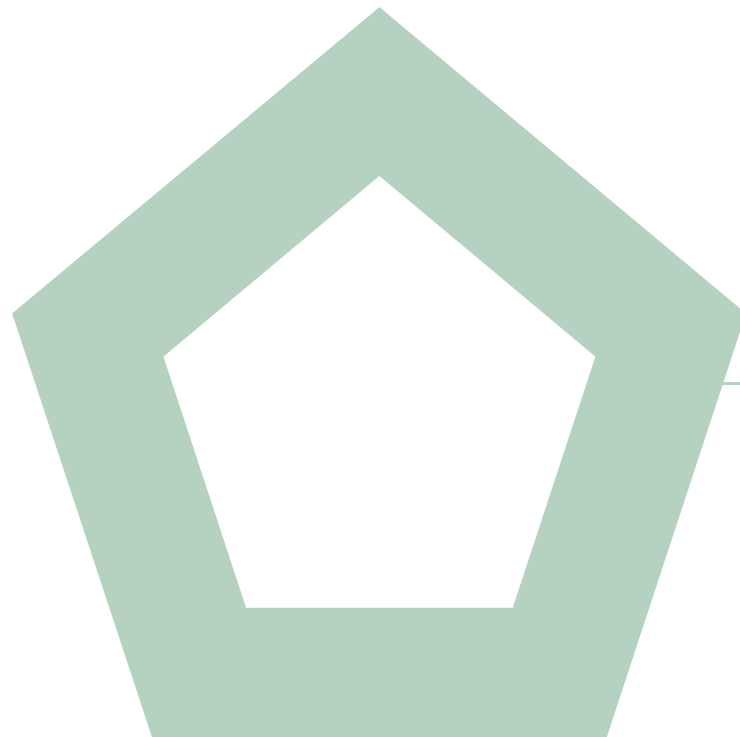


Ysgol Gymraeg Bro Morgannwg. Barry. Vale of Glamorgan Council.

SUSTAINABILITY

STAGE 3 REPORT - PART L2A COMPLIANCE ASSESSMENT

REVISION A - 14 DECEMBER 2018



STAGE 3

Audit sheet.

Rev.	Date	Description of change / purpose of issue	Prepared	Reviewed	Authorised
A	14/12/2018	For information	A. Gallotta	T. Brown	T. Agoro

This document has been prepared for Vale of Glamorgan Council only and solely for the purposes expressly defined herein. We owe no duty of care to any third parties in respect of its content. Therefore, unless expressly agreed by us in signed writing, we hereby exclude all liability to third parties, including liability for negligence, save only for liabilities that cannot be so excluded by operation of applicable law. The consequences of climate change and the effects of future changes in climatic conditions cannot be accurately predicted. This report has been based solely on the specific design assumptions and criteria stated herein.

Project number: 23/23221

Document reference: REP-2323221-5A-AG-20181214-Part L2A Compliance-Rev A.docx

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1. Executive summary

This report provides a summary of the Wales Building Regulations Part L2A 2014 assessment undertaken for the proposed extension of Ysgol Gymraeg Bro Morgannwg located in Barry.

It is understood that the new extension block identified as Phase F on the ISG construction plan is required to meet the minimum required credits to achieve BREEAM Excellent, i.e. a minimum of 5 credits under ENE01.

The energy assessment undertaken has been carried out in accordance with the “Part L2A 2014: for use in Wales” and it is deemed suitable to prove the energy performance of the proposed building hence to demonstrate the achieved credits under the Ene01 section of the BREEAM assessment.

Table 1.1 reports a summary of the Proposed Building energy performance.

1.1 Criterion 1 – CO₂ Emissions

The proposed building is demonstrated to achieve an overall CO₂ emission reduction in the order of 6% circa against the Notional Building. This is inclusive of 100 m² of photovoltaic system able to generate at least **17.0 MWh/year** of electricity on an annual basis.

It is also forecast that the proposed development can achieve an EPC A rating based on the building fabric and services specification as presented in Section 4.

