## McCann and partners

**Consulting Engineers** 

# **Ysgol Treferthyr Criccieth**

**Criccieth Primary School** 

**Building Regulations Part L2A Compliance Report** 

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# **Ysgol Treferthyr Criccieth**

Criccieth Primary School

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#### 1.0 EXECUTIVE SUMMARY

#### 1.1 Executive Summary

McCann and Partners have undertaken an analysis of the proposed **Ysgol Treferthyr Criccieth** with the aim of assessing the buildings compliance with Part-L2A of the 2014 Welsh Building Regulations and to produce a draft Energy Performance Certificate (EPC).

The buildings performance under BREEAM has also been reviewed, identifying the amount of credits achieved and the resulting classification under ENE01.

A dynamic thermal model has been constructed using EDSL TAS software. Two different scenarios have been modelled as follows:

- 1. Scenario A the inclusion of air source heat pumps (to provide the heating and hot water) and no photovoltaic panel.
- Scenario B the inclusion of air source heat pumps (to provide the heating and hot water) and 135 No. photovoltaic panels.

The results ascertained from the dynamic simulation model, allow us to draw the following conclusions:

#### Scenario A:

- The building achieves a draft Energy Performance Certificate Rating of A (20) Rated.
- The Building Emission Rate (BER) and Building Primary Energy Consumption (BPEC) are lower than the targets set by Part L2A, resulting in Criterion 1 compliance.
- The average u-values are lower than the building regulation limiting u-values, resulting in Criterion 2 compliance.
- All zones pass the limiting solar gain check, resulting in Criterion 3 compliance.
- The building achieves 6 energy credits under BREEAM's ENE01.

### Scenario B:

- The building achieves a draft Energy Performance Certificate Rating of A (0) carbon neutral Rated.
- The Building Emission Rate (BER) and Building Primary Energy Consumption (BPEC). are lower than the targets set by Part L2A, resulting in Criterion 1 compliance.
- The average u-values are lower than the building regulation limiting u-values, resulting in Criterion 2 compliance.
- All zones pass the limiting solar gain check, resulting in Criterion 3 compliance.
- The building achieves 8 energy credits under BREEAM's ENE01.



### 2.0 INTRODUCTION

#### 2.1 Introduction

This report has been created by McCann and Partners with the aim of assessing the buildings compliance with Part-L2A of the 2014 Welsh Building Regulations and to produce a draft Energy Performance Certificate (EPC).

The buildings performance will also be assessed under the BREEAM 2018 scheme, where a classification of Excellent has been targeted.

In order to obtain an Energy Performance Certificate rating and Part L2A Assessment, a dynamic simulation model has been created which provides a geometrical and thermal representation of the proposed development, using the National Calculation Methodology (NCM).

It is important to note that EPC's/Part L Assessments are used to produce comparable energy ratings only and are not to be mistaken for the proposed buildings predicted energy usage/ carbon production.

The NCM uses sets of standardised databases containing operational inputs which are used for both the proposed building and а comparison building (Notional Building). These standards include hours of operation, occupancy density, temperature set points, domestic hot water demand, fresh air flow rates and lighting (lux) levels. Other energy uses are not included e.g. unregulated small power, servers, external lighting, catering, lifts etc. The input parameters that will determine the buildings overall energy performance are the efficiencies of the building fabric and mechanical and electrical services. These parameters are pivotal to the results produced by the software and should be carefully considered. Where information has not yet been finalised, estimates of performance levels (agreed with the design team and client), will be used.



### 3.0 SITE

### 3.1 <u>Site</u>

The newly proposed Ysgol Treferthyr Criccieth building is to be constructed on the outskirts of Criccieth (Figure 1).

The development will only consist of 1 storey; including new Classrooms and Teaching spaces, a Main Hall, a Main Kitchen & Catering Facilities along with General Staff Areas.



Figure 1 - Geographical Location of New Primary School (Image taken from Google Maps)



### 4.0 MODELLING PARAMETERS

A Dynamic Simulation Model (DSM) has been produced using EDSL TAS Version 9.5.0. The DSM is a computer generated representation of the proposed building, that will simulate a comparable energy usage and carbon production, based on the building constructions, internal conditions (lighting, heating, comfort cooling, etc.), weather data (based on location) and mechanical and electrical services. The DSM will then provide a Building Regulation Compliance Document (BRUKL), which compares the building performance against the various criteria and targets set out within Building Regulation Part L2A Conservation of Fuel within buildings, in the form of a "Notional Building" and produces a Draft Energy Performance Certificate rating (EPC). The predicted energy performance of the dynamic simulation model, can then also be used to evaluate the buildings performance with regards to BREEAM.

