# The Donore Project

## Mechanical & Electrical Report

The Land Development Agency

Project number: 60648061
STG-AEC-S1b-00-XX-RE-ME-0000001

November 2022

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## Quality information

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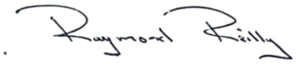
|  |  |  |  |
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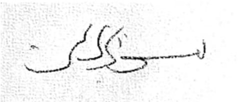

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## Revision History

| Revision | Revision date | Details | Authorized | Name | Position |
|---|---|---|---|---|---|
| P1 | 18/11/2022 | For Planning | RR | Raymond Reilly | Regional Director |
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## Table of Contents



## Figures

# 1. Introduction

The Land Development Agency, intend to apply to An Bord Pleanála for a ten-year permission under Part X (Section 175) of the Planning & Development Act 2000, as amended, for a residential development at a site located on the former St. Teresa's Gardens, Donore Avenue, Dublin 8. The site is bound by Donore Avenue to the north-east, Margaret Kennedy Road to the north-west, The Coombe Women & Infants University Hospital to the west, the former Bailey Gibson factory buildings to the south-west, and the former Player Wills factory to the south-east. The development will consist of the construction of a residential scheme of 543 no. apartments on an overall site of 3.26 ha.

The development (GFA of c. 53,234 sqm) contains the following mix of apartments: 225 No. 1 bedroom apartments (36 no. 1-person & 189 no. 2-person), 274 No. 2 bedroom apartments (including 52 No. 2 bed 3 person apartments and 222 No. 2 bed 4 person apartments), 44 No. 3 bedroom 5-person apartments, together with retail/café unit (168 sq.m.), mobility hub (52 sq.m.) and 952 sq.m. of community, artist workspace, arts and cultural space, including a creche, set out in 4 No. blocks.

The breakdown of each block will contain the following apartments:

- Block DCC1 comprises 111 No. apartments in a block of 6-7 storeys;
- Block DCC 3 comprises 247 No. apartments in a block of 6-15 storeys;
- Block DCC5 comprises 132 No. apartments in a block of 2-7 storeys;
- Block DCC6 comprises 53 No. apartments in a block of 7 storeys;

The proposed development will also provide for public open space of 3,408 sqm, communal amenity space of 4,417 sqm and an outdoor play space associated with the creche. Provision of private open space in the form of balconies or terraces is provided to all individual apartments.

The proposed development will provide 906 no. residential bicycle parking spaces which are located within secure bicycle stores. 5% of these are over-sized spaces which are for large bicycles, cargo bicycles and other non-standard bicycles. In addition, 138 spaces for visitors are distributed throughout the site.

A total of 79 no. car parking spaces are provided at undercroft level. Six of these are mobility impaired spaces (2 in each of DCC1, DCC3 & DCC5). 50% of standard spaces will be EV fitted. Up to 30 of the spaces will be reserved for car sharing (resident use only). A further 15 no. on-street spaces are proposed consisting of:

- 1 no. accessible bay (between DCC5 & DCC6)
- 1 no. short stay bay (between DCC5 & DCC6)
- 1 no. crèche set-down / loading bay (between DCC5 & DCC6)
- 1 no. set-down / loading bay (northern side of DCC5)
- 1 no. set-down/loading bay (northern side of DCC 3)
- 10 no. short stay spaces (north-east of DCC1)

In addition, 4 no. motorcycle spaces are also to be provided.

Vehicular, pedestrian and cyclist access routes are provided from a new entrance to the north-west from Margaret Kennedy Road. Provision for further vehicular, pedestrian and cyclist access points have been made to facilitate connections to the planned residential schemes on the Bailey Gibson & Player Wills sites for which there are extant permissions (Ref. No.'s ABP-307221-20 & ABP-308917-20).

The development will also provide for all associated ancillary site development infrastructure including site clearance & demolition of boundary wall along Margaret Kennedy Road and playing pitch on eastern side of site and associated fencing/lighting, the construction of foundations, 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, boundary walls, attenuation area and all associated works and infrastructure to facilitate the development including connection to foul and surface water drainage and water supply.

# 2. Existing and Proposed Utility Connections

## 2.1 Natural Gas & Mains Water

Gas infrastructure is evident through the centre of and around the site boundary. As part of the early development works and in conjunction with Gas Networks Ireland a new gas service will be connected to the main line passing through the site to serve the Centralised Plantroom. The existing GNI service passing through the site will need to be adapted and modified as required.