The Proposed Building is demonstrated to achieve the minimum required credits under the BREEAM ENE01 for BREEAM Excellent.

With respect to CO₂ emissions (Figure 1.1), it is anticipated that hot water and lighting energy requirements will contribute most to overall CO₂ emissions.

To decrease the overall CO₂ emissions, it is suggested the insulation provision on DHW vessels and distribution pipes should be increased above the minimum values suggested by the building regulation.

The lighting strategy assumes the use of LED technology throughout the extension. Due to the current stage of the design, lighting calculation are not available. It recommended to verify the thermal model once that the calculations will be available at the next design stage.

All parameters outlined in this report to be checked and validated by the design team.

Summary

The results here shown can be summarised as follows:

- The proposed building achieve compliance with Building Regulations Part L2A 2013 with a CO₂ emission reduction in the order of 6%.
- Domestic hot water requirements are dominant. Insulated vessels and distribution pipes can help to decrease the energy demand and the overall CO₂ emissions.
- PV systems are required to achieve 6 credits under BREEAM 2014 Ene01.

Next Steps

- Consider improving the DHW pipes and vessels insulation.
- Consider using high efficient LED.
- Carefully chose blind devices to avoid “blinds-down lights-on” scenario.

Table 1.1: Summary of Performance against Part L2A 2013.

Assessment	Part L Target Emission Rate (TER) – kgCO ₂ /m ²	Part L Building Emission Rate (BER) – kgCO ₂ /m ²	CO ₂ Emission Reduction beyond Part L2A 2013 (%)	Photovoltaic area (m ²)	EPC Rating	BREEAM Ene01 credits
Ysgol Gymraeg Bro Morgannwg	36.1	33.8	6.37%	100	A 25	6

