Civic Offices, **Monaghan Town,** **Co Monaghan** On behalf of: **Monaghan County Council**	HOMAN O'BRIEN Engineering Excellence.

Comhairle Contae Mhuineacháin
Monaghan County Council

Project Ref.	Document Title	Rev	Prepared by:	Issue Date	Approved by:
2221	TGD Part L Compliance & Sustainability Report	02	DM	23-11-23	DM

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1 INTRODUCTION

This report sets out to summarise the method of compliance with TGD Part L – Building other than Dwellings for the proposed civic offices at Dublin Street North, Monaghan town, Co Monaghan for our client Monaghan County Council (MCC).

A comprehensive description of the proposed development is set out in the Planning Statement. The Statutory Notices should also be referenced.

The proposed development comprises the construction of a new civic office building distributed over three floors which will encompass office accommodation, a Council chamber and a series of supporting spaces, plant, ESB substation and services enclosures. The development will be served by a surface car park, drop-off area and bicycle parking spaces.
Infrastructural works to the existing vehicular route on Slí Ógie Uí Dhufaigh, including the provision of a new clear span bridge over the River Shambles and a new vehicular access 'Quarry Walk' are also proposed. Permeability will be enhanced by a series of pedestrian and cycle links.
Ancillary development works include signage, earthworks, drainage, watermain, utilities, landscaping, boundary treatments, lighting and solar PV panels.

This report sets out the current Part L compliance and the related overall energy strategy for the proposed civic offices development, underpinned by the principles of sustainable design and use of renewable technologies.
As the design is further developed, the energy strategy will be further refined and a check conducted that compliance is still achieved.

2 ENERGY EFFICIENCY & SUSTAINABILITY

4.1 Low Carbon & Renewable Energy Solutions – Climate Action and Energy Statement

In order to reduce the energy consumption of the heating and lighting systems, integration between the architects, services engineer and structural engineer is required. This approach ensures the form of the building seeks to minimize heat gains in summer and heat loss in winter and also ensures that the choice of heating, cooling and ventilation systems will complement the building design and vice versa.

The building services design on any project is ultimately responsible for how a building will consume energy and the resultant carbon intensity. The design of heating, ventilation and lighting systems will determine the energy consumption characteristics of the building.

The approach that has been adopted to delivering a development which is both highly efficient and sustainably designed has been to involve all members of the design team from the earliest possible stage in the design process. This integrated design approach will be continued throughout the design process.

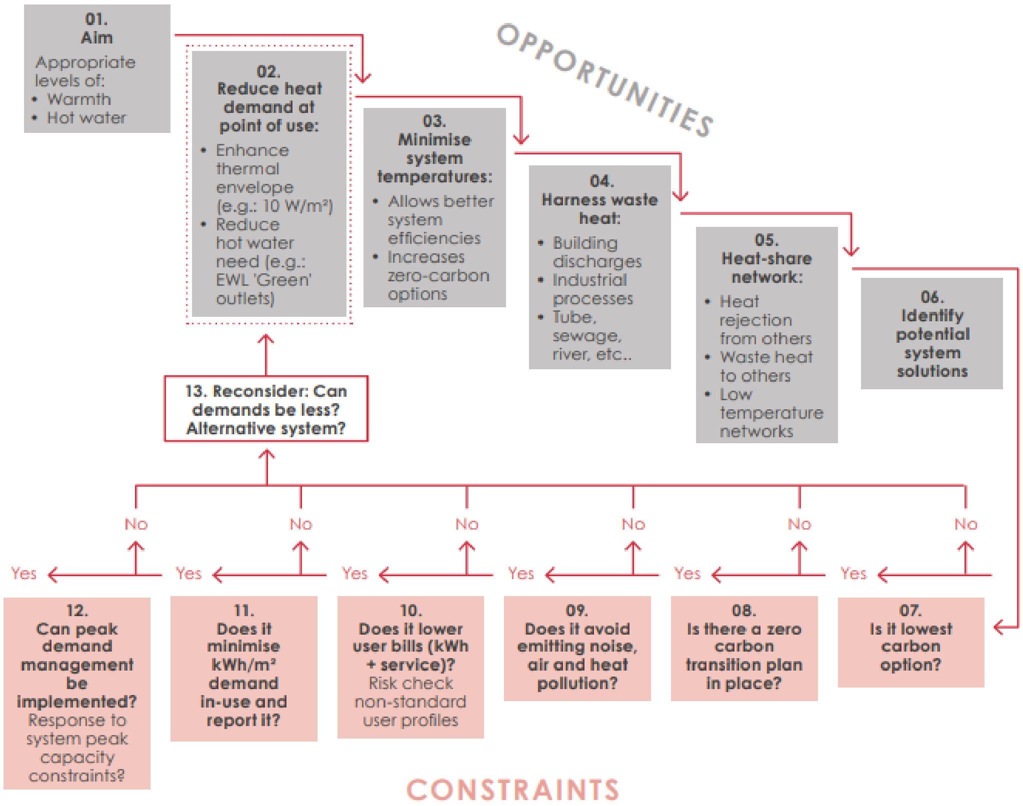
This approach ensures that the knowledge and expertise of each member of the design team was available from the outset. The goals for sustainable design were identified at this early stage and each element of the design was progressed accordingly.

De-carbonising heat energy is a multifaceted challenge and must be considered within a wider context than has previously been the case.

Heat for buildings can be derived from a wider range of alternative energy carriers and sources than is the case for many other energy-requiring sectors. This includes the use of waste heat, much of which is often produced within the building requiring the heat or heat available from other buildings close by.

Having investigated the 'opportunities' offered by the site, by harnessing building fabric enhancement, and by using all possible waste heat sources from the building and from the locality beyond the immediate site, a shortlist of possible heat systems should be tested against the constraints identified in the below Heat Decision Tree. For net zero carbon, systems fully dependant on natural gas and other fossil fuels are expected to be unsuitable.

The Heat Decision Tree below was utilized in the selection of appropriate heat generation technologies and highlights the broad range of issues that the heating system selection must address, including such non-carbon issues as avoiding higher energy bills for those least able to pay. Similarly, air quality issues, particularly in urban areas, are likely to preclude using predominantly combustion processes.



Several renewable and low carbon technologies were considered during the preliminary design process. Technical feasibility studies were conducted and details of the renewable and low carbon technologies considered, together with the outcome of the feasibility studies are set out below.

4.1.1 *Combined Heat & Power*

The inclusion of combined heat and power plant in any building scheme must be given very careful consideration due to the large capital costs involved and the potential risk of higher running costs than would be incurred if separate heating plant and grid electricity were used.

The most important consideration when designing CHP plant is to carefully assess both the heat load and the electrical load. A CHP installation will typically operate at approximately 80% combined efficiency. Approximately 60% of the useful output will be thermal energy with the remaining 40% being available as electric energy.

E.g., a CHP plant which consumes 100kWhrs of gas will produce approximately 80kWhrs of useful output. 50 kWhrs of this output will be available as thermal energy while the electric energy output will be 30kWhrs.

Given the proportion of thermal energy and electricity produced it is essential that the CHP plant is selected to meet the heat load of the building and not necessarily to meet base electrical loads.
The current electricity grid carbon intensity in Ireland (according to SEAI data available) is 330 gCO2/kWh. The ESB is currently targeting a 50% reduction in carbon intensity from 2020 status in 2030 and a carbon intensity of 38 gCO2/kWh is projected by SEAI for 2050.

As the grid carbon intensity decreases below approximately 300 gCO_2/kWh, gas CHP leads to a net increase in carbon emissions as compared with heating using grid electricity / heat pumps. Given that the plant will operate for at least 20 years, it is important to account for the likely development of the grid carbon intensity over the lifetime of the plant.

As noted above, Ireland's electricity grid is on a significant trend of decarbonisation over the period to 2030 and beyond, due to increased use of renewable sources (such as wind and bioenergy), meaning that a gas CHP plant installed in 2020 may lead to a net increase in carbon emissions for its lifetime, as such CHP will not be included in this development.

4.1.2 Heat Pump Technology

The general principal of heat pump technology is the use of electrical energy to drive a refrigerant cycle capable of extracting heat energy from one medium at one temperature and delivering this heat energy to a second medium at the desired temperature. The basic thermodynamic cycle involved is reversible which allows the heat pump to be used for heating or cooling.

The efficiency of any heat pump system is measured by its coefficient of performance (CoP). This is a comparison between the electrical energy required to run the heat pump and the useful heat output of the heat pump, e.g., a heat pump requiring 1kW of electrical power in order to deliver 3kW of heat energy has a CoP of 3.0.

This operating principle can be applied to different situations, making use of the most readily available heat source on any given site. The most common types are:

- Ground Source
- Water Source
- Air Source

Water source heat pumps generally offer the highest CoP however they can be expensive to install and maintain and must have a source of water from a well, lake or river.

An initial technical and financial analysis of the technology has shown that they will not be suitable for use within the building.

There are also concerns regarding the potential practical difficulties and programming implications of incorporating vertical boreholes on this specific site.

On a financial level, the significant increase in capital costs associated with the heat pumps and the associated boreholes is not considered to be justified by the potential savings that would be achieved.

Air source heat pump technology is a viable solution for this project. Locations for external condensers / central air to water heat pump have been located at ground level. Heat pump technology being electrically driven is considered to be a compatible technology with a future net zero carbon considering the projected carbon intensity of the national electricity grid.

Heat Pump technology will be included in the development.

4.1.3 Bio-Mass Boilers

The use of biofuel in the form of wood chip or wood pellet can provide a realistic alternative to conventional fuels such as oil or gas. In terms of heat output, biomass boilers operate in the same manner as conventional oil or gas fired boilers. There are, however, important differences to be considered.

The major drawback of a biomass heating system is the inconvenience associated with supply and storage of fuel, the increased maintenance of the boiler plant when compared to gas or oil-fired systems and the increased capital costs. The advantage of the system, however, is the practically zero net carbon emissions associated with the combustion of wood products and the marginal cost savings which can be achieved.

When natural gas is available as a potential fuel source it is always very difficult to make a sound financial argument for the inclusion of biomass heating systems. The unit cost of wood pellet or indeed wood chip (although slightly cheaper than pellet) is generally only marginally less than the unit of cost of natural gas (less than 10%).

This marginal saving is typically offset by the increase in maintenance costs and is never sufficient to offset the increase in capital costs associated with this installation of the biomass systems.

Biomass technology will not be included in the development.

4.1.4 Solar Water Heating

Solar thermal collection uses of the sun's energy and transfers the heat generated to the building's domestic hot water supply.
Two distinct types of collection panel are available. The evacuated tube array and the flat panel collector. The evacuated tube array is the more effective of the two as it is capable of generating approximately twice as much hot water from the same surface area of flat panel.
Solar thermal collection can deliver up to 50% of the total annual hot water load of a Building.

Solar Water Heating technology will not be included in the development.

