724.1847 0.0000 0.0000	Jul 110.1816 8.3454 0.4208 20.9999 20.2769 0 20.9999 20.2769 20.3743 20.3743 20.3743 20.3743 20.3743 40.3611 473.3802 16.6000 473.4417 0.0000	Aug 110.6164 8.3744 0.4610 20.9997 20.2795 0 0 20.9997 20.2796 0.3890 20.2795 20.3766 20.3766 20.3766	109.3223 8.2882 0.7170 20.9889 20.2667 0 20.9889 20.2716 0.6484 20.2667 fLA = 20.3641 20.3641 20.3641 5ep 0.6574 782.6726 14.1000 791.9199 0.0000	108.0581 8.2039 0.9611 20.8238 20.1316 0 0 20.8238 20.2637 20.1316 Living are: 20.2249 20.2249 20.2249 1012.1515 1012.1515 10.6000 1231.0434	107.2314 8.1488 0.9969 20.5122 19.8264 0 20.5122 20.2584 0.9954 19.8264 a / (4) = 19.9189 19.9189 19.9189 19.9189	Dec 106.4173 8.0945 0.9994 (8 12.2558 19.5663 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

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Full SAP Calculation Printout



raction of space heat f efficiency of main space efficiency of main space efficiency of secondary/	heating syst	tem(s) tem 1 (in tem 2 (in	%) %)	em (Table 11)						0.0000 1.0000 248.8827 0.0000 0.0000	(202 (206 (207
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
pace heating requiremen 816.7022	553.0285	406.6682		29.2598	0.0000	0.0000	0.0000	0.0000	162.8556	493.7491	814.9779	(98)
pace heating efficiency 248.8827		ng system 248.8827		248.8827	0.0000	0.0000	0.0000	0.0000	248.8827	248.8827	248.8827	(216
pace heating fuel (main 328.1475		tem) 163.3976	62.4082	11.7565	0.0000	0.0000	0.0000	0.0000	65.4347	198.3863	327.4547	(21:
pace heating efficiency 0.0000			2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
pace heating fuel (main 0.0000				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
pace heating fuel (seco		0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
later heating	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(21.
later heating requiremen 253.8027		238.6364	211.0369	205.2623	185.7479	184.1470	191.1928	192.9362	214.1267	226.3365	251.2456	(64
fficiency of water heat	er									177.3050	177.3050	(21
217)m 177.3050 uel for water heating,	kWh/month	177.3050		177.3050	177.3050	177.3050	177.3050	177.3050	177.3050		177.3050	
143.1447 pace cooling fuel requi	rement	134.5909		115.7679	104.7618	103.8589	107.8327	108.8160	120.7674	127.6537	141.7025	
221)m 0.0000 rumps and Fa 35.2097	0.0000 31.8023	0.0000 35.2097	34.0739	0.0000 35.2097	0.0000 34.0739	0.0000 35.2097	0.0000 35.2097	0.0000 34.0739	0.0000 35.2097	0.0000 34.0739	0.0000 35.2097	(23
ighting 32.2215 lectricity generated by	25.8493 PVs (Appendi	23.2744 ix M) (ne		13.1713 ity)	10.7611	12.0153	15.6180	20.2862	26.6166	30.0634	33.1170	(23
233a)m 0.0000 lectricity generated by	0.0000	0.0000	0.0000	0.0000	0.0000 ty)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(23
234a)m 0.0000 lectricity generated by	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 ity)	0.0000	0.0000	0.0000	0.0000	0.0000	(23
235a)m 0.0000 lectricity used or net	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 eneration)	0.0000	0.0000	0.0000	0.0000	(23
235c)m 0.0000 Electricity generated by	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(23
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	(23
lectricity generated by 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	(23
lectricity generated by 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	(23
lectricity used or net 235d)m 0.0000	0.0000	generated 0.0000		0.0000	N) (negati 0.0000	ve if net go 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(23
unnual totals kWh/year space heating fuel - mai ppace heating fuel - mai ppace heating fuel - sec efficiency of water heat stater heating fuel used space cooling fuel	n system 2 ondary										1379.1900 0.0000 0.0000 177.3050 1454.4630 0.0000	(21 (21 (21
lectricity for pumps an (BalancedWithHeatRec mechanical ventilatio otal electricity for the lectricity for lighting	overy, Databa on fans (SFP = e above, kWh/ g (calculated	= 0 /year in Appen	.7250) dix L)		= 0.7250)						414.5660 414.5660 260.0461	(23
nergy saving/generation V generation	technologies	(Аррепи.	ices m , m an	iu ()							0.0000	
lind generation Nydro-electric generatio Dectricity generated - Oppendix Q - special fea	Micro CHP (Ap tures)								0.0000 0.0000 0.0000	(23
nergy saved or generate nergy used otal delivered energy f											-0.0000 0.0000 3508.2650	(23
.2a. Carbon dioxide emis	sions - Indiv	/idual he	ating system	s including	micro-CHP							
							Energy kWh/year		ion factor kg CO2/kWh	ŀ	Emissions og CO2/year	
pace heating - main sys		systems					1379.1900		0.1572		216.7474 0.0000	(26
later heating (other fue pace and water heating		-					1454.4630		0.1408		204.7237 421.4711	(26
rumps, fans and electric energy for lighting	keep-hot						414.5660 260.0461		0.1387 0.1443		57.5054 37.5327	(26
otal CO2, kg/year PC Dwelling Carbon Diox	ide Emission	Rate (DE	R)				200.0401		0.1443		516.5092 3.1800	(27



Space heating - Total CO2 associ Water heating (c Space and water Pumps, fans and Energy for light Total Primary er Dwelling Primary	lated with other fuel; heating electric laing hergy kWh/y	community :) keep-hot year	systems					kWh/year 1379.1900 1454.4630 414.5660 260.0461	kg	CO2/kWh 1.5818 1.5205 1.5128 1.5338		kWh/year 2181.5749 0.0000 2211.4463 4393.0211 627.1555 398.8673 5419.0440 33.3900	(473) (278) (279) (281) (282) (286)
SAP 10 WORKSHEET													
CALCULATION OF T	TARGET EMIS												
1. Overall dwell	ling chara	cteristics											
Ground floor First floor Second floor Total floor area Dwelling volume	a TFA = (1a	a)+(1b)+(1c)+(1d)+(1e)	(1n)	16	2.3000		Area (m2) 61.1000 (1 62.1000 (1 39.1000 (1	lb) x lc) x	height (m) 2.7300 2.9600 3.0200 3d)+(3e)	(2c) = (2d) =	Volume (m3) 166.8030 183.8160 118.0820 468.7010	(1b) - (1c) - (1d) - (4)
2. Ventilation r											m ⁻	3 per hour	
Number of open of Number of open f Number of chimmer Number of flues Number of flues Number of intern Number of passiv Number of fluele	Flues eys / flues attached fattached fed chimneys nittent eximates eve vents	to solid fuc to other heas s tract fans	el boiler	ire							0 * 80 = 0 * 20 = 0 * 10 = 0 * 20 = 0 * 35 = 0 * 20 = 4 * 10 = 0 * 10 = 0 * 40 =	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 40.0000 0.0000	(6b) (6c) (6d) (6e) (6f) (7a) (7b)
Infiltration due Pressure test Pressure Test Me Measured/design Infiltration rat Number of sides	ethod AP50 ce	eys, flues a	and fans :	= (6a)+(6b)	+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		40.0000	Air change: 0 / (5) = B:	0.0853 Yes Lower Door 5.0000 0.3353	(17)
Shelter factor Infiltration rat	ce adjusted	d to include	e shelter fa	actor				(2	20) = 1 - (21)		(19)] = x (20) =	0.8500 0.2850	
Wind speed Wind factor Adj infilt rate	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	Sep 4.0000 1.0000	Oct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	
Effective ac	0.3634 0.5660	0.3563 0.5635	0.3492 0.5610	0.3135 0.5492	0.3064 0.5469	0.2708 0.5367	0.2708 0.5367	0.2637 0.5348	0.2850 0.5406	0.3064 0.5469	0.3207 0.5514	0.3349 0.5561	
3. Heat losses a													
TER Opaque door TER Opening Type Heatloss Floor 1 exposed floor External Wall 1 External Roof 2 Total net area c Fabric heat loss Party Wall 1	e (Uw = 1.:	20) 1 elements /	1; ,	Gross m2 28.0622 11.2700 19.2300	Openings m2 28.0900	2. 26. 61. 1. 99. 41. 19. 251.	Area m2 0000 0990 1000 6800 9722 2700 2300 3422 (26)(U-value W/m2K 1.0000 1.1450 0.1300 0.1300 0.1800 0.1100 0.1100 0.1100 30) + (32) = 0.0000	A x U W/K 2.0000 29.8740 7.9430 0.2184 17.9950 4.5397 2.1153 64.6854 0.0000		√-value kJ/m2K	A x K kJ/K	
Thermal mass par List of Thermal K1 Eleme E2 Other	Bridges ent		FA) in kJ/m2 other steel					Ler 16.9		-value 0.0500	Tota 0.848		(35)

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E3 Sill E4 Jamb													
E4 Jamb								15	.7600	0.0500	0.78	180	
									. 7600 . 5800	0.0500	2.02		
	nd floor (,							.4000	0.1600	2.14		
			n a dwelling	3					.4000	0.0000	0.00		
	osed floor le (insula		fter level)						. 8000 . 0000	0.3200 0.0800	0.57 0.96		
R5 Ridge	e (inverte	ed)							.5500	0.0400	0.26		
		iround floo							.4500	0.0800	1.63		
P4 Party E14 Fla		oot (insula	ation at cei	iling level)				.7000 .2300	0.1200 0.0800	3.32 0.73		
		ntermediat	e floor with	nin a dwell	ing				.0000	0.0000	0.00		
	ceiling (.6500	0.0400	0.22		
	ner (norma	ıl) tween dwel:	lings						. 8800 . 6000	0.0900 0.0600	1.60 2.19		
	e (vaulted		TINGS						.5500	0.0800	0.52		
Thermal bridges		Psi) calcu	lated using	Appendix K)							17.8606	
Point Thermal by Total fabric hea									,	33) + (36)	(36a) = + (36a) =	0.0000 82.5460	
Total Tablic lic	at 1033								(55) 1 (50)	(304) -	02.5400	(3/)
Ventilation hear						-				0.1		D	
(38)m	Jan 87.5501	Feb 87.1535	Mar 86.7647	Apr 84.9386	May 84.5969	Jun 83.0064	Jul 83.0064	Aug 82.7119	Sep 83.6191	0ct 84.5969	Nov 85.2881	Dec 86.0107	/ (38)
Heat transfer co		07.1333	00.7047	04.5500	04.3303	65.0004	03.0004	02.7113	05.0151	04.5505	03.2001	00.0107	(50)
	170.0961	169.6995	169.3107	167.4846	167.1430	165.5525	165.5525	165.2579	166.1651	167.1430	167.8341	168.5567	
Average = Sum(3	9)m / 12 =											167.4830	1
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
HLP	1.0480	1.0456	1.0432	1.0319	1.0298	1.0200	1.0200	1.0182	1.0238	1.0298	1.0341	1.0386	
HLP (average) Days in mont	31	28	31	30	31	30	31	31	30	31	30	1.0319 31	
buy5 In mone	31	20	31	50	31	50	31	31	50	31	50	31	
4. Water heating													
Assumed occupan												2.9521	. (42)
Hot water usage			70 0010	67 00	c=	63.00:0	ca c	62 2:21	64 0000	c= ====	70 0000	70	
Hot water usage	73.7171 for haths	72.6092	70.9949	67.9062	65.6268	63.0849	61.6400	63.2421	64.9983	67.7276	70.8827	73.4346	(42a
not water usage	31.8240	31.3513	30.6858	29.4586	28.5397	27.5208	26.9704	27.6313	28.3509	29.4412	30.6937	31.7164	(42b
Hot water usage	for other	uses											
Avenage deiler	44.8626	43.2312	41.5998	39.9685	38.3371	36.7057	36.7057	38.3371	39.9685	41.5998	43.2312	44.8626	
Average daily h	or water u	se (TITLIGE)	, udy)									138.2546	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
Daily hot water		1/7 1010	1/12 2005	יכככ דבר	122 5026	127 2114	125 2162	120 2100	122 2177	120 7607	1// 0075	150 0120	(///\
	150.4036 238.2025	147.1918 209.5991	143.2805 220.2168	137.3333 188.0024	132.5036 178.3754	127.3114 156.5442	125.3162 151.5591	129.2106 159.9897	133.3177 164.3941	138.7687 188.3078	144.8075 206.3049	150.0136 234.8850	
Energy content	(annual)								· -	Total = S		2296.3810	
Distribution lo				20 2004	26 7563	22 4047	22 7220	22 0005	24 6504	20 2462	20 0457	25 2220	(40)
Water storage l	35.7304 oss:	31.4399	33.0325	28.2004	26.7563	23.4816	22.7339	23.9985	24.6591	28.2462	30.9457	35.2328	(46)
Store volume												180.0000	(47)
a) If manufact			actor is kno	own (kWh/d	ay):							1.5520	
Temperature fa Enter (49) or (0.5400 0.8381	
Total storage l		,										0.0301	(33)
TC34-4	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder con	tains dedi 25.9803	cated solaı. 23.4661	r storage 25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	
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	
Total heat requ	ired for w 287.4452	ater heati 254.0764	ng calculate 269.4595	ed for each 235.6566	month 227.6180	204.1984	200.8018	209.2323	212.0483	237.5504	253.9591	284.1277	(62)
	-33.7004	-29.8049	-31.2099	-25.8431	-24.0848	-20.6095	-19.3182	-20.5429	-21.3234	-25.1380	-28.4783	-33.0763	
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	0.0000	
FGHRS Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	טטטט.ט	0.0000	(030
	253.7448	224.2715	238.2496	209.8135	203.5332	183.5889	181.4836	188.6894	190.7249	212.4125	225.4808	251.0514	
12Total per year	r (klih/von	ır)						Total p	er year (kW	h/year) = S	um(64)m =	2563.0441	l (64) 3 (64)
Electric shower		' /										2003	(04)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Heat gains from	water hos	ting bub/	month	Tot	al Energy u	sed by insta	antaneous e	lectric show	wer(s) (kWh	/year) = Su	m(64a)m =	0.0000	(64a
		105.2735	112.6162	100.6342	98.7039	90.1743	89.7875	92.5907	92.7844	102.0065	106.7197	117.4934	(65)
5. Internal gai													
Metabolic gains													
Buill3	Jan Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
	147.6056	147.6056	147.6056	147.6056	147.6056	147.6056	147.6056	147.6056	147.6056	147.6056	147.6056	147.6056	(66)
• •		a in Appen	aix L, equat	tion L9 or				475 2000	404 2255				
Lighting gains				121 2255	175 2002	181 2255	175 2007	7/4 2000		175 2007	121 225	175 2002	(67)
Lighting gains	175.3892	194.1809	175.3892	181.2355 uation L13	175.3892 or L13a), a	181.2355 lso see Tab	175.3892 le 5	175.3892	181.2355	175.3892	181.2355	175.3892	? (67)
Lighting gains Appliances gain	175.3892 s (calcula 333.6109	194.1809 ited in Appe 337.0727	175.3892 endix L, equ 328.3490	uation L13 309.7772	or L13a), a 286.3337	lso see Tab. 264.3001	le 5 249.5803	246.1185	254.8422	175.3892 273.4140	181.2355 296.8575	175.3892 318.8911	
Lighting gains Appliances gains	175.3892 s (calcula 333.6109 calculated	194.1809 ited in Appe 337.0727 I in Append	175.3892 endix L, equ 328.3490 ix L, equati	ation L13 309.7772 ion L15 or	or L13a), a 286.3337 L15a), also	lso see Tab 264.3001 see Table !	le 5 249.5803 5	246.1185	254.8422	273.4140	296.8575	318.8911	(68)
Lighting gains Appliances gain	175.3892 s (calcula 333.6109	194.1809 ited in Appe 337.0727	175.3892 endix L, equ 328.3490	uation L13 309.7772	or L13a), a 286.3337	lso see Tab. 264.3001	le 5 249.5803						(68) (69)



Losses e.g. e					-118.0845	-118.0845	-118.0845	-118.0845	-118.0845	-118.0845	-118.0845	-118.0845	(71)
Water heating	gains (Tab 159.4039	le 5) 156.6570	151.3659	139.7697	132.6666	125.2421	120.6822	124.4499	128.8672	137.1055	148.2218	157.9212	(72)
Total interna	l gains 738.6856	758.1923	725.3858	701.0641	664.6712	638.0594	612.9334	613.2392	632.2266	656.1903	696.5965	722.4832	(73)
													()
6. Solar gain													
[Jan]			Δ	irea	Solar flux		g		FF	Acce		Gains	
				m2	Table 6a W/m2		ific data Table 6b	Specific or Tab		fact Table		W	
North			10.9	200	10.6334		0.6300		.7000	0.77	'00	35.4868	(74)
South Southwest			11.5 3.6	200 500	46.7521 36.7938		0.6300 0.6300		1.7000 1.7000	0.77 0.77		164.5982 41.0431	
Solar gains Total gains	241.1280 979.8136	407.2980 1165.4903	554.2773 1279.6631	691.7217 1392.7858	786.5255 1451.1967	787.9311 1425.9905	756.5555 1369.4889	683.4669 1296.7061	600.8330 1233.0596	448.7503 1104.9407	288.0426 984.6391	206.9358 929.4190	
7. Mean inter	nal tempera												
Temperature d												21.0000	(85)
Utilisation f						Jun	Jul	Aug	Sep	0ct	Nov	Dec	
tau alpha	81.2530 6.4169	81.4430 6.4295	81.6300 6.4420	82.5200 6.5013	82.6887 6.5126	83.4831 6.5655	83.4831 6.5655	83.6319 6.5755	83.1753 6.5450	82.6887 6.5126	82.3482 6.4899	81.9951 6.4663	
util living a	rea 0.9993	0.9976	0.9927	0.9710	0.8947	0.7126	0.5279	0.5789	0.8339	0.9803	0.9979	0.9995	(86)
MIT	19.9404	20.1062	20.3251	20.6152	20.8539	20.9752	20.9969	20.9945	20.9324	20.6260	20.2296	19.9152	
Th 2 util rest of		20.0455	20.0475	20.0568	20.0585	20.0667	20.0667	20.0682	20.0635	20.0585	20.0550	20.0513	
MIT 2	0.9990 18.8024	0.9966 19.0162	0.9896 19.2964	0.9576 19.6652	0.8499 19.9386	0.6226 20.0540	0.4183 20.0659	0.4658 20.0666	0.7569 20.0213	0.9687 19.6845	0.9968 19.1818	0.9993 18.7762	(90)
Living area f	18.9558	19.1631	19.4351	19.7932	20.0620	20.1782	20.1914	20.1917	20.1441	: Living are 19.8114	19.3231	0.1348 18.9298	
Temperature a adjusted MIT	18.9558	19.1631	19.4351	19.7932	20.0620	20.1782	20.1914	20.1917	20.1441	19.8114	19.3231	0.0000 18.9298	(93)
8. Space heat													
Utilisation	Jan 0.9985	Feb	Mar 0.9867	Apr	May 0.8500	Jun	Jul 0.4331	Aug	Sep	0ct 0.9645	Nov 0.9955	Dec	(04)
Useful gains	978.3267		1262.6569		1233.5789	0.6339 903.9785	593.1522	0.4811 623.8800 16.4000	0.7644 942.5467 14.1000	1065.7403	980.2516	0.9989 928.4064	(95)
Ext temp. Heat loss rat		4.9000	6.5000	8.9000	11.7000	14.6000 923.4841	16.6000 594.5601			10.6000	7.1000	4.2000	
Space heating	kWh				1397.6437					1539.6251			
Space heating Solar heating				358.0521 h/year)	122.0642	0.0000	0.0000	0.0000	0.0000	352.5703	//1.2020	1156.4682 5424.2866	(30a)
Solar heating	0.0000	0.0000 on - total	0.0000 ner vear (k	0.0000 Wh/vear)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000	(98b)
Space heating				358.0521	122.0642	0.0000	0.0000	0.0000	0.0000	352.5703	771.2620	1156.4682	(98c)
Space heating Space heating	requiremen						0,000	0.0000	0.0000		:) / (4) =	5424.2866 33.4214	
Space meacing	per iiiz									(300	., / (+) -	33.4214	(33)
9a. Energy re													
Fraction of s Fraction of s				ntary syste	em (Table 11	.)						0.0000 1.0000	
Efficiency of Efficiency of	main space	heating sy	stem 1 (in									92.3000	(206)
Efficiency of												0.0000	
Space heating	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
	1126.8414	847.0444	689.9841	358.0521	122.0642	0.0000	0.0000	0.0000	0.0000	352.5703	771.2620	1156.4682	(98)
Space heating	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	1220.8466	917.7079	747.5451	387.9221	132.2473	0.0000	0.0000	0.0000	0.0000	381.9830	835.6034	1252.9449	(211)
Space heating	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	0.0000	0.0000	vstem 2) 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating	fuel (seco 0.0000	ndary) 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

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Water heating			
	1.4836 188.6894	190.7249 212.4125	225.4808 251.0514 (64)
	9.8000 79.8000	79.8000 85.1879	79.8000 (216) 86.5908 87.0489 (217)
	7.4230 236.4529	239.0036 249.3459	260.3981 288.4027 (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 0.0000 (221)
·	7.3041 7.3041 3.5893 17.6639	7.0685 7.3041 22.9436 30.1033	7.0685 7.3041 (231) 34.0016 37.4553 (232)
Electricity generated by PVs (Appendix M) (negative quantity)		-106.5571 -90.3389	-61.9913 -48.9078 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)			, ,
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative i	f net generation)	0.0000 0.0000	0.0000 0.0000 (235a)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000 (235c)
(233b)m -32.9242 -69.1527 -137.2971 -206.0462 -272.3588 -273.7462 -274 Electricity generated by wind turbines (Appendix M) (negative quantity)			-43.9778 -26.0546 (233b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000 (234b)
(235b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 Electricity used or net electricity generated by micro-CHP (Appendix N) (negative in	0.0000 0.0000 f net generation)	0.0000 0.0000	0.0000 0.0000 (235b)
	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000 (235d)
Space heating fuel - main system 1 Space heating fuel - main system 2			5876.8002 (211) 0.0000 (213)
Space heating fuel - secondary Efficiency of water heater			0.0000 (215) 79.8000
Water heating fuel used			3048.8314 (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)			294.1111 (232)
Energy saving/generation technologies (Appendices M ,N and Q) PV generation			-3020.0206 (233)
Wind generation Hydro-electric generation (Appendix N)			0.0000 (234) 0.0000 (235a)
Electricity generated - Micro CHP (Appendix N) Appendix Q - special features			0.0000 (235)
Energy saved or generated Energy used			-0.0000 (236) 0.0000 (237)
Total delivered energy for all uses			6285.7222 (238)
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP			
	Energy	Emission factor	Emissions
Space heating - main system 1	kWh/year 5876.8002	kg CO2/kWh 0.2100	kg CO2/year 1234.1280 (261)
Total CO2 associated with community systems Water heating (other fuel)	3048.8314	0.2100	0.0000 (373) 640.2546 (264)
Space and water heating Pumps, fans and electric keep-hot	86.0000	0.1387	1874.3826 (265) 11.9293 (267)
Energy for lighting	294.1111	0.1443	42.4493 (268)
Energy saving/generation technologies	-1191.3297	0 1747	160 4927
PV Unit electricity used in dwelling PV Unit electricity exported	-1191.3297 -1828.6909	0.1347 0.1259	-160.4827 -230.2470
Total Total CO2, kg/year			-390.7298 (269) 1538.0315 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.4800 (273)
13a. Primary energy - Individual heating systems including micro-CHP			
	Energy	Primary energy factor	Primary energy
Space heating - main system 1	kWh/year 5876.8002	kg CO2/kWh 1.1300	kWh/year 6640.7843 (275)
Total CO2 associated with community systems Water heating (other fuel)	3048.8314	1.1300	0.0000 (473) 3445.1795 (278)
Space and water heating Pumps, fans and electric keep-hot	86.0000	1.5128	10085.9638 (279) 130.1008 (281)
Energy for lighting	294.1111	1.5338	451.1175 (282)
Energy saving/generation technologies PV Unit electricity used in dwelling	-1191.3297	1.4979	-1784.4552
PV Unit electricity exported Total	-1828.6909	0.4622	-845.1641 -2629.6193 (283)
Total Primary energy kWh/year			8037.5627 (286)
Target Primary Energy Rate (TPER)			49.5200 (287)





Property Reference		BH1 L	_01-6 02 x6_Copy						Issued	on Date	12/09/	2023	_
Assessment Referenc	е	BH1 L	_01 02_Copy				Prop	Type Ref					_
Property													
SAP Rating				89	В	DER		9.84		TER	1	1.27	
Environmental				91		% DER	< TER					2.69	
CO: Emissions (t/year))			0.8		DFEE		27.71		TFEE		7.09	
Compliance Check % DPER < TPER				9.0	na	% DFE	E < TFEE	49.78		TPER		1.72	_
				10.				40.70					=
Assessor Details Client		Mr. Richard I	Denteh							Assessor ID	U	148-0001	_
NP 10 WORKSHEET ALCULATION OF D Overall dwell	FOR New B WELLING EM	uild (As De	esigned) (Version 10									
								Area	Store	/ height		Volume (m3)	
ound floor								(m2) 99.7000	(1b) x	(m) 2.7400	(2b) =	273.1780	
otal floor area Welling volume	TFA = (1a))+(1b)+(1c))+(1d)+(1e).	(1n)	9	9.7000		(3	a)+(3b)+(3c)+	(34)+(3e)	(3n) =	273.1780	(4
								(-		(54): (54)		2/2/2/00	('
mber of chimme mber of flues mber of flues mber of blocke mber of interm mber of passiv mber of fluele filtration due essure test Me asured/design filtration rat	attached t attached t d chimneys ittent ext e vents ss gas fir to chimne thod AP50	o solid fue o other hea ract fans es	el boiler ater		+(6c)+(6d)+(6e)+(6f)+(6į	;)+(7a)+(7	7b)+(7c) =		0.0000	0 * 10 = 0 * 20 = 0 * 35 = 0 * 20 = 0 * 10 = 0 * 10 = 0 * 40 = Air change / (5) =		
mber of sides													(1
elter factor filtration rat	e adjusted	to include	e shelter fa	ctor					(20) = 1 - (21)	[0.075 x) = (18)		0.8500 0.1275	
nd speed nd factor	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	Sep 4.0000 1.0000	Oct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	
j 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	C
alanced mechan mechanical ve exhaust air h balanced with	ical venti ntilation eat pump u	lation with sing Append	n heat recov dix N, (23b)	ery = (23a) x	Fmv (equati	on (N5)), ot	:herwise ((23b) = (23		_	= . • .	0.5000 0.5000 72.8000	(:
fective ac	0.2986	0.2954	0.2922	0.2762	0.2731	0.2571	0.2571	0.2539	0.2635	0.2731	0.2794	0.2858	
Heat losses a		ss paramete	er	Gross	Openings	 NetAi		U-value	ΑχU		-value	A×K	
ement				m٦	m٦		m 2	W/m2r	II / I/			レコノレ	
	0)			m2	m2	20.45	m2 600	W/m2K 1.2357	W/K 25.2709	1	cJ/m2K	kJ/K	(2

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Fabric heat lo	oss, W/K = 5	Sum (A x U)					(26)(30) + (32)	= 31.71	79			(33)
Party Wall 1 Party Floor 1							. 4700 . 7000	0.0000	0.00		0.0000	11964.6000	
Party Ceiling	1						. 7000 . 7000				0.0000 0.0000	3988.0000 2991.0000	
Internal Wall						176.	.5300			7	5.0000	13239.7500	(32c)
Heat capacity	Cm = Sum(A	x k)						(28).	(30) + (3	2) + (32a).	(32e) =	40932.8120	(34)
Thermal mass p	arameter (1		TFA) in kJ/r	m2K				` ,	. , .	, , ,	` ,	410.5598	
List of Therma K1 Ele								L	ength	Psi-value	Tot	:al	
E2 Oth	ner lintels	(including	other stee	l lintels)				11	.4100	0.0300	0.34	123	
E3 Sil E4 Jam									.9000 .9000	0.0300 0.0300	0.23 0.74		
E7 Par	ty floor be		lings (in b					48	.5400	0.0700	3.39	78	
	lcony withir orner (norma		g, wall ins	ulation con	tinuous				.6000 .4800	0.0000 0.0900	0.00 0.49		
E18 Pa	arty wall be	etween dwel						5	.4800	0.0600	0.32		
Thermal bridge			rnal area g lated using			area)		2	.7400	0.0000	0.00	900 5.5461	(36)
Point Thermal	bridges	ŕ	Ü		•				,	(24)	(36a) =	0.0000	
Total fabric h	neat loss								(,	33) + (36)	+ (36a) =	37.2640	(3/)
Ventilation he						_			_			_	
(38)m	Jan 26.9150	Feb 26.6277	Mar 26.3403	Apr 24.9036	May 24.6162	Jun 23.1795	Jul 23.1795	Aug 22.8921	Sep 23.7542	0ct 24.6162	Nov 25.1909	Dec 25.7656	(38)
Heat transfer	coeff												
Average = Sum(64.1790 39)m / 12 =	63.8917	63.6043	62.1676	61.8802	60.4435	60.4435	60.1561	61.0182	61.8802	62.4549	63.0296 62.0957	
						_						_	
HLP	Jan 0.6437	Feb 0.6408	Mar 0.6380	Apr 0.6235	May 0.6207	Jun 0.6063	Jul 0.6063	Aug 0.6034	Sep 0.6120	0ct 0.6207	Nov 0.6264	Dec 0.6322	(40)
HLP (average)												0.6228	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	
4. Water heati													
Assumed occupa Hot water usag		showers										2.7367	(42)
	96.3954	94.9468	92.8359	88.7969	85.8163	82.4924	80.6030	82.6980	84.9945	88.5634	92.6891	96.0261	(42a)
Hot water usag	ge for baths 31.8642	31.3910	30.7246	29.4958	28.5758	27.5556	27.0045	27.6663	28.3868	29.4784	30.7325	31.7565	(42h)
Hot water usag	ge for other	uses											
Average daily	44.9020 hot water u	43.2692 use (litres	41.6364 /dav)	40.0036	38.3708	36.7380	36.7380	38.3708	40.0036	41.6364	43.2692	44.9020 159.2365	
													()
Daily hot wate	Jan er use	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
•	173.1616	169.6069	165.1968	158.2964	152.7629	146.7859	144.3455	148.7350	153.3848	159.6782	166.6907	172.6846	
Energy conte Energy content		241.5180	253.9013	216.6998	205.6482	180.4904	174.5734	184.1650	189.1388	216.6818 Total = S	237.4815 Sum(45)m =	270.3823 2644.9263	
Distribution 1	loss (46)m										, ,		
Water storage	41.1368 loss:	36.2277	38.0852	32.5050	30.8472	27.0736	26.1860	27.6248	28.3708	32.5023	35.6222	40.5573	(46)
Store volume			C									110.0000	(47)
b) If manufaHot water st					ay)							0.0152	(51)
Volume facto												1.0294	
Temperature Enter (49) or												0.6000 1.0327	
Total storage		20.0162	22 0144	20, 0017	22 0144	20, 0017	22 0144	22 0144	20 0017	22 0144	20 0017	22 0144	(56)
If cylinder co	32.0144 ontains dedi	28.9162 icated sola	32.0144 r storage	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(50)
-	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	
Primary loss Combi loss	23.2624 0.0000	21.0112 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	
Total heat req						233.9841	220 0502	220 4410	242.6325	271.9586	200 0751	225 6501	(62)
WWHRS	329.5225 -73.1216	291.4455 -64.6693	309.1781 -67.7180	270.1935 -56.0732	260.9250 -52.2582	-44.7177	229.8502 -41.9157	239.4418 -44.5732	-46.2667	-54.5433	290.9751 -61.7909	325.6591 -71.7675	
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 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	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	
Output from w/	h 256.4009	226.7761	241.4601	214.1203	208.6668	189.2664	187.9345	194.8687	196.3658	217.4153	229.1842	253.8916	
			271,7001	214.1203	200.0000	107.2004	10/1.2343		er year (kW			2616.3507	(64)
12Total per ye Electric showe		ar)										2616	(64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Heat gains fro	om water hea	ating, kWh/	month	Tot	al Energy u	used by insta	antaneous e	lectric sho	wer(s) (kWh	/year) = Su	ım(64a)m =	0.0000	(64a)
0		120.2467		1 1 4.8476	112.5995	102.8080	102.2671	105.4563	105.6836	116.2681	121.7575	134.1236	(65)
5. Internal ga	ins (see Ta												
Metabolic gain	is (Table 5) Jan), Watts Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
(66)m	136.8366	136.8366	136.8366	136.8366	136.8366	136.8366	136.8366	136.8366	136.8366	136.8366	136.8366	136.8366	(66)
Lighting gains		ed in Appen 142.8689		133.3443		see Table 5 133.3443	129.0428	129.0428	133.3443	129.0428	133.3443	129.0428	(67)
					2.3.23								· /



Appliances ga	ins (calcula 255.8419	ated in App 258.4967	endix L, eq 251.8066	uation L13 237.5642	or L13a), a 219.5856	lso see Tab 202.6883	le 5 191.3999	188.7451	195.4352	209.6776	227.6562	244.5534	(68)
Cooking gains	(calculated 36.6837	d in Append 36.6837	lix L, equat 36.6837	ion L15 or 36.6837	L15a), also 36.6837	see Table 36.6837	5 36.6837	36.6837	36.6837	36.6837	36.6837	36.6837	(69)
Pumps, fans Losses e.g. e	0.0000 vaporation	0.0000 (negative v	0.0000 ralues) (Tab	0.0000 le 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Water heating	-109.4693	-109.4693	-109.4693		-109.4693	-109.4693	-109.4693	-109.4693	-109.4693	-109.4693	-109.4693	-109.4693	(71)
Total interna	182.0002	178.9385	172.9081	159.5106	151.3434	142.7889	137.4558	141.7424	146.7828	156.2744	169.1077	180.2736	(72)
TOTAL INCCINA	630.9358	644.3551	617.8085	594.4700	564.0228	542.8725	521.9495	523.5813	539.6132	559.0458	594.1591	617.9208	(73)
6. Solar gains	s												
[Jan]			А	rea	Solar flux		g		FF	Acce		Gains	
				m2	Table 6a W/m2		fic data Table 6b	Specific or Tab		fact Table		W	
North East			5.3 15.1		10.6334 19.6403		0.3300 0.3300		.8000 .8000	0.77 0.77		10.4079 54.2577	
Solar gains Total gains	64.6656 695.6014	126.0296 770.3847	208.5948 826.4033	309.2189 903.6889	385.5583 949.5812	398.1139 940.9864	377.5791 899.5286	319.5391 843.1203	243.9320 783.5452	149.6200 708.6658	80.4925 674.6515	53.2954 671.2163	
7. Mean inter													
Temperature do Utilisation fa	actor for g	ains for li	ving area,	ni1,m (see	Table 9a)							21.0000	(85)
tau alpha	Jan 177.1642 12.8109	Feb 177.9610 12.8641	Mar 178.7650 12.9177	Apr 182.8964 13.1931	May 183.7457 13.2497	Jun 188.1134 13.5409	Jul 188.1134 13.5409	Aug 189.0119 13.6008	Sep 186.3416 13.4228	0ct 183.7457 13.2497	Nov 182.0549 13.1370	Dec 180.3950 13.0263	
util living a		0.9938	0.9678	0.8190	0.6057	0.4111	0.2957	0.3282	0.5373	0.8770	0.9916	0.9990	(86)
MIT	20.7135	20.8001	20.9069	20.9908	20.9998	21.0000	21.0000	21.0000	21.0000	20.9832	20.8484	20.7046	
Th 2 util rest of		20.3934	20.3960	20.4089	20.4114	20.4244	20.4244	20.4270	20.4192	20.4114	20.4063	20.4011	
MIT 2	0.9979 20.1337	0.9909 20.2213	0.9551 20.3241	0.7839 20.4034	0.5676 20.4113	0.3741 20.4244	0.2570 20.4244	0.2873 20.4270	0.4921 20.4192	0.8389 20.4018	0.9872 20.2806	0.9985 20.1342	(90)
Living area f	20.2585	20.3459	20.4495	20.5299	20.5380	20.5483	20.5483	20.5503	+LA = 20.5442	Living are 20.5270	a / (4) = 20.4028	0.2152 20.2570	
Temperature adad	20.2585	20.3459	20.4495	20.5299	20.5380	20.5483	20.5483	20.5503	20.5442	20.5270	20.4028	0.0000 20.2570	(93)
0.6													
8. Space heat:													
Utilisation	Jan 0.9977	Feb 0.9906	Mar 0.9564	Apr 0.7913	May 0.5758	Jun 0.3821	Jul 0.2653	Aug 0.2961	Sep 0.5018	Oct 0.8468	Nov 0.9871	Dec 0.9984	(94)
Useful gains Ext temp.	694.0232 4.3000	763.1636 4.9000	790.355 1 6.5000	715.0463 8.9000	546.7422 11.7000	359.5340 14.6000	238.6475 16.6000	249.6666 16.4000	393.1943 14.1000	600.1224 10.6000	665.9682	670.1388 4.2000	(95)
Heat loss rate		986.8614	887.2510	723.0007	546.8973	359.5345	238.6475	249.6666	393.2131	614.2830	830.8277		
Space heating		150.3250	72.0905	5.7272	0.1154	0.0000	0.0000	0.0000	0.0000	10.5355	118.6988	254.3920	
Space heating Solar heating	kWh	·	,									857.5354	
Solar heating Space heating		0.0000 on - total	0.0000 per year (k	0.0000 Wh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Space heating	245.6510	150.3250 t after sol	72.0905 ar contribu	5.7272 tion - tota	0.1154 l per year	0.0000 (kWh/year)	0.0000	0.0000	0.0000	10.5355	118.6988	254.3920 857.5354	(98c
Space heating					, ,	, ,				(98c) / (4) =	8.6012	(99)
9b. Energy red													(204
Fraction of spraction of spraction of spraction of spraction of spraction of spractic spracti	pace heat f	rom communi	ty system									0.0000 1.0000	(302
Fraction of he	eat from co	mmunity Boi	lers-Space	and Water								0.5580 0.4420	(303
Factor for con Factor for cha	arging meth	od (Table 4	c(3)) for w	ater heatin	g	ng						1.0500 1.0500	(305
Distribution . Efficiency of	secondary/				g system							1.2500 0.0000	
Space heating Space heating	requiremen		70							40	440	054	
Space heat fro						0.0000	0.0000	0.0000	0.0000	10.5355	118.6988	254.3920	(98)
307a Space heat fro					0.0845	0.0000	0.0000	0.0000	0.0000	7.7159	86.9321	186.3104	
307b	142.5083	87.2073	41.8215	3.3225	0.0669	0.0000	0.0000	0.0000	0.0000	6.1119	68.8602	147.5792	

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Space heating requirement 322.4169 197.3015 94.6188 7.5170 0.1514 0.0000 0.0000	0.0000	0.0000	13.8278	155.7922	333.8895 (307)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	0.0000	13.0270	133.7322	0.0000 (308)
Space heating fuel for secondary/supplementary system 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (309)
Water heating					
Annual water heating requirement					252 2245 (54)
256.4009 226.7761 241.4601 214.1203 208.6668 189.2664 187.9345 Water heat from Combined Heat and Power = $(64) \times 0.56 \times 1.05 \times 1.25$	194.8687	196.3658	217.4153	229.1842	253.8916 (64)
310a 187.7816 166.0852 176.8394 156.8163 152.8223 138.6140 137.6385 Water heat from Boilers = $(64) \times 0.44 \times 1.05 \times 1.25$	142.7169	143.8134	159.2295	167.8488	185.9439
310b 148.7446 131.5585 140.0771 124.2165 121.0528 109.7982 109.0255	113.0482	113.9167	126.1281	132.9555	147.2889
Water heating fuel 336.5261 297.6437 316.9164 281.0329 273.8752 248.4121 246.6640	255.7651	257.7302	285.3576	300.8043	333.2327 (310)
Cooling System Energy Efficiency Ratio	0.0000	0.0000	0.0000	0.0000	0.0000 (314) 0.0000 (315)
Pumps and Fa 16.6296 15.0203 16.6296 16.0932 16.6296 16.0932 16.6296	16.6296	16.0932	16.6296	16.0932	16.6296 (331)
Lighting 23.7070 19.0187 17.1242 12.5459 9.6908 7.9175 8.8403 Electricity generated by PVs (Appendix M) (negative quantity)	11.4909	14.9256	19.5832	22.1192	24.3659 (332)
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	- 27 . 9065	-22.9726	-16.9728	-10.1931	-7.4930 (333a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (334a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (334a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (335a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335a)
Electricity generated by PVs (Appendix M) (negative quantity)					
(333b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000 (333b)
(334b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000 (334b)
(335b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (335b)
Annual totals kWh/year Space heating fuel - community heating					1125.5152 (307)
Space heating fuel - secondary Water heating fuel - community heating					0.0000 (309) 3433.9603 (310)
Efficiency of water heater					0.0000 (311)
Electricity used for heat distribution Space cooling fuel					11.2552 (313) 0.0000 (321)
Electricity for pumps and fans:					
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5875)					
mechanical ventilation fans (SFP = 0.5875) Total electricity for the above, kWh/year					195.8003 (330a) 195.8003 (331)
Electricity for lighting (calculated in Appendix L)					191.3292 (332)
Energy saving/generation technologies (Appendices M ,N and Q)					
PV generation Wind generation					-253.2279 (333) 0.0000 (334)
Hydro-electric generation (Appendix N)					0.0000 (335a)
Electricity generated - Micro CHP (Appendix N) Appendix Q - special features					0.0000 (335)
Energy saved or generated					-0.0000 (336)
Energy used Total delivered energy for all uses					0.0000 (337) 4693.3772 (338)
12b. Carbon dioxide emissions - Community heating scheme					
	Energy	Emissi	ion factor		Emissions
Electrical efficiency of CHP unit	kWh/year	k	kg CO2/kWh	k	g CO2/year 32.0000 (361)
Heat efficiency of CHP unit					49.9000 (362)
Space heating from Combined Heat and Power less credit emissions for electricity	1258.5921 -402.7495		0.2100 0.3480		264.3043 (363) -140.1568 (364)
Water heating from Combined Heat and Power	3839.9796		0.2100		806.3957 (365)
less credit emissions for electricity Efficiency of heat source Boilers	-1228.7935		0.3480		-427.6201 (366) 93.9000 (367)
Space and Water heating from Boilers	2146.2068		0.2100		111.2570 (368)
Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network	11.2552		0.0000		6.6265 (372) 0.2106 (386)
Total CO2 associated with community systems					960.2531 (373)
Space and water heating Pumps, fans and electric keep-hot	195.8003		0.1387		960.2531 (376) 27.1599 (378)
Energy for lighting	191.3292		0.1443		27.6147 (379)
Energy saving/generation technologies	053 225		0.455		22 52
PV Unit electricity used in dwelling PV Unit electricity exported	-253.2279 0.0000		0.1324 0.0000		-33.5355 0.0000
Total					-33.5355 (380)
Total CO2, kg/year EPC Dwelling Carbon Dioxide Emission Rate (DER)					981.4922 (383) 9.8400 (384)
13b. Primary energy - Community heating scheme					
		Primary ener		Prim	ary energy
Electrical efficiency of CHP unit	kWh/year	k	kg CO2/kWh		kWh/year 32.0000 (461)
Heat efficiency of CHP unit Space heating from Combined Heat and Power	1258.5921		1.1300		49.9000 (462) 1422.2091 (463)
less credit emissions for electricity	-402.7495		2.1490		-865.5086 (464)



Water heating fr	ssions for	electricit						3839.9796 1228.7935		1.1300 2.1490		4339.1776 -2640.6772	2 (466)
Efficiency of he Space and Water Electrical energ Overall CO2 fact Total CO2 associ	heating from yy for heat or for heat ated with	om Boilers distributi network		water)				2146.2068 11.2552		1.1300 0.0000		598.6686 70.1034 1.0419 4750.5173	4 (472) 9 (486) 8 (473)
Space and water Pumps, fans and Energy for light	electric ke	eep-hot						195.8003 191.3292		1.5128 1.5338		4750.5173 296.2067 293.4672	7 (478)
Energy saving/g PV Unit electric PV Unit electric Total Total Primary er	ity used in ity exporte	n dwelling ed	S					-253.2279 0.0000		1.4893 0.0000		-377.1378 0.0006 -377.1378 4963.0534	9 3 (480)
Dwelling Primary	energy Rat	ce (DPER)										49.7806	9 (484)
SAP 10 WORKSHEET CALCULATION OF T	FOR New Bu	uild (As De SIONS	signed) (Version 10	.2, February	2022)							
1. Overall dwell	ing charact	eristics											
Ground floor Total floor area				(1n)	9:	9.7000		Area (m2) 99.7000		height (m) 2.7400	(2b) =	Volume (m3) 273.1786	(1b) -
Dwelling volume								(:	3a)+(3b)+(3c)+((3d)+(3e)	(3n) =	273.1786	9 (5)
2. Ventilation r													
Number of open of Number of open f Number of chimne Number of flues Number of flues Number of blocke Number of passiv Number of fluele	Flues Pys / flues attached to attached to d chimneys wittent extra ve vents	o solid fue o other hea ract fans	l boiler	re							0 * 80 = 0 * 20 = 0 * 10 = 0 * 20 = 0 * 35 = 0 * 20 = 3 * 10 = 0 * 10 = 0 * 40 =	9.0006 9.0006 9.0006 9.0006 9.0006 30.0006	(6a) (6b) (6c) (6d) (6e) (6e) (6f) (7a)
Infiltration due Pressure test Pressure Test Me Measured/design Infiltration rat Number of sides	ethod AP50 :e	/s, flues a	nd fans =	(6a)+(6b)·	+(6c)+(6d)+(6e)+(6f)+0	(6g)+(7a)+(7	'b)+(7c) =		30.0000	Air chan (5) =	ges per hour 0.1098 Yes Blower Door 5.0006 0.3598	3 (8) 5 9 (17)
Shelter factor Infiltration rat	e adjusted	to include	shelter fa	ctor					(20) = 1 - (21)		(19)] = x (20) =		
Wind speed Wind factor	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	Sep 4.0000 1.0000	Oct 4.3000 1.0750	Nov 4.500 1.125		0 (22) 0 (22a)
Adj infilt rate	0.3900 0.5760	0.3823 0.5731	0.3747 0.5702	0.3364 0.5566	0.3288 0.5540	0.2906 0.5422	0.2906 0.5422	0.2829 0.5400	0.3058 0.5468	0.3288 0.5540	0.344 0.559		1 (22b) 5 (25)
3. Heat losses a		ss paramete	r	Gross	Openings		:Area	U-value	A×U		-value	A×k	
TER Opening Type External Wall 1 Total net area of Fabric heat loss Party Wall 1	of external	elements A		m2 6.4998	m2 20.4500	46 66	m2 .4500 .0498 .4998 (26)(3	W/m2K 1.1450 0.1800 (0.0000	W/K 23.4160 8.2890 = 31.7050 0.0000		kJ/m2K	kJ/k	(27) (29a) (31) (33) (32)
Thermal mass par List of Thermal K1 Eleme	Bridges	P = Cm / TF	A) in kJ/m2	K					Length Psi	l-value	T	420.5598 otal	3 (35)

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Point Times Dirighes Train Series Seri	E3 Sil E4 Jam E7 Par E8 Bal E16 Co E18 Pa E17 Co	l ty floor be cony withir rner (norma rty wall be prner (inver	etween dwel n a dwellin al) etween dwel eted - inte	rnal area g	locks of flulation cor	ntinuous n external a	urea)		7 24 48 6 5 5	.4100 .9000 .9000 .5400 .6000 .4800 .4800 .7400	0.0500 0.0500 0.0500 0.0700 0.0000 0.0900 0.0600 -0.0900	0.57 0.39 1.24 3.39 0.00 0.49 0.32	950 978 900 932	(36)
Same Feb Mar Apr May Jun Jul Aug Sep Oct May Decomposition Property Sept	Point Thermal	bridges	,		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	•				(33) + (36)	, ,	0.0000 37.8887	
Heat transfer coeff 91, 4172		Jan	Feb	Mar	Apr	May								
88.085		coeff												
Big	Average = Sum(65.2502	88.0048	87.8330	80.7083	80.7083	80.3707	67.1754	87.8330	00.2334	88.0637	(33)
A Nater heating energy requirements (Msh/year) 4. Nater heating energy requirements (Msh/year) 5. Sasumed occupancy 70, 1658 69, 0522 67, 5170 64, 576 62, 4119 59, 9944 58, 6204 69, 1440 51, 8142 64, 4097 67, 1126 69, 327 80 1010 water usage for mixer showers 70, 1658 69, 0522 67, 5170 64, 576 62, 4119 59, 9944 58, 6204 69, 1440 51, 8142 64, 4097 67, 1126 69, 327 80 1010 water usage for baths Not water usage for cher uses 42,659 61, 11057 39, 5545 38, 8034 36, 6522 34, 9011 34, 9011 36, 4522 38, 8034 39, 5545 61, 1057 62, 659 81, 1057 39, 5545 38, 8034 36, 6522 34, 9011 34, 9011 36, 4522 38, 8034 39, 5545 61, 1057 62, 659 81, 1057 81, 1058 81, 10													0.8905	(40)
Assumed occupancy Assumed occu		31	28	31	30	31	30	31	31	30	31	30	0.8833 31	
Assumed occupancy Not water usage for Eshar showers 100 water usage for Eshar showers 100 water usage for Eshar showers 101 water usage for Eshar showers 102 29,8214 29,823 28,8211 27,1478 25,6543 26,233 26,6974 28,0864 29,1958 39,168 103 0,2710 29,8214 29,1833 28,8211 27,1478 25,6543 26,233 26,6974 28,0864 29,1958 39,168 104 water usage for Octar uses 105 water usage for Octar uses 106 water usage for Octar uses 107,060 41,1657 39,5545 38,0834 36,4522 34,9011 34,9011 36,4522 38,0014 39,5545 41,1057 42,6565 108 water storage daily hot water use (liver/day) 109 water uses 109 water us	A Water heati	ng energy r												
Hot water usage for mixer showers 70:1895 60:5922 67.5170 64.5796 62.4119 59.9944 58.6204 68.1440 61.8142 64.4097 67.4102 66.837 10t water usage for botts 18													2.7367	(42)
30.2718 29.8214 29.1883 28.0211 27.1470 26.1778 25.6543 26.2830 26.9674 28.0045 29.1958 30.168 hot water use for other uses 42.6669 41.1057 30.5545 38.0034 36.4522 34.9011 34.9011 36.4522 38.0034 39.5545 41.1057 42.656 24.1057 30.5545 38.0034 36.4522 34.9011 34.9011 36.4522 38.0034 39.5545 41.1057 42.656 24.1057 31.1	Hot water usag	ge for mixer 70.1058	69.0522	67.5170	64.5796	62.4119	59.9944	58.6204	60.1440	61.8142	64.4097	67.4102	69.8372	
42,6569 41,1057 30,5545 38.0034 36.4522 34.9011 34.9011 36.4522 38.0034 39,5545 41.057 42,556 whereage daily hot water use (litres/day) Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Bally hot water use (1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		30.2710	29.8214	29.1883	28.0211	27.1470	26.1778	25.6543	26.2830	26.9674	28.0045	29.1958	30.1687	(42b
Daily hot water use 1	Č	42.6569	41.1057		38.0034	36.4522	34.9011	34.9011	36.4522	38.0034	39.5545	41.1057	42.6569	
Daily hot water use 134.8356 139.9794 136.2599 130.6040 126.0111 121.0733 119.1758 122.8792 126.7850 131.9688 137.7118 142.662 Energy contex (236.5383 199.3287 269.4264 178.7904 169.6352 148.8738 144.1327 152.1501 156.3386 179.8804 169.61957 223.375 Energy contex (annual) Total = Sum(45)m = 0.15 x (45)m Distribution loss (46)m = 0.15 x (45)m Store volume 101	Average dally		·		Apr	Mav	Jun	Jul	Aug	Sen	0ct	Nov		(43)
Total = Sum(45)m = 2183.857	-	er use 143.0336	139.9794	136.2599	130.6040	126.0111	121.0733	119.1758	122.8792	126.7850	131.9688	137.7118	142.6627	
33.995 29.8993 31.4140 26.8186 25.4453 22.3311 21.6199 22.8225 23.4508 26.8621 29.4294 33.506	Energy content	(annual)			178.7904	169.6352	148.8738	144.1327	152.1501	156.3386			223.3753 2183.8576	
Store volume Not water storage loss factor from Table 2 (kWh/litre/day) Not water storage loss factor from Table 2 (kWh/litre/day) Not water storage loss factor from Table 2 (kWh/litre/day) Not water storage loss factor from Table 2 (kWh/litre/day) 1.440		33.9795			26.8186	25.4453	22.3311	21.6199	22.8225	23.4508	26.8621	29.4294	33.5063	(46)
Volume factor from Table 2a Temperature factor from Table 2b Enter (49) or (54) in (55) Total storage loss 44.6400 49.3200 44.6400 43.2000 44.64000 44.6400 43.2000 44.64000 44.6400 43.2000 44.64000 44.64000 44.64000 44.64000 44.64000 44.	Store volume		lared loss	factor is n	ot known :								0.0000	(47)
44.6409 43.2200 44.6400 43.2000 44.6400 43.2000 44.6400 43.2000 44.6400 43.2000 44.6400 43.2000 44.6400 43.2000 44.6400 43.2000 44.6400 43.2000 44.6400 43.2000 44.6400 43.2000 44.6400 43.2000 44.6400 43.2000 44.6400 43.2000 44.6400 43.2000 44.6400 43.2000 44.6400 43.2000 44.6400 60.000	Volume facto Temperature Enter (49) or	or from Tabl factor from (54) in (55	le 2a n Table 2b	m Table 2 (kWh/litre/d	lay)							1.4400 0.0000 1.0000 1.4400	(52) (53)
A4,6400 43,2000 44,6400 44,6400 43,2000 44,6400 44,6400 43,2000 44,6400 43,2000 44,6400 44,6400 43,2000 44,6400 44,6	· ·	44.6400			43.2000	44.6400	43.2000	44.6400	44.6400	43.2000	44.6400	43.2000	44.6400	(56)
Combi jos 0.0000	,	44.6400	40.3200	44.6400									44.6400 0.0000	, ,
271.1763 239.6487 254.0664 221.9904 214.2752 192.0738 188.7727 196.7901 199.5386 223.7204 239.3957 268.015	Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000							0.0000	
PV diverter		271.1703	239.6487	254.0664	221.9904	214.2752							268.0153 -31 4559	
FGHRS 0.0000 0.0	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
239.1209 211.3040 224.3853 197.4133 191.3702 172.4739 170.4010 177.2535 179.2598 199.8139 212.3125 236.559 Total per year (kWh/year) = Sum(64)m = 2411.667 2411.667 2411.667 2411.667 2411.667 2411.667 2411.667 2411.667 2411.667 2411.667 2411.667 2411.667 2412.612 Colored Per year (kWh/year) Sum(64)m = Colored Per year (kWh/year) Sum(64a)m Sum(64a)m	FGHRS	0.0000											0.0000	
### Read Book ##	•	239.1209		224.3853	197.4133	191.3702	172.4739	170.4010					236.5594 2411.6677 2412	
Heat gains from water heating, kWh/month	Electric showe		0.0000	0.0000									0.0000	
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 136.8366 136.8368 136.837 136.838 136.	Heat gains fro						-							
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 136.8366 1		111.0333	90.3320	103.3403	94.0078	92.1137	84.0005	83.0301	60.3019	60.3420	93.2302	99.7931	109.9643	(65)
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m 136.8366 136.	5. Internal ga	ins (see Ta												
(66)m 136.8366 136.83		s (Table 5)), Watts							5 a a	0-+	Max.	Da-	
129.6372 143.5269 129.6372 133.9585 129.6372 133.9585 129.6372 129.6372 129.6372 133.9585 129.6372 133.9585 129.6372 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 255.8419 258.4967 251.8066 237.5642 219.5856 202.6883 191.3999 188.7451 195.4352 209.6776 227.6562 244.553 Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 36.6837 36.6837 36.6837 36.6837 36.6837 36.6837 36.6837 36.6837 36.6837 36.6837 36.6837 36.6837 36.6837 36.837		136.8366	136.8366	136.8366	136.8366	136.8366	136.8366	136.8366					Dec 136.8366	(66)
255.8419 258.4967 251.8066 237.5642 219.5856 202.6883 191.3999 188.7451 195.4352 209.6776 227.6562 244.553 Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 36.6837 36		129.6372	143.5269	129.6372	133.9585	129.6372	133.9585	129.6372	129.6372	133.9585	129.6372	133.9585	129.6372	(67)
36.6837 36.683		255.8419	258.4967	251.8066	237.5642	219.5856	202.6883	191.3999	188.7451	195.4352	209.6776	227.6562	244.5534	(68)
	Pumps, fans	36.6837 0.0000	36.6837 0.0000	36.6837 0.0000	36.6837 0.0000	36.6837	36.6837	36.6837					36.6837 0.0000	
	_	-109.4693	-109.4693			-109.4693	-109.4693	-109.4693	-109.4693	-109.4693	-109.4693	-109.4693	-109.4693	(71)
Water heating gains (Table 5) 149.2383 146.6262 141.5944 130.5664 123.8114 116.7507 112.4142 115.9972 120.1980 128.0326 138.6043 147.828 Total internal gains	_	149.2383		141.5944	130.5664	123.8114	116.7507	112.4142	115.9972	120.1980	128.0326	138.6043	147.8283	(72)



598.7684 612.7008 587.0892 566.1400 537.0852 517.4485 497.5023 498.4305 513.6426 531.3984 564.2698 586.0700 (73)