#### 3D Model



(Images taken from EDSL Tas 3D Modeller)

A significant amount of building-specific information is input to the software to form the basis of the Part L assessment and produce a geometrical and thermal representation of the proposed



development. For this reason, it is important to note that any changes to this information can/will result in changes to the results produced.

### 4.1 Architectural Drawings/Revit Model

The thermal model has been created using the following Revit model and drawings provided by Ainsley Gommon Architects:

Drawing Title
YTC-AGA-A1-XX-M3-A-0001_BuildingModel (Revit Model)
YTC-AGA-XX-00-DR-A-0004_Ground Floor Plan
YTC-AGA-XX-01-DR-A-0005_First Floor Plan
YTC-AGA-XX-02-DR-A-0006_Roof Plan

#### Note:

The information used was the latest revisions available to McCann & Partners at the time of writing and are subject to future revisions by the architect.

### 4.2 <u>Weather Data</u>

The nearest available weather station to the proposed development is located in Manchester referred to as The Manchester Typical Record Year (TRY). This weather data has been utilised for the project.

### 4.3 <u>Construction Materials</u>

To prevent excessive heat loss and to increase the energy efficiency of the building, the constructions details specified have been carefully considered to ensure an improved performance over the Building Regulation limiting values.

### **U-Values**

The u-values modelled are detailed below:

Building Element	Actual Building U- Values	Notional Building U-Values	Building Regulation Limiting U-Values
External Wall	0.14 W/m². <sup>0</sup> C	0.35 W/m <sup>2</sup> . <sup>0</sup> C	0.35 W/m². <sup>0</sup> C
Ground Floor	0.15 W/m². <sup>0</sup> C	0.22 W/m <sup>2</sup> . <sup>0</sup> C	0.25 W/m². <sup>0</sup> C
Roof	0.12 W/m². <sup>0</sup> C	0.18 W/m <sup>2</sup> . <sup>0</sup> C	0.25 W/m². <sup>0</sup> C
Frame	1.4 W/m <sup>2</sup> . <sup>0</sup> C	2.2 W/m <sup>2</sup> . <sup>0</sup> C	2.2 W/m <sup>2</sup> . <sup>0</sup> C
Glazing Pane	1.4 W/m². <sup>0</sup> C	2.2 W/m <sup>2.0</sup> C	2.2 W/m <sup>2</sup> . <sup>0</sup> C

### **Glazing Properties**



Glazing can also have a large bearing on a buildings energy performance, with Heating, Cooling and Lighting consumption all influenced by the amount of light and solar energy transmitted through the building's facade.

The performance of the glazing used in the thermal model is detailed below:

Glazing Specification	Actual Building	Notional Building
Light Transmittance:	70%	71.2%
G-Value:	0.35	0.40

### 4.4 Internal Conditions

The buildings usage is determined by a set of internal conditions provided by the National Calculation Methodology (NCM). The set chosen is dependent on the buildings purpose therefore, as the building is a school, the School set has been utilized. The internal conditions specify the set points and profiles for heating and cooling, the minimum ventilation flow rate, infiltration rate, hot water consumption, internal gains and (where relevant) the electrical consumption associated with lighting, equipment and occupancy. The values contained in the NCM internal conditions are pre-determined and cannot be altered or amended in any way for the purposes of Building Regulation Part L assessments.

### 4.5 Shading Devices

Shading elements of a building's façade can be both beneficial and/or detrimental to its energy consumption, depending on the heating and cooling strategies in place and time of year. This development has been modelled with a Brise-soliel shading device aiding the buildings solar gains. This shading device is also shown on the architect's drawings.

### 4.6 <u>Air Permeability</u>

The predicted air tightness of the building is detailed below:

	Actual	Notional	Reference
Air Permeability:	5 m³/h.m²	5 m³/h.m²	10 m³/h.m²



### 5.0 MECHANICAL & ELECTRICAL SERVICES

### 5.1 <u>Mechanical Services</u>

The buildings mechanical services are categorised in Part L2A as Heating, DWS, Auxiliary (Fans & Pumps) and Cooling.

#### 5.1.1 Heating

Heating to the building comprises of Air Source Heat Pumps (ASHPs) providing LTHW to a water central heating system. The ASHPs have a seasonal efficiency of 3.5 which is input into the model as 350%.