4.1.5 Photovoltaic (PV) Panels

PV Panels are capable of generating direct current electricity from the sun's energy, which can then be converted to alternating current and used within the building. They are generally a "maintenance free" technology as there are no moving parts. They also typically have a 20-year manufacturer's guarantee on electrical output and can be expected to operate effectively for 30 years or more.

Capital costs have also reduced significantly in recent years due to worldwide increase in production levels, particular from China. They are adaptable and scalable in that the amount installed can be selected to suit the budget available.

A PV solar array will be included.

4.1.6 Wind Turbines.

Due to the partially urban nature of the site wind energy has not been considered.

4.1.7 District Heating and Waste Heat Opportunity

There is no District Heating or Waste Heat Generation opportunities at this site.

3 BUILDING REGULATIONS

The proposed development has been analysed for compliance with Building Regulations Technical Document L 2022 Conservation of Fuel and Energy – Buildings other than Dwellings.

Part L of the Second Schedule to the Building Regulations, insofar as it relates to works related to new buildings other than dwellings, provides as follows:

L1 A building shall be designed and constructed so as to ensure that the energy performance of the building is such as to limit the amount of energy required for the operation of the building and the amount of Carbon Dioxide (CO_2) emissions associated with this energy use insofar as is reasonably practicable.

L5 For new buildings other than dwellings, the requirements of L1 shall be met by:

(a) providing that 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 level 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;

(b) providing that, the nearly zero or very low amount of energy required is covered to a very significant extent by energy from renewable sources produced on-site or nearby;

(c) limiting the heat loss and, where appropriate, availing of the heat gains through the fabric of the building;

(d) providing and commissioning energy efficient space heating and cooling systems, heating and cooling equipment, water heating systems, and ventilation systems, with effective controls;

(e) ensuring that the building is appropriately designed to limit need for cooling and, where air-conditioning or mechanical ventilation is installed, that installed systems are energy efficient, appropriately sized and adequately controlled;

(f) limiting the heat loss from pipes, ducts and vessels used for the transport or storage of heated water or air;

(g) limiting the heat gains by chilled water and refrigerant vessels, and by pipes and ducts that serve air-conditioning systems;

(h) providing energy efficient artificial lighting systems and adequate control of these systems; and

(i) providing to the building owner sufficient information about the building, the fixed building services, controls and their maintenance requirements so that the building can be operated in such a manner as to use no more fuel and energy than is reasonable.

The European Union (Energy Performance of Buildings) Regulations 2021 (S.I. No. 393 of 2021), insofar as it relates to works related to new buildings other than dwellings, provides as follows:

> Regulation 5
>
> (a) A new building shall, where technically and economically feasible, be equipped with self-regulating devices for the separate regulation of the temperature in each room or, where justified, in a designated heated zone of the building unit.
>
> (e) A new building, which has more than 10 car parking spaces, shall have installed at least one recharging point and ducting infrastructure (consisting of conduits for electric cables) for at least one in every 5 car parking spaces to enable the subsequent installation of recharging points for electric vehicles.

For the purpose of giving effect to Article 15(4) of Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018, the European Union (District Heating) Regulations 2022 (S.I. No. 534 of 2022), provides as follows:

> Regulation 3
>
> The minimum levels of energy from renewable sources, referred to in Article 15(4) of the Directive, may be fulfilled through efficient district heating and cooling using a significant share of renewable energy and waste heat and cold.

There are five main criteria that this report aims to demonstrate compliance with:

- Building Energy Rating
- Energy Performance Coefficient (NZEB)
- Carbon Performance Coefficient (NZEB)
- Renewable contribution
- Maximum elemental U-Values

In addition compliance with other criteria of Part L will be demonstrated by analysis and reports prepared by the sustainability specialist TransSolar and is contained within Appendix 01:

- Overheating Analysis
  (e) ensuring that the building is appropriately designed to limit need for cooling and, where air conditioning or mechanical ventilation is installed, that installed systems are energy efficient, appropriately sized and adequately controlled;

Building Energy Rating (BER)
Developments compliant with NZEB will usually have a BER rating between A2 – A3

Energy Performance Coefficient (EPC) & Carbon Performance Coefficient (CPC)
The definition of "nearly zero energy building" requires that "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 produced on-site or nearby;"

In order to achieve this, a target of 20% Renewables Energy Ratio (RER) has been set as the NZEB energy from renewable sources onsite or nearby target. This may be reduced to 10% if a 10% saving in overall building energy can be demonstrated through alternative measures.

The EPC and CPC are the two figures that are used to determine whether the development complies with Part L on an overall basis.

The EPC is the calculated primary energy consumption of the proposed development, divided by that of a reference building of the same size. To comply with Part L and NZEB requirements, the EPC must be better than the Maximum Energy Performance Coefficient (MPEPC) which is 1.0.

The CPC is the calculated carbon dioxide emissions of the proposed development, divided by that of a reference building of the same size. To comply with Part L and NZEB requirements, the CPC must be better than the Maximum Carbon Performance Coefficient (MPCPC) which is 1.15.

Renewable Contribution
To satisfy part L, 20% of the building energy must be provided via renewable technologies. This is measured in the form of a renewable energy ratio (RER). In the event that an EPC of 0.9 and CPC of 1.04 is achieved an RER of 10% will be required.

Maximum Elemental U-Values
Technical Guidance Document Part L 2022 sets out maximum U-Values which may not be exceeded for each construction type:

Table 1 Maximum elemental U-value [1] (W/m^2K)

Column 1 Fabric Elements	Column 2 Area – weighted Average Elemental U-Value (U_m)	Column 3 Average Elemental U-value Individual element or section of element
Roofs[2] Pitched roof - Insulation at ceiling - Insulation on slope Flat roof	 0.16 0.16 0.20	0.3
Walls[2]	0.21	0.6
Ground Floors[2,3]	0.21	0.6
Other exposed floors[2]	0.21	0.6
External personnel doors, windows[4] and rooflights[6]	1.6[5]	3.0
Curtain Walling	1.8	3.0
Vehicle access and similar large doors	1.5	3.0
High usage entrance door[7]	3.0	3.0
Swimming Pool Basin[8]	0.25	0.6

Notes:

1. The U-value includes the effect of unheated voids or other spaces.

2. Reasonable provision would also be achieved if the total heat loss through the roof, wall and floor elements did not exceed that which would be the case if each of the area weighted average U-value (Um) for these elements set out in Column 2 were achieved individually.

3. Where the source of space heating is underfloor heating, a floor U-value of 0.15 W/m^2K should generally be satisfactory.

4. Excludes display windows and similar glazing but their impact on overall performance must be taken into account in EPC and CPC calculation.

5. In buildings with high internal heat gains a less demanding area-weighted average U-Value for the glazing may be an appropriate way of reducing overall primary energy and CO_2 emissions. Where this can be shown then the average U-value for windows can be relaxed from the values given above. However values should be no worse than 2.2 W/m^2K.

6. This is the overall U-value including the frame and edge effects, and it relates to the performance of the unit in the vertical plane so, for roof-lights, it must be adjusted for the slope of the roof as described in Sect 11.1 of BR 443

7. High Usage Entrance door means a door to an entrance primarily for the use of people that is expected to experience larger volumes of traffic, and where robustness and/or powered operation is the main performance requirement. To qualify as a high-usage entrance door the door should be equipped with automatic closers and except where operational requirements preclude it, be protected by a lobby.

8. Where a swimming pool is constructed as part of a new building, reasonable provision should be made to limit heat loss from the pool basin by achieving a U Value no worse than 0.25 W/m^2K as calculated according to BS EN 13370

TGD Part L 2022

Overheating Analysis
A separate sustainability specialist has been appointed to analyse the building façade and building configuration on behalf of the Architect with an aim of having the majority of spaces as naturally ventilated. The overheating analysis undertaken by the sustainability specialist TransSolar is contained within Appendix 01.

While the Building Regulations Technical Guidance Document Part L 2022 Conservation of Fuel and Energy – Buildings other than Dwellings recommends the use of CIBSE TM52 as a methodology for overheating analysis it doesn't preclude the use of other methodologies for overheating analysis.

Various overheating standards exist across Europe due to differing climatic conditions. The standards for overheating across the UK and Ireland predominantly incorporate guidelines outlined in the CIBSE standards. Standards derived from TM52, applied under CIBSE Guide A, incorporate the methodology outlined in EN15251, identifying a running mean outdoor temperature (Trm) to determine a threshold for overheating.

TransSolar who have been selected and engaged with by the project architects Henry J Lyons are specialists for their particular field of KlimaEngineering (or Climate Engineering) which is a climate responsive design and takes advantage of the specific local climate and surroundings to maximise user comfort and passive strategies. In particular TransSolars ability to advise and guide the building envelope design.

TransSolar are based in Germany and their particular expertise on studying overheating is based on their knowledge of the applicable local standards e.g DIN EN 16798-1 (Formerly DIN EN 15251).

The methodology within DIN EN 16798-1 (Formerly DIN EN 15251) is similar to the CIBSE 52 methodology as they are both based around the study of thermal comfort models and variable threshold values based on outdoor temperature. This is due to CIBSE TM52 being a consequence of creating an appropriate overheating standard for the english speaking zone of Europe.

While TransSolar have applied the methodology of the German standard DIN EN 16798-1 (Formerly DIN EN 15251) for the design development overheating analysis, specific analysis in accordance with CIBSE TM52 has been provided for this planning compliance report.

4 INPUT DATA

A SBEM model is designed in IES VE to calculate the BER of the building. Similar to the calculation to demonstrate compliance with Part L. This report and the accompanying calculations are based on the design information and the input data has been detailed below. As the project progresses, the model can be refined, and the results will increase in accuracy.

The proposed design was modelled, which is laid out in the following pages. The following input data is applied for both buildings:

3.1 Energy & Sustainability Inputs

Building Operation and Design Criteria:

Building location: Dublin 89 *

** This is a mandatory default setting for the SBEM model and software.*

Passive Design:

Air-Permeability

Air tightness test according to CIBSE TM 23 best practice standards to achieve **$3m^3/m^2/hr$ at 50 Pa.**

U- Value Thermal Properties:

Element	**Proposed for this development**	**TGD L-2022 New Buildings Max Allowable**	**Percentage Improvement**
	W/m^2k	**W/m^2k**	
External Wall	0.21	0.21	0 %
Flat Roof	0.20	0.20	0 %
Pitched Roof	0.16	0.16	0 %
Ground Floor	0.21	0.21	0 %
Glazing			0 %
All levels	1.6	1.6	0 %

Note:

- Solar Transmission or G-Value of all windows shall not exceed 0.35.