[Jan]			^	Area	Solar flux		g		FF	Acce	ss	Gains	
[Jan]			-	m2	Table 6a W/m2	Speci	fic data Table 6b	Specific or Tab	data	fact Table	or	W	
North				3500	10.6334		0.6300		.7000	0.77		17.3859	
East 			15.1	1000	19.6403		0.6300		.7000	0.77	00	90.6350	(76)
Solar gains Fotal gains	108.0209 706.7893	210.5267 823.2275	348.4481 935.5373	516.5362 1082.6761	644.0577 1181.1429	665.0312 1182.4797	630.7288 1128.2310	533.7755 1032.2059	407.4774 921.1200	249.9334 781.3318	134.4590 698.7288	89.0276 675.0976	
7. Mean intern	nal temperat	ure (heati	ing season)										
Temperature du Utilisation fa	ctor for ga	ins for li	ving area,	ni1,m (see	Table 9a)		- 1		6	0.1		21.0000	(85)
tau	Jan 129.6763	Feb 130.0617	Mar 130.4418	Apr 132.2568	May 132.6020	Jun 134.2330	Jul 134.2330	Aug 134.5395	Sep 133.6000	0ct 132.6020	Nov 131.9055	Dec 131.1851	
alpha util living ar	9.6451 ea	9.6708	9.6961	9.8171	9.8401	9.9489	9.9489	9.9693	9.9067	9.8401	9.7937	9.7457	
J	0.9996	0.9981	0.9877	0.9002	0.6858	0.4695	0.3384	0.3858	0.6497	0.9619	0.9983	0.9998	(86)
MIT Th 2 util rest of h	20.4290 20.1668	20.5536 20.1690	20.7331 20.1713	20.9344 20.1817	20.9951 20.1837	20.9999 20.1928	21.0000 20.1928	21.0000 20.1945	20.9978 20.1893	20.8832 20.1837	20.6180 20.1797	20.4115 20.1756	
	0.9994 19.5030	0.9970	0.9812 19.8915	0.8640	0.6284 20.1809	0.4104 20.1928	0.2763	0.3182	0.5753 20.1884	0.9378 20.0827	0.9971 19.7558	0.9996	
MIT 2 Living area fr	action	19.6641		20.1279			20.1928	20.1945	fLA =	Living are	a / (4) =	19.4880	(91)
MIT Temperature ad		19.8556	20.0726	20.3015	20.3562	20.3665	20.3666	20.3679	20.3626	20.2550	19.9413	19.6868	
adjusted MIT	19.7023	19.8556	20.0726	20.3015	20.3562	20.3665	20.3666	20.3679	20.3626	20.2550	19.9413	19.6868	(93)
8. Space heati Utilisation Useful gains	Jan 0.9992 706.2573	ent Feb 0.9965 820.3447	Mar 0.9802 917.0310	Apr 0.8698 941.6809	May 0.6407 756.7385	Jun 0.4231 500.2948	Jul 0.2897 326.8173	Aug 0.3328 343.4990	Sep 0.5914 544.7177	0ct 0.9403 734.7038	Nov 0.9966 696.3765	Dec 0.9995 674.7622	
Ext temp. Heat loss rate	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Space heating	1383.3936 kWh	1339.2865	1211.9024	1004.0709	760.3194	500.3503	326.8183	343.5029	545.9715	848.0521	1133.8825	1374.9854	(97)
Space heating Solar heating		348.7289 - total p	219.3843 per year (kw	44.9208 Wh/year)	2.6642	0.0000	0.0000	0.0000	0.0000	84.3311	315.0043	520.9661 2039.7892	•
Solar heating Space heating		0.0000 n - total	0.0000 per year (k	0.0000 Wh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000	
Space heating Space heating	503.7895 requirement	348.7289 after sol	219.3843 Lar contribu	44.9208 ution – tota	2.6642 l per year	0.0000 (kWh/year)	0.0000	0.0000	0.0000	84.3311 (98c	315.0043	520.9661 2039.7892 20.4593	
 9b. Energy red													
Fraction of sp Fraction of sp Fraction of he Fraction of he Factor for cor Factor for cha Distribution 1 Efficiency of Space heating:	pace heat from come trom come trom and charging metho coss factor secondary/s	om communi munity Com munity Boi arging met d (Table 4 (Table 12c upplementa	ty system bined Heat lers-Space chod (Table lc(3)) for w	and Power-S and Water 4c(3)) for water heating	pace and Was space heati	ter						0.0000 1.0000 0.5580 0.4420 1.0000 1.0000 0.0000	(302) (303) (303) (305) (306)
Space heating	503.7895	348.7289		44.9208	2.6642	0.0000	0.0000	0.0000	0.0000	84.3311	315.0043	520.9661	(98)
Space heat fro 307a	om Combined 351.3932	Heat and P 243.2384		0.56 x 1 31.3322	.00 x 1.25 1.8583	0.0000	0.0000	0.0000	0.0000	58.8210	219.7155	363.3739	
Space heat fro 307b	om Boilers = 278.3437		44 x 1.00 x 121.2098	(1.25 24.8187	1.4720	0.0000	0.0000	0.0000	0.0000	46.5930	174.0399	287.8338	,
Space heating Efficiency of	requirement 629.7368	435.9111	274.2304	56.1510	3.3302	0.0000 e 4a or App	0.0000 endix E)	0.0000	0.0000	105.4139	393.7554	651.2076 0.0000	•
Space heating					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Water heating Annual water h	neating requ 239.1209	irement 211.3040	224.3853	197.4133	191.3702	172.4739	170.4010	177.2535	179.2598	199.8139	212.3125	236.5594	(64)

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			Cricigy
310a 166.7868 147.3845 156.5088 137.6958 133.4807 120.3005	118.8547 123.63	43 125.0337 139.3702	148.0880 165.0002
Water heat from Boilers = (64) x 0.44 x 1.00 x 1.25 310b 132.1143 116.7454 123.9729 109.0709 105.7320 95.2918	94.1465 97.93	26 99.0410 110.3972	117.3027 130.6991
Water heating fuel	213.0012 221.56		265.3906 295.6992 (310)
cooling System Energy Efficiency Ratio			0.0000 (314)
pace coolin 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.00 0.0000 0.00		0.0000 0.0000 (315) 0.0000 0.0000 (331)
ighting 26.9361 21.6091 19.4566 14.2547 11.0108 8.9959 lectricity generated by PVs (Appendix M) (negative quantity)	10.0444 13.05	51 16.9586 22.2505	25.1319 27.6847 (332)
33a)m -14.4370 -22.0056 -34.1563 -41.5519 -47.6106 -45.4456	-44.8621 -40.92	55 -34.5465 -26.4648	-16.4377 -12.2948 (333a
Lectricity generated by wind turbines (Appendix M) (negative quantity) 334a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.00	0.0000 0.0000	0.0000 0.0000 (334a
lectricity generated by hydro-electric generators (Appendix M) (negative quantit 335a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	y) 0.0000 0.00	0.0000 0.0000	0.0000 0.0000 (335a
Plectricity generated by PVs (Appendix M) (negative quantity) 333b)m -3.8106 -8.2913 -17.0196 -26.3940 -35.7554 -36.2752	-35.8811 -30.00	73 -21.4921 -12.1525	-5.1767 -2.9952 (333b
lectricity generated by wind turbines (Appendix M) (negative quantity) 334b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.00		0.0000 0.0000 (334b
lectricity generated by hydro-electric generators (Appendix M) (negative quantit	y)		·
335b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.00	0.0000 0.0000	•
pace heating fuel - community heating pace heating fuel - secondary			2549.7365 (307) 0.0000 (309)
ater heating fuel - community heating fficiency of water heater			3014.5846 (310)
lectricity used for heat distribution			0.0000 (311) 25.4974 (313)
pace cooling fuel			0.0000 (321)
lectricity for pumps and fans: otal electricity for the above, kWh/year lectricity for lighting (calculated in Appendix L)			0.0000 (331) 217.3894 (332)
nergy saving/generation technologies (Appendices M ,N and Q)			
PV generation Wind generation			-615.9903 (333) 0.0000 (334)
Hydro-electric generation (Appendix N)			0.0000 (335a)
Electricity generated - Micro CHP (Appendix N) Appendix Q - special features			0.0000 (335)
Energy saved or generated Energy used			-0.0000 (336) 0.0000 (337)
Total delivered energy for all uses			5165.7202 (338)
.2b. Carbon dioxide emissions - Community heating scheme	Ener kWh/ye	gy Emission factor	Emissions kg CO2/year
Electrical efficiency of CHP unit Heat efficiency of CHP unit			32.0000 (361) 49.9000 (362)
pace heating from Combined Heat and Power	2851.20		598.7538 (363)
less credit emissions for electricity ater heating from Combined Heat and Power	-912.38 3371.01		-317.5106 (364) 707.9139 (365)
less credit emissions for electricity fficiency of heat source Boilers	-1078.72	59 0.3480	-375.3966 (366) 93.9000 (367)
pace and Water heating from Boilers	2619.20		252.0410 (368)
lectrical energy for heat distribution (space & water) verall CO2 factor for heat network	25.49	74 0.0000	8.2743 (372) 0.2106 (386)
otal CO2 associated with community systems pace and water heating			1172.0670 (373) 1172.0670 (376)
umps, fans and electric keep-hot	0.00		0.0000 (378)
nergy for lighting	217.38	94 0.1443	31.3760 (379)
Energy saving/generation technologies V Unit electricity used in dwelling	-380.73	94 0.1330	-50.6435
V Unit electricity exported	-235.25	0.1249	-29.3944 -80.0379 (380)
otal CO2, kg/year			1123.4051 (383)
PC Target Carbon Dioxide Emission Rate (TER)			11.2700 (384)
The state of the s		 gy Primary energy factor	Primary energy
Electrical efficiency of CHP unit	kWh/ye		kWh/year 32.0000 (461)
Heat efficiency of CHP unit	2054 ==	na	49.9000 (462)
pace heating from Combined Heat and Power less credit emissions for electricity	2851.20 -912.38		3221.8654 (463) -1960.7190 (464)
ater heating from Combined Heat and Power less credit emissions for electricity	3371.01 -1078.72	1.1300	
fficiency of heat source Boilers			93.9000 (467b
pace and Water heating from Boilers lectrical energy for heat distribution (space & water)	2619.20 25.49		1356.2209 (468) 86.2550 (472)
verall CO2 factor for heat network	25.45	0.0000	1.0420 (486)
otal CO2 associated with community systems pace and water heating			5798.1677 (473) 5798.1677 (476)
rumps, fans and electric keep-hot	0.00		0.0000 (478)
nergy for lighting	217.38	94 1.5338	333.4391 (479)
Energy saving/generation technologies			

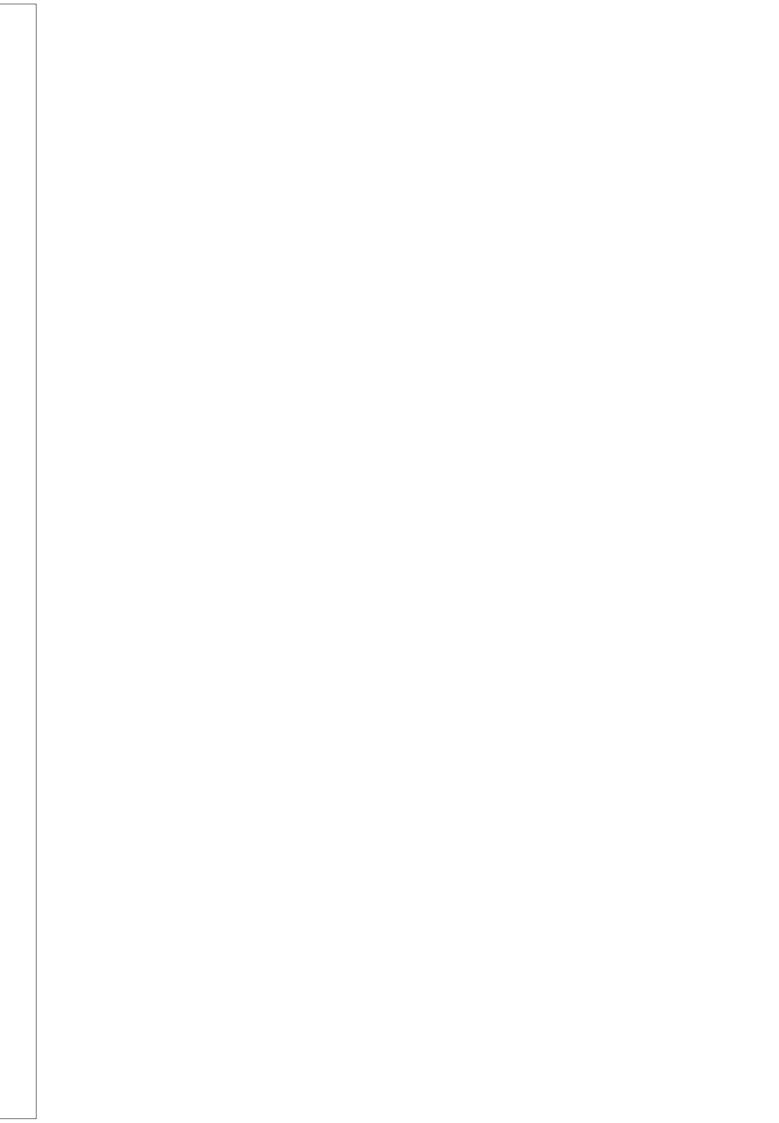


PV Unit electricity used in dwelling PV Unit electricity exported Total Total Primary energy kWh/year Target Primary Energy Rate (TPER)

-380.7394 -235.2509

1.4915 0.4586

-567.8750 -107.8861 -675.7611 (480) 5455.8456 (483) 54.7200 (484)





Property Reference		BH1+	+2 L03-6 03 x8_Co	ру					Issued	on Date	12/09	/2023	
Assessment Reference	9		+2 L03-6 03 x8_Co				Pro	p Type Ref					
Property													
SAP Rating				89) B	DER		8.87		TER	1	0.63	
Environmental				92	2 A	% DE	R < TER				1	6.56	
CO₂ Emissions (t/year)				0.8		DFEE		26.92		TFEE		6.50	
Compliance Check					ee BREL		EE < TFEE			T050		1.55	
% DPER < TPER		_		12	2.32	DPER		45.26		TPER	[5	1.62	
Assessor Details Client		Mr. Richard	Denteh							Assessor ID	į	J148 - 0001	
SAP 10 WORKSHEET ALCULATION OF DI						2022)							
Overall dwell: Ground floor Total floor area Owelling volume)+(1d)+(1e).	(1n)	11:	5.1000		Area (m2) 115.1000		y height (m) 2.7400 (. ,	Volume (m3) 315.3740	(1b (4)
2. Ventilation ra	ate										п	3 per hour	
Number of open cl Number of open f Number of chimne Number of flues a Number of flues a Number of blocke Number of interm Number of passiv Number of fluele	lues ys / flues attached t attached t d chimneys ittent ext e vents	o solid fu o other he ract fans	el boiler	re							0 * 80 = 0 * 20 = 0 * 10 = 0 * 20 = 0 * 35 = 0 * 20 = 0 * 10 = 0 * 10 = 0 * 40 =	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(6b (6c (6d (6e (6f (7a (7b
Infiltration due Pressure test Pressure Test Me Measured/design / Infiltration rato Number of sides :	thod AP50 e	ys, flues	and fans =	· (6a)+(6b)-	+(6c)+(6d)+(0	6e)+(6f)+(6	sg)+(7a)+(7b)+(7c) =		0.0000	/ (5) =	0.0000 Yes lower Door 3.0000 0.1500	(8)
Shelter factor Infiltration rate	e adjusted	to includ	e shelter fa	ictor					(20) = 1 - (21	[0.075 x) = (18) >		0.8500 0.1275	
Wind speed Wind factor Adj infilt rate	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	Sep 4.0000 1.0000	Oct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	
Balanced mechan: If mechanical ve If exhaust air ho If balanced with	ntilation eat pump u	sing Appen	dix N, (23b)	= (23a) x					0.1275	0.1371	0.1434	0.1498 0.5000 0.5000	(23
Effective ac	0.2986	0.2954	0.2922	0.2762	0.2731	0.2571	0.2571	0.2539	0.2635	0.2731	0.2794	72.8000 0.2858	
. Heat losses an			er	Gross	Openings			U-value	ΑχU	к-	-value	ΑxΚ	
window (Uw = 1.30 Front door	ð)			m2	m2	17.7	m2 7000 8000	W/m2K 1.2357 1.0000	W/K 21.8726 2.3000	ŀ	cJ/m2K	kJ/K	(27
External Wall 1			6	66.4724	20.0000	46.4	1724	0.1400	6.5061	196	0.000	8829.7560	(29

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Total net area Fabric heat los Party Wall 1 Party Floor 1 Party Ceiling 1 Internal Wall 1	s, W/K = S		Aum(A, m2)			65 115 115	.4724 (26)(.1000 .1000 .1000	30) + (32) = 0.0000	= 30.67 0.00	000 18 4 3	0.0000 0.0000	11718.0000 4604.0000 3453.0000 14550.0000	(32d) (32b)
Heat capacity C Thermal mass pa List of Thermal	rameter (T		TFA) in kJ/n	m2K				(28).	(30) + (3	2) + (32a).	(32e) =	43154.7560 374.9327	
K1 Elem E2 Othe E3 Sill E4 Jamb E7 Part E8 Balc E16 Cor E18 Par E17 Cor Thermal bridges	y floor be ony within ner (norma ty wall be ner (inver (Sum(L x	tween dwell a dwelling 1) tween dwell ted – inter	rnal area g	locks of flulation con	tinuous external a	rea)		11 7 27 48 3 5	ength .0400 .3400 .8800 .5200 .4600 .4800 .9600	Psi-value 0.0300 0.0300 0.0300 0.0700 0.0000 0.0900 0.0900 0.0000	Tot 0.33 0.22 0.83 3.39 0.00 0.49 0.65	12 02 64 64 00 32 76) (36)
Point Thermal b Total fabric he									(33) + (36)	(36a) = + (36a) =	0.0000 36.6138	
Ventilation hea	Jan 31.0724	culated mon Feb 30.7407	nthly (38)m Mar 30.4090	= 0.33 x () Apr 28.7503	25)m x (5) May 28.4185	Jun 26.7599	Jul 26.7599	Aug 26.4281	Sep 27.4233	0ct 28.4185	Nov 29.0820	Dec 29.7455	5 (38)
Heat transfer c Average = Sum(3	67.6862	67.3544	67.0227	65.3640	65.0323	63.3736	63.3736	63.0419	64.0371	65.0323	65.6958	66.3592 65.2811	
HLP	Jan 0.5881	Feb 0.5852	Mar 0.5823	Apr 0.5679	May 0.5650	Jun 0.5506	Jul 0.5506	Aug 0.5477	Sep 0.5564	Oct 0.5650	Nov 0.5708	Dec 0.5765	
HLP (average) Days in mont	31	28	31	30	31	30	31	31	30	31	30	0.5672 31	
4. Water heatin	cy)								2.8422	2 (42)
Hot water usage	98.8274	97.3422	95.1780	91.0372	87.9813	84.5735	82.6365	84.7843	87.1388	90.7977	95.0275	98.4487	' (42a
Hot water usage	32.6648	32.1797	31.4966	30.2370	29.2938	28.2479	27.6830	28.3614	29.1000	30.2191	31.5047	32.5544	(42b
Hot water usage Average daily h	46.0391	44.3649	42.6908 /day)	41.0166	39.3425	37.6683	37.6683	39.3425	41.0166	42.6908	44.3649	46.0391 163.2547	
Daily hot water	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
-	177.5313 281.1661	173.8868 247.6125	169.3653 260.3082	162.2908 222.1679	156.6176 210.8374	150.4898 185.0448	147.9879 178.9786	152.4883 188.8123	157.2554 193.9117	163.7076 222.1497 Total = S	170.8971 243.4742 um(45)m =	177.0422 277.2053 2711.6688	(45)
Distribution lo Water storage l	42.1749	= 0.15 x (4 37.1419	45)m 39.0462	33.3252	31.6256	27.7567	26.8468	28.3218	29.0868	33.3225	36.5211	41.5808	(46)
Store volume b) If manufac Hot water sto Volume factor Temperature f Enter (49) or (Total storage 1	rage loss from Tablactor from 54) in (55	factor from e 2a Table 2b			ay)							110.0000 0.0152 1.0294 0.6000 1.0327	2 (51) 4 (52) 9 (53)
If cylinder con	32.0144	28.9162 cated sola	32.0144 r storage	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(56)
Primary loss Combi loss	32.0144 23.2624 0.0000	28.9162 21.0112 0.0000	32.0144 23.2624 0.0000	30.9817 22.5120 0.0000	32.0144 23.2624 0.0000	30.9817 22.5120 0.0000	32.0144 23.2624 0.0000	32.0144 23.2624 0.0000	30.9817 22.5120 0.0000	32.0144 23.2624 0.0000	30.9817 22.5120 0.0000	32.0144 23.2624 0.0000	(59)
	336.4430 -74.9664 -0.0000 0.0000 0.0000	297.5400 -66.3009 -0.0000 0.0000	315.5850 -69.4264 -0.0000 0.0000	275.6616 -57.4878 -0.0000 0.0000 0.0000	266.1142 -53.5766 -0.0000 0.0000 0.0000	238.5385 -45.8459 -0.0000 0.0000	234.2554 -42.9732 -0.0000 0.0000 0.0000	244.0891 -45.6977 -0.0000 0.0000 0.0000	247.4054 -47.4339 -0.0000 0.0000	277.4265 -55.9193 -0.0000 0.0000 0.0000	296.9679 -63.3498 -0.0000 0.0000 0.0000	332.4821 -73.5781 -0.0000 0.0000 0.0000	(63a (63b (63c
Output from w/h 12Total per yea	261.4766	231.2391	246.1586	218.1738	212.5376	192.6926	191.2822	198.3914 Total pe	199.9715 er year (kW	221.5072 N/year) = S	233.6181 um(64)m =	258.9040 2665.9526 2666	
Electric shower		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	64a
Heat gains from		ting, kWh/r 122.2731		116.6658	al Energy u	104.3223	103.7318	lectric show	wer(s) (kwn 107.2706	118.0862	m(64a)m = 123.7501	0.0000 136.3922	
5. Internal gai			5a)										



	144.1344		144.1344	148.9388	144.1344	148.9388	144.1344	144.1344	148.9388	144.1344	148.9388	144.1344	(67)
Appliances ga	ins (calcula 278.6893	ated in App 281.5813	endix L, eq 274.2937	258.7794	or L13a), a 239. 1 953	ilso see Tab 220.7890	208.4925	205.6006	212.8882	228.4025	247.9866	266.3928	(68)
Cooking gains	(calculated 37.2111	d in Append: 37.2111	ix L, equat 37.2111	ion L15 or 37.2111	L15a), also 37.2111	see Table 37.2111	5 37.2111	37.2111	37.2111	37.2111	37.2111	37.2111	(69)
Pumps, fans Losses e.g. e	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
_	-113.6887	-113.6887		-113.6887	-113.6887	-113.6887	-113.6887	-113.6887	-113.6887	-113.6887	-113.6887	-113.6887	(71)
Water heating	185.0930	181.9540	175.7714	162.0358	153.6625	144.8921	139.4245	143.8193	148.9869	158.7180	171.8752	183.3229	(72)
Total interna	l gains 673.5499	688.7459	659.8327	635.3873	602.6254	580.2533	557.6846	559.1875	576.4472	596.8881	634.4338	659.4833	(73)
6. Solar gain	s												
[]an]			۸	rea	Solar flux	,	g		FF	Acce	ee	Gains	
[Jan]			A	m2	Table 6a	s Speci	g ific data	Specific	data	fact	or	W	
					W/m2		Table 6b	or Tab	le 6c	Table	6d		
East			17.7	000 	19.6403	} 	0.3300	0	.8000	0.77	00	63.6001	(76)
Solar gains	63.6001	124.4153	204.8942	298.8260	366.2225	374.8939	356.9143	306.5841	238.3005	147.6292	79.3018	52.3016	(83)
Total gains	737.1500	813.1611	864.7269	934.2133	968.8479	955.1472	914.5989	865.7716	814.7476	744.5173	713.7357	711.7849	
7. Mean inter	nal tomponat	tuno (hosti											
				ng anas £na		Th1 (C)						21 0000	(05)
Temperature d Utilisation f	actor for ga	ains for li	ving area,	ni1,m (see	Table 9a)			_	_			21.0000	(85)
tau	Jan 177.1031	Feb 177.9754	Mar 178.8563	Apr 183.3949	May 184.3304	Jun 189.1549	Jul 189.1549	Aug 190.1502	Sep 187.1951	0ct 184.3304	Nov 182.4688	Dec 180.6445	
alpha util living a	12.8069 rea	12.8650	12.9238	13.2263	13.2887	13.6103	13.6103	13.6767	13.4797	13.2887	13.1646	13.0430	
	0.9985	0.9937	0.9697	0.8308	0.6238	0.4246	0.3049	0.3350	0.5423	0.8773	0.9912	0.9990	(86)
MIT Th 2	20.7159 20.4408	20.8008 20.4434	20.9039 20.4460	20.9893 20.4590	20.9997 20.4616	21.0000 20.4747	21.0000 20.4747	21.0000 20.4773	21.0000 20.4694	20.9833 20.4616	20.8514 20.4564	20.7086 20.4512	
util rest of	house												
MIT 2	0.9979 20.1836	0.9911 20.2696	0.9586 20.3697	0.7989 20.4524	0.5879 20.4614	0.3898 20.4747	0.2685 20.4747	0.2969 20.4773	0.5006 20.4694	0.8427 20.4516	0.9870 20.3314	0.9985 20.1858	(90)
Living area f MIT	raction 20.3481	20.4338	20.5348	20.6183	20.6278	20.6370	20.6370	20.6388	fLA = 20.6334	Living are 20.6159	a / (4) = 20.4921	0.3090 20.3474	
Temperature a adjusted MIT	djustment 20.3481	20.4338	20.5348	20.6183	20.6278	20.6370	20.6370	20.6388	20.6334	20.6159	20.4921	0.0000 20.3474	(93)
8. Space heat	ing requirer	ment											
	Jan	Fab	Man	Ann	May	Jun	71	Aug	Fon	Oct	Nov	Dec	
Utilisation	Jan 0.9977	Feb 0.9910	Mar 0.9606	Apr 0.8085	May 0.5990	Jun 0.4006	Jul 0.2797	Aug 0.3087	Sep 0.5135	0.8531	0.9873	0.9984	
Useful gains Ext temp.	735.4891 4.3000	805.8636 4.9000	830.6459 6.5000	755.3479 8.9000	580.3362 11.7000	382.5866 14.6000	255.8402 16.6000	267.2234 16.4000	418.3530 14.1000	635.1644 10.6000	704.6892 7.1000	710.6299 4.2000	
Heat loss rat	e W 1086.2358	1046.2705	940.6484	765.9553	580.5944	382.5875	255.8402	267.2234	418.3786	651.3554	879.8064	1071.5279	(97)
Space heating		161.5535	81.8418	7.6374	0.1921	0.0000	0.0000	0.0000	0.0000	12.0461	126.0844	268.5081	(98a)
Space heating Solar heating	requirement		er year (kW	h/year)								918.8189	
Solar heating	0.0000	0.0000 on - total	0.0000 ner vear (k	0.0000 Wh/vear)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Space heating		161.5535	81.8418	7.6374	0.1921	0.0000	0.0000	0.0000	0.0000	12.0461	126.0844	268.5081	(096)
Space heating	requirement						0.0000	0.0000	0.0000			918.8189	
Space heating	per mz									(980) / (4) =	7.9828	(99)
9b. Energy re	quirements												
Fraction of s												0.0000	(301)
Fraction of s Fraction of h				and Power-S	nace and Wa	iter						1.0000 0.5580	
Fraction of h	eat from con	mmunity Boi	lers-Space	and Water	-							0.4420	(3031
Factor for co Factor for ch	arging metho	od (Table 4	c(3)) for w	ater heatin	g	ıng						1.0500 1.0500	(305
Distribution Efficiency of					g system							1.2500 0.0000	
Space heating Space heating	:												
Space heat fr	260.9555	161.5535	81.8418 nwer = (98)	7.6374 x 0.56 x 1	0.1921 05 x 1 25	0.0000	0.0000	0.0000	0.0000	12.0461	126.0844	268.5081	(98)
307a	191.1173	118.3177	59.9389	5.5934	0.1407	0.0000	0.0000	0.0000	0.0000	8.8223	92.3411	196.6486	
Space heat fr 307b	om Boilers : 151.3868	= (98) × 0.4 93.7212	44 x 1.05 x 47.4785	4.4306	0.1114	0.0000	0.0000	0.0000	0.0000	6.9883	73.1447	155.7683	

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342.5041 212.0389 107.4174 10.0240 0.2521 0.0000 0.00 Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0.0000	15.8106	165.4858	352.4169 (30 0.0000 (30
pace heating fuel for secondary/supplementary system 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00	0.0000	0.0000	0.0000	0.0000	0.0000 (30
ater heating nnual water heating requirement					
261.4766 231.2391 246.1586 218.1738 212.5376 192.6926 191.28 ater heat from Combined Heat and Power = (64) x 0.56 x 1.05 x 1.25	22 198.3914	199.9715	221.5072	233.6181	258.9040 (64
10a 191.4989 169.3537 180.2804 159.7850 155.6572 141.1232 140.09	03 145.2969	146.4541	162.2263	171.0960	189.6148
ater heat from Boilers = (64) x 0.44 x 1.05 x 1.25 10b	76 115.0918	116.0084	128.5018	135.5277	150.1967
ater heating fuel 343.1880 303.5013 323.0831 286.3531 278.9556 252.9090 251.05	78 260.3888	262.4625	290.7281	306.6237	339.8115 (31
ooling System Energy Efficiency Ratio bace coolin	0.0000	0.0000	0.0000	0.0000	0.0000 (31 0.0000 (31
umps and Fa 22.8746 20.6609 22.8746 22.1367 22.8746 22.1367 22.87	46 22.8746	22.1367	22.8746	22.1367	22.8746 (33
ighting 26.4795 21.2429 19.1269 14.0132 10.8242 8.8434 9.87 lectricity generated by PVs (Appendix M) (negative quantity)		16.6712	21.8735	24.7060	27.2155 (33
333a)m -10.0755 -15.7558 -25.1537 -31.5257 -36.9721 -35.6457 -35.18 Lectricity generated by wind turbines (Appendix M) (negative quantity)	60 -31.6607	-26.0854	-19.2985	-11.6054	-8.5373 (33
334a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.000	0.0000	0.0000	0.0000	0.0000	0.0000 (33
335a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.000	0.0000	0.0000	0.0000	0.0000	0.0000 (33
lectricity generated by PVs (Appendix M) (negative quantity) 333b)m	0.0000	0.0000	0.0000	0.0000	0.0000 (33
lectricity generated by wind turbines (Appendix M) (negative quantity) 334b)m	0.0000	0.0000	0.0000	0.0000	0.0000 (33
Lectricity generated by hydro-electric generators (Appendix M) (negative quantity) 335b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00	0.0000	0.0000	0.0000	0.0000	0.0000 (33
nual totals kWh/year	0.0000	0.0000	0.0000	0.0000	`
pace heating fuel - community heating pace heating fuel - secondary					1205.9498 (30 0.0000 (30
ater heating fuel - community heating Fficiency of water heater					3499.0627 (31 0.0000 (31
lectricity used for heat distribution pace cooling fuel					12.0595 (31 0.0000 (32
·					0.0000 (32
lectricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7000)					
mechanical ventilation fans (SFP = 0.7000) otal electricity for the above, kWh/year					269.3294 (33 269.3294 (33
lectricity for lighting (calculated in Appendix L)					213.7051 (33
nergy saving/generation technologies (Appendices M ,N and Q)					207 5047 (22
V generation ind generation					-287.5017 (33 0.0000 (33
ydro-electric generation (Appendix N) lectricity generated - Micro CHP (Appendix N)					0.0000 (33 0.0000 (33
ppendix Q - special features					
nergy saved or generated nergy used					-0.0000 (33 0.0000 (33
otal delivered energy for all uses					4900.5453 (33
2b. Carbon dioxide emissions - Community heating scheme					
	Enongy	Emico	ion factor		Emissions
	Energy kWh/year		kg CO2/kWh	k	g CO2/year
	, , ca.				
	, year				32.0000 (36 49.9000 (36
eat efficiency of CHP unit bace heating from Combined Heat and Power	1348.5370		0.2100		32.0000 (36 49.9000 (36 283.1928 (36
eat efficiency of CHP unit Dace heating from Combined Heat and Power Less credit emissions for electricity Otter heating from Combined Heat and Power	1348.5370 -431.5318 3912.7796		0.2100 0.3480 0.2100		32.0000 (36 49.9000 (36 283.1928 (36 -150.1731 (36 821.6837 (36
eat efficiency of CHP unit pace heating from Combined Heat and Power less credit emissions for electricity ster heating from Combined Heat and Power less credit emissions for electricity	1348.5370 -431.5318		0.3480		32.0000 (36 49.9000 (36 283.1928 (36 -150.1731 (36 821.6837 (36 -435.7271 (36
eat efficiency of CHP unit bace heating from Combined Heat and Power less credit emissions for electricity bater heating from Combined Heat and Power less credit emissions for electricity fficiency of heat source Boilers bace and Water heating from Boilers	1348.5370 -431.5318 3912.7796 -1252.0895 2214.7130		0.3480 0.2100 0.3480 0.2100		32.0000 (36 49.9000 (36 283.1928 (36 -150.1731 (36 821.6837 (36 -435.7271 (36 93.9000 (36 119.2079 (36
eat efficiency of CHP unit pace heating from Combined Heat and Power Less credit emissions for electricity ster heating from Combined Heat and Power Less credit emissions for electricity fficiency of heat source Boilers pace and Water heating from Boilers Lectrical energy for heat distribution (space & water) verall CO2 factor for heat network	1348.5370 -431.5318 3912.7796 -1252.0895		0.3480 0.2100 0.3480		32.0000 (36 49.9000 (36 283.1928 (36 -150.1731 (36 821.6837 (36 -435.7271 (36 93.9000 (36
eat efficiency of CHP unit bace heating from Combined Heat and Power less credit emissions for electricity bater heating from Combined Heat and Power less credit emissions for electricity fficiency of heat source Boilers bace and Water heating from Boilers lectrical energy for heat distribution (space & water) breall CO2 factor for heat network botal CO2 associated with community systems	1348.5370 -431.5318 3912.7796 -1252.0895 2214.7130		0.3480 0.2100 0.3480 0.2100		32,0000 (36 49,9000 (36 283,1928 (36 -150,1731 (36 821,6837 (36 -435,7271 (36 93,9000 (36 119,2079 (36 6,8457 (37 0,2106 (38 990,9117 (37
eat efficiency of CHP unit lace heating from Combined Heat and Power less credit emissions for electricity liter heating from Combined Heat and Power less credit emissions for electricity lefficiency of heat source Boilers lace and Water heating from Boilers lectrical energy for heat distribution (space & water) lectrical energy for heat network lectrical co2 associated with community systems lace and water heating limps, fans and electric keep-hot	1348.5370 -431.5318 3912.7796 -1252.0895 2214.7130 12.0595		0.3480 0.2100 0.3480 0.2100 0.0000		32.0000 (36 49.9000 (36 283.1928 (36 -150.1731 (36 821.6837 (36 93.9000 (36 119.2079 (36 6.8457 (37 0.2106 (38 990.9117 (37 990.9117 (37 37.3593 (37
eat efficiency of CHP unit was heating from Combined Heat and Power less credit emissions for electricity eter heating from Combined Heat and Power less credit emissions for electricity efficiency of heat source Boilers was and Water heating from Boilers lectrical energy for heat distribution (space & water) ereall CO2 factor for heat network that CO2 associated with community systems was and water heating emps, fans and electric keep-hot energy for lighting	1348.5370 -431.5318 3912.7796 -1252.0895 2214.7130 12.0595		0.3480 0.2100 0.3480 0.2100 0.0000		32.0000 (36 49.9000 (36 283.1928 (36 -150.1731 (36 821.6837 (36 -435.7271 (36 93.9000 (36 119.2079 (36 6.8457 (37 6.2106 (38 990.9117 (37
eat efficiency of CHP unit bace heating from Combined Heat and Power less credit emissions for electricity less credit emissions for electricity less credit emissions for electricity ficiency of heat source Boilers bace and Water heating from Boilers lectrical energy for heat distribution (space & water) lectrical energy for heat network lectrical energy for lighting lenergy saving/generation technologies lenergy saving/generation technologies lenergy for lighting	1348.5370 -431.5318 3912.7796 -1252.0895 2214.7130 12.0595 269.3294 213.7051		0.3480 0.2100 0.3480 0.2100 0.0000 0.1387 0.1443		32.0000 (36 49.9000 (36 283.1928 (36 -150.1731 (36 821.6837 (36 -435.7271 (36 93.9000 (36 119.2079 (36 6.8457 (37 0.2106 (38 990.9117 (37 990.9117 (37 37.3593 (37 30.8443 (37
eat efficiency of CHP unit bace heating from Combined Heat and Power less credit emissions for electricity leter heating from Combined Heat and Power less credit emissions for electricity leficiency of heat source Boilers leace and Water heating from Boilers lectrical energy for heat distribution (space & water) leverall CO2 factor for heat network letal CO2 associated with community systems leace and water heating lemps, fans and electric keep-hot levery for lighting lenergy saving/generation technologies level Unit electricity used in dwelling level Unit electricity exported	1348.5370 -431.5318 3912.7796 -1252.0895 2214.7130 12.0595 269.3294 213.7051		0.3480 0.2100 0.3480 0.2100 0.0000 0.1387 0.1443		32.0000 (36 49.9000 (36 283.1928 (36 -150.1731 (36 821.6837 (36 -435.7271 (36 93.9000 (36 119.2079 (36 6.8457 (37 0.2106 (38 990.9117 (37 37.3593 (37 37.3593 (37 30.8443 (37
eat efficiency of CHP unit bace heating from Combined Heat and Power less credit emissions for electricity less credit emissions for electricity less credit emissions for electricity fficiency of heat source Boilers lectrical energy for heat distribution (space & water) lectrical energy for heat distribution (space & water) lectrical energy for heat network lectrical co2 associated with community systems leace and water heating lumps, fans and electric keep-hot lergy for lighting lenergy saving/generation technologies / Unit electricity used in dwelling / Unit electricity exported lotal lotal CO2, kg/year	1348.5370 -431.5318 3912.7796 -1252.0895 2214.7130 12.0595 269.3294 213.7051		0.3480 0.2100 0.3480 0.2100 0.0000 0.1387 0.1443		32.0000 (36 49.9000 (36 283.1928 (36 -150.1731 (36 821.6837 (36 93.9000 (36 119.2079 (36 6.8457 (37 0.2106 (38 990.9117 (37 37.3593 (37 37.3593 (37 30.8443 (37 -38.0804 0.0000 -38.0804 (38 1021.0349 (38
Part efficiency of CHP unit wace heating from Combined Heat and Power ess credit emissions for electricity ter heating from Combined Heat and Power ess credit emissions for electricity efficiency of heat source Boilers wace and Water heating from Boilers ectrical energy for heat distribution (space & water) ereall CO2 factor for heat network that CO2 associated with community systems wace and water heating emps, fans and electric keep-hot energy for lighting energy saving/generation technologies Unit electricity used in dwelling Unit electricity exported that OC2, kg/year	1348.5370 -431.5318 3912.7796 -1252.0895 2214.7130 12.0595 269.3294 213.7051		0.3480 0.2100 0.3480 0.2100 0.0000 0.1387 0.1443		32.0000 (36 49.9000 (36 283.1928 (36 -150.1731 (36 821.6837 (36 -39.9000 (36 119.2079 (36 6.8457 (37 0.2106 (38 990.9117 (37 990.9117 (37 37.3593 (37 30.8443 (37
eat efficiency of CHP unit bace heating from Combined Heat and Power Less credit emissions for electricity leter heating from Combined Heat and Power Less credit emissions for electricity efficiency of heat source Boilers lace and Water heating from Boilers Lectrical energy for heat distribution (space & water) Lectrical energy for heat network letal CO2 factor for heat network letal CO2 associated with community systems lace and water heating lamps, fans and electric keep-hot lenergy for lighting Energy saving/generation technologies V Unit electricity used in dwelling V Unit electricity exported latal latal CO2, kg/year C Dwelling Carbon Dioxide Emission Rate (DER)	1348.5370 -431.5318 3912.7796 -1252.0895 2214.7130 12.0595 269.3294 213.7051 -287.5017 0.0000		0.3480 0.2100 0.3480 0.2100 0.0000 0.1387 0.1443		32.0000 (36 49.9000 (36 283.1928 (36 -150.1731 (36 821.6837 (36 93.9000 (36 119.2079 (36 6.8457 (37 0.2106 (38 990.9117 (37 37.3593 (37 37.3593 (37 30.8443 (37 -38.0804 0.0000 -38.0804 (38 1021.0349 (38
eat efficiency of CHP unit bace heating from Combined Heat and Power less credit emissions for electricity ster heating from Combined Heat and Power less credit emissions for electricity efficiency of heat source Boilers bace and Water heating from Boilers lectrical energy for heat distribution (space & water) verall CO2 factor for heat network btal CO2 associated with community systems bace and water heating sumps, fans and electric keep-hot lergy for lighting energy saving/generation technologies v Unit electricity used in dwelling v Unit electricity exported btal btal CO2, kg/year by Dwelling Carbon Dioxide Emission Rate (DER) Obs. Primary energy - Community heating scheme	1348.5370 -431.5318 3912.7796 -1252.0895 2214.7130 12.0595 269.3294 213.7051 -287.5017 0.0000	Primary ene	0.3480 0.2100 0.3480 0.2100 0.0000 0.1387 0.1443 0.1325 0.0000	Prim	32.0000 (36 49.9000 (36 283.1928 (36 -150.1731 (36 821.6837 (36 93.9000 (36 119.2079 (36 6.8457 (37 0.2106 (38 990.9117 (37 37.3593 (37 37.3593 (37 30.8443 (37 -38.0804 0.0000 -38.0804 (38 1021.0349 (38
eat efficiency of CHP unit pace heating from Combined Heat and Power less credit emissions for electricity after heating from Combined Heat and Power less credit emissions for electricity fficiency of heat source Boilers pace and Water heating from Boilers lectrical energy for heat distribution (space & water) verall CO2 factor for heat network otal CO2 associated with community systems pace and water heating umps, fans and electric keep-hot nergy for lighting Energy saving/generation technologies V Unit electricity used in dwelling V Unit electricity exported otal otal CO2, kg/year PC Dwelling Carbon Dioxide Emission Rate (DER) Bb. Primary energy - Community heating scheme	1348.5370 -431.5318 3912.7796 -1252.0895 2214.7130 12.0595 269.3294 213.7051 -287.5017 0.0000	-	0.3480 0.2100 0.3480 0.2100 0.0000 0.1387 0.1443 0.1325 0.0000	Prim	32.0000 (36 49.9000 (36 283.1928 (36 283.1928 (36 -150.1731 (36 821.6837 (36 -435.7271 (36 93.9000 (36 119.2079 (36 6.8457 (37 0.2106 (38 990.9117 (37 990.9117 (37 37.3593 (37 30.8443 (37 -38.0804 (38 1021.0349 (38 8.8700 (38
lectrical efficiency of CHP unit eat efficiency of CHP unit pace heating from Combined Heat and Power less credit emissions for electricity ater heating from Combined Heat and Power less credit emissions for electricity fficiency of heat source Boilers pace and Water heating from Boilers lectrical energy for heat distribution (space & water) verall CO2 factor for heat network otal CO2 associated with community systems pace and water heating umps, fans and electric keep-hot nergy for lighting Energy saving/generation technologies V Unit electricity used in dwelling V Unit electricity exported otal otal CO2, kg/year PC Dwelling Carbon Dioxide Emission Rate (DER) 3b. Primary energy - Community heating scheme lectrical efficiency of CHP unit eat efficiency of CHP unit eat efficiency of CHP unit pace heating from Combined Heat and Power	1348.5370 -431.5318 3912.7796 -1252.0895 2214.7130 12.0595 269.3294 213.7051 -287.5017 0.0000	-	0.3480 0.2100 0.3480 0.2100 0.0000 0.1387 0.1443 0.1325 0.0000	Prim	32.0000 (36 49.9000 (36 283.1928 (36 -150.1731 (36 821.6837 (36 -435.7271 (36 93.9000 (36 119.2079 (36 6.8457 (37 0.2106 (38 990.9117 (37 990.9117 (37 37.3593 (37 30.8443 (37 -38.0804 0.0000 -38.0804 (38 1021.0349 (38 8.8700 (38



TER Opening Type External Wall 1	(Uw = 1.2)			66.4724	20.0000	46.4	7000 1724 1724	1.1450 0.1800	20.2672 8.3650				(27) (29a) (31)
3. Heat losses a Element TER Opaque door	nd heat lo	ss paramete	er	Gross m2	Openings m2	Net/	Area m2 3000	U-value W/m2K 1.0000	A x U W/K 2.3000		-value kJ/m2K	A x I kJ/I	K (26)
Effective ac	0.4084 0.5834	0.4004 0.5802	0.3924 0.5770	0.3523 0.5621	0.3443 0.5593	0.3043 0.5463	0.3043 0.5463	0.2963 0.5439	0.3203 0.5513	0.5593	0.36 0.56		4 (22b) 8 (25)
Wind speed Wind factor Adj infilt rate	Jan 5.1000 1.2750 0.4084	Feb 5.0000 1.2500 0.4004	Mar 4.9000 1.2250 0.3924	Apr 4.4000 1.1000 0.3523	May 4.3000 1.0750 0.3443	Jun 3.8000 0.9500 0.3043	Jul 3.8000 0.9500 0.3043	Aug 3.7000 0.9250 0.2963	Sep 4.0000 1.0000 0.3203	Oct 4.3000 1.0750 0.3443	Nov 4.50 1.12 0.36	50 1.1756	0 (22) 0 (22a) 4 (22b)
Shelter factor Infiltration rat	e adjusted	to include	e shelter fa	actor					(20) = 1 - (21)	[0.075 x = (18)			0 (20) 3 (21)
Infiltration due Pressure test Pressure Test Me Measured/design Infiltration rat Number of sides	thod AP50 e	ys, flues a	and fans =	= (6a)+(6b)	+(6c)+(6d)+(6e)+(6f)+(бg)+(7а)+(7	7b)+(7c) =		40.0000	Air cha / (5) =	Yes Blower Door 5.0000 0.3768	8 (8) s
Number of open of Number of open f Number of chimne Number of flues Number of flues Number of blocke Number of interm Number of passiv Number of fluele	lues ys / flues attached t attached t d chimneys ittent ext e vents	o solid fue o other hea ract fans	el boiler	ire							0 * 80 0 * 20 0 * 10 0 * 20 0 * 35 0 * 20 4 * 10 0 * 10 0 * 40	= 0.0006 = 0.0006 = 0.0006 = 0.0006 = 0.0006 = 0.0006 = 0.0006	0 (6b) 0 (6c) 0 (6d) 0 (6e) 0 (6f) 0 (7a) 0 (7b) 0 (7c)
2. Ventilation r												m3 per hou	r
Ground floor Total floor area Dwelling volume	TFA = (1a)+(1b)+(1c))+(1d)+(1e).	(1n)	11	5.1000		Area (m2) 115.1000		height (m) 2.7400 3d)+(3e)	. ,	Volume (m3) = 315.3746 = 315.3746) 0 (1b) (4)
1. Overall dwell		teristics											
SAP 10 WORKSHEET CALCULATION OF T	FOR New B	uild (As De SIONS	esigned) (Version 10		2022)							
Energy saving/g PV Unit electric PV Unit electric Total Total Primary er Dwelling Primary	ity used i ity export ergy kWh/y	n dwelling ed ear						-287.5017 0.0000		1.4894 0.0000		-428.2046 0.0006 -428.2046 5209.2066 45.2606	0 6 (480 0 (483
Total CO2 associ Space and water Pumps, fans and Energy for light	ated with heating electric k	community s	systems					269.3294 213.7051		1.5128 1.5338		4902.1812 4902.1812 407.4415 327.7882	1 (473 1 (476 5 (478
Efficiency of he Space and Water Electrical energ Overall CO2 fact	heating fr y for heat	om Boilers distributi	ion (space 8	water)				2214.7130 12.0595		1.1300 0.0000		93.9000 641.4523 72.3698 1.0419	3 (468 8 (472
Water heating fr less credit emi	ssions for	electricit					-	3912.7796 -1252.0895		1.1300 2.1490		-2690.7402	

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Full SAP Calculation Printout



K1 Eler	ment								ength	Psi-value	Tot	·al	
		(including	other stee	l lintels)					ength .0400	0.0500	0.55		
E3 Sil	1	`	•	,				7	.3400	0.0500	0.36	570	
E4 Jaml			lines (in h	10 also a.C. 61	-+->				.8800	0.0500	1.39		
			lings (in b g, wall ins						.5200 .4600	0.0700 0.0000	3.39 0.00		
	rner (norma		6,						.4800	0.0900	0.49	32	
	rty wall be								.9600	0.0600 -0.0900	0.65 -0.24		
Thermal bridge			rnal area g lated using			ai ea)		2	.7400	-0.0300	-0.24	6.6136	(36)
Point Thermal I										/\	(36a) =	0.0000	
Total fabric he	eat loss									(33) + (36)	+ (36a) =	37.5458	(37)
Ventilation hea													
(38)m	Jan 60.7157	Feb 60.3786	Mar 60.0483	Apr 58.4967	May 58.2064	Jun 56.8550	Jul 56.8550	Aug 56.6048	Sep 57.3755	0ct 58.2064	Nov 58.7937	Dec 59.4076	(38)
Heat transfer		00.3700	00.0403	30.4307	30.2004	50.0550	50.0550	30.0040	37.37	30.2004	50.7557	33.4070	(30)
A	98.2615	97.9245	97.5941	96.0425	95.7522	94.4008	94.4008	94.1506	94.9214	95.7522	96.3395	96.9535	
Average = Sum(39)111 / 12 =	•										96.0411	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	(40)
HLP (average)	0.8537	0.8508	0.8479	0.8344	0.8319	0.8202	0.8202	0.8180	0.8247	0.8319	0.8370	0.8423 0.8344	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	
4. Water heati													
Assumed occupai	•											2.8422	(42)
Hot water usage	e for mixer 71.8744	showers 70.7943	69.2203	66.2088	63.9864	61.5080	60.0993	61.6613	63.3736	66.0347	69.1109	71.5991	(42a
Hot water usage	e for baths	5											
Hot water usage	31.0316 e for other	30.5707 uses	29.9217	28.7251	27.8291	26.8355	26.2989	26.9433	27.6450	28.7082	29.9294	30.9267	(42b)
not mater asage	43.7371	42.1467	40.5563	38.9658	37.3754	35.7849	35.7849	37.3754	38.9658	40.5563	42.1467	43.7371	(42c
Average daily I	hot water u	ıse (litres	/day)									134.7980	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
Daily hot water	r use 146.6432	143.5117	139.6983	133.8998	129.1909	124.1285	122.1831	125.9801	129.9845	135.2991	141.1870	146 2620	(44)
Energy conte	232.2469	204.3588	214.7111	183.3021	173.9158	152.6305	147.7699	155.9896	160.2839	183.5996	201.1468	146.2629 229.0123	
Energy content										Total = S	um(45)m =	2238.9673	
Distribution lo	oss (46)m 34.8370	= 0.15 x (45)m 32.2067	27.4953	26.0874	22.8946	22.1655	23.3984	24.0426	27.5399	30.1720	34.3518	(46)
Water storage													
Store volume b) If manufac	cturer decl	ared loss	factor is n	ot known :								0.0000	(47)
Hot water st	orage loss	factor fro			lay)							1.4400	
Volume factor Temperature												0.0000 1.0000	
Enter (49) or												1.4400	
Total storage :		40 2200	44 6400	42 2000	44 6400	42 2000	44 6400	44 6400	42 2000	44.6400	43.2000	44 6400	(56)
If cylinder co	44.6400 ntains dedi	40.3200 cated sola	44.6400 ir storage	43.2000	44.6400	43.2000	44.6400	44.6400	43.2000	44.6400	43.2000	44.6400	(30)
•	44.6400	40.3200	44.6400	43.2000	44.6400	43.2000	44.6400	44.6400	43.2000	44.6400	43.2000	44.6400	
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	
Combi loss Total heat requ	0.0000 uired for w	0.0000 water heati	0.0000 ng calculat	0.0000 ed for each	0.0000 month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
	276.8869	244.6788	259.3511	226.5021	218.5558	195.8305	192.4099	200.6296	203.4839	228.2396	244.3468	273.6523	
WWHRS PV diverter	-32.8580 -0.0000	-29.0599 -0.0000	-30.4298 -0.0000	-25.1971 -0.0000	-23.4828 -0.0000	-20.0944 -0.0000	-18.8353 -0.0000	-20.0294 -0.0000	-20.7904 -0.0000	-24.5096 -0.0000	-27.7664 -0.0000	-32.2495 -0.0000	
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	
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	
Output from w/l	n 244.0289	215.6189	228.9213	201.3050	195.0730	175.7361	173.5746	180.6002	182.6934	203.7300	216.5803	241.4028	(64)
										Nh/year) = S		2459.2646	(64)
12Total per year Electric shower		ar)										2459	(64)
22000.20 3110110.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	•
Heat gains from	m water hea	ting kWh/	month	Tot	al Energy u	used by inst	antaneous e	electric sho	wer(s) (kW	n/year) = Su	ım(64a)m =	0.0000	(64a)
neac gains ino	112.9341		107.1035	95.5079	93.5390	85.3096	84.8455	87.5786	87.8544	96.7589	101.4413	111.8586	(65)
5. Internal gas	inc (coo Ta	hle 5 and											
ga													
Metabolic gain			M			7	21		C	0-+	N	D	
(66)m	Jan 142.1108	Feb 142.1108	Mar 142.1108	Apr 142.1108	May 142.1108	Jun 142.1108	Jul 142.1108	Aug 142.1108	Sep 142.1108	0ct 142.1108	Nov 142.1108	Dec 142.1108	(66)
Lighting gains	(calculate	ed in Appen	ıdix L, equa	tion L9 or	L9a), also	see Table 5	;						
Appliances gain			147.8272 endix en		147.8272 or [13a] a		147.8272	147.8272	152.7548	147.8272	152.7548	147.8272	(67)
_	278.6893	281.5813	274.2937	258.7794	239.1953	220.7890	208.4925	205.6006	212.8882	228.4025	247.9866	266.3928	(68)
Cooking gains		in Append 37.2111	lix L, equat: 37.2111					27 2111	37 2111	27 2111	37.2111	27 2111	(60)
Pumps, fans	37.2111 0.0000	0.0000	0.0000	37.2111 0.0000	37.2111 0.0000	37.2111 0.0000	37.2111 0.0000	37.2111 0.0000	37.2111 0.0000	37.2111 0.0000	0.0000	37.2111 0.0000	
Losses e.g. ev	aporation (negative v	alues) (Tab	le 5)									
Water heating p			-113.6887	-113.6887	-113.6887	-113.6887	-113.6887	-113.6887	-113.6887	-113.6887	-113.6887	-113.6887	(71)
newering (151.7932		143.9563	132.6499	125.7245	118.4856	114.0396	117.7131	122.0200	130.0523	140.8907	150.3476	(72)



Total internal gains
643.9429 659.9953 631.7104 609.8173 578.3802 557.6627 535.9926 536.7741 553.2962 571.9152 607.2653 630.2008 (73)

													(,,,
6. Solar gain													
[Jan]			A	krea m2	Solar flux Table 6a W/m2	Speci	g ific data Table 6b	Specific or Tab		Acce fact Table	or	Gains W	
East			17.7	000	19.6403		0.6300	0	.7000	0.77	'00	106.2411	(76)
Solar gains Total gains	106.2411 750.1840	207.8301 867.8254	342.2665 973.9769	499.1753 1108.9926	611.7581 1190.1382	626.2432 1183.9059	596.2091 1132.2017	512.1348 1048.9089	398.0701 951.3663	246.6079 818.5231	132.4701 739.7354	87.3675 717.5683	
7. Mean inter	nal temperat	ure (heati											
Temperature d Utilisation fa	actor for ga	ins for li	in the livi ving area,	ni1,m (see	m Table 9, Table 9a)	Th1 (C)			6	0.1		21.0000	(85)
tau alpha	Jan 125.2490 9.3499	Feb 125.6801 9.3787	Mar 126.1055 9.4070	Apr 128.1428 9.5429	May 128.5313 9.5688	Jun 130.3713 9.6914	Jul 130.3713 9.6914	Aug 130.7178 9.7145	Sep 129.6563 9.6438	0ct 128.5313 9.5688	Nov 127.7478 9.5165	Dec 126.9388 9.4626	
util living a	nea 0.9996	0.9983	0.9905	0.9249	0.7359	0.5099	0.3668	0.4129	0.6825	0.9688	0.9984	0.9998	(86)
MIT Th 2 util rest of	20.3955 20.2070	20.5180 20.2095	20.6942 20.2120	20.9072 20.2236	20.9900 20.2258	20.9997 20.2359	21.0000 20.2359	21.0000 20.2378	20.9961 20.2320	20.8620 20.2258	20.5916 20.2214	20.3807 20.2168	` '
MIT 2 Living area f	0.9995 19.4990	0.9975 19.6578	0.9858 19.8826	0.8961 20.1417	0.6800 20.2196	0.4493 20.2358	0.3032 20.2359	0.3445 20.2378	0.6097 20.2303 fl A =	0.9497 20.0998 Living are	0.9975 19.7622	0.9996 19.4882 0.3090	(90)
MIT Temperature adjusted MIT	19.7760	19.9236 19.9236	20.1334	20.3783	20.4577	20.4719	20.4720	20.4733	20.4669	20.3353	20.0185	19.7640 0.0000 19.7640	(92)
8. Space heat:	ing requiren	 ient											
o. Space Heat.													
Utilisation Useful gains Ext temp.	Jan 0.9993 749.6700 4.3000	Feb 0.9971 865.2946 4.9000	Mar 0.9852 959.5413 6.5000	Apr 0.9024 1000.7868 8.9000	May 0.6971 829.6584 11.7000	Jun 0.4680 554.1198 14.6000	Jul 0.3228 365.5179 16.6000	Aug 0.3656 383.4907 16.4000	Sep 0.6323 601.5628 14.1000	0ct 0.9530 780.0193 10.6000	Nov 0.9971 737.6030 7.1000	Dec 0.9995 717.2364 4.2000	(95)
Heat loss rate	1520.6976	1471.1783	1330.5401	1102.4025	838.5668	554.3085	365.5222	383.5046	604.3582	932.1773	1244.5645	1508.9874	(97)
Space heating Space heating	573.6445 requirement	407.1538 - total p	276.0231 per year (kw	73.1633 lh/year)	6.6278	0.0000	0.0000	0.0000	0.0000	113.2055	365.0123	589.0628 2403.8932	
Solar heating Solar heating	0.0000 contributio	0.0000 on - total	0.0000 per year (k	0.0000 Wh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000	•
Space heating Space heating Space heating	573.6445 requirement	407.1538 after sol	276.0231 ar contribu	73.1633 ution – tota	6.6278 1 per year	0.0000 (kWh/year)	0.0000	0.0000	0.0000	113.2055	365.0123 () / (4) =	589.0628 2403.8932 20.8853	
9b. Energy re													
Fraction of spraction of spraction of he fraction of he factor for confactor for challenger for challenger for challenger for challenger for challenger for challenger for space heating	pace heat freat from coneat from con ntrol and charging metholoss factor secondary/s	rom communi nmunity Com nmunity Boi narging met od (Table 4 (Table 120	ty system blined Heat lers-Space hod (Table c(3)) for w	and Power-S and Water 4c(3)) for water heating	pace and Wa space heati g	ter						0.0000 1.0000 0.5580 0.4420 1.0000 1.2500 0.0000	(302 (303 (303 (305 (305 (306
Space heating Space heat fro	573.6445	407.1538	276.0231 Power = (98)	73.1633 x 0.56 x 1	6.6278 .00 x 1.25	0.0000	0.0000	0.0000	0.0000	113.2055	365.0123	589.0628	(98)
307a Space heat fro	400.1171 om Boilers =	283.9898 (98) x 0.	192.5261	51.0314	4.6229	0.0000	0.0000	0.0000	0.0000	78.9608	254.5961	410.8713	
307b Space heating	316.9386 requirement 717.0557	224.9525 508.9423	152.5028 345.0289	40.4227 91.4541	3.6619 8.2848	0.0000	0.0000	0.0000	0.0000	62.5460 141.5069	201.6693 456.2654	325.4572 736.3285	
Efficiency of Space heating	secondary/s	upplementa			(from Tabl	e 4a or App 0.0000	oendix E) 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(308
Water heating Annual water I Water heat fro	heating requ 244.0289	uirement 215.6189	228.9213	201.3050	195.0730	175.7361	173.5746	180.6002	182.6934	203.7300	216.5803	241.4028	

