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INXN DUB15/16

Part L Planning Report

IE-DUBZZ-XXXX-XX-ARP-RP-Z-00002

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Job number 280503-00

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ARUP

Document Verification

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		Name			
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Issue Document Verification with Document ✓

Contents

1 Introduction

This report has been prepared to provide high level commentary relating to the current Irish Building Regulations Part L for a planning application for the new data centre campus in Profile Park, Nangor Road, Clondalkin, Dublin 22.

1.1 Description of Site

The development will consist of:

10-year permission for the following development:

Removal of an existing unused wastewater treatment facility on site and the erection of two data centre buildings, gas powered energy generation compound, and all other associated ancillary buildings and works. The two data centre buildings, DUB 15 and DUB 16, will comprise a total floor area of c. 33,577m^2 over two storeys. The first 2 storey data centre building (DUB15), located to the south west of the site, will comprise 16,865m^2 data storage use, ancillary office use and associated electrical and mechanical plant rooms, loading bays, maintenance and storage space.

A second 2 storey data centre building (DUB16), located to the south east of the site, will comprise 16,712m^2 data storage areas, ancillary office use and associated electrical and mechanical plant rooms, loading bays, maintenance and storage space. Both data centre buildings will reach a height of 20m. Emergency generators and associated emission flues and plant are proposed in compounds adjacent to each data centre building.

Gas powered energy generation is proposed to the north east corner of the site to provide electricity for the first phase of the proposed development.

The application proposes to re-route and widen an existing watercourse constructed following an earlier planning permission. It is proposed to reroute this watercourse along the eastern and southern boundary of the site. Landscaping is proposed to the south of the site to screen the buildings. Fencing and security gates are proposed around the site. New access roads within the site are proposed along with 71 car parking spaces and 26 cycle spaces, bin stores, site lighting, and all associated works including underground foul and storm water drainage attenuation and utility cables and all other ancillary works. A Natura Impact Statement will be submitted to the planning authority with the application.

1.2 Site TGD Part L Requirements

Each facility consists of unheated operational space for the data centre facility and heated ancillary office space. With respect to the Building Regulations, Technical Guidance Document (TGD) Part L notes that spaces with installed heat capacity of less than 10 W/m2 are exempt from meeting the requirements of the TGD Part L

document. As such the data centre operational space is exempt from TGD Part L 2017.

Only the Power Base Build (PBB) administration area which includes ancillary office spaces will be assessed for energy performance based on the TGD Part L New Non-Domestic Build 2017.

2 Energy Standards and Regulations

There are several standards and regulations applicable to this project in relation to energy efficiency. These cover energy efficiency, energy performance in buildings and renewable energy technologies.

The current Building Regulation for Conservation of Fuel and Energy in non-domestic buildings is Part L 2017. The revision to the previous 2008 document was updated to implement the recast Energy Performance of Buildings Directive and Energy Efficiency Directive S.I. 426 2014, which sets new targets for building energy performance including a move towards "Nearly Zero Energy Buildings" (nZEB). This requires a study of technical, environmental and economic feasibility of installing high efficiency alternative energy systems.

The directive states that the definition of a Nearly Zero Energy Building is;

"*...a building that has a very high energy performance, as determined in accordance with Annex 1. The nearly zero or very low amount of energy required should be covered to a very significant extent by energy from renewable sources, including energy from renewable sources provided onsite or nearby*".

The permissible technologies allowed by Sustainable Energy Authority Ireland (SEAI) include the following:

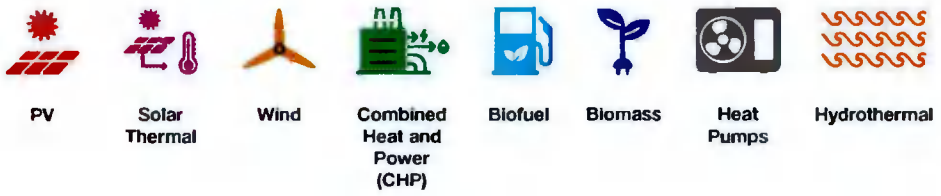

Figure 1: SEAI Part L Permissible Technologies

The following technologies were considered as part of the Part L compliance analysis:

1. Variable Refrigerant Flow (VRF) heat pump technology to provide heating and cooling to the office space.
2. Heat pump technology to provide domestic hot water to the office space.

Photovoltaic (PV) panels were considered as part of the analysis. However, based on the close proximity of the site to Baldonnel Aerodrome and the large roof area (m^2) required this option was discarded.

3 Analysis Procedure

Part L (2017) requires the building to be analysed using the calculation software Simplified Building Energy Model for Ireland iSBEM v5.5h, a non-graphical tabular based interface driven software suite.

Arup have used the industry standard software package IES, which has developed a plug-in that allows the building geometry to be created using a 3D modelling package, and then runs the required calculations as per iSBEM methodology.

