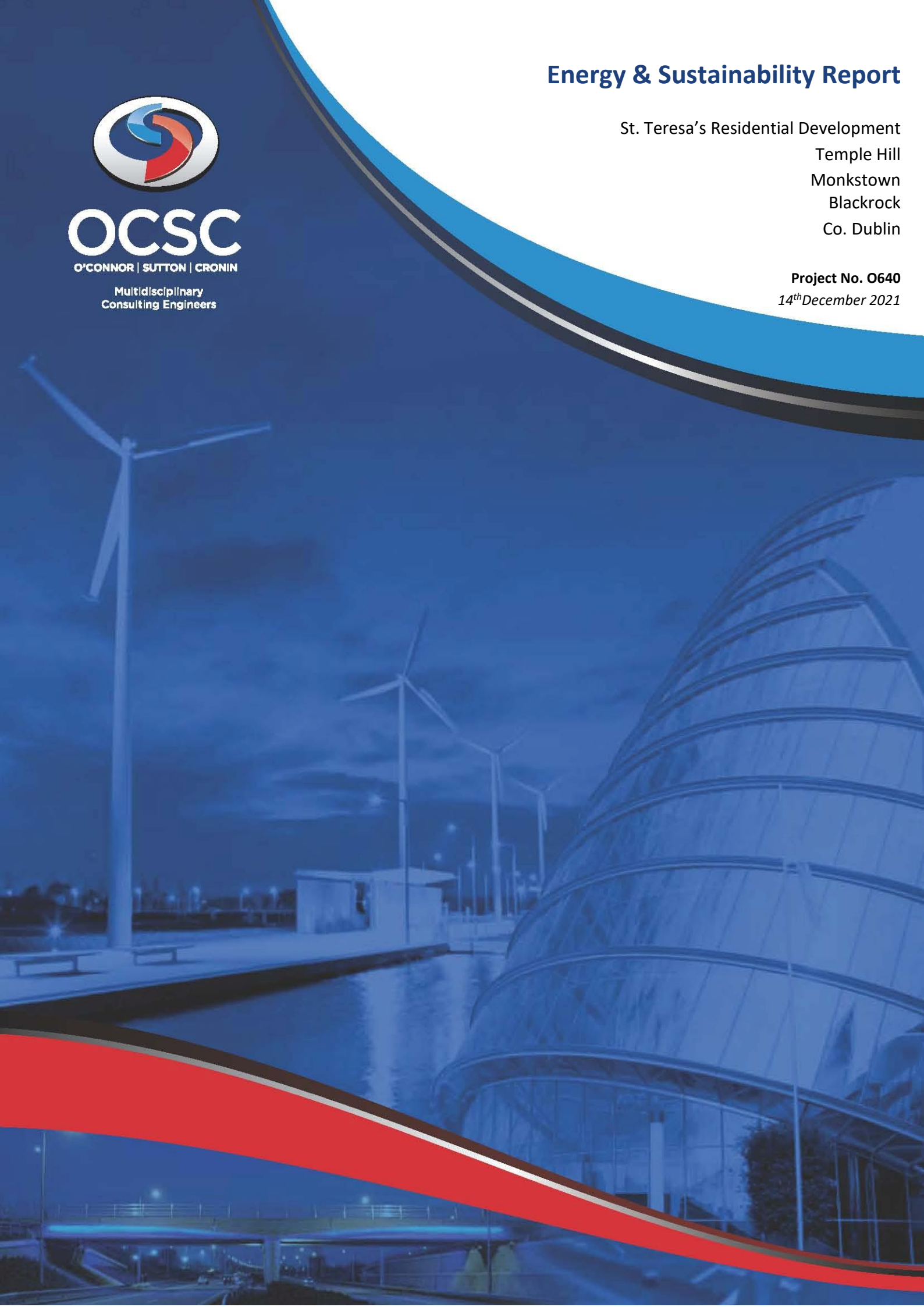


Energy & Sustainability Report

St. Teresa's Residential Development
Temple Hill
Monkstown
Blackrock
Co. Dublin

Project No. O640
14th December 2021



Energy & Sustainability Report



NOTICE

This document has been produced by O'Connor Sutton Cronin & Associates for its Client. It may not be used for any purpose other than that specified by any other person without the written permission of the authors.

DOCUMENT CONTROL & HISTORY

OCSC Job No.: O640		Project Code	Originator Code	Zone Code	Level Code	File Type	Role Type	Number Series	Status/ Suitability Code	Revision
		O640	OCSC	XX	XX	RP	YS	0001	S4	P09
Rev.	Status	Authors		Checked		Authorised		Issue Date		
9	For Planning	AT		MT		MT		14/12/2021		
8	For Planning	AT		MT		MT		19/10/2021		
7	For Planning	JS		DO'C		DO'C		11/03/2021		
6	For Comment	JS		DO'C		DO'C		10/03/2021		
5	For Comment	JS		DO'C		DO'C		05/03/2021		
4	For Comment	JS		DO'C		DO'C		19/02/2021		
3	For Planning Pre-App	JS		DO'C		DO'C		16/11/2020		
2	Draft for Planning	MT		DO'C		RB		21/01/2019		
1	Draft for Planning	MT		DO'C		RB		11/09/2018		
0	For Comment	EMcP		DO'C		RB		24/04/2018		

EXECUTIVE SUMMARY

This document provides an overview of how the project intends to integrate sustainability as a key strategy into the development's design. The report focuses on the performance targets required by the Building Regulations Part L – Conservation of Fuel and Energy and what energy measures are needed to ensure compliance. Furthermore, a Building Energy Rating (BER) of A2/A3 has been targeted throughout.

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 as an energy efficient envelope which in turn reduces the demands 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 this document.

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 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 St. Teresa's Residential Development will achieve all energy and sustainability targets.

