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Plas Coch Academic Campus Energy Statement



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Section 1 – Executive Summary

This Energy Statement addresses the planning requirements of Wrexham University as set out in Wrexham's university environmental sustainability strategy.

This Energy Statement has been prepared to illustrate the environmental aspects of the proposed development highlighting the Energy/Carbon emission profile and, assess the options available for reducing energy consumption and associated CO₂ emissions in accordance with Wrexham City Council's policies and guidelines.

All planning policies both national and local that apply to the proposed development have been reviewed together with the Building Regulations Approved document part L2A.

National and local policies require that an environmental assessment is carried out on all public projects. This project is targeting BREEAM 'Very Good ' rating under BREEAM New Construction 2014.

The baseline energy emissions have been obtained from the existing campus energy comparisons (see below)

Utility	tCO ₂ e/annum carbon emissions	Energy Consumption (Kwh/Year)
Plas Coch Electricity	715.6	1,861,504
Plas Coch Natural Gas	812.6	4,412,587
Totals	1528.2	6,274,091

The Wrexham glyndwr university environmental sustainability strategy states that a 15% reduction in gas and electricity is required by 2020. Based on the existing carbon electric carbon emission rate of **715.6 t/CO₂e/annum**, the university campus would need to achieve a 15% saving on this by utilising energy saving measures, therefore an electric carbon emission target rate of **608.26 t/CO₂e/annum** would need to be achieved by 2020. The existing natural gas carbon emission rate of **812.6 t/CO₂e/annum**, the university campus would need to achieve a **15%** saving on this by utilising energy saving measures, therefore an natural gas emission target rate of **690.71 t/CO₂e/annum** would need to be achieved by 2020

Therefore, in reducing CO₂ on the campus utilising the energy hierarchy as detailed below and in line with Wrexham glyndwr university environmental sustainability strategy to achieve **15%** carbon savings on the project we need to consider utilising energy efficiency improvements and renewable energy sources as detailed in section 5.3 and section 5.4 within this reports to meet the projected **15%** savings forecast for 2020.

In terms of energy consumption, the existing site has an total energy consumption of **6,274,091 kwh/annum**. The Wrexham glyndwr university environmental sustainability strategy states that 15% reduction is required by 2020, this would equate to a reduction of **941,113 Kwh/annum** reduction, which would amount to the total projected consumption of **5,305,978 kwh/annum** for the campus.

Section 2 – Introduction

Futureserv Ltd have been appointed to produce an Energy Statement to support the planning application for Wrexham Universities proposed plas coch campus amendments.

The Plas Coch Campus 2025 represents a major redevelopment of the Plas Coch Campus which is in need of extensive backlog maintenance in addition to investment into new facilities. This major redevelopment consists of a number of individual projects connected by extensive infrastructure and public realm works focused on enhancing the student experience within the Campus and as importantly, assisting in the delivery of state of the art academic tuition and study.

The planned works within the Academic Campus allow the currently disjointed parking provision on site to be consolidated towards the east of the Campus releasing land to the north west for redevelopment as Private Rented Sector Keyworker residential accommodation. All capital receipts from land sales will be invested back into Academic Campus improvement works. The existing student accommodation within the Northern Quarter area will be demolished as the University take ownership of the existing Wrexham Student Village accommodation to the north of the Racecourse Stadium. A further 197 new build student bedrooms are also proposed adjacent to the 323 already constructed bedrooms.

Within the Academic Campus, several new build structures and refurbishments are proposed as follows:

- **New Learning Gateway Building:** A striking, contemporary new build flexible space as a gateway into the redeveloped Campus;
- **New Inner Gateway Building:** A further central internal connection point within the Campus;
- **New Engineering Building:** A contemporary new build state of the art Engineering Building at the heart of the Campus;

- **Sports Hall Extension:** A two storey extension containing academic space and elevated spectator seating;
- **Refurbishment of social learning and academic tuition space within the existing Listed and non Listed Buildings on Campus:** Although not detailed within the application package, a series of internal refurbishment and reconfiguration works will move forward over the coming years and will be subject to individual applications as and when required;
- **Extensive parking, infrastructure and public realm works:** Consolidation of parking to create a pedestrian and cycle friendly, attractive green Campus;
- **Demolition of several redundant buildings:** Following redevelopment, a number of buildings will be surplus to requirement and will be demolished to make way for improved public realm works.

Section 3 – Development Proposals

The proposed site is to consist of the following new developments :

- **New Learning Gateway Building:** A striking, contemporary new build flexible space as a gateway into the redeveloped Campus;
- **New Inner Gateway Building:** A further central internal connection point within the Campus;
- **New Engineering Building:** A contemporary new build state of the art Engineering Building at the heart of the Campus;
- **Sports Hall Extension:** A two storey extension containing academic space and elevated spectator seating;
- **Refurbishment of social learning and academic tuition space within the existing Listed and non Listed Buildings on Campus:** Although not detailed within the application package, a series of internal refurbishment and reconfiguration works will move forward over the coming years and will be subject to individual applications as and when required;
- **Extensive parking, infrastructure and public realm works:** Consolidation of parking to create a pedestrian and cycle friendly, attractive green Campus;

Demolition of several redundant buildings: Following redevelopment, a number of buildings will be surplus to requirement and will be demolished to make way for improved public realm works

This Energy Statement has been prepared to illustrate the environmental aspects of the proposed development highlighting the Energy/Carbon emission profile and, assess the options available for reducing energy consumption and associated CO₂ emissions in accordance with Wrexham City Council's policies and guidelines.