The simulation methodology that is set out by SEAI is the Non-Domestic Energy Assessment Procedure or NEAP. Steps involved in the procedure are as follows:

- Manually create an "Actual" building model based on project specified fabric and system properties
- Compare the primary energy use and carbon dioxide emissions of the "Actual" building against that of a "Reference" building automatically generated by the SBEM software. These will result in an Energy Performance Coefficient (EPC) and a Carbon Performance Coefficient (CPC)

The results of each simulation iteration output a breakdown of building delivered energy consumption and primary energy consumptions.

The NEAP simulation determines whether the current design meets the Part L requirements for:

1. Primary energy consumption and carbon emission
2. Renewable Energy Ratio
3. Overall heat loss
4. Solar overheating

To comply with the above Part L sections, the following must be achieved:

5. The energy performance of the building is such as to limit the calculated primary energy consumption and related carbon dioxide (CO_2) emissions to a Nearly Zero Energy Building insofar as is reasonably practicable, when both energy consumption and carbon dioxide emissions are calculated using the Non-domestic Energy Assessment Procedure (NEAP) published by Sustainable Energy Authority of Ireland.
6. A very significant proportion of the energy consumption to meet the energy performance of the building is provided by renewable energy sources.
7. The heat loss must be limited. This is calculated by comparing a Part L compliant building average U-Value against the actual building average U-Value. The actual average U-Value must be less than the Part L compliant average U-Value.
8. Ensuring that the building is appropriately designed to limit the need for cooling due to the effects of solar gain. Building should be constructed so that those occupied spaces that rely on natural ventilation do not risk unacceptable levels of thermal discomfort due to overheating caused by solar gain and those

spaces that incorporate mechanical ventilation or cooling do not require excessive plant capacity to maintain the desired space conditions.

The NEAP simulation determines whether the model is compliant with Part L regulations by calculating the:

- Energy Performance Coefficient (EPC) – ratio of the primary energy of the actual building and the primary energy of the reference building
- Carbon Performance Coefficient (CPC) – ratio of the CO_2 emissions of the actual building and the CO2 emissions of the reference building
- Renewable Energy Ratio (RER) – ratio of the primary energy from renewable sources and the total primary energy

To comply with Part L the following criteria must be met:

- EPC $\leq$ 1.0
- CPC $\leq$ 1.15
- RER > 20% when EPC > 0.9 & CPC > 1.04
- RER > 10% when EPC $\leq$ 0.9 & CPC $\leq$ 1.04

4 Simulation and Input Data

The architectural building geometry, the specified mechanical plant efficiencies, lighting gains, infiltration and building fabric thermal performance properties were inputted to the model and the NEAP methodology was used to calculate the Primary Energy Consumption Rate and Carbon Emissions Rate.

National Calculation Method (NCM) templates were used to define space activities and assign HVAC loads accordingly. NCM is the National Calculation Method developed for Department for Communities and Local Government (DCLG) to implement the Energy Performance of Buildings Directive (EPBD). It was defined in DCLG's consultation document on the energy-related parts of the Building Regulations and the EPBD. NCM templates make use of standard sets of data for different activity areas and call on common databases of construction and service elements.

A 'Office or Workshop (Office)' Building Area Type was assigned and NCM activities were applied individually to the spaces in the model.

5 Model Geometry

The geometry of the IES model was based on drawings received from RKD (Shell Architect) and B&R (Fit-Out Architects) in the form of Revit models and PDF drawings. The floor area was modelled by tracing the floor plan drawings and windows were located using elevation views of the building.

For this study, only the three-story Power Base Build (PBB) Administration Building was modelled. This building represents an office facility and back of house area.

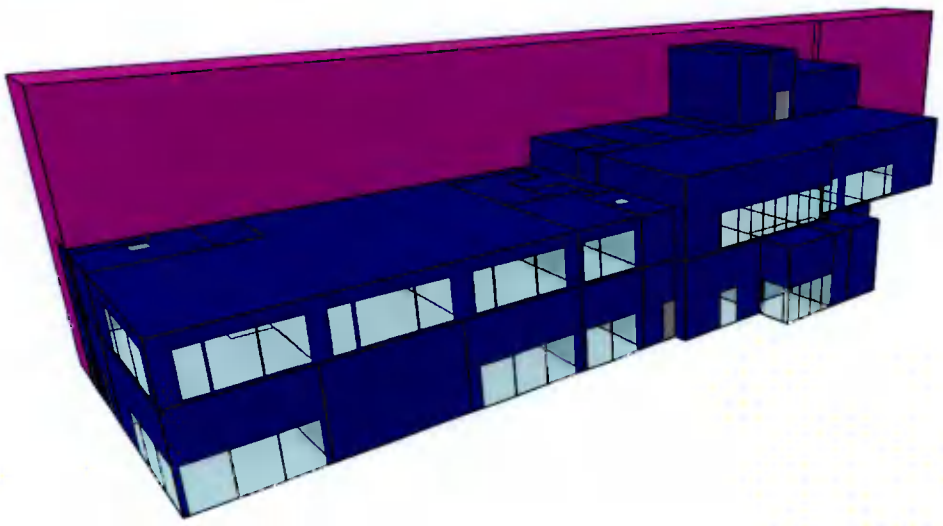

Figure 2: IES Model IT Building Geometry

6 Building Fabric Performance Requirements

6.1 Construction Properties & Infiltration

The U-values used for the model were chosen by RKD Architects in consultation with Arup. All the U-values are in-line with the maximum permissible U-values under the Part L 2017 TGD guidelines. These are baseline values that these buildings should be reaching or improving in order to comply with Part L requirements.