ENERGY & SUSTAINABILITY REPORT

INDEX	PAGE
EXECUTIVE SUMMARY	4
1. INTRODUCTION	6
2. PROPOSED DEVELOPMENT	7
3. DUN LAOGHAIRE/RATHDOWN DEVELOPMENT PLAN 2016-2022.....	11
4. PART L CONSERVATION OF FUEL & ENERGY – DWELLINGS	13
5. PART L CONSERVATION OF FUEL & ENERGY - BUILDINGS OTHER THAN DWELLINGS	14
6. PART F VENTILATION	18
7. BUILDING ENERGY RATING (BER).....	19
8. THE ENERGY HIERARCHY PLAN	20
9. KEY SUSTAINABLE FEATURES.....	31
10. CONCLUSION	35

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 St. Teresa's Residential Development located at Temple Hill, Monkstown, Blackrock, Co. Dublin.

The proposed residential aspects of the development will comply with Part L 2021 (Dwellings), and Part L 2021 (Buildings Other Than Dwellings) for non-residential areas. As part of the development's efforts to further reduce energy consumption, the project is targeting a minimum A3 BER (Building Energy Rating) across the development.

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 Residential	Yes	2021 (Dwellings)
Part L Non-residential	Yes	2021 (Buildings Other Than Dwellings)
BER Residential (New)	Yes	A2/A3
BER Non-residential (New)	Yes	A3
BER Residential (Existing)	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 St. Teresa's Residential Development.

2. PROPOSED DEVELOPMENT

The development will consist of a new residential and mixed use scheme of 493 residential units and associated residential amenities, a childcare facility and café in the form of (a) a combination of new apartment buildings (A1-C2 and D1 – E2); (b) the subdivision, conversion and re-use of 'St. Teresa's House' (Block H); and (c) the dismantling, relocation and change of use from residential to café of 'St. Teresa's Lodge' (Block G) within the site development area. A detailed development description is now set out as follows:

The proposal provides for the demolition (total c. 207 sq m GFA) of (a) a single storey return (approx. 20 sq m) along the boundary with The Alzheimer's Society of Ireland; (b) the ground floor switch room (approx. 24.9sq.m.), (c) ground floor structures northwest of St. Teresa's House (26.8sq.m), (d) basement boiler room northwest of St. Teresa's House (17.0 sq.m), (e) ground floor structures northeast of St. Teresa's house (22.0sq.m.) (f) basement stores northeast of St. Teresa's house (67.8 sq.m.) and (g) a non - original ground floor rear extension (approx. 28.5 sq m) associated with the Gate Lodge.

- The new development will provide for the construction of a new mixed-use scheme of 487 no. apartment units in the form of 11 no. new residential development blocks (Blocks A1-C2 and D1 – E2) as follows:
- Block A1 (5 storeys) comprising 37 no. apartments (33 no. 1 bed units and 4 no. 2 bed units)
- Block B1 (10 storeys) comprising 55 no. apartments (37 no. 1 bed units, 10 no. 2 bed units, 8 no. 3 bed units)
- Block B2 (8 storeys) comprising 42 no. apartments (28 no. 1 bed units, 9 no. 2 bed units and 5 no. 3 bed units)
- Block B3 (8 storeys) comprising 42 no. apartments (28 no. 1 bed units, 9 no. 2 bed units and 5 no. 3 bed units)
- Block B4 (5 storeys) comprising 41 no. apartments (4 no. studio units, 4 no. 1 bed units, 27 no. 2 bed units and 6 no. 3 bed units)
- Block C1 (3 storeys) comprising 10 no. apartments (1 no. studio units, 3 no. 1 bed units and 6 no. 2 beds)
- Block C2 (3 storeys) comprising 6 no. apartments (2 no. 1 bed units and 4 no. 2 bed units) together with a creche facility of 392 sq m at ground floor level and outdoor play area space of 302 sq m.

- Block C3 (1 storey over basement level) comprising residential amenity space of 451 sq m.
- Block D1 (6 storeys) comprising 134 no. apartments (12 no. studio units, 22 no. 1 bed units, 90 no. 2 bed units and 10 no. 3 bed units).
- Block E1 (6 storeys) comprising 70 no. apartment units (34 no. 1 bed units, 26 no. 2 bed units and 10 no. 3 bed units).
- Block E2 (6 storeys) comprising 50 units (1 no. studio units, 29 no. 1 bed units, 18 no. 2 bed units and 2 no. 3 bed units).

Each new residential unit has associated private open space in the form of a terrace / balcony.

The development also provides for Block H, which relates to the subdivision and conversion of 'St. Teresa's House' (3 storeys) into 6 no. apartments (5 no. 2 bed units and 1 no. 3 bed unit) including the demolition of non-original additions and partitions, removal and relocation of existing doors, re-instatement of blocked up windows, replacement of windows, repair, and refurbishment of joinery throughout and the upgrade of roof finishes and rainwater goods where appropriate.

It is also proposed to dismantle and relocate 'St. Teresa's Lodge' (1 storey) from its current location to a new location, 180 m south west within the development adjacent to Rockfield Park. St. Teresa's Lodge (Block G) will be deconstructed in its original location and reconstructed in a new location using original roof timbers, decorative elements, and rubble stonework, with original brickwork cleaned and re-used where appropriate.

It is also proposed to dismantle and relocate 'St. Teresa's Lodge' (1 storey - gross floor area 69.63sq m) from its current location to a new location, 180 m south west within the development adjacent to Rockfield Park. St. Teresa's Lodge (Block G) will be deconstructed in its original location and reconstructed in a new location using original roof timbers, decorative elements, and rubble stonework, with original brickwork cleaned and re-used where appropriate. A non - original extension (approx. 28.5 sq m) is proposed for demolition. The current proposal seeks a new extension of this building (approx. 26.8 sq m) and a change of use from residential to café use to deliver a Part M compliant single storey building of approx. 67.4 sq m

Total Open space (approx. 15,099.7 sq m) is proposed as follows: (a) public open space (approx. 11,572.3 sq m) in the form of a central parkland, garden link, woodland parkland (incorporating an existing folly), a tree belt; and (b) residential communal open space (approx. 3,527.4 sq m) in the form of entrance gardens, plazas, terraces, gardens and roof terraces for Blocks B2 and B3. Provision is also

made for new pedestrian connections to Rockfield Park on the southern site boundary and Temple Hill along the northern site boundary.