Active Design:

Lighting Design Criteria

- High-efficiency LED light fittings
- Target 60 lumens per watt or 6 watts per sqm for general lighting
- Target 22 lumens per watt for display lighting

Space Heating & Cooling

- Air source heat pump systems to supply Low Pressure Hot Water (LPHW) to radiator circuits located throughout both buildings with the following efficiencies:
    - Heating seasonal coefficient of performance (SCOP) – 3.20
        - (med temp operation of 55'C and outdoor air temp of -7'C)

- Local cooling in the office space
    - through the use of fan convectors (the space heating radiators with fan assistance)
    - Space heating heat pump reverse operation in summer months
    - SEER of 3.28

Heating Controls

- Central time control
- Local time control/temperature control
- Weather compensation control

Domestic Hot Water Heating

- Domestic High Temperature Heat Pump
    - COP of 3.8 (only has COP as it is always supplied a constant temp so no seasonal component)
    - DHW HTHP does 50% of the load at 3.8
    - SH HP does 50% of the load at 3.20
- DHW volume stored
    - 675 litres stored
    - Standing loss of 3.41 kWh/ 24h

Ventilation

- All occupied spaces including offices, meeting rooms, etc. shall be naturally-ventilated via openable windows.
- 10 air changes per hour extract ventilation shall be provided to toilets. Specific Fan Power of Zonal Extract Ventilation shall not exceed 1.8 w/l/s.
- Circulation Areas including corridors, stairwells, and lobbies are to be naturally-ventilated where possible.

Photovoltaic System

- PV installation
    - PV going in as a client request
    - 75KW peak power from the array

5 WATER SUPPLY & WATER CONSERVATION PLAN

The building will have a Mains Water Break Tank sized for 30 min max pumped capacity. This Break Tank will be located at ground level.

Mains Water will be pumped from the Break Tank to provide mains water at drinking outlets per floor and the 24-hour Cold-Water Storage Tank.

24-hour water storage will be provided.

Water consumption and the conservation of water has become increasingly important in recent times. There are a number of potential advantages from the conservation of water both environmentally and financially. The reduction in usage of water and the harvesting of rainwater result in reductions in energy, wastewater and in turn associated costs.
The water supply for the site will be taken from the local authority mains network.

There are a number of features which will be included in the design of the water services installation which will reduce the consumption of potable water.

1. Low Water Use Sanitary Ware

The sanitary ware selected within the buildings can have a significant effect on the water consumption. Low use appliances such as aerated taps, dual flush WC's and low water use showers will be installed throughout the development. The following is a table detailing maximum water consumption for various appliances:

Appliance	Minimum Standard
Dual Flush Cistern	6/3 Litres or better
Showers	<9 litres/min
Taps	Aerating Taps (approx 0.5l/use)
Urinals	Cistern control device or waterless urinals

2. Leak Detection

A leak detection system capable of detecting major leaks on the water supply will be included. The system will cover all mains water supply pipework between the building and the site boundary and will be capable of detecting major leaks that may otherwise go undetected

Comparisons of actual usage as recorded within the building will be compared with a pre-determined expected usage pattern any excessive consumption caused by leaks will be detected by the BMS.

3. Identification of Excessive Consumption and/or Leaks

A pulsed water meter shall be provided at the site boundary to continually record and monitor water consumption.

The pulsed meter will be linked to the Building Management System which will be programmed with a series of water consumption patterns for different times of the day, week, and year. The BMS system will continually compare actual usage with predicted norms and where an out-of-range reading is recorded, the BMS will register an alarm.

The cold-water storage tank overflows shall also be monitored on a regular basis and if found to be discharging then the mains water inlet ball valve shall be checked in conjunction with the tank outlets. Overflows shall be located to cause a "nuisance" in the event of a discharge. Any defects shall be corrected in a timely manner.

6 RESULTS FROM THE NEAP/ SBEM PART L ASSESSMENTS

These results are based on all currently available design information. As the design progresses, the model will be refined to keep the results up to date.

The results from the Part L Compliance Assessment shows that Part L compliance is being achieved across the five main criteria.

- Building Energy Rating
- Energy Performance Coefficient (NZEB)
- Carbon Performance Coefficient (NZEB)
- Renewable contribution
- Maximum elemental U-Values

BRIRL:

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.

MCC Civic Offices

Date: Fri Aug 18 15:46:55 2023

Administrative information

Building Details

Address: MCC Civic Offices, Address 2, Address 3, Address 4, Co. Monaghan, Eircode

NEAP

Calculation engine: SBEMIE

Calculation engine version: v5.6.a.0

Interface to calculation engine: Virtual Environment

Interface to calculation engine version: 7.0.22

BRIRL compliance check version: v5.6.a.0

Client Details

Name: Name

Telephone number: Phone

Address: Street Address, Co. Carlow, Eircode

Energy Assessor Details

Name: Homan O'Brien

Telephone number: +353 (01) 2056300

Email: daniel.matthews@homanobrien.ie

Address: 89 Booterstown Avenue Blackrock, Co. Dublin, A94 P2C2

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	13.8 kgCO2/m2.annum
Calculated CO2 emission rate from Actual building	5.5 kgCO2/m2.annum
Carbon Performance Coefficient (CPC)	0.4
Maximum Permitted Carbon Performance Coefficient (MPCPC)	**1.15**
Calculated primary energy consumption rate from Reference building	82.9 kWh/m2.annum
Calculated primary energy consumption rate from Actual building	43 kWh/m2.annum
Energy Performance Coefficient (EPC)	0.52
Maximum Permitted Energy Performance Coefficient (MPEPC)	**1**
Renewable Energy Ratio (RER)	0.56
Minimum Renewable Energy Ratio	**0.1**

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	0.21	0.6	0.21	LG000001_W4
Floors (ground and exposed)	0.21	0.13	0.6	0.21	L0000012_F
Pitched roofs	0.16	-	0.3	-	"No heat loss pitched roofs"
Flat roofs	0.2	0.2	0.3	0.2	L0000000_C
Windows, roof windows, and rooflights	1.6	1.6	3	1.6	LG000001_W4_O0
Personnel doors	1.6	1.5	3	1.5	L0000031_W13_O12
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	3

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	>0.95

1- Ashp - Heating and cooling with Mix Model Vent

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	3.2	3.28	-	-	-
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- Ashp - Rads with Nat Vent

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	3.2	-	-	-	-
Standard value	2.75	N/A**	N/A	N/A	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.

3- Ashp - Rads with Supply and Extract

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	3.2	-	-	-	-
Standard value	2.75	N/A**	N/A	N/A	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.

1- SYST0004-DHW

	Water heating efficiency	**Storage loss factor [kWh/litre per day]**
This building	3.2	-
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
LG_STAFF WC 01	-	-	-	1.9	-	-	-	-	-	0.65	N/A
L00_STAFF WC 01	-	-	-	1.9	-	-	-	-	-	0.65	N/A
L00_VISITOR WC	-	-	-	1.9	-	-	-	-	-	0.65	N/A
L00_STAFF ACC SHOWER	-	-	-	1.9	-	-	-	-	-	0.65	N/A
L00_STAFF WC 02	-	-	-	1.9	-	-	-	-	-	0.65	N/A
L00_MALE STAFF SHOWER	-	-	-	1.9	-	-	-	-	-	0.65	N/A
L00_FEMALE STAFF SHOWER	-	-	-	1.9	-	-	-	-	-	0.65	N/A
L01_STAFF WC 01	-	-	-	1.9	-	-	-	-	-	0.65	N/A
L01_STAFF WC 02	-	-	-	1.9	-	-	-	-	-	0.65	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	
LG_PARTY MEETING 02	127	-	-	164
LG_MEETING 01	126	-	-	172
LG_OFFICE 01	154	-	-	87
LG_MEETING 02	158	-	-	82
LG_MEETING 03	155	-	-	85
LG_PARTY MEETING 01	127	-	-	162
LG_MEETING RM 03	130	-	-	163
LG_MEETING RM 04	125	-	-	185
L00_LARGE MEETING 01	119	-	-	216
L00_LARGE MEETING 02	119	-	-	218
L00_MEETING RM 03	126	-	-	172
L00_SEO OFFICE 01	155	-	-	85
L00_SEO OFFICE 02	158	-	-	82
L00_MEETING RM 02	154	-	-	87
L00_MEETING RM 01	124	-	-	180
L00_MEETING RM 05	133	-	-	133
L00_SEO OFFICE 03	156	-	-	85
L00_SEO OFFICE 04	156	-	-	85
L00_MEETING RM 04	157	-	-	83
L00_SEO OFFICE 05	155	-	-	89
L00_COMMS	153	-	-	86
L00_PUBLIC HUDDLE SPACE 01	192	-	-	50
L00_PUBLIC HUDDLE SPACE 02	188	-	-	52
L00_PUBLIC HUDDLE SPACE 03	188	-	-	52
L01_SMALL MEETING	128	-	-	127
L01_BOARD ROOM	121	-	-	168
L01_COMMS ROOM	121	-	-	172
L01_CEO OFFICE	116	-	-	214
L01_SEO OFFICE 01	145	-	-	86
L01_DOS OFFICE 02	145	-	-	86

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
L01_HUDDLE SPACE 01	146	-	-	85
L01_HUDDLE SPACE 02	146	-	-	85
L01_MEDIUM MEETING	113	-	-	299
L01_DOS OFFICE 03	142	-	-	91
L01_SEO OFFICE 02	145	-	-	86
L01_SEO OFFICE 03	145	-	-	86
L01_DOS OFFICE 04	145	-	-	86
L01_DOS OFFICE 05	145	-	-	86
L01_SEO OFFICE 04	145	-	-	86
L01_SEO OFFICE 06	141	-	-	100
L01_SEO OFFICE 07	139	-	-	103
L01_SEO OFFICE 08	137	-	-	107
LG_COUNCIL CHAMBER	109	-	-	1025
L01_INFORMAL MEETING	103	-	-	343
L01_COLLAB 2	110	-	-	169
L01_DOS OFFICE	103	-	-	1222
L01_OPEN SPACE 1	101	-	-	1919
L01_COLLAB 1	107	-	-	203
L00_COLLAB	123	-	-	185
L00_MEETING	140	-	-	114
L00_OPEN SPACE 01	106	-	-	2623
L00_OFFICE TEA 01	-	84	-	464
L00_OPEN PLANE OFFICE SPACE 02	101	-	-	3936
L00_OFFICE TEA 02	-	74	-	311
LG_OPEN PLAN OFFICE	102	-	-	3371
LG_STAFF CANTEEN	-	79	-	750
LG_FIRE ESCAPE STAIRS 01	-	73	-	121
LG_LOBBY	-	86	-	86
LG_STORAGE 02	60	-	-	58
L00_FIRE ESCAPE STAIRS 01	-	73	-	121
L00_MAIL ROOM	60	-	-	27
L00_LOBBY 01	-	96	-	57
L00_LOBBY 02	-	84	-	142
L00_FIRE ESCAPE STAIRS 03	-	67	-	145
L00_FIRE ESCAPE STAIRS 02	-	69	-	140
L00_PUBLIC SEATING	-	60	-	1562
L01_FIRE ESCAPE STAIRS 02	-	66	-	140
L01_FIRE ESCAPE STAIRS 03	-	62	-	167
LG_STAIRS	-	64	-	335
L01_LOBBY	-	60	-	123
L01_STAIR	-	67	-	162
L01_ARRIVAL HUB	-	60	-	449
L00_STAIR 1	-	72	-	158

