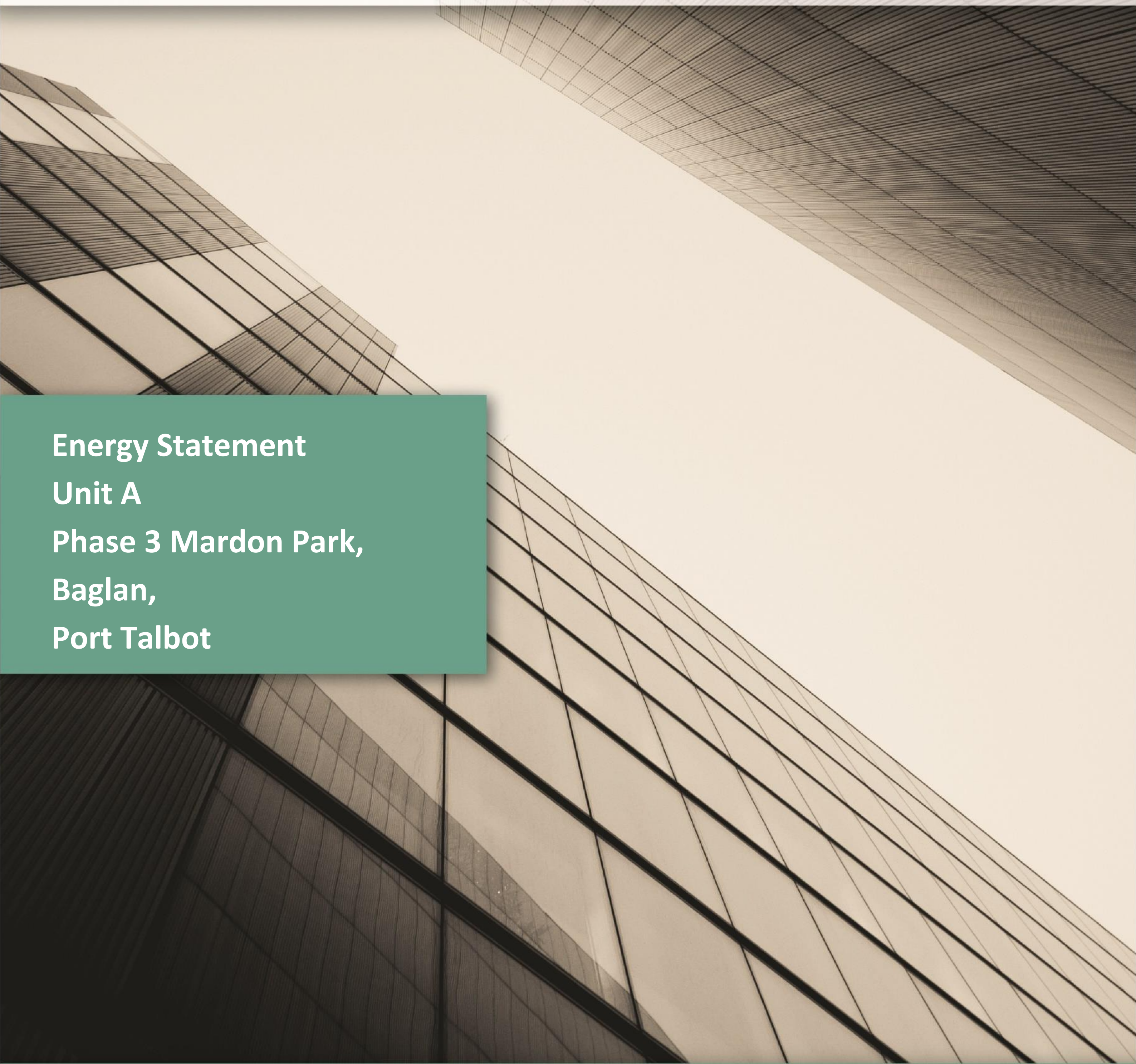
greenbuildconsult



Energy Statement
Unit A
Phase 3 Mardon Park,
Baglan,
Port Talbot

www.greenbuildconsult.co.uk

Document Control

Project	Unit A – Phase 3 Mardon Park
GBC Job Number	6289

Document Checking:

