Climate Action Energy Statement

Cherry Orchard Residential Development.

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Comments

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Content

1. Introduction

Waterman Moylan Engineering Consultants have been appointed by The Land Development Agency (LDA) to prepare this Energy Efficiency and Climate Change Adaptation Design Statement as part of the planning documentation for a proposed residential development on lands at Site 4, Cherry Orchard.

The proposed development (GFA of c. 66,399sqm) involves the construction of a residential led mixed use scheme across 16 blocks contained within 9 buildings ranging in height from 4 to 15 storeys. The development includes the provision of 708no. residential apartments comprising 547no. cost rental and 161no. social / affordable units (28no. studio units, 263no. one-bed units, 368no. two-bed units and 49no. three-bed units, together with a convenience retail supermarket (2,523sq.m GFA), 7no. retail / commercial units (totalling 373sq,m GFA), community, arts and cultural spaces delivered across 13no. community and arts / cultural units (totalling 1,222sq.m GFA), and associated external events space and community gardens (1,157sq.m) and a childcare facility (672sq.m GFA) with associated external playing space (200sq.m) and all ancillary accommodation including sub stations, plant, refuse stores, cycle stores, and metre / comms rooms. The proposed development also includes the provision of landscaped public open space of 6,123 sq. m. including a public plaza, play space, outdoor fitness trail, communal amenity space of 5,596 sq. m. Private open space for the apartment units is achieved through the provision of balconies or terraces for all individual apartments.

The proposed development will also involve the provision of sufficient car parking (including accessible car parking) and bicycle parking spaces at undercroft and surface level throughout the development. The development will also provide for all associated ancillary site development infrastructure including site clearance, boundary treatment, associated public lighting, internal roads and pathways, ESB substations, switch room, water tank rooms, storage room, meter room, sprinkler tank room, comms room, bin storage, bicycle stores, green roofs, hard and soft landscaping, play equipment, attenuation area, green and blue infrastructure including green roofs, PV panels and all associated works and infrastructure to facilitate the development including connection to foul and surface water drainage and water supply. Please refer to the statutory notices for full and complete description of the proposed development

This report identifies the energy standards with which the proposed development will have to comply and also sets out the overall strategy that will be adopted to achieve these energy efficiency targets.

The dwellings will be required to minimise overall energy use and to incorporate an adequate proportion of renewable energy in accordance with Building Regulations Part L 2022, Conservation of Energy & Fuel (hereinafter referred to as "*Part L 2022 Dwellings*").

Furthermore, the development will have to comply with the requirements of the Dublin City Council Development Plan 2022-2028.

2. Building Regulations Part L 2022 Dwellings

Compliance with Building Regulations *Part L 2022 Dwellings* is broken down into six distinct categories, known as Regulation 8; parts (a) to (f).

A summary of each of these parts as listed in Technical Guidance Document L 2022 is provided below together with a description of what is required to demonstrate compliance and suggested routes to meeting the required standards.

2.1 Regulation 8 Part (a)

The regulation requires that:

> *Providing that the energy performance of the building is such as to limit the calculated primary energy consumption and related carbon dioxide (CO2) to that of a nearly zero energy building within the meaning of the Directive insofar as is reasonably practicable.*

Part (a) is the overarching compliance target which stipulates the required overall reduction in energy consumption and carbon emissions for new dwellings.

This requires that the energy consumption and carbon emissions of every dwelling is assessed using the DEAP software and that reductions of 70% in energy consumption and 65% in carbon emissions are achieved. The baseline against which this reduction is to be measured is considered to be a dwelling which is constructed to perfectly comply with the 2005 version of Building Regulations Part L.

The ratio of the energy consumed by the proposed dwelling to a similar dwelling constructed to 2005 energy efficiency standards is referred to as the “Energy Performance Co-efficient”.

2.2 Regulation 8 Part (b)

The regulation requires that:

> *Providing that, the nearly zero or very low amount of energy required is covered to a very significant extent by energy from renewable sources, including energy from renewable sources produced on-site or nearby;*

This requires that all new dwellings are provided with a renewable energy source. The regulations state that 20% of the total energy consumed within the dwelling must be provided from renewable thermal sources (solar thermal, biomass, heat pumps) or renewable electrical sources (Photovoltaic, Micro-wind).