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
L00_STAIR 2	-	70	-	223
LG_STAIR	-	70	-	223
LG_ENTRANCE / FOYER	-	84	-	1517
LG_STAFF WC 01	-	123	-	183
L00_STAFF WC 01	-	123	-	183
L00_VISITOR WC	-	123	-	184
L00_STAFF ACC SHOWER	-	77	-	86
L00_STAFF WC 02	-	151	-	102
L00_MALE STAFF SHOWER	-	66	-	147
L00_FEMALE STAFF SHOWER	-	66	-	149
L01_STAFF WC 01	-	119	-	183
L01_STAFF WC 02	-	117	-	222

Primary Energy Contributions to RER

Technology	kWh/annum
Photovoltaic systems	79452.4
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	211783
CHP generators for space and/or water heating	0
District heating for space and/or water heating	0
Process energy	0
Total for renewables	**291235.4**
Total for renewables & non-renewables	**519676.1**

Technical Data Sheet (Actual vs. Reference Building)

Building Global Parameters

	Actual	Reference
Area (m2)	5319	5319
External area (m2)	10327	10327
Weather	DUB	DUB
Infiltration (m3/hm2 @ 50Pa)	3	3
Average conductance (W/K)	4548.4	3223.82
Average U-value (W/m2K)	0.44	0.31
Alpha value* (%)	25.74	14.55

* 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

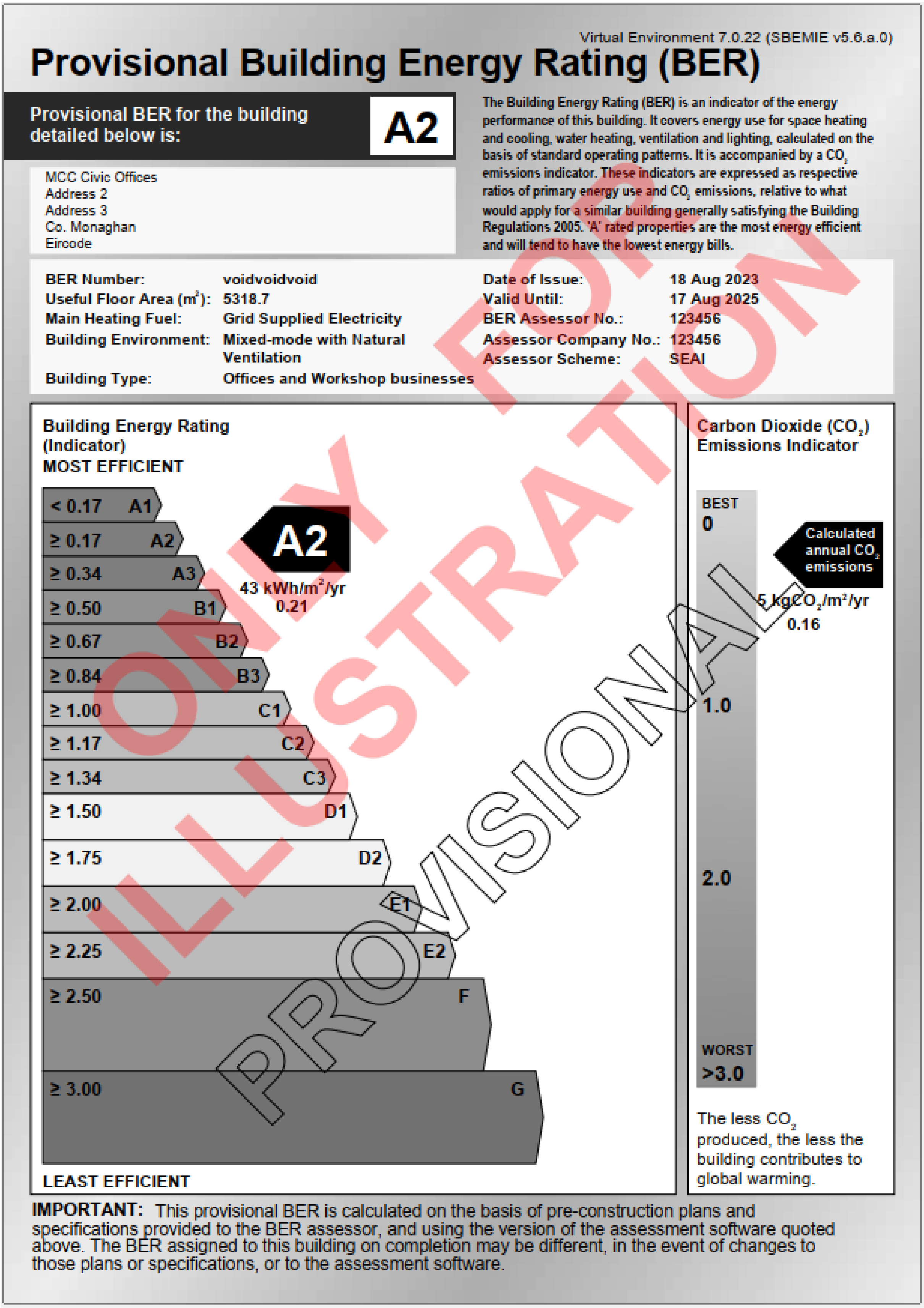
HVAC Systems Performance

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] Single room cooling system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity									
Actual	113.9	63.1	10.1	7.2	0	3.14	2.45	3.2	3.28
Reference	63.3	77.5	21.5	8	3	0.82	2.7	---	---
[ST] Central heating using water: radiators, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity									
Actual	184.1	61.1	17	0	1.8	3.01	0	3.2	0
Reference	137.1	58.4	46.5	0	0.9	0.82	0	---	---
[ST] Central heating using water: radiators, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity									
Actual	15.9	37.7	1.5	0	10.9	3.01	0	3.2	0
Reference	39.3	26.4	13.3	0	4.2	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

BER:



Virtual Environment 7.0.22 (SBEMIE v5.6.a.0)

Provisional Building Energy Rating (BER)

Provisional BER for the building detailed below is: **A2**

MCC Civic Offices
Address 2
Address 3
Co. Monaghan
Eircode

The Building Energy Rating (BER) is an indicator of the energy performance of this building. It covers energy use for space heating and cooling, water heating, ventilation and lighting, calculated on the basis of standard operating patterns. It is accompanied by a CO_2 emissions indicator. These indicators are expressed as respective ratios of primary energy use and CO_2 emissions, relative to what would apply for a similar building generally satisfying the Building Regulations 2005. 'A' rated properties are the most energy efficient and will tend to have the lowest energy bills.

BER Number:	voidvoidvoid	**Date of Issue:**	18 Aug 2023
Useful Floor Area (m^2):	5318.7	**Valid Until:**	17 Aug 2025
Main Heating Fuel:	Grid Supplied Electricity	**BER Assessor No.:**	123456
Building Environment:	Mixed-mode with Natural Ventilation	**Assessor Company No.:**	123456
		Assessor Scheme:	SEAI
Building Type:	Offices and Workshop businesses		

Building Energy Rating (Indicator)

MOST EFFICIENT

< 0.17 A1
≥ 0.17 A2
≥ 0.34 A3
≥ 0.50 B1
≥ 0.67 B2
≥ 0.84 B3
≥ 1.00 C1
≥ 1.17 C2
≥ 1.34 C3
≥ 1.50 D1
≥ 1.75 D2
≥ 2.00 E1
≥ 2.25 E2
≥ 2.50 F
≥ 3.00 G

A2
43 kWh/m^2/yr
0.21

LEAST EFFICIENT

Carbon Dioxide (CO_2) Emissions Indicator

BEST
0
1.0
2.0
WORST
>3.0

Calculated annual CO_2 emissions
5 kgCO_2/m^2/yr
0.16

The less CO_2 produced, the less the building contributes to global warming.

IMPORTANT: This provisional BER is calculated on the basis of pre-construction plans and specifications provided to the BER assessor, and using the version of the assessment software quoted above. The BER assigned to this building on completion may be different, in the event of changes to those plans or specifications, or to the assessment software.

SBEM:

SBEMIE Main Calculation Output Document

Fri Aug 18 15:46:53 2023 v5.6.a.0

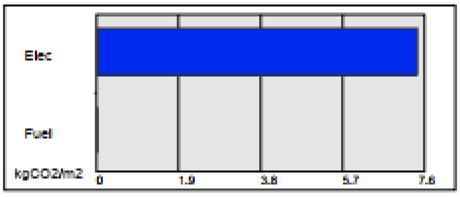
Building name

MCC Civic Offices

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

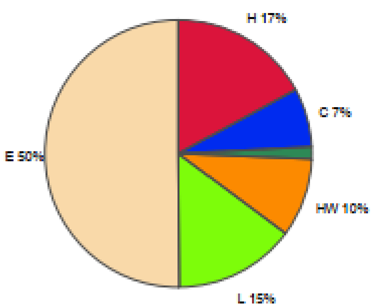


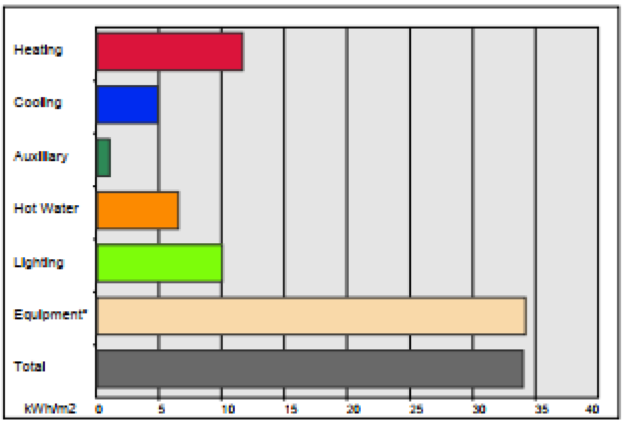
2 kgCO2/m2 displaced by the use of renewable sources.

Building area is 5318.73 m2

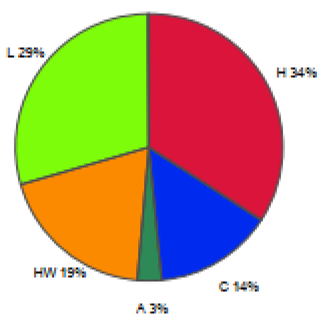
Annual Energy Consumption

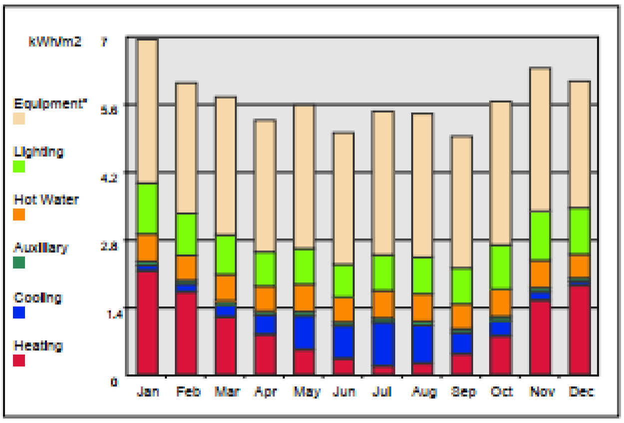
(Pie chart including Equipment end-use)





(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.

