Energy & Sustainability Report

Newlands Farm Re-Development

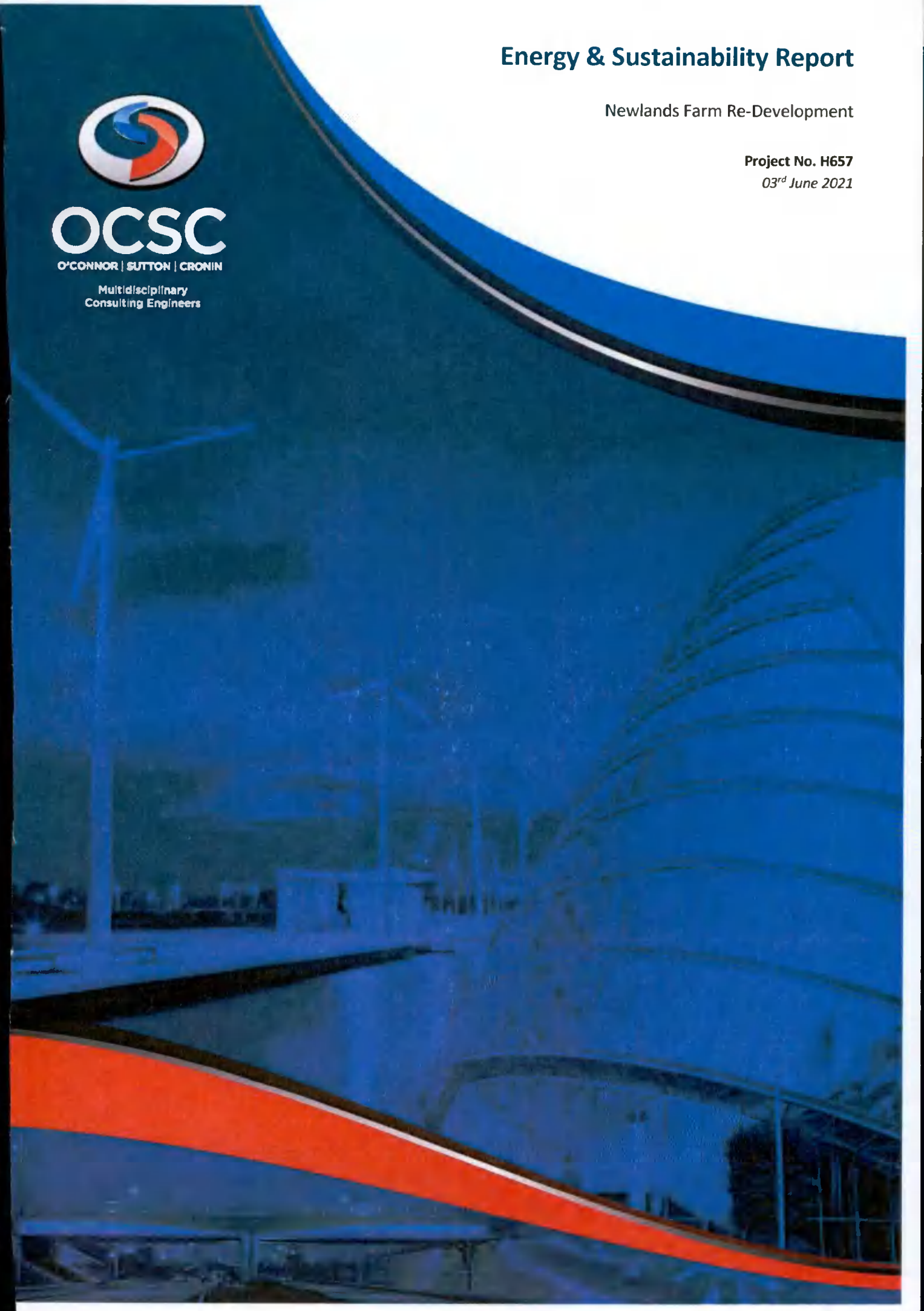
Project No. H657

03rd June 2021

OCSC

O'CONNOR | SUTTON | CRONIN

Multidisciplinary
Consulting Engineers



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NOTICE

DOCUMENT CONTROL & HISTORY

OCSC Job No.: H657	Project Code	Originator Code	Zone Code	Level Code	File Type	Role Type	Number Series	Status/ Suitability Code	Revision
	H657	OCSC	XX	XX	RP	YS	0001	S4	P01