For details of the water mains network please refer to the Infrastructure Report.

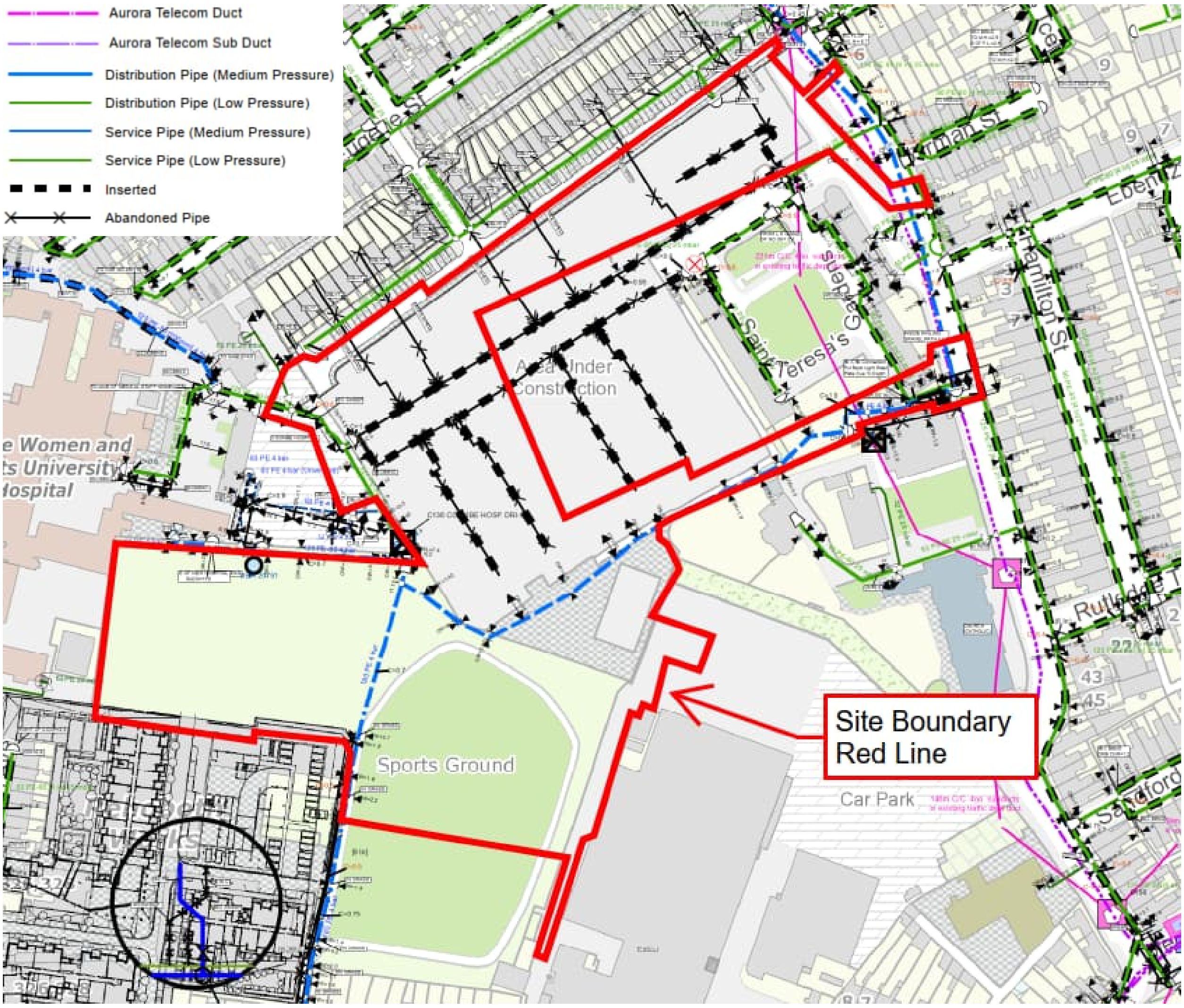


*Figure 1: Existing Gas Infrastructure*

## 2.2 Electricity

There is existing underground ESB cabling identified to the north of the proposed development (Block DCC 1), along Margaret Kennedy Road. There is no indication of MV cabling within the proposed site.

Based on initial discussions with the ESB, the MV supply will be derived from the MV network within Donore Avenue which will feed new ESB transformer substations within the development.