In practical terms, for a multiple unit development, this requirement is usually met by incorporating PV panels at roof level, incorporating air source heat pump technology or by adding an element of biomass or micro-Combined Heat & Power (CHP) to a district heating scheme.

Where CHP is included, the renewable energy is considered to be the waste heat which is generated as a by-product of the electricity produced. Specific calculation methods are set out within TGD *Part L 2022 Dwellings* which detail how compliance should be demonstrated.

2.3 Regulation 8 Part (c)

The regulation requires that:

> *Limiting heat loss and, where appropriate, availing of heat gain through the fabric of the building;*

This requires that the fabric of the building is designed to minimise heat loss from the building and that the air permeability of the structure limits the unwanted passage of air into the building.

Typical compliant U-Values are as follows.

Pitched roof	0.16 W/m^{2}K
Flat roof	0.20 W/m^{2}K
Walls	0.18 W/m^{2}K
Floor	0.18 W/m^{2}K
Windows	1.4 W/m^{2}K

The u-values of individual elements can be relaxed if required provided that compensatory measures are taken on other elements and that the overall area weighted u-value for the entire dwelling is the same as it would have been if all individual elements had complied.

The thermal bridging details of junctions in the envelope of the building (floor-wall; wall-window; wall-roof, etc) must also be designed and constructed in accordance with the guidance set out in Limiting Thermal Bridging and Air Infiltration – Acceptable Construction Details

Every dwelling must also be subjected to an air pressure test to determine the air tightness. All dwellings must achieve and air tightness of less than 5m^3/m^2/hour when tested at 50 Pascals. In multiple dwelling developments with repeating apartment types, testing can be conducted on a representative sample of units in accordance with Table 1.5.4.3 of TGD *Part L 2022 Dwellings*.

2.4 Regulation 8 Parts (d & e)

The regulation requires that:

> *Providing and commissioning energy efficient space and water heating systems with efficient heat sources and effective controls;*
>
> *Providing that all oil and gas fired boilers shall meet a minimum seasonal efficiency of 90%;*

These require that gas or oil-fired boilers are at least 90% efficient and that heating controls allow independent time control of the heating (2 zones for dwellings larger than 100m^2) and hot water. Heating in each zone should also be controlled by room thermostats (in the case of heating) and cylinder stats (in the case of hot water).

2.5 Regulation 8 Parts (f)

The regulation requires that:

> *Providing to the dwelling owner sufficient information about the building, the fixed building services 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.*

This requires that information is provided to the dwelling owner which relates to the effective and efficient operation of the systems installed in that dwelling. Instructions on how to control the heating & hot water systems based on time and temperature requirements.

2.6 Requirements for Common Areas

Section 0.1.2.3 requires that:

Where a new dwelling forms part of a larger building, the guidance in this document applies to the individual dwelling, and the relevant guidance in Technical Guidance Document L - Conservation of Fuel and Energy – Buildings other than dwellings applies to the non-dwelling parts of the building

2.7 L2A & S.I No 393 of 2021 Regulation 5 Part (f) – Electric Vehicle Charging

The regulation requires that:

> *(a) A multi-unit building containing one, or more than one, dwelling that is new shall have installed ducting infrastructure (consisting of conduits for electrical cables) for each car parking space, to enable the subsequent installation of recharging points for electric vehicles where the parking space is:*
>
> > *(i) located inside the building concerned, or*
> >
> > *(ii) is within the curtilage of the building concerned.*
>
> *(c) A new building that is a dwelling, other than where the dwelling forms part of a multi-unit building, where a parking space is located within the curtilage of the dwelling, shall have installed appropriate electric vehicle recharging infrastructure to enable the subsequent installation of recharging points for electric vehicles.*

This requires that ducting provision for the future installation of car charging point be made in all carparks with more than 10 parking spaces associated with multi-unit residential buildings. It also requires that individual / own-door dwellings which have on curtilage parking are provided with ducting infrastructure to allow the future installation of e-car charging.

3. DCC Development Plan Objectives & Policies

Chapter 3 of The Dublin City Development Plan 2022-2028 sets out a number of policies in relation to energy in use in proposed developments and the potential use of district heating / waste heat networks. The policies relevant to the proposed development at Cherry Orchard are set out below and are addressed in following chapters of this report.