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				1	ener	9у	
310a 170.2102 150.3942 159.6726 140.4102 136.0634 122.575	9 121.0683	125.9686	127.4287	142.1017	151.0648	168.3785	
Water heat from Boilers = (64) x 0.44 x 1.00 x 1.25 310b 134.8260 119.1294 126.4790 111.2210 107.7778 97.094	2 95.9000	99.7816	100.9381	112.5608	119.6606	133.3751	
Water heating fuel 305.0362 269.5236 286.1516 251.6312 243.8412 219.670	1 216.9682	225.7502	228.3668	254.6625	270.7254	301.7535	
ooling System Energy Efficiency Ratio pace coolin 0.0000 0.0000 0.0000 0.0000 0.0000 0.000		0.0000	0.0000	0.0000	0.0000	0.0000 0.0000	(315)
umps and Fa		0.0000 14.8880	0.0000 19.3381	0.0000 25.3726	0.0000 28.6583	0.0000 31.5692	
Lectricity generated by PVs (Appendix M) (negative quantity) 333a)m -16.5497 -25.1592 -38.9454 -47.2409 -54.0009 -51.493		-46.4351	-39.2880	-30.2018	-18.8204	-14.1011	
Lectricity generated by wind turbines (Appendix M) (negative quantity)		0.0000	0.0000	0.0000	0.0000	0.0000	
lectricity generated by hydro-electric generators (Appendix M) (negative qua	ntity)						
lectricity generated by PVs (Appendix M) (negative quantity)		0.0000	0.0000	0.0000	0.0000	0.0000	
333b)m -4.5164 -9.8175 -20.1352 -31.2002 -42.2420 -42.850 lectricity generated by wind turbines (Appendix M) (negative quantity)		-35.4554	-25.4066	-14.3804	-6.1326	-3.5507	
334b)m 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00000 0.000		0.0000	0.0000	0.0000	0.0000	0.0000	(3341
335b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 nnual totals kWh/year	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335b
pace heating fuel - community heating pace heating fuel - secondary						3004.8665 0.0000	
ater heating fuel - community heating						3074.0807	(310)
fficiency of water heater lectricity used for heat distribution						0.0000 30.0487	(313)
pace cooling fuel						0.0000	(321)
lectricity for pumps and fans: otal electricity for the above, kWh/year						0.0000	(331)
lectricity for lighting (calculated in Appendix L)						247.8922	
nergy saving/generation technologies (Appendices M ,N and Q) V generation						-711.1382	(333)
ind generation ydro-electric generation (Appendix N)						0.0000	(334)
lectricity generated - Micro CHP (Appendix N)						0.0000	
ppendix Q - special features nergy saved or generated						-0.0000	
nergy used otal delivered energy for all uses						0.0000 5615.7012	
lectrical efficiency of CHP unit		Energy kWh/year		on factor g CO2/kWh	k	Emissions g CO2/year 32.0000	(361)
leat efficiency of CHP unit space heating from Combined Heat and Power		3360.1513		0.2100		49.9000 705.6318	(362)
less credit emissions for electricity	•	-1075.2484		0.3480		-374.1864	(364)
later heating from Combined Heat and Power less credit emissions for electricity		3437.5492 -1100.0157		0.2100 0.3480		721.8853 -382.8055	(366)
fficiency of heat source Boilers pace and Water heating from Boilers		2861.4426		0.2100		93.9000 297.0306	
lectrical energy for heat distribution (space & water) verall CO2 factor for heat network		30.0487		0.0000		9.0652 0.2106	
otal CO2 associated with community systems pace and water heating						1280.4933	(272)
umps, fans and electric keep-hot		0.0000					
nergy for lighting				0.0000		0.0000	(376) (378)
Francy caving/gapanation task1		247.8922		0.0000 0.1443			(376) (378)
V Unit electricity used in dwelling		-433.0666		0.14430.1331		0.0000 35.7785 -57.6284	(376) (378)
V Unit electricity used in dwelling V Unit electricity exported otal				0.1443		0.0000 35.7785 -57.6284 -34.7510 -92.3794	(376) (378) (379)
V Unit electricity used in dwelling V Unit electricity exported otal otal CO2, kg/year		-433.0666		0.14430.1331		0.0000 35.7785 -57.6284 -34.7510	(376) (378) (379) (380) (383)
V Unit electricity used in dwelling V Unit electricity exported otal otal CO2, kg/year PC Target Carbon Dioxide Emission Rate (TER)		-433.0666 -278.0717		0.14430.1331		0.0000 35.7785 -57.6284 -34.7510 -92.3794 1223.8924	(376) (378) (379) (380) (383)
V Unit electricity used in dwelling V Unit electricity exported otal otal CO2, kg/year PC Target Carbon Dioxide Emission Rate (TER) 3b. Primary energy - Community heating scheme		-433.0666 -278.0717	Primary ener	0.1443 0.1331 0.1250	Prim	0.0000 35.7785 -57.6284 -34.7510 -92.3794 1223.8924	(376) (378) (379) (380) (383)
V Unit electricity used in dwelling V Unit electricity exported otal otal CO2, kg/year PC Target Carbon Dioxide Emission Rate (TER) 3b. Primary energy - Community heating scheme		-433.0666 -278.0717	-	0.1443 0.1331 0.1250	Prim	0.0000 35.7785 -57.6284 -34.7510 -92.3794 1223.8924 10.6300 nary energy kWh/year 32.0000	(376) (378) (379) (380) (383) (384)
V Unit electricity used in dwelling V Unit electricity exported otal otal CO2, kg/year PC Target Carbon Dioxide Emission Rate (TER) 3b. Primary energy - Community heating scheme lectrical efficiency of CHP unit eat efficiency of CHP unit pace heating from Combined Heat and Power		-433.0666 -278.0717 Energy kWh/year	-	0.1443 0.1331 0.1250 egy factor eg CO2/kWh		0.0000 35.7785 -57.6284 -34.7510 -92.3794 1223.8924 10.6300 arry energy kWh/year 32.0000 49.9000 3796.9709	(376) (378) (389) (383) (384) (461) (462) (463)
V Unit electricity used in dwelling V Unit electricity exported stal stal CO2, kg/year PC Target Carbon Dioxide Emission Rate (TER) BB. Primary energy - Community heating scheme Bectrical efficiency of CHP unit eat efficiency of CHP unit bace heating from Combined Heat and Power less credit emissions for electricity		-433.0666 -278.0717 Energy I	-	0.1443 0.1331 0.1250		0.0000 35.7785 -57.6284 -34.7510 -92.3794 1223.8924 10.6300 anary energy kWh/year 32.0000 49.9000	(376) (378) (380) (383) (384) (461) (462) (463) (463)
V Unit electricity used in dwelling V Unit electricity exported botal botal CO2, kg/year PC Target Carbon Dioxide Emission Rate (TER) Bb. Primary energy - Community heating scheme Lectrical efficiency of CHP unit eat efficiency of CHP unit bace heating from Combined Heat and Power Less credit emissions for electricity ater heating from Combined Heat and Power Less credit emissions for electricity		-433.0666 -278.0717 Energy I kWh/year 3360.1513 -1075.2484	-	0.1443 0.1331 0.1250 egy factor g CO2/kWh 1.1300 2.1490		0.0000 35.7785 -57.6284 -34.7510 -92.3794 1223.8924 10.6300 arry energy kWh/year 32.0000 49.9000 3796.9709 -2310.7088	(376) (379) (380) (383) (384) (461) (462) (463) (464) (465) (466)
V Unit electricity used in dwelling V Unit electricity exported otal otal CO2, kg/year PC Target Carbon Dioxide Emission Rate (TER) 3b. Primary energy - Community heating scheme lectrical efficiency of CHP unit eat efficiency of CHP unit pace heating from Combined Heat and Power less credit emissions for electricity ater heating from Combined Heat and Power less credit emissions for electricity fficiency of heat source Boilers pace and Water heating from Boilers		-433.0666 -278.0717 Energy I kWh/year 3360.1513 -1075.2484 3437.5492 -1100.0157 2861.4426	-	0.1443 0.1331 0.1250 gy factor g CO2/kWh 1.1300 2.1490 1.1300 1.1300		0.0000 35.7785 -57.6284 -34.7510 -92.3794 1223.8924 10.6300 ary energy kWh/year 32.0000 49.9000 3796.9709 -2310.7088 3884.4305 -2363.9338 93.9000 1598.3073	(376 (378 (379 (380 (383 (384 (461 (462 (463 (464 (465) (466) (466) (467 (468)
V Unit electricity used in dwelling V Unit electricity exported otal otal CO2, kg/year PC Target Carbon Dioxide Emission Rate (TER) 3b. Primary energy - Community heating scheme lectrical efficiency of CHP unit eat efficiency of CHP unit pace heating from Combined Heat and Power less credit emissions for electricity ater heating from Combined Heat and Power less credit emissions for electricity fficiency of heat source Boilers pace and Water heating from Boilers lectrical energy for heat distribution (space & water) verall CO2 factor for heat network		-433.0666 -278.0717 Energy I kWh/year 3360.1513 -1075.2484 3437.5492 -1100.0157	-	0.1443 0.1331 0.1250 egy factor g CO2/kWh 1.1300 2.1490 1.1300 2.1490		0.0000 35.7785 -57.6284 -34.7510 -92.3794 1223.8924 10.6300 anary energy kWh/year 32.0000 49.9000 3796.9709 -2310.7088 3884.4305 -2363.9338 93.9000 1598.3073 94.3294 1.0420	(388) (388) (388) (388) (461) (462) (463) (464) (465) (466) (467) (468) (468) (468) (468) (468)
V Unit electricity used in dwelling V Unit electricity exported otal otal CO2, kg/year PC Target Carbon Dioxide Emission Rate (TER) 3b. Primary energy - Community heating scheme lectrical efficiency of CHP unit eat efficiency of CHP unit pace heating from Combined Heat and Power less credit emissions for electricity ater heating from Combined Heat and Power less credit emissions for electricity fficiency of heat source Boilers pace and Water heating from Boilers lectrical energy for heat distribution (space & water) verall CO2 factor for heat network otal CO2 associated with community systems pace and water heating		-433.0666 -278.0717 Energy I kWh/year 3360.1513 -1075.2484 3437.5492 -1100.0157 2861.4426 30.0487	-	0.1443 0.1331 0.1250 Tegy factor g CO2/kwh 1.1300 2.1490 1.1300 0.0000		0.0000 35.7785 -57.6284 -34.7510 -92.3794 1223.8924 10.6300 anary energy kWh/year 32.0000 49.9000 3796.9709 -2310.7088 3884.4305 -2363.9338 93.9000 1598.3073 94.3294 1.0420 6334.5185 6334.5185	(376) (378) (379) (380) (383) (384) (461) (462) (463) (464) (465) (464) (465) (464) (465) (466) (467) (468) (472) (488) (473) (473)
Energy saving/generation technologies V Unit electricity used in dwelling V Unit electricity exported Total Total Total CO2, kg/year TPC Target Carbon Dioxide Emission Rate (TER) 3b. Primary energy - Community heating scheme Clectrical efficiency of CHP unit teat efficiency of CHP unit teat efficiency of CMB unit teat efficiency of CMB unit teat enable to the scheme of the sc		-433.0666 -278.0717 Energy I kWh/year 3360.1513 -1075.2484 3437.5492 -1100.0157 2861.4426	-	0.1443 0.1331 0.1250 gy factor g CO2/kWh 1.1300 2.1490 1.1300 1.1300		0.0000 35.7785 -57.6284 -34.7510 -92.3794 1223.8924 10.6300 arry energy kWh/year 32.0000 49.9000 49.9000 -2310.7088 3884.4305 -2363.9338 93.93000 1598.3073 94.3294 1.0420 6334.5185	(376) (378) (389) (388) (383) (384) (461) (462) (463) (464) (465) (467) (472) (486) (472) (486) (472) (476) (476) (476) (476)



PV Unit electricity used in dwelling PV Unit electricity exported Total Total Primary energy kWh/year Target Primary Energy Rate (TPER)

-433.0666 -278.0717

1.4917 0.4587

-646.0137 -127.5469 -773.5606 (480) 5941.1833 (483) 51.6200 (484)

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		GREE	EN PLANNING						Issued	on Date	12/09/	2023	
Assessment Reference	:0	L01to	5 - 09 x5_Copy_C	ору			Prop	Type Ref					_
Property													_
SAP Rating				87		DER		10.43		TER	1	1.66	
Environmental				91			R < TER					0.55	_
CO: Emissions (t/year))			0.1	74 ee BREL	DFEE % DEE	E < TFEE	22.43		TFEE		2.07	_
% DPER < TPER				5.8		DPER	ESTFEE	54.14		TPER		7.52	_
Assessor Details		Mr. Richard	Dontoh							Assessor ID		J148-0001	=
Client		Mr. Richard	Denten							Assessor ID	U	148-0001	_
AP 10 WORKSHEET ALCULATION OF DI	FOR New Bi	uild (As De		Version 10 IS COMPLIANO	.2, February CE 			Area	Storey	/ height		Volume	
ound floor								(m2) 76.3000	(1b) x	(m) 2.7400 ((2b) =	(m3) 209.0620	
otal floor area	TFA = (1a)+(1b)+(1c))+(1d)+(1e).	(1n)	7	6.3000							(4
velling volume								(3	a)+(3b)+(3c)+	(3d)+(3e)	(3n) =	209.0620	(5
mber of chimmer mber of flues; mber of flues; mber of blocke; mber of passiv mber of passiv mber of fluele filtration due essure test essure Test Me asured/design at filtration rat mber of sides;	attached to attached to d chimneys ittent extree vents ss gas firm to chimner thod AP50 e	o solid fue o other hea ract fans es	el boiler ater		+(6c)+(6d)+(6e)+(6f)+(6	g)+(7a)+(7	7b)+(7c) =		0.0000	/ (5) =	Yes lower Door 3.0000 0.1500	(6 (6 (7 (7 (7 (8
elter factor									(20) = 1 -	[0.075 x	(19)] =	0.8500	
filtration rat	e adjusted	to include	e shelter fa	ctor) = (18)		0.1275	
nd speed	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	Sep 4.0000 1.0000	Oct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	
j 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	(2
alanced mechan mechanical ve exhaust air h balanced with	ntilation eat pump u	sing Append	dix N, (23b)	= (23a) x					a)			0.5000 0.5000 72.8000	(2
fective ac	0.2986	0.2954	0.2922	0.2762	0.2731	0.2571	0.2571	0.2539	0.2635	0.2731	0.2794	0.2858	(;
Heat losses and the Heat losses and the Heat losses and the Heat losses and the Heat losses are the Heat l				Gross m2	Openings m2	NetA 12.7	m2	U-value W/m2K 1.2357	A x U W/K 15.7804		-value kJ/m2K	A x K kJ/K	

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Fabric heat los Party Wall 1 Party Floor 1 Party Ceiling : Internal Wall :	1					76 76	(26)(.4400 .3000 .3000 .5200	30) + (32) = 0.0000	0.00	180 180 41 31	3.0000 3.0000 3.0000 9.0000	3139.2000 3052.0000 2289.0000 1399.6800	(32d) (32b) (32c)
E3 Sil: E4 Jaml E7 Parr E8 Balo E16 Co E18 Par	arameter (1 1 Bridges ment er lintels b ty floor be cony withir rner (norma rty wall be	(including etween dwelling al) etween dwelling al)	other steel lings (in bl g, wall inso	l lintels) locks of fla	tinuous			Li 7 4 13 34 5 2	. , .	Psi-value 0.0300 0.0300 0.0300 0.0300 0.0700 0.0900 0.0900 0.0600	Tot 0.21 0.14 0.41 2.44 0.00 0.24 0.32	216.8186 al .00 .22 .82 .44 .00 .66 .88	(35)
Thermal bridge Point Thermal I Total fabric he	bridges	Psi) calcu	lated using	Appendix K)				(33) + (36)	(36a) = + (36a) =	3.7902 0.0000 24.4805	
(38)m	Jan 20.5980	lculated mon Feb 20.3781	nthly (38)m Mar 20.1582	= 0.33 x (3 Apr 19.0586	25)m x (5) May 18.8387	Jun 17.7392	Jul 17.7392	Aug 17.5193	Sep 18.1790	Oct 18.8387	Nov 19.2785	Dec 19.7183	(38)
Heat transfer (Average = Sum()	45.0784	44.8585	44.6386	43.5391	43.3192	42.2196	42.2196	41.9997	42.6595	43.3192	43.7590	44.1988 43.4841	(39)
HLP HLP (average) Days in mont	Jan 0.5908 31	Feb 0.5879	Mar 0.5850 31	Apr 0.5706	May 0.5677 31	Jun 0.5533 30	Jul 0.5533	Aug 0.5505 31	Sep 0.5591 30	0ct 0.5677 31	Nov 0.5735 30	Dec 0.5793 0.5699 31	(40)
Days III MOIIC	31	20	51	30	31	36	31	31	30	31	30	31	
4. Water heati													
Assumed occupa	ncy											2.3889	(42)
Hot water usage	88.3765	87.0484	85.1131	81.4101	78.6775	75.6300	73.8979	75.8186	77.9240	81.1960	84.9785	88.0379	(42a)
Hot water usage	e for baths 27.7631	27.3508	26.7701	25.6995	24.8979	24.0090	23.5289	24.1054	24.7332	25.6844	26.7770	27.6692	(42b)
Hot water usage Average daily N	39.0948	37.6732	36.2516 /day)	34.8299	33.4083	31.9867	31.9867	33.4083	34.8299	36.2516	37.6732	39.0948 142.7617	
Daily hat water	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
Energy content	155.2345 245.8534 (annual)	152.0724 216.5490	148.1348 227.6776	141.9396 194.3083	136.9837 184.4064	131.6257 161.8492	129.4134 156.5143	133.3323 165.0933	137.4872 169.5354	143.1320 194.2287 Total = S	149.4287 212.8886 um(45)m =	154.8020 242.3825 2371.2867	
Distribution lo	36.8780	= 0.15 x (4 32.4824	45)m 34.1516	29.1462	27.6610	24.2774	23.4771	24.7640	25.4303	29.1343	31.9333	36.3574	
Store volume b) If manufactor Hot water sto Volume factor Temperature Enter (49) or	orage loss r from Tabl factor from (54) in (55	factor from Le 2a n Table 2b			ay)							110.0000 0.0152 1.0294 0.6000 1.0327	(51) (52) (53)
Total storage :	32.0144 ntains dedi			30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	
Primary loss Combi loss Total heat requ	32.0144 23.2624 0.0000 uired for v	28.9162 21.0112 0.0000 water heati	32.0144 23.2624 0.0000 ng calculate	30.9817 22.5120 0.0000 ed for each	32.0144 23.2624 0.0000 month	30.9817 22.5120 0.0000	32.0144 23.2624 0.0000	32.0144 23.2624 0.0000	30.9817 22.5120 0.0000	32.0144 23.2624 0.0000	30.9817 22.5120 0.0000	32.0144 23.2624 0.0000	(59)
WWHRS PV diverter Solar input FGHRS	301.1302 -67.0388 -0.0000 0.0000 0.0000	266.4765 -59.2897 -0.0000 0.0000 0.0000	282.9544 -62.0847 -0.0000 0.0000 0.0000	247.8019 -51.4086 -0.0000 0.0000 0.0000	239.6832 -47.9110 -0.0000 0.0000 0.0000	215.3429 -40.9978 -0.0000 0.0000 0.0000	211.7911 -38.4289 -0.0000 0.0000 0.0000	220.3701 -40.8652 -0.0000 0.0000 0.0000	223.0291 -42.4179 -0.0000 0.0000 0.0000	249.5055 -50.0060 -0.0000 0.0000 0.0000	266.3823 -56.6507 -0.0000 0.0000 0.0000	297.6593 -65.7973 -0.0000 0.0000	(63a) (63b) (63c)
Output from w/l 12Total per yea	234.0914	207.1868 ar)	220.8697	196.3933	191.7722	174.3451	173.3623	179.5048 Total p	180.6112 er year (kW	199.4996 Nh/year) = S	209.7316 um(64)m =	231.8620 2399.2300 2399	
Electric shower		0.0000	0.0000	0.0000	0.0000	0.0000 sed by inst:	0.0000	0.0000	0.0000	0.0000 /year) = Sui	0.0000 m(64a)m =	0.0000 0.0000	(64a)
Heat gains from		ating, kWh/m 111.9445	nonth 119.9243	107.4024	105.5366	96.6098	96.2625	99.1149	99.1655	108.8025	113.5804	124.8136	
5. Internal ga													
Metabolic gains (66)m Lighting gains	Jan 119.4455	Feb 119.4455		Apr 119.4455	May 119.4455	Jun 119.4455 see Table 5	Jul 119.4455	Aug 119.4455	Sep 119.4455	Oct 119.4455	Nov 119.4455	Dec 119.4455	(66)
Appliances gain	108.0126	119.5854	108.0126	111.6131	108.0126	111.6131		108.0126	111.6131	108.0126	111.6131	108.0126	(67)

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Cooking gains	211.5344	213.7294	208.1979	196.4220	181.5571	167.5861	158.2527	156.0576	161.5891	173.3650	188.2299	202.2009	(68)
	34.9445	34.9445	34.9445	34.9445	34.9445	34.9445	34.9445	34.9445	34.9445	34.9445	34.9445	34.9445	
Pumps, fans Losses e.g. ev	•				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Water heating			-95.5564	-95.5564	-95.5564	-95.5564	-95.5564	-95.5564	-95.5564	-95.5564	-95.5564	-95.5564	(71)
Total internal	169.3114 l gains	166.5841	161.1885	149.1701	141.8502	134.1803	129.3850	133.2190	137.7298	146.2399	157.7506	167.7603	(72)
	547.6921	558.7326	536.2327	516.0388	490.2536	472.2131	454.4840	456.1229	469.7656	486.4512	516.4272	536.8074	(73)
6. Solar gains	 S												
 [Jan]			Aı	rea	Solar flux		g		FF	Acce	ss	Gains	
				m2	Table 6a W/m2		fic data Table 6b	Specific or Tab		fact Table		W	
South West			5.00 7.7		46.7521 19.6403		0.3300 0.3300		.8000 .8000	0.77 0.77		42.7669 27.9194	
Solar gains Total gains	70.6863 618.3784	124.6574 683.3900	179.1652 715.3979	232.0176 748.0564	265.8449 756.0985	265.6968 737.9099	255.4843 709.9683	230.5385 686.6615	197.8107 667.5764	140.3527 626.8039	85.5055 601.9327	59.9141 596.7215	
7. Mean inter	nal tempera	ture (heati	ng season)										
Temperature du Utilisation fa						Th1 (C)						21.0000	(85)
tau alpha	Jan 101.9412 7.7961	Feb 102.4409 7.8294	Mar 102.9456 7.8630	Apr 105.5454 8.0364	May 106.0812 8.0721	Jun 108.8439 8.2563	Jul 108.8439 8.2563	Aug 109.4137 8.2942	Sep 107.7217 8.1814	0ct 106.0812 8.0721	Nov 105.0150 8.0010	Dec 103.9700 7.9313	
util living a		0.9097	0.8381	0.6913	0.5313	0.3661	0.2617	0.2814	0.4406	0.7040	0.8935	0.9596	(86)
1IT Гh 2	20.7106 20.4383	20.8218 20.4409	20.9154 20.4435	20.9827 20.4565	20.9979 20.4591	20.9999 20.4722	21.0000 20.4722	21.0000 20.4748	20.9996 20.4669	20.9835 20.4591	20.8748 20.4539	20.6982 20.4487	
util rest of h	nouse 0.9444	0.8954	0.8167	0.6633	0.5009	0.3360	0.2303	0.2492	0.4067	0.6713	0.8753	0.9519	(89)
MIT 2 Living area fo MIT	20.1842 raction 20.3770	20.2898	20.3758	20.4441	20.4578	20.4721	20.4722	20.4748	20.4668 fLA = 20.6619	20.4478 Living are 20.6440	20.3517 a / (4) = 20.5432	20.1820 0.3662 20.3711	(91)
Temperature ad adjusted MIT	djustment 20.3770	20.4846	20.5734	20.6413	20.6556	20.6654	20.6655	20.6671	20.6619	20.6440	20.5432	0.0000 20.3711	(93)
8. Space heat:	ing requirer												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(0.4)
Jtilisation Jseful gains	0.9434 583.3780	0.8966 612.6974	0.8218 587.9257	0.6729 503.3611	0.5119 387.0823	0.3470 256.0526	0.2418 171.6411	0.2610 179.2157	0.4191 279.7942	0.6826 427.8451	0.8784 528.7500	0.9507 567.3049	(95)
xt temp. Weat loss rate	4.3000 e W	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
pace heating	724.7238 kWh	699.1016	628.2154	511.2056	387.9491	256.0794	171.6421	179.2177	279.9269	435.0965	588.2614	714.7412	(97)
Space heating Solar heating		58.0636 t - total pe	29.9755 er year (kWl	5.6480 h/year)	0.6449	0.0000	0.0000	0.0000	0.0000	5.3950	42.8482	109.6926 357.4292	
olar heating	0.0000 contribution	0.0000 on - total p	0.0000 per year (kl	0.0000 Wh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000	(98b)
Space heating	105.1613 requirement	58.0636 t after sola	29.9755 ar contribu	5.6480 tion - tota	0.6449 l per year	0.0000 (kWh/year)	0.0000	0.0000	0.0000	5.3950	42.8482	109.6926 357.4292	
Space heating	per m2									(98c) / (4) =	4.6845	(99)
9b. Energy red	quirements												
raction of sp	pace heat fi	rom secondai	ry/suppleme									0.0000	
Fraction of sp Fraction of he	eat from con	mmunity Coml	oined Heat a		pace and Wa	ter						1.0000 0.5580	
raction of he actor for con					space heati	ng						0.4420 1.0500	
actor for cha	arging metho	od (Table 4	c(3)) for wa	ater heatin	g	J						1.0500 1.2500	(305
fficiency of pace heating	secondary/: :	supplementa			g system							0.0000	
Space heating	105.1613	58.0636	29.9755	5.6480	0.6449	0.0000	0.0000	0.0000	0.0000	5.3950	42.8482	109.6926	(98)
Space heat fro 307a Space heat foo	77.0175	42.5244	21.9533	4.1365	0.4723	0.0000	0.0000	0.0000	0.0000	3.9512	31.3810	80.3361	
Space heat fro 307b Space heating	61.0067	33.6842	17.3895	3.2766	0.3741	0.0000	0.0000	0.0000	0.0000	3.1298	24.8573	63.6354	

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Full SAP Calculation Printout



138.0242 76.2085 39.3429 7.4131 0.8464 0.0000 0.000 Fficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	0.0000	7.0810	56.2383	143.9715 (36 0.0000 (36
pace heating fuel for secondary/supplementary system 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.000	0.0000	0.0000	0.0000	0.0000	0.0000 (30
ter heating	0.0000	0.0000	0.0000	0.0000	0.0000 (38
inual water heating requirement 234.0914 207.1868 220.8697 196.3933 191.7722 174.3451 173.362	23 179.5048	180.6112	199.4996	209.7316	231.8620 (64
ter heat from Combined Heat and Power = (64) x 0.56 x 1.05 x 1.25 0a 171.4427 151.7384 161.7595 143.8336 140.4492 127.6860 126.966	131.4648	132.2752	146.1085	153.6021	169.8099
ter heat from Boilers = (64) x 0.44 x 1.05 x 1.25 bb 135.8023 120.1942 128.1320 113.9327 111.2519 101.1420 100.573	18 104.1352	104.7771	115.7347	121.6705	134.5089
er heating fuel 307.2450 271.9327 289.8915 257.7663 251.7010 228.8279 227.538 oling System Energy Efficiency Ratio	30 235.6001	237.0523	261.8432	275.2727	304.3188 (31 0.0000 (31
ace coolin 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.000		0.0000 13.1022	0.0000 13.5389	0.0000 13.1022	0.0000 (31 13.5389 (33
hting 19.8435 15.9192 14.3334 10.5013 8.1115 6.6272 7.399 ctricity generated by PVs (Appendix M) (negative quantity)		12.4932	16.3917	18.5144	20.3950 (33
3a)m -2.7187 -4.3725 -7.1785 -9.2615 -11.1087 -10.8009 -10.666 ctricity generated by wind turbines (Appendix M) (negative quantity)	9.4705	-7.6337	-5.4554	-3.1714	-2.2912 (33
4a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 octricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000 (33
5a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (33
33b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (33
.4b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (33
5b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 ual totals kWh/year	0.0000	0.0000	0.0000	0.0000	0.0000 (33
ual totals kwn/year ce heating fuel - community heating ce heating fuel - secondary					469.1258 (36 0.0000 (36
er heating fuel - community heating					3148.9894 (31
iciency of water heater ctricity used for heat distribution					0.0000 (31 4.6913 (31
ce cooling fuel					0.0000 (32
ctricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6250)					
mechanical ventilation fans (SFP = 0.6250) al electricity for the above, kWh/year					159.4098 (33 159.4098 (33
ctricity for lighting (calculated in Appendix L)					160.1482 (33
rgy saving/generation technologies (Appendices M ,N and Q) generation					-84.1228 (33
nd generation dro-electric generation (Appendix N)					0.0000 (33 0.0000 (33
ectricity generated - Micro CHP (Appendix N) pendix Q - special features					0.0000 (33
ergy saved or generated ergy used					-0.0000 (33 0.0000 (33
al delivered energy for all uses					3853.5504 (33
o. Carbon dioxide emissions - Community heating scheme					
. Carbon dioxide emissions - Community heating scheme	Energy	Emiss	ion factor		Emissions
	Energy kWh/year		ion factor kg CO2/kWh	k _i	g CO2/year
ectrical efficiency of CHP unit ot efficiency of CHP unit	kWh/year		kg CO2/kWh	kį	g CO2/year 32.0000 (36 49.9000 (36
ctrical efficiency of CHP unit t efficiency of CHP unit ce heating from Combined Heat and Power ss credit emissions for electricity	kWh/year 524.5936 -167.8700		0.2100 0.3480	k,	g CO2/year 32.0000 (36 49.9000 (36 110.1647 (36 -58.4187 (36
ctrical efficiency of CHP unit t efficiency of CHP unit ce heating from Combined Heat and Power ss credit emissions for electricity er heating from Combined Heat and Power ss credit emissions for electricity	kWh/year 524.5936		0.2100	k _l	g CO2/year 32.0000 (36 49.9000 (36 110.1647 (36 -58.4187 (36 739.4761 (36 -392.1336 (36
ctrical efficiency of CHP unit t efficiency of CHP unit ce heating from Combined Heat and Power ss credit emissions for electricity er heating from Combined Heat and Power ss credit emissions for electricity ciciency of heat source Boilers	524.5936 -167.8700 3521.3148		0.2100 0.3480 0.2100	k _l	g CO2/year 32.0000 (36 49.9000 (36 110.1647 (36 -58.4187 (36 739.4761 (36
ctrical efficiency of CHP unit t efficiency of CHP unit ce heating from Combined Heat and Power ss credit emissions for electricity er heating from Combined Heat and Power ss credit emissions for electricity iciency of heat source Boilers ce and Water heating from Boilers ctrical energy for heat distribution (space & water)	524.5936 -167.8700 3521.3148 -1126.8207		0.2100 0.3480 0.2100 0.3480	k _i	g CO2/year 32.0000 (36 49.9000 (36 110.1647 (36 -58.4187 (36 739.4761 (36 -392.1336 (36 93.9000 (36 46.3730 (36 5.1764 (37
ctrical efficiency of CHP unit t efficiency of CHP unit ce heating from Combined Heat and Power ss credit emissions for electricity er heating from Combined Heat and Power ss credit emissions for electricity iciency of heat source Boilers ce and Water heating from Boilers ctrical energy for heat distribution (space & water) rall CO2 factor for heat network al CO2 associated with community systems	524.5936 -167.8700 3521.3148 -1126.8207 1703.0958		0.2100 0.3480 0.2100 0.3480 0.2100	k;	g CO2/year 32.0000 (36 49.9000 (36 110.1647 (36 -58.4187 (36 -392.1336 (36 93.9000 (36 46.3730 (36 5.1764 (37 761.9149 (37
ctrical efficiency of CHP unit t efficiency of CHP unit ce heating from Combined Heat and Power ss credit emissions for electricity er heating from Combined Heat and Power ss credit emissions for electricity iciency of heat source Boilers ce and Water heating from Boilers ctrical energy for heat distribution (space & water) rall CO2 factor for heat network al CO2 associated with community systems ce and water heating ps, fans and electric keep-hot	524.5936 -167.8700 3521.3148 -1126.8207 1703.0958 4.6913		0.2100 0.3480 0.2100 0.3480 0.2100 0.3480 0.2100 0.0000	k,	g CO2/year 32.0000 (36 49.9000 (36 110.1647 (36 -58.4187 (36 -392.1336 (36 93.9000 (38 46.3730 (36 5.1764 (37 0.2106 (38 761.9149 (37 761.9149 (37 22.1121 (37
ctrical efficiency of CHP unit t efficiency of CHP unit ce heating from Combined Heat and Power ss credit emissions for electricity er heating from Combined Heat and Power ss credit emissions for electricity iciency of heat source Boilers ce and Water heating from Boilers ctrical energy for heat distribution (space & water) rall CO2 factor for heat network al CO2 associated with community systems ce and water heating ps, fans and electric keep-hot rgy for lighting	524.5936 -167.8700 3521.3148 -1126.8207 1703.0958 4.6913		0.2100 0.3480 0.2100 0.3480 0.2100 0.3480 0.2100 0.0000	k;	g CO2/year 32.0000 (36 49.9000 (36 110.1647 (36 -58.4187 (36 -392.1336 (36 93.9000 (38 46.3730 (36 5.1764 (37 0.2106 (38 761.9149 (37 761.9149 (37 22.1121 (37
ctrical efficiency of CHP unit t efficiency of CHP unit ce heating from Combined Heat and Power ss credit emissions for electricity er heating from Combined Heat and Power ss credit emissions for electricity iciency of heat source Boilers ce and Water heating from Boilers ctrical energy for heat distribution (space & water) rall CO2 factor for heat network al CO2 associated with community systems ce and water heating ps, fans and electric keep-hot rgy for lighting ergy saving/generation technologies Unit electricity used in dwelling	524.5936 -167.8700 3521.3148 -1126.8207 1703.0958 4.6913 159.4098 160.1482		0.2100 0.3480 0.2100 0.3480 0.2100 0.3480 0.2100 0.0000 0.1387 0.1443	kı	g CO2/year 32.0000 (36 49.9000 (36 110.1647 (36 -58.4187 (36 -392.1336 (36 93.9000 (36 46.3730 (36 5.1764 (37 61.9149 (37 761.9149 (37 22.1121 (37 23.1143 (37
ctrical efficiency of CHP unit t efficiency of CHP unit ce heating from Combined Heat and Power ss credit emissions for electricity er heating from Combined Heat and Power ss credit emissions for electricity iciency of heat source Boilers ce and Water heating from Boilers ctrical energy for heat distribution (space & water) rall CO2 factor for heat network al CO2 associated with community systems ce and water heating ps, fans and electric keep-hot rgy for lighting ergy saving/generation technologies Unit electricity used in dwelling Unit electricity exported	524.5936 -167.8700 3521.3148 -1126.8207 1703.0958 4.6913 159.4098 160.1482		0.2100 0.3480 0.2100 0.3480 0.2100 0.3480 0.2100 0.0000	kı	g CO2/year 32.0000 (36 49.9000 (36 110.1647 (36 -58.4187 (36 -392.1336 (36 93.9000 (36 46.3730 (36 5.1764 (37 761.9149 (37 761.9149 (37 22.1121 (37 23.1143 (37
ctrical efficiency of CHP unit t efficiency of CHP unit ce heating from Combined Heat and Power ss credit emissions for electricity er heating from Combined Heat and Power ss credit emissions for electricity iciency of heat source Boilers ce and Water heating from Boilers ctrical energy for heat distribution (space & water) rall CO2 factor for heat network all CO2 associated with community systems ce and water heating ps, fans and electric keep-hot rgy for lighting ergy saving/generation technologies Unit electricity used in dwelling Unit electricity exported al al CO2, kg/year	524.5936 -167.8700 3521.3148 -1126.8207 1703.0958 4.6913 159.4098 160.1482		0.2100 0.3480 0.2100 0.3480 0.2100 0.3480 0.2100 0.0000 0.1387 0.1443	k;	g CO2/year 32.0000 (36 49.9000 (36 110.1647 (36 -58.4187 (36 -392.1336 (36 93.9000 (36 46.3730 (36 5.1764 (37 0.2106 (38 761.9149 (37 761.9149 (37 22.1121 (37 23.1143 (37
ectrical efficiency of CHP unit the efficiency of CHP unit the ce heating from Combined Heat and Power tess credit emissions for electricity ter heating from Combined Heat and Power tess credit emissions for electricity ticinency of heat source Boilers tice and Water heating from Boilers tice and Water heating from Boilers tical energy for heat distribution (space & water) terall CO2 factor for heat network tal CO2 associated with community systems tice and water heating tips, fans and electric keep-hot tipsy for lighting tergy saving/generation technologies Unit electricity used in dwelling Unit electricity exported tal tal CO2, kg/year Dwelling Carbon Dioxide Emission Rate (DER)	524.5936 -167.8700 3521.3148 -1126.8207 1703.0958 4.6913 159.4098 160.1482		0.2100 0.3480 0.2100 0.3480 0.2100 0.3480 0.2100 0.0000 0.1387 0.1443	kı	g CO2/year
ctrical efficiency of CHP unit t efficiency of CHP unit ce heating from Combined Heat and Power ss credit emissions for electricity er heating from Combined Heat and Power ss credit emissions for electricity diciency of heat source Boilers ce and Water heating from Boilers ctrical energy for heat distribution (space & water) rall CO2 factor for heat network all CO2 sasociated with community systems ce and water heating ps, fans and electric keep-hot rgy for lighting ergy saving/generation technologies Unit electricity used in dwelling Unit electricity exported al al CO2, kg/year Dwelling Carbon Dioxide Emission Rate (DER)	524.5936 -167.8700 3521.3148 -1126.8207 1703.0958 4.6913 159.4098 160.1482 -84.1228 0.0000		0.2100 0.3480 0.2100 0.3480 0.2100 0.3480 0.2100 0.0000 0.1387 0.1443 0.1319 0.0000		g CO2/year 32,0000 (36 49,9000 (36 110.1647 (36 -58,4187 (36 -392,1336 (36 93,9000 (36 46,3730 (36 5,1764 (37 761,9149 (37 22,1121 (37 23,1143 (37 -11.0974 0.0000 -11.0974 (36 796,0439 (38
ectrical efficiency of CHP unit st efficiency of CHP unit sce heating from Combined Heat and Power sess credit emissions for electricity ser heating from Combined Heat and Power ses credit emissions for electricity ficiency of heat source Boilers sec and Water heating from Boilers sectrical energy for heat distribution (space & water) sectrical energy for heat network sal CO2 sassociated with community systems sec and water heating space and water heating space and water heating space for lighting sergy saving/generation technologies Unit electricity used in dwelling Unit electricity exported sal sal CO2, kg/year Sureling Carbon Dioxide Emission Rate (DER)	524.5936 -167.8700 3521.3148 -1126.8207 1703.0958 4.6913 159.4098 160.1482 -84.1228 0.0000	Primary ene	0.2100 0.3480 0.2100 0.3480 0.2100 0.3480 0.2100 0.0000 0.1387 0.1443 0.1319 0.0000		g CO2/year
ectrical efficiency of CHP unit sit efficiency of CHP unit size heating from Combined Heat and Power sess credit emissions for electricity ser heating from Combined Heat and Power sess credit emissions for electricity sciciency of heat source Boilers size and Water heating from Boilers sectrical energy for heat distribution (space & water) small CO2 factor for heat network sall CO2 associated with community systems size and water heating space, fans and electric keep-hot sergy for lighting stergy saving/generation technologies Unit electricity used in dwelling Unit electricity exported small CO2, kg/year Community heating scheme Detrical efficiency of CHP unit	524.5936 -167.8700 3521.3148 -1126.8207 1703.0958 4.6913 159.4098 160.1482 -84.1228 0.0000	Primary ene	0.2100 0.3480 0.2100 0.3480 0.2100 0.3480 0.2100 0.0000 0.1387 0.1443 0.1319 0.0000		g CO2/year 32.0000 (36 49.9000 (36 110.1647 (36 -58.4187 (36 -392.1336 (36 93.9000 (36 6.3730 (36 5.1764 (37 60.2106 (38 761.9149 (37 22.1121 (37 23.1143 (37 -11.0974 (9.0000 (38 10.4300 (38 ary energy kWh/year 32.0000 (46
ectrical efficiency of CHP unit at efficiency of CHP unit ace heating from Combined Heat and Power ess credit emissions for electricity ter heating from Combined Heat and Power ess credit emissions for electricity ficiency of heat source Boilers ace and Water heating from Boilers ectrical energy for heat distribution (space & water) erall CO2 factor for heat network tal CO2 associated with community systems ace and water heating mps, fans and electric keep-hot ergy for lighting nergy saving/generation technologies Unit electricity used in dwelling Unit electricity exported tal tal CO2, kg/year C Dwelling Carbon Dioxide Emission Rate (DER) b. Primary energy - Community heating scheme ectrical efficiency of CHP unit ace heating from Combined Heat and Power ess credit emissions for electricity	524.5936 -167.8700 3521.3148 -1126.8207 1703.0958 4.6913 159.4098 160.1482 -84.1228 0.0000	Primary ene	0.2100 0.3480 0.2100 0.3480 0.2100 0.3480 0.2100 0.0000 0.1387 0.1443 0.1319 0.0000		g CO2/year 32.0000 (36 49.9000 (36 110.1647 (36 -58.4187 (36 -392.1336 (36 93.9000 (36 46.3730 (36 5.1764 (37 761.9149 (37 761.9149 (37 22.1121 (37 23.1143 (37 -11.0974 (0.0000 -11.0974 (38 10.4300 (38

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													(455)
less credit emi Efficiency of he	at source	Boilers	ty					-1126.8207		2.1490	•	93.9000 93.9000	(467b)
Space and Water Electrical energ	y for heat	t distribut:	ion (space 8	water)				1703.0958 4.6913		1.1300 0.0000		249.5310 55.3239	(472)
Overall CO2 fact Total CO2 associ	ated with		systems									1.0418 3769.4083	(473)
Space and water Pumps, fans and Energy for light	electric	keep-hot						159.4098 160.1482		1.5128 1.5338		3769.4083 241.1551	(478)
		tochnologi.	0.5					100.1462		1.5550		245.6406	(479)
Energy saving/g PV Unit electric	ity used :	in dwelling	25					-84.1228		1.4874		-125.1238	
PV Unit electric								0.0000		0.0000		0.0000	(480)
Total Primary en Dwelling Primary												4131.0802 54.1400	
SAP 10 WORKSHEET CALCULATION OF T			esigned) (Version 10	.2, February	2022)							
1. Overall dwell	ing chara	cteristics											
								Area (m2)	Store	y height (m)		Volume (m3)	
Ground floor Total floor area	TFA = (1a	a)+(1b)+(1c))+(1d)+(1e).	(1n)	7	6.3000		76.3000	(1b) x	2.7400	(2b) =	209.0620	(1b) - (4)
Dwelling volume	·							(:	3a)+(3b)+(3c)+	(3d)+(3e))(3n) =	209.0620	(5)
2. Ventilation r	ate												
											m:	3 per hour	
Number of open o											0 * 80 =	0.0000	
Number of open f Number of chimne	ys / flue			re							0 * 20 = 0 * 10 =	0.0000	(6c)
Number of flues Number of flues	attached 1	to other hea									0 * 20 = 0 * 35 =	0.0000	(6e)
Number of blocke Number of interm	ittent ex										0 * 20 = 3 * 10 = 0 * 10 =	0.0000 30.0000	(7a)
Number of passiv Number of fluele		res									0 * 40 =	0.0000 0.0000	
Infiltration due	to chimne	eys, flues a	and fans =	(6a)+(6b)	+(6c)+(6d)+(6e)+(6f)+	(6g)+(7a)+(1	7b)+(7c) =		30.0006	Air change:	s per hour 0.1435	
Pressure test Pressure Test Me								, , ,				Yes lower Door	
Measured/design Infiltration rat	AP50											5.0000 0.3935	. ,
Number of sides	sheltered											2	(19)
Shelter factor Infiltration rat	e adjuste	d to include	e shelter fa	ctor					(20) = 1 - (21)		x (19)] = x (20) =	0.8500 0.3345	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(22)
Wind speed Wind factor Adj infilt rate	5.1000 1.2750	5.0000 1.2500	4.9000 1.2250	4.4000 1.1000	4.3000 1.0750	3.8000 0.9500	3.8000 0.9500	3.7000 0.9250	4.0000 1.0000	4.3000 1.0750	4.5000 1.1250	4.7000 1.1750	
Effective ac	0.4265 0.5909	0.4181 0.5874	0.4097 0.5839	0.3679 0.5677	0.3596 0.5646	0.3177 0.5505	0.3177 0.5505	0.3094 0.5479		0.3596 0.5646		0.3930 0.5772	
3. Heat losses a 				Gross	Openings	No:	tArea	U-value	AxU		(-value	AxK	
TER Opening Type	(ha = 1 *	20)		m2	m2		m2 .7700	W/m2K 1.1450	W/K 14.6221		kJ/m2K	kJ/K	
External Wall 1 Total net area o	•	·		7.8404	12.7700	35	.0704 .8404	0.1800	6.3127				(29a) (31)
Fabric heat loss Party Wall 1			пыш(д, Ш4 <i>)</i>					30) + (32) 0.0000	= 20.9348 0.0000				(33)
Thermal mass par	ameter (Ti	MP = Cm / TI	FA) in kJ/m2	K		17		0.0000	0.0000			226.8186	
List of Thermal K1 Eleme	Bridges		,,					1	Length Ps:	i-value	Tota		\·/
		(including	other steel	lintels)					7.0000	0.0500	0.35	90	

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E8 Balo E16 Com E18 Pan Thermal bridges	ty floor be cony withir rner (norma rty wall be s (Sum(L x	n a dwelling al) etween dwel		ulation con	tinuous			13 34 5 2	.7400 .9400 .9200 .1400 .7400 .4800	0.0500 0.0500 0.0700 0.0000 0.0900 0.0600	0.23 0.69 2.44 0.00 0.24 0.32	970 144 1900 166	
Point Thermal b Total fabric he									(33) + (36)	(36a) = + (36a) =	25.2386	
Ventilation hea	at loss cal Jan 40.7686	lculated mon Feb 40.5250	nthly (38)m Mar 40.2862	= 0.33 x (Apr 39.1647	25)m x (5) May 38.9549	Jun 37.9780	Jul 37.9780	Aug 37.7971	Sep 38.3543	0ct 38.9549	Nov 39.3794	Dec 39.8232	(38)
Heat transfer of Average = Sum(66.0072	65.7636	65.5248	64.4033	64.1935	63.2166	63.2166	63.0358	63.5929	64.1935	64.6180	65.0618 64.4023	(39)
HLP	Jan 0.8651	Feb 0.8619	Mar 0.8588	Apr 0.8441	May 0.8413	Jun 0.8285	Jul 0.8285	Aug 0.8262	Sep 0.8335	0ct 0.8413	Nov 0.8469	Dec 0.8527	
HLP (average) Days in mont	31	28	31	30	31	30	31	31	30	31	30	0.8441 31	
4. Water heatin													
Assumed occupar	ncy											2.3889	(42)
Hot water usage	64.2739	63.3079	61.9004	59.2074	57.2200	55.0037	53.7439	55.1408	56.6720	59.0517	61.8025	64.0276	(42a)
Hot water usage	27.7631	27.3508	26.7701	25.6995	24.8979	24.0090	23.5289	24.1054	24.7332	25.6844	26.7770	27.6692	(42b)
Hot water usage Average daily h	39.0948	37.6732	36.2516 /day)	34.8299	33.4083	31.9867	31.9867	33.4083	34.8299	36.2516	37.6732	39.0948 120.5398	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
Daily hot water Energy conte	131.1318 207.6807	128.3319 182.7429	124.9221 192.0006	119.7369 163.9138	115.5262 155.5205	110.9993 136.4866	109.2595 132.1398	112.6545 139.4898	116.2352 143.3296	120.9876 164.1790	126.2527 179.8702	130.7916 204.7881	(45)
Energy content Distribution lo Water storage	oss (46)m 31.1521	= 0.15 x (4 27.4114	45)m 28.8001	24.5871	23.3281	20.4730	19.8210	20.9235	21.4994	Total = S 24.6269	26.9805	2002.1417 30.7182	
Store volume b) If manufactor Hot water sto Volume factor Temperature	orage loss from Tabl	factor from le 2a			lay)							0.0000 1.4400 0.0000 1.0000	(51) (52)
Enter (49) or (Total storage)	(54) in (55 loss	5)	44 6400	42, 2000	44 6400	43, 2000	44 6400	44.6400	43, 2000	44.6400	42, 2000	1.4400	(55)
If cylinder con				43.2000	44.6400	43.2000	44.6400	44.6400	43.2000	44.6400	43.2000	44.6400	
Primary loss Combi loss	44.6400 0.0000 0.0000	40.3200 0.0000 0.0000	44.6400 0.0000 0.0000	43.2000 0.0000 0.0000	44.6400 0.0000 0.0000	43.2000 0.0000 0.0000	44.6400 0.0000 0.0000	44.6400 0.0000 0.0000	43.2000 0.0000 0.0000	44.6400 0.0000 0.0000	43.2000 0.0000 0.0000	44.6400 0.0000 0.0000	(59)
Total heat requ	252.3207	223.0629	236.6406	207.1138	200.1605	179.6866	176.7798	184.1298	186.5296	208.8190	223.0702	249.4281	
WWHRS PV diverter Solar input	-29.3833 -0.0000 0.0000	-25.9869 -0.0000 0.0000	-27.2119 -0.0000 0.0000	-22.5326 -0.0000 0.0000	-20.9995 -0.0000 0.0000	-17.9694 -0.0000 0.0000	-16.8435 -0.0000 0.0000	-17.9114 -0.0000 0.0000	-18.5919 -0.0000 0.0000	-21.9178 -0.0000 0.0000	-24.8302 -0.0000 0.0000	-28.8392 -0.0000 0.0000	(63b)
FGHRS Output from w/h		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
12Total per yea		197.0761 ar)	209.4287	184.5812	179.1609	161.7172	159.9363	166.2185 Total p	167.9377 er year (kW	186.9013 h/year) = S	198.2400 um(64)m =	220.5889 2254.7241 2255	
Electric shower	^(s) 0.0000	0.0000	0.0000	0.0000 Tot	0.0000 al Energy u	0.0000 used by inst	0.0000 antaneous e	0.0000 lectric sho	0.0000 wer(s) (kWh	0.0000 /vear) = Su	0.0000 m(64a)m =	0.0000 0.0000	
Heat gains from	n water hea 104.7658	93.0180	month 99.5522	89.0613	87.4226	79.9418	79.6485	82.0924	82.2171	90.3015	94.3668	103.8040	
5. Internal gai	ins (see Ta	able 5 and !	5a)										
Metabolic gains), Watts							_				
(66)m Lighting gains		Feb 119.4455 ed in Appen	Mar 119.4455 dix L, equat	Apr 119.4455 tion L9 or	May 119.4455 L9a), also	Jun 119.4455 see Table 5	Jul 119.4455	Aug 119.4455	Sep 119.4455	0ct 119.4455	Nov 119.4455	Dec 119.4455	(66)
Appliances gair	110.3566	122.1805	110.3566	114.0351	110.3566	114.0351	110.3566	110.3566	114.0351	110.3566	114.0351	110.3566	(67)
Cooking gains	211.5344	213.7294	208.1979	196.4220	181.5571	167.5861	158.2527	156.0576	161.5891	173.3650	188.2299	202.2009	(68)
Pumps, fans	34.9445 0.0000	34.9445 0.0000	34.9445 0.0000	34.9445 0.0000	34.9445 0.0000	34.9445 0.0000	34.9445 0.0000	34.9445 0.0000	34.9445 0.0000	34.9445 0.0000	34.9445 0.0000	34.9445 0.0000	
Losses e.g. eva	-95.5564	-95.5564	alues) (Tab. -95.5564	le 5) -95.5564	-95.5564	-95.5564	-95.5564	-95.5564	-95.5564	-95.5564	-95.5564	-95.5564	(71)
Water heating a	140.8143	le 5) 138.4197	133.8067	123.6963	117.5034	111.0303	107.0544	110.3392	114.1904	121.3730	131.0650	139.5216	(72)
Total internal	gains 521.5389	533.1632	511.1949	492.9871	468.2507	451.4852	434.4973	435.5870	448.6483	463.9282	492.1638	510.9127	(73)