It is proposed, subject to ESB approval, provisionally, the ESB standard substations will be provisionally located as follows

- DCC 1 - 1no. single 1000kVA Tx substation
- DCC 3 - 1no. double 1000kVA Tx substation
- DCC 5 - 1no. double 1000kVA Tx substation
- DCC 6 – 1no. single 1000kVA Tx substation

Note: The substations capacity is included the provision of Electrical Vehicle Charger requirements.

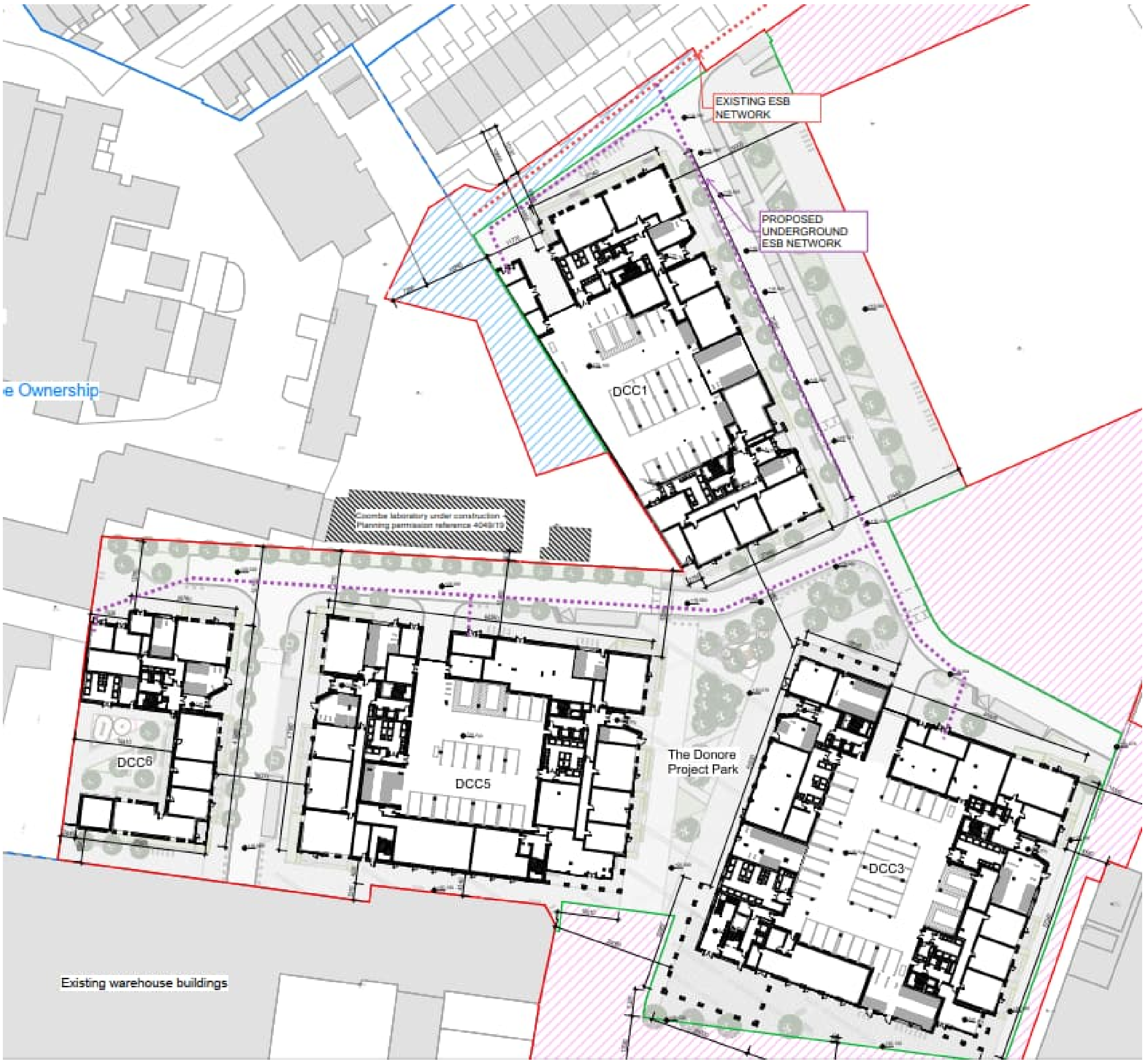


*Figure 2: Existing & Proposed MV Network*

## 2.3 Information and Communications Technology (ICT)

Existing EIR telecom ducts are located to the north of the proposed development (Block DCC 1), along Margaret Kennedy Road. Similar to the LV cabling, it is assumed the new network tie in point supply of EIR network will be along Margaret Kennedy Road. The query has been raised with EIR and the exact location subject to further discussion with EIR.

