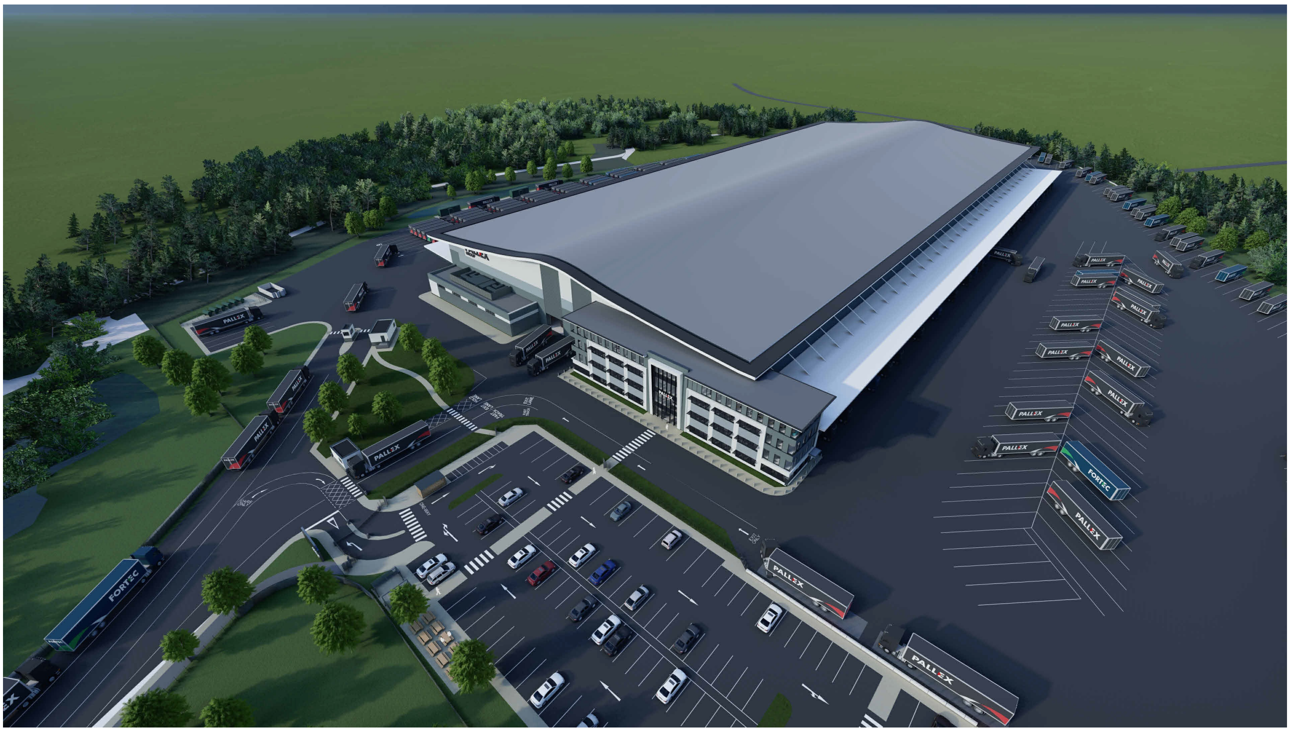
ENE 04- Passive Design Analysis Report

Excellence, Land at Wiggs Farm, Station Road, Coalville, Leicestershire



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PE 2504
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Alex.H.M

EXECUTIVE SUMMARY

The Passive Design Analysis presented in this report pertains to industrial development of Excellence, Land at Wiggs Farm, Station Road, Coalville, Leicestershire and evaluates the development in accordance with ENE 04 and BREEAM New Construction 2018 standards.

This analysis was conducted utilizing IES Virtual Environment version 2023.5.2.0, specifically ApacheSim version 7.0.26.0, which is recognized by the government as compliant with CIBSE AM11 guidelines for Building Energy and Environmental Modelling. The energy modelling was performed using a dynamic simulation model equipped with advanced features for Heating, Ventilation, and Air Conditioning (HVAC) systems and controls.

The findings indicate that the effective application of passive design strategies significantly improves energy efficiency and minimizes environmental impact. This was achieved through the use of high-performance building materials that offer enhanced insulation and the incorporation of external shading devices. The results are detailed in Table 1.

Table 1. Passive Design achievements

	Reduction	**Reduction (%)**
Total CO_2 emissions reduction per year (kg CO_2/m^2)	0.22	14.3%
Primary Energy (kWh_{PE}/m^2)	2.12	12.8%
Total regulated energy consumption reduction (kWh/m^2)	1.35	12.1%

This analysis has addressed key passive design factors, including: –

Site Location

The site, situated next to the Wood Road and B585 in Nailstone, was assessed for its accessibility and integration within the surrounding environment. The orientation and positioning of the unit have been optimized to harmonize with the site's natural features.

Site Weather

An analysis of local climatic factors, including temperature variations, solar exposure, and dominant wind patterns, was conducted to guide decisions on insulation, shading, and ventilation approaches.

Building Layout and Form

The design of the development, compact and functional, effectively minimizing thermal losses through its envelope. The strategic arrangement of auxiliary spaces enhances operational efficiency.

Daylighting and Ventilation Strategy

The incorporation of rooflights, expansive glazed areas, and brise-soleil improves natural daylighting, thereby decreasing the need for artificial lighting. Additionally, mechanical ventilation systems are in place to maintain high indoor air quality.

Thermal Mass

Concrete floor slabs and medium-density materials have been employed to help stabilize internal temperatures, thereby lessening the dependence on mechanical heating and cooling systems.

Adaptation to Climate Change

Features such as solar control glazing and insulated façades are implemented to ensure long-term resilience against temperature variations and increased rainfall.