3.1 CA10 Climate Action Energy Statements

All new developments involving 30 residential units and/or more than 1,000 sq. m. of commercial floor space, or as otherwise required by the Planning Authority, will be required to submit a **Climate Action Energy Statement** as part of the overall Design Statement to demonstrate how low carbon energy and heating solutions, have been considered as part of the overall design and planning of the proposed development.

3.2 CA15 Waste Heat, District Heating and Decentralised Energy

To actively encourage the development of low carbon and highly efficient district heating and decentralised energy systems across the city utilising low carbon heat sources such as renewable energy and waste heat recovery and to promote the connection of new developments to district heating networks where such systems exist/can be developed in a given area.

3.3 CA17 Supporting the Potential of District Heating in Dublin City

To support the potential of district heating in Dublin City, all Climate Action Energy Statements submitted to the Council (see Policy CA10) shall include an assessment of the technical, environmental and economic feasibility of district or block heating or cooling, particularly where it is based entirely, or partially on energy from renewable and waste heat sources.

In addition:

- Climate Action Energy Statements for significant new residential and commercial developments in Strategic Development and Regeneration Areas (SDRAs), will assess the feasibility of making the development 'district heating enabled' in order to facilitate a connection to an available or developing district heating network in the area.

- Climate Action Energy Statements for significant new residential and commercial developments in the Docklands SDRA will assess the feasibility of making the development 'district heating enabled' in order to facilitate a connection to the Dublin District Heating System.

3.4 Development Plan - Chapter 15

In addition to the specific policies set out above from Chapter 3 of the development plan, Chapter 15 provide further guidance regarding the use of district heating networks.

Development Plan 15.7.3 - Climate Action and Energy Statement

In order to comply with the policies set out in Section 3.5.2 'The Built Environment' and Section 3.5.3 'Energy' of Chapter 3, proposals for all new developments in excess of 30 or more residential units or 1,000 sq. m. or more of commercial floor space, or as or as otherwise required by the Planning Authority, will be required to include a Climate Action Energy Statement.

The purpose of this statement is to demonstrate how low carbon and low energy heating solutions have been considered as part of the overall design and planning of the proposed development. Having regard to the above, the statement, which shall be prepared by a certified engineer, shall address:

- the technical, environmental and economic feasibility of on-site renewable energy generation including solar PV and small scale wind power
- the technical, environmental and economic feasibility of at a minimum, the following high-efficiency alternative energy supply and heating systems
- decentralised energy supply systems based on energy from renewable and waste heat sources
- co-generation (combined heat and power)
- district or block heating or cooling, particularly where it is based entirely or partially on energy from renewable and waste heat sources
- heat pumps
- include an assessment of embodied energy impacts.

Development Plan 15.7.3.1 - District Heating Enabled' Development

In addition to the requirements set out above, Climate Action Energy Statements for significant new residential and commercial developments in SDRAs, will be required to investigate local heat sources and networks, and, where feasible, to demonstrate that the proposed development will be 'District Heating Enabled' in order to facilitate a connection to an available or developing district heating network.

The proposed development at Cherry Orchard is within SDRA 4 Park West/Cherry Orchard and, as such, the requirement to conduct the feasibility assessment outlined above shall apply to this site.

Any such investigation should have regard to the heat demand density of the area in which the proposed development is located.

Where it is not feasible for a development to be district heat enabled, the statement must provide a clear explanation as to why this is would not be the case, and must also demonstrate that the proposed development offers a similarly efficient and low carbon energy and heating solution.

For the avoidance of doubt, for a development to be 'District Heating Enabled', it should incorporate an efficient, low carbon building heat network, and/or a block communal heating network, in order to facilitate a future connection to a district heating network, without the need for significant additional retrofitting.

To this end, 'DH Enabled' development should provide for:

- an efficient, centralised, wet-based heat network within the building or within the area of the development as a whole (as appropriate);
- the allocation of sufficient space in plant rooms to accommodate suitable district heating equipment, such as heat exchangers etc.;
- the provision and safeguarding of suitable pipe routes throughout the building and complex;
- the provision and safeguarding of suitable district heating network connection routes at and beyond the site boundary

4. Building Fabric

Before considering efficient building services or renewable energy systems, the form and fabric of a building must be assessed and optimised so as to reduce the energy demand for heating, lighting and ventilation. Target performance levels have been identified by the design team and are presented below in Table 4.1.

