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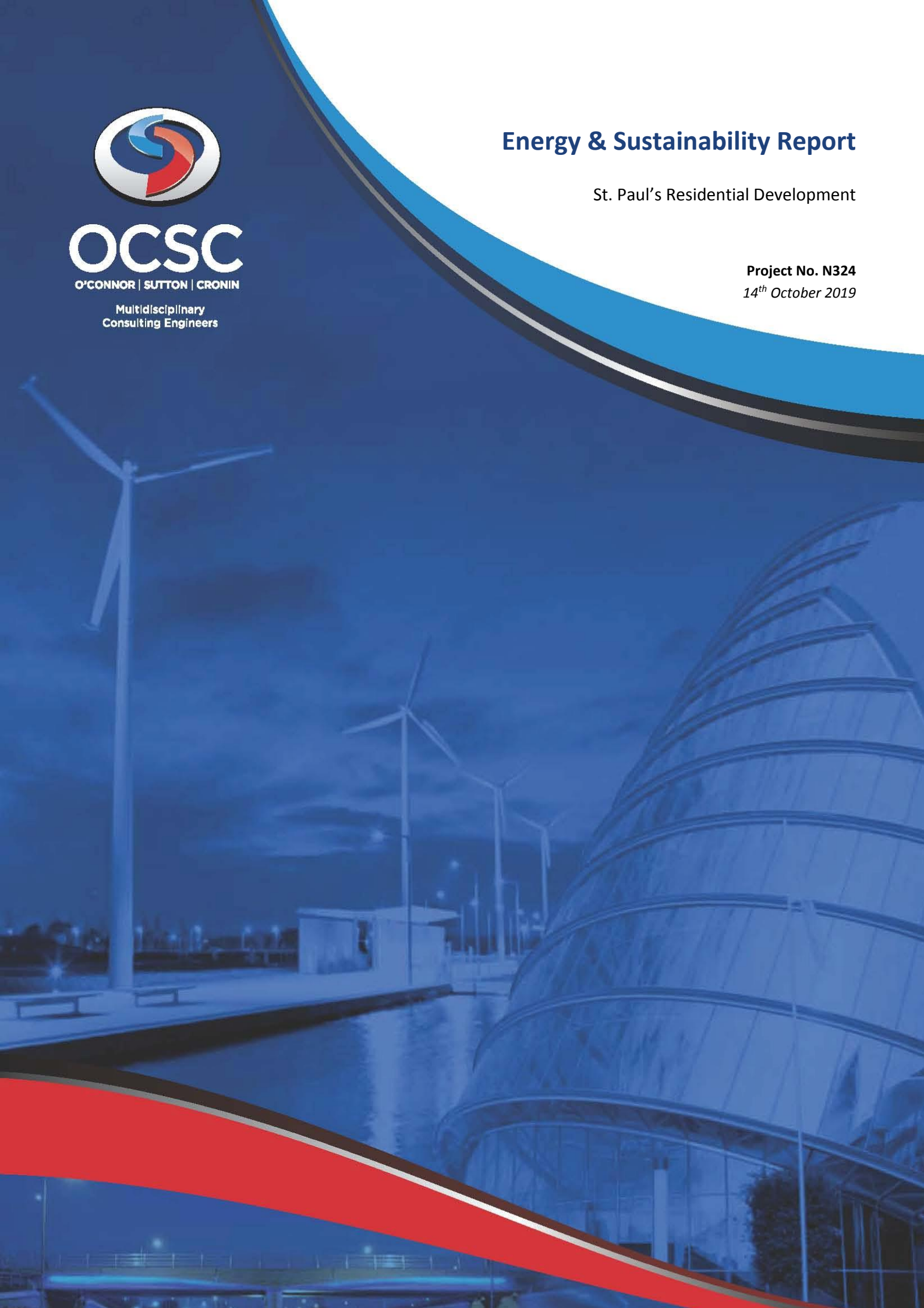
Energy & Sustainability Report

St. Paul's Residential Development

Project No. N324

14th October 2019



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NOTICE

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Energy & Sustainability Report

PROJECT NO. N324

1. INTRODUCTION

The intention of this report is to identify the energy efficiency measures associated with the design, construction, ongoing management and maintenance of the St Paul's residential development, located in Sybil Hill, Raheny, Co. Dublin.

