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L371: ANGLESEA TERRACE RESIDENTIAL DEVELOPMENT

ENERGY & SUSTAINABILITY REPORT/ CLIMATE ACTION

For
Land Development Agency.

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1 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.

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 Anglesea Terrace Residential Development development will achieve all energy and sustainability targets.

2 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 Anglesea Terrace Residential Development development located at/in Ballintemple, Cork.

The proposed residential aspects of the development will comply with Part L 2022 (Dwellings), and Part L 2022 (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.

Table 1: Energy Performance Targets

Standard / Rating	Mandatory	Target
Part L Residential	Yes	2022 (Dwellings)
Part L Non-residential	Yes	2022 (Buildings Other Than Dwellings)
BER Residential	Yes	A3
BER Non-residential	Yes	A3 minimum

The following sections identify a range of energy efficient measures that have been considered for the proposed Anglesea Terrace Residential Development development.

3 PROPOSED DEVELOPMENT

Refer to description of development in Architects Design Statement.

Figure 1. Proposed Development Site Plan

4 PART L CONSERVATION OF FUEL & ENERGY-DWELLINGS

4.1 PART L 2022 (DWELLINGS)

Part L 2022 (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 after 25th October 2022.

The Part L 2022 (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".

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 LOCATION OF NON-RESIDENTIAL ASPECTS OF THE DEVELOPMENT

The non-residential aspects of the development will consist of amenity spaces on the ground floor including a reception area and a multi-purpose space, as well as a bike store, waste store and plant management areas.

5.2 PART L 2022 (BUILDINGS OTHER THAN DWELLINGS)

The Part L 2022 (Buildings Other Than Dwellings) building regulations is the new standard for all buildings other than dwellings constructed after 25th October 2022. The Part L 2022 (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.

For new buildings other than dwellings, the Part L 2022 (NZEB) '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 (CO_2) emissions to a Nearly Zero Energy Building level insofar as is reasonably practicable, when both energy consumption and Carbon Dioxide emissions are calculated using the Non-domestic Energy Assessment Procedure (NEAP) published by Sustainable Energy Authority of Ireland (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 (2022) – 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 2022 (NZEB) '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;

c) 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.

d) 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.

5.3 RENEWABLE ENERGY RATIO (RER):

One of the most significant changes made in the newer version of the new Part L 2022 document regulations for non-residential buildings is the addition of a renewable energy contribution target for all non-residential new builds. 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.;
- This level of renewable source contributions can also be fulfilled through efficient district heating and cooling using a significant share of renewable energy and waste heat and cold;
- 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:

i. 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;

ii. 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.

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 Building Energy Rating (BER) 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.