4.1 Elemental U-Values

The U-Value of a building element is a measure of the amount of heat energy that will pass through the constituent element of the building envelope. Increasing the insulation levels in each element will reduce the heat lost during the heating season and this in turn will reduce the consumption of fuel and the associated carbon emissions and operating costs.

It is the intention of the design team to exceed the requirements of the building regulations. Target U-Values are identified below.

U-Values	**Range of Target Values Proposed**	**Part L 2022 (Dwellings) Compliant Values**	**Part L 2022 (BOTDI) Compliant Values**
Floor	0.10 to 0.18 W/m^{2}K	0.18W/m^{2}K	0.21W/m^{2}K
Roof (Flat)	0.12 to 0.20 W/m^{2}K	0.20 W/m^{2}K	0.20 W/m^{2}K
Roof (Pitched)	0.10 to 0.16 W/m^{2}K	0.16 W/m^{2}K	0.16 W/m^{2}K
Walls	0.10 to 0.18 W/m^{2}K	0.18 W/m^{2}K	0.21 W/m^{2}K
Windows	0.9 to 1.4 W/m^{2}K	1.4W/m^{2}K	1.6W/m^{2}K

Table 4.1 – Proposed Building Fabric Performance Levels

4.2 Air Permeability

A major consideration in reducing the heat losses in a building is the air infiltration. This essentially relates to the ingress of cold outdoor air into the building and the corresponding displacement of the heated internal air. This incoming cold air must be heated if comfort conditions are to be maintained. In a traditionally constructed building, infiltration can account for 30 to 40 percent of the total heat loss, however construction standards continue to improve in this area.

With good design and strict on-site control of building techniques, infiltration losses can be significantly reduced, resulting in equivalent savings in energy consumption, emissions and running costs.

In order to ensure that a sufficient level of air tightness is achieved, air permeability testing will be specified in tender documents, with the responsibility being placed on the main contractor to carry out testing and achieve the targets identified in the tender documents.

A design air permeability target of **3 m^3/m^2/hr** has been identified for the dwellings on the site. This performance level is a 40% improvement on the target of **5 m^3/m^2/hr** identified in TGD Part L 2022.

The air permeability testing will be carried out in accordance with IS EN 9972:2015 ‘Thermal Performance of Buildings” and CIBSE TM23: 2000 ‘Testing buildings for air leakage”

4.3 Thermal Bridging

Thermal bridges occur at junctions between planar elements of the building fabric and are typically defined as areas where heat can escape from the building fabric due to a lack of continuity of the insulation in the adjoining elements.

Careful design and detailing of the manner in which insulation is installed at these junctions can reduce the rate at which the heat escapes. Standard good practice details are available and are known as Acceptable Construction Details (ACDs). Adherence to these details is known to reduce the rate at which heat is lost.

The rate at which heat is lost is quantified by the Thermal Bridging Factor of the dwelling and measured in W/m2K. The Thermal Bridging Factor is used in the overall dwelling Part L calculation, this value can be entered in three different ways:

0.15W/m^2K	Used where the ACDs are not adhered to
0.08W/m^2K	Used where the ACDs are fully adhered to
< 0.08 W/m^2K	Used where the thermal details are thermally modelled and considered to perform better than the ACDs

It is intended that the ACDs will be adhered where suitable benchmarks exist and/or that thermal modelling will be carried out for any non-standard junction details within proposed development.

5. Heat Sources & Renewable Energy Options

As set out in Section 2 of this report, Part L of the building regulations requires that all new residential buildings must meet overall energy performance levels (as defined by the Energy Performance Coefficient - EPC) and must have a portion of their annual energy demand provided by renewable energy sources.

The renewable energy source can be thermal energy such as solar thermal collection, biomass boilers or heat pumps or it can be electrical energy as generated by photovoltaic solar panels or wind turbines. The minimum renewable energy contributions defined in Part L 2022 Part (b) is 20% of the total energy consumption for the dwelling.

Furthermore, as set out in Section 3 of this report, the development must comply with the requirements of the Dublin City Council Development Plan 2022- 2028, regarding the choice of energy systems and the methods used to assess each system.

5.1 Heating Source Options

In order to comply with the requirements of the Development Plan, a detailed feasibility assessment has been carried by Waterman Moylan to investigate the options available to meet the heating and hot water demands of the site and to assess the feasibility of (a) implementing a district heating solution or (b) delivering a site which is “district heating enabled”.

