Dublin City Council & PSQ Developments Ltd (Joint Applicants)

Parnell Square Cultural Quarter

Building Environment, Energy & Sustainability Report

239031-00

Issue 1 | 22 May 2018

Job number 239031-00

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Contents

1 Introduction

This report provides commentary on the mechanical and electrical systems proposed for the Parnell Square Cultural Quarter (PSCQ) development and their positive impacts on the environment, energy and sustainability of the development.

The project brief calls for the design to take careful consideration of site location, orientation, form and layout, solar gain control, local wind effects and daylighting to create a passive design that reduces the overall environmental impact of the development. This approach is at the core of the project design.

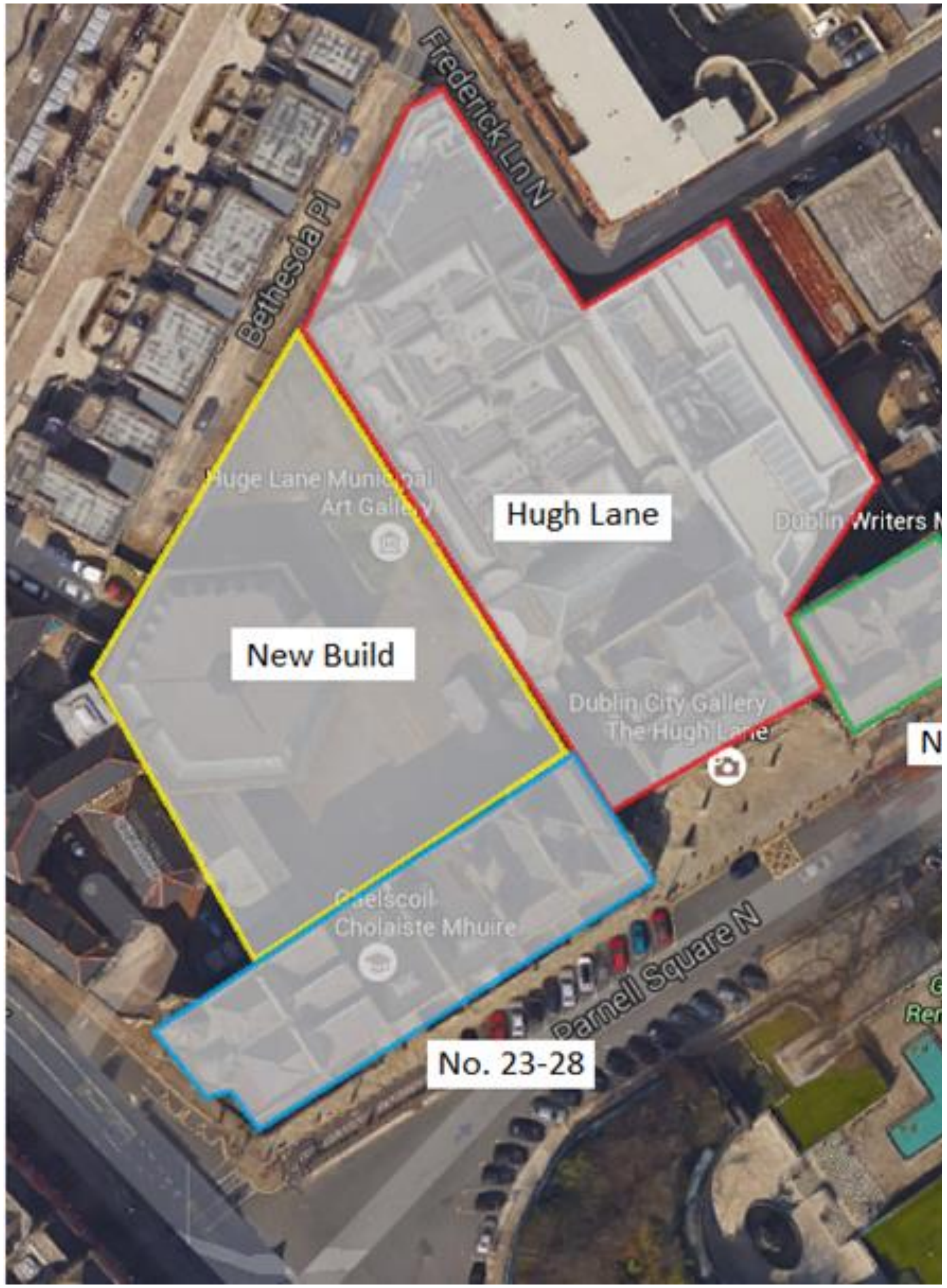
In order to satisfy the level of excellence required in low energy design the design team and Client have started from first principles and applied sustainable strategies throughout each of the design stages to develop a scheme which delivers the optimum level of energy efficiency and utility conservation.