Prepared By:	Owain Morgan	Signed:	OMorgan
Checked By:	Tom King	Signed:	
Verified By:	Daryl Fisher	Signed:	DFisher

Issue	Date	Status
1	25th February 2021	First Issue

Contents

1.0 Executive Summary

1.1 This report assesses the potential for installing on-site low or zero carbon (LZC) technologies for the new build Unit A, Mardon Park, Port Talbot against Policy RE2: Criteria for the Assessment of Renewable and Low Carbon Energy Development of Neath Port Talbot County Borough Council's local development plan.

1.2 The feasibility study will analyse energy demand for the proposed development along with the potential for installing LZC technology on-site and connecting to existing LZC or district heating systems.

1.3 The initial results of the study indicate that there are potential savings to be achieved when incorporating the analysed LZC technologies into the project, however many technologies have been discounted due to considerations of the site locality and feasibility of installing technologies for this development.

1.4 The proposed installation of a 10 kWp roof mounted south west facing Solar Photovoltaic (PV) system at this locality which is found to provide significant reductions in energy demand and CO_2 emissions. Further savings can be achieved through the provision of efficient heating systems and fabric U-Values beyond minimum Building Regulations standards.

1.5 It is expected that the proposed PV system could provide approximately 10% of the buildings electrical demand. This, combined with other energy demand reduction measures listed within the report are expected to result in a 6.9% improvement in the buildings annual CO2 emissions beyond the minimum standards of Part L2.

1.6 It is deemed unfeasible to connect to existing district heating and LZC technology networks in the vicinity of the proposed development.

2.0 Project Details

Introduction

2.1 GreenBuild Consult Ltd were commissioned to prepare an Energy Statement for the proposed development at Unit A Mardon Park, Port Talbot.

2.2 This report presents the outcome of the energy appraisal of the proposed development and details the approach that the applicant and the design team have collectively taken towards achieving a high standard of operational energy performance. This Energy Statement outlines the features that have been incorporated into the design proposals which aim to reduce the, resultant energy demand and therefore environmental impact of the scheme.

2.3 The purpose of the Energy Statement is to provide an independent verification that the design of the proposed development is in accordance with objectives of relevant planning policy at all levels and is an example of good practice in low energy design.

2.4 The Energy Statement includes:

- A brief description of the proposed development;
- An examination of the performance of the scheme in accordance with key energy policies at all levels;
- A review of the proposed development's performance against set planning objectives and good practice identifying the opportunities for incorporating low and zero carbon technologies and constraints of both the application site and the proposals.

2.5 The energy appraisal has been undertaken at an early stage to directly inform building design and ensure that the building can achieve optimal energy performance. The Energy Statement, therefore, also provides a framework for the team to monitor the scheme's performance throughout its development and operation.

The Proposed Development

2.6 The application site is found at Mardon Park, Port Talbot and the proposed development comprises the construction of a new built, part two storey warehouse (Class B8) unit totalling 2,322 m^2

2.8 The unit will comprise of a large warehouse area, office space and associated ancillary spaces.

2.9 The site is part of an existing industrial park and is bounded by other industrial units to the North and West with unused land to the rear of the building. Figures 1 and 2 illustrates the existing and proposed site location plan.