Futureserv Consulting Engineers have collaborated with the design team to provide a holistic solution for the building that will provide an efficient envelope and contain intelligent building services reducing the environmental impact of the development whilst providing comfortable living accommodation.



Section 4 – Policy and Legislation

There are a number of planning policies both national and local that apply to the proposed development.

The UK government has signed up to a legally binding agreement to reduce Carbon emissions by 34% based on 1990 levels before 2020 and by 80% before 2050, this responsibility is being discharged using the Climate Change Act 2008.

The National Planning Policy Framework (NPPF), offers specific guidance which highlights the UK's aspiration to support a transition to a Low Carbon future in a changing climate and in particular, to encourage the use of renewable resources such as Renewable Energy and states;

Planning authorities should ensure that development plans contribute to global sustainability by addressing the causes and effects of climate change through policies which reduce energy use and emissions, promote development of renewable energy resources, and take climate change impacts into account in the location and design of development.

Local Policies

The proposed development is located off Holt on the Wrexham , with the local policies adopted by Wrexham City Council outlined within Wrexham's Local Development Framework Core Strategy Development Plan, adopted in 2005, The policy states that Under the Council Priority "An Environmentally Responsible Place" Wrexham County Borough Council are committed to reducing carbon emissions by 50% by 2015/16 and 70% by 2020, against a 2005/06 baseline.

Within this document specific policies highlight carbon emissions reductions and the impacts of climate change. These are as follows;

Policy RE1: Development and Renewable Energy/Low Carbon Technology

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Development proposals are required to maximise the potential for renewable energy.

The Council will encourage 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. This includes opportunities to minimise carbon emissions associated with the heating, cooling and power systems for new development.

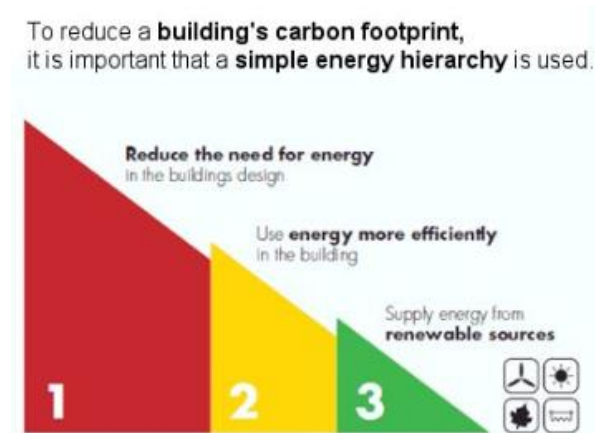
An independent energy assessment investigating the financial viability and technical feasibility of incorporating such schemes will be required to support applications.

This policy outlines the need to introduce renewable technology on any future developments in the County of Wrexham.

Wrexham Borough Council is looking to utilise low carbon measures on any future developments as outlined below.

Wrexham Borough Council is looking to provide 10% of energy requirements for low carbon energy sources for all new build projects in the borough.

To reduce a building's carbon footprint, the below hierarchy is used to assist.



Contributing to the Carbon Offset Fund

Once energy efficiency measures and renewable or low-carbon technology opportunities have been maximised, any remaining CO2 emissions can be offset through contributions to a carbon offset fund, which will be invested in off-site renewable energy and energy efficiency projects throughout the city.

BREEAM

Wrexham Borough council require the sustainability of the development assessed under BREEAM and to meet the standards set out in the table below;

All residential development achieves at least the following level of the Code for Sustainable Homes		All non-residential developments with a floor space of over 500 m ² achieve at least the following BREEAM standards.
from adoption (2010)	Level 3	BREEAM 'very good'
from 2012	Level 4	BREEAM 'excellent'
from 2016	Level 6	BREEAM 'excellent'

The development is stated to be code for sustainable homes level 3 or Breeam 'Very Good' standard.

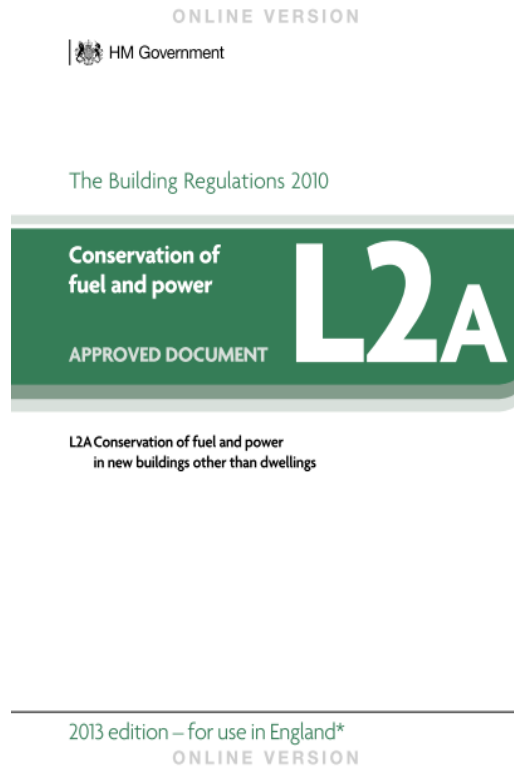
Please note that current Wrexham planning guidelines state code for sustainable homes level 3, this is now obsolete, therefore the is looking to a Breeam 'Very Good' standard across the campus.