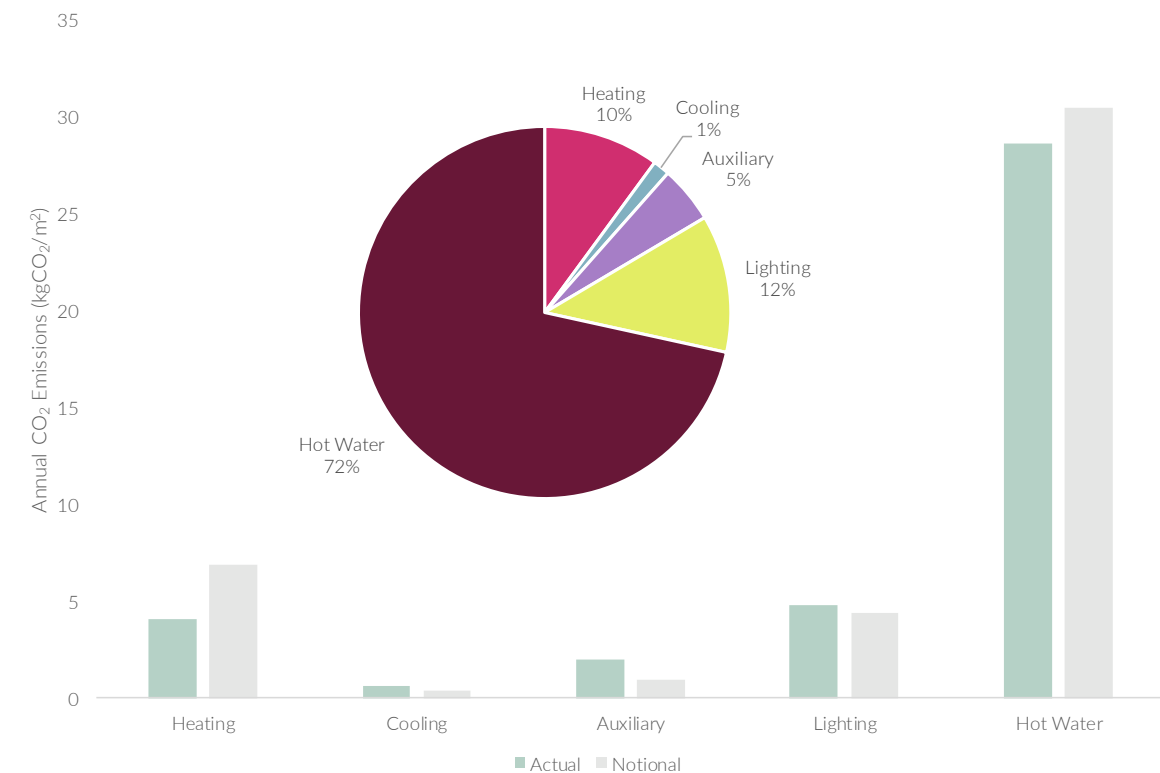


Figure 1.1: Summary of CO₂ Emissions, including comparison with Notional building (light grey).

2. Introduction

This report provides a summary of the Building Regulations Part L2A 2014 assessment undertaken for the proposed extension of Ysgol Gymraeg Bro Morgannwg located in Barry.

It is understood that the new extension block identified as Phase F on the ISG construction plan is required to meet the minimum required credits to achieve BREEAM Excellent, i.e. a minimum of 5 credits under ENE01.

The energy assessment undertaken has been carried out in accordance with the “Part L2A 2014: for use in Wales” and it is deemed suitable to prove the energy performance of the proposed building hence to demonstrate the achieved credits under the Ene01 section of the BREEAM assessment.

The results in this report relate to the performance against Part L Criterion 1 (CO₂ emissions). The corresponding number of credits achieved for BREEAM Ene01 has been also reported.

The results are based on the parameters for building fabric and services outlined in this report. It is the responsibility of the design team to validate and ensure these parameters can be achieved, and are subsequently included in relevant specification documents.

The modelling was undertaken using IES 2018 version 2018.1.0.0 software, VE compliance version 7.0.10.0 which is approved for use in assessing the performance of buildings in accordance with the Building Regulations Part L2A.

Figure 2.1 is an extract from the IES model.

2.1 Proposed Development Targets

The proposed building is located in Barry, Wales, and so the “Part L2A 2014: for use in Wales” apply.

The Welsh government encourages developments to reduce demand for energy through energy efficiency measures. For the assessed extension, a BREEAM Excellent target is set which requires a minimum of 5 credits being achieved under Ene01.

To meet the minimum requirement, the following approach has been used:

- Reducing demand for energy.
- Improving resource efficiency (sustainable design and construction).
- Reduce the primary energy demands through optimised design and LZC technologies

It is anticipated that the following targets would be applicable to the Proposed Development:

- Implement a fabric first approach to minimise energy demand.
- Consider the provision of renewable and LZC technologies to generate energy on-site.
- Achieve a minimum of 5 credits under the BREEAM 2014 ENE01.