Figure 1 – Proposed Site Location Plan (ref. J.M Design, Proposed Site Plan, no: A0-A200, 30/06/20)

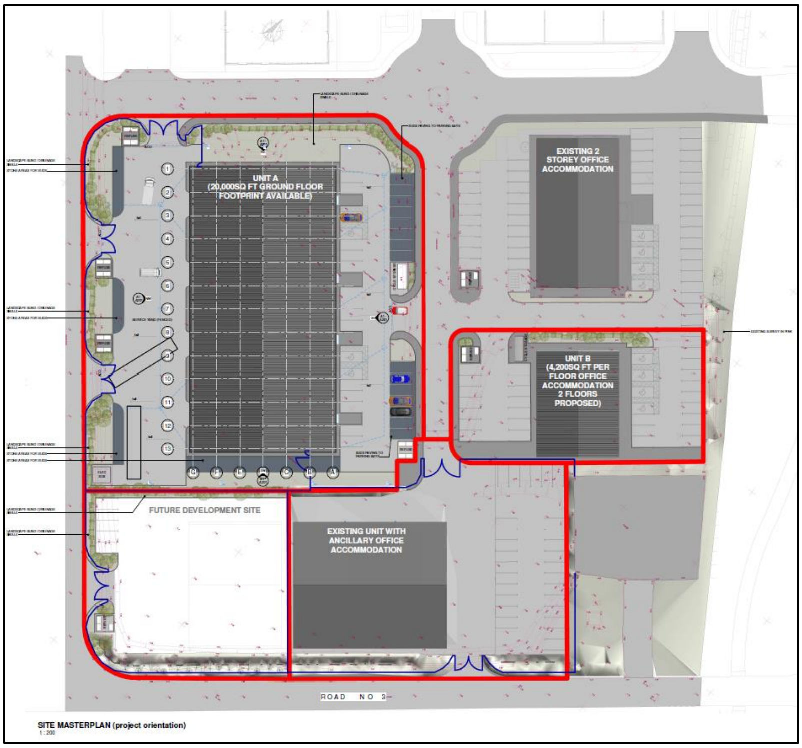


Figure 2- Proposed Floor Plan (ref: J.M Design Studio, Unit A-A301, 02/02/21)

3.0 Energy Demand Assessment

3.1 The likely energy demand of the proposed development has been calculated using drawings produced by J.M Design Studio and energy benchmarks from industry sources and energy demand calculations by Greenbuild Consult.

3.2 The methodology used to estimate the energy demand from the building at the site has been informed by the guidance of the National Calculation Methodology (NCM) modelling guide.

3.3 The software used to generate the Regulation baseline is approved by the DCLG as being compliant with the NCM, (IES VE 2021.0.0).

3.4 The compliant model has been calculated using the parameters as set out in Table 1.0 below. The Brukl documents showing the baseline energy models can be seen in Appendix A:

Table 1.0 - Construction Parameters for Unit A Mardon Park, Baglan

	Specification Overview
Fabric	U-Value
Ground Floor	0.20
External Wall	0.25
Roof	0.15
Glazing – Windows	1.4, g-value 0.60
Glazed Sections	1.4, g-value 0.35
Rooflight	1.25, g-value 0.55
External Personnel Door	2.20
Vehicle Access Doors	1.20
	Air Permeability Target m^3/hm^2
Air leakage	6
M + E	
Heating	**Flued forced convection air heaters** Seasonal efficiency 91% Warehouse **LTHW boiler with radiators** Seasonal efficiency 93% All other spaces
Ventilation	Naturally Ventilated with openable windows Destratification fans to warehouse space
Lighting	Typically 120 lm/watt throughout, lighting to warehouse designed to not 2 W/m2
Hot Water	Localised electric instantaneous water heaters & electric showes
Renewable Technology	10kWp South Westerly facing PV array

Building Primary Energy Consumption

3.5 Based on the abovementioned construction and M&E specification a predicted Primary Energy Consumption of the unit has been calculated and can be seen in Table 2.0 below;

Table 2 - Building Primary Energy Consumption

	Building Primary Energy Consumption (kWh/m^2/year)	Target Primary Energy Consumption (kWh/m^2/year)	Saving (kWh/m^2/year)	Saving (%)
Unit A	151.53	168.9	17.37	10.28%

3.6 The expected Primary Energy Consumption of Unit A in 17.37 kWh/m2/year less than the notional calculation confirming compliance with the BPEC/TPEC requirements of Part L2 and equates to an improvement of 10.28% beyond the minimum requirements.