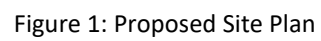
Basement areas are proposed below Blocks A1, B1 to B4 and D1 (c. 7,295 sq. m GFA). A total of 252 residential car parking spaces (161 at basement level and 91 at surface level); 1056 bicycle spaces (656 at basement level and 400 at surface level); and 20 motorcycle spaces at basement level are proposed. 8 no. car spaces for creche use are proposed at surface level.

The proposal also provides for further Bin Storage areas, Bike Storage areas, ESB substations and switch rooms with a combined floor area of 356.2 sq m at surface level.

The development also comprises works to the existing entrance to St. Teresa's; the adjoining property at 'Carmond'; and residential development at St. Vincent's Park from Temple Hill (N31/R113). Works include the realignment and upgrade of the existing signalised junction and associated footpaths to provide for improved and safer vehicular access/egress to the site and improved and safer access/egress for vehicular traffic to/from the property at 'Carmond' and the adjoining residential development at St Vincent's Park.

Emergency vehicular access and pedestrian/cyclist access is also proposed via a secondary long established existing access point along Temple Hill. There are no works proposed to the existing gates (Protected Structure) at this location.

The associated site and infrastructural works include provision for water services; foul and surface water drainage and connections; attenuation proposals; permeable paving; all landscaping works including tree protection; green roofs; boundary treatment; internal roads and footpaths; and electrical services including solar panels at roof level above Blocks A1, B1 - B4, C1-C3, D1, E1, E2.



3. DUN LAOGHAIRE/RATHDOWN DEVELOPMENT PLAN 2016-2022

The Dun Laoghaire / Rathdown County Development Plan 2016-2022 sets out the impact of climate change and how to deal with the problem in the future.

"In line with global trends, Ireland's climate is changing and the scientific consensus is that more changes are inevitable. The changes are directly related to man-made greenhouse gas emissions. There is also an economic consensus that the cost of inaction will greatly outweigh the cost of action, and that progressive Climate Change policies, based on innovation and investment in low-carbon technology, are consistent with global economic growth".

A number of important policies related to energy efficient design are outlined within the plan which are addressed as follows:

3.1. POLICY CC7: ENERGY PERFORMANCE IN NEW BUILDINGS

"It is Council policy that all new buildings will be required to meet the passive house standard or equivalent, where reasonably practicable. By equivalent we mean approaches supported by robust evidence (such as monitoring studies) to demonstrate their efficacy, with particular regard to indoor air quality, energy performance, comfort, and the prevention of surface/interstitial condensation. Buildings specifically exempted from BER ratings as set out in S.I. No 666 of 2006 are also exempted from the requirements of CC7. These requirements are in addition to the statutory requirement to comply fully with Parts A-M of Building Regulations".

The proposed St. Teresa's Residential Development., Co. Dublin will comply with this policy through the following:

- Minimise heat loss through the building fabric by utilising a high-performance thermal envelope;
- Install high efficiency heating systems in order to reduce running costs while also being considerate to the environment through harmful emission reductions;
- Utilise a high efficiency ventilation system to supply clean, fresh air into each dwelling;
- Offset the energy consumption of the development through the use of renewable energy sources such as heat pumps and solar PV panels.

3.2. POLICY CC8: EXCELLENCE IN THE BUILT ENVIRONMENT

"It is Council policy to lead by example by developing a strategy for effective climate protection within its building stock. In compliance with EU Energy Efficiency Directives of 2014, the Council will develop a strategy to promote the exemplary role of the public sector in demonstrating excellence within the built environment".

The proposed St. Teresa's development, Co. Dublin will comply with this policy through the following:

- The implementation of renewable energy systems to meet the heating and domestic hot water demands for the development in a sustainable manner;
- The use of a high-performance thermal envelope to reduce unnecessary heat loss.

These systems will aid in the development in achieving compliance with Part L NZEB legislation while also keeping in line with all policies laid out in the DLR County Plan 2016-2022.

3.3. POLICY CC9: SUSTAINABILITY IN ADAPTABLE DESIGN

"It is Council policy to promote sustainable approaches to the improvement of standards for habitable accommodation, by allowing dwellings to be flexible, accessible and adaptable in their spatial layout and design. It is important that the design of individual buildings facilitate a good quality of life for residents and secures long-term sustainability of the overall development".

The proposed development will comply with this policy through the following:

- The proposed development will facilitate a good quality of life for all occupants and also ensure this carries through to any future occupants in the development using excellent construction methods;
- The proposed site is within close proximity of Luas and Dublin bus stops, cycle networks and green spaces as well as main routes into the City centre. This allows for greater opportunities for the building occupants to utilise sustainable modes of transport;
- Adaptability of design is integrated from early design stages.

4. PART L CONSERVATION OF FUEL & ENERGY – DWELLINGS

4.1. PART L 2021 (DWELLINGS)

Part L 2021 (Dwellings) of the Technical Guidance Document has been issued by the Minister for Housing, Local Government and Heritage. This document is the new standard for dwellings constructed from 27th July 2021.

The Part L 2021 (Dwellings) 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”.

For the Part L 2021 (Dwellings) requirements, a Renewable Energy Ratio (RER) has replaced the Part L 2011 renewable requirements. A RER of 20% (ratio of total primary energy generated from renewable energy resources to total primary energy consumption) is required to achieve compliance.

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;
- Solar Thermal System;
- CHP Units (Combined Heat & Power);
- Heat Pumps (Minimum COP of 2.5).

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

5.1. PART L 2021 (BUILDINGS OTHER THAN DWELLINGS)

The Part L 2021 (Buildings Other Than Dwellings) building regulations is the new standard for all buildings other than dwellings constructed after 27th July 2021. The Part L 2021 (Buildings Other Than Dwellings) 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 significant extent by energy from renewable sources, including energy from renewable sources produced on-site or nearby”.