Reduction in CO2 emissions is seen as a major component in mitigating climate change. In this regard, areas of Government policy give rise to the following three national and regional targets:

- A national reduction in CO2 emissions by 34% in 2020 and by 80% in 2050, (from a 1990 baseline) to which buildings will need to make a proportionately higher contribution, as set out in the Climate Change Act 2008.
- A national increase in renewable energy capacity by 15% by 2020 as set out in the UK Renewable Energy Strategy, which will require an uplift in current levels.

Building Regulations Part L2A (2013)

The proposed development is being designed to comply with the Building regulations approved document Part L2A, 2013 edition. This approved document was effective on 6th April 2014.



Section 5 – Energy Strategy

5.1 - Baseline Energy Assessment

Futureserv Ltd have been provided with current energy demands for the existing campus to analyse what the future energy savings for the campus should be for this stage of the project. This will show compliance with the Building Regulations Part L2A:2013 therefore setting a reference energy baseline which needs to be achieved by 2020. This was carried out to understand the developments Carbon emissions without any Carbon Emission mitigation measures.

The main changes in this approved document from the previous revision are that;

The notional building used to determine carbon dioxide and fabric energy efficiency targets is the same size and shape as the actual building, constructed to a concurrent specification. **The Part L 2013 specifications have been strengthened to deliver 9 per cent carbon dioxide savings relative to part L 2010.**

5.2 - Passive Design Improvements

On the completion of the assessing the existing campus energy consumptions and carbon emission. The establishment of the Target Emission rates (TER), the building emissions have been identified to aid the reduction of CO2 and energy through judicious passive design. This has involved an assessment of non-energy consuming design decisions to create a fabric first approach to energy efficiency. This is through;

- Improved air permeability performance
- Better thermal Insulation

Passive fabric measures across all the building include improvements to the thermal performance and air tightness above Part L requirements of the Building Regulations and this effectively allows the building envelope to attenuate external conditions without recourse to active Building Services.

The table to the right presents the proposed material specification that will be incorporated within the any new building design proposed on the campus to limit heat losses and ensure efficient operation of the building and reduction of energy and carbon emissions ,

An airtightness of 5m³/hr/m² @50Pa has been targeted for this any new proposed developments on the campus to minimise uncontrolled ventilation. An improved air tightness reduces heat losses and energy demand.

Construction Element	Building Regulations Specification (2013)	Development Specification
Ground Floor	0.25 W/m ² k	0.18 W/m ² k
External Walls	0.35 W/m ² k	0.20 W/m ² k
Roof	0.25 W/m ² k	0.18W/m ² k
Windows	2.2 W/m ² k	1.5 W/m ² k
External Doors	2.2 W/m ² k	2.2 W/m ² k
Air Permeability	10m ³ /h/m ² @50Pa	5m ³ /h/m ² @50Pa

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5.3 - Energy Efficiency Improvements

In addition to the Passive design measures described in the preceding Section to improve the building envelope performance, the Active Building Services are to be designed to minimise direct energy consumption and CO₂ emissions, with particular emphasis on the following;

It is currently proposed for the existing buildings on the campus to have a number efficiency measures to help improve energy efficiency on the existing buildings and reduce the energy consumption through out the campus.

There are number measures that can be taken to improve energy efficiency as per below:

Improved Boiler Efficiencies

Improved boiler efficiencies can be achieved by replacing any existing boiler heating equipment within the building with new efficient boilers.

Most old gas and oil boilers are regular boilers that have a separate hot water cylinder to store hot water, rather than providing it directly from the boiler. When you replace your boiler you can buy a new regular boiler, and keep your hot water cylinder, or buy a combi boiler that doesn't need a cylinder. Typically old boilers had an efficiency of less than 70% , but now new modern boilers are typically more than 90% efficient.

Reduced Standing Losses from Pipes and Cylinders

Insulating pipework and hot water cylinders significantly reduces heat loss. Many hot water cylinders have no insulation and those that do are usually substandard.

There is evidence that heat losses in some schemes are relatively high, especially for distribution systems within new and existing constructed buildings. The economic and environmental impact of heat

losses depends on the type of heat source – if this is a low carbon and low cost source there would be less impact than for a high cost or high carbon source. However, in most cases, high heat losses will lead to higher carbon emissions, higher operating costs and a higher risk of overheating within a building.

Energy Efficient LED Lighting & Improved Lighting Controls

Reduction of Energy Consumption of Artificial Lighting

Artificial lighting is one of the largest consumers of electricity within an educational building and all necessary measures should be taken to ensure that the energy consumption of the lighting installation is minimised through measures including:

- Selection of appropriate lighting design criteria for the space.
- The selection of light sources with a high efficacy.
- The selection of luminaires with a high light output ratio.
- Provision of adaptive and intuitive occupancy sensing lighting controls to allow lighting levels to be varied to suit the tasks being carried out.
- The use of task lighting – where appropriate and where it provides an energy reduction.
- The maximised use of daylight, the lighting will be digitally dimmable where practicable, areas adjacent to windows will have daylight-linked control.
- External lighting will be controlled through central photo-cells, with astronomical time-clocks provided as over-ride facilities

Compliance with Building Regulations

Part L of the Building Regulations identifies that the average efficacy of a lighting installation shall be greater than or equal to 60 luminaire lumens per circuit Watt. It is also possible to utilise a reduced lighting efficacy where a

factor is applied to take in to account lighting controls – see the table below taken from the Non-Domestic Building Services Compliance Guide.

