JUSTIFICATION FOR DEMOLITION REPORT

FOR

SANTRY AVENUE LRD RESIDENTIAL DEVELOPMENT,

DUBLIN 9

Project:	Santry Avenue LRD Residential Development, Dublin 9
Client:	Dwyer Nolan Developments Limited
Architects:	Davey & Smith Architects
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Prepared By:	Kieran Morley, BEng(hons), PGDip, MiEI

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1. INTRODUCTION

This report firstly aims to identify the works associated with the demolition certain existing structures located on the site of the proposed Santry Avenue Large-Scale Residential Development. Secondly, it's purpose is to highlight the expected measures involved with the design and construction of the proposed development.

The proposed development aims to achieve compliance with Part L 2022 (Dwellings) for residential areas 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 design work has been carried out to develop a balanced approach to achieve this onerous target, with a number of sustainable features being incorporated into the design from the early design stages.

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	A2/A3
BER Non-residential	Yes	A3

Table 1: Energy Performance Targets

The following sections relate to the existing structure, including observations made during the initial site survey as well as the justification for demolition.

2. EXISTING STRUCTURES

The site currently comprises the Chadwicks building providers, warehouse, trade shop and offices which amount to approximately 4196m2 total floor area. The existing buildings were constructed in the 1950s as a factory and have been used as a builders providers since the 1990's. All existing structures with will be demolished and replaced with new structures.

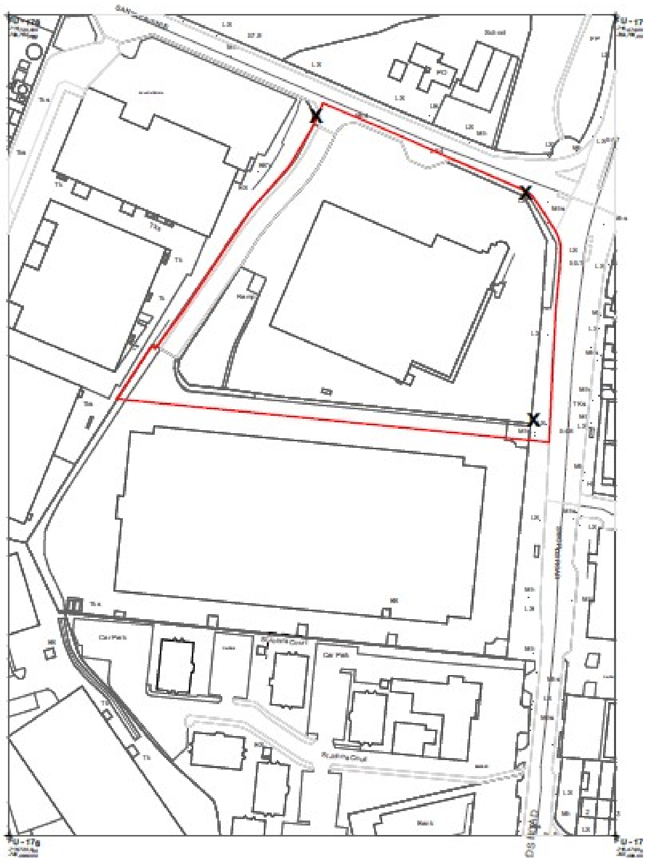


Figure 1: Existing Site Plan (OSI Map)

Based on the age of the existing buildings, and the observations made during the site survey, the U- values for all building elements (in accordance with guidance outlined in the DEAP Manual – Appendix S), are calculated as follows:

Fabric Element	DEAP (Appendix S) U-value (W/m².K)
External Walls	2.1
Flat Roof	2.3
Pitched Roof	2.3
Ground Contact & Exposed Floor	0.27
External Windows (Single Glazed)	4.8
Thermal Bridging Factor	0.15 (Default)
Air Tightness	Default assigned based on structure type

Table 2: Existing Building Performance Values

3. JUSTIFICATION FOR DEMOLITION

The following sections outline the rationale behind the proposed demolition of the relevant existing structures as opposed to the refurbishment of same as per Section 15.7.1 of the Dublin City Development Plan. The alternative solution presented is to replace the existing structures with a high performance, Part L compliant, apartment building with minimum A3 rated dwellings throughout. These new dwellings will have considerably reduced energy consumption, increased functionality and occupancy satisfaction rates. Further information on the new build aspect of the development is included in Section 5 onwards.