The development has a design target of a Building Energy Rating (BER) of A3 which is being achieved and the design is in compliance with Technical Guidance Document (TGD) Part L: Conservation of Energy and Fuel – Buildings other than Dwellings (2017).

1.1 Description of Area

The new cultural facilities at the PSCQ will be located at numbers 23-28 Parnell Square and numbers 20-21 Parnell Square, which are protected Georgian-era houses. These will be refurbished to house some of the facilities and functions required by the Library. The Cultural Quarter will also consist of a new building at the back of No. 23-28 ("New Build") which will have connections to the houses 23-28, which is adjacent to the existing Dublin City Gallery, The Hugh Lane, as shown below.

Figure 1:



2 Energy Standards and Regulations

There are a number of standards and regulations applicable to the project in relation to energy efficiency. These cover energy efficiency, energy performance in buildings and renewable energy.

The current Building Regulation for Conservation of Fuel and Energy in non-domestic buildings is Part L 2017. This 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 set new targets for building energy performance including a move towards near zero energy buildings and requires a study of the technical, environmental and economic feasibility of installing high efficiency alternative energy systems.

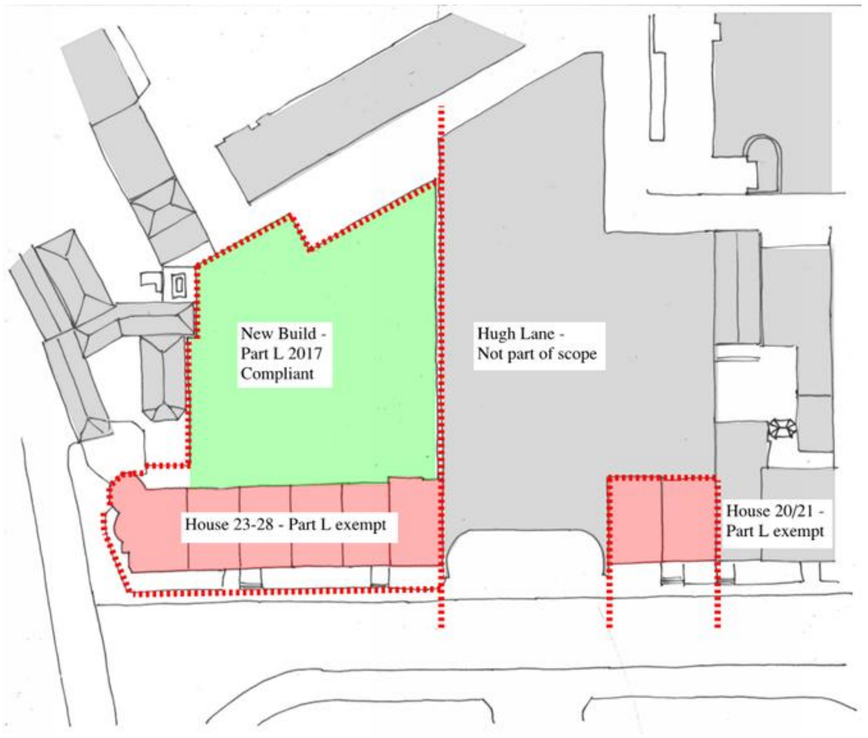
The directive states that the definition of a Nearly Zero Energy Building is;

"...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 produced onsite or nearby".