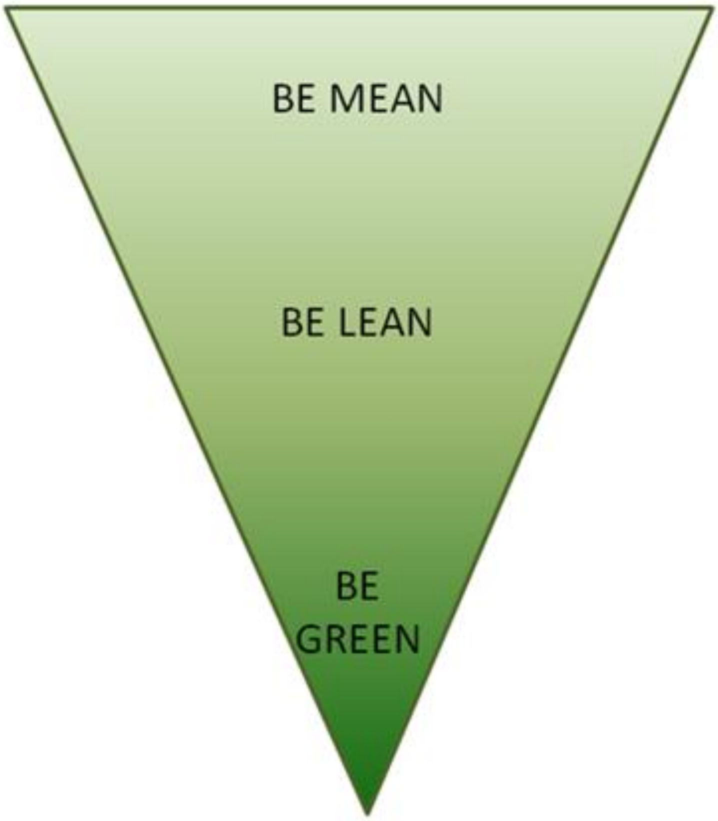


Figure 2: Energy Hierarchy Plan

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.

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.

Table 2: Residential Building Envelope Thermal Performance Targets

Fabric Element	Anglesea Terrace 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 3: Non-Residential Building Envelope Thermal Performance Targets

Fabric Element	Anglesea Terrace Residential Development 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, Roof-lights & Doors	1.40

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.

It is intended that the residential and non-residential aspects of the development will both target an air permeability rate of ≤ 3 $m^3/hr/m^2$ @50 Pa.

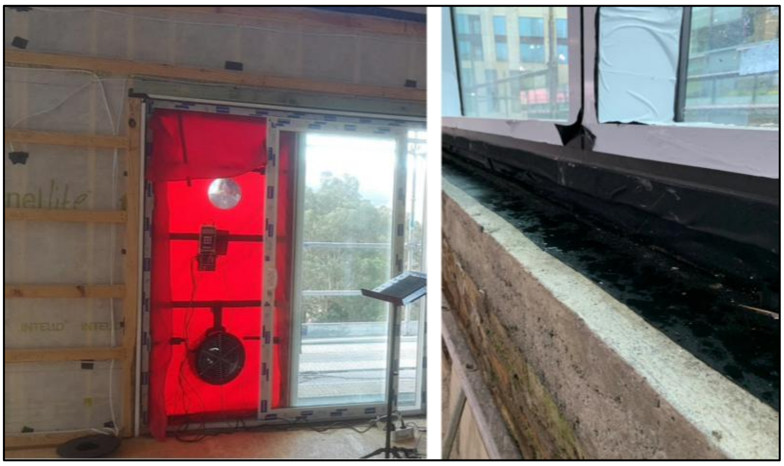


Figure 3: Air tightness testing examples

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:

A Y value of ≤ 0.08 $W/m^2.K$ is being targeted for the residential side of the development, in accordance with Part L (2022) – Dwellings requirements. The risks relating to mould growth/ condensation risks will also be assessed, in accordance with Part L (2022) – Dwellings.

Non-residential:

There are no Psi 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 (2022) – Buildings Other Than Dwellings.

