

Site 5 Wrexham

LZC Report
For Policy RE1



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1 EXECUTIVE SUMMARY

The purpose of the report is to demonstrate that the design of the proposed development at Site 5 Wrexham is adaptable and can support the inclusion of low carbon and renewable energy technologies. As the proposed development is shell only, there will be an emphasis on how the design will allow future occupants choice with respect to building services.

Overall this is to support Policy RE1: "Development and Renewable Energy/Low Carbon Technology" of the Wrexham Local Development Plan 2013 – 2028 which states:

The Council require developers of the Key Strategic Sites and major sites (100 dwellings or more or development exceeding 1000m²) to incorporate schemes which generate energy from renewable and low carbon technologies unless it is demonstrated that it would not be financially or technically viable to do so. This includes opportunities to minimise carbon emissions associated with the heating, cooling and power systems for new development.

An independent energy assessment investigating the financial viability and technical feasibility of incorporating such schemes will be required to support applications.

Section 2 will firstly demonstrate the passive design measures included in the proposed development to improve fabric efficiency and therefore reduce building service energy demand prior to the consideration of various LZC system technologies.

Following this, Section 3 will discuss the appropriateness of various low carbon and renewable technology and how the shell design supports them.

2 PASSIVE DESIGN MEASURES

2.1 BUILDING FABRIC

For this development, passive design measures centre around fabric efficiency, layout and orientation all of which passively reduce energy demand before future occupants install any heating, cooling and ventilation systems.

The proposed fabric specification is described in the table below:

Table 1 Building Fabric Specification

Building Fabric			
Element	L2A: 2014 Limiting U-values (W/m ² .k)	L2A: 2014 Notional U-values (W/m ² .k)	Proposed U-values (W/m ² .k)
Floors	0.25	0.22	0.18
External Walls	0.35	0.26	0.24
Roof	0.25	0.18	0.18
Windows	2.20	1.60	1.60/1.3 (Rooflight)
Pedestrian Doors	2.20	N/A	2.20
Vehicle Doors	1.50	N/A	1.50
Air permeability (m ² /h.m ² @ 50 pa)			
Full Building	10.0	5.0	3.0

As per Table 1 above the majority of building fabric elements surpass both limiting and notional u-values stipulated in Building Regulations Part L 2014 Wales which are applicable to this development.

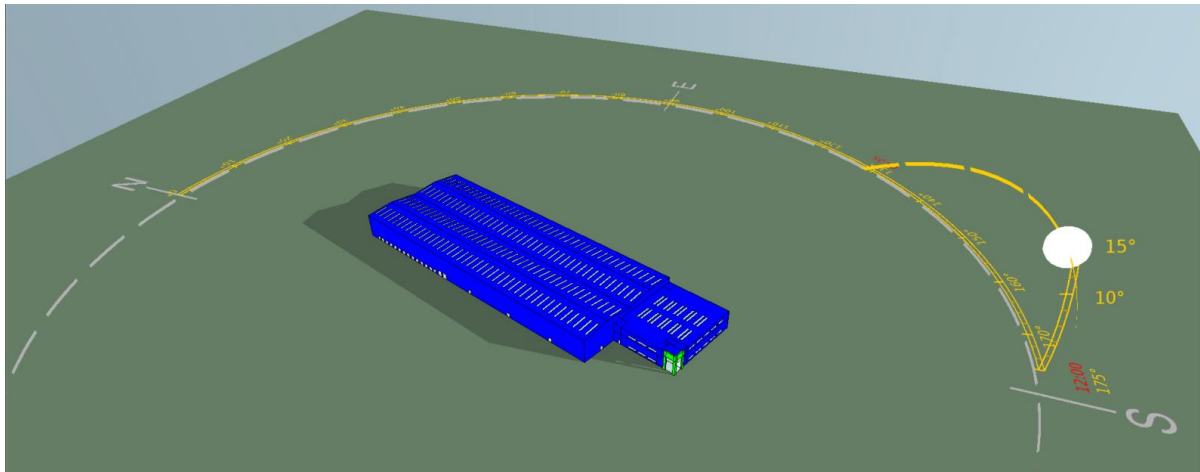
By incorporating improved u-values as per the proposed u-values column above, the development will benefit from enhanced thermal efficiency and will therefore better retain heat. As such any heating systems installed by future occupants will not be required to run as often or for as long to maintain internal temperatures in the winter. This benefit is universal meaning any low carbon heating technology installed will experience lower demand as a result of the improved fabric u-values.