Page 1 of 2

6 CONCLUSION

The results show the proposed civic office building will achieve compliance with TGD Part L (NZEB) 2022 with an A2 Rating.

The onsite renewable energy generating requirement is achieved using an Air Source Heat Pump System as the source of heat generation for the office area.

The Architects approach to a Natural Ventilation solution guided by TransSolar has facilitated a very energy efficient passive design that has negated the need for significant amounts of mechanical ventilation and mechanical cooling. This Natural Ventilation approach has saved significant amount s energy that would have been consumed by mechanical plant systems while still maintain a high degree of occupant comfort.

The provision of supplemental renewables in the form of Photovoltaics (PV) while not required makes a significant contribution on the overall assessment and results.

7 APPENDIX A - OVERHEATING ANALYSIS

County council

Monaghan – Ireland

Overheating analysis per CIBSE TM52

Felix Thumm, Michelle Hur, Daniel Lago
08/09/2023

Transsolar
KlimaEngineering

Summary

- For Monaghan County Council, risk of overheating was analysed according to recommendations in CIBSE TM52:
  - Criterion 1 – limits the number of overheated operating hours
  - Criterion 2 – limits the severity and duration of overheating in one day
  - Criterion 3 – limits the maximum temperature in a day
- Boundary conditions have been selected based on the proposed design and NCM Database.
- Of the five critical zones were selected for analysis, four are enclosed by partition walls. These zones are currently labelled as either office or meeting rooms, but have been analysed with both load profiles to allow for flexibility of the future fit-out. The fifth zone is an open office space.
- All critical zones with all load profiles show minimal risk of overheating; none of the CIBSE criteria are exceeded. Consequently, the risk of overheating for the building is also minimal.

			Criterion 1	**Criterion 2**	**Criterion 3**	
Room #	**Room**	**Load Profile**	Overheated hours ≤ 3% occupied hours	Number of days with > 6 Kh overheating	Daily maximum temperature exceedance ≤ 4 K	**Risk of overheating minimal?**
1	Meeting LGF S	Private office	1.5%	0	1.5 K	yes
1	Meeting LGF S	Meeting room	1.8%	0	1.4 K	yes
2	Meeting LGF SW	Private office	0.8%	0	1.2 K	yes
2	Meeting LGF SW	Meeting room	0.6%	0	0.9 K	yes
3	Office GF SE	Private office	0%	0	0 K	yes
3	Office GF SE	Meeting room	0%	0	0 K	yes
4	Meeting GF E	Private office	0%	0	0 K	yes
4	Meeting GF E	Meeting room	0%	0	0 K	yes
5	Open Office GF SW	Open office	0%	0	0 K	yes

Definition of Overheating in CIBSE TM52

CIBSE TM52

6.1.2 Criteria for defining overheating in free-running buildings

The following three criteria, taken together, provide a robust yet balanced assessment of the risk of overheating of buildings in the UK and Europe. A room or building that fails any two of the three criteria is classed as overheating.

(1) The first criterion sets a limit for the number of hours that the operative temperature can exceed the threshold comfort temperature (upper limit of the range of comfort temperature) by 1 K or more during the occupied hours of a typical non-heating season (1 May to 30 September).

(2) The second criterion deals with the severity of overheating within any one day, which can be as important as its frequency, the level of which is a function of both temperature rise and its duration. This criterion sets a daily limit for acceptability.

(3) The third criterion sets an absolute maximum daily temperature for a room, beyond which the level of overheating is unacceptable.

Definition of Overheating in CIBSE TM52

CIBSE TM52

(a) Criterion 1: Hours of exceedance (He)

The number of hours (H_e) during which ΔT is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3 per cent of occupied hours.

→ Overheated hours ≤ 3% occupied hours

(b) Criterion 2: Daily weighted exceedance (W_e)

To allow for the severity of overheating the weighted exceedence (W_e) shall be less than or equal to 6 in any one day where:

$$W_e = (\sum h_e) \times \text{WF}$$
$$= (h_{e0} \times 0) + (h_{e1} \times 1) + (h_{e2} \times 2) + (h_{e3} \times 3) \quad (10)$$

where the weighting factor WF $= 0$ if $\Delta T \leq 0$, otherwise WF $= \Delta T$, and h_{ey} is the time (h) when WF $= y$.

→ Daily overheating maximum ≤ 6 Kh
Number of days exceeding 6 Kh = 0

(c) Criterion 3: Upper limit temperature (T_{upp})

To set an absolute maximum value for the indoor operative temperature the value of ΔT shall not exceed 4 K.

→ Maximum temperature exceedance ≤ 4 K

Note: The maximum temperature allowable is determined by a running average of previous average daily temperatures.

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Boundary conditions

Parameter	Assumption	Comments	Parameter	Assumption	Comments
Weather file	Monaghan Future	Meteonorm	**Interior Gains**		
Analysis period	May 1 - Sept 30	per CIBSE TM52	*Private Office*		
			Occupants	0.07 person/m², 73 W/person = 120 W/person * 61% sensible	NCM Database
Geometry			Lighting	6 W/m²	Report HOB
Area	per zone		Plug loads	10 W/m²	NCM Database
Volume	per zone		*Open Office*		
			Occupants	0.11 person/m², 73 W/person = 120 W/person * 61% sensible	NCM Database
Facade			Lighting	6 W/m²	Report HOB
Window			Plug loads	15 W/m²	NCM Database
USI-Window	1.6 W/(m²·K)	TGD Part L	*Meeting Room*		
USI-Glass	1.5 W/(m²·K)	derived from Part L	Occupants	0.2 person/m², 73 W/person = 120 W/person * 61% sensible	NCM Database
g-value	0.35	Report HOB	Lighting	6 W/m²	Report HOB
Frame fraction	20%	assumed	Plug loads	5 W/m²	NCM Database
USI-Frame	1.8 W/(m²·K)	derived from Part L			
Shading	fins and perforated mesh with 50% transmission	per design	**HVAC**		
			Ventilation		
Opaque			Type	natural, max. 3 ACH for single-sided ventilation, max 5 ACH for cross-ventilation	
Roof	0.2 W/(m²·K)	TGD Part L	Heating	N/A	
Wall USI	0.21 W/(m²·K)	TGD Part L	Cooling	no active cooling	
Ground floor	0.21 W/(m²·K)	TGD Part L			
Infiltration	0.1 ACH	assumed			

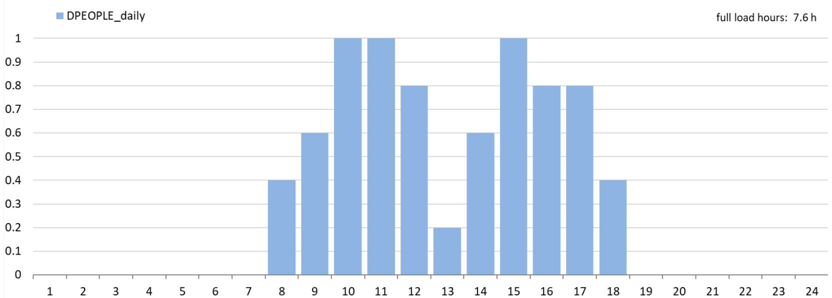
Boundary Conditions

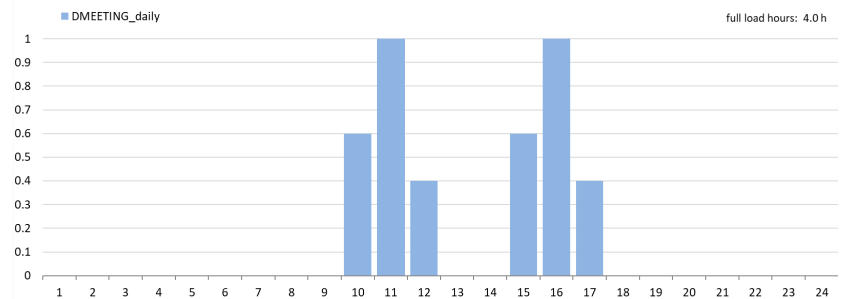
Schedule for Occupancy and Plug Loads in Office, Meeting Room