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EXECUTIVE SUMMARY

This document provides an overview of how the project intends to integrate sustainability as a key strategy into the building's redesign. The report focuses on the performance targets required by the Building Regulations Part L – Conservation of Fuel and Energy (Section 2) and what energy measures are needed to ensure compliance is achieved.

The following document sets out the energy design approach that requires the design to initially focus on an energy demand reduction. This will primarily be through passive strategies such an energy efficient envelope which in turn reduces the demand relating to items such as HVAC and renewable energy systems. This initial approach in reducing the energy demand significantly aids the project in obtaining the desired energy goals while reducing running costs. Performance criteria relating to the development's building envelope are set out within the document.

As the re-development is renovating an existing structure, Part L (2017) Section 2 (Existing Buildings Other Than Dwellings) is the main guidance document available for reference. Although certain new build elements are to be constructed, there is a degree of flexibility in the design of these new build elements, as these can be categorised as an extension to an existing building – which is also a protected structure.

The energy systems design must also focus on specifying energy efficient equipment to ensure the day to day running of the energy systems are optimised to further enhance energy savings and the related energy cost. Specifications relating to efficient heating, cooling, lighting and auxiliary equipment are also set out in this document.

This report confirms that if the energy and sustainability strategy is successfully implemented, the proposed Newlands Farm Re-Development will achieve all energy and sustainability targets.

ENERGY & SUSTAINABILITY REPORT

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1. INTRODUCTION

The purpose of this report is to identify the energy efficiency measures associated with the design, construction, ongoing management and maintenance of the proposed Newlands Farm Re-Development, located in Tallaght, Dublin 24.

The proposed development will comply with Part L 2017 (Section 2 – Existing Buildings) and also Part L 2017 (NZEB) for new build elements.
The expected BER rating can only be confirmed once system strategies and additional design intent values are confirmed.

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 stages.

Energy Performance Targets		
Standard / Rating	**Mandatory**	**Target**
Part L Non-residential	Yes	2017 (Section 1 & Section 2)
BER Non-residential	Yes	Cost Optimal Level

Table 1: Energy Performance Targets

The following sections identify a range of energy efficient measures that have been considered for the proposed Newlands Farm Re-Development.

2. PROPOSED DEVELOPMENT

The refurbishment of Katharine Tynan House or 'Whitehall', a protected structure (RPS ref. 197) includes the change of use from disused dwelling to community centre. Works will entail refurbishment of the roof and external walls, reinstatement of windows and external doors, ceilings and floors, reinstatement of a conservatory and glazed porch (10m² and 5m² respectively), new internal stairs and doors, new services and sanitary accommodation; two new single-storey open-fronted structures on part of the footprint of earlier outbuildings with an enclosed area for toilets (534m²); refurbishment of historic garden walls and gates; upgrading of the existing non-historic entrance and approach from the Ballymount Road; and provision for parking on site.