The construction values presented below in table 2 are the proposed maximum for DUB15 PBB Administration Building.

Element	Reference Building	Actual Building
Ground Floor U-value (W/m^2.K)	0.15	0.21
External Wall U-value (W/m^2.K)	0.18	0.21
Roof U-value (W/m^2.K)	0.15	0.2
Doors U-value (W/m2.K)	1.6	1.5
Windows U-value (W/m^2.K)	1.4	Standard windows: 1.6 Curtain walling: 1.8
Rooflight U-value (W/m^2.K)	1.6	1.6
g-value	0.4	0.28
Air permeability (m^3/hr/m^2 @ 50Pa)	3	5

Table 1: Construction Properties and Infiltration values

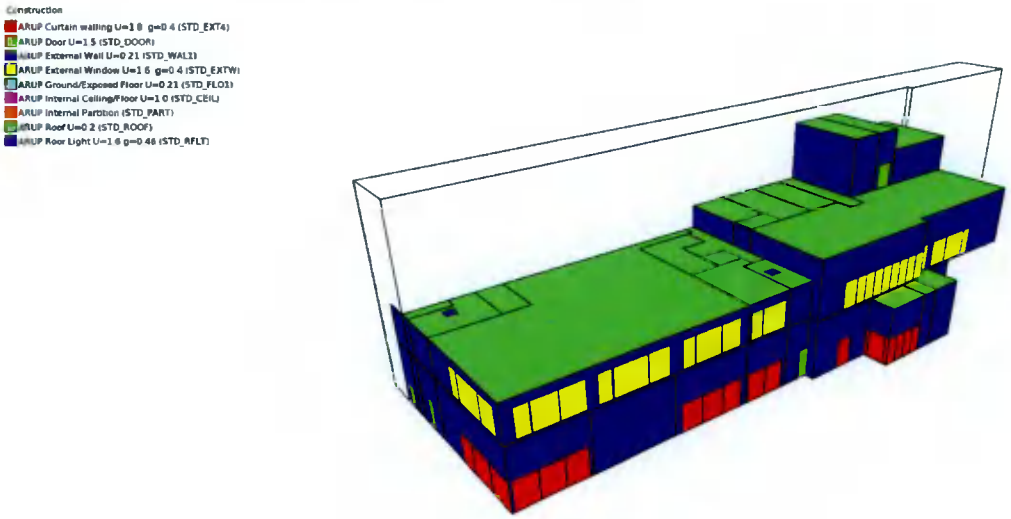

Figure 3: Constructions U-values

6.2 Efficient Passive Design Measures

The energy demand of the building will be minimised through careful design of built form and services. Optimising passive design is the most effective means, both in carbon and financial terms, of ensuring the building is inherently low in energy usage.

There are a range of energy-efficiency measures that will be applied to the building as an integral part of the design process:

- Glazed area of façade incorporates high efficiency glazing
- Daylight dimming.

The following measures shall be included to reduce CO2 emissions:

- Low velocity pipework / ductwork and low-pressure air filters to reduce fan and pump power consumption.
- High efficiency energy recovery for ventilation systems where practical.
- Zoning of equipment to allow plant to be turned off or enable out of hours setback in appropriate spaces.
- High efficiency lighting systems (LED) and appropriate artificial lighting levels.
- Energy efficient equipment including the use of premium efficiency motors with variable frequency drives (e.g. fans, pumps, lifts etc.).
- High efficiency VRF heat pumps to deliver heating and cooling.
- High efficiency heat pumps to deliver domestic hot water demand.
- Provision of a Building Management System (BMS) and metering.

The contribution of these passive design measures will impact the overall energy performance of the building.

7 HVAC and Lighting Strategy

7.1 Mechanical System Type and Efficiencies

7.1.1 Offices

The office spaces are conditioned with a VRF system and minimum fresh air supplied at a constant temperature from a central AHU with an integrated heat pump.

The following inputs have been used for the Part L analysis:

Plant Efficiencies:

- VRF System Heating SCOP: 3.94
- VRF System Cooling EER: 3.89
- VRF System Cooling SEER: 5
- AHU Specific Fan Power: 0.91 W/l/s
- Thermal Wheel Heat Recovery seasonal efficiency: 78.9%

System Controls:

- Central Time Control
- Optimum start/stop Control
- Local Time Control
- Local Temperature Control
- Weather Compensation Control

Metering Provision:

- Metering provision available: Yes
- Metering warns 'out of range values': Yes

7.1.2 Toilets and Changing Rooms

WCs and Changing Room spaces ventilation strategy consists of an extract system by a remote fan located at roof level.