There were many issues identified during the site survey, including:

- Building fabric issues/defects;
- Build quality;
- Poor ventilation rates;
- Moisture ingress/mould growth;
- Inferior product selection (Single pane windows, etc.);
- Air tightness rates;

3.1 BUILDING ENVELOPE – THERMAL PERFORMANCE

From a thermal perspective, the existing buildings were constructed in various phases during the 1950s with minimal improvements made to the envelope of the various buildings. The external façade of comprises of a standard masonry construction and a mix of double/single glazed window units. The glazing units are a significant source of heat loss. This contributes greatly to higher infiltration rates throughout the year due to poor sealing around windows, compounded by the deterioration of the glazing system over time.

The external walls were designed and constructed at a time where continuation of insulation was not considered in great detail or at the forefront of design. This, in turn, is leading to further infiltration and thermal bridging losses, which result in an increase in heat loss in addition to localised areas of draughts.

To upgrade the existing structures to Part L 2022 (NZEB) building regulation standards, the building envelope would need substantial remedial works in order to improve the internal conditions to satisfactory levels for occupants. All glazing units would need to be completely replaced with correct sealing and thermal separation to all contacting structures. Additional insulation would be required for all remaining fabric elements (wall, roof, floor, etc.) in order to further reduce unnecessary heat lost to the external environment.
The proposed new build would ensure a high-performance building façade design is adopted as Part L 2022 sets onerous building fabric performance targets. In addition, the new build would be targeting a thermal bridging factor of 0.08

$W/m^2.K$ or better, which will further reduce unnecessary heat loss.

3.2 INDOOR AIR QUALITY

Indoor environmental quality is extremely important for any occupant of a building. An inadequate indoor air environment will lead to reduced comfort conditions and help contribute to "Sick Building Syndrome". Increased indoor environmental quality will lead to a more healthy and productive environment, better internal comfort conditions as well as increased indoor air quality.

Upon inspection of the existing buildings, the ventilation is currently provided by a mix of natural ventilation methods. The openable sections in the external glazing units provide a means of ventilation. However, due to the mould problems observed on site, as well as the visible damp located at ground floor level, it is clear that adequate ventilation rates are not being achieved. In wintertime, the introduction of fresh air causes draughts, which are considered uncomfortable to occupants, so the occupant will close the window. This leads to the windows being closed for extended periods of time and results in an increase in CO_2 levels for occupants. This causes poor breathing conditions for occupants and can lead to mould/condensation issues if not correctly addressed. This issue is further compounded by the layout of the dwelling and the exposed orientation of the building, with direct sea breezes coming from a northerly direction.

The lack of fresh air being circulated throughout the building also leads to a build up of moisture. Moisture exhaled from occupants or generated by bathroom showers/washing machines, etc. can eventually lead to condensation/mould growth problems.

To ensure this is overcome in the proposed new build, it will utilise a highly efficient mechanical ventilation system. This will greatly increase air quality within the dwelling, thus increasing internal satisfaction rates for occupants.

3.3 SPACE HEATING/DOMESTIC HOT WATER PRODUCTION

Space heating is currently provided by inefficient unit heaters and electric heating of which some have no form of control (e.g. Thermostatic Valves). They are controlled manually. This allows for little control for occupants within each occupied space, greatly reducing thermal comfort. The proposed development will utilise high efficiency heat pumps in order to meet the space heating and DHW demands. The efficiencies of such systems are high and will ensure a minimum BER rating of A3 is achieved to each dwelling. The controls for the heat pump will facilitate greater occupant interaction with the heating system as well as reducing the energy requirements by allowing for greater control of each zone within the building. In addition, the use of a heat pump will supply the required renewable energy requirements (≥20%) outlined in the Part L 2022 (Dwellings) document.