Apart from EIR, the existing Aurora Telecom Network are located to the northeast of the proposed development. The query has been raised with Aurora Telecom and the exact location subject to further discussion with Aurora.

A new arrangement of 2no of 110mm EIR ducting network to be provided to the development.

Information provided by Virgin Media indicates infrastructure within Margaret Kennedy Road. It is assumed this will be the connection point for the development, subject to further discussions with Virgin Media.

Both EIR and Virgin Media ducting network shall be provided to the development so the option for provision of access to all providers is available to each household.


*Figure 3: Existing & Proposed EIR Telecommunication Network*

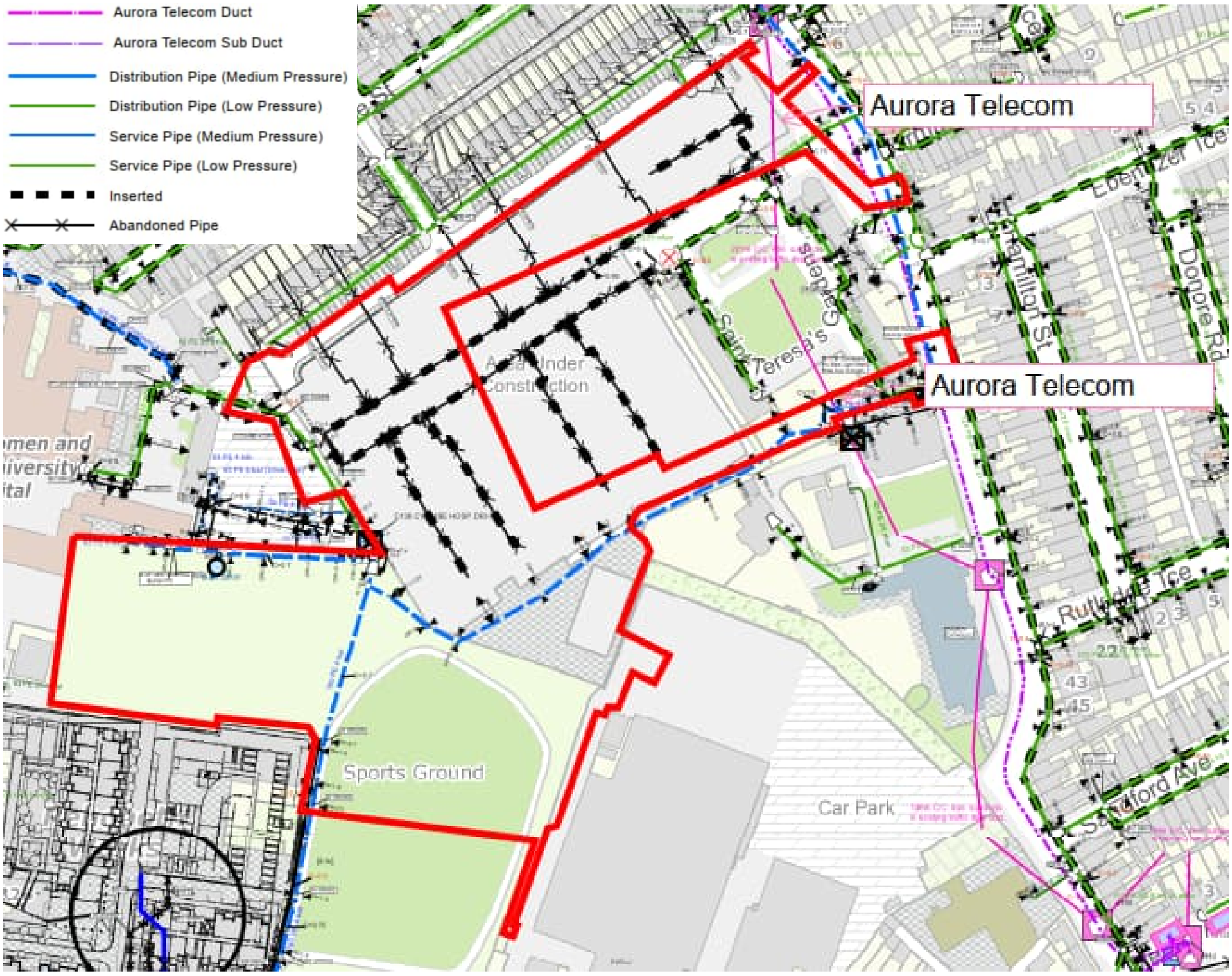


*Figure 4: Existing Aurora Telecommunication Network*

## 2.4 Telecommunication Impact Study

A high-level study has been carried out on whether the proposed high-rise residential development will have any impact on Telecommunication channels.