Dublin City Council have targeted a further improvement of 20% on the EU policy of a 20% reduction in energy use from 1990 levels to be achieved by 2020. The proposed design will meet, and in many cases exceed, these targets and act as an exemplar project in the public sector. The PSCQ development will also achieve BER of equal or greater than A3.

It is important to note that Protected Structures are exempt from compliance with Part L as set out in clause 0.6.1 Application to Buildings of Architectural or Historical Interest. In evaluation of the buildings regulatory compliance the following demarcations have been made:

Figure 2:



3 Low Energy Design Strategy

The Project Brief calls for the development to provide internal environments and engineering services installations which combine appropriately for a high quality solution using minimum energy in a cost effective and environmentally sensitive manner. The low energy aspect of the Brief is achieved through the following hierarchical sequence:

- Passive design: The use of the building's form, structure and facade to minimise energy demand.
- Active design: The use of low energy active systems to generate and distribute energy as efficiently as possible. Appropriate controls and metering will ensure that energy is used only when and where it is required and allow the facilities team to target further reductions.
- Application of appropriate renewable technologies deemed appropriate within the revised Part L 2017 calculation methodology set out by Sustainable Energy Authority of Ireland (SEAI).

Due to the protected nature of the Georgian houses, there is limited potential to improve upon the existing building fabric to reduce heat loss and infiltration. Some of the areas that have been identified as potential energy improvements that have been integrated into the design are as follow;

- Replacing existing single glazed windows with slim-lite double glazing units within no historical significance to reduce heat loss to the external environment.
- Install low conductivity insulation to roofs that are being replaced due to their poor current condition. These roof repairs will also hopefully improve air tightness within the associated houses further reducing the energy consumption.
- Providing high efficiency plant such as condensing gas boilers, low energy fans/pumps and low energy EC DC fan coil units for space conditioning.
- Maximise use of natural daylight were possible to minimise the energy consumption of artificial light and where unavoidable, replace the existing installed in-efficient technologies (incandescent light bulbs) with modern high efficiencies LEDs.

3.1 Passive Design

The **passive design** stage is crucial in helping to achieve a low energy building as it looks to reduce the need for energy to be generated in the first instance. During design development, close attention has been paid to co-ordinating and integrating the design to:

- Consider orientation, form and internal layout to optimize the design considering planning / operational requirements and the site constraints.
- Provide the potential for natural ventilation and/or mixed mode ventilation solutions where practical. The opportunities to utilise natural ventilation as a means to passively ventilate the atria space of the library when external conditions allow will significantly reduce the energy consumption versus full time mechanical ventilation.
- Utilise the available thermal mass of exposed concrete in tandem with night cooling to pre-cool spaces during summer to offset the peak mid-day solar gains.
- Reduce direct solar gain to reduce the energy consumption for comfort cooling or air conditioning. Analysis has been carried out to determine the optimum glazing ratio to minimise solar gain and cooling loads whilst maintaining the architectural design intent of high visible light transparency to optimise daylight availability.
- Maximise the use of daylighting where possible in the majority of areas to reduce dependence on artificial light and improve occupant experience.
- Improve the building thermal envelope performance (reducing air permeability, U-values and g values)
- Appropriate locations for plant to minimise distribution routes and associated energy losses.
- Target Building air permeability of at least $3.0m^3/hr$ per m^2 at 50Pa.