The passive design strategies for the scheme aims to reduce energy consumption and carbon emissions, while also providing a strong response to the specific environmental conditions of the site. This approach not only meets sustainability goals but also establishes the development as a standard for energy-efficient industrial design.

Contents

1 INTRODUCTION

D.W. Pointer has been commissioned by Barberry Bardon Limited to evaluate the anticipated operational energy consumption of the proposed project known as Excellence, Land at Wiggs Farm, Station Road, Coalville, Leicestershire. The assessment will be conducted in accordance with BREEAM New Construction Version 6, specifically focusing on ENE04, which pertains to Passive Design (Low Carbon Design). This analysis aims to determine how the development can meet the BREEAM ENE04 standards and the potential credits that can be obtained in this category.

2 Scheme Overview

The information provided indicates that the project entails the construction of an industrial warehouse Excellence, Land at Wiggs Farm, Station Road, Coalville, Leicestershire. The total area of the development is 34,780 m^2 and is intended to serve multiple purposes, including:

- Warehousing space: This is the primary function of the building, featuring a substantial floor area dedicated to storage.
- Offices: Positioned on the ground, first, second and third floors to facilitate administrative and operational activities. - Restroom and kitchenette facilities: These amenities are designed to support the staff working within the unit.
- QC office with 164 m^2 located in south-west of the site.
- The immediate vicinity of the site is depicted in the accompanying plan. (See: Appendix 1, Figure 1.)

3 BREEAM ENE04 – PASSIVE DESIGN

This feasibility study has been initiated to fulfil the requirements of the BREEAM New Construction Version 6 assessment concerning the Ene04 credit for 'Passive Design.'

Passive Design Credit

The BREEAM Ene 04 credit for 'Passive Design' outlines the following requirements:

1. To obtain the first credit under Hea04 Thermal Comfort: - Conduct thermal modelling to demonstrate that the building design achieves suitable thermal comfort levels in occupied areas. This investigation will be carried out later during Cat B of the design.

2. The project team will evaluate the proposed building design and development during the Concept Design phase to identify potential opportunities for incorporating passive design strategies.

3. Implement passive design strategies aimed at minimizing total heating, cooling, mechanical ventilation, lighting loads, and overall energy consumption, in accordance with the findings of the passive design analysis. (See section 3.0 of this report.)

4. Measure the reduction in total energy demand (kWh/m^2) and carbon dioxide emissions ($kgCO_2/m^2$) resulting from the adopted passive design strategies. (Refer to Table 2.)

4 ANALYSIS & RESULTS

The development is situated in the northwest area of Leicester, next to Wood Road and B 585 which offers convenient access to key transportation routes.

This area is characterized by a temperate maritime climate, exhibiting moderate temperature fluctuations throughout the year. The location benefits from prevailing winds that enhance natural ventilation, and the absence of significant obstructions allows for optimal access to natural light and airflow.

Temperature ranges at the site vary from −4°C to 31.3°C, with an average of 10.84°C, as illustrated in Figure 1, accommodating both winter and summer conditions. Rainfall is consistently distributed across the year, averaging between 700 and 800 mm annually, as shown in Figure 2. These climatic factors play a crucial role in shaping strategies for natural ventilation, solar control, and thermal insulation, thereby enhancing energy efficiency throughout the year.

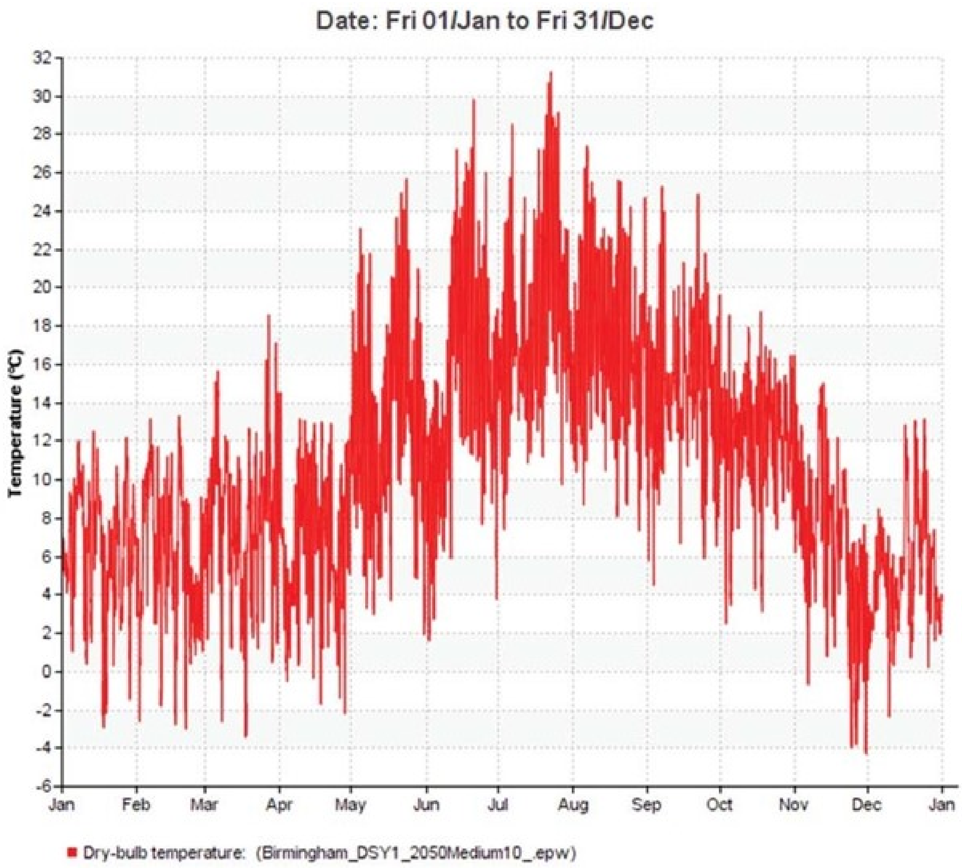


Figure 1. Annual Site Dry Bulb Temperatures

The total annual direct solar radiation measures 974.21 kWh/m2, while the diffuse solar radiation is recorded at 597.25 kWh/m2, with the highest levels of direct solar radiation occurring in July, as illustrated in Figure 2. Locations that receive less than 800 kWh/m2 of annual direct solar radiation are categorized in the lower spectrum of the global radiation scale and are typically associated with significant cloud cover.