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			A	rea m2	Solar flux Table 6a	Sneci	g fic data	Specific	FF data	Acces		Gains W	
					W/m2	or	Table 6b	or Tab	le 6c	Table 6	5d		
South West			5.00 7.7		46.7521 19.6403		0.6300 0.6300		.7000 .7000	0.776 0.776		71.4402 46.6380	
Solar gains Fotal gains	118.0782 639.6171	208.2345 741.3977	299.2872 810.4821	387.5748 880.5619	444.0819 912.3326	443.8344 895.3196	426.7749 861.2722	385.1 0 42 820.6912	330.4339 779.0821	234.4528 698.3811	142.8331 634.9969	100.0837 610.9964	
. Mean interr	nal tempera	ture (heati	ng season)										
emperature du Itilisation fa						h1 (C)						21.0000	(8
au 1pha	Jan 72.8298 5.8553	Feb 73.0996 5.8733	Mar 73.3660 5.8911	Apr 74.6436 5.9762	May 74.8876 5.9925	Jun 76.0447 6.0696	Jul 76.0447 6.0696	Aug 76.2630 6.0842	Sep 75.5948 6.0397	0ct 74.8876 5.9925	Nov 74.3956 5.9597	Dec 73.8882 5.9259	
til living ar	rea 0.9822	0.9595	0.9134	0.7995	0.6356	0.4499	0.3227	0.3529	0.5554	0.8370	0.9593	0.9857	(8
IIT h 2	20.2387 20.1973	20.4417 20.2000	20.6626 20.2027	20.8786 20.2153	20.9723 20.2177	20.9971 20.2287	20.9997 20.2287	20.9995 20.2307	20.9902 20.2244	20.8659 20.2177	20.5340 20.2129	20.2098 20.2079	
itil rest of h NIT 2 .iving area fr	0.9777 19.3236	0.9501 19.5777	0.8948 19.8464	0.7648 20.1008	0.5878 20.1959	0.3965 20.2270	0.2663 20.2286	0.2941 20.2305	0.4961 20.2182	0.7992 20.0950 Living area	0.9481 19.7055	0.9820 19.2957 0.3662	(90
III IIT emperature ac	19.6587 djustment	19.8941	20.1453	20.3856	20.4803	20.5090	20.5109	20.5121	20.5009	20.3773	20.0089	19.6304 0.0000	
djusted MIT	19.6587	19.8941	20.1453	20.3856	20.4803	20.5090	20.5109	20.5121	20.5009	20.3773	20.0089	19.6304	(9
tilisation seful gains xt temp. eat loss rate pace heating	1013.7829 kWh	Feb 0.9459 701.2915 4.9000 986.0648	Mar 0.8933 724.0330 6.5000 894.1078	Apr 0.7727 680.3683 8.9000 739.7100	May 0.6041 551.1850 11.7000 563.6348	Jun 0.4160 372.4656 14.6000 373.5483	Jul 0.2870 247.1458 16.6000 247.2362	Aug 0.3156 259.0489 16.4000 259.2087	Sep 0.5175 403.1586 14.1000 407.0525	0ct 0.8075 563.9208 10.6000 627.6392	Nov 0.9447 599.9110 7.1000 834.1455	Dec 0.9787 597.9703 4.2000 1003.9306	(9
pace heating olar heating		191.3677 : - total p	126.5357 er year (kWl	42.7260 n/year)	9.2627	0.0000	0.0000	0.0000	0.0000	47.4065	168.6488	302.0344 1178.7286	(9
olar heating pace heating		0.0000 on - total	0.0000 per year (kl	0.0000 Nh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000	(9
pace heating pace heating	290.7468 requirement	191.3677 after sol	126.5357 ar contribu	42.7260 tion - tota	9.2627 1 per year (0.0000 kWh/year)	0.0000	0.0000	0.0000	47.4065 (98c)	168.6488	302.0344 1178.7286 15.4486	
b. Energy red	quirements												
raction of spraction of spraction of he	pace heat fi eat from cor eat from cor ntrol and ch arging metho	rom communi nmunity Com nmunity Boi narging met od (Table 4 (Table 12c	ty system bined Heat a lers-Space a hod (Table a c(3)) for wa) for communi	and Power-S and Water 4c(3)) for ater heatin nity heatin	pace and Wat space heatir g	er						0.0000 1.0000 0.5580 0.4420 1.0000 1.2500 0.0000	(3)
actor for cor actor for cha istribution I fficiency of pace heating:	secondary/s	• •								47.4065	168.6488	202 0244	
actor for cor actor for cha Lstribution I fficiency of pace heating pace heating	secondary/s : requirement 290.7468 om Combined	191.3677 Heat and P				0.0000	0.0000	0.0000	0.0000			302.0344	(9
actor for cor actor for cha istribution l fficiency of bace heating bace heating bace heat fro bace heat fro bace heat fro bace heat fro	secondary/s : requirement 290.7468 om Combined 202.7959 om Boilers :	191.3677 Heat and P 133.4789 = (98) x 0.	ower = (98) 88.2586 44 x 1.00 x	x 0.56 x 1 29.8014 1.25	.00 x 1.25 6.4607	0.0000	0.0000	0.0000	0.0000	33.0660	117.6326	210.6690	(9
actor for consistor for character for charac	secondary/s: requirement 290.7468 om Combined 202.7959 om Boilers: 160.6376 requirement 363.4336	191.3677 Heat and P 133.4789 = (98) x 0. 105.7306	ower = (98) 88.2586 44 x 1.00 x 69.9109 158.1696	x 0.56 x 1 29.8014 1.25 23.6061 53.4075	.00 x 1.25 6.4607 5.1176 11.5784	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000						(3
ictor for concictor for che ictor for che ictor for che ifficiency of ictor heating: icace heating icace heat icac	secondary/: : requirement 290.7468 om Combined 202.7959 om Boilers: 160.6376 requirement 363.4336 secondary/:	191.3677 Heat and P 133.4789 = (98) x 0. 105.7306 = 239.2096 supplementa	ower = (98) 88.2586 44 x 1.00 x 69.9109 158.1696 ry heating	x 0.56 x 1 29.8014 1.25 23.6061 53.4075 system in %	.00 x 1.25 6.4607 5.1176 11.5784	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	0.0000	0.0000	33.0660 26.1921	117.6326 93.1785	210.6690 166.8740 377.5430	(:
actor for cor actor for cha istribution] fficiency of	secondary/: : requirement 290.7468 om Combined 202.7959 om Boilers 160.6376 requirement 363.4336 secondary/! fuel for se 0.0000	191.3677 Heat and P 133.4789 = (98) x 0. 105.7306 = 239.2096 supplementa econdary/su 0.0000	ower = (98) 88.2586 44 x 1.00 x 69.9109 158.1696 ry heating spplementary	x 0.56 x 1 29.8014 1.25 23.6061 53.4075 system in %	.00 x 1.25 6.4607 5.1176 11.5784 (from Table	0.0000 0.0000 0.0000 4a or App	0.0000 0.0000 0.0000 endix E)	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	33.0660 26.1921 59.2581	117.6326 93.1785 210.8111	210.6690 166.8740 377.5430 0.0000	(:

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			-1	Crici	99	
310b 123.1729 108.8845 115.7094 101.9811 98.9864 89.348 Water heating fuel	88 88.3648 91.8	3357 92.7856	103.2629	109.5276	121.8754	
278.6717 246.3451 261.7859 230.7265 223.9512 202.146	55 199.9204 207.7	731 209.9221	233.6266	247.8000	275.7362	
ooling System Energy Efficiency Ratio pace coolin 0.0000 0.0000 0.0000 0.0000 0.000 umps and Fa 0.0000 0.0000 0.0000 0.0000 0.000		0.000 0.000 0.000		0.0000 0.0000	0.0000 0.0000 0.0000	(315)
ighting 22.9299 18.3952 16.5629 12.1347 9.3732 7.658 lectricity generated by PVs (Appendix M) (negative quantity)	80 8.5505 11.1	14.4364	18.9413	21.3941	23.5672	(332)
33a)m -7.7606 -12.0565 -19.0696 -23.6564 -27.5257 -26.435 ectricity generated by wind turbines (Appendix M) (negative quantity)	60 -26.1049 -23.6	166 -19.6412	-14.6930	-8.9155	-6.5855	(333a)
34a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000		0.0000	0.0000	0.0000	0.0000	(334a)
15a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000		0.000	0.0000	0.0000	0.0000	(335a)
33b)m -1.5492 -3.4009 -7.0402 -11.0094 -15.0073 -15.258	37 -15.0900 -12.5	-8.9495	-5.0094	-2.1122	-1.2154	(333b)
ctricity generated by wind turbines (Appendix M) (negative quantity) 4b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.000		0.000	0.0000	0.0000	0.0000	(334b)
ctricity generated by hydro-electric generators (Appendix M) (negative qua 5b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.000		0.000	0.0000	0.0000	0.0000	(335b)
nual totals kWh/year see heating fuel - community heating see heating fuel - community					1473.4108	
ace heating fuel - secondary ter heating fuel - community heating					0.0000 2818.4052	(310)
ficiency of water heater ectricity used for heat distribution					0.0000 14.7341	(313)
ce cooling fuel					0.0000	(321)
ectricity for pumps and fans: cal electricity for the above, kWh/year					0.0000	
ctricity for lighting (calculated in Appendix L)					185.0576	(332)
rgy saving/generation technologies (Appendices M ,N and Q) generation					-314.2766	
nd generation dro-electric generation (Appendix N)						(335a)
ectricity generated - Micro CHP (Appendix N) pendix Q - special features					0.0000	
ergy saved or generated ergy used					-0.0000 0.0000	(337)
tal delivered energy for all uses					4162.5970	(338)
b. Carbon dioxide emissions - Community heating scheme			C+		F	
lacked and a Ciffed arms of CUD works	kWh/y	0,	sion factor kg CO2/kWh	k	Emissions og CO2/year	
ectrical efficiency of CHP unit at efficiency of CHP unit	4647				32.0000 49.9000	(362)
ace heating from Combined Heat and Power ass credit emissions for electricity	1647.6 -527.2	2389	0.2100 0.3480		346.0006 -183.4792	
er heating from Combined Heat and Power ess credit emissions for electricity	3151.6 -1008.5		0.2100 0.3480		661.8451 -350.9670	
ciency of heat source Boilers se and Water heating from Boilers	2020.2	2158	0.2100		93.9000 145.6464	
ectrical energy for heat distribution (space & water)	14.7	341	0.0000		6.2922 0.2106	
tal CO2 associated with community systems ace and water heating					903.9371 903.9371	(373)
mps, fans and electric keep-hot ergy for lighting	0.6 185.6	9000 1576	0.0000 0.1443		0.0000 26.7095	(378)
nergy saving/generation technologies	103.0	,3,0	0.1113		2017033	(3,3)
Unit electricity used in dwelling Unit electricity exported	-216.6 -98.2		0.1326 0.1247		-28.6570 -12.2494	
al	-96.2	.138	0.1247		-40.9064	(380)
al CO2, kg/year : Target Carbon Dioxide Emission Rate (TER)					889.7402 11.6600	
b. Primary energy - Community heating scheme						
	Ene kWh/y	ergy Primary en vear	ergy factor kg CO2/kWh	Prim	nary energy kWh/year	
ectrical efficiency of CHP unit eat efficiency of CHP unit					32.0000 49.9000	
ace heating from Combined Heat and Power ess credit emissions for electricity	1647.6 -527.2		1.1300 2.1490		1861.8125 -1133.0365	
ter heating from Combined Heat and Power ess credit emissions for electricity	3151.6 -1008.5		1.1300 2.1490		3561.3571 -2167.3222	
ficiency of heat source Boilers ace and Water heating from Boilers	2020.2		1.1300		93.9000 783.7165	(467b)
ectrical energy for heat distribution (space & water) rerall CO2 factor for heat network	14.7		0.0000		66.1940 1.0419	(472)
tal CO2 associated with community systems					4471.8489	(473)
ace and water heating mps, fans and electric keep-hot		9999	0.0000		4471.8489 0.0000	(478)
ergy for lighting	185.6	75/6	1.5338		283.8475	(4/9)
nergy saving/generation technologies / Unit electricity used in dwelling	-216.6		1.4901		-321.9478	
Unit electricity exported	-98.2	2158	0.4577		-44.9579	

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Total Total Primary energy kWh/year Target Primary Energy Rate (TPER) -366.9057 (480) 4388.7907 (483) 57.5200 (484)

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Property Reference			GREEN PLANNING						I:	ssued or	n Date	12/0	09/2023	
Assessment Reference	се		L011 - 01,2 x2_Copy	•			Prop	Type Ref						
Property														
CAR Redirect					l oz n	DED		10.00			ren		40.04	
SAP Rating					87 B	DER		12.00			TER		13.34	
Environmental					91 B		R < TER						10.04	
CO: Emissions (t/year	r)				0.61	DFEI		16.92			TFEE		21.17	
Compliance Check					See BREL		EE < TFEE						20.07	
% DPER < TPER					6.10	DPE	₹	61.94		1	TPER		65.97	
Assessor Details		Mr. Ric	chard Denteh							,	Assessor ID		U148-0001	
Client														
SAP 10 WORKSHEET CALCULATION OF D 1. Overall dwell Ground floor Total floor area Dwelling volume	F FOR New Bu WELLING EMI	ild (A	As Designed) 5 FOR REGULATI	(Version	ANCE			Area (m2) 51.9000			height (m) 2.7400 3d)+(3e)		Volum (m3) 142.2066 142.2066) 9 (1b) (4)
2. Ventilation r Number of open of Number of open f Number of chimme Number of flues Number of blocke Number of intern Number of passi	chimneys Flues eys / flues attached to attached to dd chimneys nittent extr	solid other	fuel boiler heater	fire								0 * 80 = 0 * 20 = 0 * 10 = 0 * 20 = 0 * 35 = 0 * 20 = 0 * 10 =	m3 per hour 0.0006 0.0006 0.0006 0.0006 0.0006 0.0006 0.0006	6a) (6a) (6b) (6c) (6d) (6e) (6f) (7a) (7b)
Number of fluele	ess gas tire	!S										0 * 40 =	0.0006	
Infiltration due Pressure test Pressure Test Me Measured/design Infiltration rat Number of sides	ethod AP50 te	rs, flu	es and fans	= (6a)+(6	b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7	7b)+(7c) =			0.0000	Air chang / (5) =	ges per hour 0.0000 Yes Blower Door 3.0000 0.1500	9 (8) s r 9 (17)
Shelter factor Infiltration rat	te adjusted	to inc	:lude shelter	factor					(20) = 1			(19)] = (20) =	0.7756 0.1162	
Wind speed Wind factor Adj infilt rate	Jan 5.1000 1.2750 0.1482	Feb 5.000 1.250 0.145	1.2250	Apr 4.4000 1.1000 0.1279	1.0750	Jun 3.8000 0.9500 0.1104	Jul 3.8000 0.9500	Aug 3.7000 0.9250	1.000	0	Oct 4.3000 1.0750 0.1250	Nov 4.5000 1.1250	1.1756	0 (22) 0 (22a) 5 (22b)
Balanced mechar If mechanical ve If exhaust air h If balanced with	nical ventil entilation neat pump us	ation ing Ap	with heat recopendix N, (23	covery 8b) = (23a)	x Fmv (equati	on (N5)),	otherwise ((23b) = (2					0.5000	0 (23a) 0 (23b)
Effective ac	0.2842	0.281	0.2784	0.2639	0.2610	0.2464	0.2464	0.2435	0.252	2	0.2610	0.2668	3 0.2726	5 (25)
3. Heat losses a	and heat los	s para	ameter											
Element				Gross	Openings	Net	Area	U-value	А	x U		-value	A x k	
glazing (Uw = 1. External Wall 1 External Roof 1	.30)			m2 19.2348 51.9000	m2 7.7700	11.	m2 7700 4648 9000	W/m2K 1.2357 0.1400 0.1000	1.	W/K 6017 6051 1900	196	kJ/m2K 0.0000 9.0000	kJ/k 2178.3126 467.1006	(27) a (29a)

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Total net are			Aum(A, m2)			71	.1348	20) 1 (22) .	_ 16 20	£0			(31)
Fabric heat learty Wall 1	USS, W/K = 3	Sum (A X U)					.5300	30) + (32) = 0.0000	= 16.39 0.00		0.0000	10535.4000	(33)
Party Floor 1 Internal Wall							.9000 .2000				0.0000 5.0000	2076.0000 5265.0000	
Heat capacity		v k)						(28)	(30) + (3				
Thermal mass	parameter (1		TFA) in kJ/m	m2K				(28).	(30) + (3	2) + (32a).	(32e) -	395.4106	
List of Therm K1 El								L	ength	Psi-value	Tot	cal	
E2 Ot E3 Si	her lintels	(including	other stee	l lintels)				3	.8400 .5600	0.0300 0.0300	0.11 0.04		
Е4 Ја	mb								.7400	0.0300	0.23	322	
	rty floor be lcony betwee								.0100 .0100	0.0700 0.0200	0.49 0.14		
	arty wall be lat roof	etween dwel	lings						.4800 .0100	0.0600 0.0800	0.32 0.56		
P4 Pa	rty wall - F								.3500	0.1200	2.56	520	(26)
Thermal bridg Point Thermal		PS1) Calcu	iated using	Appendix K)						(36a) =	4.4767 0.0000	
Total fabric	heat loss								(33) + (36)	+ (36a) =	20.8735	(37)
Ventilation h	eat loss cal Jan	lculated mo Feb	nthly (38)m Mar	= 0.33 x (Jun	Jul	Λιισ	Sen	0ct	Nov	Dec	
(38)m	13.3378	13.2014	13.0650	12.3831	May 12.2467	11.5648	11.5648	Aug 11.4284	Sep 11.8376	12.2467	12.5195	12.7923	(38)
Heat transfer	coeff 34.2113	34.0749	33.9385	33.2566	33.1202	32.4383	32.4383	32.3019	32.7111	33.1202	33.3930	33.6658	(39)
Average = Sum	(39)m / 12 =	=										33.2225	
шп	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	(40)
HLP (average)	0.6592	0.6565	0.6539	0.6408	0.6382	0.6250	0.6250	0.6224	0.6303	0.6382	0.6434	0.6487 0.6401	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	
4. Water heat			s (kWh/year)									
Assumed occup	ancy											1.7461	(42)
Hot water usa	ge for mixer 73.5573	72.4519	70.8410	67.7590	65.4846	62.9481	61.5064	63.1051	64.8575	67.5808	70.7290	73.2755	(42a)
Hot water usa	ge for baths 23.1283	22.7849	22.3012	21.4093	20.7415	20.0010	19.6010	20.0813	20.6043	21.3967	22.3069	23.0502	(42b)
Hot water usa		uses 31.3298	30.1475	28.9653	27.7830	26.6007	26.6007	27.7830	28.9653	30.1475	31.3298	32.5120	
Average daily				20.3033	27.7030	20.0007	20.0007	27.7030	20.3033	30.1473	31.3230	118.8174	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
Daily hot wat	er use 129.1977	126.5665	123.2897	118.1336	114.0091	109.5499	107.7082	110.9694	114.4270	119.1250	124.3657	128.8376	(44)
Energy conte	204.6175 + (annual)	180.2290	189.4917	161.7190	153.4781	134.7043	130.2637	137.4033	141.0999	161.6515	177.1817 um(45)m =	201.7286 1973.5683	
Distribution	loss (46)m			24 2572	22 2247	20 2057	40 5305	20.5405	24 4550		, ,		
Water storage	30.6926 loss:	27.0343	28.4238	24.2578	23.0217	20.2057	19.5396	20.6105	21.1650	24.2477	26.5773	30.2593	(46)
Store volume b) If manuf	acturer decl	lared loss	factor is n	ot known :								110.0000	(47)
Hot water s	torage loss	factor fro			ay)							0.0152	
Temperature	or from Tabl factor from	n Table 2b										1.0294 0.6000	
Enter (49) or Total storage		5)										1.0327	(55)
If cylinder c	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	(56)
-	32.0144	28.9162	32.0144	30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	
Primary loss Combi loss	23.2624 0.0000	21.0112 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	
Total heat re					month 208.7549	188.1980	185.5405	192.6801	194.5936	216.9283	230.6754	257.0054	
WWHRS	-55.7975	-49.3478	-51.6742	-42.7882	-39.8771	-34.1231	-31.9850	-34.0128	-35.3051	-41.6208	-47.1513	-54.7642	(63a)
PV diverter 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	-0.0000 0.0000	-0.0000 0.0000	-0.0000 0.0000	-0.0000 0.0000	-0.0000 0.0000	-0.0000 0.0000	
FGHRS Output from w	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
	204.0968	180.8086	193.0943	172.4244	168.8778	154.0749	153.5555	158.6672	159.2885 er vear (kW	175.3075 h/year) = S	183.5241	202.2412 2105.9609	
12Total per y		ar)						TOTAL P	, car (KW	, , cui , - 3	()		(64)
Electric show	er(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	
Heat gains fr					aı Energy u	sed by insta				/year) = Su	m(64a)m =	0.0000	(64a)
-	112.2568	99.8681		96.5665	95.2529	87.5841	87.5341	89.9080	89.7107	97.9706	101.7079	111.2962	(65)
5. Internal g	ains (see Ta												
Metabolic gai	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
(66)m Lighting gain	87.3060 s (calculate	87.3060 ed in Appen	87.3060 dix L, equa	87.3060 tion L9 or	87.3060 L9a), also	87.3060 see Table 5	87.3060	87.3060	87.3060	87.3060	87.3060	87.3060	(66)
5 5 5 5	79.0664	87.5378	79.0664	81.7020	79.0664	81.7020	79.0664	79.0664	81.7020	79.0664	81.7020	79.0664	(67)

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Appliances gas	ins (calcula 152.1665	nted in Appe 153.7456	endix L, eq 149.7665	uation L13 141.2955	or L13a), a 130.6025	lso see Tab 120.5525	le 5 113.8385	112.2595	116.2386	124.7095	135.4026	145.4526	(68)
Cooking gains								31.7306	31.7306	31.7306	31.7306	31.7306	
Pumps, fans Losses e.g. ev	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Water heating	-69.8448	-69.8448	-69.8448	-69.8448	-69.8448	-69.8448	-69.8448	-69.8448	-69.8448	-69.8448	-69.8448	-69.8448	(71)
Total internal	150.8827	148.6132	144.1229	134.1201	128.0281	121.6446	117.6534	120.8441	124.5982	131.6809	141.2609	149.5917	(72)
	431.3075	439.0884	422.1476	406.3095	386.8888	373.0909	359.7502	361.3619	371.7305	384.6486	407.5573	423.3024	(73)
6. Solar gains													
[Jan]			А	rea m2	Solar flux Table 6a W/m2	Speci	g fic data Table 6b	Specific or Tab		Acce fact Table	or	Gains W	
South			7.7		46.7521		0.7600		.8000	0.77	90	153.0589	(78)
Solar gains Total gains	153.0589 584.3664	250.6711 689.7595	319.3105 741.4581	360.8901 767.1996	376.0699 762.9587	361.9161 735.0070	353.6140 713.3642	343.4082 704.7701	333.5575 705.2880	270.3723 655.0209	181.4270 588.9843	132.2570 555.5594	
7. Mean inter	nal temperat	ure (heatir	ng season)										
Temperature du Utilisation fa	uring heatir	ng periods i	in the livi	ng area fro	m Table 9,							21.0000	(85)
tau	Jan 166.6264	Feb 167.2933	Mar 167.9656	Apr 171.4097	May ´ 172.1155	Jun 175.7337	Jul 175.7337	Aug 176.4757	Sep 174.2683	Oct 172.1155	Nov 170.7096	Dec 169.3265	
alpha util living an	12.1084 rea	12.1529	12.1977	12.4273	12.4744	12.7156	12.7156	12.7650	12.6179	12.4744	12.3806	12.2884	
Ū	0.9129	0.7848	0.6622	0.5244	0.4037	0.2825	0.2001	0.2108	0.3200	0.5258	0.7789	0.9327	(86)
MIT Th 2 util rest of h	20.9429 20.3770 nouse	20.9890 20.3794	20.9983 20.3817	20.9999 20.3934	21.0000 20.3958	21.0000 20.4075	21.0000 20.4075	21.0000 20.4099	21.0000 20.4028	20.9999 20.3958	20.9919 20.3911	20.9285 20.3864	
MIT 2 Living area f	0.8927 20.3343 raction	0.7576 20.3720	0.6345 20.3807	0.4982 20.3934	0.3775 20.3958	0.2563 20.4075	0.1731 20.4075	0.1838 20.4099	0.2923 20.4028 fLA =	0.4953 20.3957 Living are	0.7478 20.3860 a / (4) =	0.9155 20.3316 0.5451	(90)
MIT Temperature ad	20.6661 djustment	20.7083	20.7173	20.7240	20.7251	20.7305	20.7305	20.7316	20.7283	20.7251	20.7163	20.6569 0.0000	
adjusted MIT	20.6661	20.7083	20.7173	20.7240	20.7251	20.7305	20.7305	20.7316	20.7283	20.7251	20.7163	20.6569	(93)
8. Space heat	ing requiren												
	Jon				May				For	Oct	Nov	Dos	
Utilisation	Jan 0.9024	Feb 0.7721	Mar 0.6496	Apr 0.5125	May 0.3918	Jun 0.2706 198.8624	Jul 0.1878 133.9858	Aug 0.1985 139.9174	Sep 0.3074	0ct 0.5119	Nov 0.7646	Dec 0.9235	
Useful gains Ext temp. Heat loss rate	527.3587 4.3000	532.5842 4.9000	481.6196 6.5000	393.1784 8.9000	298.9128 11.7000	14.6000	16.6000	16.4000	216.8200 14.1000	335.3060 10.6000	7.1000	513.0423 4.2000	
Space heating	559.9040	538.6663	482.5157	393.2258	298.9143	198.8624	133.9858	139.9174	216.8201	335.3446	454.6875	554.0353	(97)
Space heating Solar heating	24.2137 requirement	4.0872 - total pe	0.6667 er year (kW	0.0341 h/year)	0.0011	0.0000	0.0000	0.0000	0.0000	0.0287	3.1287	30.4987 62.6590	•
Solar heating	0.0000 contributio	0.0000 on - total p	0.0000 per year (kl	0.0000 Wh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000	
Space heating Space heating	24.2137 requirement	4.0872 after sola	0.6667 ar contribu	0.0341 tion - tota	0.0011 l per year	0.0000 (kWh/year)	0.0000	0.0000	0.0000	0.0287	3.1287	30.4987 62.6590	
Space heating	per m2									(98c) / (4) =	1.2073	(99)
9b. Energy red	quirements												
Fraction of sp	pace heat fr	om secondar	ry/suppleme		m (Table 11							0.0000	
Fraction of sp Fraction of he	eat from con	munity Comb	oined Heat		pace and Wa	ter						1.0000 0.5580	(303
Fraction of he Factor for con	ntrol and ch	narging meth	nod (Table	4c(3)) for		ng						0.4420 1.0500	(305)
Factor for cha Distribution : Efficiency of	loss factor	(Table 12c)) for commu	nity heatin								1.0500 1.2500	(306)
Efficiency of Space heating: Space heating	:		y nearing	ayatem, %								0.0000	(208)
Space neating Space heat fro	24.2137	4.0872	0.6667 ower = (98)	0.0341 x 0.56 x 1	0.0011 05 x 1 25	0.0000	0.0000	0.0000	0.0000	0.0287	3.1287	30.4987	(98)
307a	17.7335	2.9934	0.4883	0.0250	0.0008	0.0000	0.0000	0.0000	0.0000	0.0210	2.2914	22.3365	
Space heat fro 307b Space heating	14.0470	2.3711	0.3868	0.0198	0.0007	0.0000	0.0000	0.0000	0.0000	0.0167	1.8151	17.6931	

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			-4.	Crici	99
31.7805 5.3644 0.8750 0.0448 0.0015 0.0000 0.0000 Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0.0000	0.0000	0.0377	4.1065	40.0296 (3) 0.0000 (3)
pace heating fuel for secondary/supplementary system 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (3
ater heating					
nual water heating requirement 204.0968 180.8086 193.0943 172.4244 168.8778 154.0749 153.5555	158.6672	159.2885	175.3075	183.5241	202.2412 (6
ter heat from Combined Heat and Power = (64) x 0.56 x 1.05 x 1.25 0a 149.4754 132.4197 141.4175 126.2793 123.6819 112.8406 112.4602	116.2039	116.6589	128.3908	134.4084	148.1164
ter heat from Boilers = (64) x 0.44 x 1.05 x 1.25 .0b	92.0468	92.4073	101.7002	106.4669	117.3252
ster heating fuel 267.8770 237.3113 253.4363 226.3070 221.6521 202.2233 201.5416	208.2508	209.0662	230.0911	240.8753	265.4415 (3
ooling System Energy Efficiency Ratio	0.0000	0.0000	0.0000	0.0000	0.0000 (3: 0.0000 (3:
Imps and Fa 8.6567 7.8190 8.6567 8.3775 8.6567 8.3775 8.6567	8.6567	8.3775	8.6567	8.3775	8.6567 (3
ighting 14.5256 11.6530 10.4922 7.6871 5.9377 4.8512 5.4166 Lectricity generated by PVs (Appendix M) (negative quantity)	7.0407	9.1451	11.9989	13.5527	14.9293 (3)
33a)m -1.8205 -2.9326 -4.8225 -6.2327 -7.4863 -7.2833 -7.1888 ectricity generated by wind turbines (Appendix M) (negative quantity)	-6.3820	-5.1372	-3.6635	-2.1253	-1.5338 (3)
34a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 ectricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000 (3
335a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (3
ectricity generated by PVs (Appendix M) (negative quantity) 33b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (3
ectricity generated by wind turbines (Appendix M) (negative quantity) 34b)m	0.0000	0.0000	0.0000	0.0000	0.0000 (3
ectricity generated by hydro-electric generators (Appendix M) (negative quantity) 35b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (3
nual totals kWh/year ace heating fuel - community heating					82.2399 (3
ace heating fuel - secondary					0.0000 (3
ter heating fuel - community heating ficiency of water heater					2764.0736 (3 0.0000 (3
ectricity used for heat distribution ace cooling fuel					0.8224 (3 0.0000 (3
ectricity for pumps and fans:					
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.5875) mechanical ventilation fans (SFP = 0.5875)					101.9262 (3
otal electricity for the above, kWh/year					101.9262 (3
ectricity for lighting (calculated in Appendix L)					117.2302 (3
nergy saving/generation technologies (Appendices M ,N and Q) / generation					-56.6085 (3)
ind generation /dro-electric generation (Appendix N)					0.0000 (3 0.0000 (3
Lectricity generated - Micro CHP (Appendix N)					0.0000 (3
ppendix Q - special features nergy saved or generated					-0.0000 (3
nergy used otal delivered energy for all uses					0.0000 (33 3008.8614 (33
2b. Carbon dioxide emissions - Community heating scheme					
······································	Energy	Emiss	ion factor		Emissions
lectrical efficiency of CHP unit	kWh/year		kg CO2/kWh	k	g CO2/year 32.0000 (3
eat efficiency of CHP unit	01 0627		0.2100		49.9000 (3
pace heating from Combined Heat and Power Less credit emissions for electricity	91.9637 -29.4284		0.2100 0.3480		19.3124 (3 -10.2411 (3
ater heating from Combined Heat and Power Less credit emissions for electricity	3090.8879 -989.0841		0.2100 0.3480		649.0865 (3 -344.2013 (3
fficiency of heat source Boilers pace and Water heating from Boilers	1339.7983		0.2100		93.9000 (3 8.1294 (3
lectrical energy for heat distribution (space & water)	0.8224		0.0000		4.0176 (3
verall CO2 factor for heat network otal CO2 associated with community systems					0.2106 (3 599.3317 (3
pace and water heating umps, fans and electric keep-hot	101.9262		0.1387		599.3317 (3 14.1384 (3
nergy for lighting	117.2302		0.1443		16.9199 (3
Energy saving/generation technologies					
/ Unit electricity used in dwelling / Unit electricity exported	-56.6085 0.0000		0.1319 0.0000		-7.4659 0.0000
otal otal CO2, kg/year					-7.4659 (3 622.9242 (3
PC Dwelling Carbon Dioxide Emission Rate (DER)					12.0000 (3
2h Dainany agangy Community hasting schows					
3b. Primary energy - Community heating scheme			_		
	Energy kWh/year	Primary ene	rgy factor kg CO2/kWh	Prim	ary energy kWh/year
lectrical efficiency of CHP unit	, ,		5,		32.0000 (4
eat efficiency of CHP unit pace heating from Combined Heat and Power	91.9637		1.1300		49.9000 (4) 103.9190 (4)
less credit emissions for electricity Water heating from Combined Heat and Power	-29.4284 3090.8879		2.1490 1.1300		-63.2416 (4) 3492.7034 (4)
			1.100		· · · · · · · · · · · · · · · · ·

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less credit emi Efficiency of he Space and Water Electrical energ Overall CO2 fact Total CO2 associ Space and water	at source heating for y for hear or for hear ated with	Boilers rom Boilers t distribut: at network	ion (space	& water)				-989.0841 1339.7983 0.8224		2.1490 1.1300 0.0000	-	-2125.5418 93.9000 43.7439 43.3185 1.0417 2965.1296 2965.1296	(467) (468) (472) (486) (473)
Pumps, fans and Energy for light	electric	keep-hot						101.9262 117.2302		1.5128 1.5338		154.1939 179.8116	(478
Energy saving/g PV Unit electric PV Unit electric Total Total Primary en Dwelling Primary	ity used : ity expor	in dwelling ted year	es					-56.6085 0.0000		1.4873 0.0000		-84.1922 0.0000 -84.1922 3214.9428 61.9400	(480 (483
SAP 10 WORKSHEET CALCULATION OF T	FOR New ARGET EMI	Build (As De SSIONS	esigned)	(Version 10	.2, February	2022)							
1. Overall dwell								Area	Storey	height		Volume	
Ground floor Total floor area Owelling volume	TFA = (1	a)+(1b)+(1c))+(1d)+(1e)	(1n)	5	1.9000		(m2) 51.9000	(1b) x Ba)+(3b)+(3c)+((m) 2.7400 3d)+(3e)		(m3) 142.2060 142.2060	(4)
?. Ventilation r											m:	3 per hour	
Number of open c Number of open f Number of chimme Number of flues Number of flues Number of blocke Number of passiv Number of fluele	lues ys / flue attached attached d chimney ittent ex e vents	to solid fud to other hea s tract fans	el boiler	ire							0 * 80 = 0 * 20 = 0 * 10 = 0 * 20 = 0 * 35 = 0 * 20 = 2 * 10 = 0 * 10 = 0 * 40 =	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(6b) (6c) (6d) (6e) (6f) (7a) (7b)
Infiltration due Pressure test Pressure Test Me Measured/design Infiltration rat	thod AP50	eys, flues a	and fans	= (6a)+(6b)	+(6c)+(6d)+(6e)+(6f)	+(6g)+(7a)+(7	7b)+(7c) =		20.0000	Air changes / (5) = Bl	s per hour 0.1406 Yes Lower Door 5.0000 0.3906	(8)
Number of sides Shelter factor Infiltration rat		d to include	e shelter f	actor					(20) = 1 - (21)		(19)] = x (20) =	0.7750 0.3027	
Wind speed Wind factor	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	0ct 4.3000	Nov 4.5000	Dec 4.7000 1.1750	
Adj infilt rate	1.2750 0.3860 0.5745	1.2500 0.3784 0.5716	1.2250 0.3709 0.5688	1.1000 0.3330 0.5555	1.0750 0.3255 0.5530	0.9500 0.2876 0.5414		0.9250 0.2800 0.5392	1.0000 0.3027 0.5458	0.3255 0.5530	1.1250 0.3406 0.5580	0.3557 0.5633	(22b
3. Heat losses a													
Element TER Opening Type External Wall 1 External Roof 1 Total net area o Fabric heat loss Party Wall 1	f externa	l elements A		Gross m2 19.2348 51.9000	Openings m2 7.7700	1: 5: 7:	etArea m2 7.7700 1.4648 1.9000 1.1348 (26)(3	U-value W/m2K 1.1450 0.1800 0.1100 80) + (32) 0.0000	A x U W/K 8.8969 2.0637 5.7090 = 16.6696 0.0000		-value kJ/m2K	A x K kJ/K	
Thermal mass par List of Thermal K1 Eleme	Bridges	MP = Cm / Ti	FA) in kJ/m	2K				ι	ength Psi.	-value	Tota	395.4106 al	(35)

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E3 Sil E4 Jan E7 Par E9 Bal E18 Pa E14 Fl P4 Par	l b ty floor be cony betwee rty wall be at roof ty wall - F	etween dwel en dwelling etween dwel Roof (insul	ation at ce	locks of fl ulation con iling level	tinuous)			1 7 7 7 5 7	.8400 .5600 .7400 .0100 .0100 .4800 .0100 .3500	0.0500 0.0500 0.0500 0.0700 0.0200 0.0600 0.0800 0.1200	0.19 0.07 0.38 0.49 0.14 0.32 0.56	80 70 07 02 88 08 20	(26)
Thermal bridge Point Thermal Total fabric h	bridges	PS1) Calcu	iated using	Appendix K)				(33) + (36)	(36a) = + (36a) =	4.7395 0.0000 21.4091	
Ventilation he	at loss cal Jan	lculated mo				7	Jul	A	Com	0ct	Nov	Dos	
(38)m Heat transfer	26.9601	26.8243	Mar 26.6912	Apr 26.0662	May 25.9493	Jun 25.4 0 49	25.4049	Aug 25.3041	Sep 25.6146	25.9493	26.1859	Dec 26.4332	(38)
Average = Sum(48.3692	48.2334	48.1004	47.4753	47.3584	46.8140	46.8140	46.7132	47.0237	47.3584	47.5950	47.8423 47.4748	(39)
HLP	Jan 0.9320	Feb 0.9294	Mar 0.9268	Apr 0.9147	May 0.9125	Jun 0.9020	Jul 0.9020	Aug 0.9001	Sep 0.9060	0ct 0.9125	Nov 0.9171	Dec 0.9218	(40)
HLP (average) Days in mont	31	28	31	30	31	30	31	31	30	31	30	0.9147 31	
4. Water heati													()
Assumed occupa Hot water usag	•	showers 52.6923	51.5208	49.2793	47.6252	45.7805	44.7320	45.8946	47.1691	49.1497	51.4393	1.7461 53.2912	
Hot water usag			22.3012	21.4093	20.7415	20.0010	19.6010	20.0813	20.6043	21.3967	22.3069	23.0502	• •
Hot water usag			30.1475	28.9653	27.7830	26.6007	26.6007	27.7830	28.9653	30.1475	31.3298	32.5120	
Average daily												100.3217	(43)
Daily hot wate	Jan r use 109.1366	Feb 106.8069	Mar 103.9694	Apr 99.6538	May 96.1496	Jun 92.3822	Jul 90.9337	Aug 93.7589	Sep 96.7386	0ct 100.6939	Nov 105.0759	Dec 108.8534	(44)
Energy conte Energy content	172.8457	152.0916	159.7971	136.4211	129.4359	113.5947	109.9764	116.0931	119.2884	136.6406	149.6999 Sum(45)m =	170.4382 1666.3227	
Distribution 1	oss (46)m 25.9268	= 0.15 x (45)m 23.9696	20.4632	19.4154	17.0392	16.4965	17.4140	17.8933	20.4961	22.4550	25.5657	(46)
Water storage Store volume		lamed lame	fastan is n	at Imai .								0.0000	(47)
b) If manufa Hot water st Volume facto Temperature Enter (49) or	orage loss or from Tabl factor from	factor from le 2a n Table 2b			ay)							1.4400 0.0000 1.0000 1.4400	(52) (53)
Total storage		40.3200	44.6400	43.2000	44.6400	43.2000	44.6400	44.6400	43.2000	44.6400	43.2000	44.6400	
If cylinder co	44.6400	40.3200	44.6400	43.2000	44.6400	43.2000	44.6400	44.6400	43.2000	44.6400	43.2000	44.6400	
Primary loss 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	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	
Total heat red	uired for w 217.4857	water heati 192.4116	ng calculato 204.4371	ed for each 179.6211	month 174.0759	156.7947	154.6164	160.7331	162.4884	181.2806	192.8999	215.0782	
WWHRS PV diverter	-24.4562 -0.0000	-21.6293 -0.0000	-22.6489 -0.0000	-18.7542 -0.0000	-17.4783 -0.0000	-14.9563 -0.0000	-14.0191 -0.0000	-14.9079 -0.0000	-15.4743 -0.0000	-18.2425 -0.0000	-20.6666 -0.0000	-24.0033 -0.0000	
Solar input 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	(63c)
Output from w/		170.7823	181.7882	160.8669	156.5976	141.8384	140.5973	145.8252	147.0140	163.0381	172.2334	191.0748	(64)
12Total per ye Electric showe		ar)						lotal p	er year (kW	h/year) = S	oum(64)m =	1964.6856 1965	
22000.20 3.10.10	0.0000	0.0000	0.0000	0.0000 Tot	0.0000 al Energy u	0.0000 sed by insta	0.0000 antaneous e	0.0000 lectric sho	0.0000 wer(s) (kWh	0.0000 /vear) = Su	0.0000 m(64a)m =	0.0000 0.0000	
Heat gains fro	m water hea 93.1832	ating, kWh/ 82.8265	month 88.8445	79.9200	78.7494	72.3302	72.2792	74.3130	74.2234	81.1450	84.3352	92.3827	
5. Internal ga Metabolic gair (66)m Lighting gains Appliances gai	s (Table 5) Jan 87.3060 (calculate 81.1655 ns (calculate 152.1665	% Watts Feb 87.3060 ed in Appen 89.8619 ated in App 153.7456	Mar 87.3060 dix L, equa 81.1655 endix L, eq 149.7665 ix L, equat	Apr 87.3060 tion L9 or 83.8711 uation L13 141.2955	May 87.3060 L9a), also 81.1655 or L13a), a	83.8711 lso see Tab 120.5525	Jul 87.3060 81.1655 le 5 113.8385		Sep 87.3060 83.8711 116.2386	0ct 87.3060 81.1655 124.7095	Nov 87.3060 83.8711 135.4026	Dec 87.3060 81.1655 145.4526	(67)
Cooking gains					21 7206	31.7306	31.7306	31.7306	31.7306	31.7306	31.7306	31.7306	(69)
Pumps, fans	31.7306 0.0000	31.7306 0.0000	31.7306 0.0000	31.7306	31.7306 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
	31.7306 0.0000 aporation (-69.8448	0.0000 (negative v -69.8448	0.0000	0.0000									(70)

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407.7701 416.0529 399.5386 385.3585 366.8059 354.0741 341.3453 342.4999 352.3895 364.1328 385.5977 399.9802 (73)

6. Solar gain	S												
[Jan]			Δ	nrea m2	Solar flux Table 6a W/m2	Speci	g fic data Table 6b	Specific or Tab		Acce fact Table	or	Gains W	
South			7.7	700	46.7521		0.6300	0	.7000	0.77	00	111.0181	(78)
Solar gains Total gains	111.0181 518.7882	181.8190 597.8718	231.6051 631.1437	261.7641 647.1225	272.7744 639.5802	262.5082 616.5823	256.4865 597.8318	249.0839 591.5838	241.9389 594.3284	196.1088 560.2416	131.5943 517.1920	95.9298 495.9100	
7. Mean inter													
Temperature d	uring heating	ng periods ains for li	in the livi ving area,	ni1,m (see	m Table 9,	Th1 (C)						21.0000	(85)
tau alpha	Jan 117.8540 8.8569	Feb 118.1857 8.8790	Mar 118.5127 8.9008	Apr 120.0729 9.0049	May 120.3694 9.0246	Jun 121.7691 9.1179	Jul 121.7691 9.1179	Aug 122.0319 9.1355	Sep 121.2262 9.0817	0ct 120.3694 9.0246	Nov 119.7711 8.9847	Dec 119.1520 8.9435	
util living a	o.9928	0.9756	0.9378	0.8387	0.6810	0.4856	0.3445	0.3632	0.5449	0.8333	0.9739	0.9949	(86)
MIT Th 2	20.5743 20.1404	20.7188 20.1426	20.8463 20.1448	20.9538 20.1550	20.9929 20.1569	20.9997 20.1658	21.0000 20.1658	21.0000 20.1674	20.9991 20.1624	20.9626 20.1569	20.7699 20.1530	20.5480 20.1490	. ,
util rest of MIT 2 Living area f	0.9896 19.6686	0.9658 19.8480	0.9157 19.9984	0.7956 20.1186	0.6227 20.1528	0.4225 20.1657	0.2792 20.1658	0.2975 20.1674	0.4793 20.1620 flA =	0.7822 20.1300 Living are	0.9616 19.9213 a / (4) =	0.9925 19.6428 0.5451	(90)
MIT Temperature a adjusted MIT	20.1623	20.3227	20.4606	20.5738	20.6107	20.6203	20.6205	20.6212	20.6183	20.5838	20.3839	20.1362 0.0000 20.1362	(92)
8. Space heat													
Utilisation Useful gains	Jan 0.9897 513.4253	Feb 0.9681 578.8096	Mar 0.9245 583.5107	Apr 0.8178 529.2043	May 0.6545 418.5771	Jun 0.4569 281.7124	Jul 0.3148 188.2125	Aug 0.3333 197.1823	Sep 0.5151 306.1516	0ct 0.8091 453.2953	Nov 0.9654 499.2996	Dec 0.9924 492.1567	
Ext temp. Heat loss rat	4.3000 e W 767.2448	4.9000 743.8880	6.5000 671.5091	8.9000 554.2197	11.7000 421.9977	14.6000 281.8340	16.6000 188.2159	16.4000 197.1881	14.1000 306.5150	10.6000 472.8179	7.1000 632.2448	4.2000 762.4245	(96)
Space heating	kWh 188.8417	110.9327	65.4708	18.0111	2.5449	0.0000	0.0000	0.0000	0.0000	14.5248	95.7206	201.0792	(98a)
Space heating 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	
Solar heating Space heating		on - total 110.9327	per year (k 65.4708	Wh/year) 18.0111	2.5449	0.0000	0.0000	0.0000	0.0000	14.5248	95.7206	0.0000 201.0792	(98c)
Space heating Space heating		t after sol	ar contribu	tion – tota	l per year	(kWh/year)				(98c) / (4) =	697.1258 13.4321	
9b. Energy re													
Fraction of s Fraction of s Fraction of h Fraction of h Factor for co Factor for co Distribution Efficiency of Space heating	pace heat fi pace heat fi leat from con leat from con introl and ch larging metho loss factor secondary/s	rom communi mmunity Com mmunity Boi harging met od (Table 4 (Table 12c supplementa	ty system bined Heat lers-Space hod (Table c(3)) for w) for commu	and Power-S and Water 4c(3)) for water heating	pace and Wa space heati g	ter						0.0000 1.0000 0.5580 0.4420 1.0000 1.0000 0.0000	(302) (303a) (303b) (305) (305a) (306)
Space heating	188.8417	110.9327	65.4708 ower = (98)	18.0111 x 0.56 x 1	2.5449 .00 x 1.25	0.0000	0.0000	0.0000	0.0000	14.5248	95.7206	201.0792	(98)
307a Space heat fr	131.7171 om Boilers :	77.3755 = (98) x 0.	45.6659 [°] 44 x 1.00 x	12.5628 1.25	1.7751	0.0000	0.0000	0.0000	0.0000	10.1310	66.7651	140.2528	
307b Space heating	236.0522	138.6658	36.1726 81.8385	9.9511	1.4061 3.1811	0.0000	0.0000	0.0000	0.0000	8.0249 18.1560	52.8856 119.6507	111.0963 251.3491	(307)
Efficiency of Space heating					(from Tabl	e 4a or App 0.0000	endix E) 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Water heating													/
Annual water Water heat fr	193.0294	170.7823	181.7882 ower = (64)	160.8669 x 0.56 x 1	156.5976 .00 x 1.25	141.8384	140.5973	145.8252	147.0140	163.0381	172.2334	191.0748	(64)
310a	134.6380	119.1207	126.7973	112.2047	109.2268	98.9323	98.0666	101.7131	102.5423	113.7191	120.1328	133.2747	

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				7	Crici	99	
Water heat from Boilers = (64) x 0.44 x 1.00 x 1.25							
	.3657 77.6800	80.5684	81.2253	90.0785	95.1589	105.5688	
	.2980 175.7466	182.2815	183.7675	203.7976	215.2917	238.8435 0.0000	, ,
Space coolin 0.0000 0.0000 0.0000 0.0000 0.0000 0.	.0000 0.0000 .0000 0.0000	0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000	(315)
	.6323 6.2888	8.1744	10.6177	13.9310	15.7350	17.3333	
	.3068 -18.0832	-16.3413	-13.5608	-10.1095	-6.1140	-4.5083	(333a
	.0000 0.0000 quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	(334a
	.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335a
	.0537 -9.9380	-8.2757	-5.8869	-3.2923	-1.3871	-0.7980	(333b
	.0000 0.0000 guantity)	0.0000	0.0000	0.0000	0.0000	0.0000	(334b
	.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335b
pace heating fuel - community heating pace heating fuel - secondary						871.4073 0.0000	
Water heating fuel - community heating						2455.8570	(310)
Electricity used for heat distribution Space cooling fuel						8.7141 0.0000	(313)
Electricity for pumps and fans:							(522)
Total electricity for the above, kWh/year Electricity for lighting (calculated in Appendix L)						0.0000 136.1070	
Energy saving/generation technologies (Appendices M ,N and Q)						23072070	(332)
PV generation Wind generation						-213.7740 0.0000	
Hydro-electric generation (Appendix N) Electricity generated - Micro CHP (Appendix N)						0.0000 0.0000	(335a)
Appendix Q´- special features Energy saved or generated						-0.0000	
Energy used Total delivered energy for all uses						0.0000 3249.5973	(337)
12b. Carbon dioxide emissions - Community heating scheme							
		Energy		ion factor	l.	Emissions	
Electrical efficiency of CHP unit		kWh/year	'	kg CO2/kWh	K	32.0000	(361)
Heat efficiency of CHP unit Space heating from Combined Heat and Power		974.4394		0.2100		49.9000 204.6323	(363)
less credit emissions for electricity Water heating from Combined Heat and Power		-311.8206 2746.2289		0.3480 0.2100		-108.5136 576.7081	(365)
less credit emissions for electricity Efficiency of heat source Boilers		-878.7932		0.3480		-305.8200 93.9000	(367)
Space and Water heating from Boilers Electrical energy for heat distribution (space & water)	:	1566.1883 8.7141		0.2100 0.0000		86.1385 4.8395	(372)
Overall CO2 factor for heat network Total CO2 associated with community systems						0.2106 700.7458	(373)
Space and water heating Pumps, fans and electric keep-hot		0.0000		0.0000		700.7458	(378)
Energy for lighting		136.1070		0.1443		19.6444	(3/9)
Energy saving/generation technologies PV Unit electricity used in dwelling		-149.1078		0.1326		-19.7685	
PV Unit electricity exported Total Total CON Jackson		-64.6661		0.1247		-8.0645 -27.8330	(380)
Total CO2, kg/year EPC Target Carbon Dioxide Emission Rate (TER)						692.5572 13.3400	
13b. Primary energy - Community heating scheme							
		Energy	Primary ene		Prim	ary energy	
Electrical efficiency of CHP unit		kWh/year	'	kg CO2/kWh		kWh/year 32.0000	(461)
Heat efficiency of CHP unit Space heating from Combined Heat and Power		974.4394		1.1300		49.9000 1101.1166	(463)
less credit emissions for electricity Water heating from Combined Heat and Power		-311.8206 2746.2289		2.1490 1.1300		-670.1025 3103.2386	(465)
less credit emissions for electricity Efficiency of heat source Boilers		-878.7932		2.1490		-1888.5267 93.9000	(467b
Space and Water heating from Boilers Electrical energy for heat distribution (space & water)		1566.1883 8.7141		1.1300 0.0000		463.5070 51.1726	(472)
Overall CO2 factor for heat network Total CO2 associated with community systems						1.0419 3466.6914	(473)
Space and water heating Pumps, fans and electric keep-hot		0.0000		0.0000		3466.6914 0.0000	(478)
Energy for lighting		136.1070		1.5338		208.7654	(479)
Energy saving/generation technologies PV Unit electricity used in dwelling		-149.1078		1.4899		-222.1514	

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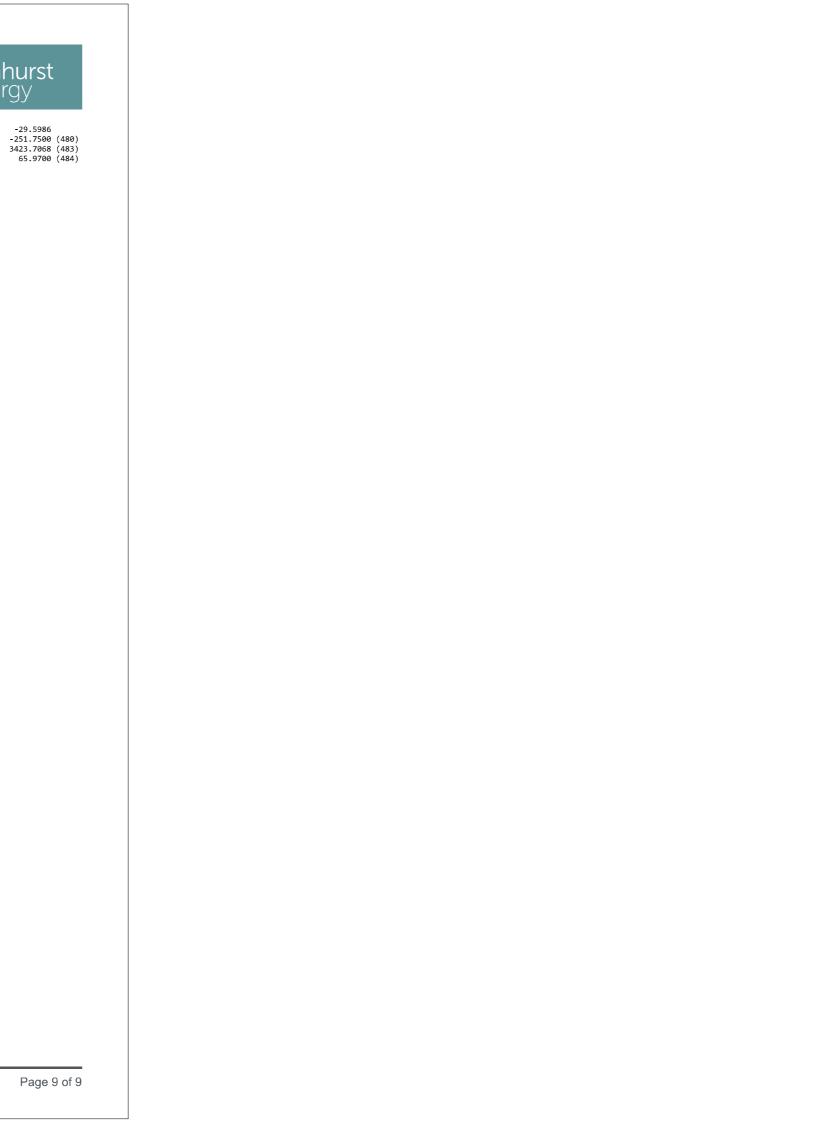


PV Unit electricity exported Total Total Primary energy kWh/year Target Primary Energy Rate (TPER)

-64.6661

0.4577

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Property Reference		L01-6	3.04 SO x6_Copy						Issued	on Date	12/09/	2023	
Assessment Referenc	:0	L00.0	4 SO_Copy				Prop	Type Ref					
Property													
SAP Rating				88	ВВ	DER		2.45		TER	1:	2.48	
Environmental				98		% DER	< TER					0.37	
CO: Emissions (t/year)			0.		DFEE		27.44		TFEE		7.80	
Compliance Check % DPER < TPER					e BREL	M DFE	E < TFEE	26.06		TPER		28 7.82	
		_			.50	DI EK		20.00					_
Assessor Details Client		Mr. Richard	Denteh							Assessor ID	U	148-0001	
AP 10 WORKSHEET ALCULATION OF D	WELLING EM	uild (As Do	esigned) (Version 10									
								Area	Store	y height		Volume	
round floor								(m2) 72.0000	(1b) x	(m) 2.7400 ((2b) =	(m3) 197.2800	
otal floor area	TFA = (1a))+(1b)+(1c)+(1d)+(1e).	(1n)	7	2.0000							(4
welling volume								(3	a)+(3b)+(3c)+	(3d)+(3e)	(3n) =	197.2800	(5
mber of chimne mber of flues mber of flues mber of blocke mber of interm mber of passiv mber of fluele defiltration due ressure test ressure Test Me resured/design	attached t attached t d chimneys ittent ext e vents ss gas fir to chimne thod AP50	o solid fuo o other hea ract fans es	el boiler ater		+(6c)+(6d)+(6e)+(6f)+(6	g)+(7a)+(7	7b)+(7c) =		0.0000	0 * 10 = 0 * 20 = 0 * 35 = 0 * 20 = 0 * 10 = 0 * 10 = 0 * 40 = Air change / (5) =	0.0000 Yes lower Door 3.0000	(6 (6 (7 (7 (7
filtration rat mber of sides												0.1500 2	(1 (1
melter factor									(20) = 1 -	[0 075	(10)1 -		
nfiltration rat	e adjusted	to include	e shelter fa	ictor						(0.075 X) = (18) >		0.8500 0.1275	
ind speed	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	Sep 4.0000 1.0000	0ct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	
lj 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	(2
alanced mechan mechanical ve exhaust air h balanced with	ntilation eat pump u	sing Append	dix N, (23b)	= (23a) x	Fmv (equati	on (N5)), o	:herwise ((23b) = (23				0.5000 0.5000 72.8000	(2
fective ac	0.2986	0.2954	0.2922	0.2762	0.2731	0.2571	0.2571	0.2539	0.2635	0.2731	0.2794	0.2858	
Heat losses a			er	Gross m2	Openings m2	NetA		U-value W/m2K	A x U W/K		-value kJ/m2K	A x K kJ/K	
ndow (the 1.3	a)					1/ 0/	200	1 2257					
ndow (Uw = 1.3 ternal Wall 1	0)		4	7.8404	14.8000	14.80 33.04		1.2357 0.1400	18.2890 4.6257	196	0.0000	6277.6760	(2