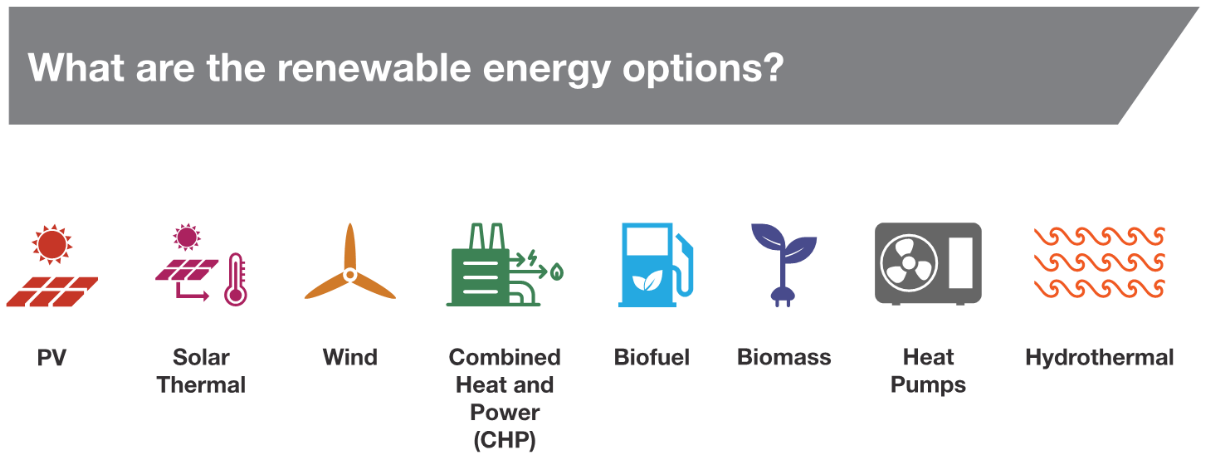
3.2 Active Design

Following the passive design measures, the design considers options to reduce energy use and to use and supply energy efficiently, for example:

- High efficiency LED lighting systems and appropriate artificial lighting levels.
- Lighting controls with perimeter areas switched separately from internal areas with daylight and occupancy (presence/absence) linking where appropriate.
- Strategies to improve the utilisation of plant and systems.
- Strategies to improve control and flexibility of the installations including provision of local user controls.
- Energy efficient equipment including the use of premium efficiency motors with variable frequency drives where practical (e.g. fans, pumps, lifts etc.).
- High efficiency, low emission heating / cooling plant.
- Zoning of equipment to allow plant to be turned off or enable out of hours setback in appropriate unoccupied spaces.
- High efficiency energy recovery for ventilation systems where practical.
- Provision of a Building Energy Management System (BEMS).
- Smart Metering.
- Low velocity pipework / ductwork and low pressure air filters to reduce fan and pump power consumption.
- Provision of user guidance, training and support to the building occupiers to increase awareness and to ensure that systems are operated as intended.
- Providing the most technically functional and economically feasible strategies for delivering the services provision to cater for the project briefs requirements within the Existing Georgian Houses.

3.3 Renewable Technologies

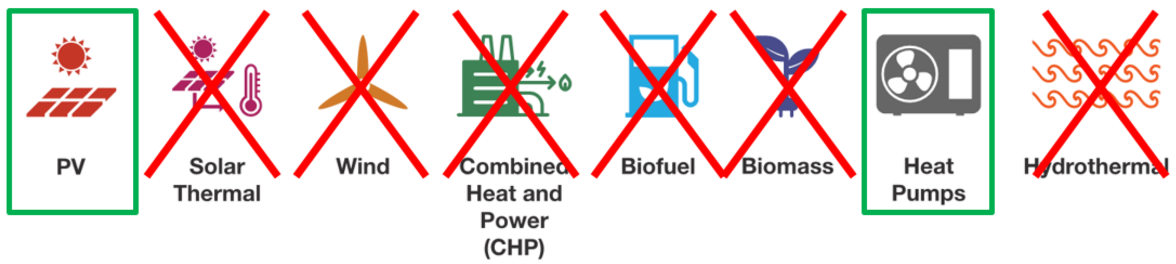
The recent revision of Part L has brought in the requirement to provide either 10% or 20% of the buildings primary energy consumption via Low or Zero Carbon Technologies. The permissible technologies allowed by SEAI include the following;



An iterative analysis was carried out to ascertain which LZC technologies form the optimal solution to incorporate within the design to meet this regulatory requirement.