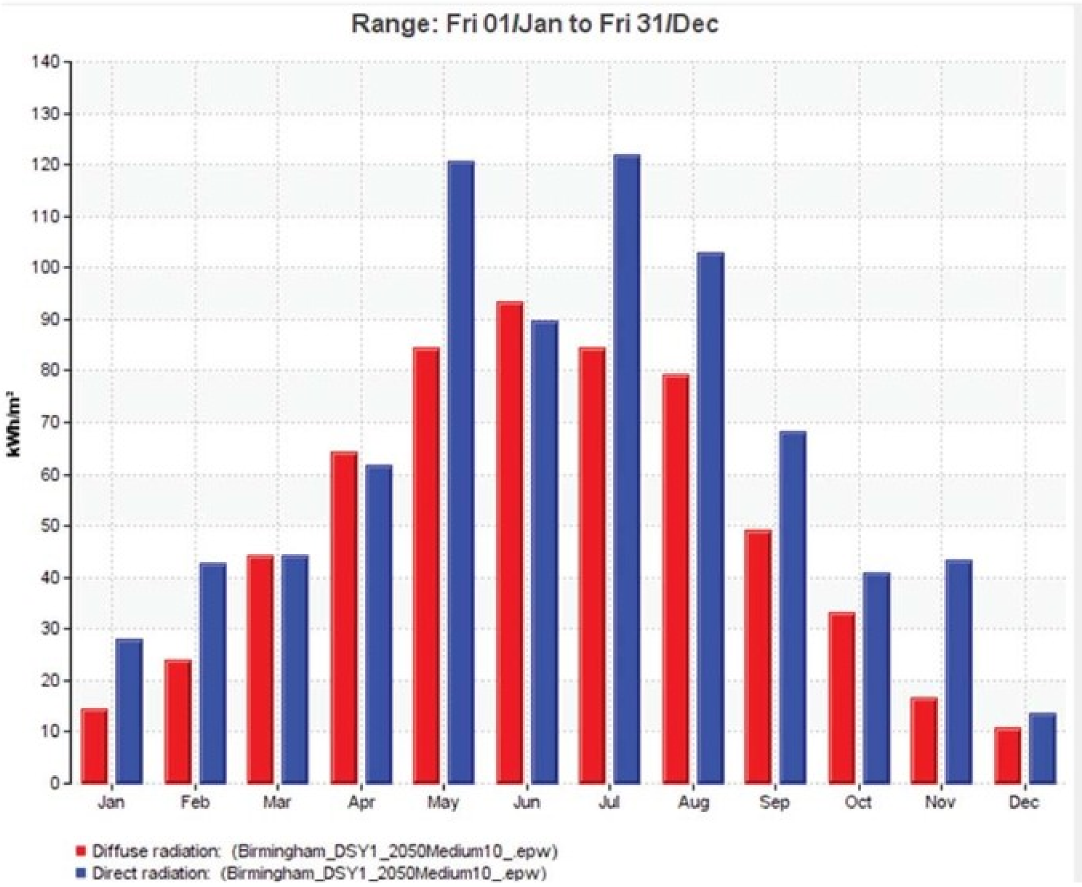


Figure 2. Direct and Diffuse Solar Radiation on Site

Building form and Layout

The proposed development features a warehouse along with offices on the ground, first, second and third floors, as well as plant areas on the second floor and additional support spaces. The site also includes QC office with 164 m^2 area, located in south-west of the site.

The design of the unit's shape and orientation has been carefully crafted to reduce energy consumption and enhance energy efficiency.

Orientation and Office Location

The offices are situated on the ground, first, second and third floors, with the primary office located to the north and north-west. The QC office building is located in south-west of the site. The building's efficient design minimizes exposed surface area, thereby reducing heat gains and losses.

Roof Design with Rooflights

The roof of the building features rooflights that facilitate the entry of natural light into the interior areas. This design minimizes reliance on artificial lighting throughout the day, thereby decreasing energy consumption associated with lighting. The rooflights are engineered to evenly distribute light, preventing glare and maximizing the utilization of sunlight.

Building Shape and Layout

The design of the building emphasizes energy efficiency through its shape and configuration. With a compact four-story structure comprising a ground floor and three upper levels, it minimizes the exterior surface area that is subject to environmental conditions, thereby decreasing both thermal losses and gains via the building envelope. The internal arrangement is strategically designed to enhance natural ventilation, promoting airflow and lessening the reliance on supplementary mechanical climate control systems.

Location and Surroundings

The microclimate in the vicinity of the development is improved due to the absence of nearby structures, facilitating unimpeded natural light and enhancing cross-ventilation. The green landscaping that envelops the site contributes to the reduction of heat islands and effectively manages rainwater runoff, thereby enhancing the thermal comfort of the outdoor space. In terms of orientation towards the north, the unit is designed to optimize natural light while minimizing the risk of overheating. The south-facing facades are kept to a minimum, which helps to lower thermal loads and decrease dependence on cooling systems.