A copy of the full report which details the findings of this study has also been submitted with the planning application for this development. A description of the systems considered within the study are summarised below along with an overview of the findings of the study presented in Section 6.

5.1.1 Option 1 - Connection to a Third-Party Off-Site District Heating Network

This approach would involve the installation district heating pipework throughout the scheme to distribute the heat generated by a third-party off-site district heating network. Each apartment would be served via a heat interface unit (HIU). The HIU will both control and meter the consumption of heat and hot water within each individual dwelling allowing occupants to set the times they need space heating and ensuring they are charged accordingly.

The source of heat for the third-party district heating network could be waste heat from nearby commercial or industrial systems such as data centres, or from municipal geothermal heat sources.

5.1.2 Option 2 - On-Site District Heating

This approach would involve the generation of heat in a central location on the site and the distribution of this heat to each apartment via a network district heating pipework. The central plant used to generate the heat could include either Air Source Heat Pumps, Combined Heat and Power (CHP) plant, high efficiency gas fired condensing boilers, or, a combination of all of these systems.

The large Air Source Heat Pumps (ASHPs) operate in the same manner as the smaller units incorporated in houses or apartments but at a larger scale. They utilise grid supplied electricity to extract thermal energy from a heat source, in this case, the ambient air. While the electricity consumed is not renewable energy, the efficiency at which a heat pump operates allows a significant portion of the heat delivered be considered as renewable. Typically, approximately 40% to 50% of the heat supplied is considered to be renewable energy

A CHP unit uses gas as its energy source to create electricity which can be utilised within the proposed development. This process of creating electricity results in the generation of “waste heat” which can then be used to meet a proportion of the heating and hot water demands of the housing development. Since the waste heat is captured it can be considered to be renewable energy and therefore contributes towards the overall 20% renewable energy requirement.

The gas fired boilers can be provided to top-up the heat produced by the CHP and heat pumps by raising the temperature of district heating system to the required level and by supplementing the overall heat production in the coldest periods of the year.

Two distinct options were considered for the delivery of an on-site district heating network:

The first (**Option 2A)** included central plant made up of a combination of heat pumps, CHPs and gas boilers.

The 2nd approach **(Option 2B)** assumed that no fossil fuels would be consumed on site that heat pumps would provide the majority of heat on the site, with the possible addition of direct acting electric boilers.

Heating pipework will be installed throughout the scheme to distribute the heat generated in the plant room throughout the apartment development, serving each apartment via a heat interface unit (HIU). The HIU will both control and meter the consumption of heat and hot water within each individual dwelling allowing occupants to set the times they need space heating and ensuring they are charged accordingly.

5.1.3 Option 3 –Exhaust Air Heat Pumps

Exhaust Air heat pumps (EAHPs) operate in a very similar manner to the more conventional air source heat pumps and utilise grid supplied electricity to extract thermal energy from a heat source, in this case, the internal air within the apartment. The internal air is extracted from kitchens and wet rooms and is drawn into the heat pump via ductwork in the ceiling void. The heat pump extracts heat from this air before expelling it from the apartment.

As noted in Section 4.2 above, the electricity consumed is not renewable energy but the efficiency at which a heat pump operates allows a significant portion of the heat delivered to the dwelling be considered as renewable.

There are a number of manufacturers offering products of this type and the certified seasonal efficiencies of some models can exceed 450% in heating mode and 170% to 190% in hot water mode. These efficiencies can deliver Part L 2022 compliance in most circumstances but in some instances may need supplementary PV panels in order to meet the required energy targets.

There is no requirement for a separate Mechanical Extract Ventilation (MEV) systems when an exhaust air heat pump is used as the heat pump draws the air from all wet rooms in the same manner as an MEV system would. The fan will run continuously to ensure that the minimum ventilation rates are maintained and the supply air to the dwelling is provided through trickle vents in each habitable room.

5.1.4 Option 4 –Exhaust Air Heat Pumps + District Heating Enabled

As set out in the Development Plan, the feasibility of delivering a scheme which is “district heating enabled” must also be assessed. In this regard, the study investigated the technical and economic feasibility of including measures to enable future connection to a third-party off site district heating network.