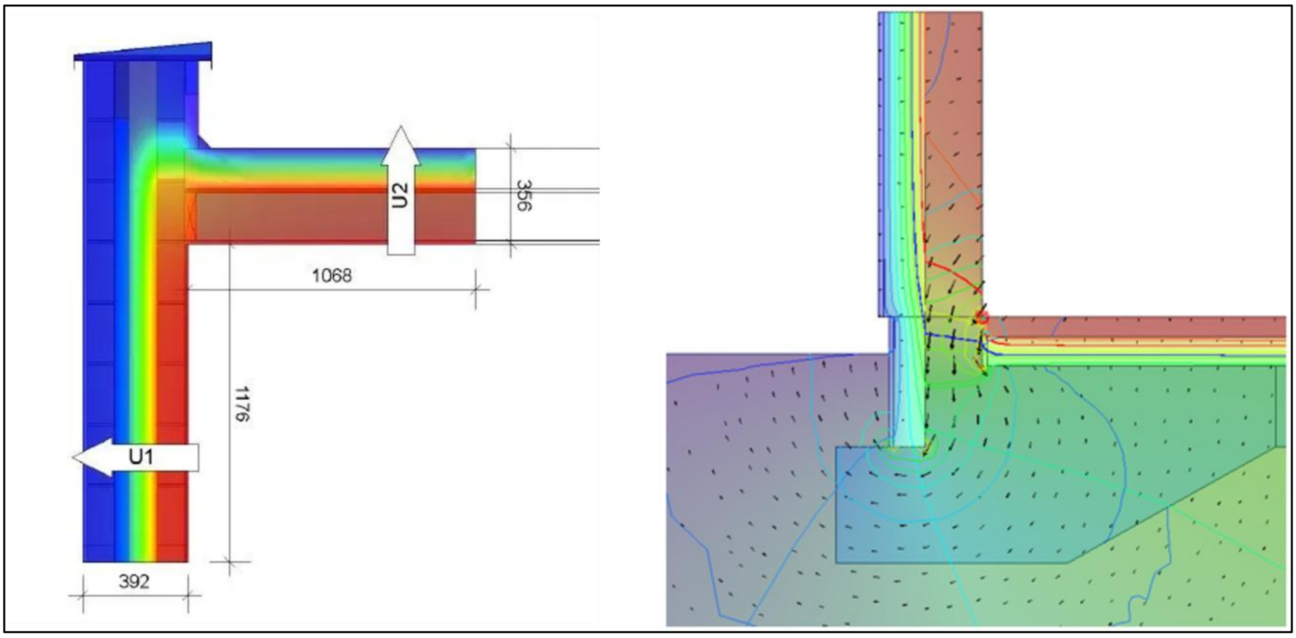


Figure 4: Thermal Bridge Assessment Examples

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 Anglesea Terrace Residential Development residential development will be evaluated and analysed with respect to overheating as outlined in Part L 2022 (Dwellings) and CIBSE TM59 (Design Methodology for the Assessment of Overheating Risk in Homes).

Non-residential:

The non-residential aspects of the proposed Anglesea Terrace Residential Development development will be evaluated and analysed with respect to overheating as outlined in Part L 2022 (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:

- Electric Panel Heaters, or
- Air Source Heat Pumps (ASHP), or
- Exhaust Air Heat Pumps (EAHP)
- Community heating via Combined Heat & Power plant (CHP), or
- Community heating via Ambient Loop

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

- Air Source Heat Pumps (ASHP), or
- Exhaust Air Heat Pumps (EAHP), or
- Community heating via Combined Heat & Power plant (CHP)
- Community heating via Ambient Loop

Ventilation: The plant options for ventilation are:

- Mechanical Ventilation and Heat Recovery (MVHR), or
- Mechanical Extract Ventilation (MEV) via the EAHP

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:

- Air Source Heat Pumps (ASHP), or
- Variable Refrigerant Flow (VRF) Heat Pumps.

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

- Air Source Heat Pumps (ASHP), or
- Instantaneous 'Under-sink' Water Heaters.

Space Cooling: The plant options for space cooling are:

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

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 CO_2 control.

Variable Speed Drives (VSDs): Variable speed drive motors are to be fitted to all fans and pumps serving 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 developments façades 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 Anglesea Terrace Residential Development development:

8.3.1 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.