Building Fabric

The design employs a fabric-first strategy, achieving improved U-values and optimal air tightness levels that greatly exceed the standards set by Building Regulations (refer to Table 2). This method effectively minimizes heat loss through the building's fabric.

Table 2. Building Fabrics

	Proposed U-Value W/(m²K)	**Limiting U-Value W/(m²K)**
Office External Walls	0.21W/m²K	0.35W/m²K
Warehouse External Walls	0.24 W/m²K	0.35 W/m²K
Ground Floor	0.15W/m²K	0.25W/m²K
Office Roof	0.15W/m²K	0.25W/m²K
Warehouse Roof	0.18W/m²K	0.25W/m²K
Rooflights	1.3W/m²K (g–value 53% LT 60%)	2.2W/m²K
Windows	1.36W/m²K (g–value 40% LT 60%)	2.2W/m²K
Personnel doors	1.6W/m²K	1.5 – 3.5W/m²K
Air permeability	3 m³/(h.m² @ 50 Pa)	10 m³/(h.m² @ 50 Pa)

The external wall finishes will adhere to the specifications set forth by the engineer, primarily consisting of concrete.

The cladding for the office's external walls (main office and QC office) will be upgraded, utilizing Kingspan or similar composite insulated panels, along with feature cladding as detailed in the drawings. These will be secured with stainless steel fasteners to the required rail system and the structural framework.

Internally, the external walls will be drylined with plasterboard, ensuring compliance with Building Regulations regarding surface spread of flame characteristics. The windows, curtain walling, and external doors will consist of double-glazed units filled with gas. Where necessary, toughened panels will be incorporated, featuring tinted or reflective glass to meet Building Regulation standards.

All toughened glazing will undergo Heat Soak Testing (HST) in accordance with current regulations. The external glazing will predominantly feature clear solar control low emissivity glass. This type of glazing permits sunlight to enter while effectively radiating and reflecting a significant portion of the sun's heat, resulting in a bright and cooler indoor environment.

The high-performance insulation indicated by the U-value figures compensates for the medium thermal capacity of the construction.

Thermal Mass

The design employs a strategic approach to thermal mass, utilizing the inherent properties of essential building materials to control indoor temperatures and improve energy efficiency.

Warehouse Areas

The warehouse facilities feature reinforced concrete floor slabs that offer substantial thermal mass. This dense material captures heat throughout the day, effectively reducing temperature variations resulting from solar exposure or equipment use. At night, the accumulated heat is slowly released, ensuring a more consistent indoor climate. This natural thermal management decreases the dependence on mechanical heating or cooling systems, especially during transitional seasons.

The external walls of the warehouses are constructed with insulated sheet cladding made from lightweight materials, which are engineered to optimize insulation performance while enhancing construction efficiency. Although these materials do not directly add to thermal mass, their superior insulating characteristics complement the concrete floors, contributing to the stability of internal temperatures.

Office Areas

In the office environments, thermal mass is utilized through the incorporation of medium-density materials, such as concrete subfloors and partition walls. These elements are strategically arranged to optimize their exposure to internal heat sources and solar energy. The design facilitates the absorption of solar energy, which enters through full-height double-glazed windows, by the thermal mass during daylight hours, allowing it to re-radiate this heat during the cooler evening periods.

This approach effectively mitigates spikes in cooling requirements during the summer and heating needs in the winter. The roofing structure in the office areas features insulated composite panels that significantly reduce heat loss in the winter while also preventing excessive heat buildup in the summer. This design complements the thermal mass strategy by establishing a well-insulated envelope that improves overall energy efficiency.

Benefits of Thermal Mass

- Temperature Control: The presence of thermal mass helps to smooth out variations in indoor temperatures, fostering a more pleasant atmosphere for residents while also lowering energy usage for Heating, Ventilation, and Air Conditioning (HVAC) systems.
- Daily Thermal Equilibrium: Thermal mass's capacity to store and emit heat throughout a 24-hour period diminishes the dependence on mechanical systems, especially in moderate weather.
- Energy Conservation: By maintaining consistent indoor temperatures, thermal mass aids buildings in meeting energy efficiency standards and enhances the effectiveness of passive design approaches.

Daylight, Ventilation, & Shading Devices

- The new structure is limited to two stories, ensuring it does not overshadow other proposed buildings and is not significantly shaded by adjacent structures or trees.
- The extensive use of glazing and large windows allows for ample natural light, minimizing reliance on artificial lighting.
- Fixed horizontal sun louvres (brise-soleil) are installed on the windows to block direct sunlight, particularly during peak daylight hours, thereby preventing excessive heat accumulation in the rooms. These features are especially effective on south or west-facing facades, as they reduce heat gain while still permitting natural light and views of the outside.
- The installation of clear solar control low-emissivity glazing achieves low g-values, reaching as low as 0.40, which decreases the amount of heat that passes through the glass.
- Rooflights, comprising 10%-15% of the roof area above the main circulation zone, facilitate natural daylight and ventilation in these shared central spaces, thereby reducing the electrical lighting demands as stipulated by the SBEM model.
- The building will utilize mechanical ventilation to ensure adequate airflow in office areas and common spaces, including circulation areas, corridors, and lift lobbies, in compliance with Building Regulations and to maintain high indoor air quality standards.