Table 42 Recommended minimum lighting efficacy with controls in new and existing buildings

General lighting in office, industrial and storage spaces		Initial luminaire lumens/circuit-watt
		60
Controls	Control factor	Reduced luminaire lumens/circuit-watt
a daylit space with photo-switching with or without override	0.90	54
b daylit space with photo-switching and dimming with or without override	0.85	51
c unoccupied space with auto on and off	0.90	54
d unoccupied space with manual on and auto off	0.85	51
e space not daylit, dimmed for constant illuminance	0.90	54
a + c	0.80	48
a + d	0.75	45
b + c	0.75	45
b + d	0.70	42
e + c	0.80	48
e + d	0.75	45
General lighting in other types of space		The average initial efficacy should be not less than 60 lamp lumens per circuit-watt
Display lighting		The average initial efficacy should be not less than 22 lamp lumens per circuit-watt

Light Sources

To reduce energy consumption and ensure longevity of the lighting system it is proposed high efficient LED luminaires are selected throughout the campus.

Heat Recovery Ventilation

Heat recovery is the collection and re-use of heat arising from any process that would otherwise be lost. The process might be inherent to a building, such as space heating, ventilation and so on, or could be something carried out as part of business activity, such as the use of ovens, furnaces and the like. Heat recovery can help to reduce the overall energy consumption of the process itself, or provide useful heat for other purposes. Ventilation systems bring cool fresh air into a building using fans in Air Handling Units (AHUs). The AHUs also contain heating coils to allow the fresh

air to be raised to the required temperature by the buildings boiler. The air continues to be heated by the occupants and equipment in the room and all this heat energy is lost when the air is extracted and dumped into the environment.

The addition of heat recovery means that some of the heat contained within the extract air can be recovered. The heat energy is passed into the incoming fresh air effectively pre-heating it and meaning the boiler needs to add less heat. The two air streams need not mix directly to allow the transfer of heat.

Where it's possible, the most cost-effective use of waste heat is usually to improve the energy efficiency of the heat generating process itself.

Common uses (or 'sinks') for recovered heat include:

- pre-heating combustion air for boilers, ovens, furnaces, and so on;
- pre-heating fresh air used to ventilate the building;
- hot water generation, including pre-heating boiler feed water;
- space heating;
- drying;
- other industrial process heating/pre-heating;
- power generation.

In most cases, heat recovery is far more efficient when the heat source and heat sink are coincident - meaning they are physically close together and occur at the same time.

Low Energy Motors in Pumps and Fans

Running motors and drives uses almost two thirds of the electricity consumed by UK industry. In fact the cost of running a motor for a year can be ten times what it cost to buy in the first place. The efficiency of your motor operation is therefore of critical importance to the lowering of your carbon footprint and reduction of your energy bills. There are five points to consider when looking at achieving energy efficient motors (see below)

1. Select higher efficient motors
2. Install variable speed control drives
3. Switch off
4. Monitor output
5. Have a motor management policy

By improving motor efficiency on existing motors around the campus , this can lead to hugh cost savings , a typical payback period is 2 years.

All fans, motors and pumps shall be specified to incorporate ECA accredited technology and appropriate controls.

Building Fabric improvements

Typically, around 75% of heat is lost through the building fabric. By improving the building fabric there are many advantages (see below) to improve energy efficiency within a building.

- Reduced energy and maintenance costs
- Better temperature control and thermal comfort for occupants
- Improved productivity
- Output and morale are enhanced through reducing draughts, solar glare, overheating, colder areas, as well as noise.
- Lower capital expenditure
- A more efficient, well-insulated building requires smaller heating and cooling systems, or even none at all.
- Better insulation or well-maintained/modified building fabric can increase a building's value and aesthetics.
- Compliance with regulation
- The government stipulates a minimum efficiency requirement for both new build and existing buildings.

By improving the building fabric of the project , the energy efficiency savings can be greatly improve the carbon footprint of the project.

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Controls

Good control is essential within a building to optimise levels of service, comfort and safety in an energy efficient manner. When installed correctly and when working properly, building controls have a range of benefits. They can:

- Minimise running costs, energy consumption and pollution associated with energy use
- Improve comfort for building users
- Prevent the unwanted or out-of-hours operation of equipment
- Limit excessive wear and tear on building systems and plant
- Minimise maintenance, repair and replacement costs
- Reduce the need for cooling by minimising the heat gains associated with the use of equipment such as lighting, fans and motors.

There are three types of control which will help improve control efficiency on the project and these are as follows:

- **Controlling by time** — time controls vary in complexity from simple 24-hour on/off timers, to sophisticated seven-day timers, which allow for control to be set for individual days of the week. Upgrading existing time controls to enable services to be switched on and off to better match daily and weekly requirements can result in substantial savings.
- **Controlling by occupancy** — building services can be altered to accommodate changing staff working times. For instance, intermittently occupied spaces will often have lights left on unnecessarily. These are areas that could be better served using controls that switch lights off when no one is around. Occupancy controls are generally used for quick response services like lighting and individual ventilation fans. They are rarely appropriate for slower response services like heating and cooling across a whole building.
- **Controlling by condition** — building services can be controlled by environmental conditions such as temperature (for heating, cooling and

ventilation systems), day-lighting (for lighting and shading systems), humidity (for ventilation systems and air conditioning systems), and even carbon dioxide levels (for ventilation systems).

By improving the control aspect of the project , the energy efficiency savings can be greatly improve the carbon footprint of the project.

