Energy & Sustainability Report

Cornelscourt Development

Project No. A587
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Energy & Sustainability Report

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1. INTRODUCTION

The intention of this report is to identify the energy efficiency measures associated with the design, construction, ongoing management and maintenance of the proposed Cornelscourt development at Cornelscourt Village, Old Bray Road, Cornelscourt Dublin 18.

The residential aspects of the proposed development will comply with Part L 2019 (NZEB), while the commercial aspects will comply with Part L 2017 (NZEB). As part of the development's efforts to further reduce energy consumption, the project is targeting an A2/A3 BER (Building Energy Rating). Extensive work has been carried out to develop a balanced design approach to achieve these onerous targets with a number of sustainable features being incorporated into the design from the early stages.

Target Energy Performance		
Standard/Rating	**Mandatory**	**Target**
Part L Residential	**Yes**	**2019 (NZEB)**
Part L Commercial	**Yes**	**2017 (NZEB)**
BER	**Yes**	**A2/A3**

Table 1: Energy Performance Targets

The following sections identify a range of energy efficient measures that have been considered for the proposed Cornelscourt development.

2. PROPOSED DEVELOPMENT

Cornel Living Limited intends to apply to An Bord Pleanala for permission for a Build - to - Rent Strategic Housing Development on lands (c. 2.14 ha) at Cornelscourt Village, Old Bray Road, Cornelscourt Dublin 18.

The proposed development shall provide for the construction of a new residential development of 468 no. units in the form of 452 no. apartment units (41 no. studio apartment units, 257 no. 1 bed apartment units, 136 no. 2 bed apartment units; and 18 no. 3 bed apartment units) and 16 no. house units (10 no. 3 bed semi-detached house units and and 6 no. 1 bed bungalow units). A café / restaurant of c. 140 sq m; office space of 149 sq m; concierge of c. 149 sq m and central residential tenant amenity space of c. 458 sq m is also proposed.

The following build - to - rent residential development is provided:

1. 452 build to rent apartment units (ranging from 1 - 12 storeys in height) in the form of 8 no. new residential blocks (Blocks A - H) as follows:
- Block A (8 - 12 storeys) comprising 134 no. apartments (12 no. studio units, 93 no. 1 bed units and 29 no. 2 bed units);
- Block B (2 - 9 storeys) comprising 103 no. apartments (18 no. studio units, 65 no. 1 bed units; 14 no. 2 bed units and 6 no. 3 bed units);
- Block C (6 - 7 storeys) comprising 82 no. apartments (6 no. studio units, 60 no. 1 bed units and 16 no. 2 bed units);
- Block D (5 storeys) comprising 36 no. apartments (1 no. studio unit, 5 no. 1 bed units; and 30 no. 2 bed units);
- Block E (4 storeys) comprising 29 no. apartments (4 no. 1 bed units; and 25 no. 2 bed units);
- Block F (2 - 4 storeys) comprising 56 no. apartments (4 no. studio units, 24 no. 1 bed units; and 16 no. 2 bed units and 12 no. 3 bed units);
- Block G (3 storeys) comprising 6 no. apartments (3 no. 1 bed units and 3 no. 2 bed units); and
- Block H (3 storeys) comprising 6 no. apartments (3 no. 1 bed units and 3 no. 2 bed units).

2. 10 no. 3 bed semi-detached houses (2 storey) and 6 no. 1 bed bunaglows (1 storey) are proposed.

Adjacent to the existing pedestrian and vehicular access point from Old Bray Road there will be a café/restaurant of 140 sq m and residential amenity area at ground and first floor providing resident support services and concierge services of 149 sq m. At first floor level is a proposed commercial office space of c. 149 sq m. Located centrally within the development attached to the southern gable of Block B there is a two storey residential amenity space of c. 458 sq m; providing for resident support facilities and amenities including reading room, lounge, gym and terrace.

Each residential unit will be afforded with private open space in the form of a balcony/terrace/roof terrace or private rear garden area. Public open space is also proposed in the form of external residential amenity spaces, play areas, courtyards and gardens.