	Building CO_2 Emissions (tonnesCO_2/year)	Target CO_2 Emissions (tonensCO_2/year)	Saving (tonnesCO_2/year)	Saving (%)
Unit A	56.7	60.8	4.2	6.9%

3.7 Regulated carbon emissions for the development are expected to exceed the minimum required to meet Building Regulations Part L2 compliance by 4.2 tonnes of CO_2 per year, equivalent to a 6.9% improvement beyond minimum requirements.

Energy Consumption by End Use

3.8 The building energy usage can be broken down to its end use which have been reported under the following categories; Heating, Cooling, Auxiliary, Lighting and Hot Water.

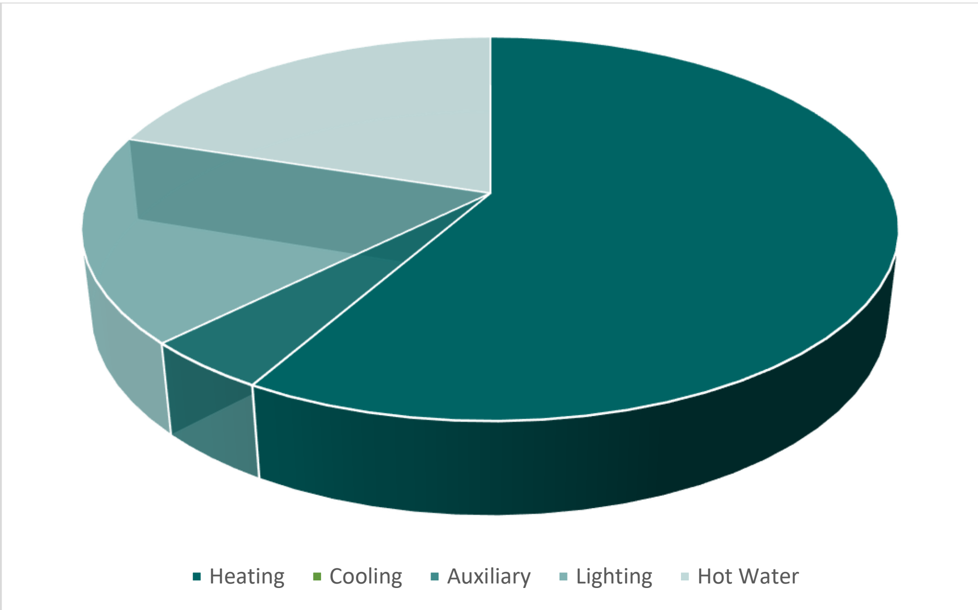
Table 3 - Energy Consumption by end use categories for Unit A

Energy Consumption by End Use Category		
Unit A		
	Calculated Energy Consumption by End Use (kWh/m^2/year)	Compliant Baseline Energy Consumption by End Use (kWh/m^2/year)
Heating	45.05	75.31
Cooling	0	0
Auxiliary	3.32	0.53
Lighting	13.48	17.41
Hot Water	15.57	17.41
TOTAL	**122.78**	**137.84**

3.9 Heating accounts for the greatest energy demand within the building while hot water and lighting also require large portions of the overall building energy usage.

3.10 The lighting energy demand is minimised due to ample natural daylight from the large rooflight areas and windows to office spaces. Hot water demand is generally higher than expected for this building type though it is likely that is due to the presence of electric showers within the changing rooms.

Figure 3 - Percentage Energy Consumption by End Use for Unit A



3.11 The energy demand can be subdivided further between the natural gas fuel and grid supplied electricity. Separating the energy demands like this allows us to calculate the portion of the electrical energy demand that could be met by on-site renewable energy generation.