Heating emitter efficiency

Highly efficient electric heat emitters would be provided complete with time and thermostatic control provisions, to minimise wasted energy when areas are unoccupied.

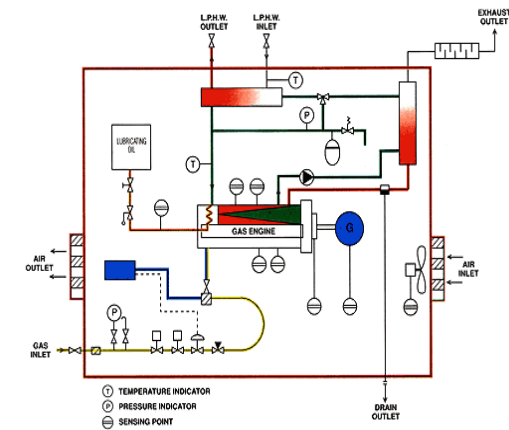
5.4 - Renewable Energy Improvements

In order to comply with Wrexham glyndwr university environmental sustainability strategy and which requires that the development's Carbon emissions are reduced by 15% when compared to a building meeting Part L of the Building Regulations 2010, renewable and/or low or zero carbon emission systems have been targeted.

All currently acknowledged and commercially available technologies have been considered and assessed with the conclusions summarised below;

Combined Heat and Power (CHP)

On-site generation of electricity and the utilisation of waste heat from this process within a building can create a beneficial arrangement whereby the transmission losses of grid supplied electricity can be omitted. The use of CHP tends to require a steady and continuous heat demand therefore the large quantities of domestic hot water associated heating demand mean that CHP Is viable option for the proposed campus.



Diagrammatic layout of small scale CHP unit



Typical CHP Unit

Taking into account the proposed campus, usage and occupancy level, it has been determined that a CHP engine of circa **2200kW_{th}** and **2100kW_e** would contribute to a reduction in Carbon emissions, it anticipated to produce around **50%** of the carbon savings required by 2020 as per Wrexham glyndwr university environmental sustainability strategy.

Absorption Chilling – Utilising Heat Rejection

Absorption chillers use heat energy to generate chilled water that can be used for air conditioning or process cooling applications. They are often used in conjunction with combined heat and power (CHP) making use of the surplus heat from CHP engines in summer to provide cooling.

An absorption chiller consists of a generator, a condenser, an evaporator and an absorber.

The basic absorption cycle employs two fluids, a refrigerant (typically water) and an absorbent (typically lithium bromide). As the absorption cycle proceeds, these two fluids are separated and combined, as follows.

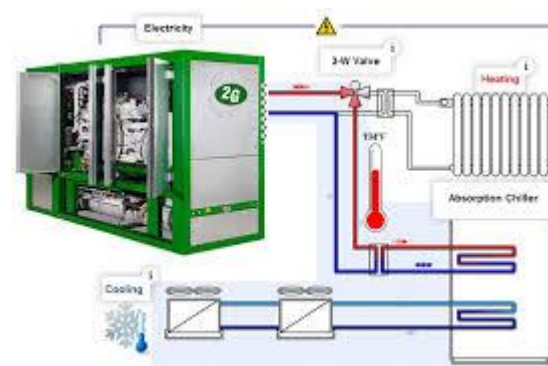
In the generator a dilute lithium bromide solution is heated, causing water to evaporate from the solution – resulting in water vapour and a concentrated lithium bromide solution. The water vapour is transported to the condenser and the lithium bromide is transported to the absorber.

In the condenser, the water vapour from the generator condenses under high pressure.

This condensed water is then transferred to a lower pressure evaporator, where it evaporates and absorbs heat from water in adjacent cooling coils. This generates chilled water that is then distributed to the cooling system.

From the evaporator, the low pressure water vapour passes to the absorber where it re-combines with the concentrated lithium bromide solution to form a dilute lithium bromide solution so that the cycle can be repeated.

Absorption chillers typically require a hot water temperature of 70-95 degC to produce chilled water at around 7 degC.

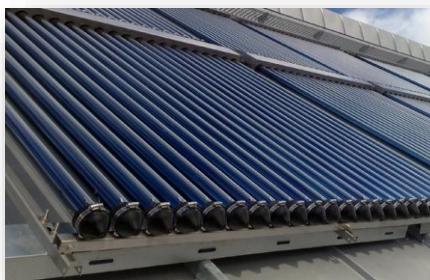


Taking into account the proposed campus, usage and occupancy level, it has been determined that an absorption chiller of approx. **1.8 Mw** utilising the CHP heat rejection would contribute to a reduction in Carbon emissions on the campus.

Solar Thermal Collectors

The use of flat plate & evacuated tube thermal panels has been identified as a potential method of harnessing renewable solar energy by pre-heating domestic hot water provision.

The recent introduction of the renewable Heat Incentive may further improve the financial viability for the technology.



Example of Solar Thermal unit

However there is a fundamental conflict between Solar Thermal Collectors and the proposed Combined Heat and Power technology as both systems would be attempting to deliver to the same heating systems and thus would effectively de-rate each other.

For this reason we have not considered the use of solar thermal collectors on this development.