For new buildings other than dwellings, the Part L 2021 (Buildings Other Than Dwellings) ‘L1’ requirements 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 (CO₂) 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 (1.0 for EPC and 1.15 for CPC);
- 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;
- i) providing to the building owner or occupants 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.

However, Part L (2021) – Buildings Other Than Dwellings now has additional requirements relating to self-regulating devices and electric vehicle charging.

For both new and existing buildings other than dwellings, the Part L 2021 (Buildings Other Than Dwellings) 'Regulation 5' requirements shall be met by:

- 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;
- b) Where a heat generator is being replaced in an existing building, where technically and economically feasible, self-regulating devices shall also be installed;
- e) A building which has more than 10 car parking spaces, that is:
 - i. New, or
 - ii. Subject to subparagraph (g), undergoing major renovation,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.
- g) The requirements of subparagraph (e) shall apply to a building undergoing major renovation where:
 - i. In a case where the car park is located inside the building, the renovation concerned include the car park or the electrical infrastructure of the building; or
 - ii. In a case where the car park is physically adjacent to the building, the renovations concerned include the car park or the electrical infrastructure of the car park.

Renewable Energy Ratio (RER):

This is the most significant change introduced as part of the Part L 2021 (Buildings Other Than Dwellings) regulations for non-residential buildings. Some of the main performance requirements are as follows:

- The new regulations will require a significant level of energy provision be provided onsite or nearby by renewable energy technologies, e.g. solar energy (thermal and photovoltaic), air and exhaust air source heat pumps, combined heat and power, biomass boiler, etc.;
- The current NZEB definition does not allow the renewable requirement to be met though the purchase of off-site green electricity;
- There are two routes in achieving compliance with the renewable target:
 - Route 1 = If the Part L compliance is achieved with no tolerance (0% margin), 20% of the building's energy use must be provided by onsite / near site renewable technologies;
 - Route 2 = If the Part L compliance is achieved with a minimum of 10% margin, then 10% of the building's energy use must be provided by onsite / near site renewable technologies. To achieve the 10% margin, the building envelope, lighting and M&E specification will likely have to be improved above minimum requirements.

For existing buildings other than dwellings, the Part L 2021 (Buildings Other Than Dwellings) 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.

However, Part L (2021) – Buildings Other Than Dwellings now has additional requirements relating to self-regulating devices and electric vehicle charging. For new and existing buildings other than dwellings, the Part L 2021 (Buildings Other Than Dwellings) 'Regulation 5' requirements shall be met by:

- 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;
- b) Where a heat generator is being replaced in an existing building, where technically and economically feasible, self-regulating devices shall also be installed;
- e) A building which has more than 10 car parking spaces, that is:
 - iii. New, or
 - iv. Subject to subparagraph (g), undergoing major renovation, 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.
- g) The requirements of subparagraph (e) shall apply to a building undergoing major renovation where:
 - iii. In a case where the car park is located inside the building, the renovation concerned include the car park or the electrical infrastructure of the building; or
 - iv. In a case where the car park is physically adjacent to the building, the renovations concerned include the car park or the electrical infrastructure of the car park.

6. 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 development will be designed to achieve compliance with Part F of the building regulations.

7. 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 (residential, 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.

8. 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.

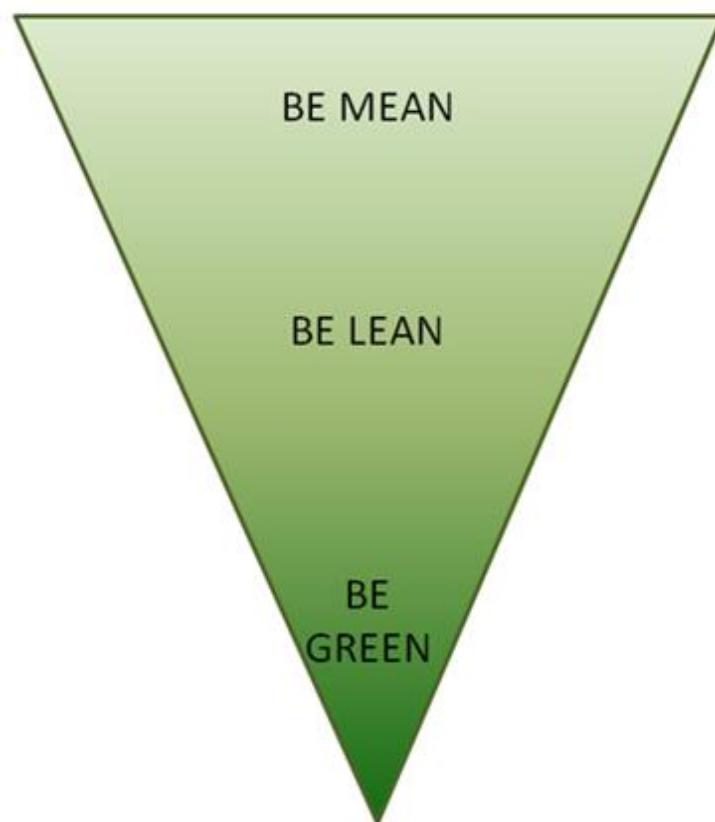


Figure 2: Energy Hierarchy Plan

8.1. 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;
- Improved air tightness; and
- Improved thermal transmittance and thermal bridging design.

8.1.1. HIGH PERFORMANCE U-VALUES

To limit the heat loss through the façade, careful consideration must be shown 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.

New Build Elements

The targeted maximum average elemental U-Values for both the residential and non-residential aspects of the proposed development are outlined in Table 2 and Table 3 below.