The following inputs have been used for the HVAC system in the Part L analysis:

- Specific Fan Power: 0.5 W/l/s
- Extract Flow Rate: 6 (ac/hr)
- No Heat Recovery

Two different heating strategies were tested in the model for the Domestic Hot Water generation:

1. Domestic Hot Water generated by instantaneous electric water heaters.
2. Domestic Hot Water generated by Heat Pump units.

The following inputs have been used for the DHW in the Part L analysis:

- Instantaneous Electric Water Heaters SCOP: 1
- Heat Pumps SCOP: 2

7.1.3 Remaining Spaces

For the remaining spaces the same HVAC strategy as the office spaces and same DHW strategy as the toilets and changing rooms was assumed. These spaces are circulation, storage and eating or cooking areas.

7.2 Lighting System

The design lighting system power consumption through-out the PBB Administration building was set to 5.7 W/m2.

The following inputs have been used for the Part L analysis:

- Design Total Wattage: 5.7W/m2
- Design Illuminance: 300lux

7.3 Renewables

Two different renewable options were assessed in order to contribute to the RER. Heat pumps for the generation of DHW and PV panels combined with the instantaneous water heaters.

Initial simulation results showed that the minimum area (m^2) of PV panels required for the building to reach the minimum RER was too high. A minimum of 300 m^2 of available roof space was required and therefore solar PV panels were discarded. Heat Pumps for DHW generation were added to bring the renewables contribution to a compliant level. As a result, the contribution of the heat pumps for heating, cooling and DHW generation contributes to the achieved RER.

8 Results

The parameters outlined in this report were inputted into IES and using the VE Compliance application the results were calculated.

The following energy and carbon performance values were calculated for the two system options considered for the heating of Domestic Hot Water:

	Instantaneous Electric Water Heaters	Heat Pump
Reference Building Primary Energy Use kWh/m2/year	81.6	92.6
Reference Building Carbon Emissions kgCO2/m2/year	15.7	17.7
Actual Building Primary Energy Use kWh/m2/year	77.8	90.9
Actual Building Carbon Emissions kgCO2/m2/year	15.3	17.9

The EPC, CPC and RER for the building design were as follows:

	Instantaneous Electric Water Heaters	Heat Pump
Energy Performance Coefficient (EPC)	0.95	0.98
Carbon Performance Coefficient (CPC)	0.98	1.01
Renewable Energy Ratio (RER)	0.13	0.23

This concludes that Heat Pumps for Domestic Hot Water are the best technology for the goal of achieving Part L compliance. Documentation to support these results has been included as appendix for the Heat Pumps case.

8.1 BRIRL Output Document

The BRIRL Output Document demonstrates compliance with specific aspects of Part L of the Building Regulation, including the EPC, CPC and RER values stated above.

As per Appendix A (BRIRL Output Document) under the section 'Heat Transmission through Building Fabric', certain U-values are highlighted in red as a result of being over the maximum U-value stated by Part L. The reason for this is because IT PBB rooms, which are non-heated spaces, were not included in the analysis. This alters the perimeter of thermal zone causing the delimiting walls between the PBB rooms and adjacent heated spaces, to become part of the thermal

zone external perimeter. These partition walls are internal to the building and have been assigned internal partitions U-values which are higher than external walls U-values. Due to this they will get highlighted in red in the BRIRL report.

As per Section 6.1 of this report, the building U-values are in-line with the maximum permissible U-values as stated in TGD Part L 2017. As a result, it is determined that the theoretical building is compliant with the requirements of TGD Part L 2017.

Appendix A

BRIRL Output Document

SBEMIE Main Calculation Output Document

BRIRL Output Document

Compliance Assessment with the Building Regulations (Ireland) TGD-Part L 2017

This report demonstrates compliance with specific aspects of Part L of the Building Regulations. Compliance with all aspects of Part L is a legal requirement. Demonstration of how compliance with every aspect is achieved may be sought from the Building Control Authority.

v_24

Date: Tue Jun 29 13:44:03 2021

Administrative information

Building Details

Address: Address 1, Address 2, Address 3, Address 4, Co. Carlow, Eircode

NEAP

Calculation engine: SBEMIE

Calculation engine version: v5.5.h.1

Interface to calculation engine: Virtual Environment

Interface to calculation engine version: 7.0.12

BRIRL compliance check version: v5.5.h.0

Client Details

Name: Name

Telephone number: Phone

Address: Street Address, Co. Carlow, Eircode

Energy Assessor Details

Name: Name

Telephone number: Phone

Email: you@yourISP

Address: Street Address, Co. Carlow, Eircode

Primary Energy Consumption, CO2 Emissions, and Renewable Energy Ratio

The compliance criteria in the TGD-L have been met.