2.2 ORIENTATION

The Shell Design orientation is optimised to ensure provision of natural daylight to office spaces with the main glazed façade of the office orientated towards the southwest. To balance daylight provision with thermal comfort; another façade with windows is situated on the northwest orientation, and no glazing is situated on the southeast orientation.

Furthermore, curtain wall glazing on the southwest corner will provide additional natural light and will include passive shading devices around the perimeter to mitigate overheating. Occupants will have the option of incorporating mechanical ventilation or active cooling via low carbon technology to support passive measures built into the shell.

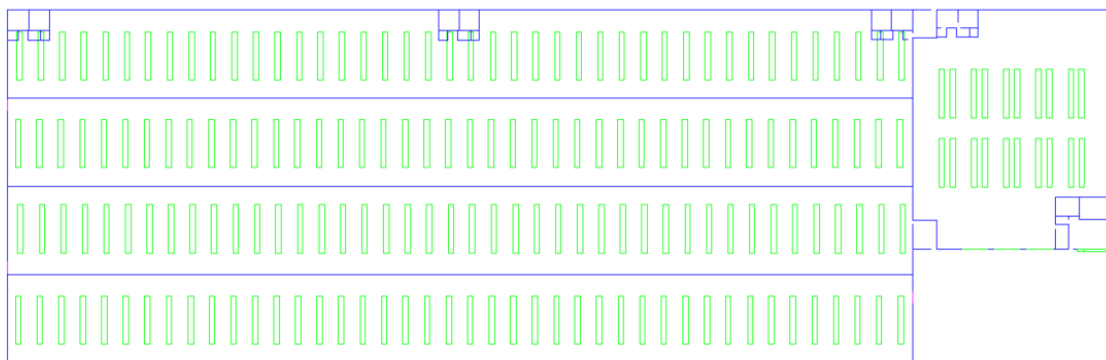
Figure 1 Energy Model Orientation



2.3 LAYOUT

The Shell design incorporates a strategic layout that places occupied office areas around the perimeter of the main structure. As per Figure 1 above it is also situated outside of the main warehouse area. This adds further design flexibility for future occupants as office areas could be adapted to include mechanical ventilation with heat recovery technology, since it has its own roof area separate from the warehouse it could also be used to house condensers for low carbon air source heat pumps.

Figure 2 Energy Model Plan View Layout



3 LOW CARBON FEASIBILITY STUDY

This section of the report will examine various low carbon technologies with respect to their appropriateness to this development. Some of the low carbon systems are intrinsically unsuitable due to the development type and location whereas others are potentially viable.

3.1 CLEANER ENERGY - CHP & DECENTRALISED ENERGY NETWORKS

3.1.1 On-site CHP

The Energy Hierarchy identifies combined heat and power (CHP) as a method of producing heat and electricity with much lower emissions than separate heat and power. Also, it encourages the creation of district heating systems supplied by CHP.

The implementation of a CHP strategy should be decided per good practice design. Key factors for the efficient implementation of the CHP system are:

- Development with high heating load for most the year, in this case the requirement for hot water.
- CHP operation based on maximum heat load for minimum 10 hours per day
- CHP operation at maximum capacity of 90% of its operating period

The implementation of a CHP unit is not to be considered for this development due to its relatively low heating and hot water demand and as such, should it be installed would be extremely inefficient and effectively would have to dump a considerable amount of the heat which it would generate.

As a result, it is inappropriate for this development.