4. ENERGY/CARBON STUDY

In order to establish an accurate performance benchmark for the proposed build, a Building Energy Rating (BER) assessment was carried out on sample units within the proposed new apartment building.

The existing scenario as a non domestic industrial unit cannot be assessed on a like for like basis, however it is estimated the existing building would achieve an E rating or lower based on unit type, survey details and year of construction. In comparison, the proposed new build scenario will achieve a minimum A3 BER, resulting in a considerable reduction in annual energy consumption and carbon emissions. The energy and carbon performance of both the existing and proposed scenarios are outlined in Tables 3 and 4 below.

Sample Apartment Proposed Scenario (50m²):

System	Fuel	Delivered Energy (kWh/yr)	Primary Energy (kWh/yr)	CO_2 Emissions (Kg/yr)
Main Space Heating	Electricity	281	491	63
Main Water Heating	Electricity	823	1,440	184
Pumps/Fans	Electricity	119	209	27
Energy for Lighting	Electricity	132	231	30
Total	N/A	1,355	2,371	304
Total (per m²)	N/A	27.36	47.88	6.13

Table 3: Energy and Carbon Performance – Proposed Dwelling

The above values are inclusive of the energy required for space heating, DHW production, electrical power required for fans/pumps etc as well as for lighting. In addition, 'plug and play' electrical appliances are not included in the above values, as these elements are not captured during the BER process.

4.1 EMBODIED CARBON

Whilst any form of construction will produce associated carbon emissions, the level of additional works required to retrofit the existing structures will also result in carbon emissions. As the existing structures are deemed not fit for purpose to limit carbon emissions as far as possible, several measures will be implemented as per policy CA8 of the Dublin City Development Plan.

POLICY CA8: CLIMATE MITIGATION ACTIONS IN THE BUILT ENVIRONMENT

"To require low carbon development in the city which will seek to reduce carbon dioxide emissions and which will meet the highest feasible environmental standards

during construction and occupation, see Section 15.7.1 when dealing with development proposals.".

For example, when considering new materials, those with EPD's (Environmental Product Declarations) will be prioritised and locally sourced as far as possible. Materials with high recycled content will be considered and any waste from demolition will be reviewed in relation to re-use and recycling as far as possible. To properly assess the effects this demolishment will have on the environment, it is important to identify the waste generated and to analyse the remaining life cycle of that waste.

4.1.1 EU LEGISLATION

In 2005, the Dublin region adopted a waste management plan that would set out to deliver targets that have been adopted from EU legislation and the EU "Waste management hierarchy".
The main principles of the EU directive are summarised below:

- To secure the conservation of nature and resources, waste generation must be minimised and avoided where possible (prevention principle);
- To secure a reduction in the impacts from waste on human health and the environment, especially to reduce the hazardous substances in waste, through the precautionary principle;
- To make sure that those who generate waste or contaminate the environment should pay the full costs of their actions through the principles of the polluter pays and producer responsibility;
- To secure an adequate infrastructure by establishing an integrated and adequate network of disposal facilities based on the principle of proximity and self-sufficiency.

The EU Waste management Hierarchy sets out the strategy of reducing the proportion of waste sent to landfill by using the following tiered system.

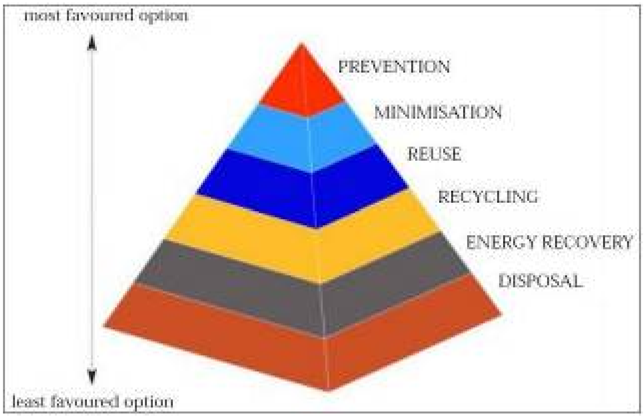


Figure 2: EU Waste Management Hierarchy

4.1.2 NATIONAL LEGISLATION

This EU directive (Directive 2008/98/EC) has been adopted at a national legislation level in the various regions. The "Dublin City Development Plan 2022-2028" sets out targets for the sustainable development of the Dublin City area. The strategy supports minimising/preventing waste and maximising material recycling, reuse and re-purposing. The plan sets out the following policies with regards to waste;