Fabric Element	St. Teresa's Residential Development Maximum Average Elemental U-value (W/m ² .K)
External Walls	0.18
Flat Roof	0.18
Pitched Roof	0.16
Ground Contact & Exposed Floor	0.18 (0.15 if underfloor heating installed)
External Windows, Roof-lights & Doors	1.40

Table 2 – Residential Building Envelope Thermal Performance Targets

Fabric Element	St. Teresa's Non-Residential Development Maximum Average Elemental U-value (W/m ² .K)
External Walls	0.20
Flat Roof	0.18
Pitched Roof	0.16
Ground Contact & Exposed Floor	0.20 (0.15 if underfloor heating installed)
External Windows, Roof-lights & Doors	1.40

Table 3 – Non-residential Building Envelope Thermal Performance Targets

Existing Elements

Each existing element to be refurbished will be analysed from the purposes of thermal performance, the risk of interstitial condensation and protecting the architectural merit of the element. After an evaluation of each of these points, the existing element will be insulated if possible.

8.1.2. 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 residential and non-residential development will both target an air permeability rate of $3 \text{ m}^3/\text{hr}/\text{m}^2$ @ 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 Examples

8.1.3. 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 residential and non-residential aspects of the development will be designed to achieve low thermal bridging values throughout.

Residential (New Build):

A Ψ value of $\leq 0.08 \text{ W/m}^2\cdot\text{K}$ is being targeted for the residential side of the development, in accordance with Part L (2021) – Dwellings requirements. The risks relating to mould growth/ condensation risks will also be assessed, in accordance with Part L (2021) – Dwellings.

Non-residential (New Build):

There are no Ψ value targets required for the non-domestic elements of the development. However, the risks relating to mould growth/ condensation risks will still have to be assessed, in accordance with Part L (2021) – Buildings Other Than Dwellings.

Existing Elements:

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

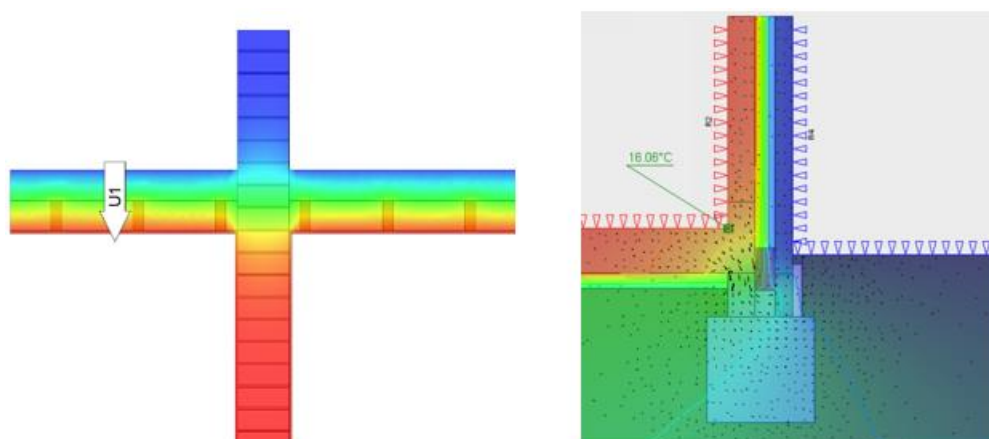


Figure 4: Thermal Bridge Assessment Examples

8.1.4. 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.

Residential:

The proposed St. Teresa's residential development will be evaluated and analysed with respect to overheating as outlined in Part L 2021 (Dwellings) and CIBSE TM59 (Design Methodology for the Assessment of Overheating Risk in Homes).

Non-residential:

The non-residential aspects of the proposed St. Teresa's development will be evaluated and analysed with respect to overheating as outlined in Part L 2021 (Buildings Other Than Dwellings) and CIBSE TM52 (Limits of Thermal Comfort: Avoiding Overheating in European Buildings).

8.2. 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 development as efficiently as possible.

8.2.1. LOW ENERGY PLANT - RESIDENTIAL

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

Space Heating: The plant options for space heating are:

- Exhaust Air Heat Pumps (EAHP), or
- District Heating via CHP.

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

- Exhaust Air Heat Pumps (EAHP), or
- District Heating via CHP.

Ventilation: The plant options for ventilation are:

- Mechanical Extract Ventilation via the EAHP, or
- Mechanical Ventilation with Heat Recovery (MVHR).

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.

8.2.2. LOW ENERGY PLANT - NON-RESIDENTIAL

To improve the overall energy efficiency of the non-residential aspect 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).

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 non-residential areas 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 and CO₂ control.

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.

8.2.3. 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.

8.2.4. ONGOING MONITORING

A BEMS (Building Energy Management System) system is to 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.

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

The following renewable technologies are being considered for implementation in the St. Teresa's residential development.

8.3.1. EXHAUST AIR HEAT PUMP

Exhaust air heat pumps collect warm air as it leaves a building via the ventilation system and then reuse the heat that would otherwise be lost to the outside to heat fresh air coming into the building or to heat water. Exhaust air heat pumps operate on a similar basis to other heat pumps such as air source heat pumps and ground source heat pumps and are suitable for providing hot water and heating for buildings such as houses, apartments or flats.