274 car parking spaces (273 at basement level and 1 at ground level), 616 bicycle parking spaces (512 at basement level and 104 at ground level) and 12 motorcycle spaces (12 at basement level) are proposed.

Basement areas of c. 9,024 sq m are proposed (Level -1) and include car parking, waste management areas and plant areas. 3 no. ESB substations and 3 no. Switch Rooms (c. 77 sq m combined) are proposed at ground level.

The development shall be served via the existing vehicular access point from the Old Bray Road. Upgrade works are proposed to this vehicular access point to facilitate the proposed development and to provide for improved access and egress for the overall development.

Provision is made for new pedestrian connections to Willow Grove; the N11; and Cornelscourt Village. Provision is also made for a new cyclist connection to the N11. A drop-off zone is also proposed at the entrance to the site.

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; boundary treatment; internal roads and footpaths; and electrical services.

Figure 1: Proposed Site Plan

3. PART L RESIDENTIAL BUILDING REGULATIONS

3.1. PART L (2019)

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

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

The definition of Nearly Zero Energy Buildings is defined as:

"'Nearly zero-energy building' means a building that has a very high energy performance, as defined in Annex 1. The nearly zero or very low amount of energy required should be covered to a very significant extent by energy from renewable sources, including energy from renewable sources produced on-site or nearby".

Renewable Energy Ratio (RER):

For the new Part L (2019) NZEB requirements, a Renewable Energy Ratio (RER) is to replace the current Part L (2011) renewable requirements. A RER of 20% (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;
- Wind Power;
- Solar Thermal System;
- CHP Units (Combined Heat & Power);
- Biomass Systems (using Biofuels);
- Heat Pumps (Minimum COP of 2.5).

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

The MPEPC is 0.30 (NZEB compliant)

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

The MPCPC is 0.35 (NZEB compliant)

4. PART L COMMERCIAL BUILDING REGULATIONS

4.1. PART L (2017)

The Part L 2017 (NZEB) building regulations is the new standard for all buildings constructed after 1st January 2019. The Part L 2017 (NZEB) 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 buil
ding 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 2017 (NZEB) 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.

Renewable Energy Ratio (RER):

This is the most significant change introduced as part of the Part L 2017 (NZEB) regulations. 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 ground 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 BER target 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 BER target 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.

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.

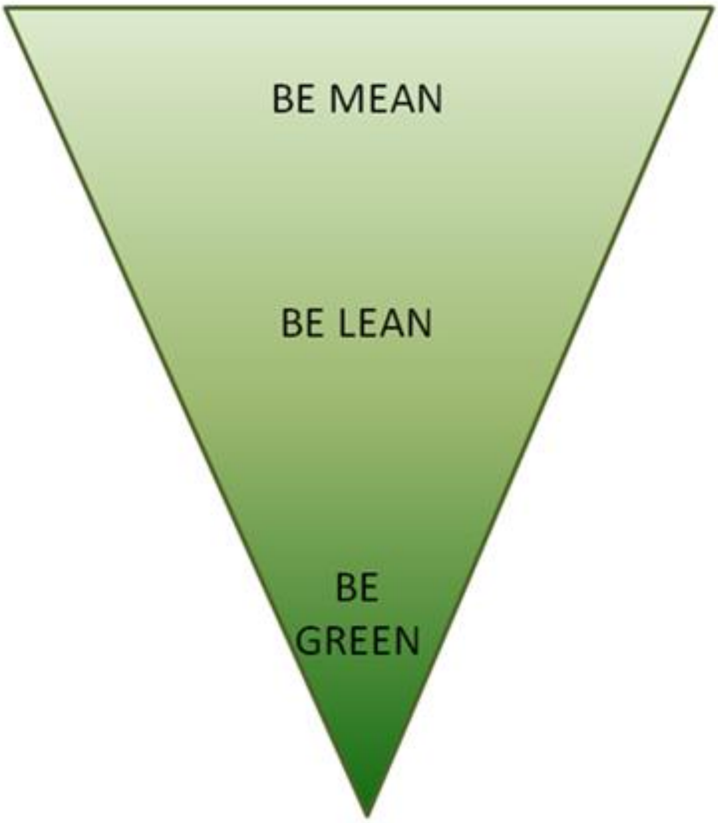


Figure 2: Energy Hierarchy Plan

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

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

- High performance U-values;
- Improved air tightness; and
- Improved thermal transmittance and thermal bridging design.