POLICY CA23: THE CIRCULAR ECONOMY

"To support the shift towards the circular economy approach as set out in a Waste Action Plan for a Circular Economy 2020 to 2025, Ireland's National Waste Policy, as updated together with The Whole of Government CircularEconomy Strategy 2022-2023".

POLICY CA24: WASTE MANAGEMENT PLANS FOR CONSTRUCTION AND DEMOLITION PROJECTS

"To have regard to existing Best Practice Guidance on Waste Management Plans for Construction and Demolition Projects as well as any future updates to these guidelines in order to ensure the consistent application of planning requirements."

4.2 ENVIRONMENTAL COST OF DEMOLITION AND REBUILD

To fully assess the environmental cost of the proposed demolition and rebuild, each waste stream must be analysed on a carbon output basis covering the demolition, transportation and end use of the material. From this, the associated environmental cost can be calculated.

The demolition of the existing buildings will be carried out by a demolition contractor (yet to be appointed). Highlighted below are some of the key points to be included within the appointed contractor's demolition works remit.

- Carry out site investigation on potentially hazardous materials contained within each structural element;
- "Soft strip" internal finishes segregating into individual materials, and recyclable and no recyclable materials. This includes fixed building services for space heating, cooling pipework, electrical equipment and cabling, etc.;
- Identify external wall build up with the intention to segregate materials that can be recycled and not recycled;
- At this point the building has been stripped to it's structural elements. All structural elements will be demolished with the purposes of reuse. Structural steel elements will be removed and recycled.

For the intended segregation, transportation and end use of all materials, a private waste management company should be employed to carry out all duties. The intended waste management company to be used in the demolition process as well as the construction stage waste is yet to be approved.

4.3 REASONS FOR DEMOLITION OVER RETROFIT

When the option of rebuild/retrofit is analysed under the environmental performance criteria, as shown above, there are areas of major work required in order to upgrade the existing structures. The energy efficiency of the existing building is poor, mainly due to the façade elements being in poor condition, using outdated products as well as being built during a time of little concern for energy awareness/usage. As a result, considerable heat loss is occurring through the fabric elements, the glazing system components, thermal bridging routes, as well as general building fabric deterioration.

Ventilation performance is also noted as being poor and inefficient. All ventilation requirements are met via openable windows, passive vents and intermittent systems. This causes issues in winter time with draughts as well as resulting in a build-up of CO_2 levels. A complete re-design of the ventilation system as well as the replacement of all ventilation equipment would be required to meet current ventilation requirements to achieve a satisfactory internal environment.

The existing building will require complete heating and ventilation re-design in order to provide a compliant, efficient residential solution and re- installation in order to meet the recommended building regulations standards for energy efficiency: TGD Part L 2022 (Dwellings & Buildings Other Than Dwellings) Conservation of Fuel and Energy – Section 2 (Existing Buildings).

5. PART L CONSERVATION OF FUEL & ENERGY – DWELLINGS

5.1. 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).

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

6.1. LOCATION OF NON-RESIDENTIAL DEVELOPMENT

The non-residential aspects of the development will consist of community/cultural space, a creche, and internal resident amenity space such as co-working space and concierge.

6.2. 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 (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 (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 (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):

One of the most significant changes made in the newer version of the new Part L 2022 document 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.;
- 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:

  - 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 2022 (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.

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 (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);
- Ventilation (what form of ventilation is used - natural ventilation, mechanical ventilation, heat recovery);
- 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 this 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.