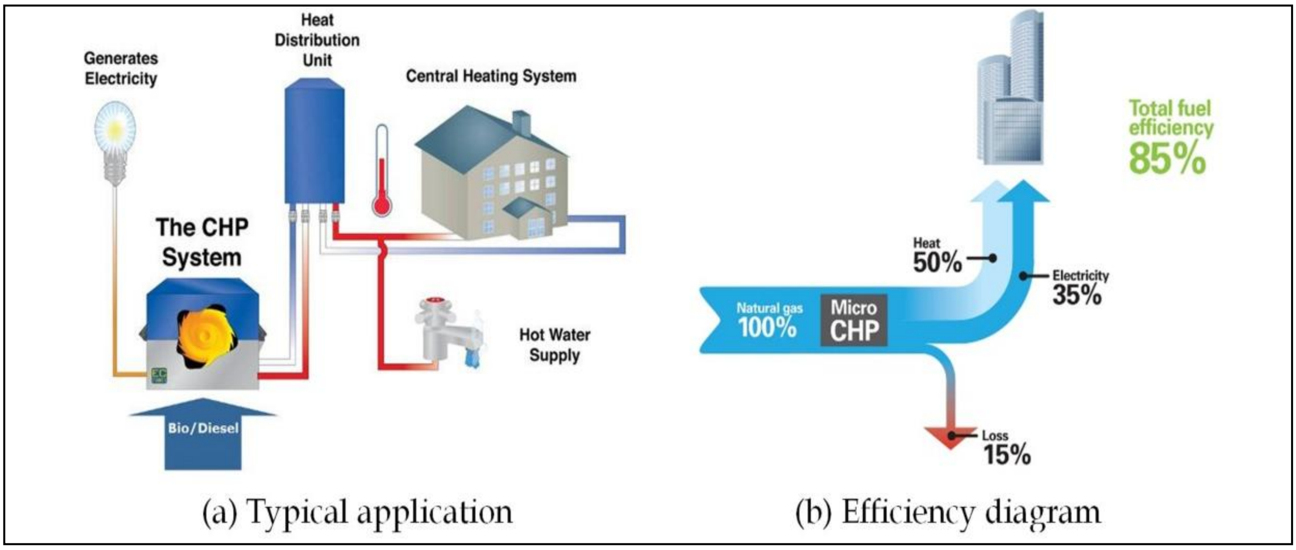


Figure 5: CHP Diagram

8.3.2 AIR SOURCE HEAT PUMP - RESIDENTIAL

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 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 a building.

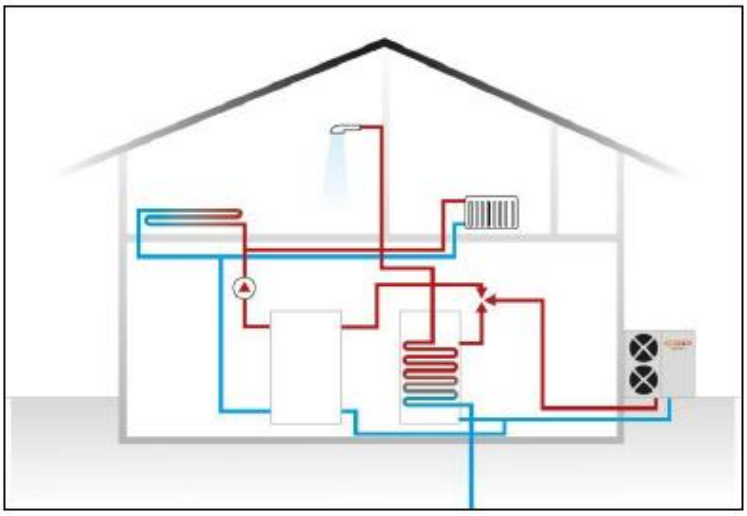


Figure 6: Air-Source Heat Pump Diagram

8.3.3 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.