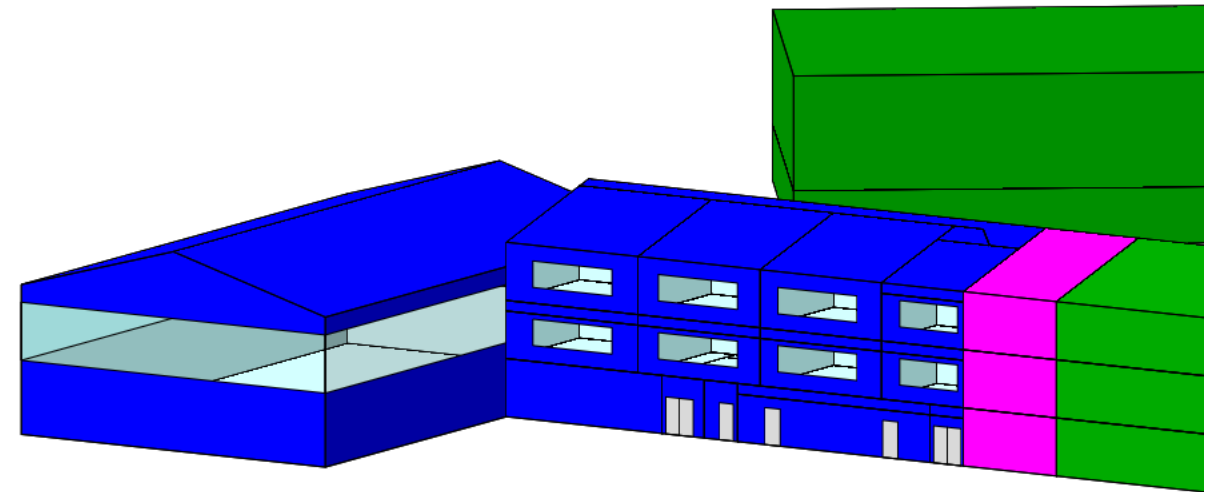


Figure 2.1: Extract from IES Model.

3. Design Standards and Regulatory Requirements

Building Regulations Part L

The building is being assessed against the Building Regulations Part L2A 2014: for use in Wales. Part L has five key criteria which must be satisfied as follows:

- **Criterion 1** - Achieving the Target Emission Rate (TER) and Target Primary Energy Consumption (TPEC).
- **Criterion 2** - Limits on design flexibility.
- **Criterion 3** - Limiting the effects of solar gains in summer.
- **Criterion 4** - Building performance consistent with the Building Emission Rate (BER).
- **Criterion 5** - Provision for energy efficient operation of the building.

Criterion 1 of the Building Regulations Part L 2014: for use in Wales requires that the building as designed is not anticipated to generate CO₂ emissions in excess of that set by a Target Emission Rate (TER) calculated in accordance with the approved the National Calculation Methodology (NCM) 2013 for non-dwellings. Furthermore, the Proposed Building BPEC (Building Primary Energy Consumption) needs to be lower than the TPEC (Target Primary Energy Consumption).

Criterion 2 places upper limits on the efficiency of controlled fittings and services.

Criterion 3 requires that zones in commercial buildings are not subject to excessive solar gains. This is demonstrated using the National Calculation Methodology (NCM) 2013.

This note focuses specifically on Criterion 1 compliance.

Energy Performance Certificate (EPC)

An EPC must be produced upon sale or let of non-dwellings and is valid for 10 years. An EPC will rank the building in terms of energy efficiency via an Asset Rating. For example, to achieve EPC B, the asset rating must be between 26 and 50 and for EPC A it is 0-25.



Figure 3.1: Approved Document Part L2A: for use in Wales

4. Model Inputs and Parameters

4.1 Approach to Assessment

The approach to the Part L2A compliance assessment has been to:

- Demonstrate compliance with the “Building Regulations Part L2A 2014: for use in Wales”.
- Determine the Energy Performance Certificate (EPC) rating.
- Achieve at least 5 BREEAM credits under the ENE01 section and meet the minimum required for BREEAM 2014 “Excellent”.

4.1.1 Building architectural information

Table 4.1 provides a summary of the drawings used to inform the construction of the models. All drawings have been supplied by ASL.

4.1.2 Building Fabric Specification

Table 4.2 provides a summary of the building fabric specification used in the model.

4.1.3 Building Services

An initial mechanical strategy has been developed and information received. Where information is not available at this stage, suitable assumptions have been taken in accordance with the good practice and with the market standards.

The mechanical strategy proposes a wet system for the classrooms, changing area and sport hall and a Variable Refrigerant Flow (VRF) system for the IT classrooms.

Local Mechanical Ventilation systems with Heat Recovery (MVHR) will be located in the VRF server IT rooms to provide the minimum fresh air rate.

The office located in the core of the extension will have a dedicated roof-mounted Air Handling Unit (AHU) to provide the requested fresh air.

All the suggested air treatment units will have a L2 leakage certificate and a low Specific Fans Power (SFP).

Table 4.3 summarises the parameters used in the Part L model.

All parameters outlined in the tables above are to be checked and validated by the design team (architect and MEP engineer).

4.1.4 Low Zero Carbon Technology

An additional iteration has been undertaken including 100m² of PV.

The system has been assumed South facing with 30° tilt angle able to harvest at least 17.0 MWh per year.

Table 4.1: Drawing reference for model construction.