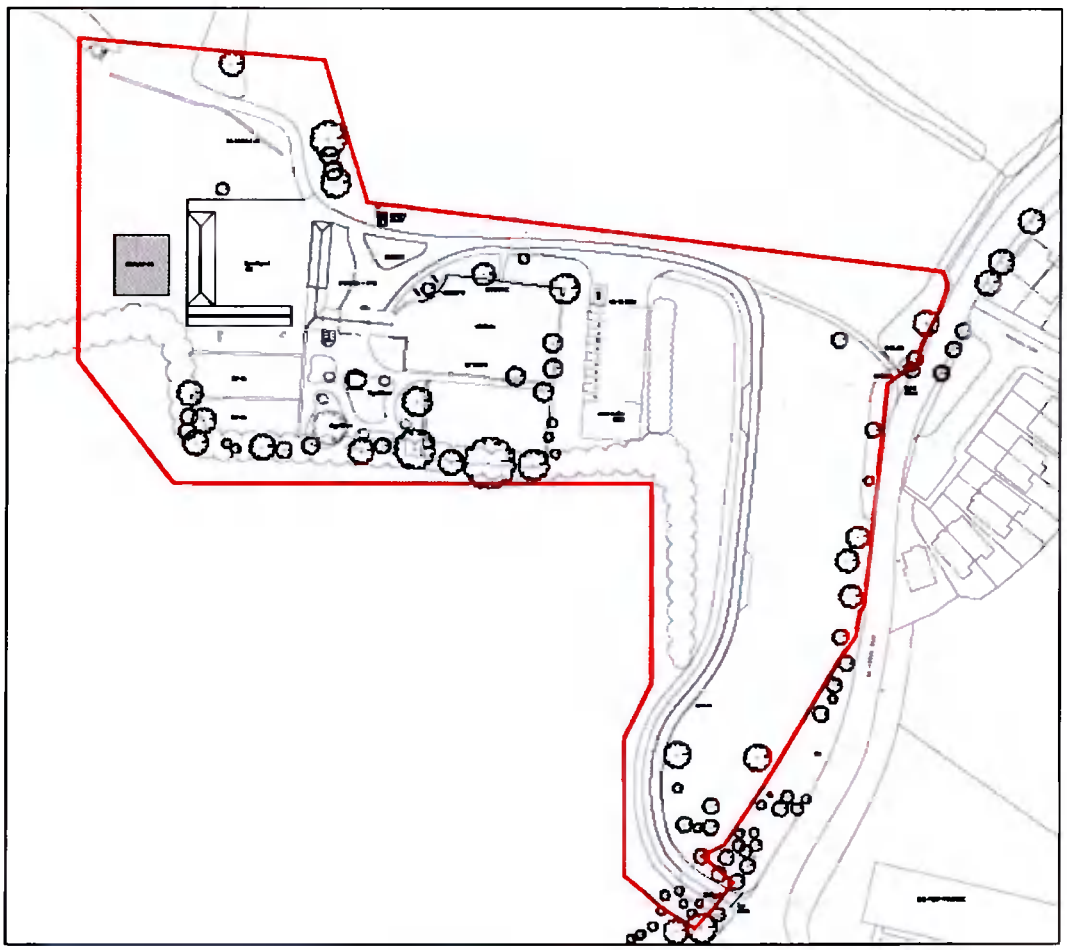


Figure 1: Proposed Site Plan

3. PART L CONSERVATION OF FUEL & ENERGY - BUILDINGS OTHER THAN DWELLINGS

3.1. PART L 2017 (SECTION 2)

For existing buildings other than dwellings, the Part L 2017 (NZEB) requirements shall be met by:

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

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

c) 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;

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

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

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

g) providing to the building owner or occupants sufficient information about the building fabric, the fixed building services, controls and their maintenance requirements when replaced so that the building can be operated in such a manner as to use no more fuel and energy than is reasonable;

h) when a building undergoes major renovation, the minimum energy performance requirement of the building or the renovated part thereof is upgraded in order to meet the cost optimal level of energy performance in so far as this is technically, functionally and economically feasible.

Although the re-development of Katharine Tynan House is technically exempt from achieving Part L compliance, due to the protected status of the building, the re-development will strive to meet the minimum requirements outlined in Part L 2017 (Section 2), wherever achievable.

4. PART F - VENTILATION

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 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.*

The proposed re-development will be designed to achieve compliance with Part F of the building regulations.