The proposed development will comply with Part L (2019). As part of the development's efforts to further reduce energy consumption, the project is targeting an A2/A3 BER (Building Energy Rating). Extensive work has been carried out to develop a balanced design approach to achieve these onerous targets with a number of sustainable features being incorporated into the design from the early design stages.

Energy Performance Target		
Standard/Rating	**Mandatory**	**Target**
Part L	**Yes**	**Part L (2019)**
BER	**Yes**	**A2/A3**

Table 1: Energy Performance Target

The following sections identify a range of energy efficient measures that have been considered for the proposed St Paul's residential development.

2. SITE DESCRIPTION

The development will consist of the construction of a residential development set out in 9 no. blocks, ranging in height from 5 to 9 storeys accommodating 657 no. apartments, residential tenant amenity spaces and a crèche. At basement level the site will accommodate a total of 465 car parking spaces, 1314 bicycle parking, storage, services and plant areas. Landscaping will include extensive communal amenity areas, and a proposed significant area of public open space.

The proposed development also includes for the widening and realignment of an existing vehicular access onto Sybil Hill Road and the demolition of an existing pre-fab building to facilitate the construction of an access road with from Sybil Hill Road between Sybil Hill House (a Protected Structure) and St Paul's College incorporating upgraded accesses to Sybil Hill House and St Paul's College and a proposed pedestrian crossing on Sybil Hill Road. The proposed development also includes for the laying of a foul water sewer in Sybil Hill Road and the routing of surface water discharge from the site via St. Anne's Park to the Naniken River and the demolition and reconstruction of existing pedestrian stream crossing in St. Anne's Park with integral surface water discharge to Naniken River.

Figure 1 – Proposed Site Layout Plan

3. PART L BUILDING REGULATIONS

3.1. PART L (2019)

The new Part L (2019) of the Technical Guidance Document has been issued by the Minister for Housing, Planning and Local Government. This document is due to be the new standard for dwellings constructed from November 2019.

The Part L (2019) Regulations set energy performance requirements to achieve Nearly Zero Energy Buildings performance as required by Article 4 (1) of the Directive for new buildings.

The definition of Nearly Zero Energy Buildings is defined as:

"'Nearly zero-energy building' means a building that has a very high energy performance, as defined in 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 on-site or nearby".

Renewable Energy Ratio (RER):

For the new Part L (2019) NZEB requirements, a Renewable Energy Ratio (RER) is to replace the current Part L (2011) renewable requirements. A RER of 20% is currently required.

In line with the requirements detailed within the Technical Guidance Document, renewable energy technologies are defined as technologies that derive their energy directly from a renewable energy source, such as:

- Solar Photo-Voltaic Systems;
- Wind Power;
- Solar Thermal System;
- CHP Units (Combined Heat & Power);
- Biomass Systems (using Biofuels);
- Heat Pumps.

To demonstrate that an acceptable primary energy consumption rate has been achieved, the calculated Energy Performance Coefficient (EPC) of the dwelling being assessed should be no greater than the Maximum Permitted Energy Performance Coefficient (MPEPC).

The MPEPC is 0.3 (NZEB compliant)

To demonstrate that an acceptable CO2 emission rate has been achieved, the calculated Carbon Performance Coefficient (CPC) of the dwelling being assessed should be no greater than the Maximum Permitted Carbon Performance Coefficient (MPCPC).

The MPCPC is 0.35 (NZEB compliant)

3.2. PART L TRANSITIONAL ARRANGEMENTS:

As it stands, the new Part L 2019 (NZEB) standard is due to come into effect with the following transitional arrangements:

- Part L 2011 will cease to have effect from 31st October 2019.
- However, the 2011 document may continue to be used in the case of:
    - Where work has started on or before 31st October 2019, or
    - Where planning approval has been applied for on or before 31st October 2019 and substantial work** has been completed by 31st October 2020.

** "Substantial work" means that:

- For houses, the structure of external walls (up to wall-plate) has been erected.
- For apartments, the structure of the roof deck has been completed.