Adaptation to Climate Change

Climate change will impact various elements of spatial planning and the built environment, particularly concerning the external building envelope. Rising summer temperatures will significantly affect thermal comfort and increase the risk of overheating, resulting in a heightened demand for cooling solutions in buildings, especially in densely populated areas. Additionally, warmer temperatures will create a greater need for urban green spaces, open areas, and enhanced shading. Increased intensity of winter precipitation will influence building facades and internal structures, leading to a higher likelihood of rainwater infiltration around openings. To mitigate these effects, solar control glazing with a high g-value has been selected for the building to minimize heat transfer through the glass. Furthermore, the design incorporates mechanical ventilation heat recovery to address potential noise and pollution concerns while preventing rain penetration.

Measuring the Performance of Passive Design Measures

Any savings achieved through the implementation of passive design strategies should be validated by comparing the energy requirements and CO_2 emissions of the building both with and without the proposed passive design strategies. To establish a baseline for this comparison, a 'standard building' should be modelled to reflect the fabric performance of the notional building as defined by local building regulations, excluding any passive design measures.

This modelling will influence the properties of the building fabric and the areas of glazing. The 'standard building' has been modelled in accordance with the guidelines outlined in the BREEAM manual.

The proposed building features high-performance building fabric, which leads to a significant reduction in primary energy demands by 12.8%, as well as a 12.1% decrease in total regulated energy consumption. Additionally, the CO_2 emissions rate is lowered by 14.3%, as detailed in Table 3. The passive BRUKLs are included in Appendix 2.

Please note that BREEAM New Construction Version 6 requires 2021 Building regulation document.

Table 3. Energy and CO_2 reduction

	Standard Building	Proposed Building	Savings	Percentage Reduction
CO_2 emissions ($kgCO_2/m^2$)	1.54	1.32	0.22	14.3%
Primary Energy (kWh_{PE}/m^2)	16.54	14.42	2.12	12.8%
Total Regulated Energy consumption (kWh/m^2)	11.13	9.78	1.35	12.1%

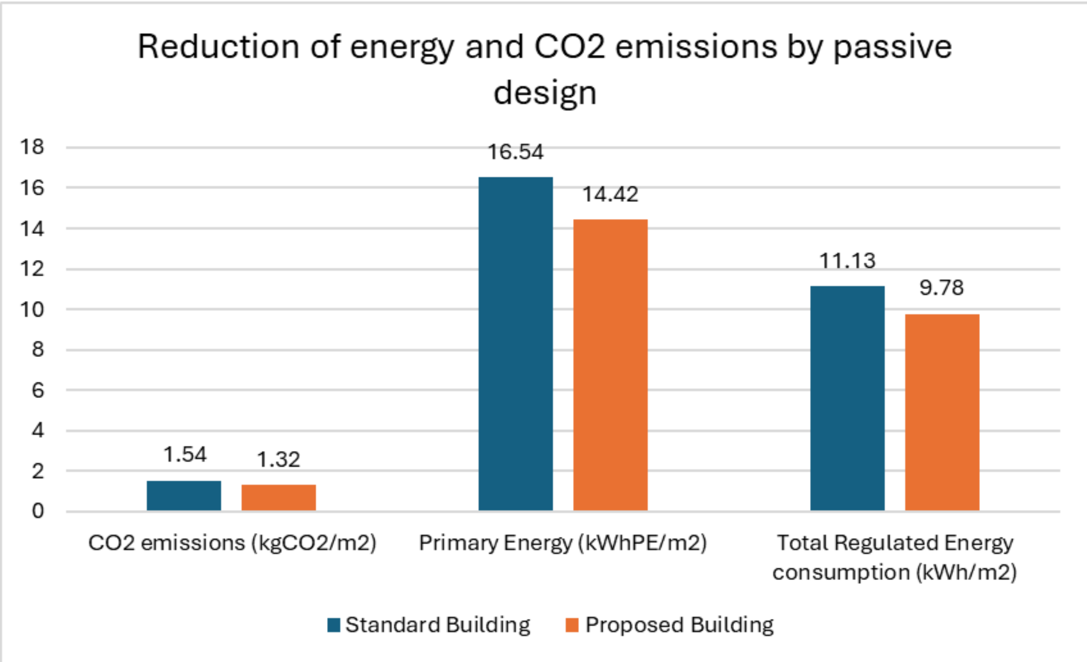
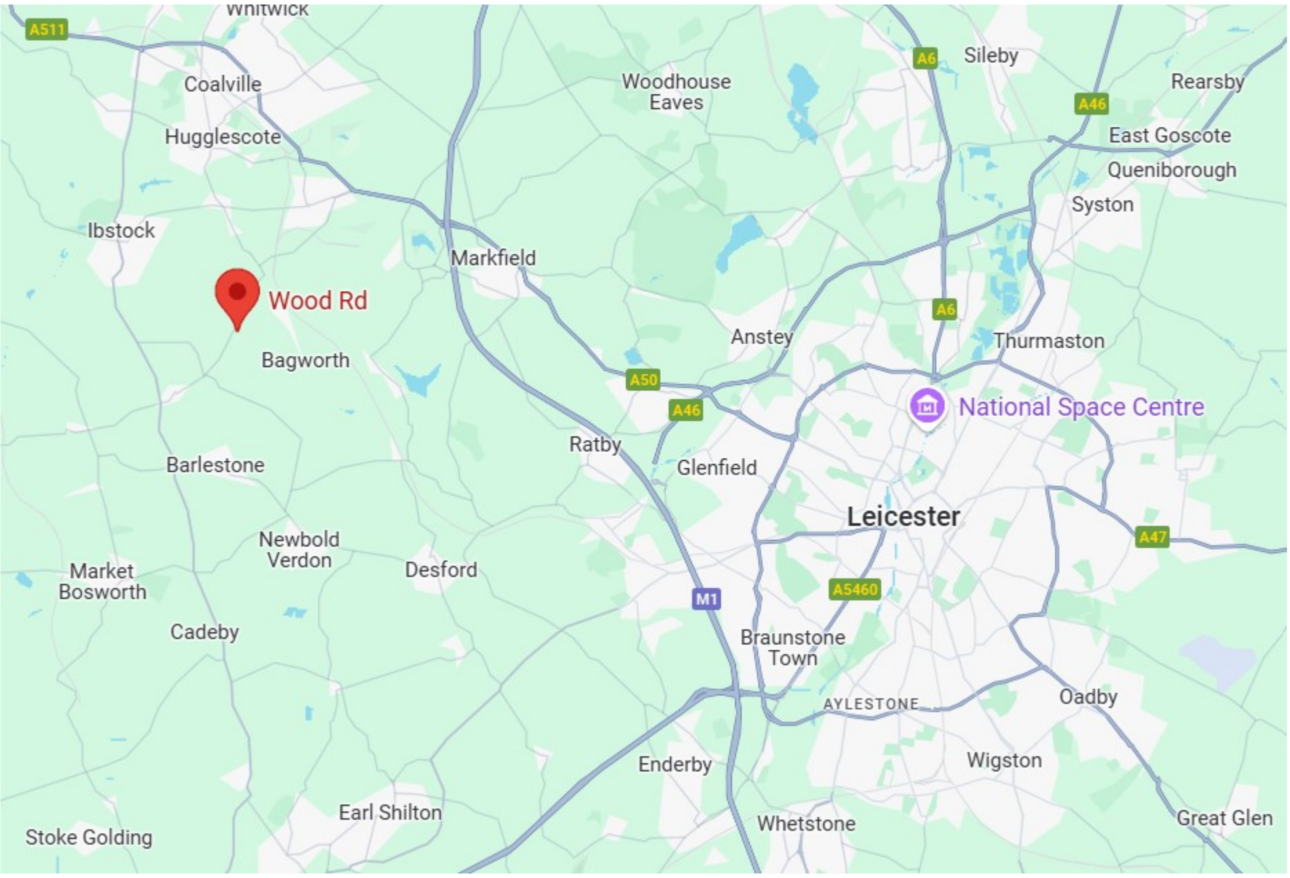