See system efficiency details below:

Heating Fuel	Electricity
Heating Technology	ASHP
Emitter Type	Radiators
Heating Source Efficiency (%)	350.0
Distribution Efficiency (%)	95.0

#### 5.1.2 Domestic Hot Water Service

The buildings domestic hot water system is generated by a hot water cylinder within the plant room fed from the ASHPs.

See system efficiency details below:

DHW Fuel	Electricity
DHW Technology	ASHP
DHW Heating Source Efficiency	350.0
Distribution Efficiency (Domestic Hot Water %)	95.0
Total Storage Volume (litres)	300.0
Insulation Conductivity (W/m*C)	0.02
Insulation Thickness (mm)	80.0
Circulation Pump Power (kW)	N/A

### 5.1.3 Auxiliary/Ventilation

Natural ventilation with heat recovery fans will provide ventilation to classroom and halls (in addition to natural ventilation).

Toilet and ancillary areas will have dedicated extract fans.

See system efficiency details below:



Auxiliary/Ventilation Fuel	Electricity	Electricity	Electricity
Ventilation Type	Natural Ventilation	NVHR	Extract
Specific Fan Power (W/l/s)	N/A	1.1	0.5
Heat Recovery Efficiency (%)	N/A	95	N/A

#### 5.1.4 Cooling

Criccieth Primary School has no cooling systems.

### 5.2 <u>Electrical Services</u>

The NCM categorises a buildings electrical services as "Lighting" and "Equipment".

#### 5.2.1 Lighting

Lighting within each classroom and clerical areas will be controlled via DALI addressable dimmable suspended linear luminaires. Occupancy detectors will be used in each classroom to control the lighting and are commissioned to operate on absence detection (manual on / auto off). Within each occupancy detectors, active daylight sensors will also be used to automatically regulate the artificial lighting depending on the ambient daylight levels to maintain a predefined illuminance of 300lux for classrooms and 500lux for clerical areas.

Recessed LED downlights will be provided within circulation spaces and toilets, which will be controlled via occupancy detectors commissioned to operate on presence detection (automatic on / automatic off).

The lighting installation will be designed using professional planning software, DIALux Version 4.13, from which the specific connected load and design illuminance for each room/space have been obtained to inform the thermal model. A summary of the design parameters is included below:

Space type	Presence detection	Daylight control
Classroom	Man ON/Auto OFF	Photocell Control Dimming
Circulation	Auto ON/Auto OFF	No Daylight Control

This table represent a brief overview of the lighting efficiencies and controls. Please refer to the BRUKL for complete design parameters associated with each space.

### 5.2.2 Equipment

The energy consumption of equipment is pre-determined by the NCM internal condition for the purposes of Part L assessments; therefore, no manual input is necessary.

#### 5.3 Miscellaneous Services



The Part L2A assessment also takes into consideration the overall power factor of the electrical installation. Power factor correction (PFC) is to be installed on the main switchgear to maintain a minimum power factor of 0.95 lagging, which has been input as follows:

Power Factor:	0.9 - 0.95

An option is also available to allow for "automatic monitoring and targeting with alarms for out of range values". This represents a complete installation that measures, records, transmits, analyses, reports, and communicates meaningful energy management information to enable the operator to manage the energy it uses. For this particular project an advanced BMS system is proposed to be installed, this feature has therefore been included in the model.

System Monitoring with warning of out of range values:	Lighting	HVAC Systems
	YES	YES

### 5.4 <u>Renewable Technologies</u>

The photovoltaic system has been accurately modelled in the dynamic simulation model to help reduce the buildings  $CO_2$  emissions and meet the Building Regulation and BREEAM requirements.

Details of the proposed PV type and installation modelled are shown below:

No. of PV	135
PV Model	LG NeON
Rating (Watts)	375 W
Module Efficiency	21.7
Location:	Roof
Mounting Angle(°):	15



### 6.0 RESULTS

Using the National Calculation Methodology (NCM) and the input parameters detailed in this report, the dynamic simulation model has produced an energy performance rating for the proposed development. The resulting energy performance of the building, is comparable to a pre-determined set of standards defined as the Notional Building and can be used to assess its compliance with Part L2A of Building Regulations. A Building Regulation Compliance Document (BRUKL) and draft Energy Performance Certificate have been produced, the results of which, are detailed below:

### 6.1 Part L 2A – BRUKL

A 2014 Part L2A (Wales) assessment has been performed for the proposed development:

### "Criterion 1:

### Scenario A Results:

To pass Criteria 1 the Building Emission rate and building primary energy consumption should not exceed the target values.