Due to the timeline for completion, the proposed development will be targeting compliance under Part L 2019 (NZEB).

4. BUILDING ENERGY RATING (BER)

As of 1st July 2009, all newly built domestic buildings and existing residential buildings that are for sale or rent require a BER (Building Energy Rating) certificate. The St Paul's residential development is targeting an A2/A3 BER throughout.

The actual building energy rating is based on the primary energy used for one year and is classified on a scale of A1 to G with A1 being the most energy efficient. It also provides the anticipated carbon emissions for a year of occupation based on the type of fuel that the building systems use. The following variables determines the extent of primary energy consumption within the building:

- Building type (office, retail, etc.)
- Building orientation
- Thermal envelope (insulation levels of the façade, roofs, ground floor etc)
- Air permeability (how much air infiltrates into the building through the façade)
- Heating systems (what type of plant is used and how efficient it is)
- Cooling systems (what type of plant is used and how efficient it is)
- Ventilation (what form of ventilation is used - natural ventilation, mixed mode mechanical ventilation)
- Fan and pump efficiency (how efficient are the pumps and fans)
- Domestic hot water generation (what type of plant is used and how efficient it is)
- Lighting systems (how efficient is the lighting)

The variables identified above will be described within this report and categorised under three main headings through "The Energy Hierarchy Plan". i.e. Be Mean, Be Lean, Be Green.

5. COMPLIANCE WITH PART F OF BUILDING REGULATIONS

This report is primarily focused around achieving compliance with Part L of the building regulations, but in doing so, the ventilation systems proposed must also comply with Part F (Ventilation) of the Technical Guidance Documents (TGD).

The new version of TGD Part F (2019) document revolves around two requirements as outlined below:

Means of ventilation.

- *F1 – Adequate and effective means of ventilation shall be provided for people in buildings. This shall be achieved by:*
  - *a) Limiting the moisture content of the air within the building so that it does not contribute to condensation and mould growth, and*
  - *b) Limiting the concentration of harmful pollutants in the air within the building.*

Condensation in roofs.

- *F2 - Adequate provision shall be made to prevent excessive condensation in the floor or in a roof void above an insulated ceiling.*

In relation to F1, the proposed design for the apartments will comply with the requirements.
In relation to F2, all roof systems throughout will be effectively ventilated in order to avoid condensation.

The new Part F 2019 standard will come into effect with the following transitional arrangements:

- Part F (2009) will cease to have effect from 31st October 2019.
- However, the 2009 document may continue to be used in the case of:
  - Where work has started on or before 31st October 2019, or
  - Where planning approval has been applied for on or before 31st October 2019 and substantial work** has been completed by 31st October 2020.

Due to the timeline for completion, the St. Paul's development will be targeting compliance under Part F (2019).

6. THE ENERGY HIERARCHY PLAN

Through the specification of an energy efficient façade and HVAC systems, the energy consumption of a building will be reduced compared to a set baseline. This ensures the environmental and economic impact of the operation of the building is reduced.

The key steps in the Energy Hierarchy Plan are outlined as follows:

1. The key philosophy of this plan is to first reduce energy demand by improving the building's thermal envelope, increasing air tightness, improving thermal transmittance and applying passive design techniques.

2. The second step is to utilise energy in the most efficient way through the selection and installation of energy efficient plant and equipment.