Solar Photovoltaic Panels

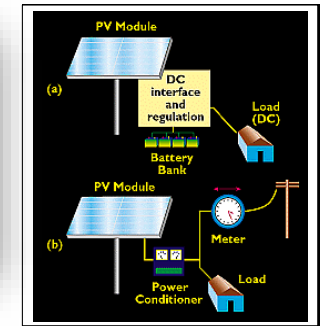
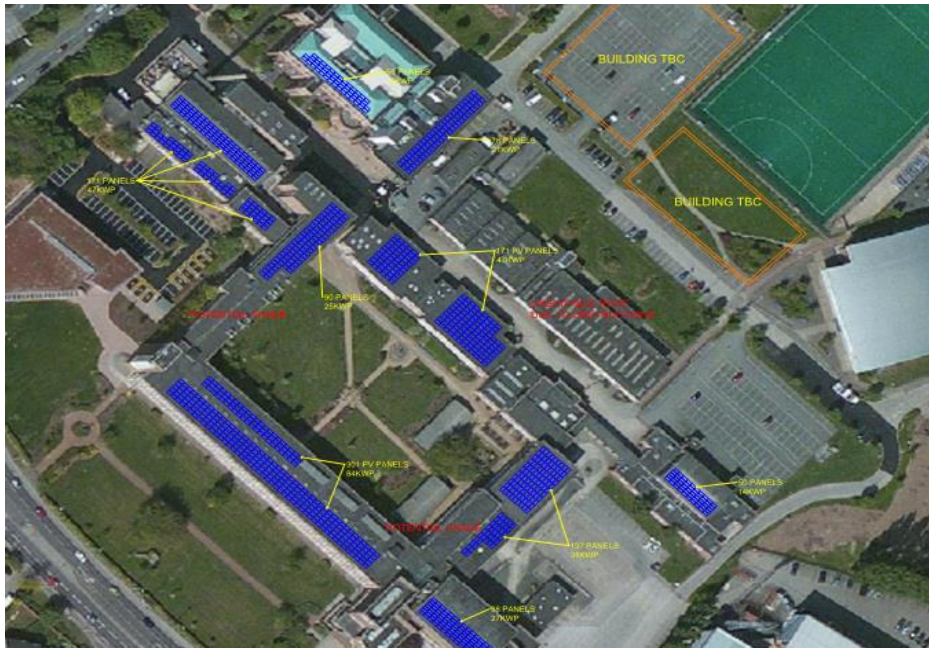
The option to utilise roof mounted or Building Integrated Photovoltaic panels to generate electrical energy is a renewable energy method of generating Carbon free electrical power.

Due to the density in occupancy on the campus, there is likely to be a fairly constant base electrical load prevalent on the buildings which may be mitigated in part by the use of Solar PV.

PV System components

However the flat roof areas of the building are relatively limited and payback periods for solar photovoltaic panels can be onerous.

We have conducted a desktop assessment of the proposed campus amendment (see below), it is anticipated that by installing solar photovoltaic panels on the existing building as well as the proposed new developments on the campus, it is anticipated to produce around **25%** of the carbon savings required by 2020 as per Wrexham Glyndwr university environmental sustainability strategy.



Wind Turbines

Wind energy can be a cost effective method of renewable power generation and turbines can produce Carbon neutral electricity with outputs ranging from watts to megawatts.

The most common design is for three blades mounted on a horizontal axis, which is free to rotate into the wind on a tall tower. The blades drive a generator either directly or via a gearbox (generally for larger machines) to produce electricity.

The electricity can either link to the grid or charge batteries. An inverter is required to convert the electricity from direct current (DC) to alternating current (AC) for feeding into the grid.

There are a variety of wind turbines on the market ranging from smaller turbines that can be attached directly to a buildings structure to larger stand-alone turbines.

City centre and sub-urban locations generally experience poorer yields for electricity output from small and medium scale wind turbines, due to obstructions and variations in local topography.

The use of PV technology shall also not be discounted as Solar PV system may be considered to contribute towards the electrical energy demand following completion of the BREEAM LZC assessment.

Wind Turbine

Also taking visual impact noise in an sleeping the use of discounted this



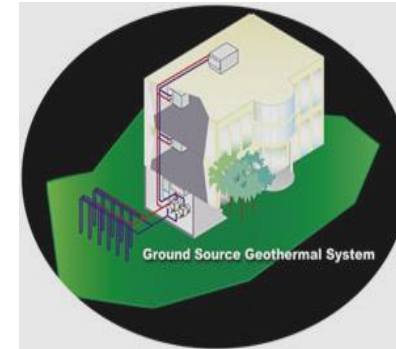
Ground Pumps

The ground below buildings remains at a constant temperature of around 10°C to 12°C offering the ability to extract energy in the winter and discharge energy in the summer from cooling with the energy exchange being achieved via open or closed loop systems linked to heat pumps.

Installation

into account the and unwanted environment with accommodation wind turbines are from inclusion at development.

Source Heat



Ground Source Heat Pump Installation

The footprint of the development and the surrounding site conditions do not have the potential to deliver an element of space available for closed loop heat exchange, due to this and the conflict with the CHP heat sink, the likely yield, peak load demand and cost feasibility, we have discounted Ground Source Heat Pumps at this development in favour of better performing technologies.

Air Source Heat Pumps

Air source heat pumps provide an accepted solution for using renewable energy taken from ambient air to heat a building in the winter and discharge heat from cooling in the summer.



Typical External Condenser Unit

The use of air source heat pumps in order to provide heating to the development would reduce the opportunity to deploy a centralised heating system that makes use of co-generation technology.

For this reason we have not considered the use of air source heat pumps on this development.