	Emission Rate	Primary Energy Consumption
Building	10.5kg/CO₂/annum	61.84Kwh/m2/annum
Target	15.6kg/CO₂/annum	81.63Kwh/m2/annum
Result	Pass	Pass

### **Scenario B Results:**

To pass Criteria 1 the Building Emission rate and building primary energy consumption should not exceed the target values

	Emission Rate	Primary Energy Consumption
Building	-0.1kg/CO <sub>2</sub> /annum	61.84Kwh/m2/annum
Target	15.6kg/CO₂/annum	81.63Kwh/m2/annum
Result	Pass	Pass

Refer to Appendix for BRUKL and EPC.



Building Element	Actual Building U- Values	Notional Building U- Values	Building Regulation Limiting U-Values
External Wall	0.14 W/m <sup>2</sup> . <sup>0</sup> C	0.26 W/m². <sup>0</sup> C	0.35 W/m². <sup>0</sup> C
Ground Floor	0.15 W/m <sup>2</sup> . <sup>0</sup> C	0.22 W/m². <sup>0</sup> C	0.25 W/m². <sup>0</sup> C
Roof	0.12 W/m <sup>2</sup> . <sup>0</sup> C	0.18 W/m². <sup>0</sup> C	0.25 W/m². <sup>0</sup> C
Frame	1.4 W/m <sup>2</sup> . <sup>0</sup> C	2.2 W/m <sup>2</sup> . <sup>0</sup> C	N/A
Glazing Pane	1.4 W/m <sup>2</sup> . <sup>0</sup> C	1.527 W/m². <sup>0</sup> C	2.2 W/m <sup>2.0</sup> C

<u>"Criterion 2:</u> The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency."

All constructions used in both scenarios of the thermal model meet the Limiting area-weighted average u-value limit set by Building Regulations. The building therefore passes Criterion 2 of Part L2A.

# <u>"Criterion 3:</u> The spaces in the building should have appropriate passive control measures to limit solar gains."

As part of the Building Regulation ADL2a Conservation of Fuel and Power in Buildings assessment, a 'limiting solar gain check' is performed for Criterion 3, where the aggregated solar gains between April and September are required to fall below a benchmark value. It is important to clarify that this does not mean that spaces are "overheating", it refers only to the amount of direct and diffuse solar energy gained by these spaces via glazed areas of the façade. It is important that this is minimised where possible to reduce the amount of cooling energy or ventilation needed to overcome the resulting rise in temperature.

The results show that solar gains are within acceptable values therefore the building passes Criteria 3 of part L2A. For full results refer to Appendix.

#### Please Note:

Energy Performance Certificates and Part L Assessments should not be used to predict the actual buildings future energy consumption and/or carbon production. The thermal model results are to form a comparable energy performance only, using the National Calculation Methodology.

The results produced by the dynamic simulation model and findings detailed in this report, are based on the buildings form at the time of writing.

Any changes to the architectural drawings and/or the input parameters detailed in this report, may result in changes to the EPC Score, Building Regulations Compliance Document and BREEAM score.

It is important that the Part L assessment is regularly monitored and updated during the design and construction phases of the project to ensure that any changes are continuously reflected in the results.

Software updates may also result in changes to thermal model results.



### APPENDIX A

### **BRUKL and Draft EPC Document Scenario A**

# BRUKL Output Document

### Compliance with Wales Building Regulations Part L 2014

### Project name

## **Criccieth Primary School**

Date: Thu Nov 12 09:15:13 2020

### Administrative information

### **Building Details**

Address: Criccieth Primary School, Criccieth,

### Certification tool

Calculation engine: TAS

Calculation engine version: "v9.5.0" Interface to calculation engine: TAS

Interface to calculation engine version: v9.5.0

BRUKL compliance check version: v5.6.a.1

### Owner Details Name: Telephone number: Address: , ,

#### Certifier details

Name: Graham Carr Telephone number: 02920 352450 Address: Faraday House, Terra Nova Way, Penarth Marina , Cardiff, CF64 1SA