3. The final step is to introduce energy from renewable sources to reduce the burden on fossil fuels.

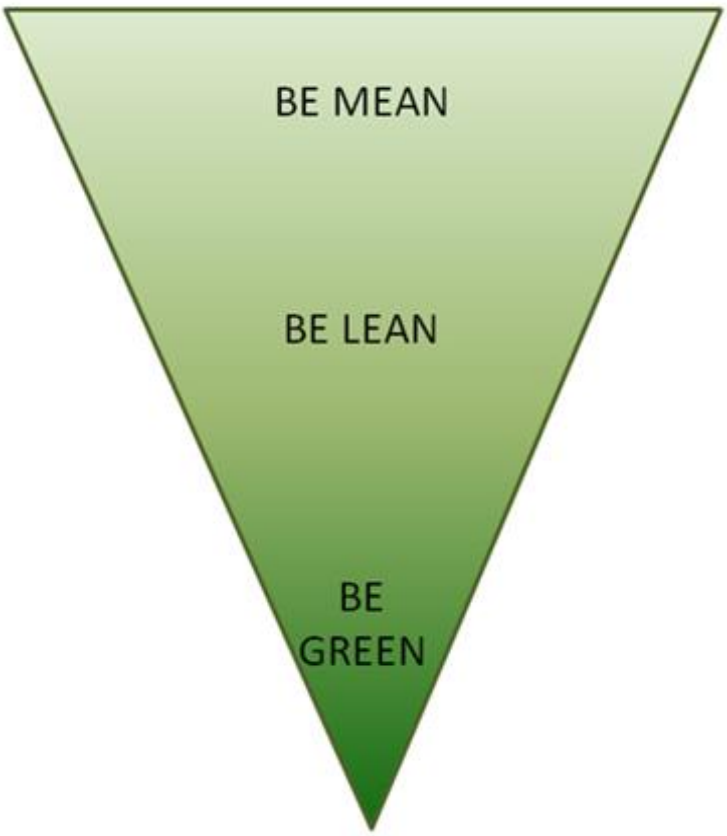

Figure 2 – Energy Hierarchy Plan

6.1. STEP 1 (BE MEAN) – USE LESS RESOURCES

The following measures will be implemented to reduce the energy consumption of the proposed development:

- High performance U-values;
- Air tightness;
- Thermal transmittance;
- Passive design measures.

6.1.1. HIGH PERFORMANCE U-VALUES

To limit the heat loss through the façade, careful consideration must be demonstrated when designing the external façade. The specification of the insulation utilised, and the continuity of insulation are crucial. Insulation slows the rate at which heat is lost to the outdoors. Heat flows in three ways: by conduction, convection and radiation.

The target average elemental U-Values for the new build elements are set out in Table 2 below and demonstrates how the proposed development will comply with Part L (2019) performance requirements. In addition, the currently proposed design is achieving a BER rating of A2/A3 for all apartments in the St. Paul's residential development.

Fabric Element	Part L 2019 (NZEB) Maximum Average Elemental U-value ($W/m^2.K$)	St Paul's Target Elemental U-value ($W/m^2.K$)
External Walls	0.18	0.18
Flat Roof	0.20	0.18
Ground Contact & Exposed Floor	0.18	0.18
External Windows & Doors	1.40	1.40
Air Permeability		
$m^3/hr/m^2@50Pa$	5	3

Table 2 – Building Envelope Thermal Performance Requirements (Apartments)

6.1.2. AIR TIGHTNESS

One major contributing factor to unnecessary heat loss is infiltration. Infiltration is the air leakage of external air into a building due to the pressure difference associated with internal and external temperatures.

Under Part L (2019), a performance level of 5 $m^3/hr/m^2$ @ 50 Pa represents a reasonable upper limit for air permeability.

It is intended the proposed development will target an air permeability rate of 3 $m^3/hr/m^2$ @ 50 Pa.

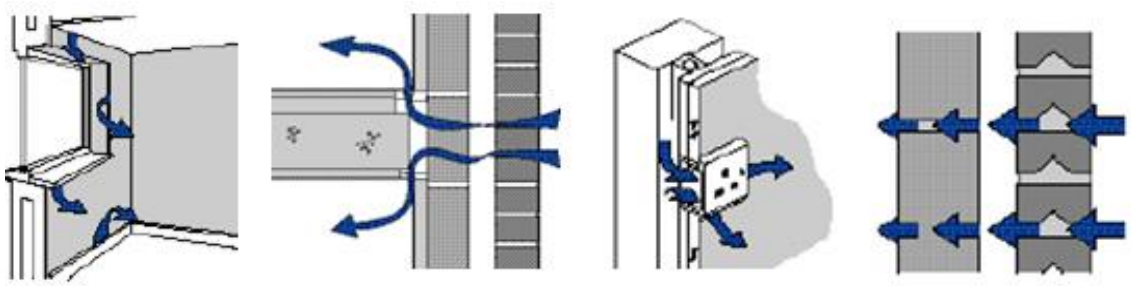

Figure 3 – Typical Air Leakage Paths

6.1.3. THERMAL TRANSMITTANCE

Thermal bridges occur where the insulation layer is penetrated by a material with a relatively high thermal conductivity and at interfaces between building elements where there is a discontinuity in the insulation. The development will be designed to achieve low thermal bridging values where possible. A Y value of ≤0.05 $W/m^2.k$ is being targeted.