Biomass

Some success on other projects has been made with the implementation of wood fuelled energy equipment forming a Carbon Neutral heat source however these projects have tended to be light density Sub-Urban or even rural in their location. The relatively constrained nature of this site, together with limited storage space and potential delivery issues reduces the opportunity to take advantage of a Biomass solution for this development.

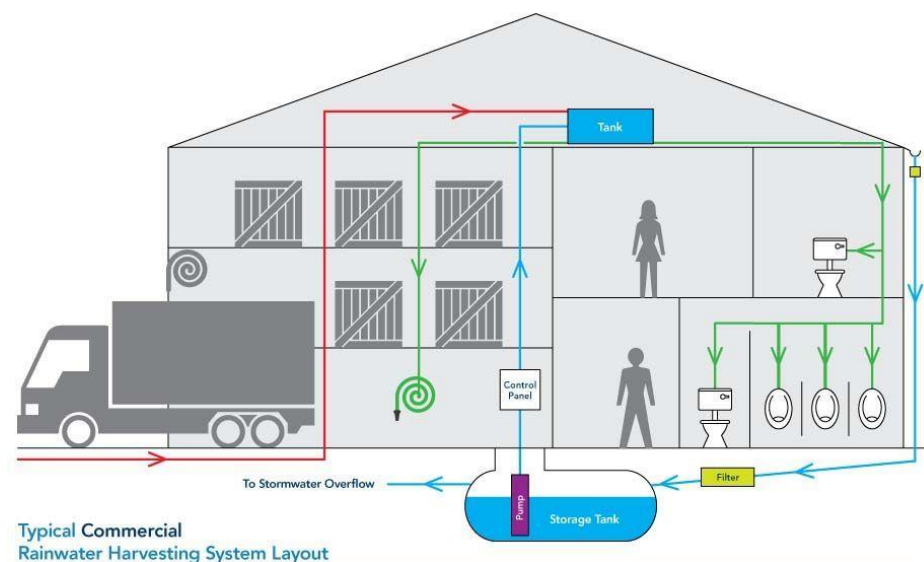


Plantroom Biomass Installation

In addition, flue emissions and the requirements the Clean Air Act has led to a dismissal of this technology for this particular scheme.

Rainwater Systems

Rainwater from roofs and hard surfaces such as car parks can be stored and used in and around properties. The rainwater from the development is typically utilised via a underground storage, which then utilises pumps to pump the rain water back up to a tank at high level within the proposed development which is then utilised via external hosing requirements and flushing purposes on toilets.



The use of rainwater technology shall not be discounted be as the reduced water consumption may contribute BREEAM LZC assessment.

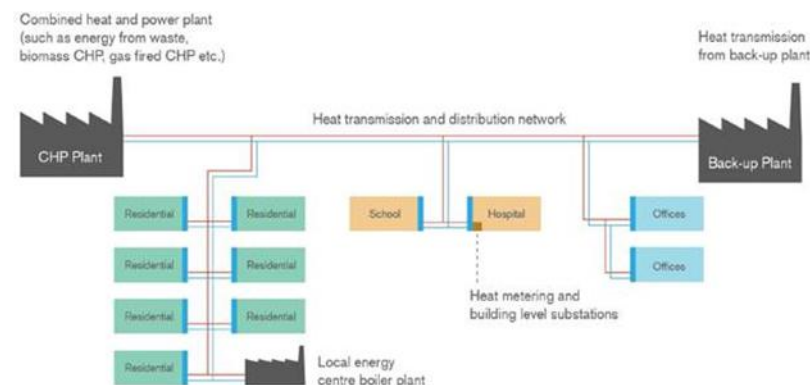
Local Heat Sources

Local heat sources are a good source of reducing CO₂ within a project, as distribution losses are minimised and greater efficiency is gained.

Three considerations are given when utilising a connection to local heat source

1. Site location and distance to local heat source
2. Energy type and temperatures i.e heating or cooling and temperature of energy medium.
3. Type of development connecting to local source.

Local supply of heat and power minimise distribution losses, thereby achieving a greater efficiency and reducing CO₂ emissions, when compared to the individual systems. In a communal energy system, energy in the form of heat, cooling, and/or electricity is generated from a central source and distributed via a network to surrounding residencies and commercial units. (see example below – source CIBSE)



During initial planning stage it was determined that project is not near any existing local heat source to provide heat for the development, therefore the existing campus will potentially be looking at providing district heating and cooling network around the site campus.

Total Assessments

The central Building Services Systems will be supplemented by Renewable and Low Carbon technologies to further reduce the associated Carbon emissions.

Of the available solutions considered, it is therefore recommended that the proposed scheme implements the following renewable energy technology:

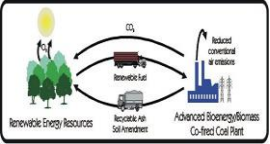
Renewable Technology	Image	Comments
Combined Heat and Power SELECTED		The integration of Combined Heat and Power technology is proposed for the new development, to provide base load domestic hot water and heat generation.