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

Building CO <sub>2</sub> emission rate (BER), kgCO <sub>2</sub> /m <sup>2</sup> .annum	10.5
Target CO <sub>2</sub> emission rate (TER), kgCO <sub>2</sub> /m <sup>2</sup> .annum	15.6
Building Primary Energy Consumption (BPEC), kWh/m <sup>2</sup> .annum	61.84
Target Primary Energy Consumption (TPEC), kWh/m <sup>2</sup> .annum	81.63
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	Ua-Limit	Ua-Calc	Ui-Cale	Surface where the maximum value occurs*
Wall**	0.35	0.14	0.14	External Wall
Floor	0.25	0.15	0.15	Ground Floor
Roof	0.25	0.12	0.13	Roof/Internal Ceiling
Windows***, roof windows, and rooflig	ghts 2.2	1.36	1.53	Curtain Walling
Personnel doors	2.2	2.2 1.46 4.37 Louvre C		
Vehicle access & similar large doors	1.5	1.5 No vehicle doors in project		
High usage entrance doors	3.5	3.5 No high usage entrance doors in project		
U <sub>s-Limit</sub> = Limiting area-weighted average U-values [W/(m <sup>2</sup> K)] U <sub>s-Catc</sub> = Calculated area-weighted average U-values [W/(m <sup>2</sup> K)] U <sub>s-Catc</sub> = Calculated maximum individual element U-values [W/(m <sup>2</sup> K)]				
<ul> <li>* There might be more than one surface where the maximum U-value occurs.</li> <li>** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.</li> <li>*** Display windows and similar glazing are excluded from the U-value check.</li> <li>N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.</li> </ul>				
Air Permeability Worst acceptable standard This building				This building
m <sup>3</sup> /(h.m <sup>2</sup> ) at 50 Pa	10 5			



McCann and partners



### As designed



### Energy Performance Certificate Non-Domestic Building

HM Government

Criccieth Primary School Criccieth

Certificate Reference Number: 0522-9698-3731-0499-1023

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



### Less energy efficient

	Technical information			
	Main heating fuel:	Other		
	Building environment:	Unconditioned		
	Total useful floor area (m <sup>2</sup> ):		1842	
Building complexity (NOS level):		5		
	Building emission rate (kgCO <sub>2</sub> /m <sup>2</sup> per year):		10.45	
	Primary energy use (kWh/m	per year):	61.84	





### APPENDIX B

### BRUKL and Draft EPC Document Scenario B

# BRUKL Output Document

### Compliance with Wales Building Regulations Part L 2014

### Project name

## **Criccieth Primary School**

Date: Wed Nov 18 16:10:44 2020

### Administrative information

### **Building Details**

Address: Criccieth Primary School, Criccieth,

### Certification tool

Calculation engine: TAS

Calculation engine version: "v9.5.0" Interface to calculation engine: TAS Interface to calculation engine version: v9.5.0

BRUKL compliance check version: v5.6.a.1

Owner Details Name: Telephone number: Address: , ,

#### Certifier details

Name: Graham Carr Telephone number: 02920 352450 Address: Faraday House, Terra Nova Way, Penarth Marina , Cardiff, CF64 1SA

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

Building CO <sub>2</sub> emission rate (BER), kgCO <sub>2</sub> /m <sup>2</sup> .annum	-0.1
Target CO <sub>2</sub> emission rate (TER), kgCO <sub>2</sub> /m <sup>2</sup> .annum	15.6
Building Primary Energy Consumption (BPEC), kWh/m <sup>2</sup> .annum	61.84
Target Primary Energy Consumption (TPEC), kWh/m <sup>2</sup> .annum	81.63
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	Ua-Limit	Ua-Calc	Ui-Cale	Surface where the maximum value occurs*
Wall**	0.35	0.14	0.14	External Wall
Floor	0.25	0.15	0.15	Ground Floor
Roof	0.25	0.12	0.13	Roof/Internal Ceiling
Windows***, roof windows, and rooflig	hts 2.2	1.36	1.53	Curtain Walling
Personnel doors	2.2	2.2 1.46 4.37 Louvre C		
Vehicle access & similar large doors	1.5	1.5 No vehicle doors in project		
High usage entrance doors	3.5	3.5 No high usage entrance doors in project		
U=calc = Limiting area-weighted average U-values [W/(m <sup>2</sup> K)] U=calc = Calculated area-weighted average U-values [W/(m <sup>2</sup> K)] U=calc = Calculated maximum individual element U-values [W/(m <sup>2</sup> K)]				
<ul> <li>* There might be more than one surface where the maximum U-value occurs.</li> <li>** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.</li> <li>*** Display windows and similar glazing are excluded from the U-value check.</li> <li>N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.</li> </ul>				
Air Permeability Worst accentable standard This building			This building	
m <sup>3</sup> /(h.m <sup>2</sup> ) at 50 Pa 1	10 5			