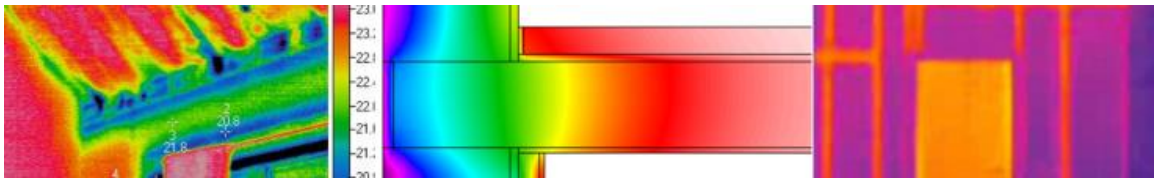

Figure 4 – Typical Thermal Bridging Details

6.1.4. PASSIVE DESIGN

The proposed St. Paul's residential development has been evaluated and analysed with respect to daylight/ sunlight/ overshadowing, in order to determine the following:

- The expected daylight levels within the living and bedroom areas of selected apartments, to give an indication of the expected daylight levels throughout the proposed development.
- The quality of amenity space being provided as part of the development, in relation to sunlight.
- Any potential overshadowing impact the proposed development may have on properties adjacent to the site.

Calculations and methodology used are in accordance with BRE Guidelines for daylight and sunlight and based on the British Research Establishments "Site Layout Planning for Daylight and Sunlight: A Good Practice Guide" by PJ Littlefair, 2011 Second Edition.

6.2. STEP 2 (BE LEAN) – USE RESOURCES EFFICIENTLY

To maximise the effectiveness of changes to the construction, it is important to use the energy sources within the building as efficiently as possible.

6.2.1. LOW ENERGY PLANT

To improve the overall energy efficiency of the heating system, plant is to be selected on the basis of performance and energy efficiency.

Space Heating: Combined Heat and Power (CHP) is being proposed in order to satisfy the space heating requirements for each apartment.

Domestic Hot Water: Combined Heat and Power (CHP) is being proposed in order to satisfy the domestic hot water requirements for each apartment.

Ventilation: The ventilation system is to be Mechanical Ventilation Heat Recovery (MVHR) for all apartments.

6.2.2. LIGHTING

The design intent for internal lighting design is to introduce artificial lighting in all applicable areas. Energy efficient light (LED) fittings will be installed throughout. The design of the building façade also allows high levels of natural daylight into occupied zones.

6.2.3. ONGOING MONITORING AND CONTORLS

A BEMS (Building Energy Management System) system is to be installed to monitor and control the use of all major systems in the apartments, including:

- Space heating;
- Water consumption.

The BEMS system is a graphical interface, which allows the facilities/building manager to monitor and control all systems throughout the building. The development manager can view operational temperatures for the heating systems to ensure that they are operating at maximum efficiency.

6.3. STEP 3 (BE GREEN) – USE OF LOW OR ZERO CARBON (LZC) TECHNOLOGY

CHP (Combined Heat and Power) and solar PV panels are being considered to serve the apartments. The CHP plant will be utilised within a central energy centre in order to supply heat and DHW services to each dwelling throughout the apartment blocks. This method of heating will aid in achieving Part L compliance in terms of the required renewable energy contribution. A solar PV system will also be installed to work in combination with the CHP system to ensure the renewable energy contribution target is achieved.

6.3.1. COMBINED HEAT AND POWER

Combined Heat and Power, or CHP as it is commonly referred to, is the simultaneous generation of usable heat and power in a single process. The system utilises the heat produced in electrical generation rather than releasing it wastefully into the atmosphere. A centralised plantroom will be utilised and will contain the CHP unit, along with all associated pipework and equipment.