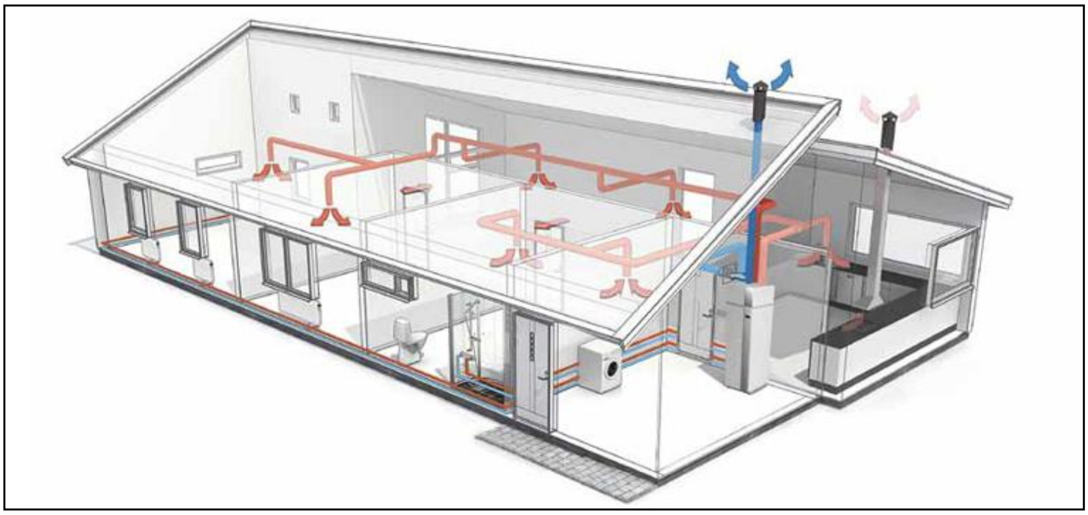


Figure 7: Example Diagram of Typical Exhaust Air Heat Pump Layout

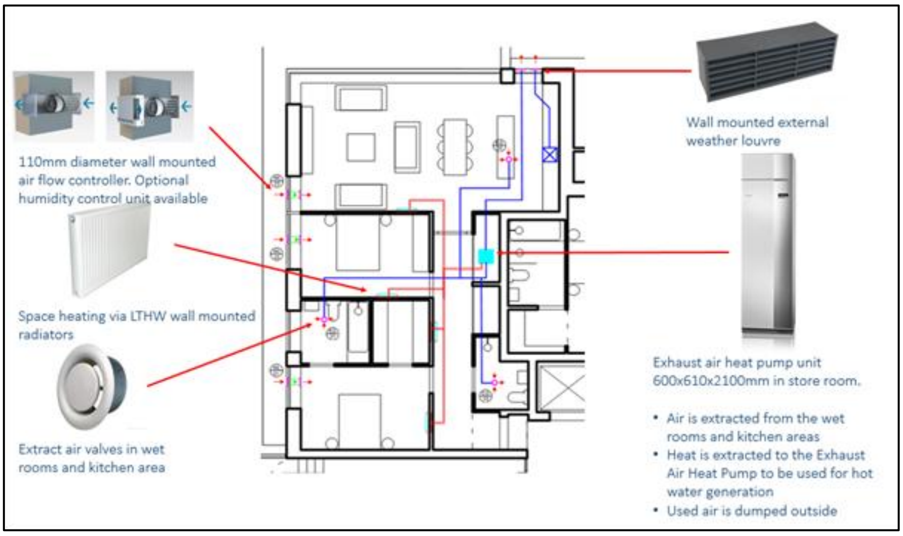


Figure 8: Example Diagram of Typical Exhaust Air Heat Pump Layout

8.3.4 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 dwelling, office or into the landlord's supply.