Table 4 - Energy Demand by fuel for Unit A

Energy Demand by fuel		
Unit A		
	Natural Gas (kWh/m^2)	Grid Supplied Electricity (kWh/m^2)
Unit A	45.05	32.27

3.12 The 10kWP roof mounted PV installation included within the model is expected to generate 3.29 $kWh/m_2/yr$ which, if all energy is consumed on site, would supply 10.2% of the electricity demand of the building.

Table 5 – Renewable Energy generation and electricity demand for Unit A

Energy Demand by fuel			
Unit A			
	Grid Supplied Electricity ($kWh/m^2/year$)	Renewable energy generated on-site ($kWh/m^2/year$)	% electricity demand supplied by generated electricity
Unit A	32.27	3.29	10.2%

4.0 On-Site Renewable/ Low Carbon Energy Generation Potential

4.1 An initial assessment of feasible renewable energy sources has been carried out with the results detailed below. The renewable energy feasibility study for the proposed development has assessed the use of wind turbines, solar thermal collectors, ground/air source heat pumps, biomass heating and photovoltaic modules.

4.2 The appraisal examines the potential of renewable energy storage against known factors as set out in Appendix C: Energy Assessment Requirements of Neath Port Talbot County Borough Council Local Development Plan 2011-2016 Renewable and Low Carbon Energy Supplementary Planning Guidance (July 2017)

Energy Supply Issues

4.3 One of the key limiting factors to renewable energy is the discrepancy between peak demand for energy and the timing of maximum energy generation. Photovoltaic panels are a proven renewable technology however they will normally generate the maximum energy output during the middle of the day in the summer while demand is likely to be lowest.

4.4 However, as shown in Table 4 above the predicted electrical energy demand of the building forms a considerable part of the overall energy demand therefore solar PV may be an effective option to consider. Consideration should be given to other factors discussed later in this section such as site orientation and layout and to the potential requirement of a night-time back-up or battery capacity to store excess production.

4.5 The intermittent mature of some renewable technologies can pose a feasibility issue. Both Wind Turbine Generators, Solar PV and Solar Thermal Collectors produce the most energy when the weather conditions are favourable and therefore cannot provide electricity continuously. There is potential to combine renewable energy sources such as Solar PV which would provide electricity during the day while Wind Turbine Generators can generate electricity at night and during winter.

Development Scale

4.6 The nature of many renewable technologies dictates that they may only be applicable at a large scale depending on the energy demand of the building.

4.7 The demand for hot water is thought to come directly from bathroom taps and electrical showers considered to only be occasionally used. To produce significant CO_2 and energy savings a large scale Solar Thermal array would be required which would produce a large amount of hot water. It is unlikely to be enough demand to justify the installation therefore this technology has been disregarded.

4.8 Large scale developments which incorporate a mix of residential and commercial properties could benefit from introducing interconnected energy generation systems and incorporate facilities to utilise waste heat from industrial processes to power or heat other areas of the development. The construction at Mardon Park does not incorporate any other form of development and therefore interconnection to achieve greater economies of scale is unsuitable.

Site Topography, Orientation & Proposed Site Layout

4.9 The topography of a site will play a major role in determining the feasibilities of certain technologies. For example, Solar PV and Hot Water systems work best when fitted in a southerly or south-westerly orientation

4.10 The wind speeds and frequencies in urban areas are expected to be insufficient to yield any significant carbon reductions. For these reasons, the application of a wind turbine for the project has not been considered.

4.11 The development is orientated in a North West-South East orientation with a large area of south westerly facing roof space. For this reason, the site topography and orientation are favourable for the installation of Solar PV to the roof of the development.

4.12 There is limited space available to allocate space for boilers and biomass fuel storage. Additionally, it is likely that fuel would be sourced from outside the area surrounding the proposed development.