The initial finding assumed the proposed residential development will not impact any existing Telecommunication Channels.

Please note that telecommunication networks are always evolving, and as such these findings remain subject to change. Further discussion will be carried out with telecommunication providers for clarification.

## 2.5 Safe Air Navigation Assessment

The desk study finding assumed the proposed residential development will not adversely impact on aviation safety.

However, consultation with Irish Aviation Authority will be carried out. Details of the plans and elevation of the buildings will be forwarded to the IAA as request a letter of confirmation.

## 2.6 Public Lighting

The existing public lighting infrastructure will be stripped out within the development and a new installation provided to serve the development. Please refer to report STG-AEC-S1b-00-XX-RE-U-01 with the Waste Management section for details of how construction waste is to be managed and External Lighting layout STG-AEC-S1b-00-00-DR-EL-020001 for new lighting installation. Lighting ducting shall be provided and comply with EN 50086-1-2-3-4:

I. Provide adequate illumination to contribute towards the safe use of the road and footpath by both vehicles and pedestrians,

II. Provide adequate illumination to contribute towards the safe use of the walkways and footpaths by pedestrians within the residential development,

III. Minimise light pollution and visual glare for pedestrians and neighbouring areas,

IV. Provide a visually interesting environment,

V. Minimise the impact of public lighting on ecological creatures (Bats), and

I. The complete external lighting installation will be designed in accordance with IS:10101 (2020); National Rules for Electrical Installations, including BS5489-1 (2013) Code of practice for the Design of Road Lighting, IS EN 13201:2003-2, Dublin City Council (DCC) – Guidelines For Exterior Public Lighting Design and Product Specification Manual (2015) and Technical Guidance Document Part M (2010) in the context of Illumination levels.

The predicted performance of the external lighting installations will be assessed in detail using predictive industry standard lighting simulation software (Lighting Reality), which is approved by the Irish local authorities.

As lighting designers, the proposed external lighting scheme will be based on best practice, National Transport Authority guidance's and, more importantly, national & international industry standards, incorporating the following considerations;

II. Light pollution

III. Disability and discomfort glare

IV. Sky glow

V. Dublin County Council (DCC) – Guidelines for Exterior Public Lighting Design

The key items that underpin the design are described below:

I. Compliance with lighting standards/ regulations for pedestrian footpath & road lighting functionality.

II. Mitigate light spill onto adjoining trees / neighbouring dwelling.

III. Coordination with landscape designer to ensure:

- Luminaire and tree positions are coordinated. (the trees will have a minimal impact on the light spill)
- Luminaires located to avoid damage to the light fitting from falling branches and to avoid the need to regularly maintain them.
- Provide hinged poles in areas deemed inaccessible to ensure full maintenance access.

To address the aforementioned, the following measures were adopted:

I. Consciously positioned luminaires, so as to limit negative spill and light pollution whilst also maintaining the required lux levels uniformly across the pedestrian footpath around the development.

II. An asymmetrical beam optic is employed to physically contain unnecessary light spillage and light pollution.

III. Illumination levels within the Donore Project residential roads will be kept to a minimum to meet the conditions of classification **P4**, that is, 5-lux average with a minimum of 1-lux, as set out in Table 3 of IS EN 13201-2:2015; a uniformity ratio of 0.2 will be achieved in all areas. Said scheme also complies with the National Transport Authority's (NTA) guidance's for cycle/pedestrian routes) at ground level as per Dublin City Council requirements while maintaining uniformity. It should be noted that this minimum light level meets the minimum safe levels for pedestrians as set out in BS5489-1:2013.