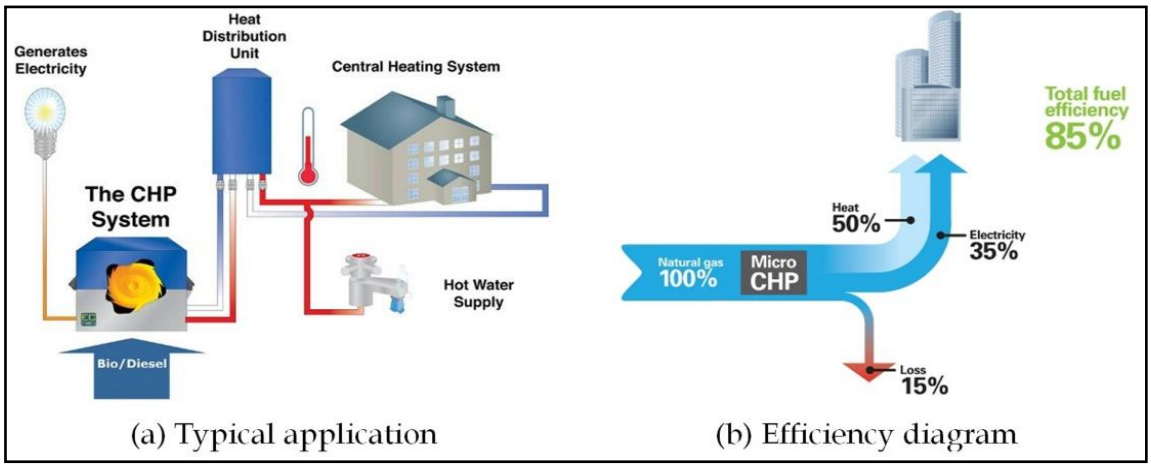

Figure 5 – CHP Benefit Diagram

The CHP unit will be sized to meet the base thermal load and the high efficiency boilers will meet the remaining loads during times of peak demand.

6.3.2. SOLAR PHOTOVOLTAICS

Solar photovoltaic (PV) panels convert solar radiation into electricity, which can be connected to the mains supply of a building. Rooftop solar PV is being considered for incorporation into the design due to the Part L and BER targets currently proposed for the St. Paul's residential development.

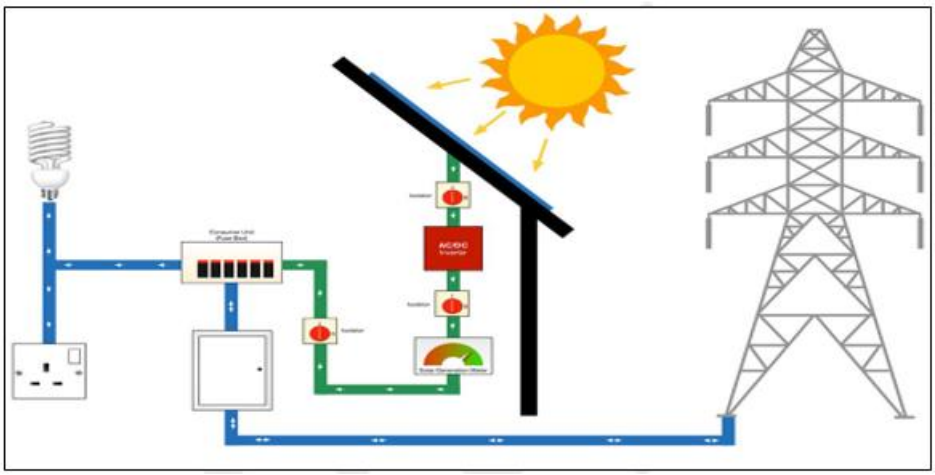

Figure 6 – Solar Photovoltaic System Schematic

7. KEY SUSTAINABLE FEATURES

Key sustainability features of the St Paul's residential development are accessibility to alternative modes of transportation, commissioning of the building's systems, a reduction of waste generation, use of water efficient fixtures and good indoor air quality for the building occupants.