Office

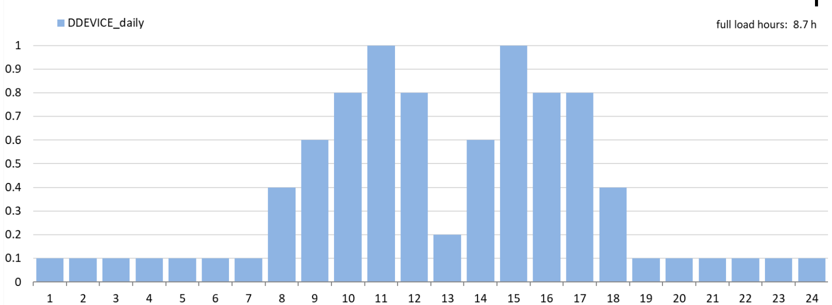
Meeting room

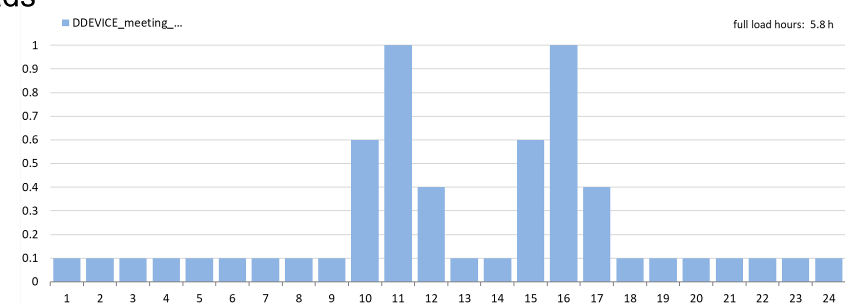
Occupancy





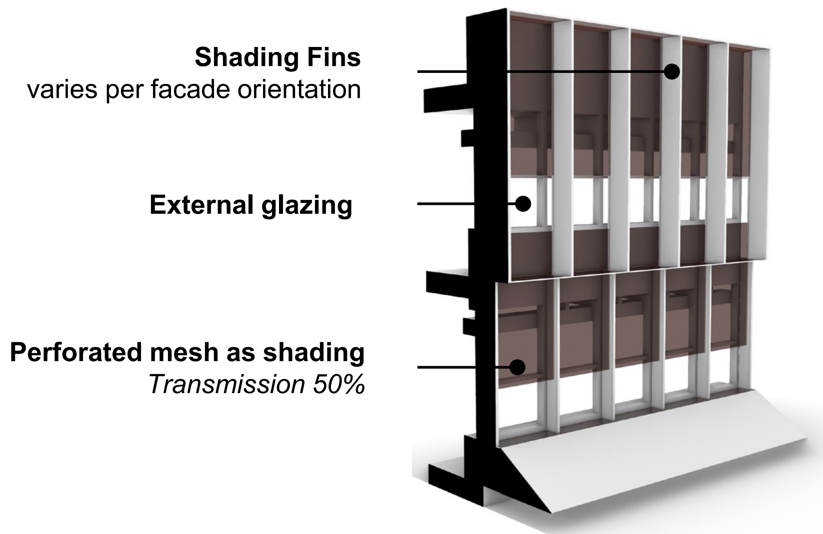
Plug loads





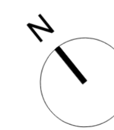
Boundary Conditions

Facade characteristics



Critical zones

Lower ground level



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Critical zones

Ground level

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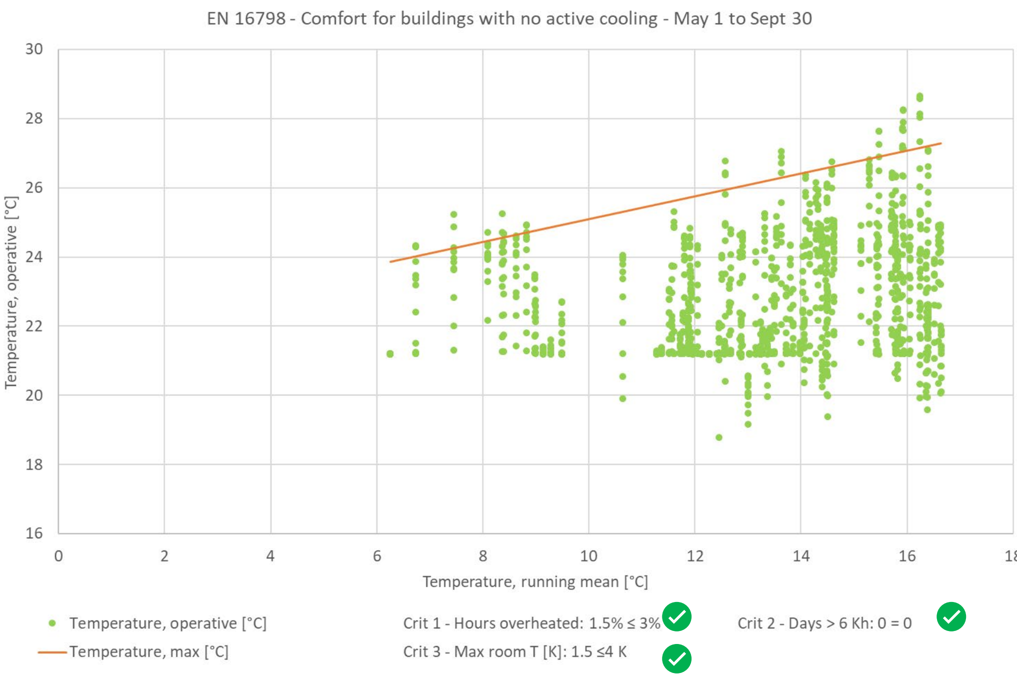
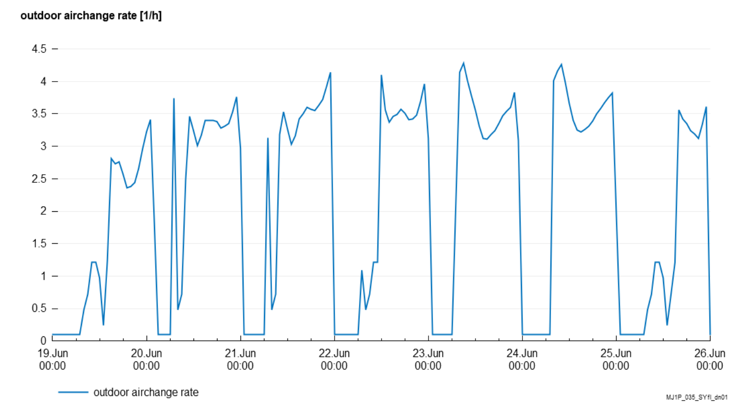
Results

Room 1: Meeting LGF S, Loads: Private Office



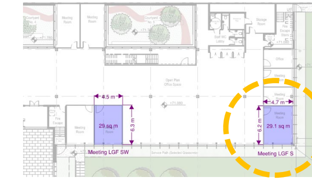


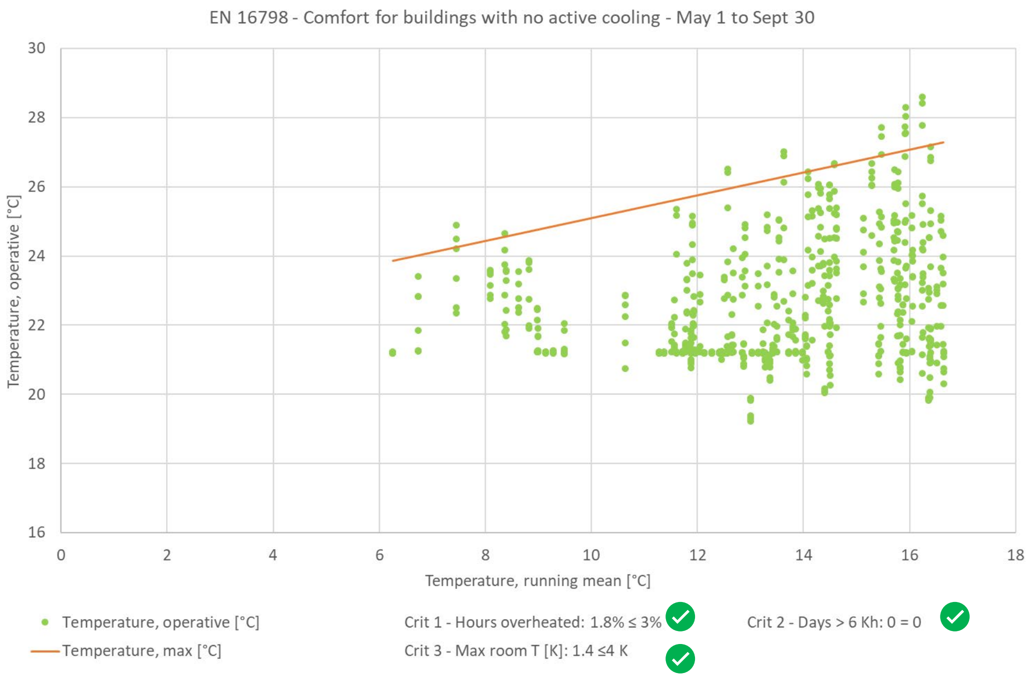
Max ACH < 5

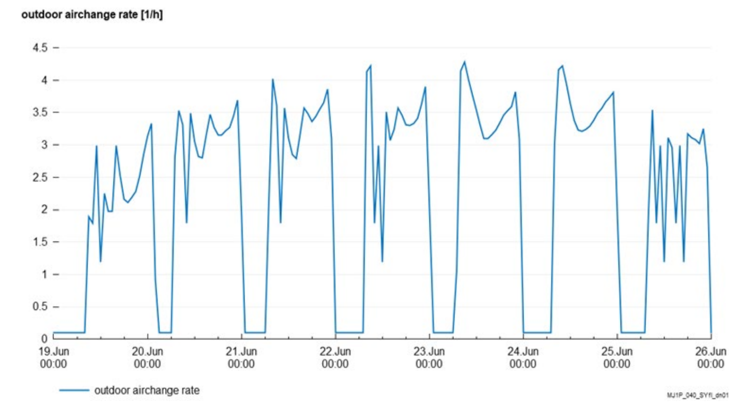
→ Room complies with all CIBSE TM52 criteria; risk of overheating is minimal

Results

Room 1: Meeting LGF S, Loads: Meeting room





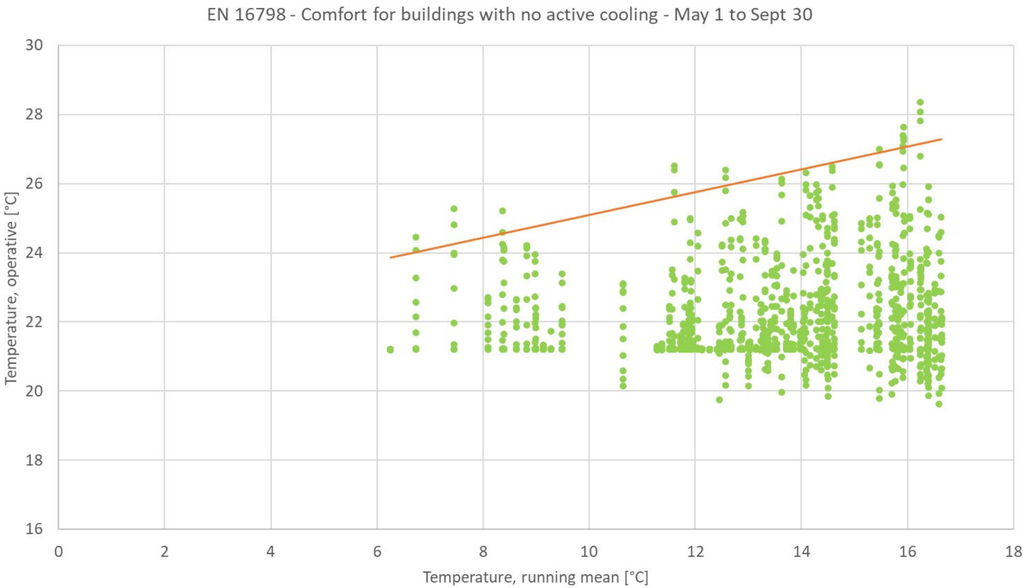


Max ACH < 5

→ Room complies with all CIBSE TM52 criteria; risk of overheating is minimal

Results

Room 2: Meeting LGF SW, Loads: Private office



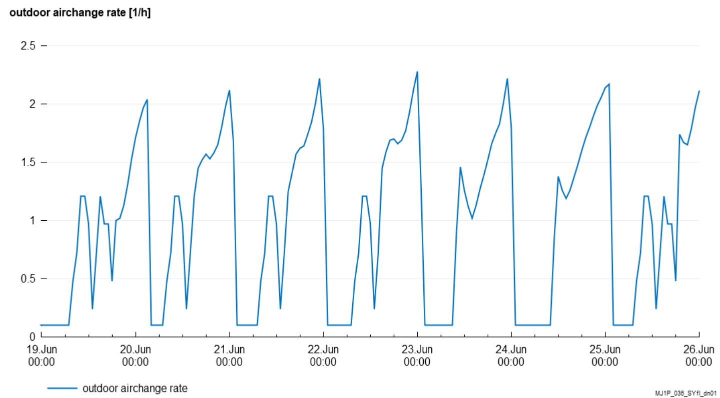
Temperature, operative [°C]