Calculated CO2 emission rate from Reference building	17.7 kgCO2/m2.annum
Calculated CO2 emission rate from Actual building	17.9 kgCO2/m2.annum
Carbon Performance Coefficient (CPC)	**1.01**
Maximum Permitted Carbon Performance Coefficient (MPCPC)	**1.15**
Calculated primary energy consumption rate from Reference building	92.6 kWh/m2.annum
Calculated primary energy consumption rate from Actual building	90.9 kWh/m2.annum
Energy Performance Coefficient (EPC)	**0.98**
Maximum Permitted Energy Performance Coefficient (MPEPC)	**1**
Renewable Energy Ratio (RER)	**0.23**
Minimum Renewable Energy Ratio	**0.2**

Heat Transmission through Building Fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Limit}$	$U_{i\text{-}Calc}$	Surface with maximum U-value*
Walls**	0.21	0.32	0.6	1.79	01000005_W1_A0
Floors (ground and exposed)	0.21	0.22	0.6	0.22	0G000001_F
Pitched roofs	0.16	-	0.3	-	"No heat loss pitched roofs"
Flat roofs	0.2	0.23	0.3	1	0G00000D_C_A1
Windows, roof windows, and rooflights	1.6	1.68	3	1.8	0G000001_W6_O0
Personnel doors	1.6	1.5	3	1.5	0G000011_W4_O0
Vehicle access & similar large doors	1.5	-	3	-	"No ext. vehicle access doors"
High usage entrance doors	3	-	3	-	"No ext. high usage entrance doors"

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

* There might be more than one surface with the maximum U-value. ** Automatic U-value check by the tool does not apply to curtain walls whose area-weighted average and individual limiting standards are 1.8 and 3 W/m2K, respectively.

Air Permeability	Upper Limit	This Building's Value
m3/(h.m2) at 50 Pa	5	5

Building Services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Building Regulations documents for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- Remaining_Rooms

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.94	3.89	-	-	-
Standard value	2.75	4.14**	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

** Standard shown is for split and multi-split air conditioners <6 kW. For systems 6-12 kW, limiting efficiency is 3.87.

2- Toilets_and_Changing_Rooms

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2	-	-	3	-
Standard value	2.75	N/A**	N/A	1.5^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

** No automatic check on chiller efficiency has been performed by the tool in this case. Refer to Building Regulations documents for limiting efficiency.

^ Limiting SFP may be extended by the amounts specified in the Building Regulations documents if the system includes additional components as listed in those documents.

1- SYST0000-DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	2	0.008
Standard value	0.8*	N/A

* Standard shown is for all types except absorption and gas engine heat pumps.

2- SYST0003-DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	2	0.008
Standard value	0.8*	N/A

* Standard shown is for all types except absorption and gas engine heat pumps.

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Building Regulations documents
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
0G_TECH_	-	-	-	0.9	-	-	-	-	-	0.79	N/A
0G_STORE_035	-	-	-	0.9	-	-	-	-	-	0.79	N/A
0G_STORE_	-	-	-	0.9	-	-	-	-	-	0.79	N/A
0G_STORE_	-	-	-	0.9	-	-	-	-	-	0.79	N/A
0G_OFFICE_	-	-	-	0.9	-	-	-	-	-	0.79	N/A
0G_LOBBY_022	-	-	-	0.9	-	-	-	-	-	0.79	N/A
0G_STORE_028	-	-	-	0.9	-	-	-	-	-	0.79	N/A
0G_ENTRANCE_009	-	-	-	0.9	-	-	-	-	-	0.79	N/A
0G_LIFT_019	-	-	-	0.9	-	-	-	-	-	0.79	N/A
0G_KITCHEN_017	-	-	-	0.9	-	-	-	-	-	0.79	N/A
0G_CONFERENCE_	-	-	-	0.9	-	-	-	-	-	0.79	N/A
0G_ACCESS_	-	-	-	0.9	-	-	-	-	-	0.79	N/A
0G_BREAKOUT_026	-	-	-	0.9	-	-	-	-	-	0.79	N/A
0G_LOBBY_	-	-	-	0.9	-	-	-	-	-	0.79	N/A
0G_SECURITY_012	-	-	-	0.9	-	-	-	-	-	0.79	N/A
0G_FES_	-	-	-	0.9	-	-	-	-	-	0.79	N/A
0G_STORE_001	-	-	-	0.9	-	-	-	-	-	0.79	N/A
0G_STORE_008	-	-	-	0.9	-	-	-	-	-	0.79	N/A
0G_VIS._	-	-	-	0.9	-	-	-	-	-	0.79	N/A
0G_STAIRCASE_	-	-	-	0.9	-	-	-	-	-	0.79	N/A
0G_MEETING_	-	-	-	0.9	-	-	-	-	-	0.79	N/A
OG_FES_STAIR	-	-	-	0.9	-	-	-	-	-	0.79	N/A
OG_ROOM_004	-	-	-	0.9	-	-	-	-	-	0.79	N/A
0G_CORRIDOR_015	-	-	-	0.9	-	-	-	-	-	0.79	N/A
OG_INCOMING_WATER_014	-	-	-	0.9	-	-	-	-	-	0.79	N/A
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0G_LOADING_	-	-	-	0.9	-	-	-	-	-	0.79	N/A
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01_CUSTOMER	-	-	-	0.9	-	-	-	-	-	0.79	N/A
L1_FES	-	-	-	0.9	-	-	-	-	-	0.79	N/A
01_STORE	-	-	-	0.9	-	-	-	-	-	0.79	N/A
L1_CORRIDOR	-	-	-	0.9	-	-	-	-	-	0.79	N/A
R1_ROOM_2	-	-	-	0.9	-	-	-	-	-	0.79	N/A
R1_STAIRCASE	-	-	-	0.9	-	-	-	-	-	0.79	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	
0G_TECH_	109	-	-	349
0G_STORE_035	141	-	-	8
0G_STORE_	141	-	-	18
0G_STORE_	141	-	-	23
0G_OFFICE_	198	-	-	117
0G_LOBBY_022	-	118	15	67
0G_STORE_028	141	-	-	12
0G_ENTRANCE_009	-	118	15	396
0G_LIFT_019	141	-	-	123
0G_KITCHEN_017	-	118	-	215
0G_CONFERENCE_	109	-	-	383
0G_ACCESS_	-	220	-	31
0G_BREAKOUT_026	106	-	-	358
0G_LOBBY_	-	135	15	98
0G_SECURITY_012	109	-	-	621
0G_FES_	-	157	-	54
0G_STORE_001	141	-	-	10
0G_STORE_008	141	-	-	12
0G_VIS._	-	220	-	23
0G_STAIRCASE_	-	157	-	52
0G_MEETING_	109	-	-	529
OG_FES_STAIR	-	157	-	51
OG_ROOM_004	109	-	-	81
0G_CORRIDOR_015	-	157	-	431
OG_INCOMING_WATER_014	198	-	-	33
01_CUSTOMER	106	-	-	2051
01_FES	-	67	-	168
01_STORE	40	-	-	27
01_LIFT	-	158	-	55
L1_ACCESS	-	77	-	102
01_FUTURE	126	-	-	232
01_STAIRCASE_007	-	94	-	155
01_SECURE	-	216	15	126
01_FES	-	159	-	39
01_STORE	40	-	-	25
L1_CORRIDOR	-	71	-	669
0G_LOADING_	-	135	15	205
R1_ROOM_1	211	-	-	146
01_CUSTOMER	115	-	-	1699
L1_FES	-	101	-	166
01_STORE	40	-	-	35
L1_CORRIDOR	-	91	-	793

