WARM
Low Energy Building Practice

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ENERGY AND PASSIVHAUS REPORT

THE ESTATE SERVICES CENTRE

FOR

UNIVERSITY OF EXETER

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INTRODUCTION

THE PROJECT

A new Estate Services Centre comprising offices, workshop, glasshouses, polytunnels, growing area and storage buildings, with associated infrastructure and landscaping (all matters reserved).

WARM

WARM are Passivhaus specialists providing consultancy, certification, training and testing to the Passivhaus standard. WARM have been involved in nearly every non-domestic Passivhaus in the UK, with projects spanning archives, laboratory buildings, sports facilities, teaching, accommodation and offices.

BACKGROUND

EXETER CITY COUNCIL, CORE STRATEGY (ADOPTED FEBRUARY 2012), POLICY CP14: RENEWABLE AND LOW CARBON ENERGY

Policy CP14 asks that:

New development (either new build or conversion) with a floorspace of at least 1,000 sq. metres, or comprising ten or more dwellings, will be required to use decentralised and renewable or low carbon energy sources, to cut predicted CO_2 emissions by the equivalent of at least 10% over and above those required to meet the building regulations current at the time of building regulations approval, unless it can be demonstrated that it would not be viable or feasible to do so.

The University of Exeter declared an Environment and Climate Emergency, on 20th of May 2019 and published their Environment and Climate Emergency Working Group White Paper in November 2019. As part of the University's goals for reducing their carbon and energy use, it was agreed that the proposed development will be based on meeting the Passivhaus standard. This sets a new paradigm and exceeds the Target Emission Rate requirement set by the current Building Regulations Approved Document Part L2A, 2013.

PASSIVHAUS STRATEGY

Passivhaus offers a proven strategy to deliver real low energy buildings. It addresses all energy consumption not just building fabric which makes it particularly well suited to optimising energy performance of larger buildings such as this.

To comply with the Passivhaus standard a Passivhaus certifier must undertake a quality assurance assessment of the design and build against the certification criteria. The key criteria for Passivhaus Classic certification are:

HEATING ENERGY LIMIT OF ≤ 15kWh/m^2.yr

The heating energy target is the annual number of kWh of heating energy demand for every m^2 of treated floor area.

The heating energy and PER are calculated through the Passivhaus Planning Package (PHPP) software.

PER (PRIMARY ENERGY RENEWABLE) LIMIT ≤ 60kWh/m^2.yr*

As well as the heating, Passivhaus limits all other energy use within the building to ensure the design of services and selection of equipment is energy efficient through the PER assessment. The PER covers all energy use within the building, and factors in how much more energy must be supplied if it all comes from renewable sources, including all losses incurred along the way.

*Primary Energy can be as high as 75kWh/m^{2}yr but the difference (15kWh/m^{2}yr) must be offset with renewables.

OVERHEATING LIMIT OF NO MORE THAT 5% OF THE YEAR AT OVER 25ºC

Overheating needs careful consideration and the Passivhaus approach will ensure that all opportunities to get the best out of the design are considered.

PASSIVHAUS IMPLEMENTATION

Low energy design and Passivhaus imposes constraints on design and materials selection, this has informed the illustrative design and will continue to be an essential part of the design development.

The proposed building layout and appearance is fundamental in meeting the energy performance and design choices have been carefully considered to take account of these constraints. Any changes from the design may impact on the likelihood of meeting the standard.

Below are examples of how various aspects of the design have been incorporated.

STEP 1: SHARING IS BETTER

Heat loss is a function of surface area, so going for a compact shape means that heat loss can be minimised before the building fabric specification is considered.

The Form Heat Loss Factor (Form Factor for short) is the ratio of heat loss area (walls, roof, floor) divided by the nett internal floor area; this s a way of indicating the efficiency of the shape.

Service centre

The Estate Service Centre has a form factor of 2.88. The heated areas of the building have been grouped, and an external escape stair added to improve the form factor. However, this configuration will always be relatively poor because of the unheated ground floor and vaulted roof means there is a lot of heat loss area.

The poorer form factor will need to be made up with thicker insulation, a rough indication is shown on diagram below:

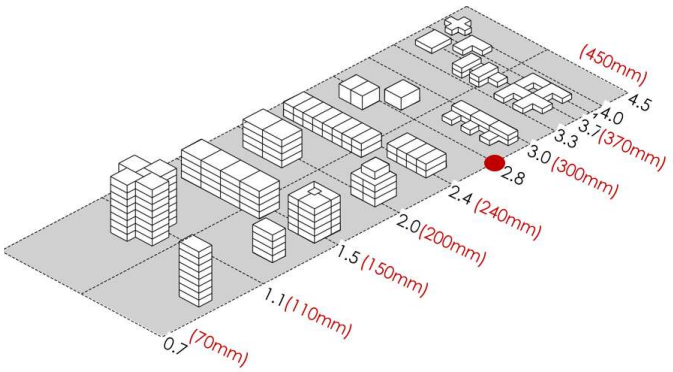

Figure 1 Form Factors in black with typical insulation thicknesses to meet Passivhaus in red. The red dot represents the service centre

STEP 2: DESIGN FOR COMFORT

To make sure the building is comfortable in the summer the heat gains should be reduced as far as possible. Heat gains come from occupants, equipment, building services and the sun.

Orientation has a striking impact on solar gain in the summer where windows facing South and North have lower solar gain than those facing East and West; for this reason the former is preferred.

Service centre

The window orientation is limited to South West facing glazing so overhangs and careful sizing have been employed:

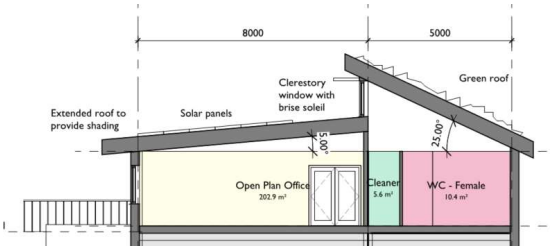

Figure 2 Section showing glazing with overhangs

CONCLUSION

To achieve Passivhaus it is necessary to consider the energy performance throughout the remainder of the design but analysis of work to date shows that Passivhaus is achievable.