Uploaded	Source	Data Type	Description	Revision
19.11.2018	ASL	Revit file	Revit Model	-
29.11.2018	ASL	Revit file	Revit Model	-

Table 4.2: Building fabric parameters used in the compliance model.

Parameter	U-value (W/m ² *K)	Thermal mass KJ(m ² *k)
External Wall	0.16	Very lightweight
Roof	0.15	100
Ground Floor	0.22	85
Internal wall	1.10	Very lightweight
Opaque Door	2.20	n/a
Window and Curtain Wall (including frame) U-value	1.40	n/a
g-value	0.40	n/a
North window and Curtain Wall (including frame) U-value	1.40	n/a
g-value	0.50	n/a

Table 4.3: M&E specification used in the compliance model.

Parameter	Target
Heating system	
Wet system	- 95% efficient boiler to generate the required heat - Variable speed pump with differential pressure sensors
VRF system	- 4.50 Seasonal Coefficient of Performance (SCoP)
Cooling system	
VRF system	- 3.60 Energy Efficiency Ratio (EER) - 5.00 Seasonal Energy Efficiency Ratio (SEER)
Ventilation system	
AHU	- SFP: 1.80 W/l/s - HR: 85% - L2 AHU leakage tested
MVHR	- SFP: 1.40 W/l/s

Parameter		Target
		<ul style="list-style-type: none"> - HR: 85% - L2 MV leakage tested - Temperature and CO₂ control system on a room basis
	Extract system	<ul style="list-style-type: none"> - SFP: 0.50 W/l/s - Fan remote from zone - HR: n/a
	Natural ventilation	Through openable windows
Lighting		
	Lighting	90 lm/W
	Lighting Controls	For all the areas: Out of Range control system linked with BMS Circulation / Common areas: <ul style="list-style-type: none"> - Presence detection – time switch Classrooms / Offices: <ul style="list-style-type: none"> - Presence and absence detection – time switch Toilets: <ul style="list-style-type: none"> - Presence detection – time switch Store area, cupboards and staff rooms <ul style="list-style-type: none"> - Presence detection – time switch
	Daylighting	Daylighting dimming system applied where suitable.
Domestic Hot Water (DHW)		
		Boiler: <ul style="list-style-type: none"> - 98% efficient boiler Storage: <ul style="list-style-type: none"> - Volume: 500 litres - Losses: 0.005 kWh/l day Secondary circulation: <ul style="list-style-type: none"> - Losses: 7 W/m - Loop length: 100m - Pump power: 0.15 kW - Pump time switch
	Power Factor Correction	>0.95
Renewables		
	PV	100 m ²

5. Results

5.1 Energy and CO₂ Emissions

Table 5.1 below presents a summary of the anticipated performance against the Building Regulations Part L2A 2014: for use in Wales based on the parameters outlined in this report.

The proposed building is demonstrated to achieve an overall CO₂ emission reduction in the order of 20% circa against the Notional Building / Part L baseline. This is inclusive of 100 m² of photovoltaic system able to generate at least **17.0 MWh/year** of electricity.

It is therefore demonstrated that the proposed building can achieve 6 credits under the BREEAM Ene 01 part.

Table 5.1: Summary of Performance against Part L2A 2013.

Assessment	Part L Target Emission Rate (TER) – kgCO ₂ /m ²	Part L Building Emission Rate (BER) – kgCO ₂ /m ²	CO ₂ Emission Reduction beyond Part L2A 2013 (%)	Photovoltaic area (m ²)	EPC Rating	BREEAM Ene01 credits
Ysgol Gymraeg Bro Morgannwg	36.1	33.8	6.37%	100	A 25	6

Please refer to Appendix A for a copy of the BRUKL document.

Energy and carbon analysis

As shown in Figure 5.1, the energy requirements for the building are largely dominated by hot water demands (DMH) (84%) requirements followed by heating (7%).

With respect to CO₂ emissions (Figure 5.2), it is anticipated that hot water demands and lighting energy requirements will contribute most to overall CO₂ emissions (84% combined).