3.1.2 Decentralised Energy Network

The feasibility of connecting into an existing heating network or providing the building with its own combined heat and power plant has been assessed through the use of UK CHP Development Map.

At the moment, there is no decentralized energy network available and in particular a district heating network in the proximity of the proposed development site that would allow the development to connect to such a network.

As such any benefit from connecting to this system is not possible.

3.1.3 Micro - CHP

Micro CHP has not been considered further for this project for the following reasons:

Micro-CHP is a relatively new concept. Since they were released, issues have been raised in relation to unproven technology, inefficiency for shorter run cycles and lack of technical knowledge that can limit the practical application of micro-CHP at present.

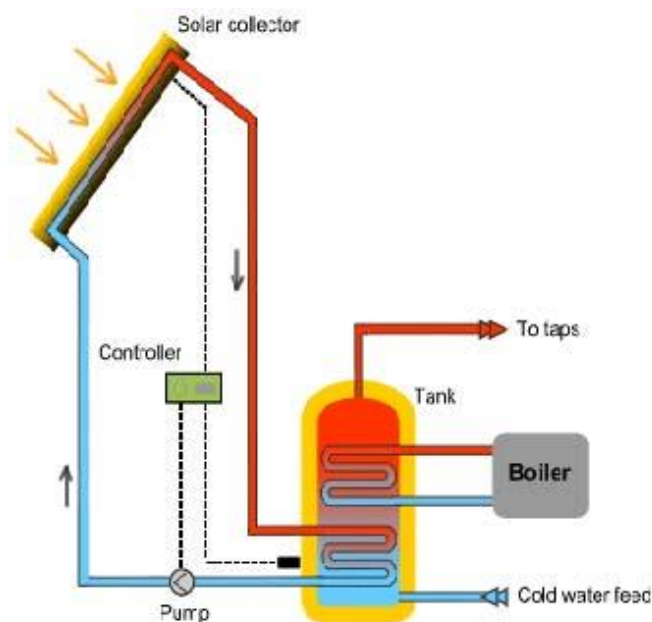
In addition, these are a fossil fuel, of which reliance on should be reduced where possible

3.2 LOW ZERO CARBON FEASIBILITY STUDY

This section of the report will examine various low carbon and renewable technologies with respect to their appropriateness to this development. Some of the LZCs are intrinsically unsuitable due to the development type and location whereas others are potentially viable.

3.3 SOLAR WATER HEATING

Figure 3 Solar Thermal Diagram



Solar thermal panels utilise the sun's energy to generate hot water for use within the building. The panels are commonly provided in either flat plate or evacuated tube arrangements. The panels are ideally located facing south at an approximate 30° inclination angle in areas where they are not subjected to shade.

The use of solar thermal will introduce further pipework which emits heat into the building which will therefore increase the internal gains and reduce the effectiveness of the passive design discussed previously in this report and increase the cooling load. Future occupants would need to consider these factors when solar water heating is considered.

With that said the shell design will include roof space for solar panels (be it for water heating or conventional PV panels for energy). The design is therefore flexible with respect to this renewable technology and therefore supports Policy RE1.

3.4 WIND TURBINES

Wind turbines generate electrical energy derived from kinetic energy provided by the local wind resource. The performance of wind turbines depends greatly on the wind speed and turbulence that in turn is influenced by the terrain and installation height.

Figure 4 Typical 6kW Wind Turbine Example



As the site does not lend itself to the installation of a wind turbine given its proximity to other commercial units and residential areas, incorporation of this technology is not technically practical and no provision for it has been allowed for within the shell design. Priority has been given to more practical technologies such as air source heat pumps, MVHR and solar PV.

3.5 PHOTOVOLTAIC CELLS (PV)

Photovoltaic (PV) panels utilise the sun's energy to generate electricity. The optimum location for PV panels is south facing at an approximate 30° inclination angle in areas where they are not subjected to shade.

Figure 5 PV Examples



Photovoltaics would be an appropriate renewable technology that this project can take advantage of. The orientation of the shell design mentioned in section 2 also ensures there will be south facing roof space available for PV installation by future occupants. This design flexibility gives occupants a choice in respect to this technology and therefore supports Policy RE1.