7.1. LOCATION AND TRANSPORTATION

The proposed development will offer occupants travelling to and from the development alternative modes of transport other than the need to rely on a car. Developing in an area that has strong public transport nodes offers users the opportunity to travel to and from the site using alternative modes of transport. As a result, the increased density of the development will result in efficient use of public transportation.

The following figures identify the local Dublin bicycle lanes, bicycle trails, Dublin bus stations, Dublin dart stations and car sharing locations and their proximity to the proposed development. Note, there will be a car-sharing facility located on-site within the development.

Figure 7 – Bicycle Lanes and Trails

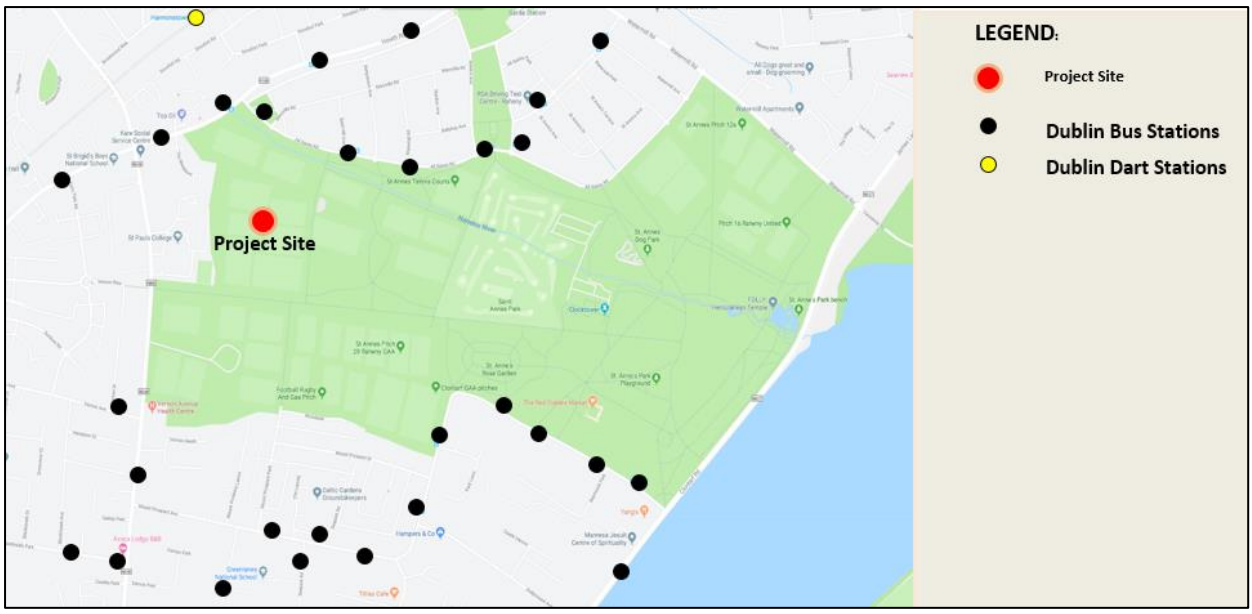

Figure 8 – Dublin Bus and Dart Stations

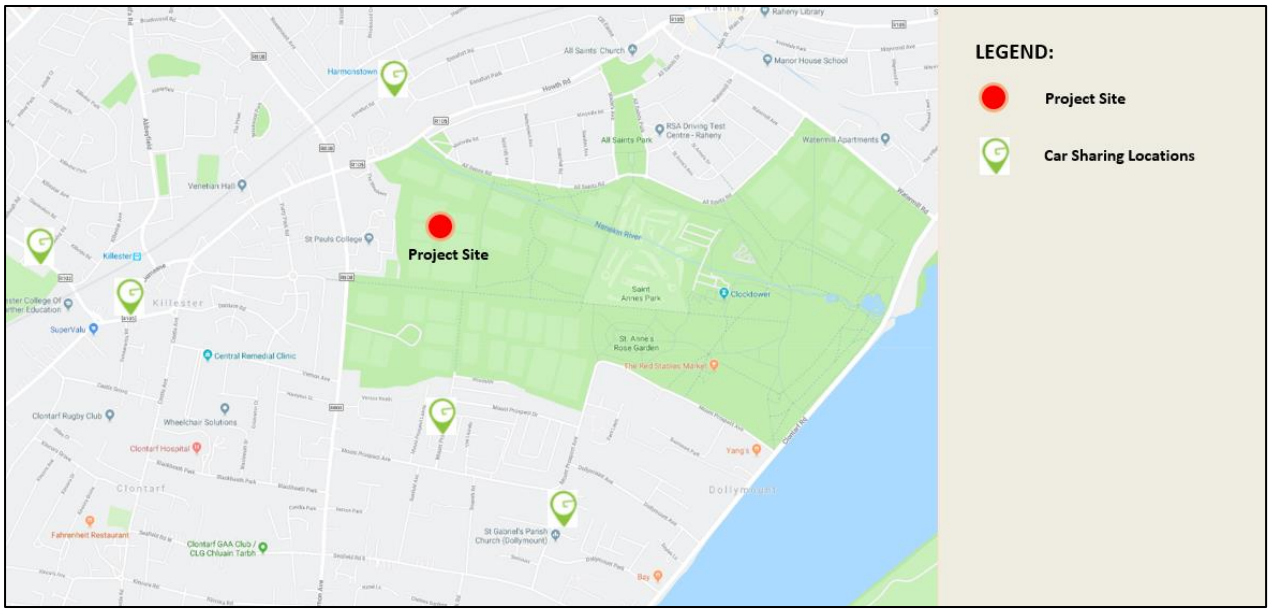

Figure 9 – Car Sharing Locations

7.2. COMMISSIONING

To ensure efficient operation of the building all systems will be commissioned. Commissioning of a building's systems ensures that the sustainable energy-design can be fully realised, with fewer operational issues during the building's lifetime. Building users' productivity improves and operational costs decrease also.

7.3. MATERIALS AND RESOURCES

The building will be designed and operated with the aim to reduce waste generation throughout construction and operation. Where possible, waste streams will be separated on site and recycled or re-used. Where possible local materials will be specified, and in addition materials that contain recycled content will be considered as preferable.

7.4. WATER EFFICIENCY

With increasing costs associated with potable water use in commercial buildings, the proposed development will incorporate measures to reduce water usage through the appropriate selection of low consumption sanitary fittings and water monitoring facilities.

7.5. INDOOR ENVIRONMENTAL QUALITY

As part of the sustainable design strategy, consideration of occupants and staff will be an integral part of the design process. As the productivity and well-being of building users depends strongly on the quality of the indoor environment, the following aspects will be addressed:

- Adequate ventilation and filtration;
- Low-emitting materials; and
- Natural daylight and views to the external environment.

7.6. BICYCLE FACILITIES

Cycling offers a sustainable alternative to personal vehicle use, which reduces gas and particulate emissions, noise pollution and congestion in busy urban areas. The proposed development will provide 1314 bicycle parking spaces for the building occupants.

8. CONCLUSION

A sustainable approach has been adopted by the design team for the St Paul's residential development. Through detailed design, a number of sustainability and efficiency features have been considered throughout.
The proposed development will comply with Part L (2019), as well as targeting an A2/A3 BER.

The optimised approach is based on the Energy Hierarchy Plan - Be Mean, Be Lean, Be Green.

Be Mean

- The façade performance specification has been optimised to limit heat loss, improve air tightness and thermal transmittance and to maximise natural daylight.

Be Lean

- High efficiency plant will be specified to take advantage of the optimised façade design measures that have been introduced.
- A low energy lighting design will be utilised to further reduce energy consumption and increase occupant thermal comfort.

Be Green

- The apartments will utilise CHP plant in order to supply heating and DHW to each apartment within the development. Solar PV panels are also being proposed within the development. This will also help ensure the renewable energy contribution target is achieved.

A number of sustainable design features have been considered within the design to achieve the sustainability targets of the proposed refurbishment. These include:

- The proximity of the development to public transportation networks;
- Water efficiency measures such as low consumption sanitary fittings; and
- Improved indoor environmental quality.

This report confirms that if the energy and sustainability strategy is successfully implemented, the proposed St. Paul's residential development will satisfy all Part L and BER requirements.

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