To decrease the overall CO₂ emissions, it is suggested the insulation provision on DHW vessels and distribution pipes should be increased above the minimum values suggested by the building regulation.

The lighting strategy assumes the use of LED technology throughout the extension. Due to the actual stage of the design, lighting calculation are not available so it recommended to verify the thermal model once that the calculations will be available in the next design stage.

Blinds and other obscurant that will be provided in the classrooms should be carefully chosen to enable the regulation of the daylight accessing the spaces and so to avoid the “blinds down-lights on” scenario.

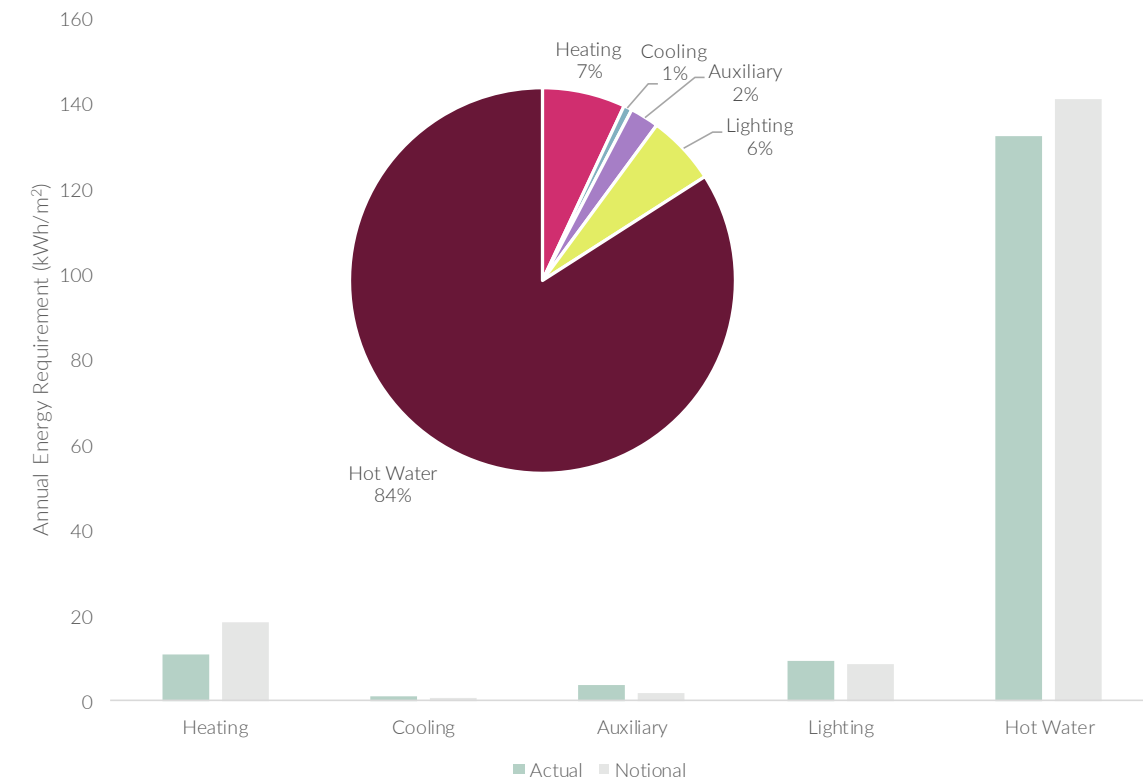


Figure 5.1: Summary of Energy Requirements, including comparison with Notional building.