3.6 SOURCE HEATING AND COOLING

The Air Source Heat Pumps can be linked with indoor units to heat and cool the space. These could be either ceiling mounted cassette units, wall mounted units or floor mounted units. This would have the benefit of also providing cooling to each room in summer months.

The outdoor units can be located anywhere and are not dependant on orientation. They need to be externally mounted and in a local compound to be safe. Space for which is included as part of the shell design therefore supporting system choice and flexibility for future occupants.

3.7 BIOMASS BOILER

Biomass is considered to be a renewable fuel source as the CO₂ absorbed during the growth period is assessed as being approximately equal to the CO₂ emitted during combustion and hence deemed "carbon neutral". Biomass for boilers is typically wood either in chip or pellet form.

Biomass boilers require fuel storage together with associated transportation and delivery to the store location.

Figure 6 Biomass Example



As this technology still emits CO₂ emissions on-site (even though off-set by CO₂ absorbed in the growth period), it may not be appropriate given the proximity of other buildings to the biomass boiler CO₂ emissions. Furthermore, this technology requires delivery of pellets to use as fuel which comes with its own transport related CO₂ emissions. The shell building could potentially be adapted by future occupants to include plant space for this system however as low carbon solution it is a less viable option than other more appropriate technologies.

3.8 HYDROGEN READY GAS BOILERS

As most existing gas boilers can be adapted to a more hydrogen focused fuel mix this technology is very simple in terms of cost and installation. The shell design has space available for plant areas in which to house the boilers etc should future occupants wish to explore this option. There would be no requirement for fuel deliveries and on-site CO₂ emissions would be minimal due to the hydrogen mix. As a low carbon option this technology is viable and the shell design is flexible enough to give future occupants a choice therefore supporting Policy RE1.

4 LZC TECHNOLOGY SUMMARY

Following the assessment of various low and zero carbon technologies it has been determined that the most appropriate and feasible options include: air source heat pumps, Photovoltaics and hydrogen ready gas boilers.

As such the as-designed shell build ensures that future occupants can incorporate, or adapt the building to incorporate, the above appropriate technologies. This is achieved by providing roof space for PV installation, ensuring space is available for new plant areas to house boilers or secure compounds for condensers etc and allowing roof void space for associated pipe/ductwork.

Having identified a number of feasible LZC technologies and determined that the shell only design is adaptable enough accommodate such systems; the shell design supports the objectives of Policy RE1.

5 CONCLUSION

The LZC Technology Study for Site 5 Wrexham has adopted a hierarchical approach of using passive and low energy design to reduce CO₂ emissions and primary energy demand followed by the study of low and zero carbon technologies as appropriate.

As the development is Shell Only, there will be no installed HVAC systems present on completion. However, to appropriately address Policy RE1 which promotes the inclusion of low and zero carbon technologies, this study has been conducted to determine the adaptability of the shell design. Specifically in relation to how it offers future occupants' choice in respect to LZC technologies that could be installed as part of the fit-out.

- 1) Firstly, the base shell fabric shall incorporate low u-values as depicted to minimise heat losses and reduce the energy demand of any future installed heating system. Orientation and layout will ensure that natural lighting is maximised, and that overheating is minimised.
- 2) As per Section 4 above it has been determined that the shell design could offer future occupants a choice of 3nr low-zero carbon technologies appropriate to this site. These include air source heat pumps, hydrogen ready gas boilers and solar PV technology.

Additional technologies as shown in Section 3 can also be supported by the shell design however the 3nr technologies above would be the most practical options in terms of installation, cost and impact on CO₂. Although the development is shell only and the final installed systems are unknown, this study has identified appropriate systems that could be installed afforded by the adaptability of the shell design. It is therefore the conclusion of this report that the proposed development supports the objectives of Policy RE1: Development and Renewable Energy/Low Carbon Technology of the Wrexham Local Development Plan 2013-2028.