Temperature, max [°C]

Crit 1 - Hours overheated: 0.8% ≤ 3%

Crit 2 - Days > 6 Kh: 0 = 0

Crit 3 - Max room T [K]: 1.2 ≤4 K



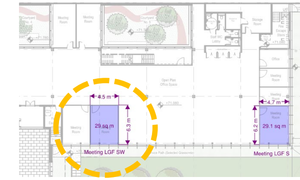
Max ACH < 3

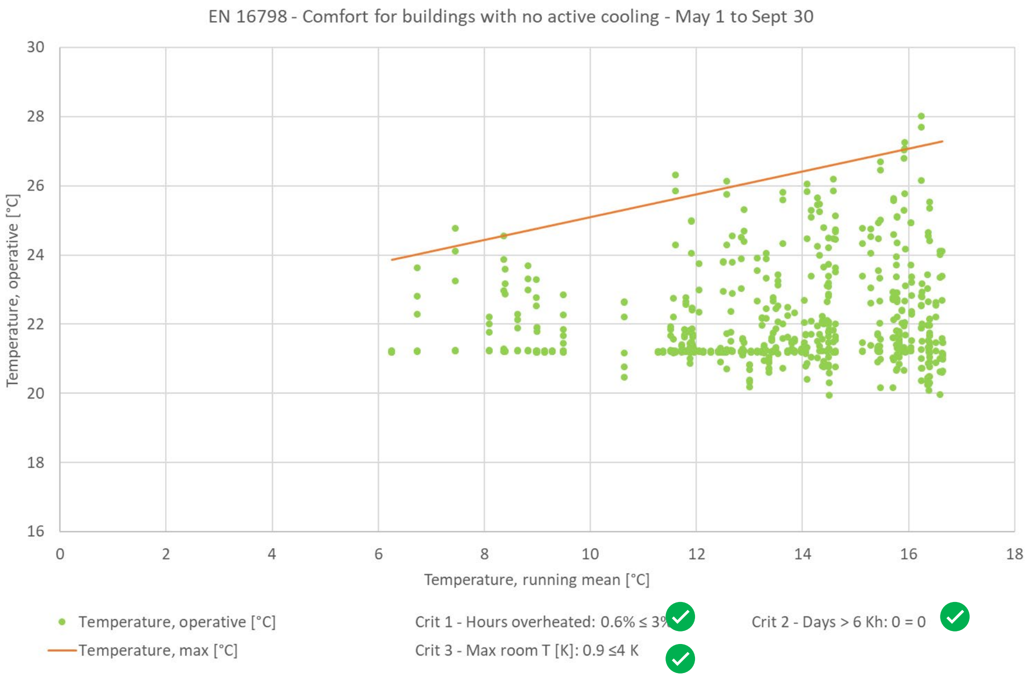
→ Room complies with all CIBSE TM52 criteria; risk of overheating is minimal

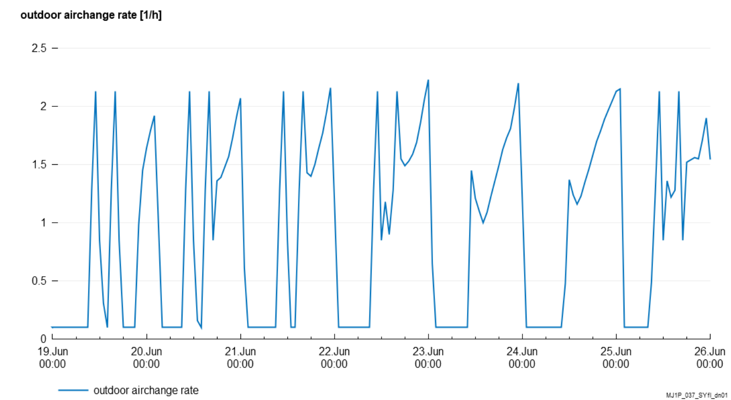
Transsolar KlimaEngineering

Results

Room 2: Meeting LGF SW, Loads: Meeting room







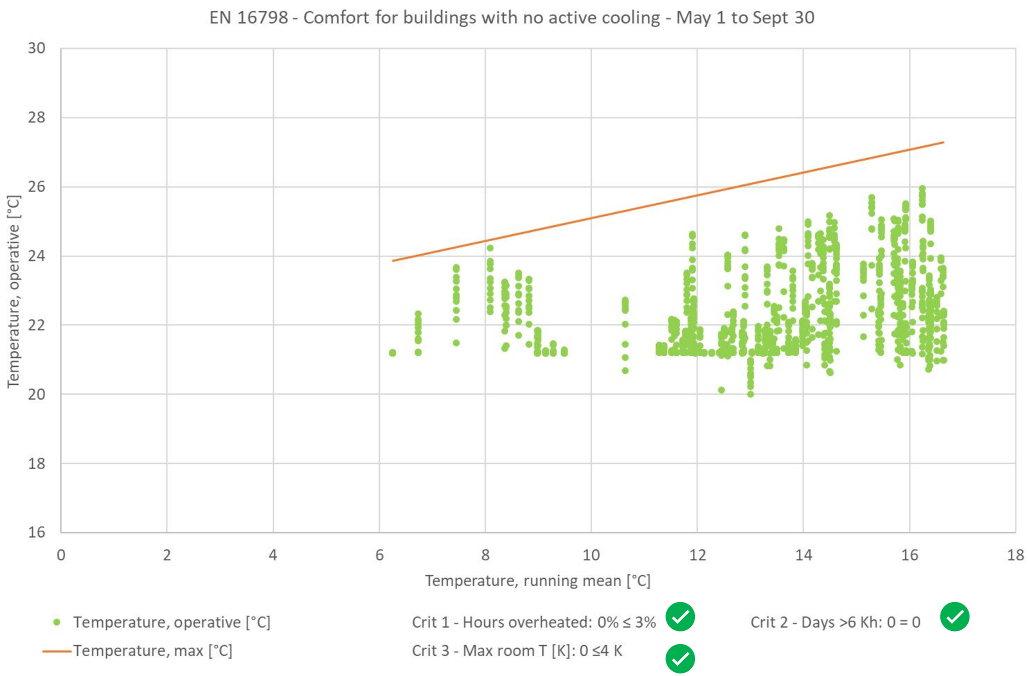
Max ACH < 3

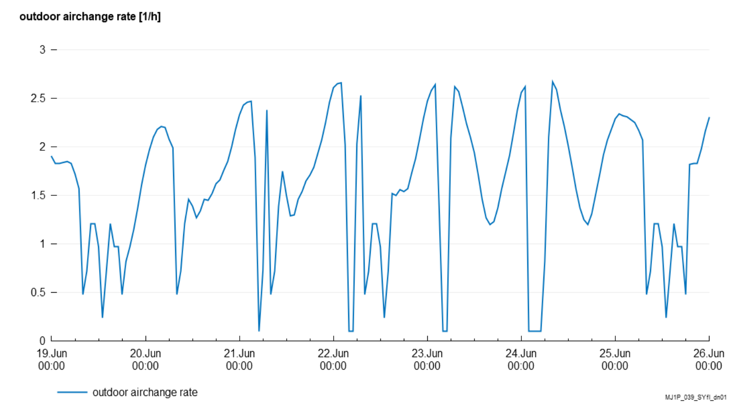
→ Room complies with all CIBSE TM52 criteria; risk of overheating is minimal

Transsolar KlimaEngineering

Results

Room 3: Office GF SE, Loads: Private office





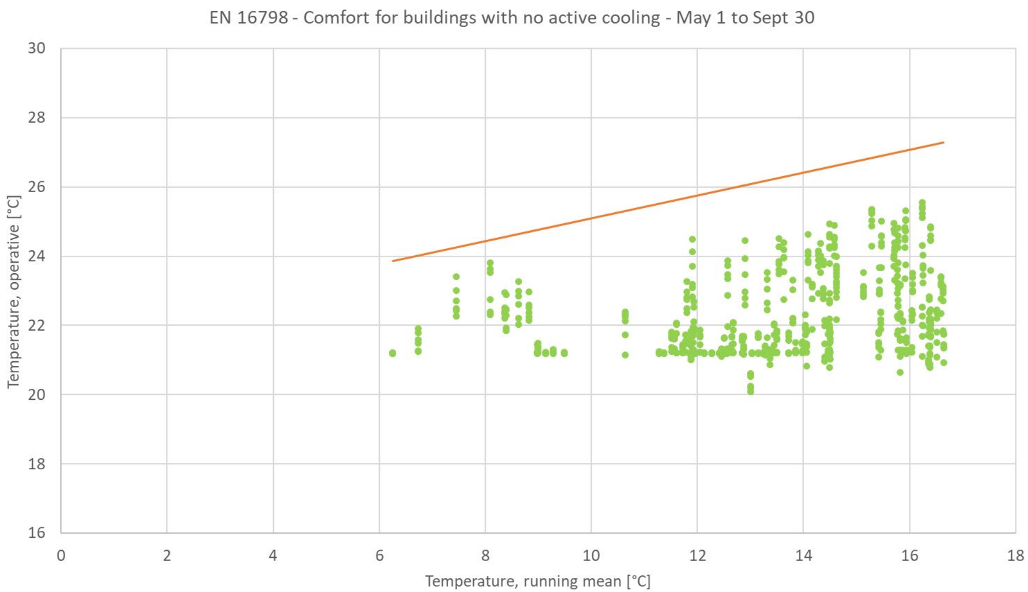
Max ACH < 3

→ Room complies with all CIBSE TM52 criteria; risk of overheating is minimal

Transsolar KlimaEngineering

Results

Room 3: Office GF SE, Loads: Meeting room

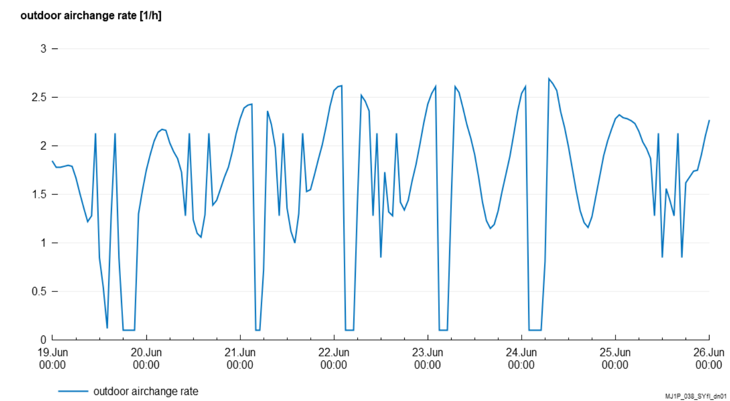


- Temperature, operative [°C]
- Temperature, max [°C]