The calculation methodology set out from SEAI was used to validate each iteration to determine if it was sufficient to meet the criteria outlined within Part L 2017.

The design utilises Air Source Heat Pumps as the primary heating & cooling source for the building, optimising the energy efficiency of the plant by using low flow and return heating water temperatures paired with heat emitters that perform effectively at these temperatures (underfloor heating, perimeter trench convector heaters where applicable). An array of photovoltaics solar panels is proposed to provide supplementary electrical energy production if the heat pumps alone cannot achieve the Renewable Energy Ratio requirements.



4 Achieving the targets

The following addresses the compliance with the regulations set out within Part L 2017. These are based on the current scheme design and will be refined as part of the ongoing detailed design process.

4.1 Building Regulations Part L

The Simplified Building Energy Modelling (SBEM) software is used to simulate compliance with Building Regulations Part L. The following sections demonstrate compliance with a number of parameters therein.

4.1.1 Compliance with Carbon Emissions

The Part L **target** CO_2 emission rate of an equivalent development is 14.1 $kgCO_2/m^2$/year

The **calculated** CO_2 emission rate for the proposed development is 10.01 $kgCO_2/m^2$/year.

The above demonstrates that the building is Part L compliant in terms of carbon emissions.

4.1.2 Compliance with Energy Consumption

The Part L **target** Primary Energy Consumption rate of an equivalent development is 71.85 kWh/m^2/year

The **calculated** Primary Energy Consumption rate of the proposed development is 48.56 kWh/m^2/year.

The above demonstrates that the building is compliant in terms of energy consumption.

4.1.3 Compliance with Primary Renewable Energy Requirements

The Part L **target** Primary Renewable Energy contribution for an equivalent development is 17.96 kWh/m^2/year

The **calculated** Primary Energy Consumption Rate of the proposed development is 23.71 kWh/m^2/year.

The above demonstrates that the building is compliant in terms of renewable energy contribution.

4.1.4 Compliance with solar overheating

For naturally ventilated rooms, the room temperature should not exceed 25°C for not more than 5% of the occupancy period and should not exceed 28°C for more than 1% of the occupancy period. Efficient glazing and sufficient window opening area which minimises the solar gain into the rooms and optimises natural ventilation have been chosen to achieve this target.

For each ventilation strategy, rooms have been simulated to check Part L compliance. The simulation demonstrates that all rooms are compliant with solar overheating requirements.

4.2 BER A3

In order to assess that the BER target is achievable an iSBEM model using an approved SEAI software has been created. A simulation model generates the energy consumption profile for the building which is compared with a notional similar building and a Building Energy Rating is produced for the specific building being modelled.

The BER results based on the current design, which are subject to modification as the design develops, are currently on target to achieve A3.

A draft example certificate is provided within Appendix A.