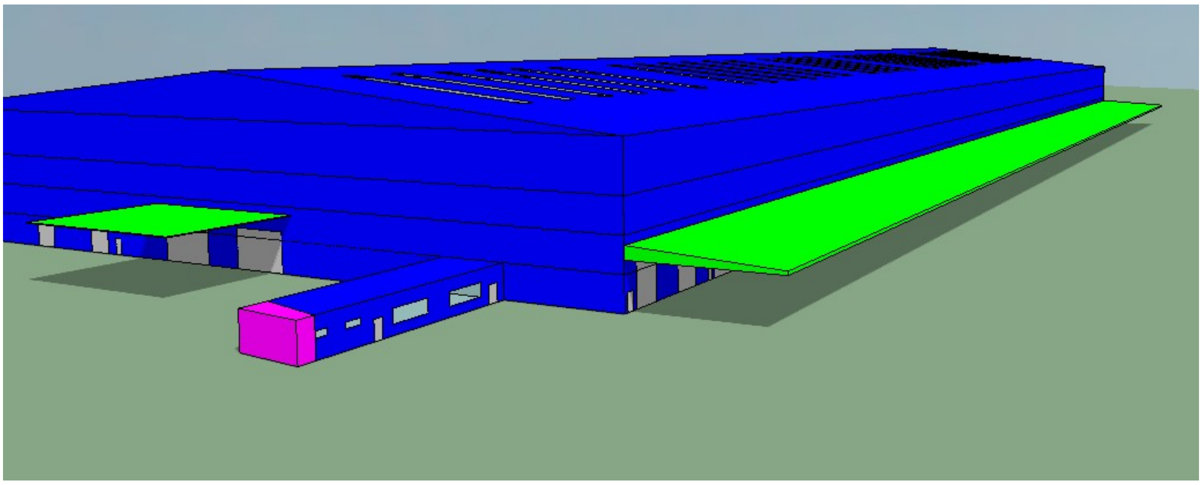
Figure 3. Energy and CO_2 reduction by passive design.