Crit 1 - Hours overheated: 0% ≤ 3% ✓

Crit 2 - Days > 6 Kh: 0 = 0 ✓

Crit 3 - Max room T [K]: 0 ≤4 K ✓

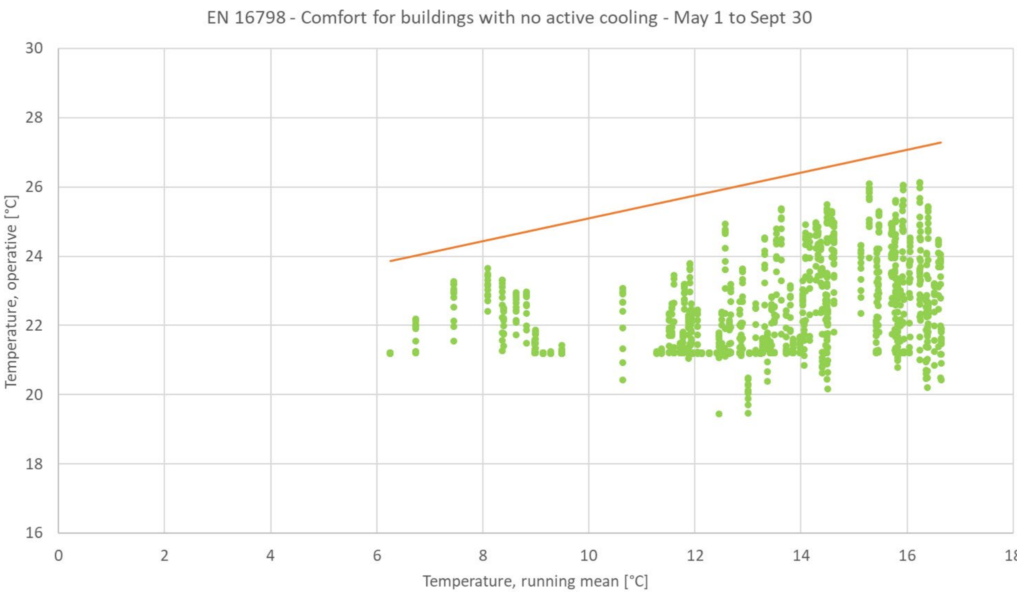


Max ACH < 3

→ Room complies with all CIBSE TM52 criteria; risk of overheating is minimal

Results

Room 4: Meeting GF E, Loads: Private Office



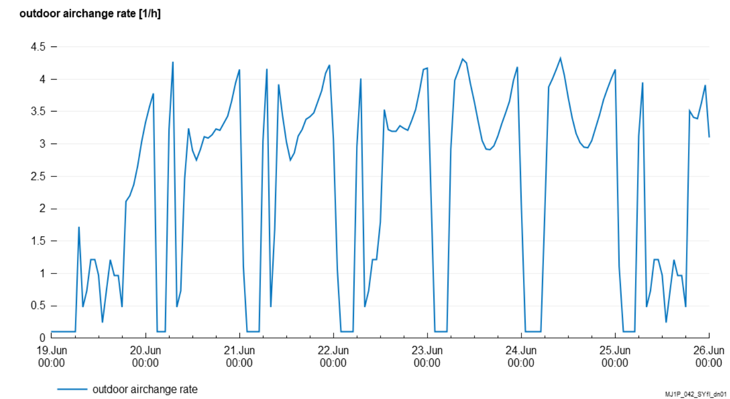
Temperature, operative [°C]

Temperature, max [°C]

Crit 1 - Hours overheated: 0% ≤ 3%

Crit 2 - Days > 6 Kh: 0 = 0

Crit 3 - Max room T [K]: 0 ≤4 K



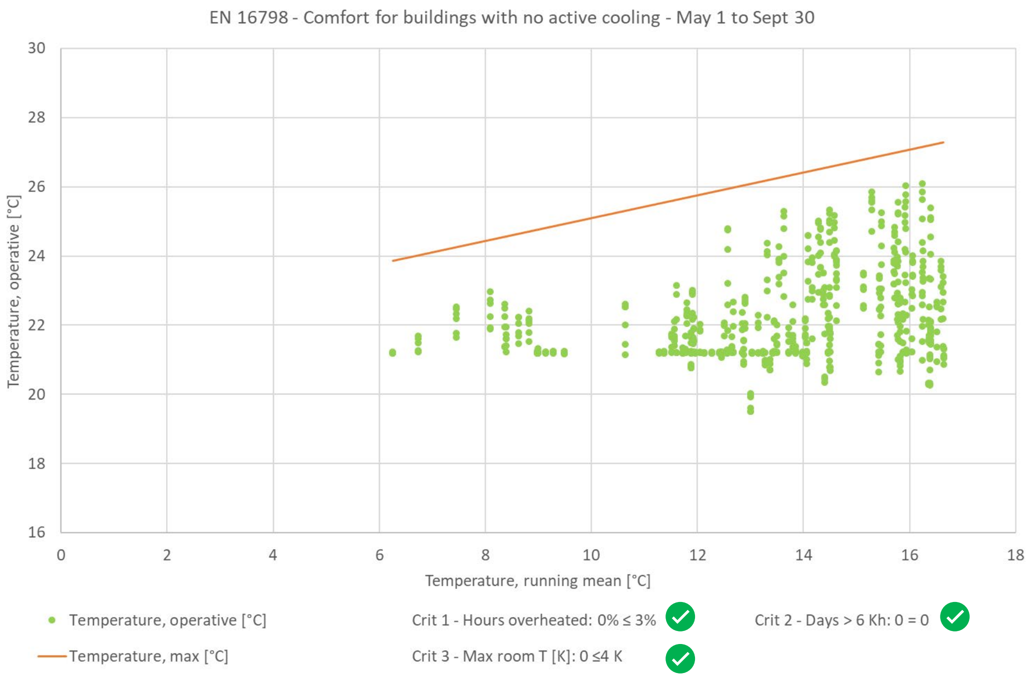
Max ACH < 5

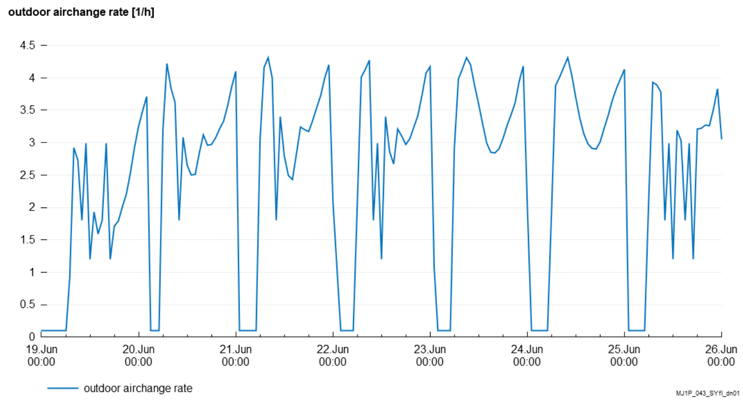
→ Room complies with all CIBSE TM52 criteria; risk of overheating is minimal

Transsolar KlimaEngineering

Results

Room 4: Meeting GF E, Loads: Meeting room





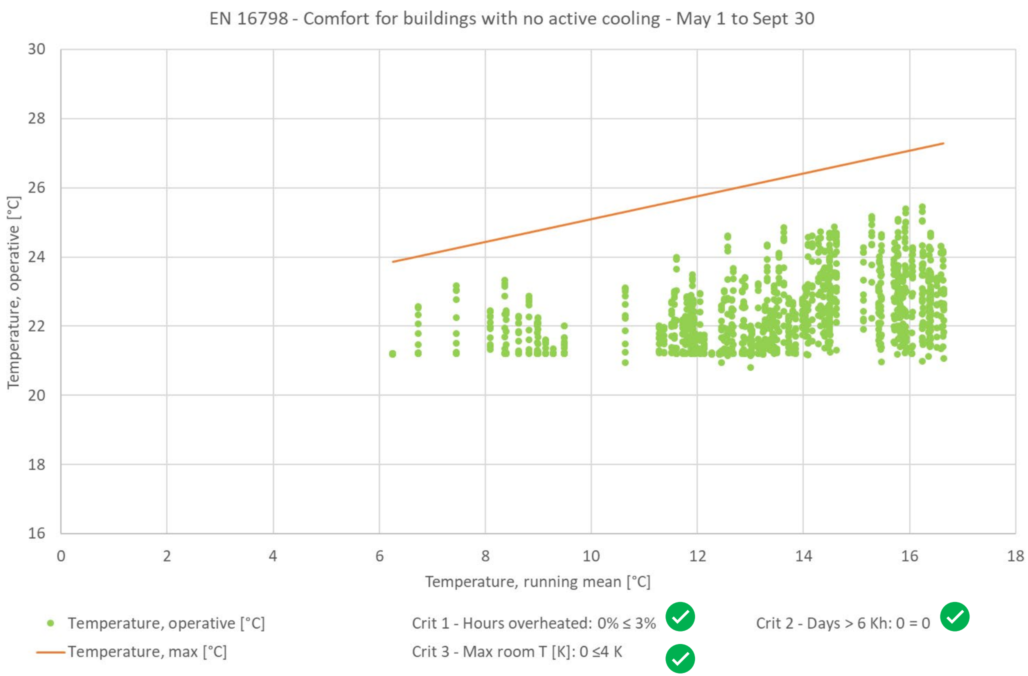
Max ACH < 5

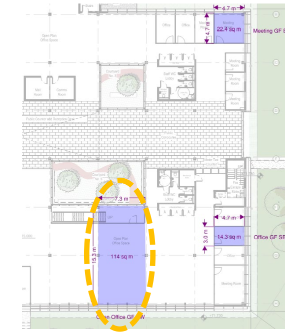
→ Room complies with all CIBSE TM52 criteria; risk of overheating is minimal

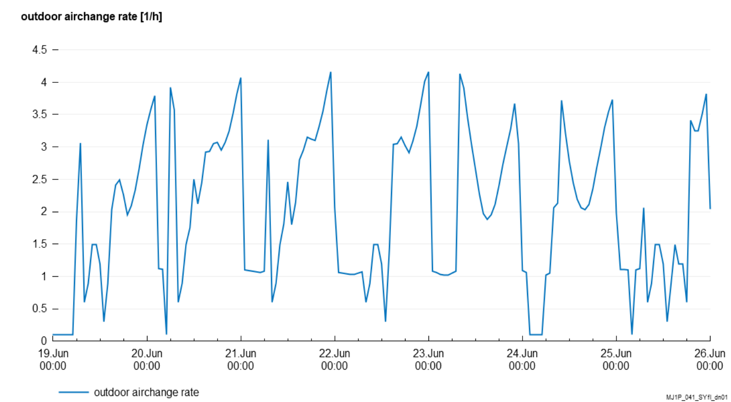
Transsolar KlimaEngineering

Results

Room 5: Open Office GF SW, Loads: Open office







Max ACH < 5

→ Room complies with all CIBSE TM52 criteria; risk of overheating is minimal

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