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
R1_ROOM_2	114	-	-	427
R1_STAIRCASE	-	91	-	180
0G_MALE_	-	118	-	141
0G_CHANGING_023	-	118	-	31
0G_ACC_WC&SH	-	118	-	63
01_FEMALE	-	136	-	195
01_CHANGING	-	104	-	42

Solar Gain in Summer

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
0G_TECH_	YES (+8.1%)	NO
0G_STORE_035	N/A	N/A
0G_STORE_	N/A	N/A
0G_STORE_	N/A	N/A
0G_OFFICE_	N/A	N/A
0G_LOBBY_022	N/A	N/A
0G_STORE_028	N/A	N/A
0G_ENTRANCE_009	N/A	N/A
0G_LIFT_019	N/A	N/A
0G_KITCHEN_017	N/A	N/A
0G_CONFERENCE_	NO (-73.5%)	NO
0G_ACCESS_	N/A	N/A
0G_BREAKOUT_026	YES (+8.6%)	NO
0G_LOBBY_	YES (+43.9%)	NO
0G_SECURITY_012	N/A	N/A
0G_FES_	N/A	N/A
0G_STORE_001	N/A	N/A
0G_STORE_008	N/A	N/A
0G_VIS._	N/A	N/A
0G_STAIRCASE_	N/A	N/A
0G_MEETING_	YES (+17.3%)	NO
OG_FES_STAIR	N/A	N/A
OG_ROOM_004	N/A	N/A
0G_CORRIDOR_015	N/A	N/A
OG_INCOMING_WATER_014	N/A	N/A
01_CUSTOMER	NO (-1%)	NO
01_FES	NO (-80.8%)	NO
01_STORE	N/A	N/A
01_LIFT	N/A	N/A
L1_ACCESS	NO (-55.9%)	NO
01_FUTURE	YES (+1.9%)	NO
01_STAIRCASE_007	N/A	N/A
01_SECURE	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
01_FES	N/A	N/A
01_STORE	N/A	N/A
L1_CORRIDOR	N/A	N/A
0G_LOADING_	N/A	N/A
R1_ROOM_1	N/A	N/A
01_CUSTOMER	NO (-49.7%)	NO
L1_FES	N/A	N/A
01_STORE	N/A	N/A
L1_CORRIDOR	N/A	N/A
R1_ROOM_2	NO (-92.8%)	NO
R1_STAIRCASE	N/A	N/A
0G_MALE_	N/A	N/A
0G_CHANGING_023	N/A	N/A
0G_ACC_WC&SH	N/A	N/A
01_FEMALE	N/A	N/A
01_CHANGING	N/A	N/A