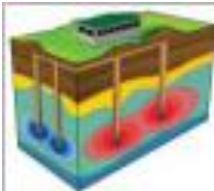
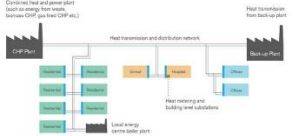
- Combined Heat and Power System
- Solar Photovoltaic panels

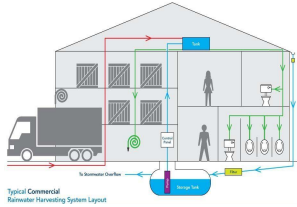
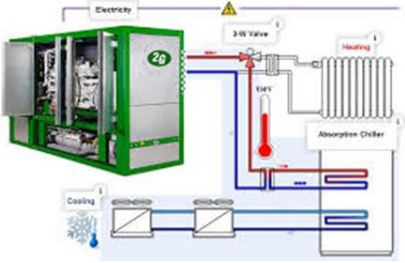
The inclusion of Combined Heat and Power technology (CHP) is considered to be the most appropriate for this development and has been incorporated into the primary heat generation for the hot water systems. This will reduce the primary energy use requirement within the development, i.e. the Domestic Hot Water generation, the use of PV also helps offset the carbon requirements for the project.

The Energy Model has been calculated to take account the selected renewable energy technologies proposed for this development.

Solar Photovoltaic SELECTED		The flat roof areas of the building are relatively limited and payback periods for Photovoltaic panels can be onerous, however the systems are low maintenance, easily integrated with building design and no there are limited ongoing costs.
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Air Source Heat Pumps DISCOUNTED		The use of Air Source Heat Pumps has been discounted as they will conflict with the implantation of CHP technology and the opportunity to utilise waste heat from the CHP engine.
Solar Thermal DISCOUNTED		There is potential to include flat panel solar thermal collector located at roof level serving the domestic hot water systems. However this solution would conflict with the selected LZC for heat discharge capacity.
Biomass Boilers DISCOUNTED		Biomass boiler solutions have been discounted at this location due to potential clean air issues, deliverability logistics and the lack of available storage space for

		the required quantity of fuel.
Wind Turbines DISCOUNTED		Wind turbines have been discounted due to the resulting visual/noise impact from the equipment, and relatively poor performance of the solution when used within Urban and Sub-Urban locations.
Ground Source Heat Pump DISCOUNTED		The inclusion of Ground Source Heat Pumps have been discounted within this development due to the conflict with the selected CHP technology, system cost viability and also the site constraints.
Local Heat Source SELECTED		The inclusion of local heat sources has been included within this development due

		location of the development.
Rainwater Harvesting SELECTED		The inclusion of rainwater harvesting is to be considered to meet water consumption guidelines as set out by DEC Regulations.
Absorption Chillers SELECTED		The inclusion of absorption chillers to utilise the heat reject of the proposed CHP is deemed a viable option for this project due to the site demand.

5.5 - Energy Generation and Distribution Systems

The case for renewable energy systems is clear and we understand that Wrexham City Councils current energy policy requires developments to make the fullest contribution to the mitigation of climate change, and to minimise Carbon Dioxide emissions.

As a consultant, Futureserv has an over-arching philosophy delivering design of truly sustainable energy systems, employing the widely recognised hierarchy;

- Be Lean - Reduce demand wherever possible utilising passive measures.
- Be Clean - Where energy is used, then it should be optimised to operate at the highest efficiencies practical.
- Be Green - Take advantage of renewable options to reduce fossil fuel energy sources.

The Plas coch campus development will be designed to be served by a Central Energy Strategy, with Low Temperature Hot Water generated by gas fired boiler plant and CHP units located within an integral energy centre, the LTHW pipework distribution shall be distributed around the Buildings within service ducts and district heating and cooling pipework.

The central heating plant will be designed around a high efficiency heat generator, providing Domestic Water Heating. Pre-heat to the systems will utilise Low Carbon energy taken from Combined Heat & Power system combined with an absorption chiller acting as lead heat source in conjunction with thermal storage conjunction. The absorption chiller will utilise heat rejection from the chp and utilise a proposed district cooling network to provide cooling to buildings which have cooling requirements. The project will encompass PV requirements to meet Part L compliance and also offset the carbon reduction measures required on the project.

The main Mechanical and Electrical plant systems would be located within purpose designed plant spaces located in the existing energy centre to allow adequate access for future maintenance and plant replacement.

All plant and equipment would be equipped with energy control measures incorporating variable speed drives, with low energy motors provided on ventilation fans and hydraulic pumps.

Section 6 - Conclusions

This energy statement has summarised the energy hierarchy requirements for Plas coch campus to respond to emission reduction targets set out within the Wrexham City Council Local Development Framework Core Strategy Development Plan.

The development will incorporate passive energy techniques available in the construction industry to reduce its ongoing requirement to consume energy to heat, ventilate and light the building, this is achieved by improved efficient fabric design in excess of the thermal properties set out within the Building Regulations.

The development will incorporate energy efficiency measures in its Building Services to reduce the carbon footprint of the site below the passive improvement stage, using highly efficient heat generation plant, heat recovery systems and energy efficient and highly controllable lighting.

The central heating plant will be designed around a high efficiency heat generator, providing Domestic Water Heating. Pre-heat to the systems will utilise Low Carbon energy taken from Combined Heat & Power system combined with an absorption chiller acting as lead heat source in conjunction with thermal storage conjunction. The absorption chiller will utilise heat rejection from the chp and utilise a proposed district cooling network to provide cooling to buildings which have cooling requirements. The project will encompass PV requirements to meet Part L compliance and also offset the carbon reduction measures required on the project.

Overall, the Carbon emissions from the proposed plas coch campus development shows potential for a **15 %** reduction in emissions from baseline set by current Building Regulations Part L 2013 to achieve the reduction targets set out in the glyndwr university environmental sustainability strategy.

The strategy improves on the fundamental principles of the Building Regulations, and will make a significant contribution to reducing the annual CO₂ emissions on the plas coch campus.