5. BUILDING ENERGY RATING (BER)

As of 1st July 2009, all newly built domestic and non-domestic buildings and existing buildings that are for sale or rent require a BER (Building Energy Rating) certificate.

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 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); and
- Lighting systems (how efficient is the lighting).

The areas 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.

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.

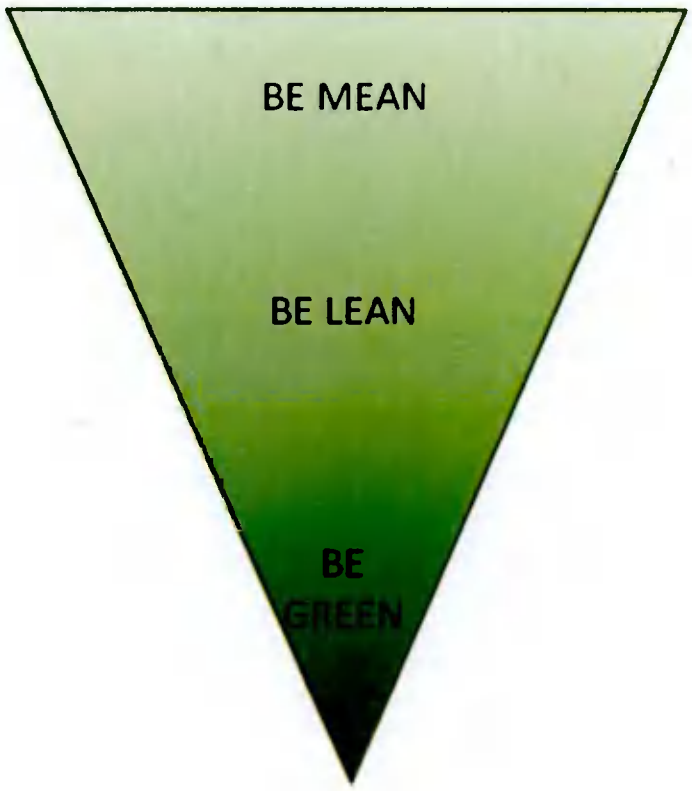


Figure 2: Energy Hierarchy Plan

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

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

- High performance U-values, wherever achievable;
- Improved air tightness rates; and
- Improved thermal transmittance and limiting unnecessary thermal bridging.

6.1.1. HIGH PERFORMANCE U-VALUES

To limit the heat loss through the façade, careful consideration must be shown when designing/ renovating 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 targeted maximum average elemental U-Values for the non-residential aspects of the proposed re-development are outlined in Table 2 and Table 3 below.

Fabric Element	Newlands Farm Maximum Average Elemental U-value ($W/m^2.K$)
External Walls	0.35
Flat Roof	0.25
Pitched Roof (Insulation at Ceiling)	0.16
Pitched Roof (Insulation on Slope)	0.25
Ground Contact & Exposed Floor	0.45 (0.15 if underfloor heating installed)
External Windows & Doors	1.40

Table 2: Façade Envelope Thermal Performance Targets (Renovated Elements)

Fabric Element	Newlands Farm Maximum Average Elemental U-value ($W/m^2.K$)
External Walls	0.21
Flat Roof	0.20
Pitched Roof	0.16
Ground Contact & Exposed Floor	0.21 (0.15 if underfloor heating installed)
External Windows & Doors	1.40

Table 3: Façade Envelope Thermal Performance Targets (New Build Elements)

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.

New Build Elements

It is intended that the new aspects of the re-development will both target an air permeability rate of **5** $m^3/hr/m^2$ @ 50 Pa.

Existing Elements

Every effort will be made to improve the air tightness of the existing building elements where possible.

Figure 3 – Air Tightness Testing

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.

New Build Elements

The new aspects of the re-development will be designed to achieve low thermal bridging values throughout. Thermal Bridging targets to comply with all Part L 2017 (NZEB) requirements.

Existing Elements

Where any element of the existing building shows a risk of thermal bridging, every effort will be made to reduce the risk.