Overheating

Zone	Risk of overheating
0G_TECH_	N/A
0G_STORE_035	N/A
0G_STORE_	N/A
0G_STORE_	N/A
0G_OFFICE_	N/A
0G_LOBBY_022	N/A
0G_STORE_028	N/A
0G_ENTRANCE_009	N/A
0G_LIFT_019	N/A
0G_KITCHEN_017	N/A
0G_CONFERENCE_	N/A
0G_ACCESS_	N/A
0G_BREAKOUT_026	N/A
0G_LOBBY_	N/A
0G_SECURITY_012	N/A
0G_FES_	N/A
0G_STORE_001	N/A
0G_STORE_008	N/A
0G_VIS._	N/A
0G_STAIRCASE_	N/A
0G_MEETING_	N/A
OG_FES_STAIR	N/A
OG_ROOM_004	N/A
0G_CORRIDOR_015	N/A
OG_INCOMING_WATER_014	N/A
01_CUSTOMER	N/A
01_FES	N/A
01_STORE	N/A

Zone	Risk of overheating
01_LIFT	N/A
L1_ACCESS	N/A
01_FUTURE	N/A
01_STAIRCASE_007	N/A
01_SECURE	N/A
01_FES	N/A
01_STORE	N/A
L1_CORRIDOR	N/A
0G_LOADING_	N/A
R1_ROOM_1	N/A
01_CUSTOMER	N/A
L1_FES	N/A
01_STORE	N/A
L1_CORRIDOR	N/A
R1_ROOM_2	N/A
R1_STAIRCASE	N/A
0G_MALE_	Significant risk
0G_CHANGING_023	High risk
0G_ACC_WC&SH	High risk
01_FEMALE	Low risk
01_CHANGING	High risk

Primary Energy Contributions to RER

Technology	kWh/annum
Photovoltaic systems	0
Wind turbines	0
Solar thermal for water heating	0
Biomass for space and/or water heating	0
Biogas for space and/or water heating	0
Heat pumps for space and/or water heating	62590.8
CHP generators for space and/or water heating	0
District heating for space and/or water heating	0
Process energy	0
Total for renewables	**62590.8**
Total for renewables & non-renewables	**269771.1**

Technical Data Sheet (Actual vs. Reference Building)

Building Global Parameters

	Actual	Reference
Area (m2)	2298	2298
External area (m2)	4222	4222
Weather	DUB	DUB
Infiltration (m3/hm2 @ 50Pa)	5	3
Average conductance (W/K)	1492.98	1269.38
Average U-value (W/m2K)	0.35	0.3
Alpha value* (%)	11.47	13.58

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

Building Use

% area	Building Type
	Retail/Financial and Professional services
	Restaurants and Cafes/Drinking Est./Takeaways
100	**Offices and Workshop businesses**
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Inst.: Hospitals and Care Homes
	Residential Inst.: Residential Primary schools
	Residential Inst.: Universities and colleges
	Secure Residential Inst.
	Residential spaces
	Non-residential Inst.: Community/Day Centre
	Non-residential Inst.: Libraries, Museums, and Galleries
	Non-residential Inst.: Primary Education
	Non-residential Inst.: Primary Health Care Building
	Non-residential Inst.: Law Courts
	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
	Non-residential Inst.: Post-primary Education
	Residential Inst.: Residential Post-primary schools

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] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	70.8	51.6	5.1	3.8	3.4	3.87	3.74	3.94	5
	Reference	63.2	73.4	21.4	5.7	5.7	0.82	3.6	----	----
[ST] Central heating using air distribution, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	52.4	31.8	5.5	0	70.6	2.64	0	2	0
	Reference	32.7	38.9	11.1	0	13.6	0.82	0	----	----

Key to terms

Alpha value (%)	= percentage of the building's average heat transfer coefficient which is due to thermal bridging
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

SBEMIE Main Calculation Output Document

Tue Jun 29 13:44:00 2021 v5.5.h.1

Building name

v_24

Building type: Offices and Workshop businesses

SBEMIE is an energy calculation tool for the purpose of assessing and demonstrating compliance with Building Regulations (Technical Guidance Document - Part L for the Republic of Ireland) and producing Building Energy Ratings. Although the data produced by the tool may be of use in the design process, **SBEMIE is not intended as a building design tool.**

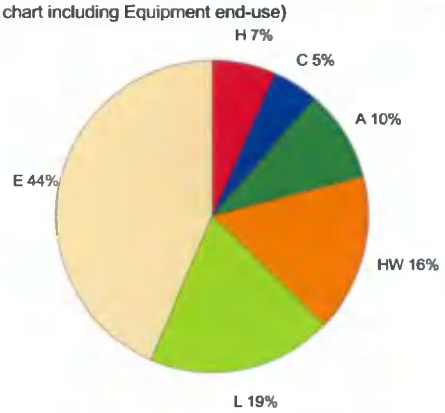
Building Energy Performance and CO2 emissions