### As designed



### Energy Performance Certificate Non-Domestic Building

HM Government

Criccieth Primary School Criccieth Certificate Reference Number: 0522-9698-3731-0499-1023

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



### Less energy efficient

Technical information				
Main heating fuel:	Other			
Building environment:	Unconditioned			
Total useful floor area (m <sup>2</sup> ):		1842		
Building complexity (NOS level):		5		
Building emission rate (kgCO <sub>2</sub> /m <sup>2</sup> per year):		-0.08		
Primary energy use (kWh/r	n°per year):	61.84		





### APPENDIX C

### **BREEAM: ENE01 Assessment - Scenario A**

Assessment			
Criteria	Actual	Notional	
Photovoltaic systems	2.010	10.190	kWh/m²
Wind turbines			kWh/m²
CHP generators			kWh/m²
Solar thermal			
systems			kWh/m²
Building energy demand	25.380	32.000	MJ/m²yr
Building primary energy consumption	61.840	81.630	kWh/m²yr
Building CO <sub>2</sub> -eq emissions	10.500	15.600	KgCO <sub>2</sub> -eq/m <sup>2</sup> yr

Building Score

Total BREEAM credits achieved	6
Heating and cooling demand energy performance ratio (EPRdem)	0.285
Primary consumption energy performance ratio (EPRpc)	0.050
CO <sub>2</sub> -eq energy performance ratio (EPRCO <sub>2</sub> -eq)	0.266
Overall building energy performance ratio (EPRnc)	0.601
% improvement over building regulations (CO2-eq)	32.69%



### APPENDIX D

### **BREEAM: ENEO1 Assessment - Scenario B**

Assessment				
Criteria		Actual	Notional	
Pho	tovoltaic systems	20.300	6.360	kWh/m²
	Wind turbines			kWh/m²
	CHP generators			kWh/m²
	Solar thermal systems			kWh/m²
	Building energy demand	25.380	32.000	MJ/m²yr
ene	Building primary ergy consumption	61.840	81.630	kWh/m²yr
	Building CO <sub>2</sub> -eq emissions	-0.100	15.600	KgCO <sub>2</sub> -eq/m <sup>2</sup> yr
Building Score				
Total BREEAN	I credits achieved	8		
Heating and cooling demand energy p	erformance ratio (FPRdem)	0.285		

0.050

0.266

0.601

32.69%

Primary consumption energy performance ratio (EPRpc)

CO<sub>2</sub>-eq energy performance ratio (EPRCO<sub>2</sub>-eq)

Overall building energy performance ratio (EPRnc)

% improvement over building regulations (CO2-eq)