5.2 Apartment Corridors/Landlord Areas

In accordance with the requirements of Part L 2022, the common areas within the apartment blocks are required to meet the requirements of Part L 2022 for “Buildings Other Than Dwellings”. Under Part L 2022, a portion (10% to 20%) of the energy demand of the common areas must be met by a renewable energy source. The energy demand within these spaces will be exclusively provided by electrical energy (lighting, space heating & lifts etc) so a photovoltaic array would be best suited to meet this renewable energy demand.

5.3 Electric Vehicle Charging Facilities

The measures that will be included to facilitate the charging of electric vehicles will be in accordance with the DCC Development Plan 2022-2028 and shall exceed the minimum requirements identified in TGD Part L 2022.

The provisions included shall be two-fold:

- Of the total 444 parking space provided in the proposed development, a total of 222 spaces shall be provided with functioning charging facilities for electric vehicles (50%)
- The remaining 222 spaces shall be provided with ducting to facilitate the installation of the relevant infrastructure to accommodate future EV charging(50%).

5.4 Embodied Carbon Assessment

The DCC Development Plan 2022-2028 notes that the Climate Action Energy Plan should also include an assessment of the embodied carbon impacts of a proposed low energy heating solutions proposed.

The calculation and assessment of the embodied carbon of various aspects of the a building’s fabric and structure have become more common in recent years, there are less well established methods for assessing the embodied carbon of mechanical and electrical systems within buildings. This is primarily due to the difficulty in determining the embodied carbon in items of plant or equipment, which themselves are often constructed from numerous other sub-components.

CIBSE TM65 has been published by the Chartered Institute of Building Services Engineers in an attempt to address this, however even within this document it is noted that the assessment of embodied carbon for mechanical and electrical building services is very difficult.

The approach proposed within CIBSE TM65 is based on 3 possible metrics, in order of preference (and accuracy) these are:

1. Environmental Product Declarations (EPDs)
2. Manufacturer Form Section A & B (allowing “mid-level” calculation)
3. Manufacturer Form Section A only (allowing “basic” calculation)

However, as this approach is relatively new (TM65 was first published in 2021) few manufacturers of equipment have yet implemented the use of EPDs and use of Manufacturer Forms is also in it’s infancy, meaning that there is little information available.

At planning stage of a project, no decisions have yet been made on the specific equipment suppliers or manufacturers so there is no means of having “Manufacturer Forms” completed. Therefore, as illustrated in Figure 4.2 in TM65 (reproduced below) it is not possible to carry out any calculations on embodied carbon for the systems being considered.

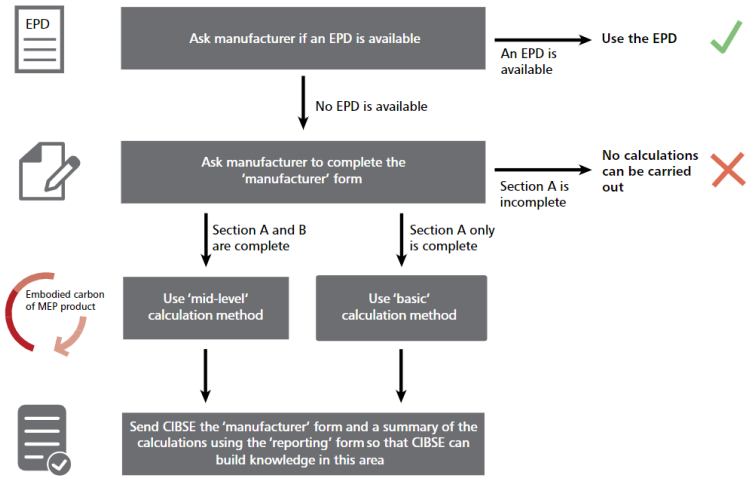

Figure 4.2 Steps taken to understand the embodied carbon impact of a MEP product

6. Study Findings

The preceding sections of this report set out the regulatory requirements with which the scheme will have to comply while identifying a number of technologies and design approaches that may be utilised to achieve compliance.

Option 1 offer the best performance in terms of carbon emissions and running costs and is expected to have capital costs that are in line with the most cost effective alternative solutions. However as there are no known third-party off-site district heating networks available for connection to the site this option must be discounted.

Option 2A is the only proposed solution that involves the longer term use of fossil fuels on site. The analysis shows that **Option 2A** will have a higher running costs and higher carbon emissions than alternative approaches unless the third-party network is available within 12 years of occupancy. The capital costs for Option 2A are also estimated ot be 18% higher than those for the most cost effective alternative systems. Therefore, based on a combination of factors, this option must be discounted.