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Cobuic book lo	U/V ((A v. 11)					(26) (20) . (22)	22.01	4.6			(22)
Fabric heat lo: Party Wall 1	SS, W/K = S	Sum (A X U)				58	.2000	30) + (32) : 0.0000	= 22.91 0.00		0.0000	10476.0000	(33) (32)
Party Floor 1	1						.0000				0.0000	2880.0000	
Party Ceiling : Internal Wall :							.0000 .3600				0.0000 5.0000	2160.0000 8877.0000	
	S (A	1.3						(20)	(20) . (2	2) . (22-)	(22-)		·
Heat capacity (Thermal mass pa			TFA) in k3/r	m2K				(28).	(30) + (3	2) + (32a).	(32e) =	30670.6760 425.9816	
List of Therma	l Bridges	,	1177 211 1371										(33.
K1 Eler		(including	other stee	l lintals)					ength .5700	Psi-value 0.0300	Tot 0.22		
E3 Sil		(Including	other stee.	i iiiiteis)					.9900	0.0300	0.17		
E4 Jaml									.1000	0.0300	0.51		
		etween dwel. etween dwel:	lings (in bi	locks of fl	ats)				.9200 .4800	0.0700 0.0600	2.44 0.32		
E16 Co	rner (norma	al)							.7400	0.0900	0.24	166	
			g, wall ins rnal area g			unoa)			.8000 .7400	0.0000 -0.0900	0.00 -0.24		
Thermal bridges						ii cu j		_	.7400	0.0500	0.2-	3.6930	(36
Point Thermal N Total fabric he									,	22) . (26)	(36a) =	0.0000	
TOTAL TABRIC N	eat loss								(33) + (36)	+ (36a) =	26.6076	(3/
Ventilation hea						_			-			_	
(38)m	Jan 19.4371	Feb 19.2296	Mar 19.0221	Apr 17.9845	May 17.7770	Jun 16.7395	Jul 16.7395	Aug 16.5319	Sep 17.1545	0ct 17.7770	Nov 18.1921	Dec 18.6071	(38
Heat transfer (13.2230	13.0221	1713043	1717770	1017333	1017555	10.3313	17.1343	1717770	1011721	10.0071	(50
Average = Sum(46.0448 39)m / 12 =	45.8373	45.6297	44.5922	44.3847	43.3471	43.3471	43.1396	43.7621	44.3847	44.7997	45.2147 44.5403	
Average - Sum(.	JJ/III / 12 -	_										44.5405	
HLP	Jan 0.6395	Feb 0.6366	Mar 0.6337	Apr 0.6193	May 0.6165	Jun 0.6020	Jul 0.6020	Aug 0.5992	Sep 0.6078	0ct 0.6165	Nov 0.6222	Dec 0.6280	(10
nir HLP (average)	0.0333	0.0300	0.033/	0.0173	0.0103	0.0020	0.0020	0.3332	0.00/6	0.0103	0.0222	0.6186	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	
4. Water heati													
Assumed occupa		a chauanc										2.2937	(42
Hot water usage	86.1812	84.8860	82.9988	79.3878	76.7230	73.7513	72.0621	73.9351	75.9883	79.1790	82.8675	85.8510	(42
Hot water usage	e for baths 27.0765	26.6744	26.1081	25.0640	24.2822	23.4152	22.9470	23.5093	24.1216	25.0492	26.1148	26.9849	(42
Hot water usage			20.1081	23.0040	24.2022	23.4132	22.94/0	23.3693	24.1210	23.0432	20.1148	20.9849	(42
Average daily H	38.1196 hot water ι	36.7335 use (litres	35.3473 /day)	33.9611	32.5749	31.1888	31.1888	32.5749	33.9611	35.3473	36.7335	38.1196 139.2145	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
Daily hot water	r use				-	• • • • • • • • • • • • • • • • • • • •		_	0.01				
Energy conte	151.3773	148.2938 211.1684	144.4541 222.0206	138.4129 189.4803	133.5801 179.8245	128.3553 157.8278	126.1979 152.6254	130.0194 160.9911	134.0709 165.3229	139.5755 189.4026	145.7158 207.5988	150.9555 236.3599	
Energy content		211.1064	222.0200	109.4003	179.0243	137.0276	132.0234	100.5511	103.3229		Sum(45)m =	2312.3670	
Distribution lo				20 4224	26 0727	22 6742	22 0020	24 1407	24 7004	20 4104	24 1200	25 4540	(45
Water storage	35.9617 loss:	31.6753	33.3031	28.4221	26.9737	23.6742	22.8938	24.1487	24.7984	28.4104	31.1398	35.4540	(46
Store volume												180.0000	
a) If manufact Temperature :			actor is kno	own (kWh/d	ay):							1.5200 0.6000	
Enter (49) or												0.9120	
Total storage :		25 5260	20 2720	27 2600	20 2720	27 2600	20 2720	20 2720	27 2600	20 2720	27 2600	20 2720	/50
If cylinder co	28.2720 ntains dedi	25.5360 icated sola	28.2720 r storage	27.3600	28.2720	27.3600	28.2720	28.2720	27.3600	28.2720	27.3600	28.2720	(56
	28.2720	25.5360	28.2720	27.3600	28.2720	27.3600	28.2720	28.2720	27.3600	28.2720	27.3600	28.2720	(57
Primary loss Combi loss	23.2624 0.0000	21.0112 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624	
combi ioss Total heat requ						טטטט.ט	0.0000	0.0000	0.0000	טטטט.ט	0.0000	0.0000	(01
-	291.2790	257.7156	273.5550	239.3523	231.3589	207.6998	204.1598	212.5255	215.1949	240.9370	257.4708	287.8943	
WWHRS PV diverter	-65.3735 -0.0000	-57.8168 -0.0000	-60.5425 -0.0000	-50.1315 -0.0000	-46.7208 -0.0000	-39.9793 -0.0000	-37.4742 -0.0000	-39.8501 -0.0000	-41.3641 -0.0000	-48.7638 -0.0000	-55.2434 -0.0000	-64.1628 -0.0000	
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	•
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	(63
Output from w/l	n 225.9055	199.8988	213.0125	189.2208	184.6381	167.7205	166.6856	172.6754	173.8307	192.1732	202.2274	223.7314	(64
407.1.3									er year (kW			2311.7201	(64
12Total per yea Electric showe		ar)										2312	(64
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Heat gains from	m water hea	ating, kWh/	month	Tot	al Energy u	sed by inst	antaneous e	iectric sho	wer(s) (kWh	/year) = Su	m(64a)m =	0.0000	(64
Bazııs		107.4513		102.8998	101.0192	92.3754	91.9755	94.7571	94.8675	104.2039	108.9242	119.8172	(65
5. Internal ga													
Metabolic gain:	s (Table 5) Jan), Watts Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
(66)m	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	114.6842	(66
Lighting gains	(calculate 101.8450		dix L, equat 101.8450			see Table 5 105.2399	101.8450	101 8450	105 2200	101 8450	105 2200	101 0450	167
Appliances gai					101.8450 or L13a), a			101.8450	105.2399	101.8450	105.2399	101.8450	(0/
Ţ.	201.9192		198.7344		173.3045	159.9686	151.0594	148.9641	154.2442	165.4848	179.6741	193.0100	(68

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Cooking gains Pumps, fans	(calculated 34.4684 0.0000	in Appendi: 34.4684 0.0000	x L, equat 34.4684 0.0000	ion L15 or L 34.4684 0.0000	.15a), also 34.4684 0.0000	34.4684 0.0000	5 34.4684 0.0000	34.4684 0.0000	34.4684 0.0000	34.4684 0.0000	34.4684 0.0000	34.4684 0.0000	
osses e.g. ev					-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	
ater heating			154.6362	142.9164	135.7785	128.2991	123.6230	127.3617	131.7604	140.0590	151.2836	161.0446	
otal internal		534.0745	512.6210	493.0553	468.3333	450.9128	433.9326	435.5761	448.6497	464.7941	493.6028	513.3049	
. Solar gains													
Jan]			А	rea m2	Solar flux Table 6a W/m2	a Speci	g fic data Table 6b	Specific or Tab		Acces facto Table 6	or	Gains W	
lorth lest			11.6 3.1		10.6334 19.6403		0.3300 0.3300		.8000 .8000	0.778 0.778		22.6639 11.3187	
olar gains otal gains	33.9826 557.7093	65.4536 599.5281	110.0617 622.6827	171.3974 664.4527	224.4236 692.7569	237.1985 688.1114	222.6836 656.6163	180.8387 616.4147	130.8975 579.5471	77.8302 542.6242	42.0719 535.6747	28.2017 541.5065	
. Mean interr emperature du	uring heatin	g periods i	n the livi		Table 9,							21.0000	(85)
Itilisation fa	Jan 185.0293	Feb 185.8670	Mar 186.7123	Apr 191.0567	May 191.9500	Jun 196.5445	Jul 196.5445	Aug 197.4900	Sep 194.6806	0ct 191.9500	Nov 190.1717	Dec 188.4261	
alpha util living ar	13.3353 rea 0.9962	13.3911 0.9878	13.4475 0.9554	13.7371 0.8029	13.7967 0.5957	14.1030 0.4032	14.1030 0.2905	14.1660 0.3219	13.9787 0.5210	13.7967 0.8357	0.9800	13.5617 0.9971	
IIT h 2	20.7829 20.3946	20.8516 20.3971	20.9321 20.3997	20.9938 20.4126	20.9999 20.4152	21.0000 20.4282	21.0000 20.4282	21.0000 20.4308	21.0000 20.4230	20.9917 20.4152	20.9003 20.4100	20.7762 20.4049	
itil rest of h NIT 2	nouse 0.9943 20.1511	0.9824 20.2386	0.9390 20.3350	0.7674 20.4081	0.5583 20.4151	0.3671 20.4282	0.2527 20.4282	0.2821 20.4308	0.4774 20.4230	0.7949 20.4096	0.9704 20.3100	0.9956 20.1518	
iving area fr IT	20.3898	20.4702	20.5606	20.6294	20.6360	20.6442	20.6442	20.6458	fLA = 20.6410	Living area 20.6295	20.5330	0.3778 20.3877	1 1
emperature ad adjusted MIT	djustment 20.3898	20.4702	20.5606	20.6294	20.6360	20.6442	20.6442	20.6458	20.6410	20.6295	20.5330	0.0000 20.3877	(93)
 3. Space heati	ing requirem	ent											
tilisation	Jan 0.9943	Feb 0.9831	Mar 0.9438	Apr 0.7807	May 0.5724	Jun 0.3807	Jul 0.2670	Aug 0.2971	Sep 0.4939	0ct 0.8102	Nov 0.9727	Dec 0.9956	(94)
seful gains xt temp.	554.5295 4.3000	589.4134 4.9000	587.7029 6.5000	518.7543 8.9000	396.5457 11.7000	261.9978 14.6000	175.3038 16.6000	183.1621 16.4000	286.2384 14.1000	439.6547 10.6000	521.0464 7.1000	539.1101 4.2000	
leat loss rate space heating	740.8498	713.6956	641.5802	523.0379	396.6229	261.9980	175.3038	183.1621	286.2460	445.1548	601.7950	731.9223	(97)
pace heating olar heating	138.6223 requirement	83.5176 - total per	40.0848 r year (kW	3.0842 h/year)	0.0575	0.0000	0.0000	0.0000	0.0000	4.0921	58.1390	143.4523 471.0497	
olar heating	0.0000 contributio	0.0000 n - total p	0.0000 er year (kl	0.0000 Wh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000	
pace heating	138.6223 requirement	83.5176 after sola	40.0848 r contribu	3.0842 tion - total	0.0575 per year	0.0000 (kWh/year)	0.0000	0.0000	0.0000	4.0921	58.1390	143.4523 471.0497	
Space heating	per mz									(980)	/ (4) =	6.5424	(99)
b. Energy red	quirements												
raction of sp raction of sp raction of he	oace heat fr oace heat fr	om secondary	y/suppleme y system	ntary system								0.0000 1.0000 1.0000	(302)
actor for cor actor for cha istribution l fficiency of pace heating:	ntrol and ch arging metho loss factor secondary/s	arging method d (Table 4c (Table 12c)	od (Table ((3)) for w for commu	4c(3)) for s ater heating nity heating	,	ing						1.0000 1.0000 1.1000 0.0000	(305) (305a (306)
pace heating	requirement 138.6223	83.5176	40.0848	3.0842	0.0575	0.0000	0.0000	0.0000	0.0000	4.0921	58.1390	143.4523	(98)
pace heat fro 07a	152.4846	91.8694	.00 x 1.00 44.0932	x 1.10 3.3926	0.0632	0.0000	0.0000	0.0000	0.0000	4.5013	63.9529	157.7975	
Space heating	152.4846 secondary/s	91.8694 upplementary			0.0632 (from Tabl	0.0000 Le 4a or App	0.0000 endix E)	0.0000	0.0000	4.5013	63.9529	157.7975 0.0000	
Space heating	fuel for se 0.0000	condary/sup 0.0000	plementary 0.0000	system 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(309)

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Water heating						
Annual water heating requirement 225.9055 199.8988 213.0125 189.2208 184.6381 167.7205 166.6856	172.6754	173.8307 1	192.1732	202.2274	223.7314	(64)
Water heat from Heat pump = $(64) \times 1.00 \times 1.00 \times 1.10$ 310a 248.4960 219.8887 234.3138 208.1429 203.1019 184.4926 183.3542	189.9430	191.2138 2	211.3906	222.4501	246.1046	
Water heating fuel 248.4960 219.8887 234.3138 208.1429 203.1019 184.4926 183.3542	189.9430	191.2138 2	211.3906	222.4501	246.1046	(310)
Cooling System Energy Efficiency Ratio Space coolin	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000	
Pumps and Fa 12.7759 11.5395 12.7759 12.3638 12.7759 12.3638 12.7759 Lighting 18.7104 15.0102 13.5150 9.9017 7.6483 6.2488 6.9771	12.7759 9.0691	12.3638	12.7759 15.4557	12.3638 17.4572	12.7759 19.2304	(331)
Electricity generated by PVs (Appendix M) (negative quantity) (333a)m -3.1377 -5.0265 -8.2200 -10.5622 -12.6292 -12.2650 -12.1052	-10.7735	-8.7105	-6.2552	-3.6537	-2.6464	
Electricity generated by wind turbines (Appendix M) (negative quantity) (334a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000	0.0000	0.0000		
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)					0.0000	
(335a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	
(333b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	(333b)
(334b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	(334b)
(335b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 Annual totals kWh/year	0.0000	0.0000	0.0000	0.0000	0.0000	(335b)
Space heating fuel - community heating Space heating fuel - secondary Water heating fuel - community heating Efficiency of water heater Electricity used for heat distribution Space cooling fuel					518.1547 0.0000 2542.8921 0.0000 5.1815 0.0000	(309) (310) (311) (313)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6250)						
mechanical ventilation fans (SFP = 0.6250) Total electricity for the above, kWh/year Electricity for lighting (calculated in Appendix L)					150.4260 150.4260 151.0036	(331)
<pre>Energy saving/generation technologies (Appendices M ,N and Q) PV generation</pre>					-95.9852	(333)
Wind generation Hydro-electric generation (Appendix N) Electricity generated - Micro CHP (Appendix N)					0.0000 0.0000 0.0000	(335a)
Appendix Q - special features Energy saved or generated Energy used					-0.0000 0.0000	
12b. Carbon dioxide emissions - Community heating scheme						
Efficiency of heat source Heat pump	Energy kWh/year	Emission kg	factor CO2/kWh	k	Emissions CO2/year 310.0000	(367)
Space and Water heating from Heat pump Electrical energy for heat distribution (space & water)	987.4344 5.1815		0.1598 0.0000		26.7045 4.4044	(367)
Overall CO2 factor for heat network Total CO2 associated with community systems					0.0479 146.4825	(386)
Space and water heating Pumps, fans and electric keep-hot	150.4260		0.1387		146.4825 20.8659	(376)
Energy for lighting	151.0036		0.1443		21.7945	
Energy saving/generation technologies	05 0055		0.4330		12 ((2)	
PV Unit electricity used in dwelling PV Unit electricity exported	-95.9852 0.0000		0.1320 0.0000		-12.6694 0.0000	
Total Total CO2, kg/year					-12.6694 176.4736	(383)
EPC Dwelling Carbon Dioxide Emission Rate (DER)					2.4500	(384)
13b. Primary energy - Community heating scheme						
		Primary energy	factor	Prim	ary energy	
Efficiency of heat source Heat pump	kWh/year		CO2/kWh		kWh/year 310.0000	(467a)
Space and Water heating from Heat pump Electrical energy for heat distribution (space & water)	987.4344 5.1815		1.5914 0.0000		265.9893 46.8992	(467)
Overall CO2 factor for heat network Total CO2 associated with community systems					0.5096 1559.7757	(486)
Space and water heating Pumps, fans and electric keep-hot	150.4260		1.5128		1559.7757 227.5645	(476)
Energy for lighting	151.0036		1.5338		231.6144	
Energy saving/generation technologies	05 0050		1 4077		142 7045	
PV Unit electricity used in dwelling PV Unit electricity exported	-95.9852 0.0000		1.4877 0.0000		-142.7945 0.0000	
Total						(480)
Total Primary energy kWh/year					-142.7945 1876.1600	(483)
Dwelling Primary energy Rwn/year Dwelling Primary energy Rate (DPER)						(483)

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SAP 10 WORKSHEET CALCULATION OF T			signed) ((Version 10	.2, February	2022)							
1. Overall dwell													
Ground floor Total floor area	TFA = (1a	a)+(1b)+(1c)	+(1d)+(1e)	(1n)	7	2.0000		Area (m2) 72.0000	(1b) x	y height (m) 2.7400		Volume (m3) 197.2800	(1b) (4)
Dwelling volume								(:	3a)+(3b)+(3c)+	(3d)+(3e)	(3n) =	197.2800	(5)
2. Ventilation r													
Number of open c	himnevs										m3 0 * 80 =	per hour 0.0000	(6a)
Number of open f Number of chimne Number of flues Number of flues Number of interm Number of passiv Number of fluele	lues ys / flues attached f attached f d chimneys ittent ext e vents	to solid fue to other hea s tract fans	l boiler	ire							0 * 20 = 0 * 10 = 0 * 20 = 0 * 35 = 0 * 20 = 3 * 10 = 0 * 10 = 0 * 40 =	0.0000 0.0000 0.0000 0.0000 0.0000 30.0000 0.0000	(6b) (6c) (6d) (6e) (6f) (7a) (7b)
Infiltration due Pressure test Pressure Test Me Measured/design Infiltration rat Number of sides	thod AP50 e	eys, flues a	nd fans =	= (6a)+(6b)	+(6c)+(6d)+(6e)+(6f)+((6g)+(7a)+(7b)+(7c) =		30.0006	Air changes 0 / (5) = Blo	0.1521 Yes ower Door 5.0000 0.4021	(17)
Shelter factor Infiltration rat		d to include	shelter fa	actor					(20) = 1 - (21		(19)] = x (20) =	0.8500 0.3418	(20)
Wind speed Wind factor Adj infilt rate	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	Sep 4.0000 1.0000	Oct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	` '
Effective ac	0.4357 0.5949	0.4272 0.5912	0.4187 0.5876	0.3759 0.5707	0.3674 0.5675	0.3247 0.5527	0.3247 0.5527	0.3161 0.5500	0.3418 0.5584	0.3674 0.5675	0.3845 0.5739	0.4016 0.5806	
3. Heat losses a 			r 	Gross	Openings		:Area	U-value	A v. II		(-value	A v. V	
TER Opening Type	(Uw = 1.2	20)		m2	Openings m2	14.	m2 .8000	W/m2K 1.1450	A x U W/K 16.9466		kJ/m2K	A x K kJ/K	(27)
External Wall 1 Total net area o Fabric heat loss Party Wall 1				17.8404	14.8000	47.	0404 8404 (26)(3 2000	0.1800 30) + (32) 0.0000	5.9473 = 22.8938 0.0000				(29a) (31) (33) (32)
Thermal mass par List of Thermal		MP = Cm / TF	A) in kJ/m2	2K								435.9816	(35)
K1 Eleme E2 Other E3 Sill E4 Jamb E7 Party E18 Part E16 Corn E8 Balco	floor be y wall be er (normal ny within er (inver	a dwelling, ted – intern	ngs (in blo ngs wall insul al area gre	ocks of fla lation cont	inuous external are	ea)		1: 34	7.5700 5.9900 7.1000 4.9200 5.4800 2.7400 5.8000	i-value 0.0500 0.0500 0.0500 0.0700 0.0600 0.0900 0.0000 -0.0900	Tota: 0.378: 0.299; 0.855; 2.444: 0.328; 0.246; 0.000;	5 5 0 4 8 6	(36)
Point Thermal br Total fabric hea	idges	,		.,					(33) + (36)	(36a) = + (36a) =	0.0000 27.2000	
	Jan 38.7317	culated mont Feb 38.4917	hly (38)m = Mar 38.2565	= 0.33 x (2 Apr 37.1515	5)m x (5) May 36.9448	Jun 35.9824	Jul 35.9824	Aug 35.8042	Sep 36.3531	Oct 36.9448	Nov 37.3630	Dec 37.8002	(38)
Heat transfer co Average = Sum(39	65.9317	65.6918	65.4565	64.3516	64.1448	63.1825	63.1825	63.0043	63.5532	64.1448	64.5631	65.0003 64.3506	(39)

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LP LP (average)	Jan 0.9157	Feb 0.9124	Mar 0.9091	Apr 0.8938	May 0.8909	Jun 0.8775	Jul 0.8775	Aug 0.8751	Sep 0.8827	0ct 0.8909	Nov 0.8967	Dec 0.9028 (0.8938
ys in mont	31	28	31	30	31	30	31	31	30	31	30	31
Water heati	ng energy r	equirements										
sumed occupa												2.2937 (
t water usag		showers 61.7353	60.3627	57.7366	55.7986	53.6373	52.4088	53.7710	55.2642	57.5847	60.2673	62.4371 (
t water usag	e for baths											
t water usag			26.1081	25.0640	24.2822	23.4152	22.9470	23.5093	24.1216	25.0492	26.1148	26.9849 (
erage daily	38.1196 hot water u	36.7335 se (litres,	35.3473 /day)	33.9611	32.5749	31.1888	31.1888	32.5749	33.9611	35.3473	36.7335	38.1196 (117.5446 (
ily hot water	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec
ily hot wate ergy conte ergy content	127.8733 202.5201	125.1431 178.2021	121.8181 187.2299	116.7617 159.8409	112.6557 151.6562	108.2413 133.0953	106.5446 128.8565	109.8552 136.0237	113.3469 139.7680	117.9812 160.0994 Total = Si	123.1155 175.4006	127.5416 (199.6994 (1952.3920
stribution 1	oss (46)m			22 0761	22 7404	10.0643	10 3305	20 4026	20.0652			
ter storage	30.3780 loss:	26.7303	28.0845	23.9761	22.7484	19.9643	19.3285	20.4036	20.9652	24.0149	26.3101	29.9549 (
ore volume If manufac Temperature ter (49) or	factor from	Table 2b	actor is kn	own (kWh/d	lay):							180.0000 (1.5520 (0.5400 (0.8381 (
otal storage		23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (
cylinder co				25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (
rimary 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 (
ombi loss otal heat req						0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (
IHRS	251.7627 -28.6534	222.6793 -25.3413	236.4725 -26.5360	207.4951 -21.9728	200.8989 -20.4779	180.7495 -17.5231	178.0991 -16.4251	185.2664 -17.4664	187.4222 -18.1300	209.3420 -21.3733	223.0548 -24.2134	248.9420 (-28.1228 (
diverter lar 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	-0.0000 0.0000	-0.0000 0.0000	-0.0000 0.0000	-0.0000 0.0000	-0.0000 0.0000	-0.0000 (0.0000 (
iHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (
itput from w/	223.1093	197.3380	209.9366	185.5223	180.4210	163.2265	161.6740	167.8000	169.2922	187.9687	198.8415	220.8192 (
Total per ye		r)						Total p	er year (kWl	n/year) = Si	um(64)m =	2265.9493 (2266 (
ectric showe	r(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 (
at gains fro				Tot	al Energy u	sed by insta		lectric sho	wer(s) (kWh	/year) = Sur	m(64a)m =	0.0000
B	106.7321	94.8340	101.6481	91.2705	89.8198	82.3776	82.2389	84.6220	84.5962	92.6272	96.4441	105.7942 (
Internal ga												
etabolic gain	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec
66)m Ighting gains	(calculate						114.6842	114.6842	114.6842	114.6842	114.6842	114.6842 (
opliances gai	102.2951 ns (calcula			105.7050 uation L13	102.2951 or L13a), a	105.7050 lso see Tabl	102.2951 e 5	102.2951	105.7050	102.2951	105.7050	102.2951 (
ooking gains	201.9192	204.0145	198.7344	187.4938	173.3045	159.9686	151.0594	148.9641	154.2442	165.4848	179.6741	193.0100 (
	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684	34.4684 (
mps, fans sses e.g. ev			, ,	,	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (
	-91.7474 gains (Tabl	-91.7474 e 5)	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474	-91.7474 (
ater heating	143.4571		136.6237	126.7645	120.7256	114.4133	110.5362	113.7393	117.4948	124.4989	133.9501	142.1965 (
_	•	518.7971	498.0586	480.3686	456.7305	437.4921	421.2960	422.4038	434.8492	452.6841	479.7344	497.9068 (
_	508.0767											
otal internal												
otal internal				rea	Solar flux		g		FF data	Acces		Gains
otal internal Solar gains			A			Specif		Specific or Tab	data	Acce: facto Table (or	Gains W
otal internal Solar gains Jan] orth est			A	rea m2 500	Solar flux Table 6a	Specif or T	g ic data able 6b 0.6300 0.6300	Specific or Tab 0 0	data	facto	or 5d 90	
otal internal Solar gains Jan]			A 11.6	rea m2 500	Solar flux Table 6a W/m2 10.6334	Specif or T	g ic data able 6b 0.6300	Specific or Tab 0 0	data le 6c .7000	facto Table 0	or 5d 90	W 37.8590 (

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	nal temperat	ure (heati	ng season)										
Temperature du Utilisation fa	uring heatin	ng periods	in the livi		n Table 9,							21.0000	(85)
	Jan - 122 2524	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec 124.1476	
tau alpha	132.2524 9.8168	132.7356 9.8490	133.2126 9.8808	135.4999 10.0333	135.9366 10.0624	138.0071 10.2005	138.0071 10.2005	138.3975 10.2265	137.2022 10.1468	135.9366 10.0624	135.0561 10.0037	134.1476 9.9432	
util living ar		0.9976	0.0000	0.0163	0.7100	0.4849	0.3504	0.4000	0.6671	0.0502	0.0071	0.9995	(00)
	0.9993	0.9976	0.9890	0.9162	0.7100	0.4849	0.3504	0.4000	0.00/1	0.9582	0.9971	0.9995	(80)
NIT h 2 Hil rest of h	20.4830 20.1542 nouse	20.5846 20.1570	20.7351 20.1598	20.9264 20.1728	20.9941 20.1752	20.9999 20.1866	21.0000 20.1866	21.0000 20.1888	20.9975 20.1822	20.8949 20.1752	20.6630 20.1703	20.4720 20.1651	
	0.9989	0.9962	0.9828	0.8822	0.6505	0.4233	0.2857	0.3295	0.5903	0.9316	0.9951	0.9992	
IIT 2 .iving area fr	19.5595 raction	19.6914	19.8827	20.1120	20.1720	20.1866	20.1866	20.1887	20.1813 fLA =	20.0868 Living area	19.8029 a / (4) =	19.5546 0.3778	. ,
IT	19.9084	20.0288	20.2047	20.4197	20.4826	20.4938	20.4939	20.4952	20.4896	20.3921	20.1278	19.9011 0.0000	(92)
emperature ad adjusted MIT	19.9084	20.0288	20.2047	20.4197	20.4826	20.4938	20.4939	20.4952	20.4896	20.3921	20.1278	19.9011	(93)
3. Space heati	ing requiren												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(0.4)
Jtilisation Jseful gains	0.9987 564.1361	0.9960 625.5974	0.9832 670.4449	0.8933 684.8796	0.6730 559.6967	0.4466 372.3318	0.3101 246.0255	0.3561 258.0118	0.6195 404.8458	0.9398 547.5963	0.9950 547.2713	0.9991 544.5195	
xt 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	
eat loss rate pace heating	1029.0870	993.8388	897.0630	741.3085	563.3554	372.3872	246.0266	258.0161	406.0825	628.1106	841.1175	1020.5787	(97)
pace heating	345.9235	247.4582 t - total pe	168.6039 er year (kWl	40.6288 n/year)	2.7220	0.0000	0.0000	0.0000	0.0000	59.9027	211.5693	354.1880 1430.9965	(98a)
Solar heating Solar heating	0.0000	0.0000 on - total p	0.0000 per year (kl	0.0000 Wh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Space heating	kWh 345.9235	247.4582	168.6039	40.6288	2.7220	0.0000	0.0000	0.0000	0.0000	59.9027	211.5693	354.1880	(98c)
Space heating Space heating		t after sol	ar contribu	tion - total	l per year	(kWh/year)				(98c)	/ (4) =	1430.9965 19.8750	(99)
Fraction of sp Fraction of sp Efficiency of Efficiency of	pace heat fr main space			ntary system	n (lable li)							(204)
fficiency of		heating sys	stem 1 (in S stem 2 (in S	%)	(1222 22							0.0000 1.0000 92.3000 0.0000 0.0000	(202) (206) (207)
fficiency of		heating sys	stem 1 (in S stem 2 (in S	%)	May	Jun	Jul	Aug	Sep	0ct	Nov	1.0000 92.3000 0.0000	(202) (206) (207)
	Jan requirement	heating system supplementar Feb	stem 1 (in 5 stem 2 (in 5 ry heating :	%) system, % Apr	May	Jun		_				1.0000 92.3000 0.0000 0.0000 Dec	(202) (206) (207) (208)
pace heating	Jan requirement 345.9235 efficiency	heating system supplementar Feb 247.4582 (main heat:	stem 1 (in 5 stem 2 (in 5 ry heating 9 Mar 168.6039 ing system 1	%) system, % Apr 40.6288 1)	May 2.7220	Jun 0.0000	0.0000	0.0000	0.0000	59.9027	211.5693	1.0000 92.3000 0.0000 0.0000 Dec	(202) (206) (207) (208)
pace heating	Jan requirement 345.9235 efficiency 92.3000	Feb 247.4582 (main heat: 92.3000	stem 1 (in 5 stem 2 (in 5 ry heating s	%) system, % Apr 40.6288	May	Jun		_				1.0000 92.3000 0.0000 0.0000 Dec	(202) (206) (207) (208)
pace heating pace heating pace heating	Jan requirement 345.9235 efficiency 92.3000 fuel (main 374.7817	Feb 247.4582 (main heating system of the system) from the system of the	stem 1 (in 9 stem 2 (in 9 ry heating 9 Mar 168.6039 ing system 92.3000 stem) 182.6695	Apr 40.6288 1) 92.3000 44.0182	May 2.7220	Jun 0.0000	0.0000	0.0000	0.0000	59.9027	211.5693	1.0000 92.3000 0.0000 0.0000 Dec	(202) (206) (207) (208) (98) (210)
pace heating pace heating pace heating pace heating	Jan requirement 345.9235 efficiency 92.3000 fuel (main 374.7817 efficiency 0.0000	Feb 247.4582 (main heat: 92.3000 heating syz (main heat: 9.0000)	stem 1 (in 5 stem 2 (in 5 ry heating : Mar 168.6039 ing system: 92.3000 stem) 182.6695 ing system: 0.0000	Apr 40.6288 1) 92.3000 44.0182	May 2.7220 92.3000	Jun 0.0000 0.0000	0.0000 0.0000	0.0000	0.0000	59.9027 92.3000	211.5693 92.3000	1.0000 92.3000 0.0000 0.0000 Dec 354.1880 92.3000	(202) (206) (207) (208) (98) (210) (211)
pace heating pace heating pace heating	Jan requirement 345.9235 efficiency 92.3000 fuel (main 374.7817 efficiency 0.0000 fuel (main	heating sysupplemental Feb 247.4582 (main heat: 92.3000 heating sy: 268.1021 (main heat: 0.0000 heating sysupplemental)	stem 1 (in 5 stem 2 (in 5 ry heating : Mar 168.6039 ing system : 92.3000 stem) 182.6695 ing system : 0.0000 stem 2)	%) system, % Apr 40.6288 1) 92.3000 44.0182 2) 0.0000	May 2.7220 92.3000 2.9491 0.0000	Jun 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	59.9027 92.3000 64.9000 0.0000	211.5693 92.3000 229.2192 0.0000	1.0000 92.3000 0.0000 0.0000 Dec 354.1880 92.3000 383.7357 0.0000	(202) (206) (207) (208) (98) (210) (211) (212)
pace heating pace heating pace heating pace heating pace heating	Jan requirement 345,9235 efficiency 92,3000 fuel (main 374,7817 0.0000 fuel (main 0.0000 fuel (secon	Feb 247.4582 (main heating sy: 268.1021 (main heat: 9.0000 heating sy: 0.0000 heating sy:	stem 1 (in 5 stem 2 (in 5 ry heating : Mar 168.6039 ing system: 92.3000 stem) 182.6695 ing system: 0.0000 stem 2) 0.0000	%) System, % Apr 40.6288 1) 92.3000 44.0182 2) 0.0000 0.0000	May 2.7220 92.3000 2.9491 0.0000	Jun 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	59.9027 92.3000 64.9000 0.0000	211.5693 92.3000 229.2192 0.0000 0.0000	1.0000 92.3300 0.0000 0.0000 Dec 354.1880 92.3000 383.7357 0.0000	(202) (206) (207) (208) (98) (210) (211) (212) (213)
pace heating pace heating pace heating pace heating pace heating	Jan requirement 345.9235 efficiency 92.3000 fuel (main 374.7817 efficiency 0.0000 fuel (main 0.0000	heating sysupplemental Feb 247.4582 (main heat: 92.3000 heating sysupplemental 268.1021 (main heat: 0.0000 heating sysupplemental	stem 1 (in 5 stem 2 (in 5 ry heating : Mar 168.6039 ing system : 92.3000 stem) 182.6695 ing system : 0.0000 stem 2)	%) system, % Apr 40.6288 1) 92.3000 44.0182 2) 0.0000	May 2.7220 92.3000 2.9491 0.0000	Jun 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	59.9027 92.3000 64.9000 0.0000	211.5693 92.3000 229.2192 0.0000	1.0000 92.3000 0.0000 0.0000 Dec 354.1880 92.3000 383.7357 0.0000	(202) (206) (207) (208) (98) (210) (211) (212) (213)
pace heating	secondary/s Jan requirement 345.9235 efficiency 92.3000 fuel (main 374.7817 efficiency 0.0000 fuel (main 0.0000 fuel (secon 0.0000	Feb 247.4582 (main heating system) Peb 247.4582 (main heating system) Peb 268.1021 (main heating system) Peb 268.0000 heating system) Peb 268.0000 heating system (main heating system) Peb 268.0000 heating system) Peb 268.00000 heating system (main heating syste	stem 1 (in 5 stem 2 (in 5 ry heating : Mar 168.6039 ing system: 92.3000 stem) 182.6695 ing system: 0.0000 stem 2) 0.0000	%) System, % Apr 40.6288 1) 92.3000 44.0182 2) 0.0000 0.0000	May 2.7220 92.3000 2.9491 0.0000	Jun 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	59.9027 92.3000 64.9000 0.0000	211.5693 92.3000 229.2192 0.0000 0.0000	1.0000 92.3300 0.0000 0.0000 Dec 354.1880 92.3000 383.7357 0.0000	(202) (206) (207) (208) (98) (210) (211) (212) (213)
pace heating	secondary/s Jan requirement 345.9235 efficiency 92.3000 fuel (main 374.7817 efficiency 0.0000 fuel (main 0.0000 fuel (secon 0.0000	Feb 247.4582 (main heating system) Peb 247.4582 (main heating system) Peb 268.1021 (main heating system) Peb 268.0000 heating system) Peb 268.0000 heating system (main heating system) Peb 268.0000 heating system) Peb 268.00000 heating system (main heating syste	stem 1 (in 5 stem 2 (in 5 ry heating : Mar 168.6039 ing system: 92.3000 stem) 182.6695 ing system: 0.0000 stem 2) 0.0000	%) System, % Apr 40.6288 1) 92.3000 44.0182 2) 0.0000 0.0000	May 2.7220 92.3000 2.9491 0.0000	Jun 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	59.9027 92.3000 64.9000 0.0000	211.5693 92.3000 229.2192 0.0000 0.0000	1.0000 92.3300 0.0000 0.0000 Dec 354.1880 92.3000 383.7357 0.0000	(202) (206) (207) (208) (98) (210) (211) (212) (213) (215)
pace heating pater heating fficiency of	secondary/s Jan requirement 345.9235 efficiency 92.3000 fuel (main 374.7817 efficiency 0.0000 fuel (main 0.00000 fuel (secon 0.00000 requirement 223.1093 water heate	heating sysupplemental Feb 247.4582 (main heat: 92.3000 heating sysupplemental 0.0000 heating sysupplemental 0.00000 heating sysupplemental 0.0000 heating s	Mar 168.6039 ing system: 92.3000 stem) 182.6695 ing system: 0.0000 0.0000 209.9366	%) System, % Apr 40.6288 1) 92.3000 44.0182 2) 0.0000 0.0000 0.0000	May 2.7220 92.3000 2.9491 0.0000 0.0000	Jun 0.0000 0.0000 0.0000 0.0000 0.0000 163.2265	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	59.9027 92.3000 64.9000 0.0000 0.0000 187.9687	211.5693 92.3000 229.2192 0.0000 0.0000 198.8415	1.0000 92.33000 0.0000 0.0000 Dec 354.1880 92.3000 383.7357 0.0000 0.0000	(202) (206) (207) (208) (98) (210) (211) (212) (213) (215)
pace heating after heating after heating afficiency of 217)m	Jan requirement 345.9235 efficiency 92.3000 fuel (main 374.7817 efficiency 0.0000 fuel (main 0.0000 fuel (main 0.0000 requirement 223.1093 water heate 85.0395 rheating, H	heating sysupplemental Feb 247.4582 (main heat: 92.3000) heating sysupplemental 0.0000 heating sysupplemental 0.0000 heating sysupplemental 0.0000 heating sysupplemental 0.00000 dary) 0.00000 197.3380 er 84.5685 kWh/month	stem 1 (in stem 2 (in	%) System, % Apr 40.6288 1) 92.3000 44.0182 2) 0.0000 0.0000 185.5223 81.2800	May 2.7220 92.3000 2.9491 0.0000 0.0000 180.4210 79.9204	Jun 0.0000 0.0000 0.0000 0.0000 0.0000 163.2265 79.8000	0.0000 0.0000 0.0000 0.0000 0.0000 161.6740 79.8000	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 167.8000 79.8000	0.0000 0.0000 0.0000 0.0000 0.0000 169.2922 79.8000	59.9027 92.3000 64.9000 0.0000 0.0000 187.9687 81.8037	211.5693 92.3000 229.2192 0.0000 0.0000 198.8415 84.1992	1.0000 92.3000 0.0000 0.0000 Dec 354.1880 92.3000 383.7357 0.0000 0.0000 220.8192 79.8000 85.1136	(292) (296) (297) (298) (98) (210) (211) (213) (215) (64) (216) (217)
pace heating pater heating efficiency of 217)m unel for water	secondary/s Jan requirement 345.9235 efficiency 92.3000 fuel (main 374.7817 efficiency 0.0000 fuel (main 0.0000 fuel (secon 0.0000 requirement 223.1093 water heate 85.0395 red2.3595	heating sysupplemental Feb 247.4582 (main heat: 92.3000 heating sysup.60000 heating sysup.60000 dary) 0.0000	Mar 168.6039 ing system: 92.3000 stem) 182.6695 ing system: 0.0000 0.0000 209.9366	%) System, % Apr 40.6288 1) 92.3000 44.0182 2) 0.0000 0.0000 0.0000	May 2.7220 92.3000 2.9491 0.0000 0.0000	Jun 0.0000 0.0000 0.0000 0.0000 0.0000 163.2265	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	59.9027 92.3000 64.9000 0.0000 0.0000 187.9687	211.5693 92.3000 229.2192 0.0000 0.0000 198.8415	1.0000 92.33000 0.0000 0.0000 Dec 354.1880 92.3000 383.7357 0.0000 0.0000	(292) (296) (297) (298) (98) (210) (211) (213) (215) (64) (216) (217)
pace heating ater heating ater heating efficiency of 217)m unel for water pace cooling 221)m	Jan requirement 345.9235 efficiency 92.3000 fuel (main 374.7817 efficiency 0.0000 fuel (main 0.0000 fuel (secor 0.0000 requirement 223.1093 water heatc 85.0395 heating, k 262.3595 fuel requirement 0.0000	heating sysupplemental Feb 247.4582 (main heat: 92.3000 heating sy: 268.1021 (main heat: 0.0000 heating sy: 0.0000 dary) 0.0000 197.3380 er 84.5685 kWh/month 233.3471 rement 0.0000	Mar 168.6039 ing system: 92.3000 stem) 182.6695 ing system: 0.0000 stem 2) 0.0000 209.9366 83.5727 251.2024 0.0000	%) System, % Apr 40.6288 1) 92.3000 44.0182 2) 0.0000 0.0000 185.5223 81.2800 228.2510 0.0000	May 2.7220 92.3000 2.9491 0.0000 0.0000 180.4210 79.9204 225.7509 0.0000	Jun 0.0000 0.0000 0.0000 0.0000 0.0000 163.2265 79.8000 204.5444 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 161.6740 79.8000 202.5991 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 167.8000 79.8000 210.2757 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 169.2922 79.8000 212.1456 0.0000	59.9027 92.3000 64.9000 0.0000 0.0000 187.9687 81.8037 229.7804 0.0000	211.5693 92.3000 229.2192 0.0000 0.0000 198.8415 84.1992 236.1561 0.0000	1.0000 92.3000 0.0000 0.0000 Dec 354.1880 92.3000 383.7357 0.0000 0.0000 220.8192 79.8000 85.1136 259.4406 0.0000	(202) (206) (207) (208) (98) (210) (211) (213) (215) (64) (217) (219) (219) (221)
pace heating ater heating ater heating ater heating ater heating fficiency of 217)m uel for water pace cooling 221)m umps and Fa	secondary/s Jan requirement 345.9235 efficiency 92.3000 fuel (main 374.7817 efficiency 0.0000 fuel (main 0.0000) fuel (secon 0.0000) requirement 223.1093 water heatt 85.0395 heating, k 262.3595 fuel requir 0.0000 7.3041	heating sysupplemental Feb 247.4582 (main heat: 92.3000 heating sysupplemental 0.0000 heating sysupplemental 0.0000 dary) 0.0000 197.3380 er 84.5685 kWh/month 233.3471 rement 0.0000 6.5973	Mar 168.6039 168.6039 192.3000 stem 1 182.6695 182.6695 193.3000 180.0000 209.9366 83.5727 251.2024 0.0000 7.3041	%) System, % Apr 40.6288 1) 92.3000 44.0182 2) 0.0000 0.0000 185.5223 81.2800 228.2510 0.0000 7.0685	May 2.7220 92.3000 2.9491 0.0000 0.0000 180.4210 79.9204 225.7509 0.0000 7.3041	Jun 0.0000 0.0000 0.0000 0.0000 163.2265 79.8000 204.5444 0.0000 7.0685	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 161.6740 79.8000 202.5991 0.0000 7.3041	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 79.8000 210.2757 0.0000 7.3041	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 169.2922 79.8000 212.1456 0.0000 7.0685	59.9027 92.3000 64.9000 0.0000 0.0000 187.9687 81.8037 229.7804 0.0000 7.3041	211.5693 92.3000 229.2192 0.0000 0.0000 198.8415 84.1992 236.1561 0.0000 7.0685	1.0000 92.3000 0.0000 0.0000 Dec 354.1880 92.3000 383.7357 0.0000 0.0000 220.8192 79.8000 85.1136 259.4406 0.0000 7.3041	(202) (206) (207) (208) (207) (208) (210) (211) (213) (215) (64) (217) (219) (221) (231)
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pace heating ater heating ater heating fficiency of 217)m uel for water pace cooling 221)m umps and Fa ighting lectricity ge 233a)m lectricity ge 235a)m lectricity us 235c)m lectricity ge 233b)m lectricity ge 233c)m lectricity ge 235c)m lectricity ge 233b)m	secondary/s Jan requirement 345,9235 efficiency 92,3000 fuel (main 374,7817 0,0000 fuel (main 0,0000 fuel (secon 0,0000 requirement 223,1093 water heate 85,0395 heating, t 262,3595 fuel requi 0,0000 7,3041 21,2549 enerated by -7,9527 enerated by 0,0000 enerated by 0,0000 sed or net 6 0,0000 enerated by -1,6311	heating sysupplemental Feb 247.4582 (main heat: 92.3000 heating sysupplemental 268.1021 (main heat: 0.0000 heating sysup. 0.0000 dary) 0.0000 197.3380 84.5685 kd/month 233.3471 rement 0.0000 6.5973 17.0515 PVs (Appent -12.3348 wind turbin 0.0000 hydro-electicity 0.0000 electricity 0.0000 PVs (Appent -3.5775	stem 1 (in stem 2 (in	%) System, % Apr 40.6288 1) 92.3000 44.0182 2) 0.0000 0.0000 185.5223 81.2800 228.2510 0.0000 7.0685 11.2482 ative quanti24.1407 ix M) (negators (Appendons (Appen	May 2.7220 92.3000 2.9491 0.0000 0.0000 180.4210 79.9204 225.7509 0.0000 7.3041 8.6885 ity) -28.0746 tive quantifi 0.0000 pix M) (negrous of the company of	Jun 0.0000 0.0000 0.0000 0.0000 163.2265 79.8000 204.5444 0.0000 7.0685 7.0986 -26.9689 Ey) 0.0000 nive quanti 0.0000 N) (negatii 0.0000 -15.9518	0.0000 0.0000 0.0000 0.0000 0.0000 161.6740 79.8000 202.5991 0.0000 7.3041 7.9259 -26.6424 0.0000 ve if net g 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 167.8000 79.8000 210.2757 0.0000 7.3041 10.3024 -24.1143 0.0000 eneration) 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 169.2922 79.8000 212.1456 0.0000 7.0685 13.3818 -20.0659 0.0000 0.0000	59.9027 92.3000 64.9000 0.0000 0.0000 187.9687 81.8037 229.7804 0.0000 7.3041 17.5576 -15.0285 0.0000 0.0000	211.5693 92.3000 229.2192 0.0000 0.0000 198.8415 84.1992 236.1561 0.0000 7.0685 19.8313 -9.1322 0.0000 0.0000	1.0000 92.3000 0.0000 0.0000 Dec 354.1880 92.3000 383.7357 0.0000 0.0000 220.8192 79.8000 85.1136 259.4406 0.0000 7.3041 21.8456 -6.7512 0.0000 0.0000	(202) (206) (207) (208) (207) (208) (210) (211) (212) (213) (215) (219) (221) (232) (233a) (235a) (235a) (235c) (233b)
Efficiency of Space heating Space cooling (217)m Space cooling (221)m Space cooling (221)m Space cooling (231)m Space cooling (233a)m Space cooling (233a)m Space cooling (233b)m Space cooling (234b)m Space co	secondary/s Jan requirement 345.9235 efficiency 92.3800 fuel (main 374.7817 efficiency 0.0000 fuel (main 0.0000 fuel (main 233.1093 water heate 85.0395 heating, k 262.3595 fuel requirement 21.2549 enerated by -7.9527 enerated by 0.0000 enerated by -1.6311 enerated by 0.0000	heating sysupplemental Feb 247.4582 (main heat: 92.3000 heating sysupplemental 92.88.1021 (main heat: 0.0000 heating sysupplemental 9.0000 dary) 0.0000 84.5685 klh/month 233.3471 rement 0.0000 6.5973 17.0515 PVs (Appent -12.3348 wind turbin 0.0000 hydro-electicity 0.0000 PVs (Appent -3.5775 wind turbin 0.0000 hydro-electicity 0.0000 hydro-electicity 0.0000 hydro-electicity	Mar 168.6039 ing system: 92.3000 stem) 182.6695 ing system: 9.0000 6.0000 209.9366 83.5727 251.2024 0.0000 7.3041 15.3530 dix M) (neg19.4826 nes (Append. 0.0000 dix M) (neg7.3956 nes (Append. 0.0000 dric generar 0.0000 dric generar 0.0000	Apr 40.6288 1) 92.3000 44.0182 2) 0.0000 0.0000 185.5223 81.2800 228.2510 0.0000 7.0685 11.2482 ative quanti24.1467 ix M) (negat 0.0000 ative quanti11.5453	May 2.7220 92.3000 2.9491 0.0000 0.0000 180.4210 79.9204 225.7509 0.0000 7.3041 8.6885 ity) -28.0746 cive quantificity 0.0000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.000000	Jun 0.0000 0.0000 0.0000 0.0000 163.2265 79.8000 204.5444 0.0000 7.0685 7.0986 -26.9689 Ey) 0.0000 ative quantion 0.0000 -15.9518 Ey) 0.0000 ative quantion 0.0000 -15.9518	0.0000 0.0000 0.0000 0.0000 0.0000 161.6740 79.8000 202.5991 0.0000 7.3041 7.9259 -26.6424 0.0000 ity) 0.0000 ve if net g 0.0000 -15.7648 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 167.8000 79.8000 210.2757 0.0000 7.3041 10.3024 -24.1143 0.0000 eneration) 0.0000 -13.1410 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 169.2922 79.8000 212.1456 0.0000 7.0685 13.3818 -20.0659 0.0000 0.0000 0.0000	59.9027 92.3000 64.9000 0.0000 0.0000 187.9687 81.8037 229.7804 0.0000 7.3041 17.5576 -15.0285 0.0000 0.0000 0.0000	211.5693 92.3000 229.2192 0.0000 0.0000 198.8415 84.1992 236.1561 0.0000 7.0685 19.8313 -9.1322 0.0000 0.0000 0.0000	1.0000 92.3000 0.0000 0.0000 Dec 354.1880 92.3000 383.7357 0.0000 0.0000 220.8192 79.8000 85.1136 259.4406 0.0000 7.3041 21.8456 -6.7512 0.0000 0.0000 0.0000	(292) (296) (297) (298) (98) (210) (211) (212) (213) (215) (241) (232) (233a) (235a) (235a) (234b) (234b)
Space heating Space cooling Space heating Sp	secondary/s Jan requirement 345,9235 efficiency 92,3000 fuel (main 374,7817 0,0000 fuel (main 0,0000 fuel (secon 0,0000 requirement 223,1093 water heate 85,0395 r heating, l 262,3595 fuel requir 0,0000 generated by -7,9527 enerated by 0,0000 enerated by 0,0000 enerated by 1,6311 enerated by 0,0000 enerated by -1,6311 enerated by 0,00000 enerated by 0,00000 enerated by 0,00000 enerated by 0,00000	heating sysupplemental Feb 247.4582 (main heat: 92.3000 heating sysupplemental 268.1021 (main heat: 0.0000 heating sysupplemental 0.0000 heating sysupplemental 0.0000 197.338	stem 1 (in stem 2 (in	Apr 40.6288 1) 92.3000 44.0182 2) 0.0000 0.0000 0.0000 185.5223 81.2800 228.2510 0.0000 7.0685 11.2482 ative quanti-24.1407 ix M) (negators (Appendon) 0.0000 0.0000 0.0000 185.5223 11.2482 12.2482 1	May 2.7220 92.3000 2.9491 0.0000 0.0000 180.4210 79.9204 225.7509 0.0000 7.3041 8.6885 ity) -28.0746 cive quantification (Appendix 0.0000) 0.0000 ity) -15.7102 cive quantification (0.0000) ity) (15.7102 cive quantification (0.0000) ity)	Jun 0.0000 0.0000 0.0000 0.0000 0.0000 163.2265 79.8000 204.5444 0.0000 7.0685 7.0986 -26.9689 Ey) 0.0000 ative quant: 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 161.6740 79.8000 202.5991 0.0000 7.3041 7.9259 -26.6424 0.0000 0.0000 -15.7648 0.0000 0.00000	0.0000 0.0000 0.0000 0.0000 0.0000 167.8000 79.8000 210.2757 0.0000 7.3041 10.3024 -24.1143 0.0000 eneration) 0.0000 -13.1410 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 169.2922 79.8000 212.1456 0.0000 7.0685 13.3818 -20.0659 0.0000 0.0000 0.0000	59.9027 92.3000 64.9000 0.0000 0.0000 187.9687 81.8037 229.7804 0.0000 7.3041 17.5576 -15.0285 0.0000 0.0000 0.0000	211.5693 92.3000 229.2192 0.0000 0.0000 198.8415 84.1992 236.1561 0.0000 7.0685 19.8313 -9.1322 0.0000 0.0000 0.0000	1.0000 92.3000 0.0000 0.0000 Dec 354.1880 92.3000 383.7357 0.0000 0.0000 220.8192 79.8000 85.1136 259.4406 0.0000 7.3041 21.8456 -6.7512 0.0000 0.0000 0.0000	(292) (296) (297) (298) (98) (210) (211) (212) (213) (215) (241) (232) (233a) (235a) (235a) (234b) (234b)

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(235d)m 0.0000 Annual totals kWh/year	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	·
Space heating fuel - mair Space heating fuel - mair											1550.3754 0.0000	
Space heating fuel - seco	ondary										0.0000	
Efficiency of water heate	er.										79.8000	(040)
Water heating fuel used Space cooling fuel											2755.8526 0.0000	
Electricity for pumps and												
Total electricity for the Electricity for lighting			. 17								86.0000 171.5393	. ,
Energy saving/generation			-	0)							1,1.5555	(232)
PV generation	cccimologics	(Арренитес	3 m , iv and	۷)							-323.5255	
Wind generation Hydro-electric generation	(Annendiv N)										0.0000 0.0000	
Electricity generated - M											0.0000	
Appendix Q - special feat Energy saved or generated											-0.0000	(236)
Energy used											0.0000	(237)
Total delivered energy fo	or all uses										4240.2418	(238)
12a. Carbon dioxide emiss	sions - Indivi	dual heati	ng systems	including	micro-CHP							
							Energy		on factor		Emissions	
Space heating - main syst	rem 1						kWh/year 1550.3754	k	g CO2/kWh 0.2100	Kξ	g CO2/year 325.5788	(261)
Total CO2 associated with		stems					1990.9794		0.2100		0.0000	
Water heating (other fuel	1)						2755.8526		0.2100		578.7291	
Space and water heating Pumps, fans and electric	koon-hot						86.0000		0.1387		904.3079 11.9293	
Energy for lighting	keep-liot						171.5393		0.1443		24.7584	
Energy saving/generation	n technologies	i										
PV Unit electricity used							-220.6887		0.1326		-29.2744	
PV Unit electricity expor Total	'ted						-102.8368		0.1248		-12.8326 -42.1069	(269)
Total CO2, kg/year											898.8886	
EPC Target Carbon Dioxide	e Emission Rat	e (TER)									12.4800	(273)
	dividual heati	ng systems	including	micro-CHP								
	dividual heati	ng systems	including	micro-CHP			Energy P	rimary ener		Prima	ary energy	
13a. Primary energy - Inc	dividual heati	ng systems	including	micro-CHP			Energy Pi		g CO2/kWh	Prima	kWh/year	(275)
13a. Primary energy - Inc	dividual heati tem 1	ng systems	including	micro-CHP			Energy P			Prima		
13a. Primary energy - Inc	dividual heati tem 1 n community sy	ng systems	including	micro-CHP			Energy Pi		g CO2/kWh		kWh/year 1751.9242 0.0000 3114.1135	(473) (278)
13a. Primary energy - Inc Space heating - main syst Total CO2 associated with Water heating (other fuel Space and water heating	dividual heati 	ng systems	including	micro-CHP			Energy Pr kWh/year 1550.3754 2755.8526		g CO2/kWh 1.1300 1.1300		kWh/year 1751.9242 0.0000 3114.1135 4866.0377	(473) (278) (279)
Space heating - main syst Total CO2 associated with Water heating (other fuel Space and water heating Pumps, fans and electric	dividual heati 	ng systems	including	micro-CHP			Energy Po kWh/year 1550.3754		g CO2/kWh 1.1300		kWh/year 1751.9242 0.0000 3114.1135	(473) (278) (279) (281)
Space heating - main syst Total CO2 associated with Water heating (other fuel Space and water heating Pumps, fans and electric Energy for lighting Energy saving/generation	tem 1 n community sy l) keep-hot n technologies	ng systems	including	micro-CHP			Energy Pi kWh/year 1550.3754 2755.8526 86.0000 171.5393		g CO2/kWh 1.1300 1.1300 1.5128 1.5338		kWh/year 1751.9242 0.0000 3114.1135 4866.0377 130.1008 263.1127	(473) (278) (279) (281)
Space heating - main syst Total CO2 associated with Water heating (other fuel Space and water heating Pumps, fans and electric Energy for lighting Energy saving/generatior PV Unit electricity used	tem 1 n community sy l) keep-hot n technologies in dwelling	ng systems	including	micro-CHP			Energy Pr kWh/year 1550.3754 2755.8526 86.0000 171.5393		g CO2/kWh 1.1300 1.1300 1.5128 1.5338		kWh/year 1751.9242 0.0000 3114.1135 4866.0377 130.1008 263.1127	(473) (278) (279) (281)
13a. Primary energy - Inc Space heating - main syst Total CO2 associated with Water heating (other fuel Space and water heating Pumps, fans and electric Energy for lighting Energy saving/generation PV Unit electricity used PV Unit electricity expor	tem 1 n community sy l) keep-hot n technologies in dwelling	ng systems	including	micro-CHP			Energy Pi kWh/year 1550.3754 2755.8526 86.0000 171.5393		g CO2/kWh 1.1300 1.1300 1.5128 1.5338		kWh/year 1751.9242 0.0000 3114.1135 4866.0377 130.1008 263.1127 -328.8571 -47.0988	(473) (278) (279) (281) (282)
Space heating - main syst Total CO2 associated with Water heating (other fuel Space and water heating Pumps, fans and electric Energy for lighting	tem 1 n community sy l) keep-hot n technologies in dwelling tted	ng systems	including	micro-CHP			Energy Pr kWh/year 1550.3754 2755.8526 86.0000 171.5393		g CO2/kWh 1.1300 1.1300 1.5128 1.5338		kWh/year 1751.9242 0.0000 3114.1135 4866.0377 130.1008 263.1127	(473) (278) (279) (281) (282) (283) (286)

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Property Reference		LC	02.02 x1_Copy_Cop	y					Issue	d on Date	12/0	09/2023	
Assessment Referen	ice	LC	02.02 x1_Copy_Cop	у			Prop	Type Ref					
Property													
SAP Rating					87 B	DER		1.70		TER		10.15	
Environmental					98 A	% DE	R < TER					83.25	
CO ₂ Emissions (t/yea	ır)				0.17	DFE		23.27		TFEE		30.66	
Compliance Check					See BREL	% DF	EE < TFEE					24.11	
% DPER < TPER					67.78	DPE	₹	17.36		TPER		53.88	
Assessor Details		Mr. Richa	ard Denteh							Assessor II	D	U148-0001	
SAP 10 WORKSHEE CALCULATION OF 1. Overall dwel Ground floor First floor Total floor are Dwelling volume	DWELLING EMI	SSIONS	FOR RÉGULATI	ONS COMPLIA	ANCE	2022)		Area (m2) 61.9000 61.8000	(1b) x	ey height (m) 2.5000 2.9500 +(3d)+(3e)	(2b) = (2c) =	Volume (m3) 154,7500 182,3100 337,0600	(1b) - (1c) - (4)
2. Ventilation												m3 per hour	
Number of open Number of open Number of chimn Number of flues Number of flues Number of inter Number of passi Number of fluel	flues eys / flues attached to attached to ed chimneys mittent extr	solid other act fan	fuel boiler heater	fire							0 * 80 = 0 * 20 = 0 * 10 = 0 * 20 = 0 * 35 = 0 * 20 = 0 * 10 = 0 * 10 = 0 * 40 =	0.0000 0.0000 0.0000	(6b) (6c) (6d) (6e) (6e) (6f) (7a)
Infiltration du	e to chimnev	s flue	s and fans	= (6a)+(6b	1)+(6c)+(6d)+((6e)+(6f)+(5g)+(7a)+(7	7h)+(7c) =		a aaa	Air chang 0 / (5) =	ges per hour 0.0000	
Pressure test Pressure Test M Measured/design Infiltration ra Number of sides	ethod AP50 te	,		().(0.	, (, (ou))(> > \ > > \	5, (-2).(/	, (-2) -		- 10000	. (-/	Yes Blower Door 3.0000 0.1500	(17)
Shelter factor Infiltration ra	te adjusted	to incl	ude shelter	factor					(20) = 1 - (2		x (19)] = x (20) =	0.9250 0.1388	
Wind speed Wind factor Adj infilt rate		Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	1.0000	Oct 4.3000 1.0750	Nov 4.5000 1.1250	1.1750	(22a)
Balanced mecha If mechanical v If exhaust air If balanced wit	entilation heat pump us	ing App	endix N, (23	b) = (23a)						0.1492	0.1561	0.5000	(22b) (23a) (23b) (23c)
Effective ac	0.4619	0.4584	0.4550	0.4376	0.4342	0.4168	0.4168	0.4133	0.4238	0.4342	0.4411	0.4480	(25)
3. Heat losses	and heat los	s param	eter										
Element window (Uw = 0.				Gross m2	Openings m2		Area m2 5000	U-value W/m2K 0.7752	A x W/ 18.217	K	K-value kJ/m2K	A x K kJ/K	
External Wall 1				127.4340	23.5000	103.		0.1300	13.511		90.0000	19747.4600	