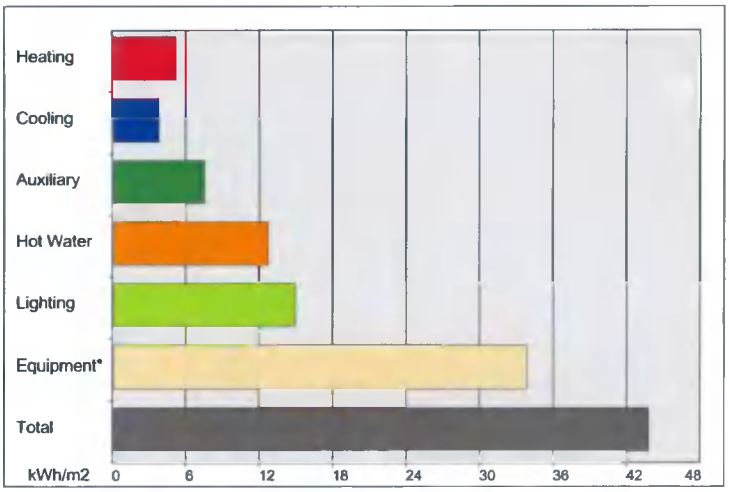
0 kgCO2/m2 displaced by the use of renewable sources.

Building area is 2298.29 m2

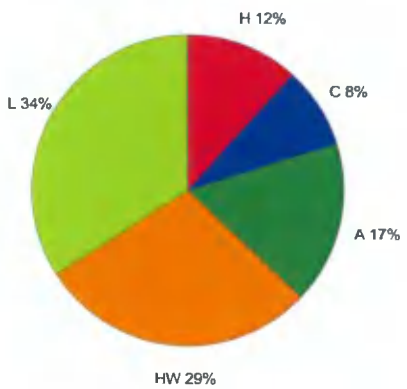
Annual Energy Consumption

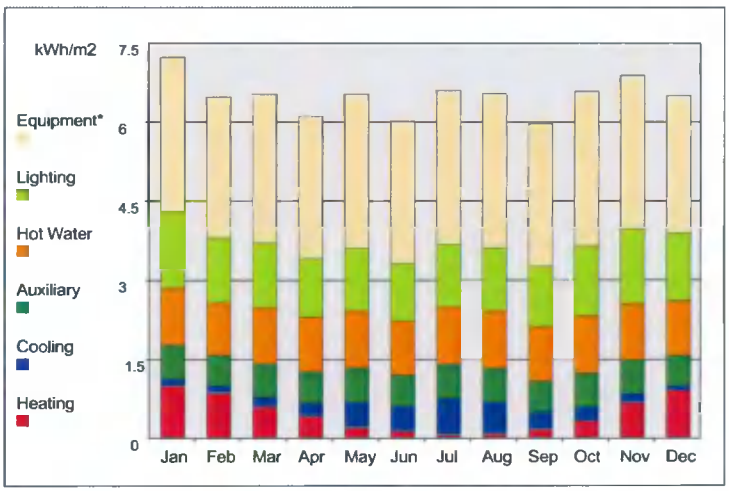
(Pie chart including Equipment end-use)





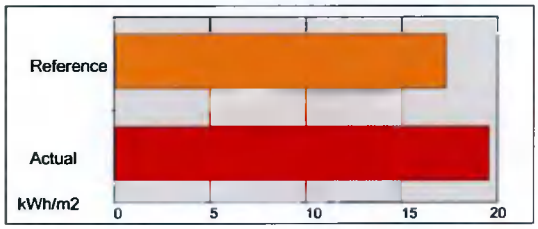
(Pie chart excluding Equipment end-use)

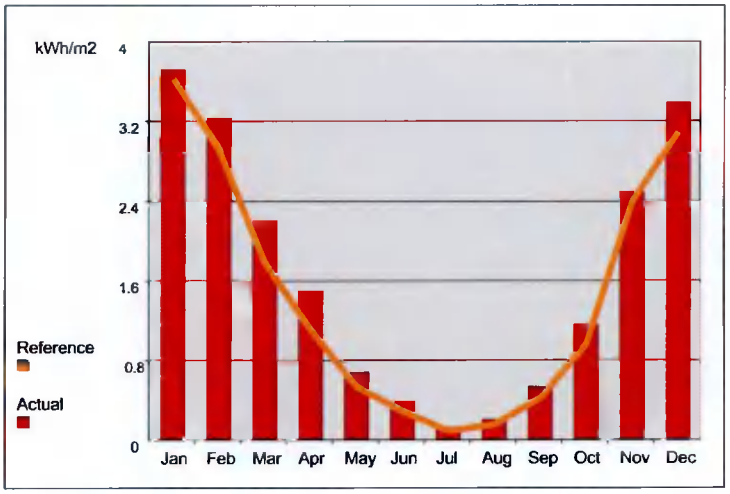




(*) Although energy consumption by equipment is shown in the graphs for information, this end-use has not been included in the total results of the building or the calculation of the ratings.

Annual Heating Demand





Annual Cooling Demand