Option 2B involves the use of an on-site district heating system utilising only air source heat pumps. At the time of writing this report, it is unclear if large commercial heat pumps can be correctly accounted for within the regulatory compliance procedures set out by the SEAI for residential developments and this may present compliance problems for the development if this approach were to be adopted. The analysis shows that **Option 2B** will have a higher running costs than the counterfactual system and will have higher carbon emissions than the counterfactual system unless the third-party network is available within 21 years of occupancy. The capital costs for **Option 2B** are also 17% higher than those for alternative systems. Therefore, based on a combination of factors, this option must be discounted.

Option 3 involves the use of individual heat pumps within each residential unit and is therefore the same as the counterfactual scenario. This option is seen to have the lower carbon emissions than Option 2A and Option 2B if the third-party off-site network does not become available within 12 years and 21 years respectively. It is also shown to have lower running costs from the outset. It is for this reason that Option 3 has been identified as the most advantageous system for the site, both in terms of carbon performance and economic feasibility.

The assessment then considered the impacts that including a **District Heating Enabled Option** would have on the performance of the scheme. As this would include the exact same as those in the Option 3, the performance in terms of running costs and carbon emissions would be identical. The capital costs of the **active systems** installed on Day 1 are also identical however there would be significant additional costs associated with the provision of additional plant space, below ground heating pipework, space within each building for DHS sub-stations and the installation of pipework within the common areas of each apartment block. The costs associated with this additional installation is significant with an estimated cost uplift of 35% over the counterfactual scenario. This would add approximately € 6,000 to the cost of each apartment.

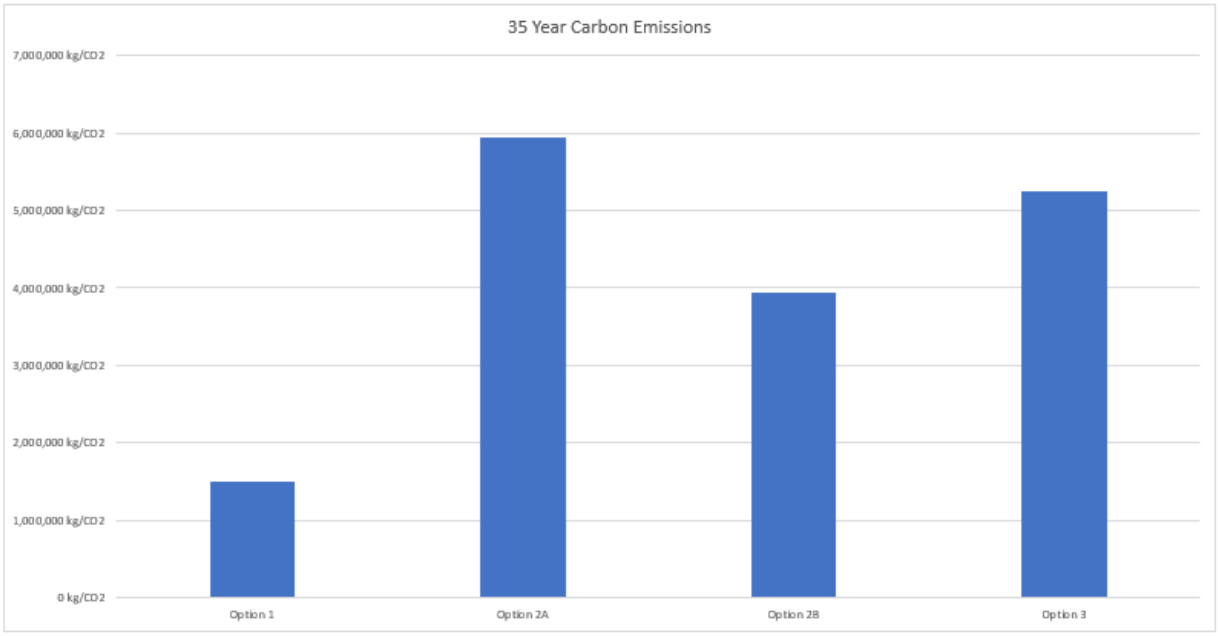

*Figure 6.1 – Carbon Emissions of 4 assessed systems assuming a low carbon Third Party Off Site District Heating Network is available within **10 years** of site completion.*