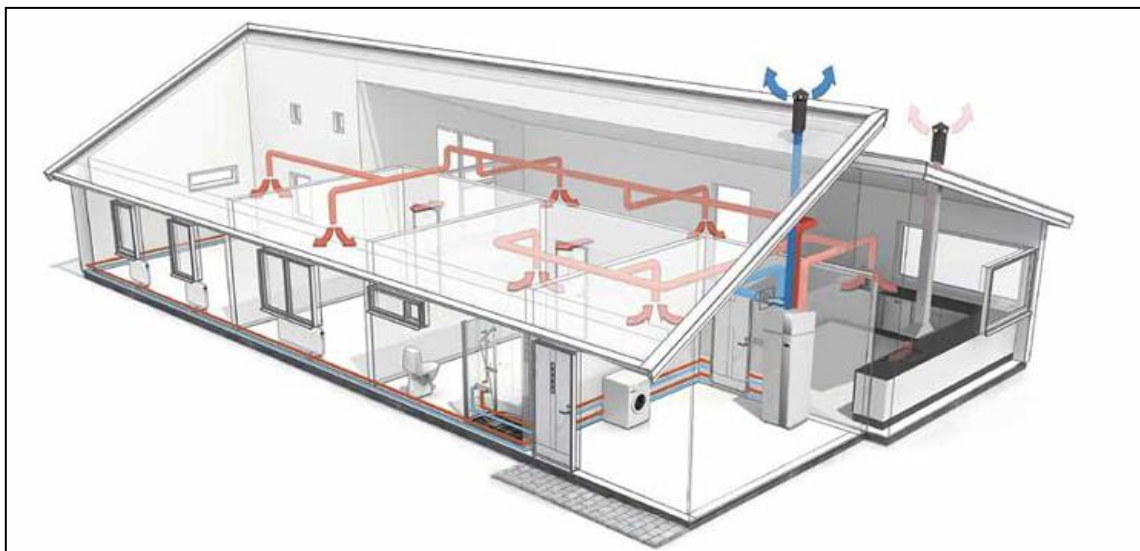


Figure 6: Example Diagram of Typical Exhaust Air Heat Pump Layout

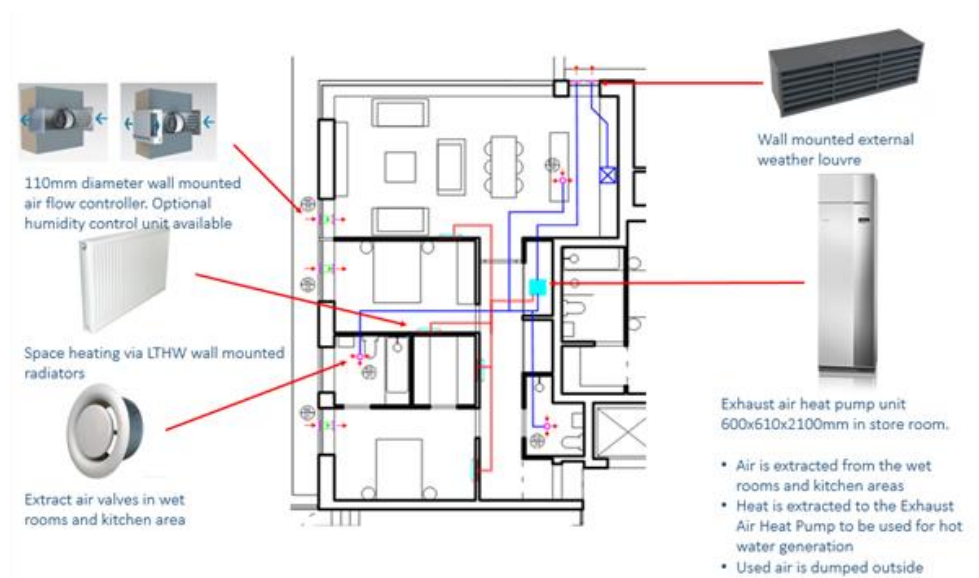


Figure 7: Example Diagram of Typical Exhaust Air Heat Pump Layout

8.3.2. 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.

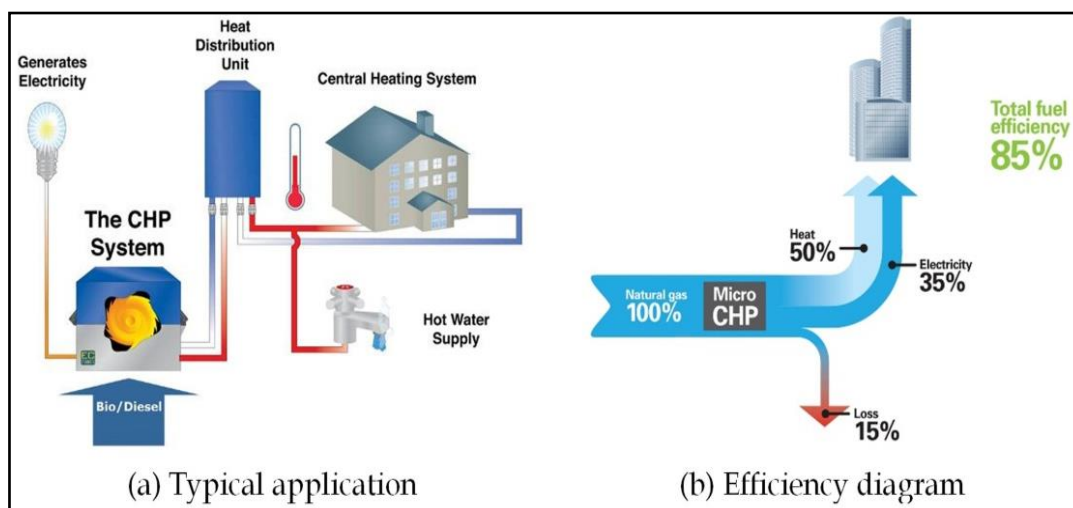


Figure 8: CHP Diagram

8.3.3. SOLAR PHOTOVOLTAICS

Photovoltaic (PV) Panels convert the solar radiation into electricity, which can be connected to the mains supply of a dwelling. 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 dwelling, office or into the landlord's supply.

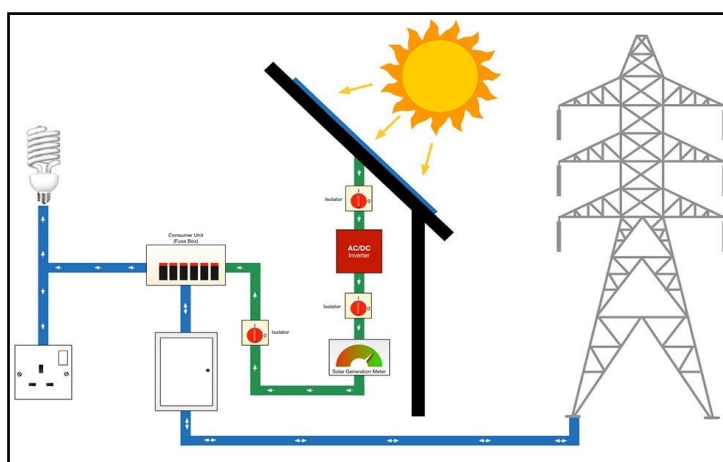


Figure 9: Solar PV Diagram

8.3.4. AIR SOURCE HEAT PUMP – NON-RESIDENTIAL

Air-Source Heat Pumps (ASHP) are deemed a renewable energy technology under Part L 2021 (NZEB). In heating mode, ASHPs are designed to extract heat from the ambient outside air and release it inside the building via heat emitters. In cooling mode, the cycle is reversed with heat being extracted from inside the building to the outside.