6.1.1. 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 commercial aspects of the proposed development are outlined in Table 2 and Table 3 below.

Fabric Element	Cornelscourt - Residential Maximum Average Elemental U-value ($W/m^2.K$)
Above & Below Grade 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 & Doors	1.40

Table 2: Residential Building Envelope Thermal Performance Targets

Fabric Element	Cornelscourt - Commercial Maximum Average Elemental U-value ($W/m^2.K$)
Above & Below Grade 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: Commercial Building Envelope Thermal Performance Targets

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.

It is intended residential and commercial development will both target an air permeability rate of 3 $m^3/hr/m^2$ @ 50 Pa.

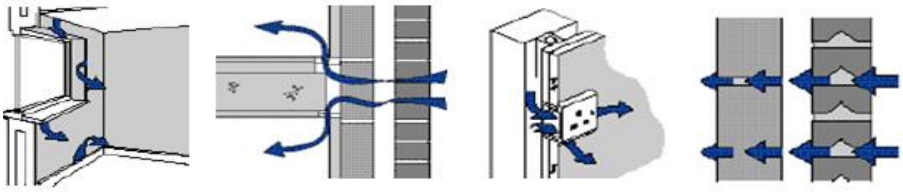


Figure 3: Typical Air Leakage Paths

6.1.3. THERMAL TRANSMITTANCE

Thermal bridges occur where the insulation layer is penetrated by a material with a relatively high thermal conductivity and at interfaces between building elements where there is a discontinuity in the insulation. Where an existing construction element to be retained shows a risk of thermal bridging, every effort will be made to reduce the risk by upgrading the façade to ensure continuity of insulation to limit local thermal bridging as much as practically possible.

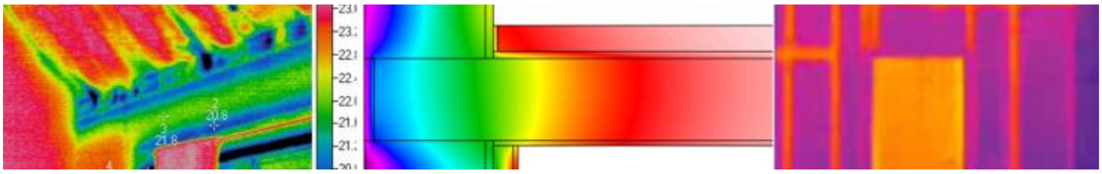


Figure 4: Typical Thermal Bridging Details

The new development will be designed to achieve low thermal bridging values throughout. A Y value of ≤ 0.05 W/m^2K must be achieved for the residential development in accordance with Part L (2019) requirements.

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 homes can be extremely uncomfortable for the occupant and can ultimately lead to costly mitigation measures.

The proposed Cornelscourt development will be evaluated and analysed with respect to overheating as outlined in Part L 2019 (NZEB) and Part L 2017 (NZEB).

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 - 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:

- Air Source Heat Pumps (ASHP), or
- Exhaust Air Heat Pumps (EAHP).

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

- Air Source Heat Pumps (ASHP), or
- Exhaust Air Heat Pumps (EAHP).

Ventilation: The plant options for ventilation are:

- Mechanical ventilation and heat recovery, or
- Whole house extract 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.

6.2.2. LOW ENERGY PLANT - COMMERCIAL

To improve the overall energy efficiency of the commercial 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)

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

- High Efficiency Condensing Gas Boilers, or
- Air Source Heat Pumps (ASHP)

Ventilation: The proposed ventilation strategy for the building will predominately be mechanically ventilated. The 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 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.

6.2.3. 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.

6.2.4. 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.

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

The following renewable technologies are being considered for implementation in the Cornelscourt development.

6.3.1. 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 apartment or into the landlord's supply.