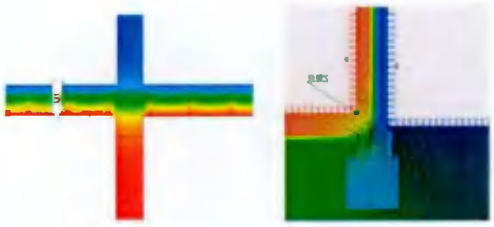


Figure 4 – Thermal Bridge Assessment

6.1.4. OVERHEATING ANALYSIS

Due to factors such as climate change, population increase and construction of high-rise buildings there has been an increase in high internal temperatures. Overheating of buildings can be extremely uncomfortable for the occupant and can ultimately lead to costly mitigation measures.

The proposed Newlands Farm re-development will be evaluated and analysed with respect to overheating as outlined in Part L 2017 (NZEB) and CIBSE TM52 (Limits of Thermal Comfort: Avoiding Overheating in European Buildings).

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 - NON-RESIDENTIAL

To improve the overall energy efficiency of the development, plant is to be selected based on performance and energy efficiency.

Space Heating: The plant options for space heating are:

- High Efficiency Condensing Gas Boilers, or
- Air Source Heat Pumps (ASHP), or
- Variable Refrigerant Flow (VRF) Heat Pumps.

Domestic Hot Water: The plant options for domestic hot water are:

- High Efficiency Condensing Gas Boilers, or
- Air Source Heat Pumps (ASHP), or
- Electric Point of Use Heaters.

Space Cooling: The plant options for space cooling are:

- Natural ventilation where possible, and/or
- Variable Refrigerant Flow (VRF) Heat Pumps, or
- Air Source Heat Pumps (ASHP).

Ventilation: The proposed ventilation strategy for the building will be natural ventilation where possible and/or mechanical ventilation. The mechanical ventilation system will be a high efficiency, variable speed drive system that also incorporates heat recovery.

Variable Speed Drives (VSDs): Variable speed drive motors are to be fitted to all fans and pumps servicing all HVAC systems. Standard fans and pumps operate at a constant speed to meet maximum demand even though only half the building may be occupied. VSDs have the ability to ramp up or down depending on the load requirements, making this the most efficient auxiliary system to install.

6.2.2. LIGHTING

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

6.2.3. ONGOING MONITORING

A BEMS (Building Energy Management System) system may be installed to monitor the use of all major systems in the building. The BEMS system is a graphical interface that allows the facilities/building manager to monitor and control all systems throughout the building.

6.3. STEP 3 (BE GREEN) – USE OF RENEWABLE TECHNOLOGIES

The following renewable technologies are being considered for implementation in the Newlands Farm re-development.

6.3.1. AIR SOURCE HEAT PUMP

Air source heat pumps convert energy from the air to provide heat and hot water for buildings. They are powered by electricity and are highly efficient. The air source heat pump is located outside in the open air and it uses a fan to draw air across it. This air then flows over a heat exchanger, which contains a refrigerant liquid. An evaporator uses the latent heat from the air to heat the refrigerant sufficiently until it boils and turns to a gas. This gas is then compressed which causes a significant rise in temperature. An additional heat exchanger removes the heat from the refrigerant which can then be used as useful heat within the building.