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external Roof 1 fotal net area of abric heat loss larty Wall 1 larty Floor 1 larty Ceiling 1 internal Wall 1 internal Floor 1	s, W/K = S		Aum(A, m2)	8.0000		135 67 61 53 221	.0000 .4340 (26)(.3000 .9000 .8000 .5800	0.1000 30) + (32) = 0.0000		285 000 180 40 30	9.0000 9.0000 9.0000 9.0000 9.0000 8.0000	12114.0000	(32d (32b (32c
leat capacity Cm Thermal mass par ist of Thermal	rameter (T		ΓFA) in kJ/r	m2K				(28).	(30) + (32) + (32a).	(32e) =	39130.0800 316.3305	
K1 Eleme E2 Other E3 Sill E4 Jamb E6 Inter E16 Corr E18 Part E7 Party E24 Eave E14 Flat	ent rmediate f ner (norma ty wall be y floor be es (insula t roof (Sum(L x	loor withir 1) tween dwell tween dwell tion at cei	lings (in bi iling level	g locks of fl - inverted)			17 15 33 23 16 10 36 4	ength 1500 .5700 .5200 .5000 .2000 .2000 .8000 1000 1000	Psi-value 0.0500 0.0500 0.0500 0.0500 0.0000 0.0600 0.0700 0.1500 0.0800	Tot 0.88 0.77 1.67 0.06 1.48 0.62 2.52 0.61 0.64	775 785 760 900 680 180 170 550 180 9.2080	(36)
oint Thermal br otal fabric hea										(33) + (36)	(36a) = + (36a) =	0.0000 41.7365	(37)
entilation heat	t loss cal Jan	culated mor Feb	nthly (38)m Mar	= 0.33 x (25)m x (5) May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
38)m leat transfer co	51.3777	50.9919	50.6061	48.6769	48.2911	46.3620	46.3620	45.9761	47.1336	48.2911	49.0628	49.8344	(38)
verage = Sum(39	93.1142 9)m / 12 =	92.7284	92.3426	90.4134	90.0276	88.0984	88.0984	87.7126	88.8701	90.0276	90.7992	91.5709 90.3170	
ILP	Jan 0.7527	Feb 0.7496	Mar 0.7465	Apr 0.7309	May 0.7278	Jun 0.7122	Jul 0.7122	Aug 0.7091	Sep 0.7184	0ct 0.7278	Nov 0.7340	Dec 0.7403	
NLP (average) Nays in mont	31	28	31	30	31	30	31	31	30	31	30	0.7301 31	
verage daily ho	44.0887 ot water u Jan use	42.4855 se (litres,	Mar	39.2790 Apr	37.6758 May	36.0726 Jun	36.0726 Jul	37.6758 Aug	39.2790 Sep	40.8823 Oct 161.3443	42.4855 Nov 168.4422	44.0887 160.9265 Dec	(43)
		171.4218 244.1024 = 0.15 x (4	166.9829 256.6465	159.9995 219.0313	154.4128 207.8694	148.3730 182.4420	145.8796 176.4287	150.2974 186.0996	154.9812 191.1073	161.3443 218.9427 Total = S	239.9767	174.4992 273.2236 2673.0063	
Water storage lo	41.5704	36.6154	38.4970	32.8547	31.1804	27.3663	26.4643	27.9149	28.6661	32.8414	35.9965	40.9835	
b) If manufact Hot water stor Volume factor Temperature fa	rage loss from Tabl	factor from e 2a			ay)							110.0000 0.0152 1.0294 0.6000	(51) (52)
nter (49) or (9 otal storage lo	54) in (55 oss)										1.0327	(55)
f cylinder cont				30.9817	32.0144	30.9817	32.0144	32.0144	30.9817	32.0144	30.9817	32.0144	
rimary loss	32.0144 23.2624 0.0000	28.9162 21.0112 0.0000	32.0144 23.2624 0.0000	30.9817 22.5120 0.0000	32.0144 23.2624 0.0000	30.9817 22.5120 0.0000	32.0144 23.2624 0.0000	32.0144 23.2624 0.0000	30.9817 22.5120 0.0000	32.0144 23.2624 0.0000	30.9817 22.5120 0.0000	32.0144 23.2624 0.0000	(59)
otal heat requi	ired for w	ater heatin	ng calculate	ed for each	month								
	332.4129 -75.5667	294.0298 -66.8318	311.9233 -69.9824	272.5250 -57.9482	263.1462 -54.0057	235.9356 -46.2130	231.7055 -43.3174	241.3764 -46.0637	244.6010 -47.8138	274.2195 -56.3672	293.4704 -63.8572	328.5004 -74.1673	
V diverter olar 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	-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
GHRS utput from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
2Total per year	256.8462 ^ (kWh/yea	227.1980 r)	241.9408	214.5768	209.1405	189.7226	188.3882	195.3127 Total pe	196.7872 er year (k	217.8523 Wh/year) = S	229.6132 um(64)m =	254.3331 2621.7116 2622	(64)
lectric shower	(s) 0.0000	0.0000	0.0000	0.0000 Tot	0.0000 al Energy u	0.0000 sed by inst	0.0000 antaneous e	0.0000 lectric show	0.0000 uer(s) (kW	0.0000 h/year) = Sui	0.0000 m(64a)m =	0.0000 0.0000	
eat gains from		ting, kWh/r 121.1060	month 129.5564	115.6229	113.3380	103.4569	102.8840	106.0996	106.3381		122.5872	135.0683	
										,,	,		(00)

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(66)m	Jan 143.8273	Feb 143.8273	Mar 143.8273	Apr 143.8273	May 143.8273	Jun 143.8273	Jul 143.8273	Aug 143.8273	Sep 143.8273	Oct 143.8273	Nov 143.8273	Dec 143.8273	(66)
Lighting gain	s (calculat 148.1891	ed in Appen 164.0665	dix L, equa 148.1891	tion L9 or 153.1287	L9a), also 148.1891	see Table 5 153.1287	148.1891	148.1891	153.1287	148.1891	153.1287	148.1891	
Appliances ga								213.9117	221.4939	237.6353	258.0111	277.1614	
Cooking gains								37.3827	37.3827	37.3827	37.3827	37.3827	. ,
Pumps, fans Losses e.g. e	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
	-115.0619	-115.0619	-115.0619		-115.0619	-115.0619	-115.0619	-115.0619	-115.0619	-115.0619	-115.0619	-115.0619	(71)
Water heating	183.2919	180.2172	174.1349	160.5873	152.3360	143.6901	138.2849	142.6069	147.6918	157.2848	170.2600	181.5434	(72)
Total interna	687.5842	703.3957	673.8539	649.1044	615.5377	592.6812	569.5428	570.8559	588.4626	609.2574	647.5480	673.0421	(73)
5. Solar gain	5 												
[Jan]			Δ	irea	Solar flux		g	C1 C1 -	FF	Acce		Gains	
				m2	Table 6a W/m2		fic data Table 6b	Specific or Tab		fact Table		W	
North			4.3	8000	10.6334		0.5000		.8000	0.77		12.6746	
Southeast South			6.3	7500 8000	36.7938 46.7521		0.5000 0.5000	0	.8000	0.77 0.77	00	58.6457 81.6459	(78)
West 			7.1	.500	19.6403		0.5000		.8000	0.77	00	38.9266	(80)
Solar gains	191.8928	333.9808	473.5751	610.8722	703.5031	706.1699	677.6496 1247.1923	607.8365	521.2642	373.8195 983.0769	231.1949 878.7429	163.3156	` '
Total gains	8/9.4//0	1037.3703	1147.4269	1259.9766	1519.0406	1290.0311	1247.1923	1176.0924	1109.7209	363.0709	0/0./429	836.3577	(64)
7. Mean inter	nal tempera	ture (heati	ng season)										
Temperature d						Th1 (C)						21.0000	(85)
Jtilisation f	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
alpha	116.7326 8.7822	117.2183 8.8146	117.7081 8.8472	120.2196 9.0146	120.7348 9.0490	123.3786 9.2252	123.3786 9.2252	123.9214 9.2614	122.3073 9.1538	120.7348 9.0490	119.7088 8.9806	118.7000 8.9133	
ıtil living a	rea 0.9971	0.9873	0.9533	0.8260	0.6309	0.4340	0.3108	0.3423	0.5515	0.8771	0.9879	0.9980	(86)
1IT	20.4833	20.6427	20.8130	20.9593	20.9961	20.9999	21.0000	21.0000	20.9991	20.9434	20.6989	20.4628	
h 2 til rest of	20.2945 nouse	20.2972	20.2999	20.3136	20.3164	20.3301	20.3301	20.3328	20.3246	20.3164	20.3109	20.3054	(88)
IIT 2	0.9960 19.6948	0.9829 19.8980	0.9389 20.1071	0.7907 20.2786	0.5861 20.3138	0.3886 20.3300	0.2635 20.3301	0.2927 20.3328	0.4981 20.3241	0.8404 20.2687	0.9829 19.9815	0.9972 19.6777	
iving area f NIT	19.8691	20.0626	20.2632	20.4291	20.4646	20.4781	20.4782	20.4803	fLA = 20.4733	Living are 20.4179	a / (4) = 20.1402	0.2211 19.8513	
Temperature a adjusted MIT	djustment 19.8691	20.0626	20.2632	20.4291	20.4646	20.4781	20.4782	20.4803	20.4733	20.4179	20.1402	0.0000 19.8513	
3. Space heat	· .												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
Jtilisation Jseful gains	0.9951 875.1513	0.9811 1017.7379	0.9380 1076.3024	0.7969 1004.0512	0.5959 786.0089	0.3987 517.7898	0.2739 341.6611	0.3036 357.8926	0.5099 565.8116	0.8463 832.0020	0.9813 862.3397	0.9966 833.4798	
Ext temp. Heat loss rat	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Space heating	1449.7081	1406.0071	1270.9281	1042.3826	789.0592	517.8542	341.6627	357.8966	566.4000	883.8812	1184.0366	1433.2022	(97)
Space heating	427.4702	260.9169 t - total n	144.8015 er vear (kw	27.5986 Jh/vear)	2.2694	0.0000	0.0000	0.0000	0.0000	38.5981	231.6217	446.1935 1579.4699	
Solar heating		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Solar heating Space heating	contributi				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
_	427.4702	260.9169	144.8015	27.5986	2.2694	0.0000	0.0000	0.0000	0.0000	38.5981	231.6217	446.1935	
Space heating Space heating		t arter sor	ar contribu	ition - tota	i per year	(KWII/ year')				(98c	(4) =	1579.4699 12.7686	
9b. Energy re	quirements												
													(301)
			ry/suppleme	entary syste	m (Table 11)						0.0000 1.0000	
raction of s raction of h	pace heat f eat from co	rom communi mmunity Hea	ry/suppleme ty system t pump-Spac	e and Water									(302) (303a)
Fraction of s Fraction of h Factor for co Factor for ch	pace heat f eat from co ntrol and c arging meth	rom communi mmunity Hea harging met od (Table 4	ry/suppleme ty system t pump-Spac hod (Table c(3)) for w	e and Water 4c(3)) for water heatin	space heati g							1.0000 1.0000 1.0000 1.0000	(302) (303a) (305) (305a)
Fraction of s Fraction of s Fraction of h Factor for co Factor for ch Distribution Efficiency of Space heating	pace heat feat from control and carging metholoss factor secondary/	rom communi mmunity Hea harging met od (Table 4 (Table 12c	ry/suppleme ty system t pump-Spac hod (Table c(3)) for w) for commu	e and Water 4c(3)) for water heatin	space heati g							1.0000 1.0000 1.0000	(302) (303a) (305) (305a) (306)

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427.4702 260.9169 144.8015 27.5986 2.2694 0.0000 0.000						
	0.0000	0.0000	38.5981	231.6217	446.1935	(98
pace heat from Heat pump = (98) x 1.00 x 1.00 x 1.10 07a	0.0000	0.0000	42.4579	254.7839	490.8128	
pace heating requirement 470.2172 287.0086 159.2816 30.3585 2.4963 0.0000 0.000	0.0000	0.0000	42.4579	254.7839	490.8128	(30
ifficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) pace heating fuel for secondary/supplementary system					0.0000	(30
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(30
nter heating Unual water heating requirement						
256.8462 227.1980 241.9408 214.5768 209.1405 189.7226 188.388 Her heat from Heat pump = (64) x 1.00 x 1.00 x 1.10	2 195.3127	196.7872	217.8523	229.6132	254.3331	(64
10a 282.5308 249.9178 266.1349 236.0345 230.0545 208.6949 207.227 eter heating fuel	0 214.8440	216.4659	239.6375	252.5746	279.7664	
282.5308 249.9178 266.1349 236.0345 230.0545 208.6949 207.227 poling System Energy Efficiency Ratio	214.8440	216.4659	239.6375	252.5746	279.7664 0.0000	•
pace coolin 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.000000		0.0000 32.1084	0.0000 33.1787	0.0000 32.1084	0.0000 33.1787	
ghting 27.2245 21.8405 19.6649 14.4074 11.1287 9.0922 10.151 ectricity generated by PVs (Appendix M) (negative quantity)		17.1401	22.4888	25.4010	27.9811	
333a)m -26.0461 -41.8579 -69.2042 -87.3847 -100.9413 -96.6488 -95.007 Lectricity generated by wind turbines (Appendix M) (negative quantity)	2 -85.8801	- 70.3875	-51.3888	-30.0738	-21.7541	(33
334a)m 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(33
335a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(33
ectricity generated by PVs (Appendix M) (negative quantity) 335)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(33
lectricity generated by wind turbines (Appendix M) (negative quantity) 334b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.000	0.0000	0.0000	0.0000	0.0000	0.0000	(33
ectricity generated by hydro-electric generators (Appendix M) (negative quantity) 335b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.000	0.0000	0.0000	0.0000	0.0000	0.0000	(33
nual totals kWh/year ace heating fuel - community heating					1737.4168	•
ace heating fuel - secondary ter heating fuel - community heating					0.0000 2883.8827	
ficiency of water heater ectricity used for heat distribution					0.0000 17.3742	
pace cooling fuel					0.0000	(3
lectricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.9500)						
mechanical ventilation fans (SFP = 0.9500) otal electricity for the above, kWh/year					390.6525 390.6525	
lectricity for lighting (calculated in Appendix L)					219.7170	
nergy saving/generation technologies (Appendices M ,N and Q) V generation					- 776.5747	(3:
ind generation					0.0000	(33
ydro-electric generation (Appendix N) lectricity generated - Micro CHP (Appendix N)					0.0000 0.0000	
Appendix Q - special features nergy saved or generated					-0.0000	/2-
Energy used					0 0000	
oral nativelen euel. RA Lou. all neez					0.0000 4455.0944	(33
oral meliverem emergy ton all mses						(33
						(33
	Energy kWh/year		ion factor	k	4455.0944 Emissions	(3:
	kWh/year		kg CO2/kWh	k	4455.0944 Emissions of CO2/year 310.0000	(33)
2b. Carbon dioxide emissions - Community heating scheme				k	Emissions g CO2/year 310.0000 88.9861 6.8158	(3: (3: (3: (3: (3:
2b. Carbon dioxide emissions - Community heating scheme fficiency of heat source Heat pump pace and Water heating from Heat pump lectrical energy for heat distribution (space & water) werall CO2 factor for heat network otal CO2 associated with community systems	kWh/year 1490.7418		0.1588	k	Emissions g CO2/year 310.0000 88.9861 6.8158 0.0491 226.6814	(3) (3) (3) (3) (3) (3)
2b. Carbon dioxide emissions - Community heating scheme fficiency of heat source Heat pump pace and Water heating from Heat pump lectrical energy for heat distribution (space & water) verall CO2 factor for heat network otal CO2 associated with community systems pace and water heating umps, fans and electric keep-hot	kWh/year 1490.7418 17.3742 390.6525		0.1588 0.0000 0.1387	k	Emissions g CO2/year 310.0000 88.9861 6.8158 0.0491	(3 (3 (3 (3 (3 (3 (3
2b. Carbon dioxide emissions - Community heating scheme fficiency of heat source Heat pump pace and Water heating from Heat pump lectrical energy for heat distribution (space & water) verall CO2 factor for heat network otal CO2 associated with community systems pace and water heating umps, fans and electric keep-hot	kWh/year 1490.7418 17.3742		0.1588 0.0000	k	Emissions gc CO2/year 310.0000 88.9861 6.8158 0.0491 226.6814 226.6814	(3 (3 (3 (3 (3 (3 (3 (3
2b. Carbon dioxide emissions - Community heating scheme fficiency of heat source Heat pump pace and Water heating from Heat pump lectrical energy for heat distribution (space & water) verall CO2 factor for heat network otal CO2 associated with community systems pace and water heating umps, fans and electric keep-hot nergy for lighting Energy saving/generation technologies	kWh/year 1490.7418 17.3742 390.6525		0.1588 0.0000 0.1387	k	Emissions g CO2/year 310.0000 88.9861 6.8158 0.0491 226.6814 226.6814 54.1883	(3 (3 (3 (3 (3 (3 (3 (3
2b. Carbon dioxide emissions - Community heating scheme Fficiency of heat source Heat pump pace and Water heating from Heat pump lectrical energy for heat distribution (space & water) verall CO2 factor for heat network potal CO2 associated with community systems pace and water heating umps, fans and electric keep-hot hergy for lighting Energy saving/generation technologies V Unit electricity used in dwelling V Unit electricity exported	kWh/year 1490.7418 17.3742 390.6525 219.7170		0.1588 0.0000 0.1387 0.1443	k	Emissions sg CO2/year 310.0000 88.9861 6.8158 0.0491 226.6814 226.6814 54.1883 31.7120	(3 (3 (3 (3 (3 (3 (3 (3
2b. Carbon dioxide emissions - Community heating scheme fficiency of heat source Heat pump pace and Water heating from Heat pump lectrical energy for heat distribution (space & water) verall CO2 factor for heat network total CO2 associated with community systems pace and water heating umps, fans and electric keep-hot nergy for lighting Energy saving/generation technologies / Unit electricity used in dwelling / Unit electricity exported total total CO2, kg/year	kWh/year 1490.7418 17.3742 390.6525 219.7170		0.1588 0.0000 0.1387 0.1443	k	Emissions (g CO2/year 310.0000 88.9861 6.8158 0.0491 226.6814 54.1883 31.7120 -102.7768 0.0000 -102.7768 209.8049	(3 (3 (3 (3 (3 (3 (3 (3 (3 (3 (3 (3 (3 (
2b. Carbon dioxide emissions - Community heating scheme fficiency of heat source Heat pump pace and Water heating from Heat pump lectrical energy for heat distribution (space & water) verall CO2 factor for heat network total CO2 associated with community systems pace and water heating umps, fans and electric keep-hot nergy for lighting Energy saving/generation technologies V Unit electricity used in dwelling V Unit electricity exported total total CO2, kg/year	kWh/year 1490.7418 17.3742 390.6525 219.7170		0.1588 0.0000 0.1387 0.1443	k	Emissions (g CO2/year 310.0000 88.9861 6.8158 0.0491 226.6814 241.883 31.7120 -102.7768 0.0000 -102.7768	(3 (3 (3 (3 (3 (3 (3 (3 (3 (3 (3 (3 (3 (
fficiency of heat source Heat pump pace and Water heating from Heat pump lectrical energy for heat distribution (space & water) verall CO2 factor for heat network otal CO2 associated with community systems pace and water heating umps, fans and electric keep-hot nergy for lighting Energy saving/generation technologies V Unit electricity used in dwelling V Unit electricity exported otal otal CO2, kg/year PC Dwelling Carbon Dioxide Emission Rate (DER)	kWh/year 1490.7418 17.3742 390.6525 219.7170 -776.5747 0.0000		0.1588 0.0000 0.1387 0.1443	k	Emissions (g CO2/year 310.0000 88.9861 6.8158 0.0491 226.6814 54.1883 31.7120 -102.7768 0.0000 -102.7768 209.8049	(3) (3) (3) (3) (3) (3) (3) (3)
2b. Carbon dioxide emissions - Community heating scheme fficiency of heat source Heat pump pace and Water heating from Heat pump lectrical energy for heat distribution (space & water) verall CO2 factor for heat network otal CO2 associated with community systems pace and water heating umps, fans and electric keep-hot nergy for lighting Energy saving/generation technologies V Unit electricity used in dwelling V Unit electricity exported otal otal CO2, kg/year PC Dwelling Carbon Dioxide Emission Rate (DER)	kWh/year 1490.7418 17.3742 390.6525 219.7170 -776.5747 0.0000		0.1387 0.1443 0.1323 0.0000		Emissions (g CO2/year 310.0000 88.9861 6.8158 0.0491 226.6814 54.1883 31.7120 -102.7768 0.0000 -102.7768 209.8049	(3 (3 (3 (3 (3 (3 (3 (3 (3 (3 (3 (3 (3 (
2b. Carbon dioxide emissions - Community heating scheme fficiency of heat source Heat pump pace and Water heating from Heat pump lectrical energy for heat distribution (space & water) verall CO2 factor for heat network otal CO2 associated with community systems pace and water heating umps, fans and electric keep-hot nergy for lighting Energy saving/generation technologies V Unit electricity used in dwelling V Unit electricity exported otal otal CO2, kg/year PC Dwelling Carbon Dioxide Emission Rate (DER) 3b. Primary energy - Community heating scheme	kWh/year 1490.7418 17.3742 390.6525 219.7170 -776.5747 0.0000	Primary ene	0.1387 0.1443 0.1323 0.0000		Emissions (202/year 310.0000 88.9861 6.8158 0.0491 226.6814 54.1883 31.7120 -102.7768 0.0000 -102.7768 209.8049 1.7000	(3 (3 (3 (3 (3 (3 (3 (3 (3 (3 (3 (3 (3 (
2b. Carbon dioxide emissions - Community heating scheme fficiency of heat source Heat pump pace and Water heating from Heat pump lectrical energy for heat distribution (space & water) verall CO2 factor for heat network otal CO2 associated with community systems pace and water heating umps, fans and electric keep-hot nergy for lighting Energy saving/generation technologies V Unit electricity used in dwelling V Unit electricity exported otal otal otal CO2, kg/year PC Dwelling Carbon Dioxide Emission Rate (DER) 3b. Primary energy - Community heating scheme fficiency of heat source Heat pump pace and Water heating from Heat pump	kwh/year 1490.7418 17.3742 390.6525 219.7170 -776.5747 0.0000 Energy kWh/year 1490.7418	Primary ene	0.1387 0.1387 0.1443 0.1323 0.0000		Emissions (CO2/year 310.0000 88.9861 6.8158 0.0491 226.6814 54.1883 31.7120 -102.7768 0.0000 -102.7768 209.8849 1.7000 arry energy kWh/year 310.0000 889.8324	(3) (3) (3) (3) (3) (3) (3) (3) (3) (3)
2b. Carbon dioxide emissions - Community heating scheme fficiency of heat source Heat pump pace and Water heating from Heat pump lectrical energy for heat distribution (space & water) verall CO2 factor for heat network otal CO2 associated with community systems pace and water heating umps, fans and electric keep-hot nergy for lighting Energy saving/generation technologies V Unit electricity used in dwelling V Unit electricity exported otal otal CO2, kg/year PC Dwelling Carbon Dioxide Emission Rate (DER) 3b. Primary energy - Community heating scheme fficiency of heat source Heat pump pace and Water heating from Heat pump lectrical energy for heat distribution (space & water) verall CO2 factor for heat network	kWh/year 1490.7418 17.3742 390.6525 219.7170 -776.5747 0.0000	Primary ene	0.1387 0.1443 0.1323 0.0000		Emissions GCO2/year 310.0000 88.9861 6.8158 0.0491 226.6814 226.6814 54.1883 31.7120 -102.7768 0.0000 -102.7768 209.8849 1.7000	(33) (33) (33) (33) (33) (33) (33) (34) (44) (4
Efficiency of heat source Heat pump space and Water heating from Heat of Space & Water) Worall CO2 factor for heat network Total CO2 associated with community systems space and water heating space sp	kwh/year 1490.7418 17.3742 390.6525 219.7170 -776.5747 0.0000 Energy kWh/year 1490.7418	Primary ene	0.1387 0.1387 0.1443 0.1323 0.0000		Emissions (CO2/year 310.0000 88.9861 6.8158 0.0491 226.6814 54.1883 31.7120 -102.7768 0.0000 -102.7768 209.8049 1.7000 889.8324 71.4256 0.5140 2375.4777	(36) (36) (36) (37) (38) (38) (38) (38) (38) (46) (46) (47) (47) (47) (47) (47) (47) (47) (47
Efficiency of heat source Heat pump Space and Water heating from Heat retwork Total CO2 factor for heat network Total CO2 associated with community systems Space and water heating Tumps, fans and electric keep-hot Sinergy saving/generation technologies Total CO2, kg/year SPC Dwelling Carbon Dioxide Emission Rate (DER) Space and Water heating from Heat pump Space and water heating Total CO2 associated with community systems Space and water heating Tumps, fans and electric keep-hot Space and water heating Tumps, fans and electric keep-hot Space and space in the space water in the	kwh/year 1490.7418 17.3742 390.6525 219.7170 -776.5747 0.0000 Energy kWh/year 1490.7418	Primary ene	0.1387 0.1387 0.1443 0.1323 0.0000		Emissions Ig CO2/year 310.0000 88.9861 6.8158 0.0491 226.6814 54.1883 31.7120 -102.7768 0.0000 -102.7768 209.8049 1.7000	(36) (36) (36) (37) (37) (38) (37) (38) (37) (38) (38) (46) (47) (48) (47) (47) (47) (47) (47)

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Energy saving/g PV Unit electric PV Unit electric Total Total Primary er Dwelling Primary	ity used in ity export	in dwelling ted /ear	25					-776.5747 0.0000		1.4890 0.0000		-1156.3247 0.0000 -1156.3247 2147.1415 17.3600	(480) (483)
SAP 10 WORKSHEET CALCULATION OF T	FOR New E	Build (As De	esigned) ((Version 10	.2, February	2022)							
1. Overall dwell	ling charac	cteristics											
Ground floor First floor Total floor area Dwelling volume						3.7000		Area (m2) 61.9000 61.8000	(1b) x	ey height (m) 2.5000 2.9500 +(3d)+(3e)	(2c) =	Volume (m3) 154.7500 182.3100 337.0600	(1b) (1c) (4)
2. Ventilation r	ate												
Number of open of Number of chimme Number of flues Number of flues Number of intern Number of passix Number of fluels	Flues eys / flues attached to attached to conditional to	to solid fue to other hea tract fans	el boiler	ire							m. 0 * 80 = 0 * 20 = 0 * 10 = 0 * 20 = 0 * 35 = 0 * 20 = 4 * 10 = 0 * 10 = 0 * 40 =	9.0000 0.0000 0.0000 0.0000 0.0000 0.0000 40.0000 0.0000	(6a) (6b) (6c) (6d) (6e) (6f) (7a) (7b)
Infiltration due Pressure test Pressure Test Me Measured/design Infiltration rat Number of sides	ethod AP50 ce	eys, flues a	and fans =	= (6a)+(6b)	+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		40.0000	Air change / (5) = B	0.1187 Yes lower Door 5.0000 0.3687	(8) (17)
Shelter factor Infiltration rat	ce adjusted	d to include	e shelter fa	actor					(20) = 1 - (2)	[0.075 x 1) = (18)		0.9250 0.3410	1 1
Wind speed Wind factor Adj infilt rate	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	Sep 4.0000 1.0000	Oct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	. ,
Effective ac	0.4348 0.5945	0.4263 0.5909	0.4178 0.5873	0.3751 0.5704	0.3666 0.5672	0.3240 0.5525	0.3240 0.5525	0.3154 0.5498	0.3410 0.5581	0.3666 0.5672	0.3837 0.5736	0.4007 0.5803	
3. Heat losses a	and heat lo	oss paramete	er										
Element TER Opening Type External Wall 1 External Roof 1 Total net area of Fabric heat loss Party Wall 1	of external	l elements /		Gross m2 27.4340 8.0000	Openings m2 23.5000	23. 103. 8. 135.	Area m2 5000 9340 0000 4340 (26)(3000	U-value W/m2K 1.1450 0.1800 0.1100 30) + (32) 0.0000	A x 1 W// 26.908-18.708-0.8800 = 46.496-0.0000	(1 1 2	-value kJ/m2K	A x K kJ/K	
Thermal mass par List of Thermal K1 Eleme E2 Other E3 Sill E4 Jamb E6 Inter E16 Corr E18 Part E7 Party	Bridges ent clintels clintels crediate finer (normal cy wall bet compared finer (insulated)	(including of loor within l) ween dwell: tween dwell:	other steel a dwelling	lintels) ocks of fla				1: 1: 3: 2: 10 16	Length P: 7.1500 5.5700 3.5200 3.5200 6.2000 6.2000 6.2000 6.1000 4.1000 8.1000	5i-value 0.0500 0.0500 0.0500 0.0900 0.0900 0.0700 0.2400 0.0800	Tot. 0.85 0.77: 1.67: 0.00 1.45: 0.64: 2.52: 0.98: 0.64:	75 85 60 90 80 80 70	

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	ridges at loss	,	lated using						(33) + (36)	(36a) = + (36a) =	9.5770 0.0000 56.0735	·
/entilation hea	t loss cal Jan 66.1291	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	/20
	oeff 122.2027	65.7209 121.7944	65.3207 121.3942	63.4410	63.0893 119.1628	61.4521	61.4521 117.5256	61.1489	62.0827 118.1562	63.0893 119.1628	63.8007 119.8743	64.5445 120.6180	·
Average = Sum(3	9)m / 12 = Jan	= Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	119.5128 Dec	
HLP HLP (average)	0.9879	0.9846	0.9814	0.9662	0.9633	0.9501	0.9501	0.9476	0.9552	0.9633	0.9691	0.9751 0.9662	(48
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	
 1. Water heatin													
Assumed occupan												2.8765	(42
Hot water usage	72.4501	71.3613	69.7747	66.7391	64.4989	62.0006	60.5806	62.1552	63.8812	66.5636	69.6644	72.1725	(42
Hot water usage Hot water usage	31.2791	30.8146	30.1604	28.9542	28.0511	27.0496	26.5087	27.1583	27.8655	28.9372	30.1682	31.1734	(4
Average daily h	44.0887	42.4855	40.8823 /day)	39.2790	37.6758	36.0726	36.0726	37.6758	39.2790	40.8823	42.4855	44.0887 135.8778	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
	147.8179 234.1074	144.6613 205.9958	140.8174 216.4311	134.9724 184.7704	130.2258 175.3089	125.1228 153.8531	123.1619 148.9536	126.9892 157.2392	131.0258 161.5679	136.3830 185.0704	142.3180 202.7581 Sum(45)m =	147.4346 230.8469 2256.9027	•
Distribution lo		= 0.15 x (30.8994	45)m 32.4647	27.7156	26.2963	23.0780	22.3430	23.5859	24.2352	27.7606	30.4137	34.6270	(4
Water storage l Store volume a) If manufact	urer decla		actor is kn	own (kWh/d	ay):							180.0000 1.5520	(4
Temperature f inter (49) or (otal storage l	54) in (55											0.5400 0.8381	
f cylinder con	25.9803	23.4661 icated sola	25.9803 r storage	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(5
rimary loss	25.9803 23.2624	23.4661 21.0112	25.9803 23.2624	25.1422 22.5120	25.9803 23.2624	25.1422 22.5120	25.9803 23.2624	25.9803 23.2624	25.1422 22.5120	25.9803 23.2624	25.1422 22.5120	25.9803 23.2624	(5
Combi loss Fotal heat requ						0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
	283.3501 -33.1211 -0.0000	250.4731 -29.2926 -0.0000	265.6737 -30.6735 -0.0000	232.4246 -25.3989 -0.0000	224.5516 -23.6709 -0.0000	201.5073 -20.2553 -0.0000	198.1963 -18.9861 -0.0000	206.4819 -20.1899 -0.0000	209.2221 -20.9569 -0.0000	234.3131 -24.7059 -0.0000	250.4123 -27.9888 -0.0000	280.0895 -32.5078 -0.0000	(6
Solar input 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	0.0000	(6
Output from w/h	250.2289	221.1805	235.0002	207.0257	200.8807	181.2520	179.2101	186.2920 Total p	188.2651 er year (kW	209.6071 h/vear) = S	222.4235 Sum(64)m =	247.5818 2528.9476	
12Total per yea Electric shower		ar)						·	, ,	.,	, ,	2529	
	0.0000	0.0000	0.0000	0.0000 Tot	0.0000 al Energy u	0.0000 sed by inst	0.0000 antaneous e	0.0000 lectric sho	0.0000 wer(s) (kWh	0.0000 /year) = Su	0.0000 um(64a)m =	0.0000 0.0000	
Heat gains from	water hea 117.2348	ating, kWh/ 104.0754		99.5595	97.6843	89.2795	88.9212	91.6762	91.8447	100.9300	105.5404	116.1507	(6
. Internal gai													
Metabolic gains	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	10
ighting gains	(calculate				143.8273 L9a), also: 148.1891	143.8273 see Table 5 153.1287	143.8273 148.1891	143.8273 148.1891	143.8273 153.1287	143.8273 148.1891	143.8273 153.1287	143.8273 148.1891	
Appliances gain			endix L, eq					213.9117	221.4939	237.6353	258.0111	277.1614	•
Cooking gains (37.3827	37.3827	37.3827	37.3827	37.3827	
omps, fans osses e.g. eva					3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	
_	ains (Tabl	le 5)	-115.0619			-115.0619	-115.0619	-115.0619	-115.0619	-115.0619	-115.0619	-115.0619	
Water heating g		154.8741 681.0526	149.6740 652.3929	138.2771	131.2962 597.4979	123.9993 572.9904	119.5177 550.7756	123.2207 551.4697	127.5620 568.3328	135.6587 590.6313	146.5839 626.8719	156.1166 650.6152	
Water heating g Total internal	664.8660												
Water heating g Total internal													
ater heating g otal internal													

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					W/m2	or	Table 6b	or Tab	le 6c	Table (5d		
North Southeast South West			4.3 5.7 6.3 7.1	500 000	10.6334 36.7938 46.7521 19.6403		0.6300 0.6300 0.6300 0.6300	0	.7000 .7000 .7000 .7000	0.776 0.776 0.776 0.776	99 99	13.9737 64.6569 90.0146 42.9166	(77) (78)
Solar gains Total gains	211.5618 876.4278	368.2138 1049.2664	522.1165 1174.5095	673.4866 1303.2808	775.6121 1373.1100	778.5523 1351.5427	747.1087 1297.8842	670.1397 1221.6094	574.6938 1143.0267	412.1360 1002.7673	254.8924 881.7643	180.0554 830.6707	
7. Mean inter	rnal tempera												
Temperature o	luring heati	ng periods	in the livi	ng area fro	n Table 9,							21.0000	(85)
Jtilisation f	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
tau alpha util living a	90.1692	90.4714 7.0314	90.7697 7.0513	92.1973 7.1465	92.4694 7.1646	93.7575 7.2505	93.7575 7.2505	94.0000 7.2667	93.2571 7.2171	92.4694 7.1646	91.9206 7.1280	91.3537 7.0902	
icii iiving a	0.9985	0.9942	0.9800	0.9178	0.7665	0.5530	0.3981	0.4408	0.6942	0.9491	0.9949	0.9989	(86)
4ΙΤ Γh 2	20.1539 20.0934	20.3336	20.5574 20.0989	20.8180 20.1116	20.9594 20.1140	20.9965 20.1251	20.9997 20.1251	20.9994 20.1272	20.9841 20.1208	20.7905 20.1140	20.4257 20.1092	20.1298 20.1041	
util rest of		0.9919	0.9720	0.8891	0.7078	0.4792	0.3192	0.3575	0.6146	0.9243	0.9925	0.9985	
4IT 2 ∟iving area f	19.1104 raction	19.3414	19.6242	19.9423	20.0852	20.1236	20.1251	20.1270	20.1125 fLA =	19.9206 Living area	19.4700 a / (4) =	19.0880 0.2211	
NIT emperature a		19.5608	19.8306	20.1359	20.2785	20.3166	20.3185	20.3199	20.3052	20.1129	19.6813	19.3184 0.0000	` ,
adjusted MIT	19.3412	19.5608	19.8306	20.1359	20.2785	20.3166	20.3185	20.3199	20.3052	20.1129	19.6813	19.3184	(93)
3. Space heat													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
Jtilisation Jseful gains	0.9971 873.8729	0.9900 1038.8253	0.9690 1138.1448	0.8900 1159.8655	0.7192 987.5866	0.4955 669.7108	0.3366 436.9051	0.3760 459.2685	0.6319 722.2318	0.9242 926.7745	0.9908 873.6772	0.9979 828.9531	
Ext temp. Heat loss rat	4.3000 e W	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
pace heating	g kWh		1618.2514		1022.2387	671.8446	437.0134	459.5039		1133.5869		1823.5472	
pace heating		501.8325 t - total p	357.1993 er year (kW	131.7488 h/year)	25.7811	0.0000	0.0000	0.0000	0.0000	153.8684	456.8378	739.9780 3084.6082	
olar heating	0.0000 contributi	0.0000 on - total	0.0000 per year (k	0.0000 Wh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000	(98b)
Space heating Space heating	717.3621	501.8325 t after sol	357.1993 ar contribu	131.7488 tion - tota	25.7811 l per year	0.0000 (kWh/year)	0.0000	0.0000	0.0000	153.8684	456.8378	739.9780 3084.6082	(98c)
Space heating	g per m2									(98c)) / (4) =	24.9362	(99)
9a. Energy re	quirements	- Individua	l heating s	ystems, inc	luding micr								
Fraction of s	pace heat f	rom seconda											
Efficiency of				ncary system	m (Table 11)						0.0000	
fficiency of	main space	heating sy heating sy	stem(s) stem 1 (in stem 2 (in	%) %)	n (Table 11)						0.0000 1.0000 92.3000 0.0000 0.0000	(202) (206) (207)
Efficiency of Efficiency of	main space secondary/ Jan	heating sy heating sy supplementa Feb	stem(s) stem 1 (in stem 2 (in	%) %)	m (Table 11 May) Jun	Jul	Aug	Sep	Oct	Nov	1.0000 92.3000 0.0000	(202) (206) (207)
Efficiency of Efficiency of Space heating	main space secondary/ Jan requiremen 717.3621	heating sy heating sy supplementa Feb t 501.8325	stem(s) stem 1 (in stem 2 (in ry heating Mar 357.1993	%) %) system, % Apr 131.7488	·		Jul 0.0000	Aug 0.0000	Sep 0.0000	Oct 153.8684	Nov 456.8378	1.0000 92.3000 0.0000 0.0000	(202) (206) (207) (208)
efficiency of efficiency of Space heating Space heating	Jan requiremen 717.3621 efficiency 92.3000	heating sy heating sy supplementa Feb t 501.8325 (main heat 92.3000	stem(s) stem 1 (in stem 2 (in ry heating Mar 357.1993 ing system 92.3000	%) %) system, % Apr 131.7488	May	Jun		_	•			1.0000 92.3000 0.0000 0.0000 Dec	(202) (206) (207) (208)
Efficiency of Efficiency of Space heating Space heating Space heating Space heating Space heating Space heating	Jan requiremen 717.3621 efficiency 92.3000 fuel (main 777.2071	heating sy heating sy supplementa Feb t 501.8325 (main heat 92.3000 heating sy 543.6972	stem(s) stem 1 (in stem 2 (in ry heating Mar 357.1993 ing system 92.3000 stem) 386.9982	%) %) system, % Apr 131.7488 1) 92.3000 142.7398	May 25.7811	Jun 0.0000	0.0000	0.0000	0.0000	153.8684	456.8378	1.0000 92.3000 0.0000 0.0000 Dec	(202) (206) (207) (208) (98) (210)
efficiency of efficiency of space heating space heating space heating space heating space heating space heating	Jan requiremen 717,3621 gefficiency 92,3000 gfuel (main 777,2071 gefficiency 0.0000	heating sy heating sy supplementa Feb t 501.8325 (main heat 92.3000 heating sy 543.6972 (main heat 0.0000	stem(s) stem 1 (in stem 2 (in ry heating Mar 357.1993 ing system 92.3000 stem) 386.9982 ing system 0.0000	%) %) system, % Apr 131.7488 1) 92.3000 142.7398	May 25.7811 92.3000	Jun 0.0000 0.0000	0.0000 0.0000	0.0000	0.0000	153.8684 92.3000	456.8378 92.3000	1.0000 92.3000 0.0000 0.0000 Dec 739.9780 92.3000	(202) (206) (207) (208) (98) (210) (211)
efficiency of efficiency of space heating	main space secondary/ Jan requiremen 717.3621 sefficiency 92.3000 fuel (main 777.2071 sefficiency 0.0000 stul (main 0.0000	heating sy heating sy supplementa Feb t 501.8325 (main heat 92.3000 heating sy 543.6972 (main heat 0.0000 heating sy 0.0000	stem(s) stem 1 (in stem 2 (in ry heating Mar 357.1993 ing system 92.3000 stem) 386.9982 ing system 0.0000	%) %) system, % Apr 131.7488 1) 92.3000 142.7398 2)	May 25.7811 92.3000 27.9319	Jun 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	153.8684 92.3000 166.7047	456.8378 92.3000 494.9488	1.0000 92.3000 0.0000 0.0000 Dec 739.9780 92.3000 801.7097	(202) (206) (207) (208) (98) (210) (211) (212)
Efficiency of Efficiency of Space heating	Jan grequiremen 717.3621 gefficiency 92.3000 gfuel (main 777.2071 gefficiency 0.0000 gfuel (main 0.0000 gfuel (seco	heating sy heating sy supplementa Feb t 501.8325 (main heat 92.3000 heating sy 543.6972 (main heat 0.0000 heating sy 0.0000	stem(s) stem 1 (in stem 2 (in ry heating Mar 357.1993 ing system 92.3000 stem) 386.9982 ing system 0.0000 stem 2)	%) %) system, % Apr 131.7488 1) 92.3000 142.7398 2) 0.0000	May 25.7811 92.3000 27.9319 0.0000	Jun 0.0000 0.0000 0.0000	0.00000.00000.0000	0.0000 0.0000 0.0000 0.0000	0.00000.00000.0000	153.8684 92.3000 166.7047 0.0000	456.8378 92.3000 494.9488 0.0000	1.0000 92.3000 0.0000 0.0000 Dec 739.9780 92.3000 801.7097 0.0000	(202) (206) (207) (208) (98) (210) (211) (212) (213)
Efficiency of Ef	main space secondary/ Jan grequiremen 717.3621 gefficiency 92.3000 gfuel (main 777.2071 gefficiency 0.0000 gfuel (main 0.0000 gfuel (seco 0.0000	heating sy heating sy supplementa Feb t 501.8325 (main heat 92.3000 heating sy 543.6972 (main heat 0.0000 heating sy 0.0000 ndary) 0.0000	stem(s) stem 1 (in stem 2 (in ry heating Mar 357.1993 ing system 92.3000 stem) 386.9982 ing system 0.0000 stem 2) 0.0000 0.0000	%) %) system, % Apr 131.7488 1) 92.3000 142.7398 2) 0.0000 0.0000	May 25.7811 92.3000 27.9319 0.0000 0.0000	Jun 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000	153.8684 92.3000 166.7047 0.0000 0.0000	456.8378 92.3000 494.9488 0.0000 0.0000	1.0000 92.3000 0.0000 0.0000 Dec 739.9780 92.3000 801.7097 0.0000 0.0000	(202) (206) (207) (208) (98) (210) (211) (212) (213) (215)
Efficiency of Ef	main space secondary/ Jan requiremen 717.3621 sefficiency 92.3000 fuel (main 777.2071 sefficiency 0.0000 fuel (seco 0.0000 series) fuel seco 0.0000 series fuel seco	heating sy heating sy supplementa Feb t 501.8325 (main heat 92.3000 heating sy 543.6972 (main heat 0.0000 heating sy 0.0000 ndary) 0.0000	Stem(s) stem 1 (in stem 2 (in ry heating Mar 357.1993 ing system 92.3000 stem) 386.9982 ing system 0.0000 stem 2) 0.0000 0.0000	%) %) system, % Apr 131.7488 1) 92.3000 142.7398 2) 0.0000 0.0000	May 25.7811 92.3000 27.9319 0.0000 0.0000	Jun 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 179.2101	0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	153.8684 92.3000 166.7047 0.0000 0.0000 209.6071	456.8378 92.3000 494.9488 0.0000 0.0000	1.0000 92.3000 0.0000 0.0000 Dec 739.9780 92.3000 801.7097 0.0000 0.0000	(202) (206) (207) (208) (210) (211) (212) (213) (215) (64) (216)
Efficiency of Ef	main space secondary/ Jan grequiremen 717.3621 gefficiency 92.3000 gfuel (main 777.2071 gefficiency 0.0000 gfuel (seco 0.0000 gfuel (seco 0.0000 gfuel seco 0.00000 gfuel seco 0.0000 gfuel seco 0.00000 gfuel seco 0.0000 gfuel seco 0.00000 gfuel seco 0.0000 gfuel seco 0.0000 gfuel seco 0.0000 gfuel se	heating sy heating sy supplementa Feb t 501.8325 (main heat 92.3000 heating sy 543.6972 (main heat 0.0000 heating sy 0.0000 ndary) 0.0000	stem(s) stem 1 (in stem 2 (in ry heating Mar 357.1993 ing system 92.3000 stem) 386.9982 ing system 0.0000 stem 2) 0.0000 235.0002 84.9960	%) %) system, % Apr 131.7488 1) 92.3000 142.7398 2) 0.0000 0.0000 207.0257 83.0744	May 25.7811 92.3000 27.9319 0.0000 0.0000 200.8807 80.7307	Jun 0.0000 0.0000 0.0000 0.0000 0.0000 181.2520 79.8000	0.0000 0.0000 0.0000 0.0000 0.0000 179.2101 79.8000	0.0000 0.0000 0.0000 0.0000 0.0000 186.2920 79.8000	0.0000 0.0000 0.0000 0.0000 0.0000 188.2651 79.8000	153.8684 92.3000 166.7047 0.0000 0.0000 209.6071 83.3773	456.8378 92.3000 494.9488 0.0000 0.0000 222.4235 85.6374	1.0000 92.3000 0.0000 0.0000 Dec 739.9780 92.3000 801.7097 0.0000 0.0000 247.5818 79.8000 86.3583	(202) (206) (207) (208) (98) (210) (211) (212) (213) (215) (64) (216) (217)
Efficiency of (217) muster for water for w	main space secondary/ Jan Rrequiremen 717.3621 Refficiency 92.3000 Fuel (main 777.2071 Refficiency 0.0000 Refuel (seco 0.0000 Refuel (seco 0.0000 Refuel (seco 0.0000	heating sy heating sy supplementa Feb t 501.8325 (main heat 92.3000 heating sy 543.6972 (main heat 0.0000 heating sy 0.0000 ndary) 0.0000	Stem(s) stem 1 (in stem 2 (in ry heating Mar 357.1993 ing system 92.3000 stem) 386.9982 ing system 0.0000 stem 2) 0.0000 0.0000	%) %) system, % Apr 131.7488 1) 92.3000 142.7398 2) 0.0000 0.0000	May 25.7811 92.3000 27.9319 0.0000 0.0000	Jun 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 179.2101	0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	153.8684 92.3000 166.7047 0.0000 0.0000 209.6071	456.8378 92.3000 494.9488 0.0000 0.0000	1.0000 92.3000 0.0000 0.0000 Dec 739.9780 92.3000 801.7097 0.0000 0.0000	(202) (206) (207) (208) (98) (210) (211) (212) (213) (215) (64) (216) (217) (219)
Efficiency of Efficiency of Efficiency of Space heating Water heating Water heating Efficiency of (217) m Fuel for water Space cooling (221) m Pumps and Falighting	main space secondary/ Jan requiremen 717.3621 sefficiency 92.3000 sfuel (main 0.0000 sfuel (main 0.0000 sfuel (main 0.0000 sfuel (seco 0.0000) sfuel (seco 0.00000) sfuel (seco 0.0000) sfuel (seco 0.00000) sfuel (seco 0.00000) sfuel (seco 0.00000) sfuel (seco 0.00000) sfuel (seco 0.000	heating sy heating sy heating sy supplementa Feb t 501.8325 (main heat 92.3000 heating sy 543.6972 (main heat 0.0000 heating sy 0.0000 dary) 0.0000 tt 221.1805 er 85.8384 kWh/month 257.6707 rement	stem(s) stem 1 (in stem 2 (in ry heating Mar 357.1993 ing system 92.3000 stem) 386.9982 ing system 0.0000 stem 2) 0.0000 235.0002 84.9960 276.4838	%) %) system, % Apr 131.7488 1) 92.3000 142.7398 2) 0.0000 0.0000 207.0257 83.0744 249.2052	May 25.7811 92.3000 27.9319 0.0000 0.0000 200.8807 80.7307 248.8283	Jun 0.0000 0.0000 0.0000 0.0000 0.0000 181.2520 79.8000 227.1328	0.0000 0.0000 0.0000 0.0000 0.0000 179.2101 79.8000 224.5741	0.0000 0.0000 0.0000 0.0000 0.0000 186.2920 79.8000 233.4486	0.0000 0.0000 0.0000 0.0000 0.0000 188.2651 79.8000 235.9212	153.8684 92.3000 166.7047 0.0000 0.0000 209.6071 83.3773 251.3960	456.8378 92.3000 494.9488 0.0000 0.0000 222.4235 85.6374 259.7271	1.0000 92.3000 0.0000 0.0000 Dec 739.9780 92.3000 801.7097 0.0000 0.0000 247.5818 79.8000 86.3583 286.6915	(202) (206) (207) (208) (98) (210) (211) (212) (213) (215) (64) (217) (219) (219) (221) (231)

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Full SAP Calculation Printout



Electricity generated by wind turbines (Appendix M) (negative quantity)						2 2222	(024.)
Electricity generated by hydro-electric generators (Appendix M) (negative		0.0000	0.0000	0.0000	0.0000	0.0000	
(235a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0. Electricity used or net electricity generated by micro-CHP (Appendix N) (n	.0000 0.0000 negative if net g	0.0000 (eneration	0.0000	0.0000	0.0000	0.0000	(235a)
(235c)m 0.0000 0.0000 0.0000 0.0000 0.0000 0. Electricity generated by PVs (Appendix M) (negative quantity)	.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
	.4090 - 67.6393	- 56.7353	-40.8678	-23.3288	-10.0357	-5.8393	(233b)
(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)
` '	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
	negative if net g .0000 0.0000	generation) 0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year Space heating fuel - main system 1 Space heating fuel - main system 2 Space heating fuel - secondary						3341.9374 0.0000 0.0000	(213)
Efficiency of water heater Water heating fuel used Space cooling fuel						79.8000 3041.0874 0.0000	
Electricity for pumps and fans: Total electricity for the above, kWh/year Electricity for lighting (calculated in Appendix L)						86.0000 248.4991	
Energy saving/generation technologies (Appendices M ,N and Q) PV generation						-1019.0304	
Wind generation Hydro-electric generation (Appendix N) Electricity generated - Micro CHP (Appendix N) Appendix Q - special features						0.0000 0.0000 0.0000	(235a)
Energy saved or generated Energy used						-0.0000 0.0000	
12a. Carbon dioxide emissions - Individual heating systems including micro							
12a. Carbon dioxide emissions - individual heating systems including mich							
Constitution and such a		Energy kWh/year		ion factor kg CO2/kWh	k	Emissions g CO2/year	(261)
Space heating - main system 1 Total CO2 associated with community systems		3341.9374		0.2100		701.8068 0.0000	(373)
Water heating (other fuel) Space and water heating		3041.0874		0.2100		638.6283 1340.4352	
Pumps, fans and electric keep-hot Energy for lighting		86.0000 248.4991		0.1387 0.1443		11.9293 35.8661	
Energy saving/generation technologies							(268)
PV Unit electricity used in dwelling PV Unit electricity exported		-572.2961 -446.7343				-76.3180	(268)
Total				0.1334 0.1252		-55.9223	(268)
							(269) (272)
EPC Target Carbon Dioxide Emission Rate (TER)						-55.9223 -132.2403 1255.9903	(269) (272)
EPC Target Carbon Dioxide Emission Rate (TER)			Primary ene	0.1252	Prim	-55.9223 -132.2403 1255.9903 10.1500	(269) (272)
EPC Target Carbon Dioxide Emission Rate (TER) 13a. Primary energy - Individual heating systems including micro-CHP		Energy kWh/year	-	0.1252 rgy factor kg CO2/kWh	Prim	-55.9223 -132.2403 1255.9903 10.1500	(269) (272) (273)
EPC Target Carbon Dioxide Emission Rate (TER) 13a. Primary energy - Individual heating systems including micro-CHP Space heating - main system 1 Total CO2 associated with community systems		Energy	-	0.1252	Prim.	-55.9223 -132.2403 1255.9903 10.1500 hary energy kWh/year 3776.3892 0.0000	(269) (272) (273) (273)
EPC Target Carbon Dioxide Emission Rate (TER) 13a. Primary energy - Individual heating systems including micro-CHP Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Space and water heating		Energy kWh/year 3341.9374 3041.0874	-	0.1252 rgy factor (g CO2/kWh	Prim.	-55.9223 -132.2403 1255.9903 10.1500 arry energy kWh/year 3776.3892 0.0000 3436.4287 7212.8180	(269) (272) (273) (275) (473) (278) (279)
EPC Target Carbon Dioxide Emission Rate (TER) 13a. Primary energy - Individual heating systems including micro-CHP Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Space and water heating Pumps, fans and electric keep-hot		Energy kWh/year 3341.9374	-	0.1252 rgy factor cg CO2/kWh 1.1300	Prim	-55.9223 -132.2403 1255.9903 10.1500 ary energy kWh/year 3776.3892 0.0000 3436.4287	(269) (272) (273) (273) (275) (473) (278) (278) (279) (281)
EPC Target Carbon Dioxide Emission Rate (TER) 13a. Primary energy - Individual heating systems including micro-CHP Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Space and water heating Pumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies		Energy kWh/year 3341.9374 3041.0874 86.0000 248.4991	-	0.1252 rgy factor (g CO2/kWh 1.1300 1.1300 1.5128 1.5338	Prim	-55.9223 -132.2403 1255.9903 10.1500 arry energy kWh/year 3776.3892 0.0000 3436.4287 7212.8180 130.1008 381.1562	(269) (272) (273) (273) (275) (473) (278) (278) (279) (281)
EPC Target Carbon Dioxide Emission Rate (TER) 13a. Primary energy - Individual heating systems including micro-CHP Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Space and water heating Pumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported		Energy kWh/year 3341.9374 3041.0874 86.0000	-	0.1252 rgy factor kg CO2/kWh 1.1300 1.1300 1.5128		-55.9223 -132.2403 1255.9903 10.1500 10.1500 arry energy kWh/year 3776.3892 0.0000 3436.4287 7212.8180 130.1008 381.1562	(269) (272) (273) (273) (275) (473) (278) (279) (281) (282)
Space heating - main system 1 Total CO2 associated with community systems Water heating (other fuel) Space and water heating Pumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies		Energy kWh/year 3341.9374 3041.0874 86.0000 248.4991	-	0.1252 rgy factor (g CO2/kWh 1.1300 1.5128 1.5338 1.4928		-55.923 -132.2403 1255.9903 10.1500 10.1500 arry energy kWh/year 3776.3892 0.0000 3436.4287 7212.8180 130.1008 381.1562	(269) (272) (273) (273) (275) (473) (278) (278) (281) (282) (283) (286)

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Property Reference		L07-9.	03 MA x3_Copy						Issued	on Date	12/09	/2023	
Assessment Reference	•	L07-9	03 MA x3_Copy				Prop	Type Ref					
Property													
SAP Rating				87	'В	DER		2.53		TER	1	2.80	
Environmental				98	3 A	% DEF	R < TER				8	0.23	
CO: Emissions (t/year)				0.	16	DFEE		29.07		TFEE	2	9.40	
Compliance Check					ee BREL		E < TFEE					.13	
% DPER < TPER				61	.33	DPER		26.88		TPER	6	9.50	
Assessor Details		Mr. Richard D	Denteh							Assessor ID	U	1148-0001	
Client													
AP 10 WORKSHEET ALCULATION OF DW	FOR New B	uild (As De	signed) (Version 10									
Overall dwell: round floor otal floor area welling volume	ing charac	teristics 	+(1d)+(1e).			2.2000		Area (m2) 72.2000	•	y height (m) 2.7400 (Volume (m3) 197.8280 197.8280	(1 (4
Ventilation random of open of imber of open finder of filmes amber of flues amber of flues a	nimneys lues /s / flues attached t	o solid fue o other hea	el boiler	re							0 * 80 = 0 * 20 = 0 * 10 = 0 * 20 = 0 * 35 =	0.0000 0.0000 0.0000 0.0000 0.0000	(6 (6 (6 (6
umber of blocked umber of intermi umber of passive umber of flueles ufiltration due	ittent ext e vents ss gas fir	ract fans es	nd fans =	(6a)+(6b)-	+(6c)+(6d)+(6e)+(6f)+(6	g)+(7a)+(7	'b)+(7c) =				0.0000 0.0000 0.0000 0.0000 s per hour 0.0000	(7 (7
ressure test ressure Test Met easured/design A afiltration rate umber of sides s	chod AP50											Yes lower Door 3.0000 0.1500	(1
nelter factor nfiltration rate	e adjusted	to include	shelter fa	ctor					(20) = 1 - (21)	[0.075 x) = (18) x		0.8500 0.1275	
ind speed ind factor dj infilt rate	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	Sep 4.0000 1.0000	Oct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	
Balanced mechani f mechanical ver f exhaust air he f balanced with	ntilation eat pump u	sing Append	lix N, (23b)	= (23a) x					0.1275 a)	0.1371	0.1434	0.1498 0.5000 0.5000 72.8000	(2
fective ac	0.2986	0.2954	0.2922	0.2762	0.2731	0.2571	0.2571	0.2539	0.2635	0.2731	0.2794	0.2858	(2
Heat losses ar		ss paramete	r										
lement Indow (Uw = 1.30				Gross m2	Openings m2	NetA 15.4	m2 300	U-value W/m2K 1.2357	A x U W/K 19.0675	k	value J/m2K	A x K kJ/K	(2
xternal Wall 1 otal net area o	external	elements A		6.1426	15.4300	40.7 56.1		0.1400	5.6998	190	0.0000	7735.3940	(2