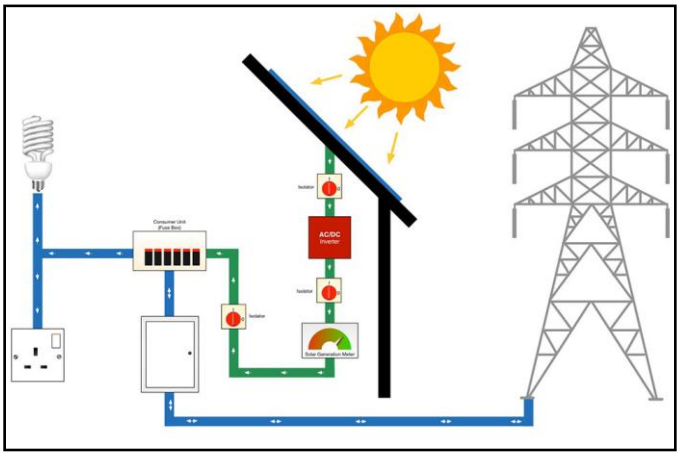


Figure 5: Solar PV Diagram

6.3.2. EXHAUST AIR HEAT PUMP

Exhaust Air Heat Pumps (EAHP) are deemed a renewable energy technology under Part L (NZEB). Intake air is provided via wall vents or window vents within habitable rooms, the intake air is heated up within the occupied spaces, air is extracted from wet room and kitchens, heat is extracted from the air and used for hot water via the Exhaust Air Heap Pump, used air is dumped outside.

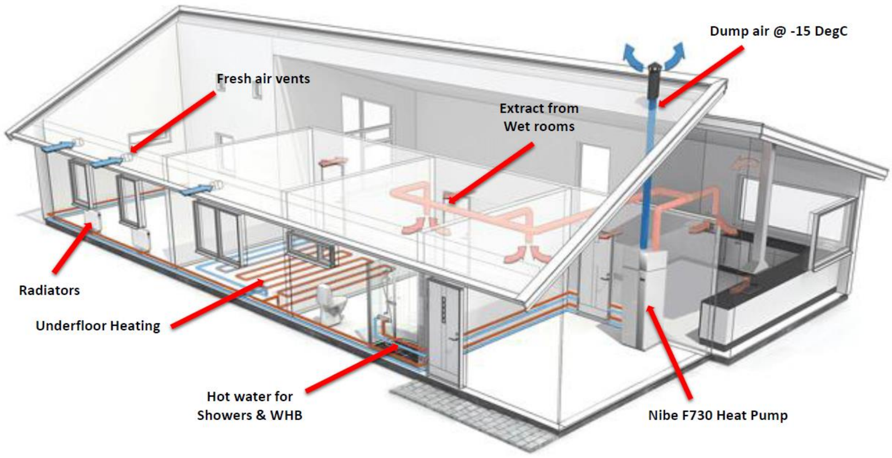


Figure 6: Exhaust Air Heat Pump Diagram

6.3.3. AIR SOURCE HEAT PUMP

Air source heat pumps convert energy from the air to provide heat and hot water for dwellings. 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 dwelling.