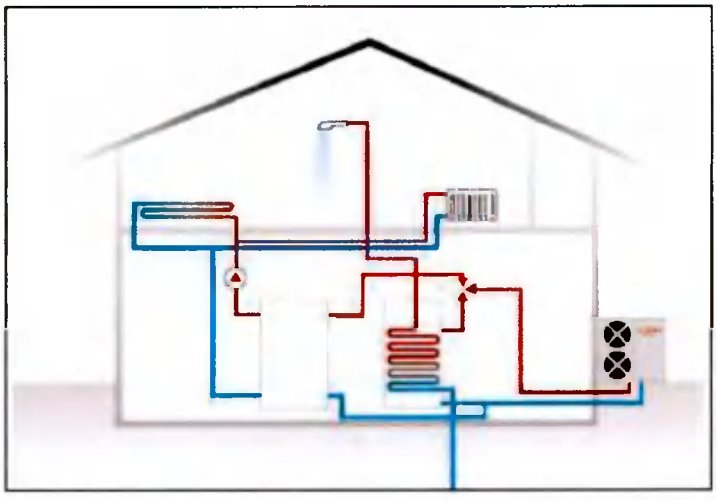


Figure 5: Air-Source Heat Pump Diagram

6.3.2. SOLAR PHOTOVOLTAICS

Photovoltaic (PV) Panels convert the solar radiation into electricity, which can be connected to the mains supply of a building. The panels are placed on the roof and are most efficient with an incline angle of 30°. Panels are typically arranged in arrays on building roofs, with the produced electricity fed either directly into the landlord's supply.

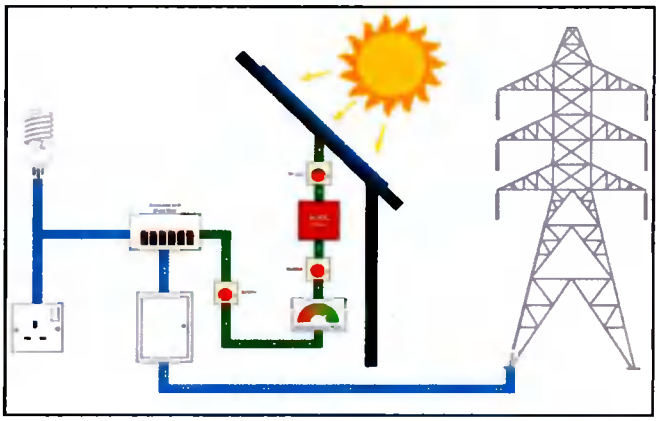


Figure 6: Solar PV Diagram

6.3.3. VRF HEAT PUMPS

Variable Refrigerant Flow systems utilise heat pumps in order to provide space heating as well as space cooling. These systems are capable of serving multiple zones with different heating and cooling requirements and they can modulate their output according to zone requirements, increasing system efficiencies and reducing the energy demand of these systems.

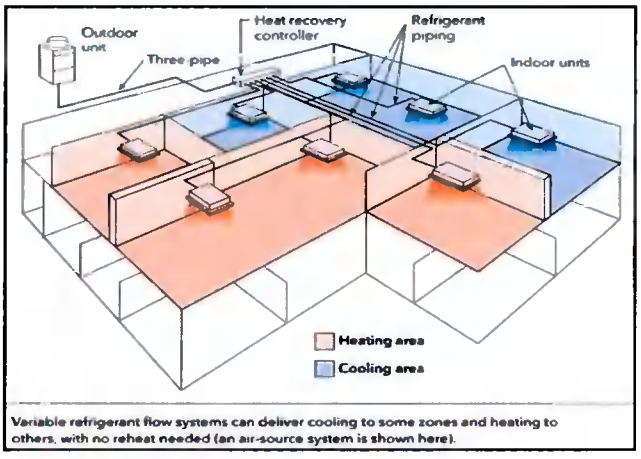


Figure 7: Typical VRF Schematic Diagram

7. CONCLUSION

A holistic sustainable approach been adopted by the design team for the proposed Newlands Farm re-development located in Tallaght, Dublin 24. Through detailed design, a number of sustainability and efficiency features have been considered throughout.

The proposed re-development will comply with Part L 2017 (Section 2). 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.