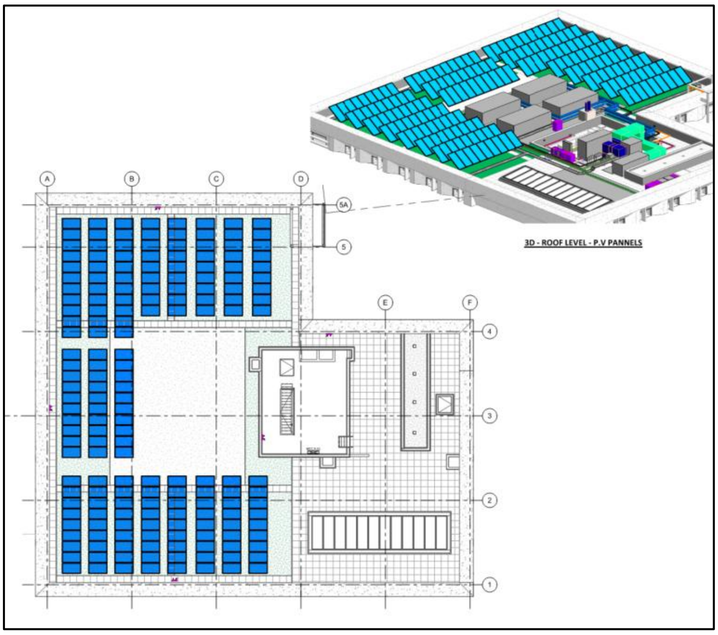


Figure 9: Solar PV Diagram

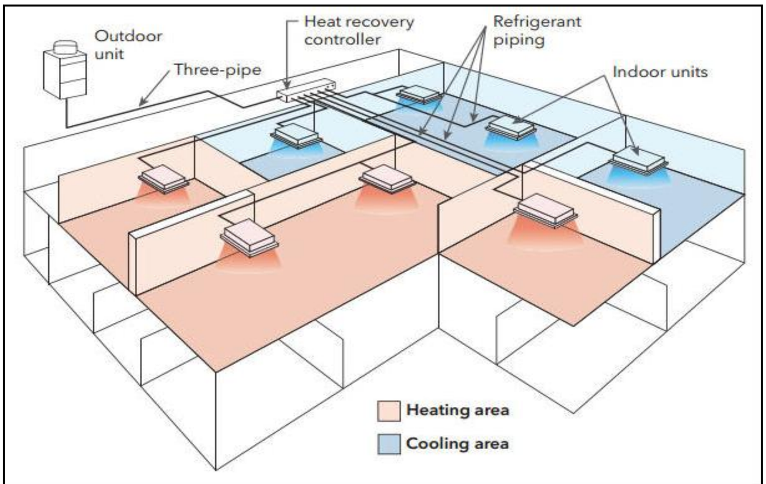
8.3.5 AIR SOURCE HEAT PUMP – NON-RESIDENTIAL

Air-Source Heat Pumps (ASHP) are deemed a renewable energy technology under Part L 2022 (Buildings Other Than dwellings). 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

8.3.6 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.



Variable refrigerant flow systems can deliver cooling to some zones and heating to others, with no reheat needed (an air-source system is shown here).

Figure 11: Typical VFT Schematic Diagram

8.3.7 COMMUNITY HEATING VIA AMBIENT LOOP

This strategy utilises a central ambient loop to supply energy to in-apartment heat pumps. These heat pumps then uplift the energy from the central loop to provide space heating and domestic hot water to apartments. Ambient loops operate at significantly lower temperatures than traditional communal high temperature heating systems. A centralised plantroom will be utilised to contain the unit supplying the ambient loop, along with all associated pipework and equipment.

Figure 12: Glendimplex Zeroth Energy System (Ambient Loop)

9 KEY SUSTAINABLE FEATURES

The location of the Anglesea Terrace Residential Development 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 Bus Eireann stops and their proximity to the proposed development.