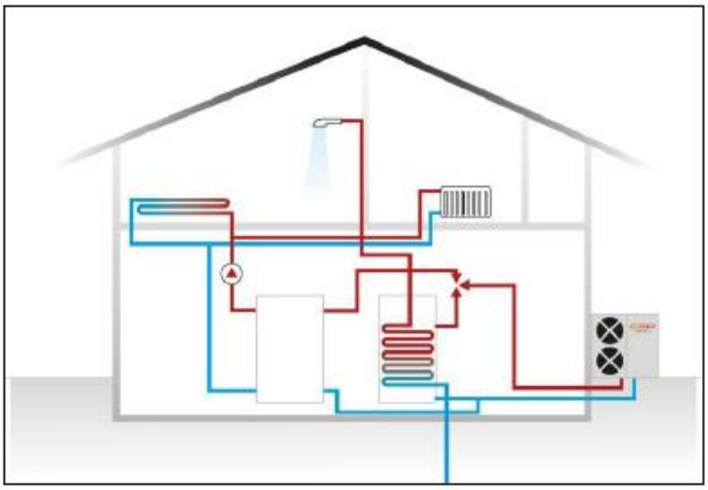
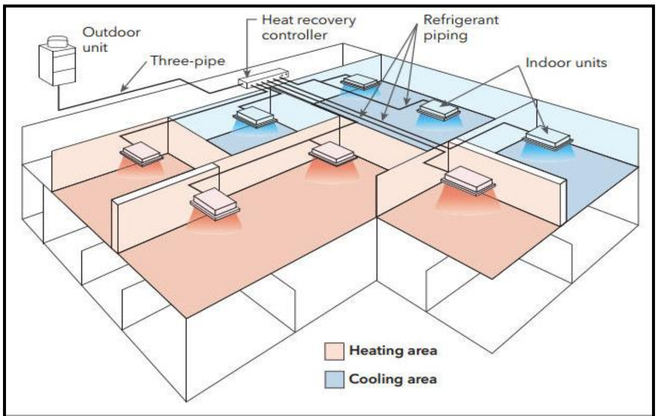


Figure 7: Air-Source Heat Pump Diagram

6.3.4. VARIABLE REFRIGERANT FLOW

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 8: Typical VRF Schematic Diagram

7. KEY SUSTAINABLE FEATURES

The location of the Cornelscourt 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.

7.1. LOCATION AND TRANSPORTATION

The proposed development will offer occupants travelling to and from the building 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.

Figure 9 and 10 identifies the local Dublin Bus stops and car sharing locations and their proximity to the proposed development.