4.13 Though biomass is a cleaner fuel than gas or heating oil, it should be noted, however, that fossil fuels are utilised in the production, processing and transportation of biomass fuels. Therefore, a key issue when choosing the biomass fuel supplier is the distance between the grower and the boilers as well as the method of transportation.

4.14 Although many biomass burners will meet Clean Air Act requirements, combustion of wood biomass releases higher quantities of NO_X, SO_X and particulates (PM10 and PM2.5) compared to a comparable system fuelled by natural gas, which can adversely affect local air quality.

4.15 Biomass could technically be burned at the application site but is not preferred given site spatial limitations, the management burden of fuel deliveries and removal of ash and the potential impact on local air quality given the proximity of existing residential dwellings. For these reasons Biomass has been deemed unfeasible for the project.

4.16 There are a number of configurations for Ground Source Heat Pump (GSHP) systems, however the installation of a vertical collector system or horizontal collector system is not considered technically feasible for the project, given the restricted areas available for their installation.

4.17 Given the expense of installation, the number of boreholes required to meet the load requirements of the proposed development, along with a severely limited installation area for collectors (horizontal and vertical) it is not recommended to install a ground coupling at the proposed development.

Suitability of the Locality

4.18 As discussed in Section 2 the development sits within Mardon Park with other adjacent industrial, office and warehouse units. There are no housing development adjacent to the site.

4.19 The roof of other adjacent industrial unit contains a large area of Solar PV panels indicating that local policy and neighbouring properties are likely to support such an installation.

4.20 As discussed previously, biomass heating can produce higher quantities of NOx, SOx and particulates and therefore careful consideration and consultation should be carried out should the design team wish to investigate this option further.

4.21 The development area is not registered as a Listed Building and is not located within a Conservation Area.

Viability and Cost Effectiveness

4.22 Although the main purpose of this study is to evaluate the environmental impact of proposed renewable technologies the economic cost of implementing measures should not be disregarded.

4.23 As discussed previously it is deemed that to achieve a large reduction in carbon emissions a significant amount of solar thermal capacity will be required while it is unlikely that the development will require the amount of water produced therefore this option would be unviable.

4.24 Ground source heat pumps are thought to be unfeasible for this development due to site constraints however there are also significant costs involved with installation which proves this option unviable.

4.25 The carbon-saving potential of ASHPs is likely to be modest compared to the radiant gas heating alternative therefore have been disregarded in this assessment.

4.26 A 10kWp PV array has been proposed for installation on the roof space at the proposed development. PV arrays may also be integrated into building fabric, external shading devices and glazing, but are not advised in this instance.

4.27 The PV array will help compensate the energy used by equipment, lighting and hot water heating produced for this development and is therefore found to be a viable option.

5.0 Potential to Connect to Existing Renewable/ Low Carbon Energy Sources

5.1 There are currently no proposals to connect to existing renewable/low carbon energy sources as part of this development.

5.2 There is a large solar PV array on the roof of an adjacent building however practicality and the costs associated with connecting with this system are likely to be excessive when compared to the costs of introducing a separate renewable energy system for this development therefore this option has been disregarded.

6.0 Potential for District Heating Systems

6.1 District heating is the provision of heating and hot water to multiple buildings through the use of insulated pipework.

6.2 There are currently no district heating networks in operation within the vicinity of the development. It is expected the costs involved with setting up this type of system would exceed the potential economic and environmental savings achieved.

7.0 Potential to Share On-Site Renewable/Low Carbon Energy

7.1 In some developments where renewable energy is proposed surplus energy produced can be shared between a number of buildings on the same network.

7.2 This could potentially be proposed for this development however it is unknown when future development adjacent to Unit A. It also appears that the other units adjacent to Unit A also have south-westerly facing roof surfaces ideal for the installation of Solar PV and would therefore have the potential to benefit from their own installation.