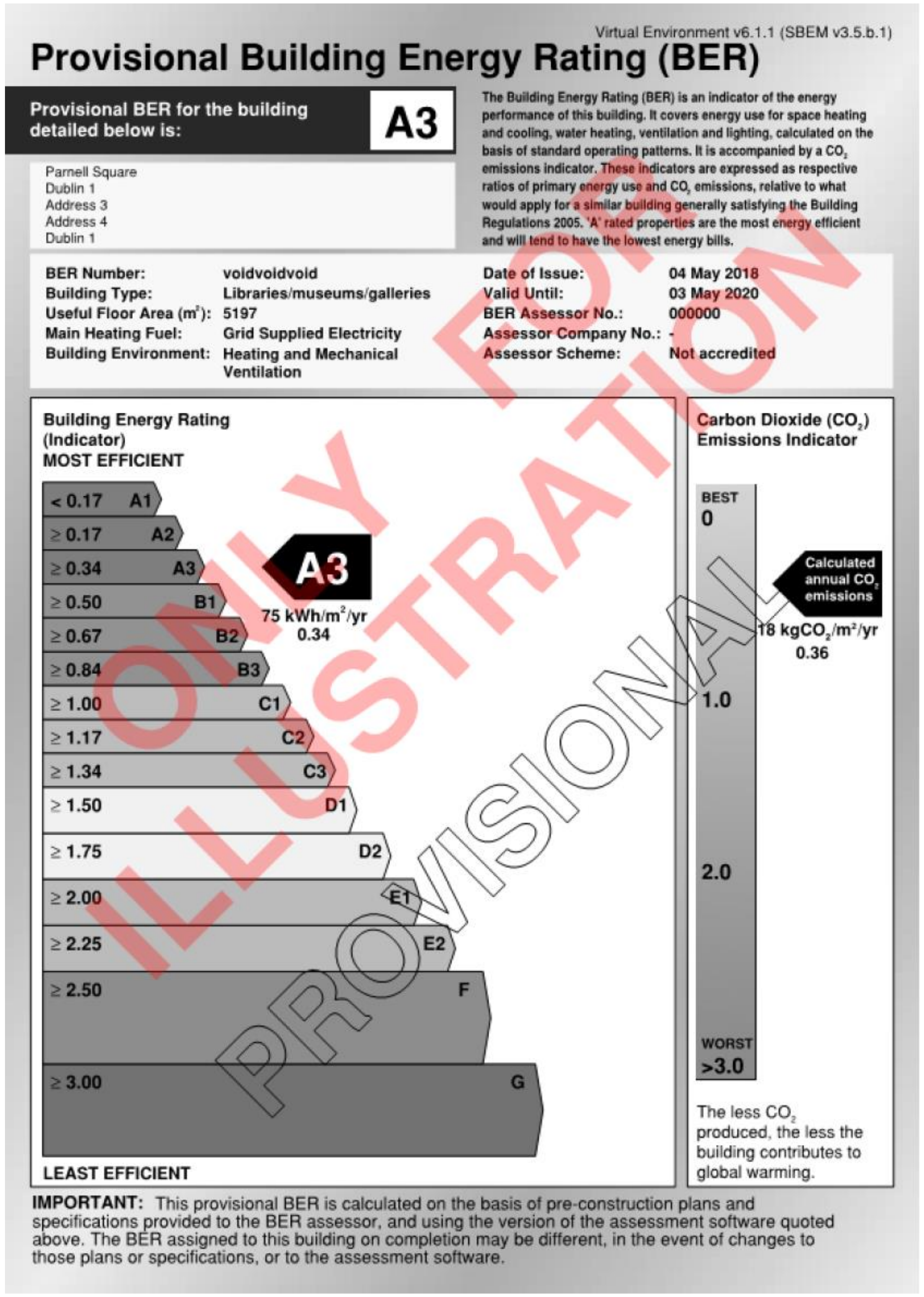
5 Conclusion

The energy performance of the development will meet or exceed all statutory requirements and deliver on targets set out in the Brief including Part L Compliance and achieving a BER of A3.

Appendix A

BER Certificate

Figure 3:



Virtual Environment v6.1.1 (SBEM v3.5.b.1)

Provisional Building Energy Rating (BER)

Provisional BER for the building detailed below is: **A3**

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.

Parnell Square
Dublin 1
Address 3
Address 4
Dublin 1

BER Number:	voidvoidvoid	**Date of Issue:**	04 May 2018
Building Type:	Libraries/museums/galleries	**Valid Until:**	03 May 2020
Useful Floor Area (m^2):	5197	**BER Assessor No.:**	000000
Main Heating Fuel:	Grid Supplied Electricity	**Assessor Company No.:**	-
Building Environment:	Heating and Mechanical Ventilation	**Assessor Scheme:**	Not accredited

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.