### APPENDIX E

### Criterion 3 - Results

Zone Name	Lighting Type	Facade Length (m)	Floor Area (m²)	Actual Solar Gain (kWh)	Solar Gain Limit (kWh)	Solar Gain (%)	Internal Blinds	Solar Gain Check	Daylight Factor (%)
ALN Classroom	Side Lit	7.06	59.26	630.02	1805.97	-65.11	FALSE	TRUE	1.1
Nursery Classroom	Side Lit	8.95	73.96	834.45	2289.13	-63.55	FALSE	TRUE	1.23
Reception Classroom	Side Lit	7.07	58.97	631.99	1809.22	-65.07	FALSE	TRUE	1.1
Year1/2_Classroom	Side Lit	7.12	59.59	611.95	1820.47	-66.39	FALSE	TRUE	1.09
Year3/4_Classroom	Side Lit	7.05	58.80	739.86	1801.62	-58.93	FALSE	TRUE	1.1
Year4/5_Classroom	Side Lit	7.05	58.81	736.73	1802.01	-59.12	FALSE	TRUE	1.1
Year5/6_Classroom	Side Lit	7.13	63.91	743.56	1823.62	-59.23	FALSE	TRUE	0.94
Cylch Meithrin Classroom 9	Side Lit	9.31	76.20	2127.33	2379.76	-10.61	FALSE	TRUE	2.56
Practical Teaching 1	Side Lit	9.91	15.20	324.85	2533.85	-87.18	FALSE	TRUE	1.18
Practical Teaching 2	Side Lit	0.00	14.84	0	538.88	- 100.00	FALSE	TRUE	0
Practical Teaching 3	Side Lit	8.46	15.84	324.89	2163.34	-84.98	FALSE	TRUE	1.16
Practical Teaching 4	Side Lit	0.00	14.89	0	540.75	- 100.00	FALSE	TRUE	0
Practical Teaching 5	Side Lit	0.00	14.28	0	518.68	- 100.00	FALSE	TRUE	0
Practical Teaching 6	Side Lit	3.06	12.14	426.96	783.53	-45.51	FALSE	TRUE	2.29
Class Store 1	Neither	0.00	6.87	0	249.66	- 100.00	FALSE	FALSE	0
Class Store 2	Neither	0.00	6.88	0	249.84	- 100.00	FALSE	FALSE	0
Class Store 3	Neither	0.00	6.77	0	246.06	- 100.00	FALSE	FALSE	0
Class Store 4	Neither	0.00	5.27	0	191.28	- 100.00	FALSE	FALSE	0
Class Store 5	Neither	0.00	5.74	0	208.59	- 100.00	FALSE	FALSE	0
Class Store 6	Neither	0.00	16.26	0	590.70	- 100.00	FALSE	FALSE	0
Class Store 8	Neither	2.81	9.67	176.79	718.01	-75.38	FALSE	FALSE	1.35
CLK 1	Neither	3.08	9.51	191.47	786.49	-75.65	FALSE	FALSE	1.06
CLK 2	Neither	0.00	5.03	0	182.83	- 100.00	FALSE	FALSE	0
CLK 3	Neither	0.00	4.98	0	181.00	- 100.00	FALSE	FALSE	0
CLK 4	Neither	4.12	7.87	202.98	1054.05	-80.74	FALSE	FALSE	1.21



Zone Name	Lighting Type	Facade Length (m)	Floor Area (m²)	Actual Solar Gain (kWh)	Solar Gain Limit (kWh)	Solar Gain (%)	Internal Blinds	Solar Gain Check	Daylight Factor (%)
CLK 5	Neither	5.06	10.53	308.51	1293.94	-76.16	FALSE	FALSE	1.54
CLK 6	Neither	5.02	10.40	203.18	1284.74	-84.18	FALSE	FALSE	1.03
CLK 7	Neither	4.11	7.32	97.21	1051.24	-90.75	FALSE	FALSE	0.63
Specialist Store 1	Neither	4.84	9.85	147.03	1236.43	-88.11	FALSE	FALSE	1.13
Specialist Store 2	Neither	0.00	8.03	0	291.64	- 100.00	FALSE	FALSE	0
Specialist Store 3	Neither	0.00	8.36	0	303.50	- 100.00	FALSE	FALSE	0
WC 1	Side Lit	0.00	12.88	0	467.89	- 100.00	FALSE	FALSE	0
WC 2_Changing	Neither	0.00	5.92	0	215.05	- 100.00	FALSE	FALSE	0
WC 3_Disabled	Side Lit	0.00	4.18	0	151.95	- 100.00	FALSE	FALSE	0
WC 4_Female	Side Lit	0.00	13.74	0	498.87	- 100.00	FALSE	FALSE	0
WC 5_Male	Side Lit	0.00	14.34	0	520.88	- 100.00	FALSE	FALSE	0
WC 6	Side Lit	4.08	7.72	97.22	1043.87	-90.69	FALSE	FALSE	0.61
WC 7_Staff Shower	Neither	0.00	7.06	0	256.40	- 100.00	FALSE	FALSE	0
WC 8	Side Lit	0.00	7.41	0	269.30	- 100.00	FALSE	FALSE	0
WC 9	Side Lit	0.00	11.91	0	432.61	- 100.00	FALSE	FALSE	0
WC 10	Side Lit	0.00	4.13	0	149.99	- 100.00	FALSE	FALSE	0
WC 11_Disabled	Side Lit	0.00	3.56	0	129.36	- 100.00	FALSE	FALSE	0
WC 12	Side Lit	0.00	3.91	0	141.99	- 100.00	FALSE	FALSE	0
WC 14_Changing	Neither	0.00	7.52	0	273.28	- 100.00	FALSE	FALSE	0
WC 15_Changing	Neither	0.00	7.52	0	273.30	- 100.00	FALSE	FALSE	0
Library/Resource/Food Science	Side Lit	16.89	61.89	1961.32	4319.42	-54.59	FALSE	FALSE	2.71
Entrance/Reception	Side Lit	2.34	10.30	295.54	598.87	-50.65	FALSE	TRUE	2.1
ALN Lobby	Side Lit	1.85	8.01	178.5	473.52	-62.30	FALSE	FALSE	1.44
Lobby	Side Lit	0.00	4.84	0	175.63	- 100.00	FALSE	FALSE	0
WC 16	Side Lit	2.04	5.80	53.94	520.95	-89.65	FALSE	FALSE	0.54
Office	Side Lit	1.99	6.15	208.53	508.75	-59.01	FALSE	TRUE	1.5
Staff Rm	Side Lit	7.71	31.41	990.58	1970.63	-49.73	FALSE	TRUE	2.1
PPA	Side Lit	4.45	7.66	215.46	1137.01	-81.05	FALSE	TRUE	1.51
Reprographics	Side Lit	1.40	3.67	206.76	358.29	-42.29	FALSE	TRUE	2.38
Therapist Rm	Side Lit	0.00	12.04	0	437.17	- 100.00	FALSE	TRUE	0