8.0 Conclusions & Recommendations

8.1 The incorporation of LZC technology for the development could have potential benefits of CO_2 emissions, energy demand and running cost savings depending on which technology is used.

8.2 Of the technologies proposed the most feasible is thought to be a Solar PV array. A 10 kWp array is found to provide significant reduction in energy demand and CO_2 emissions of the proposed Unit.

8.3 This technology also has the benefit of being easily retrofitted to the roof of the building therefore more capacity could be added should more demanding equipment be proposed within the facility thus increasing the electricity demand of the building or be integrated to a battery system in future.

8.4 In total, the building is expected to meet Building Regulations Part L2 requirements and provide a 6.9% betterment in CO2 emissions.

8.5 In addition to reduced CO2 emissions, energy generated on-site by the proposed 10 kWp array could supply approximately 10.2% of the building's annual electrical needs.

REFERENCES

1 Building Regulations Approved Document L2a: Conservation of Fuel and Power in new buildings other than dwellings (2014 edition incorporating 2016 amendments) https://www.labc.co.uk/sites/default/files/EXT.Approved-Document-L-2014-Conservation-of-Fuel-%26-Power-L2A-New-Buildings-Other-than-Dwellings.JMCN_.v1.030417.pdf

2 Neath Port Talbot County Borough Council Local Development Plan 2011-2016 Renewable and Low Carbon Energy Supplementary Planning Guidance (July 017)

APPENDIX 1:
ENERGY MODELLING RESULTS for
The extension to Unit A Mardon Park

Overview

The modelling of the building has been undertaken using approved National Calculation Method software (IESVE). The modelling results included here are an early state of the iterative process where the fabric performance and building systems are refined to meet building design and amenity targets.

BRUKL Output Document

Compliance with Wales Building Regulations Part L 2014

Llywodraeth Cymru
Welsh Government

Project name

UNIT A

As designed

Date: Thu Feb 25 14:55:39 2021

Administrative information

Building Details

Address: MARDON PARK PHASE 3, PORT TALBOT, SA12 7AX

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.b.0

Interface to calculation engine: Virtual Environment

Interface to calculation engine version: v7.0.13

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Owain Morgan

Telephone number:

Address: , ,

Criterion 1: The calculated BER and BPEC for the building must not exceed the targets

Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	24.4	
Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	26.2	
Building Primary Energy Consumption (BPEC), kWh/m^2.annum	151.53	
Target Primary Energy Consumption (TPEC), kWh/m^2.annum	168.9	
Do the building's emissions and primary energy consumption exceed the targets?	BER =< TER	BPEC =< TPEC

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a-Limit}$	U_{a-Calc}	U_{i-Calc}	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.26	"CH000004_W0"
Floor	0.25	0.2	0.2	"NW000000_F"
Roof	0.25	0.16	0.16	"NW000000_C"
Windows***, roof windows, and rooflights	2.2	1.08	1.43	"NW000003_W0_O0"
Personnel doors	2.2	2.2	2.2	"NW000000_W2_O0"
Vehicle access & similar large doors	1.5	1.24	1.24	"NW000000_W2_O1"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

$U_{a-Limit}$ = 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)]

* There might be more than one surface where the maximum U-value occurs.
** 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.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	7

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

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- Flued Gas Fired Air Heaters

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	-	-	-
Standard value	0.91	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	NO				

2- LTHW Boiler

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.94	-	-	-	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	NO				
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

3- Electric Showers

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	-	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	NO				

1- SYST0006-DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

2- SYST0008-DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	-
Standard value	N/A	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	**Zone**	**Standard**
WC (D-FF16)	-	-	0.5	-	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
WC 2 no.	-	-	0.5	-	-	-	-	-	-	-	N/A
Lockers (D-FF15)	-	-	0.5	-	-	-	-	-	-	-	N/A
WC - (D-FF20)	-	-	0.5	-	-	-	-	-	-	-	N/A
Changing Area - Shower (D-FF17)	-	-	0.5	-	-	-	-	-	-	-	N/A
Changing Area - Dry (D-FF17)	-	-	0.5	-	-	-	-	-	-	-	N/A
Changing Area - Shower (D-FF18)	-	-	0.5	-	-	-	-	-	-	-	N/A
Changing Area- Dry (D-FF18)	-	-	0.5	-	-	-	-	-	-	-	N/A