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Fabric heat los Party Wall 1 Party Floor 1 Party Ceiling 1 Internal Wall 1	L L					72 72	.0900 .2000 .2000 .8300	30) + (32) = 0.0000	0.000	00 18 4 3 7	0.0000 0.0000 0.0000 5.0000	10096.2000 2888.0000 2166.0000 6062.2500	(32d (32d (32d
Heat capacity (Thermal mass pa List of Thermal K1 Elen	rameter (T Bridges		TFA) in kJ/r	n2K					(30) + (33 ength	2) + (32a). Psi-value	(32e) =	400.9397	
E2 Othe E3 Sill E4 Jamb	er lintels		other steel		ats)			9 7 17	.4800 .9000 .0400 .9800	0.0300 0.0300 0.0300 0.0700	0.28 0.23 0.51 2.86	370 .12	
E16 Cor E8 Balo E17 Cor	rner (norma cony within rner (inver	i a dwelling ted – inte	g, wall insu rnal area gr	reater than	external a	rea)		5 5	.4800 .4800 .8400 .7400	0.0600 0.0900 0.0000 -0.0900	0.32 0.49 0.00 -0.24	932 900 166	(26)
Thermal bridges Point Thermal b Total fabric he	ridges	PSI) Calcu.	rated using	Appendix K)				(:	33) + (36)	(36a) = + (36a) =	4.4766 0.0000 29.2439)
Ventilation hea	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
(38)m Heat transfer o	19.4911 coeff 48.7350	19.2830 48.5269	19.0749 48.3188	18.0345 47.2783	17.8264 47.0703	16.7860 46.0298	16.7860 46.0298	16.5779 45.8217	17.2021 46.4460	17.8264 47.0703	18.2426 47.4864	18.6588 47.9026	•
Average = Sum(3	39)m / 12 = Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	47.2263 Dec	
HLP (average)	0.6750	0.6721	0.6692	0.6548	0.6519	0.6375	0.6375	Aug 0.6346	0.6433	0.6519	0.6577	0.6635 0.6541	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	
4. Water heatir	ng energy r	equirements)									
Assumed occupar	ісу											2.2983	(42
Hot water usage Hot water usage	86.2882	84.9915	83.1019	79.4865	76.8184	73.8429	72.1517	74.0270	76.0827	79.2774	82.9705	85.9576	(42
Hot water usage	27.1100	26.7073	26.1404	25.0950	24.3122	23.4442	22.9754	23.5384	24.1514	25.0802	26.1471	27.0183	(42
Average daily h	38.1672 not water u	36.7793 use (litres,	35.3914 /day)	34.0035	32.6156	31.2277	31.2277	32.6156	34.0035	35.39 1 4	36.7793	38.1672 139.3875	
Daily hot water	Jan use	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec	
Energy content		148.4781 211.4309	144.6336 222.2965	138.5849 189.7158	133.7461 180.0480	128.5148 158.0240	126.3547 152.8151	130.1810 161.1912	134.2376 165.5283	139.7489 189.6380 Total = S	145.8968 207.8568 um(45)m =	151.1431 236.6536 2315.2407	(45
Distribution lo Water storage]	36.0064	= 0.15 x (4 31.7146	33.3445	28.4574	27.0072	23.7036	22.9223	24.1787	24.8292	28.4457	31.1785	35.4980	(46)
Store volume a) If manufact Temperature 1 Enter (49) or (actor from [54] in (55	Table 2b	actor is kno	own (kWh/d	ay):							180.0000 1.5200 0.6000 0.9120	(48 (49
Total storage If cylinder cor	28.2720	25.5360	28.2720	27.3600	28.2720	27.3600	28.2720	28.2720	27.3600	28.2720	27.3600	28.2720	(56
IF Cyllinder Cor Primary loss	28.2720 23.2624	25.5360 21.0112	28.2720 23.2624	27.3600 22.5120	28.2720 23.2624	27.3600 22.5120	28.2720 23.2624	28.2720 23.2624	27.3600 22.5120	28.2720 23.2624	27.3600 22.5120	28.2720 23.2624	
Combi loss Total heat requ	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
WWHRS	291.5769 -65.4547	257.9781 -57.8887	273.83 0 9 -60.6177	239.5878 -50.1938	231.5824 -46.7788	207.8960 -40.0290	204.3495 -37.5208	212.7256 -39.8996	215.4003 -41.4155	241.1724 -48.8244	257.7288 -55.3121	288.1880 -64.2426	
PV diverter 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	-0.0000 0.0000	-0.0000 0.0000	-0.0000 0.0000	-0.0000 0.0000	-0.0000 0.0000	-0.0000 0.0000	(63
FGHRS Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63
12Total per yea		200.0894 ir)	213.2132	189.3940	184.8036	167.8670	166.8287	172.8260 Total p	173.9848 er year (kWl	192.3480 h/year) = S	202.4167 um(64)m =	223.9454 2313.8391 2314	. (64
Electric shower	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 lectric sho	0.0000	0.0000	0.0000 m(64a)m =	0.0000 0.0000	
Heat gains from		ting, kWh/r 107.5385	month 115.1411	102.9781	al Energy u 101.0935	92.4406	92.0385	94.8236	94.9358	/year) = Su 104.2822	109.0100	119.9148	
5. Internal gai			5a) 										
	(Table 5)			Ann	May	Jun	Jul	Aug	Sep	Oct	N	Dos	
(66)m	Jan 114.9164	Feb 114.9164	Mar 114.9164	Apr 114.9164	May 114.9164	Jun 114.9164	114.9164	114.9164	114.9164	0ct 114.9164	Nov 114.9164	Dec 114.9164	(66
_	114.9164	114.9164 ed in Append	114.9164 dix L, equat	114.9164	114.9164	114.9164	114.9164						-

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Cooking gains	(calculated 34.4916	d in Appendi 34.4916	x L, equat 34.4916	ion L15 or l 34.4916	15a), also 34.4916	see Table 34.4916	5 34.4916	34.4916	34.4916	34.4916	34.4916	34.4916	(60)
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	
∟osses e.g. e\	-91.9332	-91.9332	-91.9332	-91.9332	- 91.9332	-91.9332	-91.9332	-91.9332	-91.9332	-91.9332	-91.9332	-91.9332	(71)
Water heating	gains (Tab) 162.6904	le 5) 160.0276	154.7596	143.0252	135.8783	128.3897	123.7077	127.4511	131.8552	140.1642	151.4028	161.1759	(72)
Total internal	l gains 524.6172	534.9911	513.4944	493.8964	469.1257	451.6735	434.6596	436.3029	449.4016	465.5741	494.4366	514.1733	(73)
													,
6. Solar gains	s												
[Jan]				rea m2	Solar flux Table 6a	c a Speci	g fic data	Specific		Acce:	or	Gains W	
 North			9.8	 500	W/m2 10.6334		Table 6b 0.3300		le 6c .8000	Table (19.1622	(74)
East			5.5		19.6403		0.3300		.8000	0.77		20.0502	
Solar gains Total gains	39.2124 563.8296	75.8424 610.8334	126.8200 640.3144	194.1574 688.0538	250.0967 719.2224	262.3267 714.0002	247.0917 681.7513	203.4184 639.7213	149.9413 599.3429	90.1320 555.7061	48.6393 543.0759	32.4629 546.6361	
7. Mean intern		ture (heatin											
		<u>-</u>										21.0000	(85)
Utilisation fa						Jun	Jul	Aug	Sep	0ct	Nov	Dec	` ,
tau alpha	164.9958 11.9997	165.7033 12.0469	166.4170 12.0945	170.0793 12.3386	170.8312 12.3887	174.6926 12.6462	174.6926 12.6462	175.4860 12.6991	173.1273 12.5418	170.8312 12.3887	169.3340 12.2889	167.8628 12.1909	
util living ar	rea 0.9962	0.9883	0.9581	0.8157	0.6081	0.4126	0.2971	0.3295	0.5346	0.8542	0.9826	0.9971	(86)
MIT	20.7308	20.8103	20.9069	20.9884	20.9996	21.0000	21.0000	21.0000	20.9999	20.9841	20.8647	20.7223	
Γh 2 util rest of h		20.3655	20.3681	20.3809	20.3835	20.3963	20.3963	20.3989	20.3912	20.3835	20.3783	20.3732	
MIT 2	0.9945 20.0587	0.9833 20.1601	0.9428 20.2771	0.7796 20.3721	0.5681 20.3833	0.3737 20.3963	0.2563 20.3963	0.2864 20.3989	0.4875 20.3912	0.8136 20.3720	0.9743 20.2391	0.9958 20.0571	(90)
Living area fr MIT	20.3235	20.4163	20.5253	20.6150	20.6261	20.6342	20.6342	20.6358	fLA = 20.6310	Living area 20.6132	a / (4) = 20.4856	0.3940 20.3192	(92)
Temperature ac adjusted MIT	djustment 20.3235	20.4163	20.5253	20.6150	20.6261	20.6342	20.6342	20.6358	20.6310	20.6132	20.4856	0.0000 20.3192	
8. Space heati	ing require	ment											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(0.1)
Jtilisation Jseful gains Ext temp.	0.9943 560.6371 4.3000	0.9838 600.9094 4.9000	0.9470 606.3942 6.5000	0.7935 545.9990 8.9000	0.5839 419.9310 11.7000	0.3890 277.7523 14.6000	0.2724 185.6938 16.6000	0.3034 194.0902 16.4000	0.5061 303.3117 14.1000	0.8293 460.8680 10.6000	0.9760 530.0319 7.1000	0.9956 544.2425 4.2000	(95)
Heat loss rate		752.9600	677.6843	553.8640	420.1551	277.7534	185.6938	194.0902	303.3410	471.3233	635.6357	772.1531	
Space heating		102.1780	53.0398	5.6628	0.1667	0.0000	0.0000	0.0000	0.0000	7.7787	76.0347	169.5655	
Space heating Solar heating	requirement				012007	0.0000		0.0000	010000	,,,,,,,	, , , , ,	578.3069	
Solar heating	0.0000 contribution	0.0000 on - total p	0.0000 er year (kl	0.0000 Wh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000	
Space heating	163.8804	102.1780	53.0398	5.6628	0.1667	0.0000	0.0000	0.0000	0.0000	7.7787	76.0347	169.5655	
Space heating Space heating		t after sola	ir contribu	tion - total	i per year	(KWN/year)				(98c) / (4) =	578.3069 8.0098	
9b. Energy red	quirements												
raction of sp raction of sp				ntary system	n (Table 11	L)						0.0000 1.0000	
raction of he	eat from cor	mmunity Heat	pump-Spac		naco hoati	ina						1.0000	(303a
actor for cor	arging metho	od (Table 4c	(3)) for w	ater heating	g	rng						1.0000	(305a
Distribution Distribution Distribution Distribution	secondary/s				g system							1.1000 0.0000	
Space heating: Space heating	requirement			_							_		
Space heat fro		$0 = (98) \times 1$			0.1667	0.0000	0.0000	0.0000	0.0000	7.7787	76.0347	169.5655	
307a Space heating			58.3438	6.2291	0.1834	0.0000	0.0000	0.0000	0.0000	8.5566	83.6382	186.5221	
fficiency of					0.1834 (from Tab]	0.0000 Le 4a or App	0.0000 endix E)	0.0000	0.0000	8.5566	83.6382	186.5221 0.0000	
Space heating	fuel for se 0.0000	econdary/sup 0.0000	plementary 0.0000	system 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(309)

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Water heating						
Annual water heating requirement 226.1222 200.0894 213.2132 189.3940 184.8036 167.8670 166.8287	172.8260	173.9848	192.3480	202.4167	223.9454	(64)
Water heat from Heat pump = (64) x 1.00 x 1.00 x 1.10 310a 248.7344 220.0983 234.5346 208.3334 203.2839 184.6537 183.5116	190.1086	191.3833	211.5828	222.6584	246.3400	
Water heating fuel 248.7344 220.0983 234.5346 208.3334 203.2839 184.6537 183.5116		191.3833	211.5828	222.6584	246.3400	(310)
Cooling System Energy Efficiency Ratio Space coolin		0.0000	0.0000	0.0000	0.0000	(314)
Pumps and Fa 12.8114 11.5716 12.8114 12.3981 12.8114 12.3981 12.8114	12.8114	12.3981	12.8114	12.3981	12.8114	(331)
Lighting 18.7528 15.0442 13.5456 9.9241 7.6656 6.2629 6.9925 Electricity generated by PVs (Appendix M) (negative quantity)		11.8065	15.4907	17.4967	19.2739	
(333a)m -3.1381 -5.0274 -8.2217 -10.5650 -12.6329 -12.2688 -12.1089 Electricity generated by wind turbines (Appendix M) (negative quantity)		-8.7127	-6.2565	-3.6543	-2.6467	` ,
(334a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	(334a)
(335a)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	(335a)
(333b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(333b)
(334b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	(334b)
(335b)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(335b)
Annual totals kWh/year Space heating fuel - community heating					636.1375	
Space heating fuel - secondary Water heating fuel - community heating					0.0000 2545.2230	(310)
Efficiency of water heater Electricity used for heat distribution					0.0000 6.3614	: :
Space cooling fuel					0.0000	(321)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6250)						
mechanical ventilation fans (SFP = 0.6250) Total electricity for the above, kWh/year					150.8439 150.8439	
Electricity for lighting (calculated in Appendix L)					151.3454	1 1
Energy saving/generation technologies (Appendices M ,N and Q)						(222)
PV generation Wind generation					-96.0095 0.0000	(334)
Hydro-electric generation (Appendix N) Electricity generated - Micro CHP (Appendix N)					0.0000 0.0000	
Appendix Q - special features Energy saved or generated					-0.0000	(336)
Energy used Total delivered energy for all uses					0.0000 3387.5403	(337)
Energy used Total delivered energy for all uses					0.0000 3387.5403	(337)
Total delivered energy for all uses						(337)
Total delivered energy for all uses 12b. Carbon dioxide emissions - Community heating scheme						(337)
Total delivered energy for all uses	Energy		on factor		3387.5403 Emissions	(337)
Total delivered energy for all uses 12b. Carbon dioxide emissions - Community heating scheme Efficiency of heat source Heat pump	Energy kWh/year		g CO2/kWh	k	3387.5403 Emissions g CO2/year 310.0000	(337) (338)
Total delivered energy for all uses 12b. Carbon dioxide emissions - Community heating scheme Efficiency of heat source Heat pump Space and Water heating from Heat pump Electrical energy for heat distribution (space & water)	Energy			k	3387.5403 Emissions g CO2/year	(337) (338) (367) (367)
Total delivered energy for all uses 12b. Carbon dioxide emissions - Community heating scheme Efficiency of heat source Heat pump Space and Water heating from Heat pump Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network	Energy kWh/year 1026.2453		g CO2/kWh 0.1594	k	Emissions g CO2/year 310.0000 32.7112	(367) (367) (367) (367) (372) (386)
Total delivered energy for all uses 12b. Carbon dioxide emissions - Community heating scheme Efficiency of heat source Heat pump Space and Water heating from Heat pump Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems Space and water heating	Energy kWh/year 1026.2453 6.3614		0.1594 0.0000	k	Emissions g CO2/year 310.0000 32.7112 4.5939 0.0480 152.7850 152.7850	(367) (367) (367) (367) (376) (373) (376)
Total delivered energy for all uses 12b. Carbon dioxide emissions - Community heating scheme Efficiency of heat source Heat pump Space and Water heating from Heat pump Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems	Energy kWh/year 1026.2453		g CO2/kWh 0.1594	k	Emissions g C02/year 310.0000 32.7112 4.5939 0.0480 152.7850	(367) (367) (367) (367) (372) (386) (373) (376) (378)
Total delivered energy for all uses 12b. Carbon dioxide emissions - Community heating scheme Efficiency of heat source Heat pump Space and Water heating from Heat pump Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems Space and water heating Pumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies	Energy kWh/year 1026.2453 6.3614 150.8439 151.3454		0.1594 0.0000 0.1387 0.1443	k	Emissions g CO2/year 310.0000 32.7112 4.5939 0.0480 152.7850 20.9239 21.8438	(367) (367) (367) (367) (372) (386) (373) (376) (378)
Total delivered energy for all uses 12b. Carbon dioxide emissions - Community heating scheme Efficiency of heat source Heat pump Space and Water heating from Heat pump Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems Space and water heating Pumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported	Energy kWh/year 1026.2453 6.3614		g CO2/kWh 0.1594 0.0000 0.1387	k	Emissions g CO2/year 310.0000 32.7112 4.5939 0.0480 152.7850 152.7850 20.9239 21.8438	(367) (367) (367) (373) (376) (373) (376) (378) (379)
Total delivered energy for all uses 12b. Carbon dioxide emissions - Community heating scheme Efficiency of heat source Heat pump Space and Water heating from Heat pump Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems Space and water heating Pumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total Total CO2, kg/year	Energy kWh/year 1026.2453 6.3614 150.8439 151.3454		0.1594 0.0000 0.1387 0.1443	k	Emissions g CO2/year 310.0000 32.7112 4.5939 0.0480 152.7850 20.9239 21.8438 -12.6725 0.0000 -12.6725 182.8803	(337) (338) (367) (367) (372) (386) (373) (378) (379) (380) (383)
Total delivered energy for all uses 12b. Carbon dioxide emissions - Community heating scheme 12b. Carbon dioxide emissions - Community heating scheme Efficiency of heat source Heat pump Space and Water heating from Heat pump Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems Space and water heating Pumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total	Energy kWh/year 1026.2453 6.3614 150.8439 151.3454		0.1594 0.0000 0.1387 0.1443	k	Emissions g CO2/year 310.0000 32.7112 4.5939 0.0480 152.7850 20.9239 21.8438 -12.6725 0.0000 -12.6725	(337) (338) (367) (367) (372) (386) (373) (378) (379) (380) (383)
Total delivered energy for all uses 12b. Carbon dioxide emissions - Community heating scheme Efficiency of heat source Heat pump Space and Water heating from Heat pump Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems Space and water heating Pumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total Total CO2, kg/year	Energy kWh/year 1026.2453 6.3614 150.8439 151.3454		0.1594 0.0000 0.1387 0.1443	k	Emissions g CO2/year 310.0000 32.7112 4.5939 0.0480 152.7850 20.9239 21.8438 -12.6725 0.0000 -12.6725 182.8803	(337) (338) (367) (367) (372) (386) (373) (378) (379) (380) (383)
Total delivered energy for all uses 12b. Carbon dioxide emissions - Community heating scheme Efficiency of heat source Heat pump Space and Water heating from Heat pump Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems Space and water heating Pumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total Total CO2, kg/year EPC Dwelling Carbon Dioxide Emission Rate (DER)	Energy kWh/year 1026.2453 6.3614 150.8439 151.3454 -96.0095 0.0000		0.1594 0.0000 0.1387 0.1443	k	Emissions g CO2/year 310.0000 32.7112 4.5939 0.0480 152.7850 20.9239 21.8438 -12.6725 0.0000 -12.6725 182.8803	(337) (338) (367) (367) (372) (386) (373) (378) (379) (380) (383)
Total delivered energy for all uses 12b. Carbon dioxide emissions - Community heating scheme Efficiency of heat source Heat pump Space and Water heating from Heat pump Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems Space and water heating Pumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total Total CO2, kg/year EPC Dwelling Carbon Dioxide Emission Rate (DER)	Energy kWh/year 1026.2453 6.3614 150.8439 151.3454 -96.0095 0.0000	k	0.1594 0.0000 0.1387 0.1443 0.1320 0.0000		Emissions g CO2/year 310.0000 32.7112 4.5939 0.0480 152.7850 20.9239 21.8438 -12.6725 0.0000 -12.6725 182.8803 2.5300	(337) (338) (367) (367) (372) (386) (373) (378) (379) (388) (379)
Total delivered energy for all uses 12b. Carbon dioxide emissions - Community heating scheme Efficiency of heat source Heat pump Space and Water heating from Heat pump Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems Space and water heating Pumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total Total CO2, kg/year EPC Dwelling Carbon Dioxide Emission Rate (DER)	Energy kWh/year 1026.2453 6.3614 150.8439 151.3454 -96.0095 0.0000	k Primary ener	0.1594 0.0000 0.1387 0.1443 0.1320 0.0000		Emissions g CO2/year 310.0000 32.7112 4.5939 0.0480 152.7850 20.9239 21.8438 -12.6725 0.0000 -12.6725 182.8803 2.5300	(367) (367) (367) (367) (379) (386) (373) (376) (379) (380) (383) (384)
Total delivered energy for all uses 12b. Carbon dioxide emissions - Community heating scheme Efficiency of heat source Heat pump Space and Water heating from Heat pump Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems Space and water heating Pumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total Total CO2, kg/year EPC Dwelling Carbon Dioxide Emission Rate (DER) Efficiency of heat source Heat pump Space and Water heating from Heat pump	Energy kWh/year 1026.2453 6.3614 150.8439 151.3454 -96.0095 0.0000	k Primary ener	g CO2/kWh 0.1594 0.0000 0.1387 0.1443 0.1320 0.0000 egy factor g CO2/kWh 1.5900		Emissions g CO2/year 310.0000 32.7112 4.5939 0.0480 152.7850 20.9239 21.8438 -12.6725 0.0000 -12.6725 182.8803 2.5300 ary energy kWh/year 310.0000 326.2845	(367) (367) (367) (367) (372) (386) (373) (378) (379) (388) (383) (384) (467a) (467a)
Total delivered energy for all uses 12b. Carbon dioxide emissions - Community heating scheme Efficiency of heat source Heat pump Space and Water heating from Heat pump Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems Space and water heating Pumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total Total CO2, kg/year EPC Dwelling Carbon Dioxide Emission Rate (DER) Efficiency of heat source Heat pump Space and Water heating from Heat pump Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network	Energy kWh/year 1026.2453 6.3614 150.8439 151.3454 -96.0095 0.0000	k Primary ener	g CO2/kWh 0.1594 0.0000 0.1387 0.1443 0.1320 0.0000		Emissions g CO2/year 310.0000 32.7112 4.5939 0.0480 152.7850 20.9239 21.8438 -12.6725 0.0000 -12.6725 182.8803 2.5300 ary energy kWh/year 310.0000 326.2845 48.8038 0.5102	(337) (338) (367) (367) (367) (372) (386) (373) (378) (379) (383) (384) (467a) (467a) (467) (472) (472) (486)
Total delivered energy for all uses 12b. Carbon dioxide emissions - Community heating scheme 12c. Carbon dioxide emissions - Community systems 12c. Carbon dioxide for heat network 12c. Carbon dioxide distribution (space & water) 12c. Carbon dioxide emissions 12c. Carbon dioxide emissions 12c. Carbon dioxide emission Rate (DER)	Energy kWh/year 1026.2453 6.3614 150.8439 151.3454 -96.0095 0.0000	k Primary ener	g CO2/kWh 0.1594 0.0000 0.1387 0.1443 0.1320 0.0000 egy factor g CO2/kWh 1.5900		Emissions g CO2/year 310.0000 32.7112 4.5939 0.0480 152.7850 152.7850 20.9239 21.8438 -12.6725 0.0000 -12.6725 182.8803 2.5300 ary energy kWh/year 310.0000 326.2845 48.8038	(367) (367) (367) (367) (372) (386) (373) (378) (379) (388) (379) (384) (467a) (467a) (467) (472) (486) (473)
Total delivered energy for all uses 12b. Carbon dioxide emissions - Community heating scheme Efficiency of heat source Heat pump Space and Water heating from Heat pump Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems Space and water heating Pumps, fans and electric keep-hot Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total Total CO2, kg/year EPC Dwelling Carbon Dioxide Emission Rate (DER) Efficiency of heat source Heat pump Space and Water heating from Heat pump Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems Space and water heating Pumps, fans and electric keep-hot	Energy kWh/year 1026.2453 6.3614 150.8439 151.3454 -96.0095 0.0000	k Primary ener	g CO2/kWh 0.1594 0.0000 0.1387 0.1443 0.1320 0.0000 egy factor g CO2/kWh 1.5900		Emissions g CO2/year 310.0000 32.7112 4.5939 0.0480 152.7850 20.9239 21.8438 -12.6725 0.0000 -12.6725 182.8803 2.5300 ary energy kWh/year 310.0000 326.2845 48.8038 0.5102 1623.1204 228.1966	(367) (338) (367) (367) (379) (386) (373) (376) (378) (379) (380) (383) (384) (467a) (467a) (467) (472) (486) (472) (478)
Total delivered energy for all uses 12b. Carbon dioxide emissions - Community heating scheme Efficiency of heat source Heat pump Space and Water heating from Heat pump Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems Space and water heating Pumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total CO2, kg/year EPC Dwelling Carbon Dioxide Emission Rate (DER) 13b. Primary energy - Community heating scheme Efficiency of heat source Heat pump Space and Water heating from Heat pump Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems Space and water heating Pumps, fans and electric keep-hot Energy for lighting	Energy kWh/year 1026.2453 6.3614 150.8439 151.3454 -96.0095 0.0000 Energy kWh/year 1026.2453 6.3614 150.8439	k Primary ener	g CO2/kWh		Emissions g CO2/year 310.0000 32.7112 4.5939 0.0480 152.7850 152.7850 20.9239 21.8438 -12.6725 8.2803 2.5300 ary energy kWh/year 310.0000 326.2845 48.8038 0.5102 1623.1204 1623.1204	(367) (338) (367) (367) (379) (386) (373) (376) (378) (379) (380) (383) (384) (467a) (467a) (467) (472) (486) (472) (478)
Total delivered energy for all uses 12b. Carbon dioxide emissions - Community heating scheme 12c. Carbon dioxide emissions - Community heating scheme 13c. Carbon dioxide emissions - Community heating scheme 13c. Carbon dioxide emissions - Community heating scheme 13c. Carbon dioxide emissions - Community Space & water) 13c. Carbon dioxide emission from Heat pump 13c. Carbon dioxide did community systems 13c. Carbon dioxide did community systems 13c. Carbon dioxide emission technologies 13c. Carbon dioxide emission carbon divide emission Rate (DER) 13b. Primary energy - Community heating scheme 13b. Primary energy - Community heating scheme 13c. Carbon dioxide emission Rate (DER) 13b. Primary energy - Community heating scheme 13c. Carbon dioxide emission (space & water) 13c. Car	Energy kWh/year 1026.2453 6.3614 150.8439 151.3454 -96.0095 0.0000 Energy kWh/year 1026.2453 6.3614 150.8439 151.3454 -96.0095	k Primary ener	g CO2/kWh 0.1594 0.0000 0.1387 0.1443 0.1320 0.0000 gy factor g CO2/kWh 1.5900 0.0000 1.5128 1.5338		Emissions g CO2/year 310.0000 32.7112 4.5939 0.9480 152.7850 20.9239 21.8438 -12.6725 0.0000 -12.6725 182.8803 2.5300 ary energy kWh/year 310.0000 326.2845 4.8.8038 0.5102 1623.1204 1623.1204 1623.1204 -228.1966 232.1387	(367) (338) (367) (367) (379) (386) (373) (376) (378) (379) (380) (383) (384) (467a) (467a) (467) (472) (486) (472) (478)
Total delivered energy for all uses 12b. Carbon dioxide emissions - Community heating scheme 12b. Carbon dioxide emissions - Community heating scheme Efficiency of heat source Heat pump Space and Water heating from Heat pump Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems Space and water heating Pumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total Total CO2, kg/year EPC Dwelling Carbon Dioxide Emission Rate (DER) 13b. Primary energy - Community heating scheme Efficiency of heat source Heat pump Space and Water heating from Heat pump Electrical energy for heat distribution (space & water) Overall CO2 factor for heat network Total CO2 associated with community systems Space and water heating Pumps, fans and electric keep-hot Energy for lighting Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total	Energy kWh/year 1026.2453 6.3614 150.8439 151.3454 -96.0095 0.0000 Energy kWh/year 1026.2453 6.3614 150.8439 151.3454	k Primary ener	eg CO2/kWh 0.1594 0.0000 0.1387 0.1443 0.1320 0.0000 egy factor g CO2/kWh 1.5900 0.0000		Emissions g CO2/year 310.0000 32.7112 4.5939 0.0480 152.7850 152.7850 20.9239 21.8438 -12.6725 182.8803 2.5300 ary energy kWh/year 310.0000 326.2845 48.8038 0.5102 228.1204 1623.1204 1623.1204 228.1966 232.1387 -142.8304	(367) (367) (367) (367) (372) (386) (373) (376) (378) (383) (379) (384) (467a) (467) (472) (486) (473) (476) (478) (479)
Total delivered energy for all uses 12b. Carbon dioxide emissions - Community heating scheme 12c. Carbon dioxide emissions - Community space & water) 12c. Carbon dioxide heat distribution (space & water) 12c. Carbon dioxide for heat distribution (space & water) 12c. Carbon dioxide with community systems 12c. Carbon dioxide for heat formunity systems 12c. Carbon dioxide for heat formunity systems 12c. Carbon dioxide for heat formunity heating problem for the formunity for heat for heat for for heat fo	Energy kWh/year 1026.2453 6.3614 150.8439 151.3454 -96.0095 0.0000 Energy kWh/year 1026.2453 6.3614 150.8439 151.3454 -96.0095	k Primary ener	g CO2/kWh 0.1594 0.0000 0.1387 0.1443 0.1320 0.0000 gy factor g CO2/kWh 1.5900 0.0000 1.5128 1.5338		Emissions g CO2/year 310.0000 32.7112 4.5939 0.0480 152.7850 152.7850 20.9239 21.8438 -12.6725 0.0000 -12.6725 182.8803 2.5300 ary energy kWh/year 310.0000 326.2845 48.8038 0.5102 1623.1204 228.1966 232.1387 -142.8304 0.0000	(337) (338) (367) (367) (367) (372) (386) (373) (378) (379) (383) (384) (467) (472) (472) (472) (472) (474) (474) (474) (475) (478) (479)

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SAP 10 WORKSHEET CALCULATION OF T			signed) (Version 10	.2, February	2022)							
1. Overall dwell		cteristics											
Ground floor Total floor area	TFA = (1a	a)+(1b)+(1c)	+(1d)+(1e).	(1n)	7	2.2000		Area (m2) 72.2000		y height (m) 2.7400	(2b) =	Volume (m3) 197.8280	(1b) (4)
Dwelling volume								(:	3a)+(3b)+(3c)+	(3d)+(3e))(3n) =	197.8280	(5)
2. Ventilation r													
Number of open c	himnevs										m3 0 * 80 =	per hour 0.0000	(6a)
Number of open f Number of chimne Number of flues Number of flues Number of blocke Number of interm Number of passiv Number of fluele	lues ys / flues attached t attached t d chimneys ittent ext e vents	to solid fue to other hea s tract fans	l boiler	re							0 * 20 = 0 * 10 = 0 * 20 = 0 * 35 = 0 * 20 = 3 * 10 = 0 * 10 = 0 * 40 =	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(6b) (6c) (6d) (6e) (6f) (7a) (7b)
Infiltration due Pressure test Pressure Test Me Measured/design Infiltration rat Number of sides	thod AP50 e	e y s, flues a	nd fans =	= (6a)+(6b)·	+(6c)+(6d)+(6e)+(6f)+((6g)+(7a)+(7	7b)+(7c) =		30.0000	Air changes 3 / (5) =	0.1516 Yes ower Door 5.0000 0.4016	(17)
Shelter factor Infiltration rat	e adjusted	d to include	shelter fa	actor					(20) = 1 - (21		(19)] = x (20) =	0.8500 0.3414	
Wind speed Wind factor Adj infilt rate	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	Sep 4.0000 1.0000	Oct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	` '
Effective ac	0.4353 0.5947	0.4267 0.5911	0.4182 0.5875	0.3755 0.5705	0.3670 0.5673	0.3243 0.5526	0.3243 0.5526	0.3158 0.5499	0.3414 0.5583	0.3670 0.5673	0.3841 0.5738	0.4011 0.5805	
Heat losses aElement			r 	Gross	Openings	Net	:Area	U-value	ΑχU	k	(-value	AxK	
TER Opening Type External Wall 1	(Uw = 1.2	20)		m2 66.1426	m2 15.4300		m2 4300 7126	W/m2K 1.1450 0.1800	W/K 17.6679 7.3283		kJ/m2K	kJ/K	(27) (29a)
Total net area o Fabric heat loss Party Wall 1				70.1420	13.4300	56.	1426	30) + (32) 0.0000					(31) (33) (32)
Thermal mass par List of Thermal K1 Eleme	Bridges nt	MP = Cm / TF							ength Ps	i-value 0.0500	Tota] 0.4740		(35)
E3 Sill E4 Jamb E7 Party E18 Part E16 Corn E8 Balco E17 Corn	floor bet y wall bet er (normal ny within er (invert	tween dwelli tween dwelli l) a dwelling, ted – intern	ngs (in blo ngs wall insul al area gre	ocks of fla lation cont		ea)		1	7.9000 7.0400 0.9800 5.4800 5.4800 5.8400	0.0500 0.0500 0.0500 0.0700 0.0600 0.0900 0.0900	0.3956 0.8526 2.8686 0.3288 0.4932 0.0006	9 9 5 3 2 9	(25)
Thermal bridges Point Thermal br Total fabric hea	idges	SI) CAICUIA	cen natilik t	ърренитх к)					(33) + (36)	(36a) = + (36a) =	5.1650 0.0000 30.1612	
	Jan 38.8263	culated mont Feb 38.5862	hly (38)m = Mar 38.3508	= 0.33 x (2 Apr 37.2451	5)m x (5) May 37.0382	Jun 36.0752	Jul 36.0752	Aug 35.8969	Sep 36.4461	Oct 37.0382	Nov 37.4567	Dec 37.8942	(38)
Heat transfer co Average = Sum(39	68.9875	68.7474	68.5120	67.4063	67.1994	66.2364	66.2364	66.0581	66.6073	67.1994	67.6179	68.0554 67.4053	(39)

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Full SAP Calculation Printout



p P (average)	Jan 0.9555	Feb 0.9522	Mar 0.9489	Apr 0.9336	May 0.9307	Jun 0.9174	Jul 0.9174	Aug 0.9149	Sep 0.9225	0ct 0.9307	Nov 0.9365	Dec 0.9426 (4 0.9336
ys in mont	31	28	31	30	31	30	31	31	30	31	30	31
			s (kWh/year)									(
umed occupa water usag	e for mixer											2.2983 (4
water usag	62.7551 e for baths	61.8120	60.4377	57.8083	55.8679	53.7039	52.4739	53.8378	55.3329	57.6563	60.3422	62.5146 (4
water usag	27.1100 e for other	26.7073 uses	26.1404	25.0950	24.3122	23.4442	22.9754	23.5384	24.1514	25.0802	26.1471	27.0183 (4
rage daily	38.1672 hot water u	36.7793 se (litres	35.3914 /day)	34.0035	32.6156	31.2277	31.2277	32.6156	34.0035	35.39 1 4	36.7793	38.1672 (4 117.6907 (4
ly hot wate	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec
ly hot wate rgy conte rgy content	128.0322 202.7718	125.2986 178.4236	121.9695 187.4626	116.9068 160.0395	112.7957 151.8447	108.3758 133.2607	106.6770 129.0166	109.9918 136.1928	113.4877 139.9417	118.1278 160.2984 Total = S	123.2685 175.6186	127.7001 (4 199.9476 (4 1954.8185
	oss (46)m			24 0050	22 7767	10 0001	10 2525	20 4280	20, 0012	24.0448	26.3428	
er storage	30.4158 loss:	26.7635	28.1194	24.0059	22.7767	19.9891	19.3525	20.4289	20.9913	24.0448	26.3428	29.9921 (4
emperature er (49) or	factor from (54) in (55	Table 2b	actor is kno	own (kWh/d	day):							180.0000 (4 1.5520 (4 0.5400 (4 0.8381 (5
al storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (
-	ntains dedi 25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (5
mary loss oi loss	23.2624 0.0000	21.0112 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 (5 0.0000 (6
al heat req	uired for w 252.0144	ater heati 222.9008	ng calculate 236.7052	ed for each 207.6937	n month 201.0873	180.9149	178.2593	185.4355	187.5959	209.5410	223.2728	249.1902 (
RS diverter	-28.6890 -0.0000	-25.3728 -0.0000	-26.5689 -0.0000	-22.0001 -0.0000	-20.5033 -0.0000	-17.5448 -0.0000	-16.4455 -0.0000	-17.4881 -0.0000	-18.1526 -0.0000	-21.3999 -0.0000	-24.2435 -0.0000	-28.1577 (6 -0.0000 (6
ar 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 (
RS out from w/		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (6
	223.3254	197.5280	210.1363	185.6936	180.5840	163.3701	161.8138	167.9473 Total p	169.4434 er year (kW	188.1412 h/year) = S	199.0294 um(64)m =	221.0325 (6 2268.0450 (6
otal per ye ctric showe	ar (kWh/yea r(s)	r)										2268 (6
	0.0000	0.0000	0.0000	0.0000 Tot	0.0000 al Energy us	0.0000 sed by inst	0.0000 antaneous e	0.0000 lectric sho	0.0000 wer(s) (kWh	0.0000 /year) = Su	0.0000 m(64a)m =	0.0000 (i 0.0000 (i
gains fro	m water hea 106.8157	ting, kWh/ 94.9076	month 101.7254	91.3365	89.8825	82.4326	82.2922	84.6782	84.6540	92.6933	96.5166	105.8767 (6
	ins (see Ta											
abolic gain	s (Table 5) Jan	, Watts Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	0ct	Nov	Dec
)m nting gains		114.9164 d in Appen	114.9164 dix L, equat	114.9164 tion L9 or	114.9164 L9a), also s	114.9164 see Table 5	114.9164	114.9164	114.9164	114.9164	114.9164	114.9164 (6
liances gai	102.2420 ns (calcula	113.1965 ted in App	102.2420 endix L. eau		102.2420 or L13a), all	105.6501 Lso see Tab	102.2420 le 5	102.2420	105.6501	102.2420	105.6501	102.2420 (
	202.3763	204.4763	199.1843	187.9182	173.6968 L15a), also	160.3307	151.4014	149.3013	154.5933	165.8594	180.0808	193.4469 (6
os, fans	34.4916 3.0000	34.4916 3.0000	34.4916 3.0000	34.4916 3.0000	34.4916 3.0000	34.4916 0.0000	34.4916 0.0000	34.4916 0.0000	34.4916 0.0000	34.4916 3.0000	34.4916 3.0000	34.4916 (6 3.0000 (7
_	-91.9332	-91.9332	alues) (Tabl -91.9332	le 5) -91.9332	-91.9332	-91.9332	-91.9332	-91.9332	-91.9332	-91.9332	-91.9332	-91.9332 (
er heating	gains (Tabl 143.5695	e 5) 141.2316	136.7277	126.8563	120.8098	114.4897	110.6077	113.8148	117.5750	124.5878	134.0508	142.3074 (
al internal	gains 508.6628	519.3794	498.6290	480.8995	457.2236	437.9454	421.7260	422.8331	435.2933	453.1642	480.2566	498.4712 (7
Solar gains												
			Ar	rea m2	Solar flux Table 6a W/m2		g fic data Table 6b	Specific or Tab		Acce fact Table	or	Gains W
n]							0.6300	۵	7000	0.77	00	32.0096 (7
n] th t			9.85 5.58		10.6334 19.6403		0.6300 0.6300		.7000 .7000	0.77 0.77		33.4929 (7

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. Mean inter			ng season)										
emperature du tilisation fa	uring heati	ng periods i	in the livio	ng area fro ni1,m (see	m Table 9, Table 9a)	Th1 (C)			So.	Oct	Nov	21.0000	(85)
au	Jan 119.4654	Feb 119.8827	Mar 120.2947	Apr 122.2679	May 122.6443	Jun 124.4274	Jul 124.4274	Aug 124.7633	Sep 123.7345	Oct 122.6443	Nov 121.8852	Dec 121.1016	
lpha il living an	8.9644	8.9922	9.0196	9.1512	9.1763	9.2952	9.2952	9.3176	9.2490	9.1763	9.1257	9.0734	
ir irving a	0.9990	0.9967	0.9857	0.9072	0.7046	0.4835	0.3492	0.3984	0.6646	0.9541	0.9963	0.9993	(86)
T 2	20.4171 20.1206	20.5334 20.1234	20.7044 20.1261	20.9140 20.1390	20.9915 20.1414	20.9997 20.1527	21.0000 20.1527	21.0000 20.1548	20.9962 20.1484	20.8758 20.1414	20.6158 20.1366	20.4035 20.1314	
il rest of h	0.9985	0.9950	0.9782	0.8718	0.6440	0.4197	0.2820	0.3252	0.5857	0.9266	0.9940	0.9989	(89)
T 2 ving area f	19.4507	19.6011	19.8174	20.0670	20.1365	20.1526	20.1527	20.1548	20.1468	20.0354 Living area	19.7175	19.4423 0.3940	(90)
T mperature ad	19.8315	19.9685	20.1669	20.4007	20.4734	20.4864	20.4866	20.4878	20.4815	20.3666	20.0714	19.8211 0.0000	(92)
justed MIT	19.8315	19.9685	20.1669	20.4007	20.4734	20.4864	20.4866	20.4878	20.4815	20.3666	20.0714	19.8211	(93)
Space heat:	ing require	ment											
	_								_			_	
ilisation	Jan 0.9983	Feb 0.9946	Mar 0.9787	Apr 0.8835	May 0.6678	Jun 0.4449	Jul 0.3085	Aug 0.3541	Sep 0.6170	0ct 0.9350	Nov 0.9938	Dec 0.9987	(94)
eful gains t temp.	573.1706 4.3000	642.5555 4.9000	695.3108 6.5000	711.4282 8.9000	584.3402 11.7000	389.7799 14.6000	257.4305 16.6000	270.0241 16.4000	423.1020 14.1000	564.4624 10.6000	558.0180 7.1000	551.9962 4.2000	(95)
at loss rate ace heating	1071.4788	1035.9178	936.3486	775.2219	589.5694	389.8965	257.4336	270.0351	425.0536	656.3071	877.1015	1063.0992	(97)
ace heating	370.7413 requiremen	264.3395 t - total pe	179.3321 er year (kWl	45.9314 h/year)	3.8905	0.0000	0.0000	0.0000	0.0000	68.3325	229.7401	380.2606 1542.5681	(98a
lar heating	0.0000 contribution	0.0000 on - total p	0.0000 per year (kl	0.0000 Wh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000	(98b
ace heating ace heating	370.7413	264.3395 t after sola	179.3321 ar contribu	45.9314 tion - tota	3.8905 l per year	0.0000 (kWh/year)	0.0000	0.0000	0.0000	68.3325	229.7401	380.2606 1542.5681	(98c
						o-CHP						0.0000	(201
raction of spraction of spraction of spraction of friciency of	pace heat fi pace heat fi main space main space	rom secondar rom main sys heating sys heating sys	ry/supplementstem(s) stem(s) stem 1 (in 5	ntary system %) %)		o-CHP							(202 (206 (207
action of sp action of sp ficiency of ficiency of ficiency of	pace heat fi pace heat fi main space main space secondary/	rom secondar rom main sys heating sys heating sys supplementar	ry/supplementstem(s) stem(s) stem 1 (in 5	ntary system %) %)		o-CHP	Jul	Aug	Sep	0ct	Nov	1.0000 92.3000 0.0000	(202 (206 (207
action of sp action of sp ficiency of ficiency of ficiency of	pace heat fi pace heat fi main space main space secondary/: Jan requiremen 370.7413	rom secondar rom main sys heating sys heating sys supplementar Feb t 264.3395	ry/supplements stem(s) stem 1 (in 5 stem 2 (in 5 ry heating stem 2 T79.3321	ntary system %) %) system, % Apr 45.9314	m (Table 11	o-CHP)			Sep 0.0000	Oct 68.3325	Nov 229.7401	1.0000 92.3000 0.0000 0.0000	(202 (206 (207 (208
action of spaction of spaction of space of ficiency of ficiency of ficiency of ace heating ace heating	pace heat fi main space main space secondary/: Jan requiremen 370.7413 efficiency 92.3000	rom secondai rom main sy: heating sy: heating sy: supplementai Feb t 264.3395 (main heat: 92.3000	ry/supplements tem(s) stem 1 (in % stem 2 (in % ry heating stem 1 (in % stem 2 (in % system 3 (in % syst	ntary system %) %) system, % Apr 45.9314	m (Table 11	o-CHP)) Jun	Jul	Aug				1.0000 92.3000 0.0000 0.0000 Dec	(202 (206 (207 (208 (98)
action of sg action of sg ficiency of ficiency of ficiency of ace heating ace heating	pace heat fi main space main space main space secondary/s Jan requiremen 370.7413 efficiency 92.3000 fuel (main 401.6699 efficiency	rom secondar rom main sys heating sys heating sys supplementar Feb t 264.3395 (main heating sys 286.3917 (main heating sys	ry/supplements stem(s) stem 1 (in 5 stem 2 (in 5 ry heating : Mar 179.3321 ing system: 92.3000 stem) 194.2927 ing system:	%) %) %) %) %y Apr 45.9314 1) 92.3000 49.7632	May 3.8905 92.3000 4.2150	Jun 0.0000 0.0000 0.0000	Jul 0.0000 0.0000 0.0000	Aug 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	68.3325 92.3000 74.0330	229.7401 92.3000 248.9059	1.0000 92.3000 0.0000 0.0000 Dec 380.2606 92.3000 411.9834	(202 (206 (207 (208 (98) (216
action of sy action of sy ficiency of ficiency of ficiency of ace heating ace heating ace heating	pace heat fi pace heat fi main space main space secondary/: Jan requiremen 370.7413 efficiency 92.3000 fuel (main 401.6699 efficiency 0.0000 fuel (main	rom secondar rom main sys heating sys heating sys supplementar Feb t 264.3395 (main heat: 92.3000 heating sys 286.3917 (main heat: 0.0000 heating sys	ry/supplements stem(s) stem 1 (in 5 stem 2 (in 5 ry heating : Mar 179.3321 sing system: 92.3000 stem) 194.2927 sing system: 0.0000 stem 2)	%) %) %) system, % Apr 45.9314 1) 92.3000 49.7632 2) 0.0000	May 3.8905 92.3000 4.2150 0.0000	Jun 0.0000 0.0000 0.0000	Jul 0.0000 0.0000 0.0000	Aug 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	68.3325 92.3000 74.0330 0.0000	229.7401 92.3000 248.9059 0.0000	1.0000 92.3000 0.0000 0.0000 Dec 380.2606 92.3000 411.9834 0.0000	(202 (206 (207 (208 (98) (216 (211 (212
action of sy action of sy ficiency of ficiency of ficiency of ace heating ace heating ace heating ace heating	pace heat fi pace heat fi main space main space secondary/s requiremen 370.7413 efficiency 92.3000 fuel (main 401.6699 efficiency 0.0000 fuel (main 0.0000	rom secondar rom main sys heating sys heating sys supplementar Feb t 264.3395 (main heat: 92.3000 heating sys 286.3917 (main heat: 0.0000 heating sys 0.0000	ry/supplements stem (s) stem 1 (in stem 2 (in stem 3 (i	%) %) %) system, % Apr 45.9314 1) 92.3000 49.7632	May 3.8905 92.3000 4.2150	Jun 0.0000 0.0000 0.0000	Jul 0.0000 0.0000 0.0000	Aug 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	68.3325 92.3000 74.0330	229.7401 92.3000 248.9059	1.0000 92.3000 0.0000 0.0000 Dec 380.2606 92.3000 411.9834	(202 (208 (208 (208 (208 (218 (218 (218 (218
action of sy action of sy ficiency of ficiency of ficiency of ace heating ace heating ace heating ace heating ace heating ace heating	ppace heat fi pace heat fi main space main space secondary/s Jan requiremen 370.7413 efficiency 92.3000 fuel (main 401.6699 efficiency 0.0000 fuel (main 0.0000 fuel (secon 0.0000	rom secondar rom main sy: heating sy: heating sy: supplementar Z64.3395 (main heat: 92.3000 heating sy: 286.3917 (main heat: 0.0000 heating sy: 0.0000 ndary) 0.0000	ry/supplements stem(s) stem 1 (in stem 2 (in	Apr 45.9314 1) 92.3000 49.7632 0.0000	May 3.8905 92.3000 4.2150 0.0000	Jun 0.0000 0.0000 0.0000 0.0000	Jul 0.0000 0.0000 0.0000 0.0000	Aug 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	68.3325 92.3000 74.0330 0.0000 0.0000	229.7401 92.3000 248.9059 0.0000 0.0000	1.0000 92.3000 0.0000 0.0000 Dec 380.2606 92.3000 411.9834 0.0000	(202 (208 (208 (208 (208 (218 (218 (218 (218
action of spaction of spaction of space of space heating ace heating	pace heat fi pace heat fi main space main space secondary/: Jan requiremen 370.7413 efficiency 92.3000 fuel (main 401.6699 efficiency 0.0000 fuel (main 0.0000 fuel (secon 0.0000	rom secondar rom main sys heating sys heating sys supplementar Feb t 264.3395 (main heat: 92.3000 heating sys 286.3917 (main heat: 0.0000 heating sys 0.0000 heating sys 0.0000	ry/supplements stem(s) stem 1 (in stem 2 (in	Apr 45.9314 1) 92.3000 49.7632 0.0000	May 3.8905 92.3000 4.2150 0.0000	Jun 0.0000 0.0000 0.0000 0.0000	Jul 0.0000 0.0000 0.0000 0.0000	Aug 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	68.3325 92.3000 74.0330 0.0000 0.0000	229.7401 92.3000 248.9059 0.0000 0.0000	1.0000 92.3000 0.0000 0.0000 Dec 380.2606 92.3000 411.9834 0.0000 0.0000	(20) (20) (20) (20) (21) (21) (21) (21) (21)
action of spaction of spaction of spaction of space ficiency of ficiency of ace heating ace ficiency of 17)m	Jan requiremen Jan Jan Jan Jan Jan Jan Jan Jan Jan Ja	rom secondar rom main sys heating sys heating sys supplementar Feb t 264.3395 (main heating sys 286.3917 (main heating sys 0.0000 heating sys 0.0000 heating sys 100000 heating sys 1000000 heating sys 1000000 heating sys 1000000 heating sys 100000000000000000000000000000000000	ry/supplements stem (s) stem 1 (in stem 2 (i	Apr 45.9314 1) 92.3000 49.7632 0.0000 0.0000	May 3.8905 92.3000 4.2150 0.0000 0.0000	Jun 0.0000 0.0000 0.0000 0.0000 0.0000	Jul 0.0000 0.0000 0.0000 0.0000 0.0000	Aug 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	68.3325 92.3000 74.0330 0.0000 0.0000	229.7401 92.3000 248.9059 0.0000 0.0000	1.0000 92.3000 0.0000 0.0000 Dec 380.2506 92.3000 411.9834 0.0000 0.0000	(202 (206 (207 (208 (218 (211 (211 (211 (211 (211 (211 (21
action of sy action of sy ficiency of ficiency of ficiency of ficiency of ace heating ace heating ace heating ace heating ace heating ace heating fice heating	ppace heat fi pace heat fi main space main space secondary/s requirement 370.7413 efficiency 92.3000 fuel (main 401.6699 efficiency 0.0000 fuel (main 0.0000 fuel (secon 0.0000	rom secondar rom main sys heating sys heating sys supplementar Feb t 264.3395 (main heat: 92.3000 heating sys 286.3917 (main heat: 0.0000 heating sys 0.0000 t 197.5280 er 84.7139 kWh/month 233.1707	ry/supplement stem(s) stem 1 (in stem 2 (in	Apr 45.9314 1) 92.3000 49.7632 2) 0.0000 0.0000 185.6936	May 3.8905 92.3000 4.2150 0.0000 0.0000	Jun 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	Jul 0.0000 0.0000 0.0000 0.0000 0.0000 161.8138	Aug 0.0000 0.0000 0.0000 0.0000 0.0000 167.9473	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	68.3325 92.3000 74.0330 0.0000 0.0000 0.0000	229.7401 92.3000 248.9059 0.0000 0.0000	1.0000 92.3000 0.0000 0.0000 Dec 380.2606 92.3000 411.9834 0.0000 0.0000	(202 (206 (207 (208 (98) (211 (212 (213 (215 (215 (217
action of spaction of spaction of spaction of space in space space heating ace cooling 21)m	Jan Requirement Jan Requiremen	rom secondar rom main sy: heating sy: heating sy: supplementar Feb t 264.3395 (main heat: 92.3000 heating sy: 286.3917 (main heat: 0.0000 heating sy: 0.0000 t 197.5280 er 84.7139 kWh/month 233.1707 rement 0.0000	ry/supplement stem(s) stem(s) stem 1 (in stem 2 (in ste	Apr 45.9314 1) 92.3000 49.7632 2) 0.0000 0.0000 185.6936 81.4367 228.0220 0.0000	May 3.8905 92.3000 4.2150 0.0000 0.0000 180.5840 79.9709 225.8121 0.0000	Jun 0.0000 0.0000 0.0000 0.0000 0.0000 163.3701 79.8000 204.7244 0.0000	Jul 0.0000 0.0000 0.0000 0.0000 0.0000 161.8138 79.8000 202.7742 0.0000	Aug 0.0000 0.0000 0.0000 0.0000 0.0000 167.9473 79.8000 210.4603 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 169.4434 79.8000 212.3350 0.0000	68.3325 92.3000 74.0330 0.0000 0.0000 188.1412 82.0147 229.3994 0.0000	229.7401 92.3000 248.9059 0.0000 0.0000 199.0294 84.3824 235.8659 0.0000	1.0000 92.3000 0.0000 0.0000 Dec 380.2506 92.3000 411.9834 0.0000 0.0000 221.0325 79.8000 85.2651 259.2298 0.0000	(202 (206 (207 (208 (218 (211 (212 (213 (215 (214 (216 (217 (217 (217 (217 (217 (217 (217 (217
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action of spaction of spaction of spaction of space in space space heating ace ace cooling and faghting acetricity governing space according space accordi	pace heat fi pace heat fi main space main space secondary/s Jan requirement 370.7413 efficiency 92.3000 fuel (main 0.0000 fuel (main 0.0000 fuel (secon 223.3254 water heat: 85.1882 rheating, 262.1553 fuel requirement 223.3254 water heat: 92.1553 fuel requirement 21.2439 92.12439 92.12439 92.12439 92.12439 92.12439	rom secondar rom main sys heating sys heating sys supplementar feb t 264.3395 (main heat: 92.3000 heating sys 286.3917 (main heat: 0.0000 heating sys 0.0000 heating sys 84.7139 kWh/month 233.1707 rement 0.0000 6.5973 17.0426 FVS (Appenc -12.3677	ry/supplements stem(s) stem 1 (in 5 stem 2 (in 5 ry heating 1 stem 2 (in 5 ry heating 1 stem 2 (in 5 stem) 194.2927 (ing system 2) 0.0000 (in 6 stem) 194.2927 (ing system 2) 0.0000 (in 6 stem) 0.0000 (Apr 45.9314 1) 92.3000 49.7632 2) 0.0000 0.0000 185.6936 81.4367 228.0220 0.0000 7.0685 11.2424 ative quant: -24.2038	May 3.8905 92.3000 4.2150 0.0000 0.0000 180.5840 79.9709 225.8121 0.0000 7.3041 8.6840 ity) -28.1474	Jun 0.0000 0.0000 0.0000 0.0000 0.0000 163.3701 79.8000 204.7244 0.0000 7.0685 7.0949 -27.0385	Jul 0.0000 0.0000 0.0000 0.0000 0.0000 161.8138 79.8000 202.7742 0.0000 7.3041	Aug 0.0000 0.0000 0.0000 0.0000 167.9473 79.8000 210.4603 0.0000 7.3041	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 169.4434 79.8000 212.3350 0.0000 7.0685	68.3325 92.3000 74.0330 0.0000 0.0000 0.0000 188.1412 82.0147 229.3994 0.0000 7.3041	229.7401 92.3000 248.9059 0.0000 0.0000 199.0294 84.3824 235.8659 0.0000 7.0685	1.0000 92.3000 0.0000 0.0000 Dec 380.2606 92.3000 411.9834 0.0000 0.0000 221.0325 79.8000 85.2651 259.2298 0.0000 7.3041	(298) (298) (218) (211) (211) (212) (644) (211) (212) (213) (213) (213) (223) (233)
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Full SAP Calculation Printout



(235d)m 0.0000 Annual totals kWh/year Space heating fuel - main		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 1671.2547	(211)
Space heating fuel - main Space heating fuel - second											0.0000 0.0000	
Efficiency of water heate											79.8000	(21),
Water heating fuel used											2754.9890 0.0000	
Space cooling fuel											0.0000	(221,
Electricity for pumps and		,02n									96 9999	(221)
Total electricity for the Electricity for lighting			L)								86.0000 171.4502	
				0)								
Energy saving/generation PV generation	technologies	(Appendice	S m , n anu	Q)							-324.4242	(233)
Wind generation											0.0000	, ,
Hydro-electric generation Electricity generated - M											0.0000 0.0000	
Appendix Q - special feat	tures										0.0000	(226)
Energy saved or generated Energy used	1										-0.0000 0.0000	
Total delivered energy fo	or all uses										4359.2697	1 1
12a. Carbon dioxide emiss												
							Energy		on factor	le.	Emissions g CO2/year	
Space heating - main syst	em 1						kWh/year 1671.2547	K	g CO2/kWh 0.2100	K	350.9635	(261)
Total CO2 associated with	n community sy	/stems									0.0000	(373)
Water heating (other fuel Space and water heating	.)						2754.9890		0.2100		578.5477 929.5112	
Pumps, fans and electric	keep-hot						86.0000		0.1387		11.9293	
Energy for lighting							171.4502		0.1443		24.7456	(268)
Energy saving/generation		5										
PV Unit electricity used							-221.2652 -103.1590		0.1327 0.1248		-29.3509 -12.8728	
PV Unit electricity expor Total	rea						-103.1590		0.1248		-12.8728 -42.2238	(269)
Total CO2, kg/year											923.9622	(272)
EPC Target Carbon Dioxide	Emission Rat	te (TER)									12.8000	(273)
 13a. Primary energy - Ind												
								Primarv ener	gy factor	Prim	ary energv	
							Energy kWh/year	Primary ener; kį	g CO2/kWh	Prim	ary energy kWh/year	
Space heating - main syst							Energy			Prim	kWh/year 1888.5178	
Space heating – main syst Total CO2 associated with	cem 1						Energy kWh/year		g CO2/kWh	Prim	kWh/year 1888.5178 0.0000	(473)
Space heating – main syst Total CO2 associated with Water heating (other fuel Space and water heating	cem 1 n community sy l)						Energy kWh/year 1671.2547 2754.9890		g CO2/kWh 1.1300 1.1300	Prim.	kWh/year 1888.5178 0.0000 3113.1375 5001.6553	(473) (278) (279)
Space heating - main syst Total CO2 associated with Water heating (other fuel Space and water heating Pumps, fans and electric	cem 1 n community sy l)						Energy kWh/year 1671.2547 2754.9890 86.0000		g CO2/kWh 1.1300 1.1300 1.5128	Prim	kWh/year 1888.5178 0.0000 3113.1375 5001.6553 130.1008	(473) (278) (279) (281)
Space heating - main syst Total CO2 associated with Water heating (other fuel Space and water heating Pumps, fans and electric	cem 1 n community sy l)						Energy kWh/year 1671.2547 2754.9890		g CO2/kWh 1.1300 1.1300	Prim	kWh/year 1888.5178 0.0000 3113.1375 5001.6553	(473) (278) (279) (281)
Space heating - main syst Total CO2 associated with Water heating (other fuel Space and water heating Pumps, fans and electric Energy for lighting	tem 1 n community sy l) keep-hot n technologies	ystems					Energy kWh/year 1671.2547 2754.9890 86.0000 171.4502		g CO2/kWh 1.1300 1.1300 1.5128 1.5338	Prim	kWh/year 1888.5178 0.0000 3113.1375 5001.6553 130.1008 262.9761	(473) (278) (279) (281)
Space heating - main syst Total CO2 associated with Water heating (other fuel Space and water heating Pumps, fans and electric Energy for lighting Energy saving/generation PV Unit electricity used	tem 1 n community sy l) keep-hot n technologies in dwelling	ystems					Energy kWh/year 1671.2547 2754.9890 86.0000 171.4502		g CO2/kWh 1.1300 1.1300 1.5128 1.5338	Prim	kWh/year 1888.5178 0.0000 3113.1375 5001.6553 130.1008 262.9761	(473) (278) (279) (281)
Space heating - main syst Total CO2 associated with Water heating (other fuel Space and water heating Pumps, fans and electric Energy for lighting Energy saving/generation PV Unit electricity used PV Unit electricity expor	tem 1 n community sy l) keep-hot n technologies in dwelling	ystems					Energy kWh/year 1671.2547 2754.9890 86.0000 171.4502		g CO2/kWh 1.1300 1.1300 1.5128 1.5338	Prim.	kWh/year 1888.5178 0.0000 3113.1375 5001.6553 130.1008 262.9761	(473) (278) (279) (281) (282)
Space heating - main syst Total CO2 associated with Water heating (other fuel Space and water heating Pumps, fans and electric Energy for lighting	tem 1 n community sy l) keep-hot n technologies in dwelling ted	ystems					Energy kWh/year 1671.2547 2754.9890 86.0000 171.4502		g CO2/kWh 1.1300 1.1300 1.5128 1.5338	Prim.	kWh/year 1888.5178 0.0000 3113.1375 5001.6553 130.1008 262.9761 -329.7166 -47.2465	(473) (278) (279) (281) (282) (283) (286)

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Appendix A.3 – BRUKL Reports (Be Lean)

BRUKL Output Document



Compliance with England Building Regulations Part L 2021

Project name

Block F - Office - Be Clean

As designed

Date: Wed Aug 09 12:17:54 2023

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache Calculation engine version: 7.0.22

Interface to calculation engine: IES Virtual Environment Interface to calculation engine version: 7.0.22

BRUKL compliance module version: v6.1.e.1

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Foundation area [m²]: 24.15

The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m ² annum	12.4
Building CO₂ emission rate (BER), kgCO₂/m²annum	10.57
Target primary energy rate (TPER), kWhpe/m²annum	73.19
Building primary energy rate (BPER), kWh _{PE} /m²annum	69.68
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-Limit}	Ua-Calc	U _{i-Calc}	First surface with maximum value
Walls*	0.26	0.14	0.14	09000001:Surf[2]
Floors	0.18	0.1	0.1	09000001:Surf[3]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	-	-	No flat roofs in building
Windows** and roof windows	1.6	0.8	0.8	09000001:Surf[0]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	0.8	0.8	09000001:Surf[1]
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-Limit} = Limiting area-weighted average U-values [W/(m²	K)]	•	U i-Calc = Ca	alculated maximum individual element U-values [W/(m²K)]

U_{a-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.