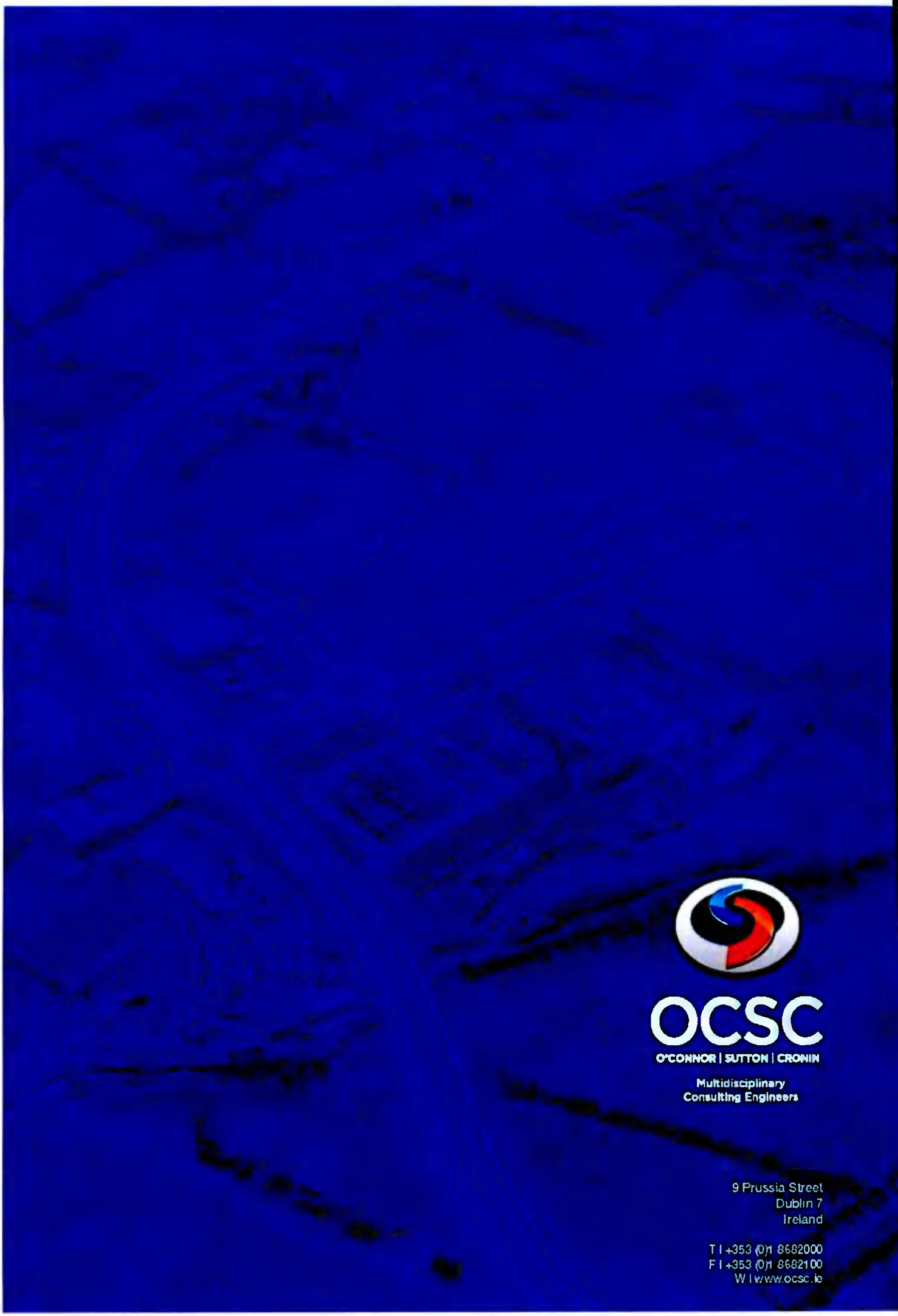
Be Lean

- High efficiency central plant will be specified where applicable 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

- Renewable energy technologies such as Air Source Heat Pumps, Solar PV and VRF Heat Pumps will be considered for implementation.

This report confirms that if the energy and sustainability strategy is successfully implemented, the proposed Newlands Farm re-development will satisfy all required Part L and BER requirements, as much as is technically, functionally and economically feasible.



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