APPENDIX 1: FIGURES and IMAGES

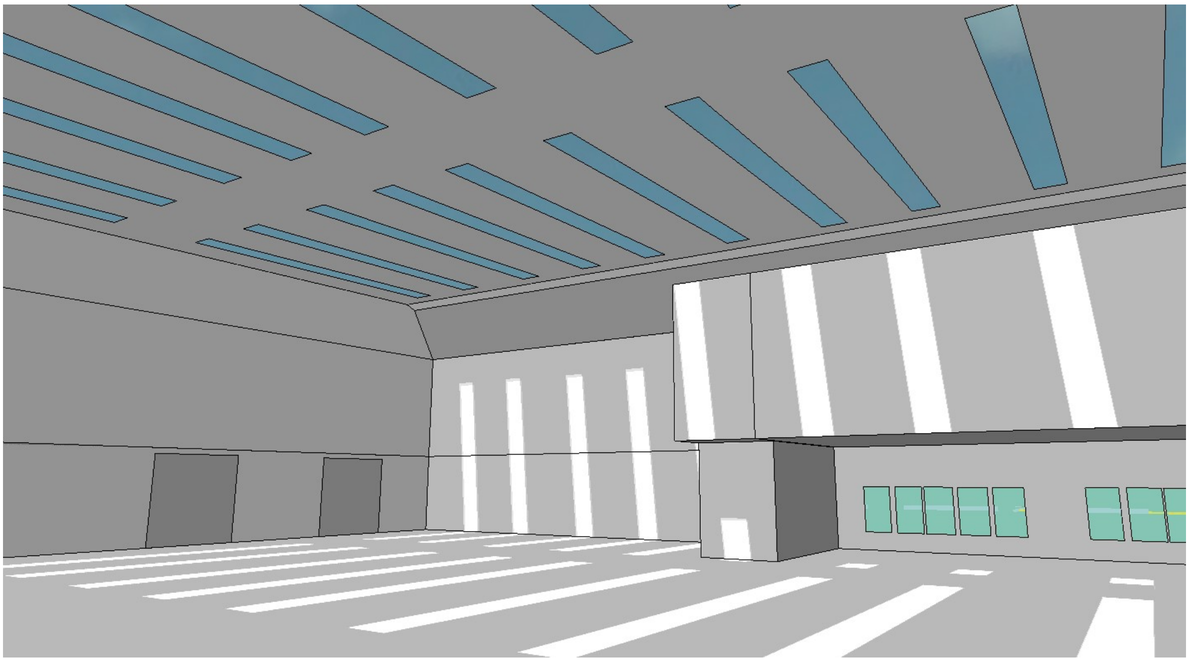


1. Site Location.

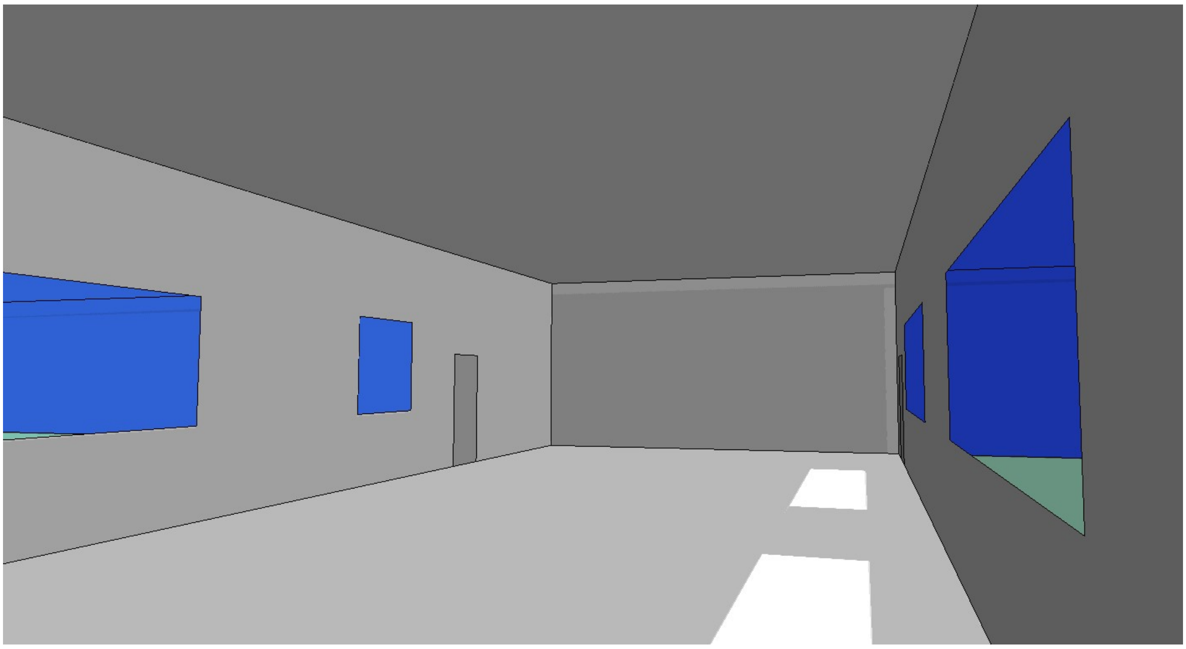
2. Orientation to maximize the natural light



3. IES 3D model of the development.



4. Roof light to minimize the lighting



5. Internal view of the IES 3D model.

APPENDIX 2: BRUKL REPORT

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Excellence Land at Wiggs Farm LZC No PV

As designed

Date: Tue May 13 12:05:50 2025

Administrative information

Building Details

Address: Station Road, Coalville, Leicestershire, LE67 1GE

Certifier details

Name: Worcestershire

Telephone number: DW Pointer & Partners

Address: 4 Sugar Brook Court, Aston Road, Bromsgrove, +44 01527 578257

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.28

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.28

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

Foundation area [m²]: 611

The CO_2 emission and primary energy rates of the building must not exceed the targets

Target CO_2 emission rate (TER), $kgCO_2/m^2annum$	1.54	
Building CO_2 emission rate (BER), $kgCO_2/m^2annum$	1.32	
Target primary energy rate (TPER), kWh_{pe}/m^2annum	16.54	
Building primary energy rate (BPER), kWh_{pe}/m^2annum	14.42	
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}	U_{i-Calc}	First surface with maximum value
Walls*	0.26	0.24	0.26	WR000000:Surf[173]
Floors	0.18	0.15	0.15	WR000000:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.16	0.16	WR000000:Surf[211]
Windows** and roof windows	1.6	1.31	1.31	WR000003:Surf[6]
Rooflights***	2.2	1.3	1.3	WR000000:Surf[183]
Personnel doors^	1.6	1.3	1.6	G0000009: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)]
U_{i-Calc} = Calculated maximum individual element 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	3

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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	NO
Whole building electric power factor achieved by power factor correction	>0.95

1- AHU- REYA20A

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.14	6.63	0	1.56	0.81
Standard value	2.5*	N/A	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	YES				

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

2- AHU-DX ERA250AYF

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.5	7.3	0	-	0.81
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	YES				

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

3- AHU- REYA22A

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.41	7.17	0	1.56	0.81
Standard value	2.5*	N/A	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	YES				

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

1- DHW Heat Pump

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	3.35	0.005
Standard value	2*	N/A

* Standard shown is for all types except absorption and gas engine heat pumps.