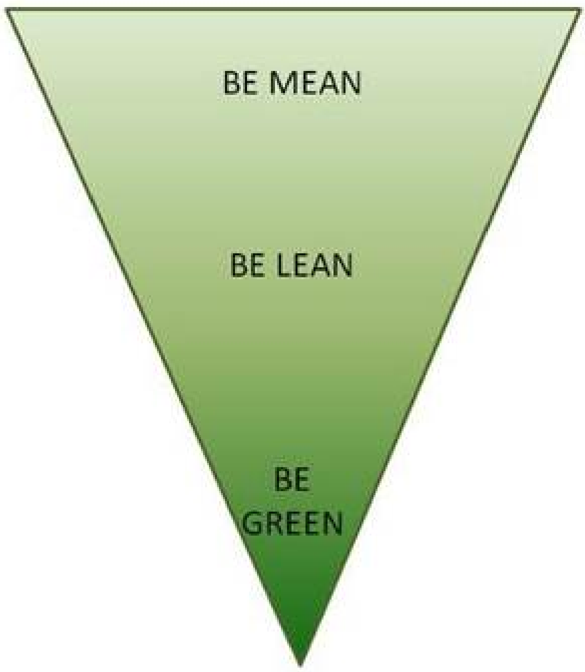


Figure 4: Energy Hierarchy Plan

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

8.1. 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.

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	Santry Avenue Large-Scale Residential Development Maximum Average Elemental U-value (W/m².K)
External Walls	0.18
Flat Roof	0.18
Ground Contact & Exposed Floor	0.18 (0.15 if underfloor heating installed)
External Windows & Doors	1.40

Table 5: Residential Building Envelope Thermal Performance Targets

Fabric Element	Santry Avenue Large-Scale Residential Development Maximum Average Elemental U-value (W/m².K)
External Walls	0.21
Flat Roof	0.18
Ground Contact & Exposed Floor	0.21 (0.15 if underfloor heating installed)
External Windows & Doors	1.40

Table 6: Non-residential Building Envelope Thermal Performance Targets

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 residential and non-residential development will both target an air permeability rate of 3 $m^3/hr/m^2$ @ 50 Pa.

Figure 5: Air Tightness Testing

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.

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 Santry Avenue large-scale 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 Santry Avenue large-scale residential 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 building 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 following space heating plant has been considered for implementation:

- Exhaust Air Heat Pumps (EAHP), or
- Electric Panel Heaters.

Domestic Hot Water: The following domestic hot water plant has been considered for implementation:

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

Ventilation: The following ventilation strategy has been considered for implementation:

- Mechanical Extract Ventilation via the EAHP, or

- Mechanical Ventilation and Heat Recovery (MVHR).

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 following space heating plant has been considered for implementation:

- Variable Refrigerant Flow (VRF) Heat Pumps.

Space Cooling: The plant options for space cooling are:

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

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

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

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

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 Santry Avenue 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.