Zone Name	Lighting Type	Facade Length (m)	Floor Area (m²)	Actual Solar Gain (kWh)	Solar Gain Limit (kWh)	Solar Gain (%)	Internal Blinds	Solar Gain Check	Daylight Factor (%)
Small Group Rm	Side Lit	0.00	8.09	0	293.81	-	FALSE	TRUE	0
				_		100.00			
Small Group Rm 2	Side Lit	0.00	13.26	0	481.67	- 100.00	FALSE	TRUE	0
Kitchen/Servery	Side Lit	5.27	55.69	247.8	1348.03	-81.62	FALSE	FALSE	0.55
Freezer Str	Neither	4.93	6.79	124.56	1261.57	-90.13	FALSE	FALSE	0.94
Veg & Pot Str	Neither	0.00	4.16	0	151.04	- 100.00	FALSE	FALSE	0
WC	Side Lit	2.20	3.03	72.58	562.51	-87.10	FALSE	FALSE	0.82
Circulation	Side Lit	1.49	5.02	245.1	380.92	-35.65	FALSE	FALSE	1.93
COSHH	Neither	0.86	1.48	0	219.54	- 100.00	FALSE	FALSE	0
Kitchen Office	Side Lit	1.47	5.84	56.2	377.11	-85.10	FALSE	TRUE	0.55
Kitchen	Side Lit	3.04	6.83	165.04	777.57	-78.78	FALSE	FALSE	1.06
Plant Room	Neither	2.86	27.03	426.04	730.11	-41.65	FALSE	FALSE	1.52
Comms Rm	Neither	2.56	4.82	0	655.13	- 100.00	FALSE	FALSE	0
Switch Rm	Neither	1.39	5.72	0	354.94	- 100.00	FALSE	FALSE	0
Hygiene Facility	Side Lit	0.00	12.08	0	438.76	- 100.00	FALSE	TRUE	0
Sick Bay	Side Lit	0.00	16.17	0	587.39	- 100.00	FALSE	TRUE	0
Cln Str	Neither	0.00	6.97	0	253.00	- 100.00	FALSE	FALSE	0
Pestr (INT)	Neither	4.34	9.55	146.18	1108.55	-86.81	FALSE	FALSE	1.17
Staging Str	Neither	0.00	7.49	0	271.91	- 100.00	FALSE	FALSE	0
Heads Office	Side Lit	5.35	23.86	144.98	1367.39	-89.40	FALSE	TRUE	0.65
General Office	Side Lit	2.50	10.80	49.29	639.63	-92.29	FALSE	TRUE	0.38
Caretaker	Neither	0.00	5.96	0	216.50	- 100.00	FALSE	FALSE	0
Stock Rm	Neither	0.00	5.91	0	214.68	- 100.00	FALSE	FALSE	0
Chair Str	Neither	3.83	28.81	0	978.13	- 100.00	FALSE	FALSE	0
Main Hall	Top Lit	22.48	171.52	5011.22	8730.05	-42.60	FALSE	TRUE	2.99
Main Hall Entrance	Side Lit	0.00	5.99	0	217.64	- 100.00	FALSE	FALSE	0
FF_ Plant Room	Neither	8.36	45.42	243.07	2138.13	-88.63	FALSE	FALSE	0.31

## McCann and partners

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