"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
G0.Warehouse	130	-	-
G0. Forklift Maintenance	130	-	-
G0. Stairs	130	-	-
G0. Offices 01	130	-	-
G0. Dis WC	130	-	-
G0.Shower	130	-	-
G0. Fem WC	130	-	-

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
G0. Stairs	130	-	-
G0. Lobby	130	130	1.038
G0.Plant Room	130	-	-
G0. Offices 02	130	-	-
G0. Escape Stairs 2	130	-	-
G0. Cleaners	130	-	-
F1. Dis WC	130	-	-
F1.Shower	130	-	-
F1. Fem WC	130	-	-
F1. Stairs	130	-	-
F1. Reception	130	130	1.038
F1.Male WC	130	-	-
F1.Cleaners	130	-	-
G0.Office	130	-	-
F1. Offices 01	130	-	-
F1. Reception	130	130	1.038
F1. Offices 02	130	-	-
F2. Dis WC	130	-	-
F2.Shower	130	-	-
F2. Fem WC	130	-	-
F2. Reception	130	130	1.038
F2.Male WC	130	-	-
F2.Cleaners	130	-	-
F2. Offices 01	130	-	-
F2. Reception	130	130	1.038
F3. Dis WC	130	-	-
F3.Shower	130	-	-
F3. Fem WC	130	-	-
F3.Male WC	130	-	-
F3.Cleaners	130	-	-
F3. Reception	130	130	1.038
F3. Offices 02	130	-	-
F3. Reception	130	130	1.038
F3. Offices 01	130	-	-
G0 QC offices	130	-	-
G0. Reception	130	130	1.038
G0. Reception	130	130	0
F2. MR	130	-	-
F2.MR	130	-	-
F2. Offices 02	130	-	-

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?
G0.Warehouse	NO (-10.4%)	NO
G0. Offices 01	NO (-9.3%)	NO
G0. Dis WC	N/A	N/A
G0.Shower	N/A	N/A
G0. Fem WC	N/A	N/A
G0. Lobby	N/A	N/A
G0. Offices 02	YES (+20%)	NO
F1. Dis WC	N/A	N/A
F1.Shower	N/A	N/A
F1. Fem WC	N/A	N/A
F1. Reception	YES (+114%)	NO
F1.Male WC	N/A	N/A
F1.Cleaners	N/A	N/A
G0.Office	N/A	N/A
F1. Offices 01	YES (+9.7%)	NO
F1. Reception	N/A	N/A
F1. Offices 02	YES (+49.4%)	NO
F2. Dis WC	N/A	N/A
F2.Shower	N/A	N/A
F2. Fem WC	N/A	N/A
F2. Reception	N/A	N/A
F2.Male WC	N/A	N/A
F2.Cleaners	N/A	N/A
F2. Offices 01	YES (+10%)	NO
F2. Reception	N/A	N/A
F3. Dis WC	N/A	N/A
F3.Shower	N/A	N/A
F3. Fem WC	N/A	N/A
F3.Male WC	N/A	N/A
F3.Cleaners	N/A	N/A
F3. Reception	N/A	N/A
F3. Offices 02	YES (+134.4%)	NO
F3. Reception	N/A	N/A
F3. Offices 01	YES (+56.8%)	NO
G0 QC offices	NO (-58.1%)	NO
G0. Reception	YES (+215.4%)	NO
G0. Reception	YES (+104.5%)	NO
F2. MR	YES (+259.3%)	NO
F2.MR	YES (+224.7%)	NO
F2. Offices 02	YES (+51.5%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

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Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m²]	34779.6	34779.6
External area [m²]	82172.2	82172.2
Weather	LEE	LEE
Infiltration [m³/hm²@ 50Pa]	3	5
Average conductance [W/K]	20195.4	27695.3
Average U-value [W/m²K]	0.25	0.34
Alpha value* [%]	25	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
100	**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	0.35	0.88
Cooling	0.4	0.19
Auxiliary	0.38	0.83
Lighting	6.84	3.48
Hot water	1.81	5.74
Equipment*	34.17	34.17
TOTAL**	**9.78**	**11.13**

* 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 & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	12.35	12.06
Primary energy [kWh_{PE}/m^2]	14.42	16.54
Total emissions [kg/m²]	1.32	1.54

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HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	64.3	108	4.2	6.5	6.3	4.27	4.61	4.14	6.63
	Notional	100.2	49	10	2.9	13.6	2.78	4.63	----	----
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	58	111.8	3.5	6.2	6.3	4.55	4.99	4.41	7.17
	Notional	88.1	49.5	8.8	3	13.5	2.78	4.63	----	----
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	186.7	29.3	11.8	1.5	0	4.41	5.46	4.5	7.3
	Notional	330.4	25.1	33	1.5	0	2.78	4.63	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

Heat dem [MJ/m2] - Heating energy demand
Cool dem [MJ/m2] - Cooling energy demand
Heat con [kWh/m2] - Heating energy consumption
Cool con [kWh/m2] - Cooling energy consumption
Aux con [kWh/m2] - Auxiliary energy consumption
Heat SSEFF - Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER - Cooling system seasonal energy efficiency ratio
Heat gen SSEFF - Heating generator seasonal efficiency
Cool gen SSEER - Cooling generator seasonal energy efficiency ratio
ST - System type
HS - Heat source
HFT - Heating fuel type
CFT - Cooling fuel type

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