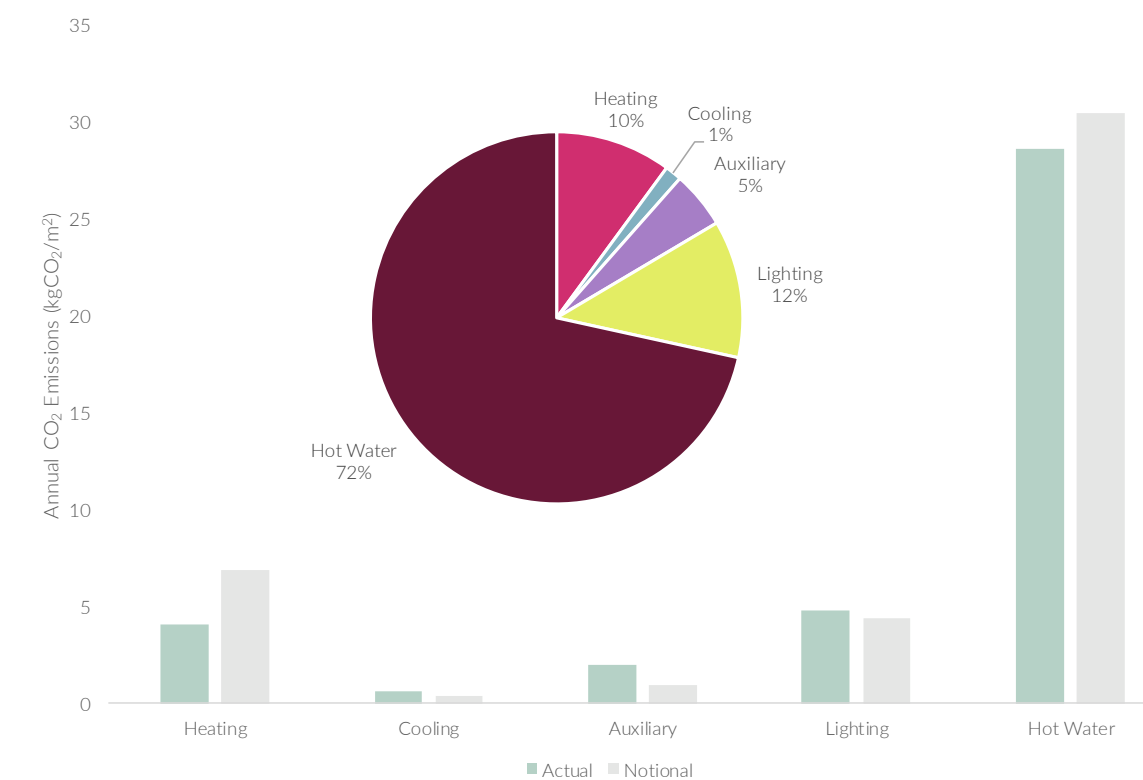


Figure 5.2: Summary of CO₂ Emissions, including comparison with Notional building.

6. Conclusion

This note has presented a summary of the results of the Ysgol Gymreag Bro Morgannwg against the Building Regulations Part L2A 2014: for use in Wales.

6.1 Criterion 1 – CO₂ Emissions

The reported analyses have been undertaken in accordance with the Building Regulations Part L2A using approved IES 2018 version 2018.1.0.0 software.

Please refer to Appendix A for a copy of the BRUKL output document.

It is also forecast that the proposed development can achieve an EPC A rating based on the building fabric and services specification as presented in Section 4.

It has also been demonstrated that with the inclusion of 100 m² of PV generating 17.0 MWh of electricity on an annual basis, the proposed building can achieve a 6.37% reduction in CO₂ emissions beyond Part L2A “baseline”.

A BREEAM “Excellent” rating is also targeted. As such, a minimum of 5 credits is required for BREEAM Ene 01. It has been demonstrated via this modelling that 6 credits can be achieved, therefore meeting the minimum required credit for BREEAM “Excellent”.

All parameters outlined in this report to be checked and validated by the design team.

Summary

The results here shown can be summarised as follows:

- The proposed building achieve compliance with Building Regulations Part L2A 2013 with a CO₂ emission reduction in the order of 6%.
- The building performance is headed by the domestic hot water demands. Insulated vessels and distribution pipes can help to decrease the energy demand and the overall CO₂ emissions.
- PV are required to achieve 6 credits under BREEAM 2014 Ene01.

Next Steps

- Consider improving the DHW pipes insulation.
- Consider reducing the AHUs SFPs.
- Carefully chose blind devices to avoid “blinds-down lights-on” scenario.