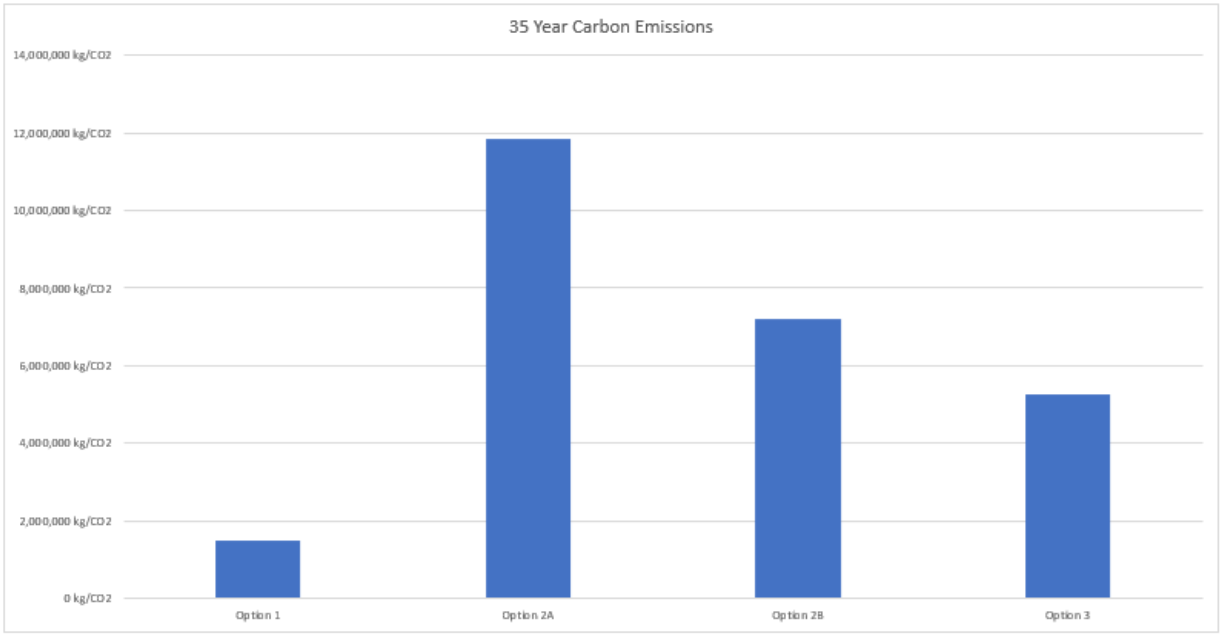

*Figure 6.2 – Carbon Emissions of 4 assessed systems assuming **no low carbon Third Party Off Site District Heating Network becomes available during the first 35 years of site operation.***

7. Recommendations

A detailed feasibility study was completed to determine the technical, environmental and economic feasibility of connection to an existing or planned low carbon off-site district heating solution. Alternatively, where no such network exists, the study is required to to demonstrate that, where feasible, the proposed development will be 'District Heating Enabled' in order to facilitate a connection to an available or developing district heating network.

The findings of the study are as follows:

- There is no existing third-party off-site heat network within the vicinity of the site
- Discussions with DCC and Codema have revealed that there are currently no plans to develop a district heating network in the vicinity of the site
- Analysis of the option of introducing an on-site district heating network have shown that carbon emissions associated with on on-site district heating network have the potential to be lower than using individual heat pumps but only if a low carbon off-site district heating network was to become available between 12 and 21 years after occupancy.
- Operational cost analysis has shown that the provision of individual heat pumps within each unit on the site offers the most economically advantageous solution for residents of the site on the basis of Year 1 operation, regardless of whether a district heating connection becomes available.
- Capital cost analysis of the 4 proposed solutions indicate that the provision of individual heat pumps within each unit on the site offers the most economically advantageous solution for the site.
- The approach involving the use of individual heat pumps within each apartment is considered to be the most beneficial solution in terms of carbon emissions and running costs.
- The addition of measures to make the site "district heating enabled" will add significant costs to the project. They do not align with the overall cost plan for the project and are not considered to be feasible.

It is recommended that the heating, hot water and renewable energy strategy for the be based on individual heat pumps within each apartment and that no provisions be made to make the site district heating enabled.

UK and Ireland Office Locations