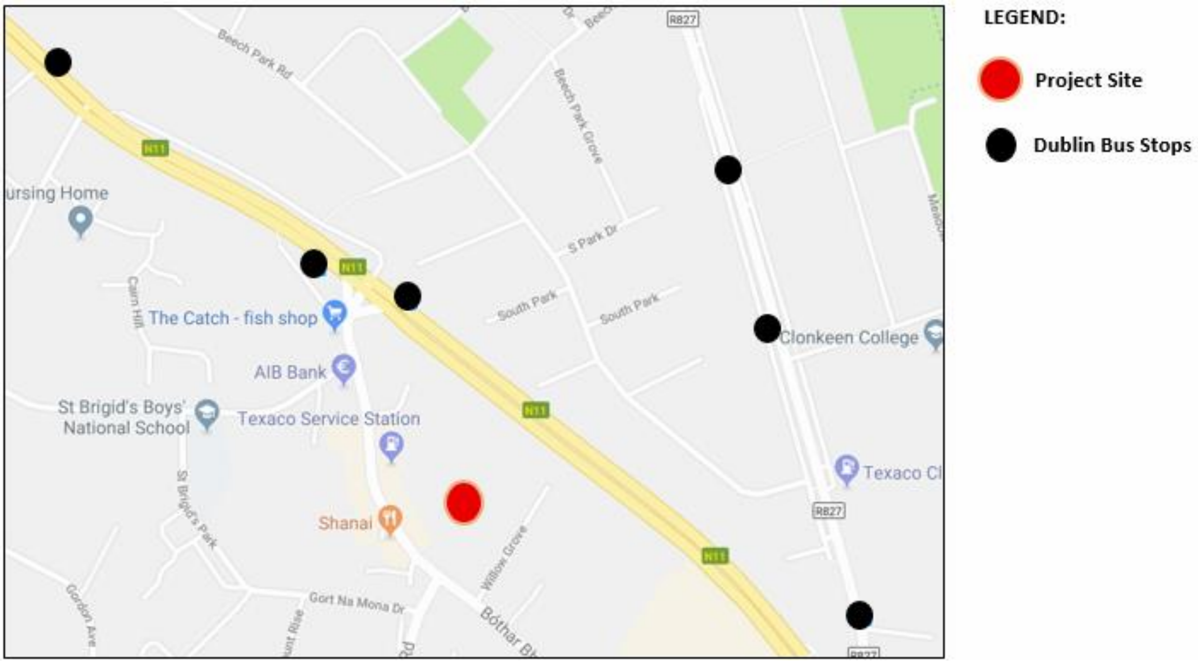


Figure 9: Local Dublin Bus Stops

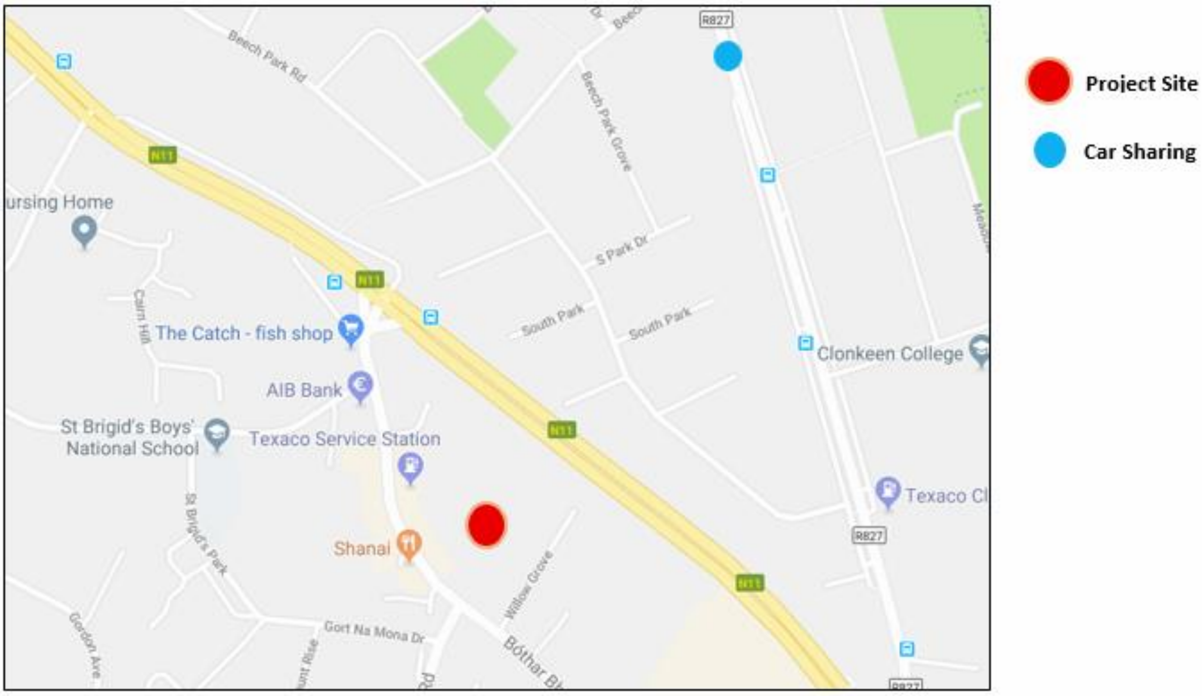


Figure 10: Local Car Sharing Locations

7.2. SEDUM ROOF

A sedum roof is proposed for the development, which can provide microclimates for insects, birds and other species. They also offer excellent thermal properties and can help to reduce space conditioning requirements as well as reducing surface water run-off from rainfall.

7.3. COMMISSIONING

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

7.4. MATERIALS AND RESOURCES

The building 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.

7.5. 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.

7.6. 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.

7.7. 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.

8. CONCLUSION

A holistic sustainable approach been adopted by the design team for the proposed Cornelscourt residential development at Old Bray Road, Dublin 18. Through detailed design, a number of sustainability and efficiency features have been considered throughout.

The proposed development will comply with Part L 2019 (NZEB) for residential and Part L 2017 (NEZB) for commercial, as well as targeting an A2/A3 BER.

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

Be Mean

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

Be Lean

- High efficiency 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, Exhaust Air Heat Pumps, Solar PV, and Variable Refrigeration Flow systems 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 refurbishment. These include:

- The proximity of the development to public transportation networks;
- Natural daylight;
- 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 Cornelscourt residential development will satisfy all Part L and BER requirements.

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