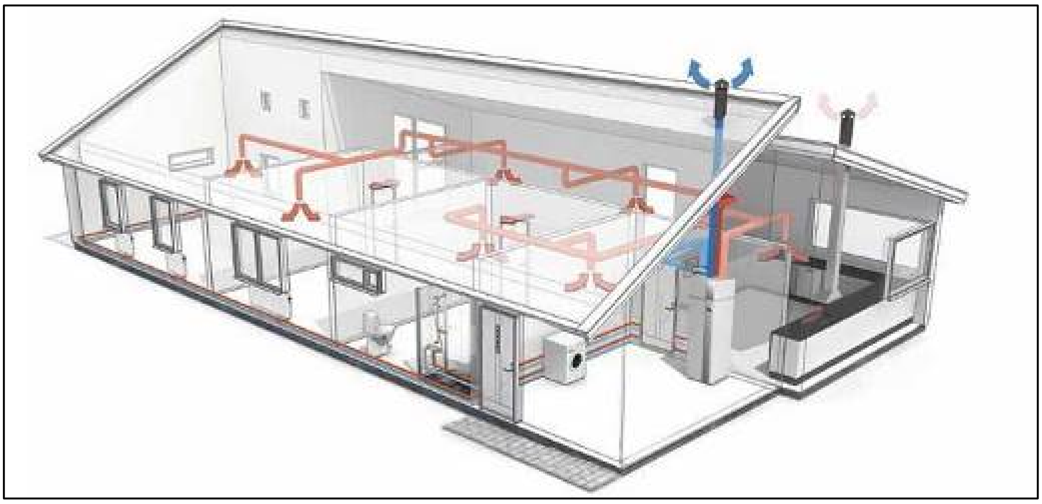


Figure 7: Example Diagram of Typical Exhaust Air Heat Pump Layout

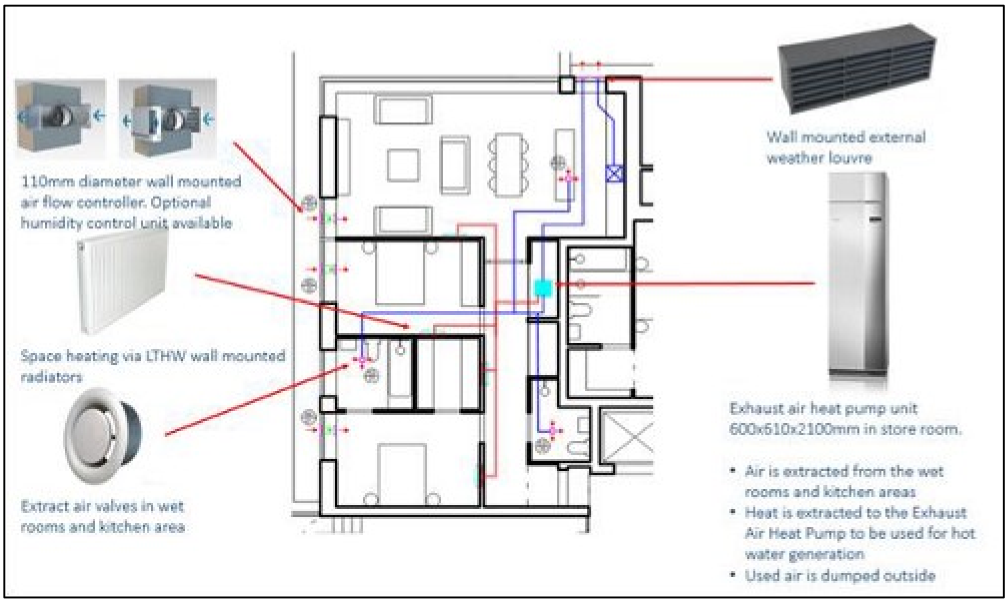


Figure 8: Example Diagram of Typical Apartment Exhaust Air Heat Pump Layout

8.3.2. EXHAUST AIR SOURCE HEAT PUMP

Air source heat pumps convert energy from the air to provide hot water for buildings. They are powered by electricity and are highly efficient. The air source heat pump proposed, pulls in external air via insulated ductwork. 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 to heat water within the dwelling.