Figure 10: Air-Source Heat Pump

8.3.5. 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.

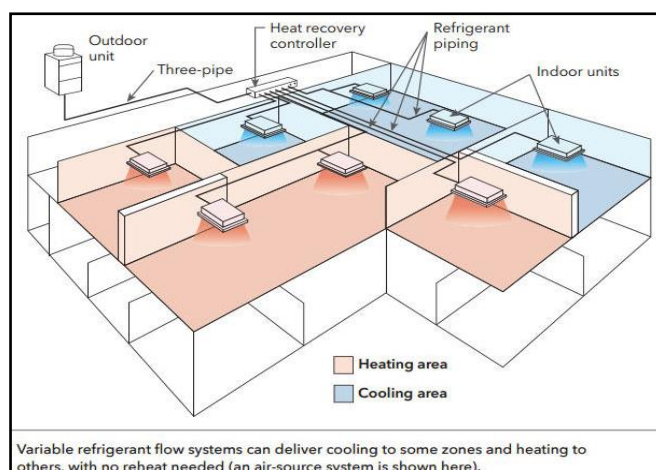


Figure 11: Typical VRF Schematic Diagram

9. KEY SUSTAINABLE FEATURES

The location of the St. Teresa's Residential Development provides availability to alternative modes of transportation, use of water efficient fixtures, consideration for materials and resources and indoor environmental quality for the building occupants.

9.1. 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.

The following figures identify the local Luas stops, Train stations, Dublin bus stops, bicycle lanes and local car sharing locations and their proximity to the proposed development.