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	2.5

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- System HN

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(I/s)]	HR efficiency					
This system	s system 1 3.92 0 1.1 0.85									
Standard value	N/A	N/A	N/A	2^	N/A					
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system YES										
^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.										

"No HWS in project, or hot water is provided by HVAC system"

1- District heating network

	Emission factor [kgCO ₂ /kWh]	Primary energy factor [kWh _{PE} /kWh]
This building	0.273	1.356
Standard value	0.35	N/A

Zone-level mechanical ventilation, exhaust, and terminal units

20.	te level mediamon ventilation, exhaust, and terminal antis
ID	System type in the Approved Documents
Α	Local supply or extract ventilation units
В	Zonal supply system where the fan is remote from the zone
С	Zonal extract system where the fan is remote from the zone
D	Zonal balanced supply and extract ventilation system
Е	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
Н	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter
NB: L	imiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

Zone name				UD officion ou							
ID of system type	Α	В	С	D	Е	F	G	Н	ı	HR efficiency	
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
BF-04 Marketing Suite	-	-	-	-	-	-	-	0.3	-	-	N/A
Closing room	-	-	-	-	-	-	-	0.3	-	-	N/A
WC	-	-	-	-	-	-	-	0.3	-	-	N/A
Kitchennette	-	-	-	-	-	-	-	0.3	-	-	N/A
WC ACC.	-	-	-	-	-	-	-	0.3	-	-	N/A
WC	-	-	-	-	-	-	-	0.3	-	-	N/A
Cafe Offering	-	-	-	-	-	-	-	0.3	-	-	N/A
BF04 Marketing Suite	-	-	-	-	-	-	-	0.3	-	-	N/A
Shower	-	-	-	-	-	-	-	0.3	-	-	N/A
Shower lobby	-	-	-	-	-	-	-	0.3	-	-	N/A
Resident Offices	-	-	-	-	-	-	-	0.3	-	-	N/A

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^{***} Values for rooflights refer to the horizontal position. ** Display windows and similar glazing are excluded from the U-value check.

[^] For fire doors, limiting U-value is 1.8 W/m2K

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	
BF-04 Marketing Suite	125	-	•	
Closing room	125	-	•	
WC	125	-	•	
Kitchennette	125	-	-	
WC ACC.	125	-	-	
WC	125	-	-	
Cafe Offering	125	-	-	
BF04 Marketing Suite	125	-	-	
Shower	125	-	-	
Shower lobby	125	-	-	
Resident Offices	125	-	-	

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?
BF-04 Marketing Suite	NO (-14%)	NO
Closing room	N/A	N/A
WC	N/A	N/A
Kitchennette	N/A	N/A
WC ACC.	N/A	N/A
WC	N/A	N/A
Cafe Offering	YES (+32.7%)	NO
BF04 Marketing Suite	NO (-2.7%)	NO
Shower	N/A	N/A
Shower lobby	N/A	N/A
Resident Offices	NO (-36.1%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?			
Is evidence of such assessment available as a separate submission?	NO		
Are any such measures included in the proposed design?	YES		

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m²]	289.8	289.8
External area [m²]	490.3	490.3
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	147.81	187.97
Average U-value [W/m²K]	0.3	0.38
Alpha value* [%]	9.99	10

^{*} Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

o Area	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways

00 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/m²]

	Actual	Notional
Heating	9.63	18.16
Cooling	7.04	2.1
Auxiliary	9.78	11.58
Lighting	3.88	8.47
Hot water	19.01	24.4
Equipment*	35.73	35.73
TOTAL**	49.33	64.71

^{*} 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/m²]

	Actual	Notional
Photovoltaic systems	0	2.74
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	0	2.74

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	113.41	94.12
Primary energy [kWh _{PE} /m ²]	69.68	73.19
Total emissions [kg/m²]	10.57	12.4

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H	HVAC Systems Performance									
Sys	stem Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2		Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST	[ST] Fan coil systems, [HS] District heating, [HFT] District Heating, [CFT] Electricity									
	Actual	31.1	82.3	9.6	7	9.8	0.9	3.25	1	3.92
	Notional	59.2	34.9	18.2	2.1	8.9	0.91	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 efficient

= 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

= Heat source = Heating fuel type HS HFT CFT = Cooling fuel type

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BRUKL Output Document



Compliance with England Building Regulations Part L 2021

Project name

Block F - Resi Areas - Be Clean

As designed

Date: Fri Aug 04 17:16:56 2023

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache Calculation engine version: 7.0.22

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.22 BRUKL compliance module version: v6.1.e.1

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Foundation area [m²]: 5.81

The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m ² annum	7.74
Building CO ₂ emission rate (BER), kgCO ₂ /m ² :annum	5.4
Target primary energy rate (TPER), kWh _{PE} /m²annum	60.88
Building primary energy rate (BPER), kWh _{PE} /m²annum	50.12
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-Limit}	Ua-Calc	U _{i-Calc}	First surface with maximum value
Walls*	0.26	0.14	0.14	0900000E:Surf[1]
Floors	0.18	0.1	0.1	0900000E:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	-	-	No flat roofs in building
Windows** and roof windows	1.6	-	-	No windows, galzed doors, or roof windows in building
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	1	1	0900000E:Surf[3]
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-Limit} = Limiting area-weighted average U-values [W/(m ²	²K)1		Ui-Calc = Ca	alculated maximum individual element U-values [W/(m²K)]

U_{a-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.

*** Values for rooflights refer to the horizontal position. ** Display windows and similar glazing are excluded from the U-value check.

^ 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	2.5

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- System HN

· Cyclem · m						
	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(I/s)]	HR efficiency	
This system 1 3.92 0 1				1.1	0.85	
Standard value	N/A	N/A	N/A	2^	N/A	
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system YES						
^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.						

"No HWS in project, or hot water is provided by HVAC system"

1- District heating network

Emission factor [kgCO ₂ /kWh]		Primary energy factor [kWh _{PE} /kWh]
This building	0.273	1.356
Standard value	0.35	N/A

Zone-level mechanical ventilation, exhaust, and terminal units

	Zono level mechanical ventuation, exhaust, and terminal ante						
ID	System type in the Approved Documents						
Α	Local supply or extract ventilation units						
В	Zonal supply system where the fan is remote from the zone						
С	Zonal extract system where the fan is remote from the zone						
D	Zonal balanced supply and extract ventilation system						
Е	Local balanced supply and extract ventilation units						
F	Other local ventilation units						
G	Fan assisted terminal variable air volume units						
Н	Fan coil units						
I	Kitchen extract with the fan remote from the zone and a grease filter						
NB: L	NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.						

Zone name			SFP [W/(I/s)]								UD officionav	
	ID of system type	Α	В	С	D	E	F	G	Н	ı	HR efficiency	
	Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
Circulation		-	-	-	-	-	-	-	0.3	-	-	N/A
Parcel		-	-	-	-	-	-	-	0.3	-	-	N/A
Security room		-	-	-	-	-	-	-	0.3	-	-	N/A

General lighting and display lighting	General luminaire	inaire Display light source		
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]	
Standard value	95	80	0.3	
Circulation	125	-	-	
Parcel	125	-	-	
Security room	125	-	-	

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The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	Solar gain limit exceeded	d? (%) Internal blinds used?
Circulation	N/A	N/A
Parcel	N/A	N/A
Security room	N/A	N/A

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m²]	69.7	69.7
External area [m²]	118.3	118.3
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	18.52	41.81
Average U-value [W/m²K]	0.16	0.35
Alpha value* [%]	10	10

^{*} Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area Building Type

Retail/Financial and Professional Services
Restaurants and Cafes/Drinking Establishments/Takeaways
Offices and Workshop Businesses
General Industrial and Special Industrial Groups
Storage or Distribution

100 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/m²]

	Actual	Notional
Heating	4.67	15.17
Cooling	3.9	3.25
Auxiliary	11.65	16.45
Lighting	12.62	12.88
Hot water	1.1	1.07
Equipment*	39.86	39.86
TOTAL**	33.94	48.83

^{*} 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/m²]

	Actual	Notional
Photovoltaic systems	0	2.74
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	0	2.74

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	60.62	103.72
Primary energy [kWh _{PE} /m ²]	50.12	60.88
Total emissions [kg/m²]	5.4	7.74

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ŀ	HVAC Systems Performance									
Sys	stem Type	Heat dem MJ/m2	Cool dem MJ/m2			Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST	[ST] Fan coil systems, [HS] District heating, [HFT] District Heating, [CFT] Electricity									
	Actual	15.1	45.6	4.7	3.9	11.7	0.9	3.25	1	3.92
	Notional	49.5	54.3	15.2	3.3	16.4	0.91	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 efficient

= 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

= Heat source = Heating fuel type HS HFT CFT = Cooling fuel type

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BRUKL Output Document



Compliance with England Building Regulations Part L 2021

Project name

Block F - Retail - Be Clean

As designed

Date: Wed Aug 09 13:37:28 2023

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache
Calculation engine version: 7.0.22

Interface to calculation engine: IES Virtual Environment

U i-calc = Calculated maximum individual element U-values [W/(m²K)]

Interface to calculation engine version: 7.0.22 BRUKL compliance module version: v6.1.e.1

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Foundation area [m²]: 16.1

The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m ² annum	7.81
Building CO₂ emission rate (BER), kgCO₂/m²annum	6.86
Target primary energy rate (TPER), kWhpe/m²annum	58.21
Building primary energy rate (BPER), kWh _{PE} /m²annum	57.44
Do the building's emission and primary energy rates exceed the targets?	BER =< TER BPER =< TPE

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	U _{a-Limit}	Ua-Calc	Ui-Calc	First surface with maximum value
Walls*	0.26	0.14	0.14	09000000:Surf[2]
Floors	0.18	0.1	0.1	09000000:Surf[3]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	-	-	No flat roofs in building
Windows** and roof windows	1.6	0.8	0.8	09000000:Surf[0]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	0.8	0.8	09000000:Surf[1]
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-Limit} = Limiting area-weighted average U-values [W/(m²K)]

U_{a-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	2.5

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- System HN

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(I/s)]	HR efficiency		
This system	1	3.92	0	1.1	0.85		
Standard value	N/A	N/A	N/A	2^	N/A		
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system YES							
^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.							

"No HWS in project, or hot water is provided by HVAC system"

1- District heating network

	Emission factor [kgCO ₂ /kWh]	Primary energy factor [kWh _{PE} /kWh]
This building	0.273	1.356
Standard value	0.35	N/A

Zone-level mechanical ventilation, exhaust, and terminal units

	ne level mediamon ventilation, exhaust, and terminal anti-
ID	System type in the Approved Documents
Α	Local supply or extract ventilation units
В	Zonal supply system where the fan is remote from the zone
С	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
Н	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter
NB: L	Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

Zone name		SFP [W/(I/s)]						HR efficiency				
	ID of system type	Α	В	С	D	E	F	G	Н	I	пке	eniciency
	Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
BF02 Retail		-	-	-	-	-	-	-	0.3	-	-	N/A
BF01 Retail		-	-	-	-	-	-	-	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		
BF02 Retail	125	100	1.2		
BF01 Retail	125	100	1.2		

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?
BF02 Retail	YES (+6.6%)	NO

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Zone	Solar gain limit exceeded? (%)	Internal blinds used?
BF01 Retail	NO (-10.2%)	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?	NO
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m²]	193.2	193.2
External area [m²]	354.3	354.3
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	117.8	145.75
Average U-value [W/m²K]	0.33	0.41
Alpha value* [%]	9.99	10

^{*} Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Are	ea Building Type
100	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups

Hotels
Residential Institutions: Hospitals and Care Homes
Residential Institutions: Residential Schools
Residential Institutions: Universities and Colleges

Secure Residential Institutions

Residential Spaces

Storage or Distribution

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/m²]

	Actual	Notional
Heating	9.41	16.55
Cooling	8.58	2.36
Auxiliary	13.44	12.26
Lighting	6.13	14.5
Hot water	1.93	1.87
Equipment*	20.25	20.25
TOTAL**	39.49	47.55

^{*} 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/m²]

	Actual	Notional
Photovoltaic systems	0	2.74
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	0	2.74

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	130.74	93.29
Primary energy [kWh _{PE} /m ²]	57.44	58.21
Total emissions [kg/m ²]	6.86	7.81

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ŀ	HVAC Systems Performance									
System Type		Heat dem MJ/m2	Cool dem MJ/m2			Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Fan coil s	ystems, [HS	6] District h	eating, [HF	T] District I	leating, [CF	T] Electric	ity		
	Actual 30.4 100.4 9.4 8.6 13.4 0.9 3.25 1 3.92							3.92		
	Notional	53.9	39.4	16.5	2.4	12.3	0.91	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 efficient

= 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

= Heat source = Heating fuel type HS HFT CFT = Cooling fuel type

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BRUKL Output Document



Compliance with England Building Regulations Part L 2021

Project name

Block H - Resi areas - Be Clean

As built

Date: Thu Aug 10 08:35:11 2023

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache Calculation engine version: 7.0.22

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.22

BRUKL compliance module version: v6.1.e.1

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Foundation area [m²]: 21.03

The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m ² annum	8.97
Building CO ₂ emission rate (BER), kgCO ₂ /m ² :annum	6.98
Target primary energy rate (TPER), kWhpe/m²annum	66.23
Building primary energy rate (BPER), kWh _{PE} /m²annum	62.03
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-Limit}	Ua-Calc	U _{i-Calc}	First surface with maximum value
Walls*	0.26	0.14	0.14	BL000007:Surf[2]
Floors	0.18	0.1	0.1	BL000007:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	-	-	No flat roofs in building
Windows** and roof windows	1.6	0.8	0.8	BL000007:Surf[1]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	0.8	0.8	BL000007:Surf[5]
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-Limit} = Limiting area-weighted average U-values [W/(m ²	K)]		U i-Calc = Ca	alculated maximum individual element U-values [W/(m²K)]

U_{a-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.

^ 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	2.5	

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	
Whole building electric power factor achieved by power factor correction	<0.9

1- system

,						
	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(I/s)]	HR efficiency	
This system	1	3.92	0	1.1	0.85	
Standard value	N/A	N/A	N/A	2^	N/A	
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system YES						
^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.						

"No HWS in project, or hot water is provided by HVAC system"

1- District heating network

	Emission factor [kgCO ₂ /kWh]	Primary energy factor [kWh _{PE} /kWh]
This building	0.273	1.356
Standard value	0.35	N/A

Zone-level mechanical ventilation, exhaust, and terminal units

	Zone level mediamous ventilation, exhaust, and terminal and		
ID	System type in the Approved Documents		
Α	Local supply or extract ventilation units		
В	Zonal supply system where the fan is remote from the zone		
С	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		
Н	Fan coil units		
I	Kitchen extract with the fan remote from the zone and a grease filter		
NB: L	Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.		

Zone name		SFP [W/(I/s)]						UD -#:-:			
ID of system type	Α	В	С	D	E	F	G	Н	1	HR efficiency	
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
LOBBY	-	-	-	-	-	-	-	0.3	-	-	N/A
CORRIDOR	-	-	-	-	-	-	-	0.3	-	-	N/A
LOBBY	-	-	-	-	-	-	-	0.3	-	-	N/A
CORRIDOR	-	-	-	-	-	-	-	0.3	-	-	N/A
LOBBY & POST	-	-	-	-	-	-	-	0.3	-	-	N/A
LOBBY & POST	-	ļ-	-	-	-	-	-	0.3	-	-	N/A
LOBBY	-	-	-	-	-	-	-	0.3	-	-	N/A
LOBBY	-	-	-	-	-	-	-	0.3	-	-	N/A

General lighting and display lighting	General luminaire	Displa	y light source
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
LOBBY	125	-	-

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^{***} Values for rooflights refer to the horizontal position. ** Display windows and similar glazing are excluded from the U-value check.

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	
CORRIDOR	125	1	-	
LOBBY	125	1	-	
CORRIDOR	125	1	-	
LOBBY & POST	125	1	-	
LOBBY & POST	125	1	-	
LOBBY	125	-	-	
LOBBY	125	-	-	

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?
LOBBY	NO (-44.5%)	NO
CORRIDOR	N/A	N/A
LOBBY	NO (-12.7%)	NO
CORRIDOR	N/A	N/A
LOBBY & POST	YES (+4.5%)	NO
LOBBY & POST	YES (+7.5%)	NO
LOBBY	N/A	N/A
LOBBY	N/A	N/A

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?	NO
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m²]	168.3	168.3
External area [m²]	286.9	286.9
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	82.95	110.41
Average U-value [W/m²K]	0.29	0.38
Alpha value* [%]	9.99	10

^{*} Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution
100	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/m²]

	Actual	Notional
Heating	9.26	19.52
Cooling	7.15	2.64
Auxiliary	17.79	16.23
Lighting	8.07	12.31
Hot water	0	0
Equipment*	48.62	48.62
TOTAL**	42.27	50.71

^{*} 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/m²]

	Actual	Notional
Photovoltaic systems	0	4.11
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	0	4.11

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	113.31	107.69
Primary energy [kWh _{PE} /m ²]	62.03	66.23
Total emissions [kg/m²]	6.98	8.97

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HVAC Systems Performance										
System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2		Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Fan coil systems, [HS] District heating, [HFT] District Heating, [CFT] Electricity										
	Actual	29.8	83.5	9.3	7.1	17.8	0.89	3.24	1	3.92
	Notional	63.6	44.1	19.5	2.6	16.2	0.91	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 efficient

= 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

= Heat source = Heating fuel type = Cooling fuel type HS HFT CFT

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Compliance with England Building Regulations Part L 2021

Project name

Block H - retail - Be Clean

As built

Date: Wed Aug 09 14:07:47 2023

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache Calculation engine version: 7.0.22

Interface to calculation engine: IES Virtual Environment Interface to calculation engine version: 7.0.22

BRUKL compliance module version: v6.1.e.1

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Foundation area [m²]: 101.2

The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m ² annum	9.14		
Building CO ₂ emission rate (BER), kgCO ₂ /m ² :annum	6.86		
Target primary energy rate (TPER), kWh _{PE} /m²annum	67.15		
Building primary energy rate (BPER), kWh _{PE} /m²annum	57.91		
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-Limit}	Ua-Calc	Ui-Calc	First surface with maximum value
Walls*	0.26	0.14	0.14	BL000003:Surf[5]
Floors	0.18	0.1	0.1	BL000003:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	-	-	No flat roofs in building
Windows** and roof windows	1.6	0.8	0.8	BL000003:Surf[1]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	0.8	0.8	BL000003:Surf[3]
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-Limit} = Limiting area-weighted average U-values [W/(m ²	K)]	•	U i-Calc = Ca	alculated maximum individual element U-values [W/(m²K)]

U_{a-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
m3/(h.m2) at 50 Pa	8	2.5

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- system

,							
	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(I/s)]	HR efficiency		
This system	1	3.92	0	1.1	0.85		
Standard value	N/A	N/A	N/A	2^	N/A		
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system YES							
^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.							

"No HWS in project, or hot water is provided by HVAC system"

1- District heating network

	Emission factor [kgCO ₂ /kWh]	Primary energy factor [kWh _{PE} /kWh]
This building	0.273	1.356
Standard value	0.35	N/A

Zone-level mechanical ventilation, exhaust, and terminal units

201	ie-ievei mechanicai ventilation, exhaust, and terminai units
ID	System type in the Approved Documents
Α	Local supply or extract ventilation units
В	Zonal supply system where the fan is remote from the zone
С	Zonal extract system where the fan is remote from the zone
D	Zonal balanced supply and extract ventilation system
Е	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
Н	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter
NB: L	imiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

Zone name	SFP [W/(I/s)]					UD officionav					
ID of system type	Α	В	С	D	E	F	G	Н	ı	HR efficiency	
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
RETAIL BH3 - 01	-	-	-	-	-	-	-	0.3	-	-	N/A
RETAIL BH3 - 02	-	-	-	-	-	-	-	0.3	-	-	N/A
RETAIL BH3 - 03	-	-	-	-	-	-	-	0.3	-	-	N/A
RETAIL BH3 - 04	-	-	-	-	-	-	-	0.3	-	-	N/A
RETAIL BH2 - 01	-	-	-	-	-	-	-	0.3	-	-	N/A
RETAIL BH2 - 02	-	-	-	-	-	-	-	0.3	-	-	N/A
RETAIL BH2 - 03	-	-	-	-	-	-	-	0.3	-	-	N/A
RETAIL BH2 - 04	-	-	-	-	-	-	-	0.3	-	-	N/A
RETAIL BH2 - 05	-	-	-	-	-	-	-	0.3	-	-	N/A
RETAIL BH2 - 06	-	-	-	-	-	-	-	0.3	-	-	N/A
RETAIL BH2 - 06	-	-	-	-	-	-	-	0.3	-	-	N/A
RETAIL BH2 - 05	-	-	-	-	-	-	-	0.3	-	-	N/A
RETAIL BH2 - 04	-	-	-	-	-	-	-	0.3	-	-	N/A

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Zone name		SFP [W/(I/s)]					UD officionay					
ID of system type	Α	В	С	D	E	F	G	Н	1	пне	HR efficiency	
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard	
RETAIL BH2 - 01	-	-	-	-	-	-	-	0.3	-	-	N/A	
RETAIL BH2 - 03	-	-	-	-	-	-	-	0.3	-	-	N/A	
RETAIL BH2 - 02	-	-	-	-	-	-	-	0.3	-	-	N/A	
RETAIL BOH	-	-	-	-	-	-	-	0.3	-	-	N/A	
WC & SHOWER	-	-	-	-	-	-	-	0.3	-	-	N/A	

General lighting and display lighting	General luminaire	Display light source				
Zone name	Efficacy [lm/W]	Efficacy [lm/W]				
Standard value	95	80	0.3			
RETAIL BH3 - 01	125	100	1.5			
RETAIL BH3 - 02	125	100	1.5			
RETAIL BH3 - 03	125	100	1.5			
RETAIL BH3 - 04	125	100	1.5			
RETAIL BH2 - 01	125	100	1.5			
RETAIL BH2 - 02	125	100	1.5			
RETAIL BH2 - 03	125	100	1.5			
RETAIL BH2 - 04	125	100	1.5			
RETAIL BH2 - 05	125	100	1.5			
RETAIL BH2 - 06	125	100	1.5			
RETAIL BH2 - 06	125	100	1.5			
RETAIL BH2 - 05	125	100	1.5			
RETAIL BH2 - 04	125	100	1.5			
RETAIL BH2 - 01	125	100	1.5			
RETAIL BH2 - 03	125	100	1.5			
RETAIL BH2 - 02	125	100	1.5			
RETAIL BOH	125	-	-			
WC & SHOWER	125	-	-			

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?
RETAIL BH3 - 01	NO (-62%)	NO
RETAIL BH3 - 02	NO (-52.4%)	NO
RETAIL BH3 - 03	NO (-44.3%)	NO
RETAIL BH3 - 04	NO (-47.5%)	NO
RETAIL BH2 - 01	NO (-43.9%)	NO
RETAIL BH2 - 02	NO (-14.3%)	NO
RETAIL BH2 - 03	NO (-23.2%)	NO
RETAIL BH2 - 04	NO (-48.4%)	NO
RETAIL BH2 - 05	YES (+14.3%)	NO
RETAIL BH2 - 06	NO (-31.9%)	NO
RETAIL BH2 - 06	NO (-31.9%)	NO
RETAIL BH2 - 05	NO (-9.6%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
RETAIL BH2 - 04	NO (-37.3%)	NO
RETAIL BH2 - 01	NO (-43.9%)	NO
RETAIL BH2 - 03	NO (-25.7%)	NO
RETAIL BH2 - 02	NO (-14.6%)	NO
RETAIL BOH	NO (-52.1%)	NO
WC & SHOWER	N/A	N/A

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?					
s evidence of such assessment available as a separate submission?					
Are any such measures included in the proposed design?	YES				

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Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

Building Use

	Actual	Notional
Floor area [m²]	809.6	809.6
External area [m²]	1526.3	1526.3
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	431.71	620.95
Average U-value [W/m²K]	0.28	0.41
Alpha value* [%]	9.99	10

* Percentage of the building's average h	eat transfer coefficient which	is due to thermal bridging

	70 AIC	a building type
Ī	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/m²]

Actual	Notional
8.84	18.04
6.89	2.73
12.49	12.94
9.4	15.63
2.04	1.99
28.87	28.87
39.66	51.32
	8.84 6.89 12.49 9.4 2.04 28.87

^{*} 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/m²]

	Actual	Notional
Photovoltaic systems	0	4.11
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	0	4.11

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	108.89	104.27
Primary energy [kWh _{PE} /m ²]	57.91	67.15
Total emissions [kg/m²]	6.86	9.14

F	IVAC Sys	tems Per	formanc	е						
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] Fan coil systems, [HS] District heating, [HFT] District Heating, [CFT] Electricity										
	Actual	28.5	80.4	8.8	6.9	12.5	0.89	3.24	1	3.92
	Notional	58.8	45.5	18	2.7	12.9	0.91	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

= Heating system seasonal efficiency (for notional building, value depends on activity glazing class) Heat SSEFF

Cool SSEER = Cooling system seasonal energy efficiency ratio

Heat gen SSEFF = Heating generator seasonal efficiency

Cool gen SSEER = Cooling generator seasonal energy efficiency ratio

= System type HS = Heat source HFT = Heating fuel type CFT = Cooling fuel type

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Compliance with England Building Regulations Part L 2021

Project name

Block I - Resi Areas - Be Lean

As built

Date: Fri Aug 04 17:53:49 2023

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache
Calculation engine version: 7.0.22

Interface to calculation engine: IES Virtual Environment

Ui-Calc = Calculated maximum individual element U-values [W/(m²K)]

Interface to calculation engine version: 7.0.22

BRUKL compliance module version: v6.1.e.1

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Foundation area [m²]: 9.7

The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m²annum	12.67
Building CO ₂ emission rate (BER), kgCO ₂ /m ² :annum	10.55
Target primary energy rate (TPER), kWh _{PE} /m²:annum	137.2
Building primary energy rate (BPER), kWh _{PE} /m²annum	114.26
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-Limit}	Ua-Calc	U _{i-Calc}	First surface with maximum value
Walls*	0.26	0.14	0.14	GF000000:Surf[3]
Floors	0.18	0.1	0.1	GF000000:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	-	-	No flat roofs in building
Windows** and roof windows	1.6	1.4	1.4	GF000000: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-Limit} = Limiting area-weighted average U-values [W/(m²K)]

U_{a-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.

^ 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
m³/(h.m²) at 50 Pa	8	2.5

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- Heat Pump (no cooling) (Lean)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(I/s)]	HF	Refficiency	
This system	2.64	-	0.2	1.1	0.8	35	
Standard value	2.5*	N/A	N/A	1.9^	N/A	Ą	
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system YES							
	Automatic monitoring & targeting with alarms for out-of-range values for this TVAC system. TES						

^{*} Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

1- Heat Pump (Hot water Lean)

	Water heating efficiency Storage loss factor [kWh/litre per da	
This building	2.86	-
Standard value	1	N/A

[&]quot;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	
Lobby	125	-	-	
Parcel	125	-	-	
Resi Amenity	125	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?
Resi Amenity	NO (-24.1%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

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[^] Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m²]	106.7	106.7
External area [m²]	213.3	213.3
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	71	82.93
Average U-value [W/m²K]	0.33	0.39
Alpha value* [%]	10	10

^{*} Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

1	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution

100 Hotels

Residential Institutions: Hospitals and Care Homes Residential Institutions: Residential Schools Residential Institutions: Universities and Colleges Secure Residential Institutions

Secure nesiderillar iristitu

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/m²]

	Actual	Notional
Heating	3.81	4.95
Cooling	0	0
Auxiliary	11.81	19.81
Lighting	11.52	15.43
Hot water	48.13	52.48
Equipment*	62.2	62.2
TOTAL**	75.27	92.68

^{*} 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/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	38.48	49.56
Primary energy [kWh _{PE} /m ²]	114.26	137.2
Total emissions [kg/m²]	10.55	12.67

Н	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	[ST] Central heating using air distribution, [HS] ASHP, [HFT] Electricity, [CFT] Electricity									
	Actual	38.5	0	3.8	0	11.8	2.81	0	2.64	0
	Notional	49.6	0	5	0	11.8	2.78	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)

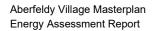
Cool SSEER = Cooling system seasonal energy efficiency ratio

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

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Appendix A.4 - BRUKL Reports (Be Green)



Compliance with England Building Regulations Part L 2021

Project name

Block F - Office - Be Green

As designed

Date: Wed Aug 09 12:19:55 2023

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache Calculation engine version: 7.0.22

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.22

BRUKL compliance module version: v6.1.e.1

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Foundation area [m²]: 24.15

The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m ² :annum	12.4		
Building CO ₂ emission rate (BER), kgCO ₂ /m ² :annum	9.26		
Target primary energy rate (TPER), kWh _{PE} /m²:annum	73.19		
Building primary energy rate (BPER), kWh _{PE} /m ² :annum	54.85		
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-Limit}	Ua-Calc	Ui-Calc	First surface with maximum value
Walls*	0.26	0.14	0.14	09000001:Surf[2]
Floors	0.18	0.1	0.1	09000001:Surf[3]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	-	-	No flat roofs in building
Windows** and roof windows	1.6	0.8	0.8	09000001:Surf[0]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	0.8	0.8	09000001:Surf[1]
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-Limit} = Limiting area-weighted average U-values [W/(m²	K)]	•	U i-Calc = Ca	alculated maximum individual element U-values [W/(m²K)]

U_{a-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.

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	2.5

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- System HN

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(I/s)]	HR efficiency
This system	1	3.92	0	1.1	0.85
Standard value	N/A	N/A	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system YES					
^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.					

"No HWS in project, or hot water is provided by HVAC system"

1- District heating network

	Emission factor [kgCO ₂ /kWh]	Primary energy factor [kWh _{PE} /kWh]
This building	0.273	1.356
Standard value	0.35	N/A

Zone-level mechanical ventilation, exhaust, and terminal units

	ne level mediamon ventilation, exhaust, and terminal anti-
ID	System type in the Approved Documents
Α	Local supply or extract ventilation units
В	Zonal supply system where the fan is remote from the zone
С	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
Н	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter
NB: L	Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

Zone name ID of system type		SFP [W/(I/s)]							UD efficiences		
		A B C D E F		G H		ı	HR efficiency				
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
BF-04 Marketing Suite	-	-	-	-	-	-	-	0.3	-	-	N/A
Closing room	-	-	-	-	-	-	-	0.3	-	-	N/A
WC	-	-	-	-	-	-	-	0.3	-	-	N/A
Kitchennette	-	-	-	-	-	-	-	0.3	-	-	N/A
WC ACC.	-	-	-	-	-	-	-	0.3	-	-	N/A
WC	-	-	-	-	-	-	-	0.3	-	-	N/A
Cafe Offering	-	-	-	-	-	-	-	0.3	-	-	N/A
BF04 Marketing Suite	-	-	-	-	-	-	-	0.3	-	-	N/A
Shower	-	-	-	-	-	-	-	0.3	-	-	N/A
Shower lobby	-	-	-	-	-	-	-	0.3	-	-	N/A
Resident Offices	-	-	-	-	-	-	-	0.3	-	-	N/A

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^{***} Values for rooflights refer to the horizontal position. ** Display windows and similar glazing are excluded from the U-value check.

[^] For fire doors, limiting U-value is 1.8 W/m2K

General lighting and display lighting	General luminaire	Displa	y light source
Zone name	Efficacy [lm/W]	Efficacy [Im/W]	Power density [W/m²]
Standard value	95	80	0.3
BF-04 Marketing Suite	125	-	•
Closing room	125	-	-
WC	125	-	-
Kitchennette	125	-	-
WC ACC.	125	-	-
WC	125	-	-
Cafe Offering	125	-	-
BF04 Marketing Suite	125	-	-
Shower	125	-	-
Shower lobby	125	-	-
Resident Offices	125	-	-

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?
BF-04 Marketing Suite	NO (-14%)	NO
Closing room	N/A	N/A
WC	N/A	N/A
Kitchennette	N/A	N/A
WC ACC.	N/A	N/A
WC	N/A	N/A
Cafe Offering	YES (+32.7%)	NO
BF04 Marketing Suite	NO (-2.7%)	NO
Shower	N/A	N/A
Shower lobby	N/A	N/A
Resident Offices	NO (-36.1%)	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?	NO
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m²]	289.8	289.8
External area [m²]	490.3	490.3
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	147.81	187.97
Average U-value [W/m²K]	0.3	0.38
Alpha value* [%]	9.99	10

^{*} Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

o Aica	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways

0 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/m²]

	Actual	Notional
Heating	9.63	18.16
Cooling	7.04	2.1
Auxiliary	9.78	11.58
Lighting	3.88	8.47
Hot water	19.01	24.4
Equipment*	35.73	35.73
TOTAL**	49.33	64.71

^{*} 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/m²]

	Actual	Notional
Photovoltaic systems	10.06	2.74
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	10.06	2.74

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	113.41	94.12
Primary energy [kWh _{PE} /m ²]	54.85	73.19
Total emissions [kg/m²]	9.26	12.4

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H	HVAC Systems Performance										
System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2		Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Fan coil s	ystems, [HS	S] District h	eating, [HF	T] District I	leating, [CF	T] Electrici	ity			
	Actual	31.1	82.3	9.6	7	9.8	0.9	3.25	1	3.92	
	Notional	59.2	34.9	18.2	2.1	8.9	0.91	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 efficient

= 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

= Heat source = Heating fuel type HS HFT CFT = Cooling fuel type

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Compliance with England Building Regulations Part L 2021

Project name

Block F - Resi Areas - Be Green

As designed

Date: Fri Aug 04 17:17:56 2023

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache Calculation engine version: 7.0.22

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.22 BRUKL compliance module version: v6.1.e.1

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Foundation area [m²]: 5.81

The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m ² annum	7.74			
Building CO ₂ emission rate (BER), kgCO ₂ /m ² :annum	3.91			
Target primary energy rate (TPER), kWh _{PE} /m²annum	60.88			
Building primary energy rate (BPER), kWh _{PE} /m²annum	33.15			
Do the building's emission and primary energy rates exceed the targets?	BER =< TER BPER =< TPE			

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	U _{a-Limit}	U _{a-Calc}	U _{i-Calc}	First surface with maximum value			
Walls*	0.26	0.14	0.14	0900000E:Surf[1]			
Floors	0.18	0.1	0.1	0900000E:Surf[0]			
Pitched roofs	0.16	-	-	No pitched roofs in building			
Flat roofs	0.18	-	-	No flat roofs in building			
Windows** and roof windows	1.6	-	-	No windows, galzed doors, or roof windows in bui	ıildin		
Rooflights***	2.2	-	-	No roof lights in building			
Personnel doors^	1.6	1	1	0900000E:Surf[3]			
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-Limit} = Limiting area-weighted average U-values [W/(m ²			Ui-Calc = Ca	alculated maximum individual element U-values [W/(m²K)]			

U_{a-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.

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
m³/(h.m²) at 50 Pa	8	2.5

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- System HN

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(I/s)]	HR efficiency				
This system	1	3.92	0	1.1	0.85				
Standard value	N/A	N/A	N/A	2^	N/A				
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system YES									
^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.									

"No HWS in project, or hot water is provided by HVAC system"

1- District heating network

	Emission factor [kgCO ₂ /kWh]	Primary energy factor [kWh _{PE} /kWh]
This building	0.273	1.356
Standard value	0.35	N/A

Zone-level mechanical ventilation, exhaust, and terminal units

	Zone level mediamon ventilation, exhaust, and terminal ante							
ID	System type in the Approved Documents							
Α	Local supply or extract ventilation units							
В	Zonal supply system where the fan is remote from the zone							
С	Zonal extract system where the fan is remote from the zone							
D	Zonal balanced supply and extract ventilation system							
Е	Local balanced supply and extract ventilation units							
F	Other local ventilation units							
G	Fan assisted terminal variable air volume units							
Н	Fan coil units							
I	Kitchen extract with the fan remote from the zone and a grease filter							
NB: L	imiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.							

Zone name		SFP [W/(I/s)]								IID officion ou		
	ID of system type	Α	В	С	D	E	F	G	Н	ı	HR efficiency	
	Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
Circulation		-	-	-	-	-	-	-	0.3	-	-	N/A
Parcel		-	-	-	-	-	-	-	0.3	-	-	N/A
Security room		-	-	-	-	-	-	-	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	
Circulation	125	-	-	
Parcel	125	-	-	
Security room	125	-	-	

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^{***} Values for rooflights refer to the horizontal position. ** Display windows and similar glazing are excluded from the U-value check.

[^] For fire doors, limiting U-value is 1.8 W/m2K

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?	
Circulation	N/A	N/A	
Parcel	N/A	N/A	
Security room	N/A	N/A	

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?			
Is evidence of such assessment available as a separate submission?	NO		
Are any such measures included in the proposed design?	YES		

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m²]	69.7	69.7
External area [m²]	118.3	118.3
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	18.52	41.81
Average U-value [W/m²K]	0.16	0.35
Alpha value* [%]	10	10

^{*} Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area Building Type 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/m²]

	Actual	Notional
Heating	4.67	15.17
Cooling	3.9	3.25
Auxiliary	11.65	16.45
Lighting	12.62	12.88
Hot water	1.1	1.07
Equipment*	39.86	39.86
TOTAL**	33.94	48.83

^{*} 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/m²]

	Actual	Notional
Photovoltaic systems	11.5	2.74
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	11.5	2.74

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	60.62	103.72
Primary energy [kWh _{PE} /m ²]	33.15	60.88
Total emissions [kg/m ²]	3.91	7.74

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ŀ	HVAC Systems Performance									
System Type		Heat dem MJ/m2	Cool dem MJ/m2			Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Fan coil s	ystems, [HS	6] District h	eating, [HF	T] District I	leating, [CF	T] Electric	ity		
	Actual	15.1	45.6	4.7	3.9	11.7	0.9	3.25	1	3.92
	Notional	49.5	54.3	15.2	3.3	16.4	0.91	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 efficient

= 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

= Heat source = Heating fuel type HS HFT CFT = Cooling fuel type

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Compliance with England Building Regulations Part L 2021

Project name

Block F - Retail - Be Green

As designed

Date: Wed Aug 09 13:38:48 2023

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache
Calculation engine version: 7.0.22

Interface to calculation engine: IES Virtual Environment

U i-calc = Calculated maximum individual element U-values [W/(m²K)]

Interface to calculation engine version: 7.0.22

BRUKL compliance module version: v6.1.e.1

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Foundation area [m²]: 16.1

BER =< TER | BPER =< TPER

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The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO₂ emission rate (TER), kgCO₂/m²annum 7.81 Building CO₂ emission rate (BER), kgCO₂/m²annum 5.56 Target primary energy rate (TPER), kWh₂e/m²annum 58.21 Building primary energy rate (BPER), kWh₂e/m²annum 42.63

The performance of the building fabric and fixed building services should achieve

Do the building's emission and primary energy rates exceed the targets?

reasonable overall standards of energy efficiency

Fabric element	U _{a-Limit}	Ua-Calc	Ui-Calc	First surface with maximum value
Walls*	0.26	0.14	0.14	09000000:Surf[2]
Floors	0.18	0.1	0.1	09000000:Surf[3]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	-	-	No flat roofs in building
Windows** and roof windows	1.6	0.8	0.8	09000000:Surf[0]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors [^]	1.6	0.8	0.8	09000000:Surf[1]
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-Limit} = Limiting area-weighted average U-values [W/(m²K)]

U_{a-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	2.5

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- System HN

· Gyotom · m ·						
	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(I/s)]	HR efficiency	
This system	1	3.92	0	1.1	0.85	
Standard value	N/A	N/A	N/A	2^	N/A	
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system YES						
^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.						

"No HWS in project, or hot water is provided by HVAC system"

1- District heating network

	Emission factor [kgCO ₂ /kWh]	Primary energy factor [kWh _{PE} /kWh]
This building	0.273	1.356
Standard value	0.35	N/A

Zone-level mechanical ventilation, exhaust, and terminal units

	no lovoi moonamoai voittiation, oxilatiot, ana torriniai amto
ID	System type in the Approved Documents
Α	Local supply or extract ventilation units
В	Zonal supply system where the fan is remote from the zone
С	Zonal extract system where the fan is remote from the zone
D	Zonal balanced supply and extract ventilation system
Е	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
Н	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter
NB: L	Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

Zone name			SFP [W/(I/s)]							UD officionav		
	ID of system type	Α	В	С	D	E	F	G	Н	I	HR efficiency	
	Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
BF02 Retail		-	-	-	-	-	-	-	0.3	-	-	N/A
BF01 Retail		-	-	-	-	-	-	-	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		
BF02 Retail	125	100	1.2		
BF01 Retail	125	100	1.2		

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?
BF02 Retail	YES (+6.6%)	NO

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Zone	Solar gain limit exceeded? (%)	Internal blinds used?
BF01 Retail	NO (-10.2%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?					
Is evidence of such assessment available as a separate submission?	NO				
Are any such measures included in the proposed design?	YES				

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m²]	193.2	193.2
External area [m²]	354.3	354.3
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	117.8	145.75
Average U-value [W/m²K]	0.33	0.41
Alpha value* [%]	9.99	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/m²]

	Actual	Notional
Heating	9.41	16.55
Cooling	8.58	2.36
Auxiliary	13.44	12.26
Lighting	6.13	14.5
Hot water	1.93	1.87
Equipment*	20.25	20.25
TOTAL**	39.49	47.55

^{*} 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/m²]

	Actual	Notional
Photovoltaic systems	10.04	2.74
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	10.04	2.74

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	130.74	93.29
Primary energy [kWh _{PE} /m ²]	42.63	58.21
Total emissions [kg/m²]	5.56	7.81

Page 3 of 5

H	HVAC Systems Performance									
Sys	System Type Heat dem MJ/m2 Cool dem Heat con kWh/m2 kWh/m2 kWh/m2 Heat Cool SEEF SEER SEEF SEER								Cool gen SEER	
[ST] Fan coil s	ystems, [HS	S] District h	eating, [HF	T] District I	leating, [CF	T] Electric	ity		
	Actual	30.4	100.4	9.4	8.6	13.4	0.9	3.25	1	3.92
	Notional	53.9	39.4	16.5	2.4	12.3	0.91	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 efficient

= 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

= Heat source = Heating fuel type HS HFT CFT = Cooling fuel type

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Compliance with England Building Regulations Part L 2021

Project name

Block H - retail - Be Green

As built

Date: Wed Aug 09 14:04:20 2023

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache Calculation engine version: 7.0.22

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.22 BRUKL compliance module version: v6.1.e.1

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Foundation area [m²]: 101.2

The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m ² annum	9.14	
Building CO ₂ emission rate (BER), kgCO ₂ /m ² :annum	5.97	
Target primary energy rate (TPER), kWh _{PE} /m²annum	67.15	
Building primary energy rate (BPER), kWh _{PE} /m²annum	47.77	
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-Limit}	U _{a-Calc}	Ui-Calc	First surface with maximum value
Walls*	0.26	0.14	0.14	BL000003:Surf[5]
Floors	0.18	0.1	0.1	BL000003:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	-	-	No flat roofs in building
Windows** and roof windows	1.6	0.8	0.8	BL000003:Surf[1]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	0.8	0.8	BL000003:Surf[3]
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-Limit} = Limiting area-weighted average U-values [W/(m ²	K)]	•	U i-Calc = Ca	alculated maximum individual element U-values [W/(m²K)]

U_{a-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.

^ 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	2.5

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- system

,						
	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(I/s)]	HR efficiency	
This system	1	3.92	0	1.1	0.85	
Standard value	N/A	N/A	N/A	2^	N/A	
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system YES						
^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.						

"No HWS in project, or hot water is provided by HVAC system"

1- District heating network

	Emission factor [kgCO ₂ /kWh]	Primary energy factor [kWh _{PE} /kWh]
This building	0.273	1.356
Standard value	0.35	N/A

Zone-level mechanical ventilation, exhaust, and terminal units

	Zono level modification, exhaust, and terminal ante				
ID	System type in the Approved Documents				
Α	Local supply or extract ventilation units				
В	Zonal supply system where the fan is remote from the zone				
С	Zonal extract system where the fan is remote from the zone				
D	Zonal balanced supply and extract ventilation system				
Е	Local balanced supply and extract ventilation units				
F	Other local ventilation units				
G	Fan assisted terminal variable air volume units				
Н	Fan coil units				
I	Kitchen extract with the fan remote from the zone and a grease filter				
NB: L	imiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.				

Zone name		SFP [W/(I/s)]								LID efficience		
ID of system type	Α	В	С	D	E	F	G	Н	ı	HR efficiency		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard	
RETAIL BH3 - 01	-	-	-	-	-	-	-	0.3	-	-	N/A	
RETAIL BH3 - 02	-	-	-	-	-	-	-	0.3	-	-	N/A	
RETAIL BH3 - 03	-	-	-	-	-	-	-	0.3	-	-	N/A	
RETAIL BH3 - 04	-	-	-	-	-	-	-	0.3	-	-	N/A	
RETAIL BH2 - 01	-	-	-	-	-	-	-	0.3	-	-	N/A	
RETAIL BH2 - 02	-	-	-	-	-	-	-	0.3	-	-	N/A	
RETAIL BH2 - 03	-	-	-	-	-	-	-	0.3	-	-	N/A	
RETAIL BH2 - 04	-	-	-	-	-	-	-	0.3	-	-	N/A	
RETAIL BH2 - 05	-	-	-	-	-	-	-	0.3	-	-	N/A	
RETAIL BH2 - 06	-	-	-	-	-	-	-	0.3	-	-	N/A	
RETAIL BH2 - 06	-	-	-	-	-	-	-	0.3	-	-	N/A	
RETAIL BH2 - 05	-	-	-	-	-	-	-	0.3	-	-	N/A	
RETAIL BH2 - 04	-	-	l -	T -	-	-	-	0.3	l _	_	N/A	

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^{**} Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position.

Zone name		SFP [W/(I/s)]				UD efficiency					
ID of system type	Α	В	С	D	E	F	G	Н	1	HR efficiency	
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
RETAIL BH2 - 01	-	-	-	-	-	-	-	0.3	-	-	N/A
RETAIL BH2 - 03	-	-	-	-	-	-	-	0.3	-	-	N/A
RETAIL BH2 - 02	-	-	-	-	-	-	-	0.3	-	-	N/A
RETAIL BOH	-	-	-	-	-	-	-	0.3	-	-	N/A
WC & SHOWER	-	-	-	-	-	-	-	0.3	-	-	N/A

General lighting and display lighting	General luminaire	Displa	y light source
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	
Standard value	95	80	0.3
RETAIL BH3 - 01	125	100	1.5
RETAIL BH3 - 02	125	100	1.5
RETAIL BH3 - 03	125	100	1.5
RETAIL BH3 - 04	125	100	1.5
RETAIL BH2 - 01	125	100	1.5
RETAIL BH2 - 02	125	100	1.5
RETAIL BH2 - 03	125	100	1.5
RETAIL BH2 - 04	125	100	1.5
RETAIL BH2 - 05	125	100	1.5
RETAIL BH2 - 06	125	100	1.5
RETAIL BH2 - 06	125	100	1.5
RETAIL BH2 - 05	125	100	1.5
RETAIL BH2 - 04	125	100	1.5
RETAIL BH2 - 01	125	100	1.5
RETAIL BH2 - 03	125	100	1.5
RETAIL BH2 - 02	125	100	1.5
RETAIL BOH	125	-	-
WC & SHOWER	125	-	-

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?
RETAIL BH3 - 01	NO (-62%)	NO
RETAIL BH3 - 02	NO (-52.4%)	NO
RETAIL BH3 - 03	NO (-44.3%)	NO
RETAIL BH3 - 04	NO (-47.5%)	NO
RETAIL BH2 - 01	NO (-43.9%)	NO
RETAIL BH2 - 02	NO (-14.3%)	NO
RETAIL BH2 - 03	NO (-23.2%)	NO
RETAIL BH2 - 04	NO (-48.4%)	NO
RETAIL BH2 - 05	YES (+14.3%)	NO
RETAIL BH2 - 06	NO (-31.9%)	NO
RETAIL BH2 - 06	NO (-31.9%)	NO
RETAIL BH2 - 05	NO (-9.6%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
RETAIL BH2 - 04	NO (-37.3%)	NO
RETAIL BH2 - 01	NO (-43.9%)	NO
RETAIL BH2 - 03	NO (-25.7%)	NO
RETAIL BH2 - 02	NO (-14.6%)	NO
RETAIL BOH	NO (-52.1%)	NO
WC & SHOWER	N/A	N/A

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?	NO
Are any such measures included in the proposed design?	YES

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Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

Building Use

	Actual	Notional
Floor area [m²]	809.6	809.6
External area [m ²]	1526.3	1526.3
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	431.71	620.95
Average U-value [W/m²K]	0.28	0.41
Alpha value* [%]	9.99	10

^{*} Percentage of the building's average heat transfer coefficient which is due to thermal bridging

% Ar	ea Building Type
100	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
	Offices and Warkshap Pusingsons

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/m²]

	Actual	Notional
Heating	8.84	18.04
Cooling	6.89	2.73
Auxiliary	12.49	12.94
Lighting	9.4	15.63
Hot water	2.04	1.99
Equipment*	28.87	28.87
TOTAL**	39.66	51.32

^{*} 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/m²]

	Actual	Notional
Photovoltaic systems	6.87	4.11
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	6.87	4.11

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	108.89	104.27
Primary energy [kWh _{PE} /m ²]	47.77	67.15
Total emissions [kg/m²]	5.97	9.14

ŀ	HVAC Systems Performance									
Sys	stem 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	[ST] Fan coil systems, [HS] District heating, [HFT] District Heating, [CFT] Electricity									
	Actual	28.5	80.4	8.8	6.9	12.5	0.89	3.24	1	3.92
	Notional	58.8	45.5	18	2.7	12.9	0.91	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

= Heating system seasonal efficiency (for notional building, value depends on activity glazing class) Heat SSEFF

Cool SSEER = Cooling system seasonal energy efficiency ratio

Heat gen SSEFF = Heating generator seasonal efficiency

Cool gen SSEER = Cooling generator seasonal energy efficiency ratio

= System type HS = Heat source HFT = Heating fuel type CFT = Cooling fuel type

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Compliance with England Building Regulations Part L 2021

Project name

Block I - Resi Areas - Be Green

As built

Date: Fri Aug 04 17:55:56 2023

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache Calculation engine version: 7.0.22

Interface to calculation engine: IES Virtual Environment Interface to calculation engine version: 7.0.22

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

BRUKL compliance module version: v6.1.e.1

U i-calc = Calculated maximum individual element U-values [W/(m²K)]

Foundation area [m²]: 9.7

The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m ² annum	12.67
Building CO₂ emission rate (BER), kgCO₂/m²annum	9.94
Target primary energy rate (TPER), kWhpe/m²annum	137.2
Building primary energy rate (BPER), kWh _{PE} /m²annum	107.73
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-Limit}	Ua-Calc	Ui-Calc	First surface with maximum value
Walls*	0.26	0.14	0.14	GF000000:Surf[3]
Floors	0.18	0.1	0.1	GF000000:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	-	-	No flat roofs in building
Windows** and roof windows	1.6	1.4	1.4	GF000000: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

 $U_{a-Limit} = Limiting area-weighted average U-values [W/(m²K)]$

U_{a-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.

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	2.5

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- Heat Pump (no cooling)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(I/s)]	HR efficiency		
This system	3.1	-	0.2	1.1	0.85		
Standard value	2.5*	N/A	N/A	1.9^	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.

1- Heat Pump (Hot water)

	Water heating efficiency	Storage loss factor [kWh/litre per day]			
This building	3.1	-			
Standard value	1	N/A			

[&]quot;No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

General lighting and display lighting	General luminaire	Displa	y light source
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
Lobby	125	-	-
Parcel	125	-	-
Resi Amenity	125	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?	
Resi Amenity	NO (-24.1%)	NO	

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?		
Is evidence of such assessment available as a separate submission?	NO	
Are any such measures included in the proposed design?	NO	

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^{***} Values for rooflights refer to the horizontal position. ** Display windows and similar glazing are excluded from the U-value check.

[^] For fire doors, limiting U-value is 1.8 W/m2K

Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m ²]	106.7	106.7
External area [m²]	213.3	213.3
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	71	82.93
Average U-value [W/m²K]	0.33	0.39
Alpha value* [%]	10	10

^{*} Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area

l	Building Type
	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

100 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/m²]

	Actual	Notional
Heating	3.24	4.95
Cooling	0	0
Auxiliary	11.81	19.81
Lighting	11.52	15.43
Hot water	44.4	52.48
Equipment*	62.2	62.2
TOTAL**	70.98	92.68

^{*} 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/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	38.48	49.56
Primary energy [kWh _{PE} /m ²]	107.73	137.2
Total emissions [kg/m²]	9.94	12.67

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] Central heating using air distribution, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	38.5	0	3.2	0	11.8	3.3	0	3.1	0
	Notional	49.6	0	5	0	11.8	2.78	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

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HARCA

POPLAR BUSIN



ABERFELDY VILLAGE MASTERPLAN