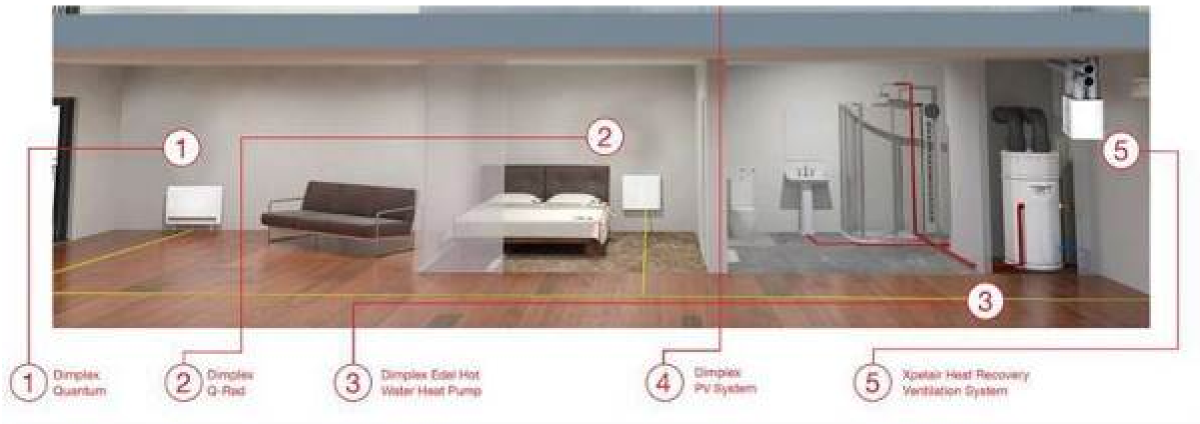


Figure 9: Typical Air-Source Heat Pump with Electric Panel Heaters Arrangement

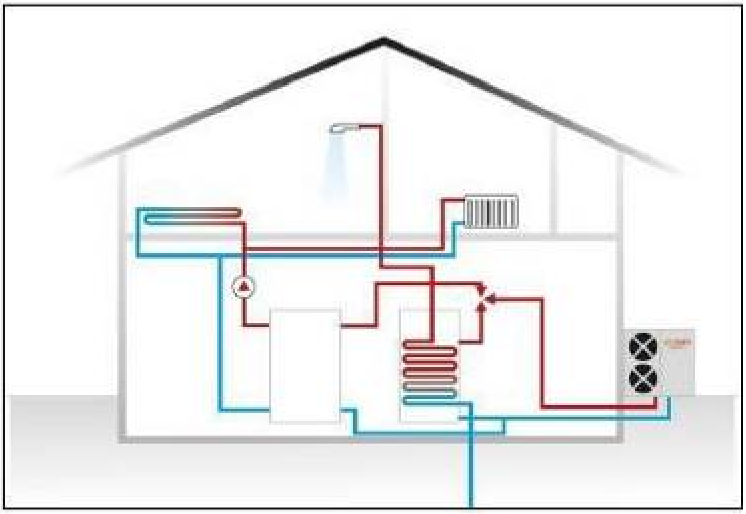
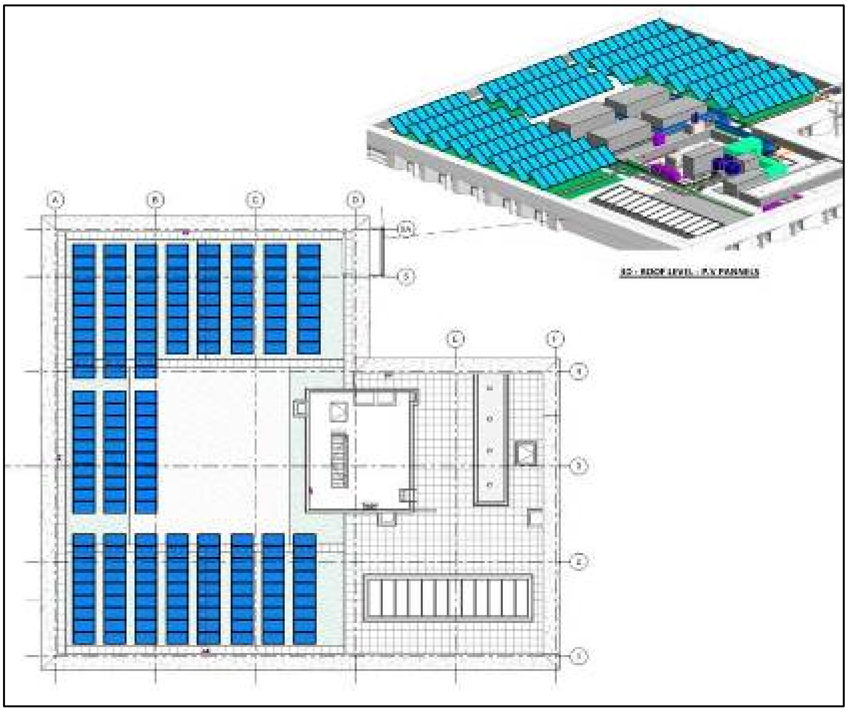