General lighting and display lighting

	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
Warehouse (B-GF01)	223	-	-	2846
Store (D-FF09)	120	-	-	515
Store (D-FF08)	120	-	-	515
Office (D-FF13)	120	-	-	95
Office (D-GF02)	120	-	-	97
Circ - Lobby (D-FF12)	-	120	-	42
Breakout (D-FF10)	-	120	-	86
Plant Room (A-GF04)	120	-	-	27
WC (D-FF16)	-	120	-	20
Circ - Lockers lobby	-	120	-	9
WC 2 no.	-	120	-	23
Lockers (D-FF15)	120	-	-	10
Plant Room (B-GF04)	120	-	-	27
Store (D-GF03)	120	-	-	122
Circ - Production Lobby (D-FF19)	-	120	-	45
WC - (D-FF20)	-	120	-	37
Store (D-FF07)	120	-	-	523
Store (D-FF06)	120	-	-	523
Circ - FF	-	120	-	33
Office (A-FF01)	120	-	-	185
Office (D-FF05)	120	-	-	240
Store - Product/Demonstration Area (D-FF04)	120	-	-	492
Circ - FF	-	120	-	37
ICT Server Room (D-FF21)	120	-	-	26
Changing Area - Shower (D-FF17)	-	120	-	8
Changing Area - Dry (D-FF17)	120	-	-	13
Changing Area - Shower (D-FF18)	-	120	-	8
Changing Area- Dry (D-FF18)	120	-	-	13

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Warehouse (B-GF01)	NO (-43.7%)	NO
Store (D-FF09)	NO (-45.9%)	NO
Store (D-FF08)	NO (-56%)	NO
Office (D-FF13)	N/A	N/A
Office (D-GF02)	NO (-4.4%)	NO
Breakout (D-FF10)	NO (-68.7%)	NO
Store (D-GF03)	NO (-80.1%)	NO
Store (D-FF07)	NO (-49.3%)	NO
Store (D-FF06)	NO (-56.6%)	NO
Office (A-FF01)	NO (-42.5%)	NO
Office (D-FF05)	NO (-53%)	NO
Store - Product/Demonstration Area (D-FF04)	NO (-69.6%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER and BPEC

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	2322.5	2322.5
External area [m^2]	4859.3	4859.3
Weather	CAR	CAR
Infiltration [m^3/hm^2@ 50Pa]	7	7
Average conductance [W/K]	1297.47	1803.28
Average U-value [W/m^2K]	0.27	0.37
Alpha value* [%]	13	41.79

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

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
100	**B8 Storage or Distribution**
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 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/m^2]

	Actual	Notional
Heating	45.05	75.31
Cooling	0	0
Auxiliary	3.32	0.53
Lighting	13.48	18.11
Hot water	15.47	17.41
Equipment*	34.9	34.9
TOTAL**	**77.31**	**111.35**

* 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/m^2]

	Actual	Notional
Photovoltaic systems	3.29	6.36
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	209.97	342.16
Primary energy* [kWh/m^2]	151.53	168.9
Total emissions [kg/m^2]	24.4	26.2

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

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] Flued forced-convection air heaters, [HS] Air heater, [HFT] Natural Gas, [CFT] Electricity										
	Actual	148.3	73.7	52.2	0	3.3	0.79	0	0.91	0
	Notional	262	114	88.8	0	0	0.82	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	101.9	89.1	33.7	0	3.3	0.84	0	0.94	0
	Notional	158.9	129.8	53.9	0	1.4	0.82	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
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