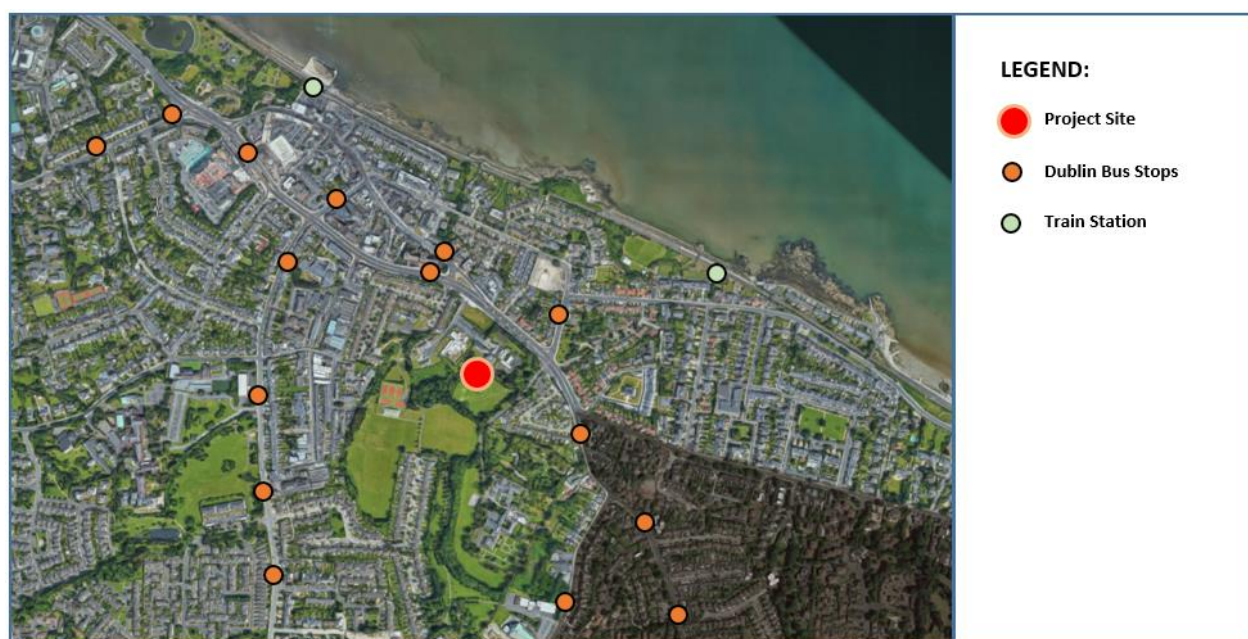


Figure 13: Local Train and Dublin Bus Stops

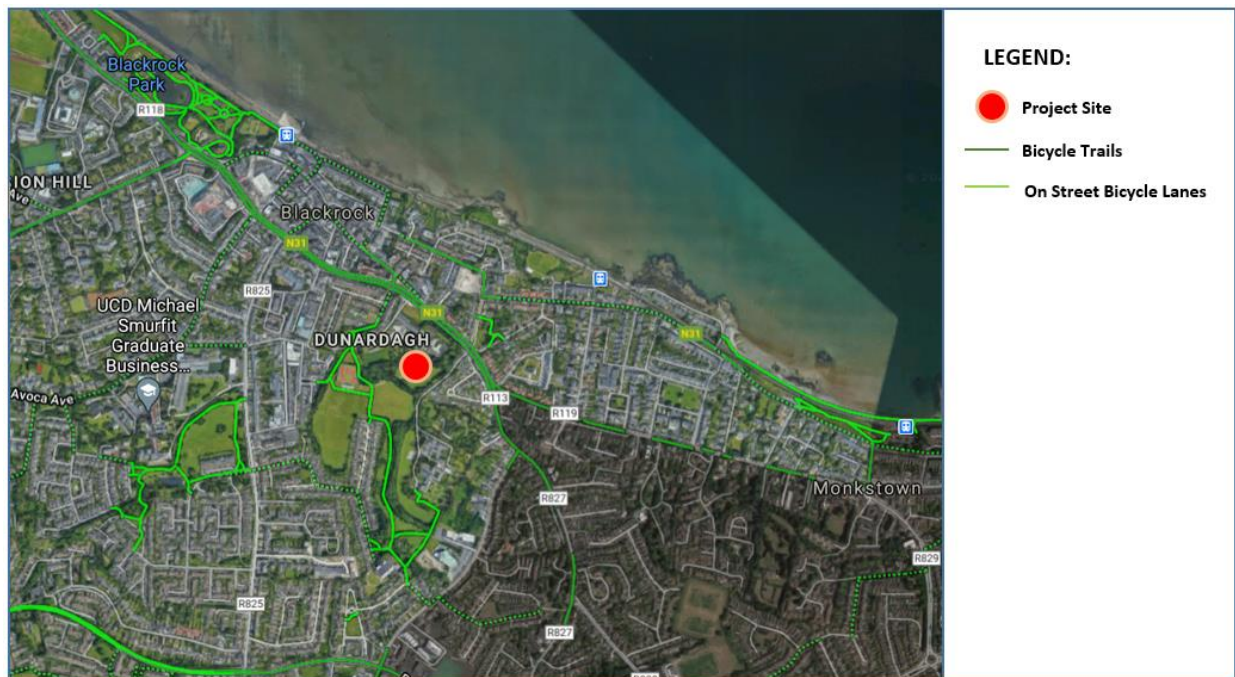


Figure 14: Local Bicycle Lanes & Trails

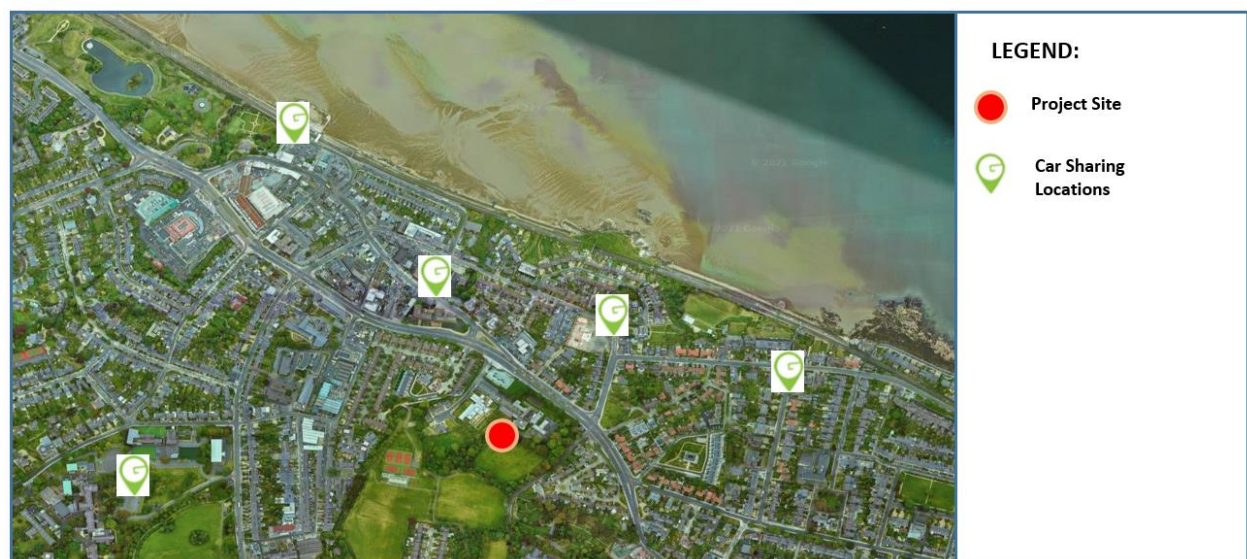


Figure 15: Local Car Sharing Locations

9.2. COMMISSIONING

To ensure efficient operation of the development, all systems will be commissioned. Commissioning of a developments 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.

9.3. MATERIALS AND RESOURCES

The development will be designed and operated with the aim of a reduction in waste generation through 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.

9.4. WATER EFFICIENCY

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

9.5. BICYCLE FACILITIES

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

9.6. 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.

9.7. ELECTRIC VEHICLE CHARGING

As part of the sustainable design strategy, the development shall provide the following provisions relating to electric vehicle charging:

Residential Dwellings:

- Installation of 'infrastructure' for E.V charging for residential buildings with more than 10 car parking spaces, to allow for future installation of recharging points.

Non-residential Buildings:

- Where the development has more than 10 car parking spaces, to provide one car recharging point for E.V charging;
- Where the development has more than 10 car parking spaces, to provide at least one accessible recharging point (or 5% of total recharging points – whichever the greater), as also outlined within Part M;
- Where the development has more than 10 car parking spaces, to provide mandatory 'infrastructure' for E.V charging for at least one in every 5 parking bays to allow for future installation of recharging points.

The St. Teresa's development will provide 50 No. EV car parking charging locations throughout the development.

10. CONCLUSION

A holistic sustainable approach been adopted by the design team for the proposed St. Teresa's Residential Development located at Temple Hill, Monkstown, Blackrock, Co. Dublin. Through detailed design, a number of sustainability and efficiency features have been considered throughout.

The proposed residential development will comply with residential Part L 2021 (Dwellings), as well as targeting an A2/A3 BER, while the proposed non-residential development will comply with non-residential Part L 2021 (Buildings Other Than Dwellings), as well as targeting an 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 central 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

- Renewable energy technologies such as Exhaust Air Heat Pumps (EAHP), Combined Heat and Power (CHP), Solar PV and VRF Heat Pumps will be considered for implementation.

A number of sustainable design features have been considered within the design to achieve the sustainability targets of the proposed development. 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. Teresa's Residential Development will satisfy all Part L and BER requirements.



OCSC

O'CONNOR | SUTTON | CRONIN

Multidisciplinary
Consulting Engineers

9 Prussia Street
Dublin 7
Ireland

T | +353 (0)1 8682000
F | +353 (0)1 8682100
W | www.ocsc.ie