Figure 10: Air-Source Heat Pump Diagram

8.3.3. SOLAR PHOTOVOLTAICS

Photovoltaic (PV) Panels convert the solar radiation into electricity, which can be connected to the mains supply of a 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 11: Solar PV Diagram

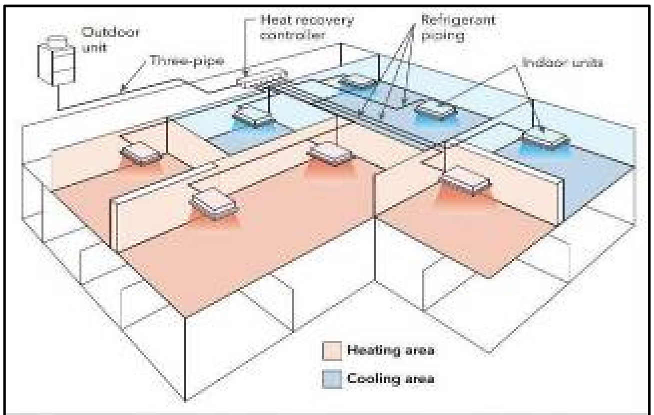
8.3.4. AIR SOURCE HEAT PUMP – NON-RESIDENTIAL

Air-Source Heat Pumps (ASHP) are deemed a renewabl energy technology under Part L 2022 (Buildings Other Tha dwellings). In heating mode, ASHPs are designed to extrac heat from the ambient outside air and release it inside th building via heat emitters. In cooling mode, the cycle reversed with heat being extracted from inside the buildin to the outside.

Figure 12: 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.



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 13: Typical VRF Schematic Diagram

9. KEY SUSTAINABLE FEATURES

The location of the Santry Avenue 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, Dublin bus stops, bicycle lanes and local car sharing locations and their proximity to the proposed development.

9.2. COMMISSIONING

To ensure efficient operation of the building 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. GREEN ROOF

Extensive green roofs are being incorporated into the design throughout. This will not only enhance the ecology value of the proposed scheme but will also form part of the SuDS design and contribute to rainwater attenuation and reducing the urban heat island effect.

9.8. 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.

10. CONCLUSION

A fully sustainable approach been adopted by the design team for the proposed Santry Avenue Large- Scale Residential Development. The first step in the analysis undertaken involved carrying out a comprehensive site survey of the property. This was in order to better understand the current condition of the property, the issues being encountered by occupants, as well as possible remedies/solutions.
There were several issues noted during this in-depth site survey, including:

- Building fabric issues/defects;
- Build quality;
- Poor ventilation rates;
- Moisture ingress/mould growth;
- Inferior product selection (Single pane windows, etc.);
- Air tightness rates;

As a result of the above points, as well as the detailed analysis carried out on the existing scenario, a proposed entirely new dwelling was further investigated.

The design of the of the proposed building followed the 'Energy Hierarchy Plan', as outlined previously in Section 8. The optimised approach is based on the following core values:

Be Mean, Be Lean, Be Green.

Be Mean

- For the fabric elements, 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 centralised 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 heat pumps will be considered for implementation;

As highlighted previously within Section 4, a full re-assessment of the proposed development was modelled within the DEAP software. The results of this analysis concluded that within the sample apartment, there is an expected significant drop of primary energy consumption and carbon emissions.

As a result of this reduction in both primary energy consumption and associated carbon emissions, a minimum Building Energy Rating (BER) of A3 for each individual dwelling is currently targeted for the proposed development. In addition, Part L (2022) compliance will also be shown to be achieved through the specification of high-performance façade elements, the proposed mechanical ventilation strategy as well as the high efficiency heating systems. Taking the above into account, it can be confirmed that the demolition of certain existing buildings and the replacement of these with new buildings will allow energy and sustainability targets to be more feasibly attained. It should also be noted that none of the buildings proposed for demolition are protected structures.

This report confirms that if the energy and sustainability strategy is successfully implemented, the proposed Santry Avenue Large-Scale Residential Development will satisfy all Part L and BER requirements.