7. Appendix A – BRUKL and EPC Extract

Ysgol Gymraeg Bro Morgannwg - BRUKL

BRUKL Output Document

Compliance with Wales Building Regulations Part L 2014

Project name

YGBM	As designed
-------------	--------------------

Date: Wed Dec 05 16:34:32 2018

Administrative information

<p>Building Details</p> <p>Address: Address 1, City, Postcode</p>	<p>Owner Details</p> <p>Name: Name</p> <p>Telephone number: Phone</p> <p>Address: Street Address, City, Postcode</p>
<p>Certification tool</p> <p>Calculation engine: Apache</p> <p>Calculation engine version: 7.0.10</p> <p>Interface to calculation engine: IES Virtual Environment</p> <p>Interface to calculation engine version: 7.0.10</p> <p>BRUKL compliance check version: v5.4.b.0</p>	<p>Certifier details</p> <p>Name: Name</p> <p>Telephone number: Phone</p> <p>Address: Street Address, City, Postcode</p>

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	33.8
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	36.1
Building Primary Energy Consumption (BPEC), kWh/m ² .annum	196
Target Primary Energy Consumption (TPEC), kWh/m ² .annum	206.76
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	0.16	0.16	LG000005:Surf[2]
Floor	0.25	0.22	0.22	LG000005:Surf[0]
Roof	0.25	0.15	0.15	LG000004:Surf[9]
Windows***, roof windows, and rooflights	2.2	1.4	1.4	LG000005:Surf[1]
Personnel doors	2.2	2.2	2.2	LG00000A:Surf[1]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

U_{a-Limit} = Limiting area-weighted average U-values [W/(m²K)]
 U_{a-Calc} = Calculated area-weighted average U-values [W/(m²K)]
 U_{i-Calc} = Calculated maximum individual element U-values [W/(m²K)]
 * 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	3

Page 1 of 6

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters	Actual	Notional	Building Use
Area [m ²]	2222.9	2222.9	% 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 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 100 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
External area [m ²]	3974.7	3974.7	
Weather	CAR	CAR	
Infiltration [m ³ /h.m ² @ 50Pa]	3	3	
Average conductance [W/K]	1264.73	1358.43	
Average U-value [W/m ² K]	0.32	0.34	
Alpha value* [%]	10.44	10	

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

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	10.96	18.6
Cooling	1.12	0.76
Auxiliary	3.82	1.82
Lighting	9.22	8.43
Hot water	132.51	141.04
Equipment*	23.4	23.4
TOTAL**	157.62	170.65

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
 ** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	7.5	6.36
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	50.37	70.43
Primary energy* [kWh/m ²]	196	206.76
Total emissions [kg/m ²]	33.8	36.1

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

Ysgol Gymraeg Bro Morgannwg - EPC

Energy Performance Certificate
HM Government

Non-Domestic Building

Address 1

Address 2

Address 3

Address 4

Barry

Postcode

Certificate Reference Number:
0000-0040-0030-9000-0803

This certificate shows the energy rating of this building. It indicates the energy efficiency of the building fabric and the heating, ventilation, cooling and lighting systems. The rating is compared to two benchmarks for this type of building: one appropriate for new buildings and one appropriate for existing buildings. There is more advice on how to interpret this information in the guidance document *Energy Performance Certificates for the construction, sale and let of non-dwellings* available on the Government's website at www.gov.uk/government/collections/energy-performance-certificates.

Energy Performance Asset Rating

More energy efficient

A+

Net zero CO₂ emissions

A 0-25

◀ 25
This is how energy efficient the building is.

B 26-50

C 51-75

D 76-100

E 101-125

F 126-150

G Over 150

Less energy efficient

Technical information

Main heating fuel:	Natural Gas
Building environment:	Heating and Natural Ventilation
Total useful floor area (m ²):	2222.924
Building complexity (NOS level):	5
Building emission rate (kgCO ₂ /m ² per year):	33.77
Primary energy use (kWh/m ² per year):	196

Benchmarks

Buildings similar to this one could have ratings as follows:

26

If newly built

71

If typical of the existing stock



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