Bus

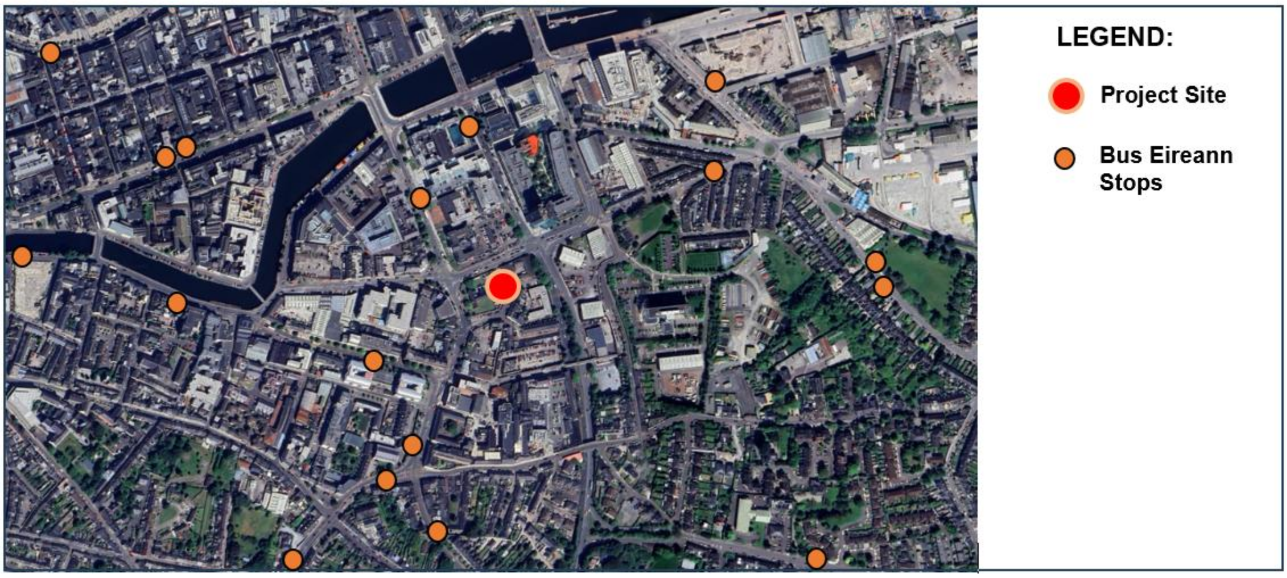


Figure 13: Local Bus Eireann Stops

TFI Bikes/Trails:

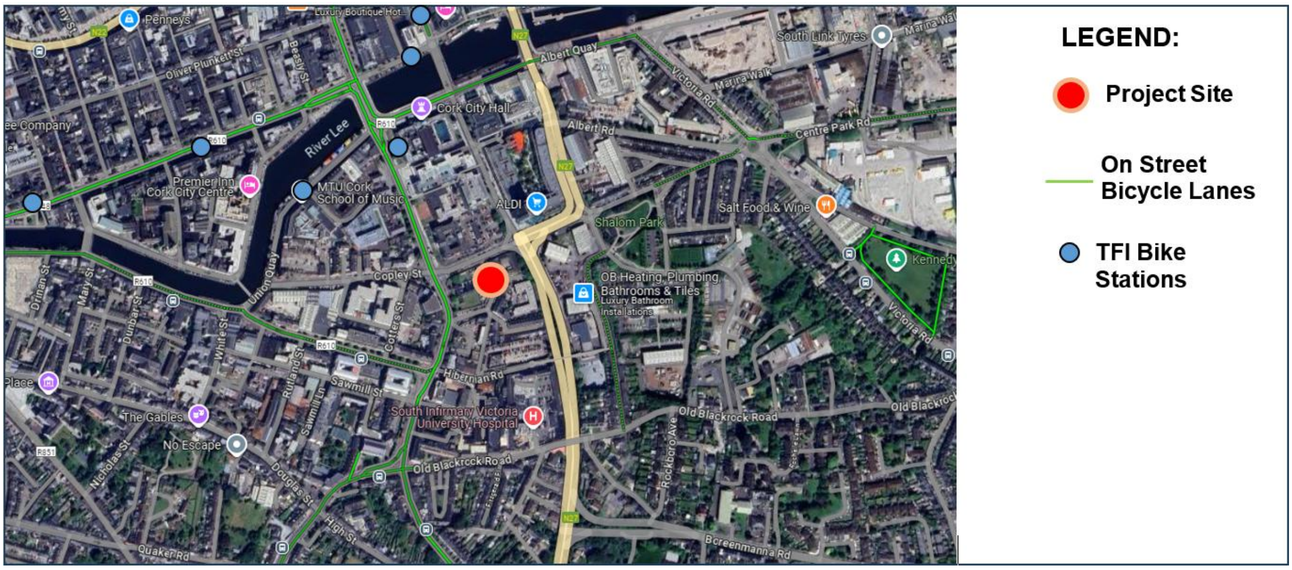


Figure 14: Local Bicycle Lanes and TFI Bike Stations

Go-Car:

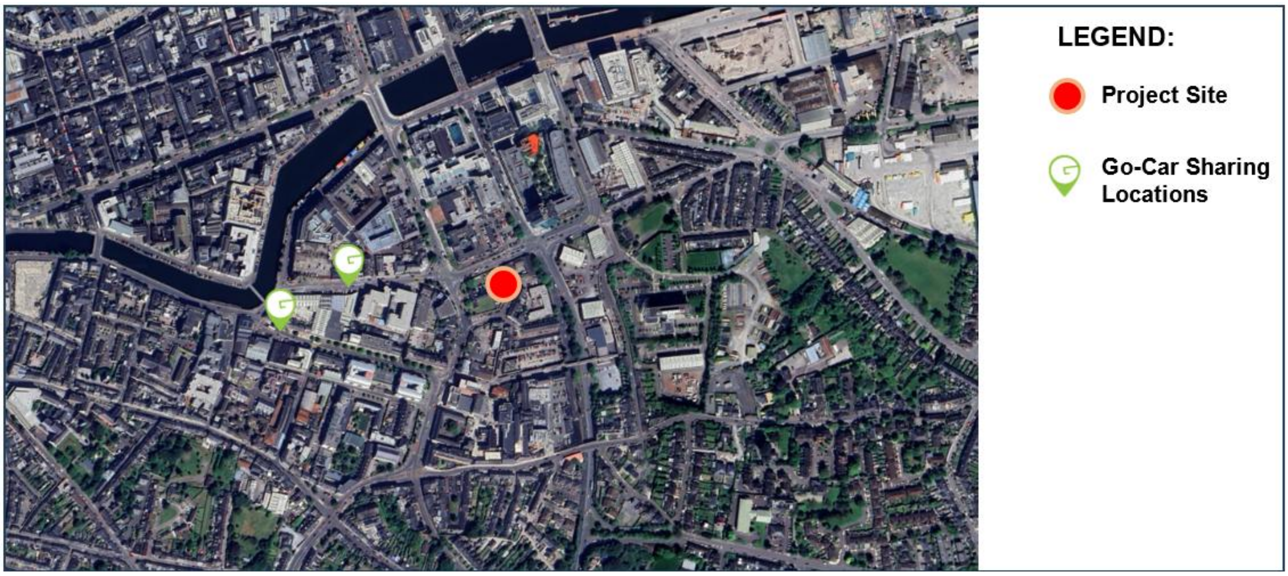


Figure 15: Local Car Sharing Locations

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 DUBLIN DISTRICT HEATING SYSTEM (DDHS)

The DDHS will utilise waste heat generated by the 'Waste to Heat' plant in Ringsend, and distribute hot water to homes and businesses around the general Docklands area of the city.

As part of the sustainable design strategy, the development shall provide infrastructure for a possible future connection to the DDHS scheme.

10 CONCLUSION

A holistic sustainable approach been adopted by the design team for the proposed Anglesea Terrace Residential Development development located in Ballintemple, Cork . Through detailed design, a number of sustainability and efficiency features have been considered throughout.

The proposed residential development will comply with residential Part L 2022 (Dwellings), as well as targeting an A2/A3 BER, while the proposed non-residential development will comply with non-residential Part L 2022 (Buildings other Than Dwellings), and target a minimum BER rating of A3

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 Combined Heat and Power (CHP), Air Source Heat Pumps (ASHP), Exhaust Air Heat Pump (EAHP), 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.
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This report confirms that if the energy and sustainability strategy is successfully implemented, the proposed Anglesea Terrace Residential Development development will satisfy all Part L and BER requirements.

11 VERIFICATION

Lanz Yanson BE. Energy Engineering

Energy Engineer

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