IV. It is proposed that 6-metre-high LED lamp standards will provide illumination to the residential roads. This design is cognisant of the fact that light pollution both in terms of sky glow and light spill. It is assumed that the public will be required to match the existing development for consistency. Based on initial information provided these shall be Thorn Lighting ISARO Pro. Lighting poles shall be provisionally provided at 20m centres, subject to verification at the next stage of design

V. On the pedestrian walkway throughout the Donore Project site and the pedestrian walkway exiting the site, features type luminaires will be provided. These areas are designed to classification **P4** (5 Lux average, with a minimum of 1 Lux, as stipulated in IS EN 13201-2:2015).

For the roadway lighting, it is proposed to utilise low wattage LED luminaires with +5/-20° inclination to the adjacent surface (Figure 5).

For the pedestrian/amenity lighting, it is proposed to utilise low wattage floodlight LED luminaires mounted on the feature columns to suit the aesthetic element of the landscape layout throughout the development.

Luminaires will be positioned to comply with IS EN 16462-2 (2007) requirements meeting average Illuminance (Em), uniformity (Uo) and glare rating (GRL) requirements. Switching control of the lighting columns will be achieved by means of photocell control. Each individual luminaire shall be capable of being switched "ON" from dusk to dawn, unless otherwise requested by Dublin City Council.

All the lighting columns within the main road are supplied from a lighting unmetered micro-pillar, and the lighting columns within the parks will be supplied from the Landlord supply in respective blocks.

For ease of future maintenance Public Lighting poles will be proposed in retention sockets in so far as is possible and drop-down/hinged columns will be considered in inaccessible areas by MEWP. Retention sockets will be designed in conjunction with specialist manufacturers and suppliers depending on the space allowable below ground.

Retention socket shall be compliant with Dublin City Council specification for public lighting.


***Figure 5: Roadway Lighting ISARO PRO***

***Figure 6: Feature Lighting Escofet Full LED***

# 3. Part L of the Building Regulations & Dublin City Development Plan

## 3.1 Part L of the Building Regulations

The EU Energy Performance of Buildings Directive (EPBD), transposed into Irish Law from 2006 onwards, contains a range of provisions to improve the energy performance of new buildings. It is the main European legislative instrument to improve energy performance of buildings within the EU. In 2010 the EPBD was recast to include the requirement that member states should ensure that all new buildings are 'Nearly Zero- Energy Buildings' by the 31st December 2020.

'Nearly Zero-Energy Buildings', or NZEB, means a building that has a very high energy performance, as determined in accordance with Annex I of the EPBD. 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. The actual energy performance to meet NZEB standards are set by the member states using cost optimal analyses and guidelines set by the EU Commission.

To meet these requirements the Department of Housing, Planning and Local Government (DHPLG) issued a revised Part L of the Building Regulations (to incorporate S.I. No. 292/2019 and S.I. No. 393/2021 – European Union Energy Performance of Buildings) for Dwellings in 2021. Some of the improvements over previous Part L Regulations include:

- A reduction in the Energy Performance Coefficient (EPC) from 0.4 to 0.3 (an improvement in performance of 25%)
- Amendments to the renewable energy provisions
- Increased thermal performance of the building fabric (lower U values and air permeability)
- Changes in the Dwelling Energy Assessment Procedure (DEAP) including more emphasis on hot water efficiency
- More emphasis on energy efficient lighting design
- Increased requirements for renovation projects
- Improved Mechanical & Electrical Services and Lighting specifications.

The regulations represent a marked improvement in building standards with respect to energy efficiency. The revised Part L Regulations will heavily influence the design of the Donore Project Residential Development and will form the main design basis for the project.

## 3.2 Dublin City Development Plan

Chapter 3 of the draft Dublin City Development Plan 2022-2028 outlines a strategic approach to climate action. It states that all developments will need to 'demonstrate how low carbon energy and heating solutions, have been considered as part of the overall design and planning of the proposed development' as well as explaining how renewable energy sources (e.g. solar, wind, geothermal and ambient heat pumps) and district heating / waste heat recovery can be used to serve future developments.

In line with Chapter 3 the Donore Project is proposing to utilise air to water heat pumps to serve a centralised heating system. We note also that in the future this centralised system can be connected to a newer, larger, more efficient district heating system.

# 4. Mechanical Design Crite#ria

## 4.1 External Design Criteria

The external design criteria are based on 2021 weather data published by ASHRAE. Summer and winter design temperatures are based on annual extremes.

| Location | Dublin, Ireland |
|---|---|
| Elevation | 25m (approx.) |
| Summer Temperature | 24.4ºC Dry Bulb / 19.4ºC Wet Bulb |
| Winter Temperature | -5.4ºC (saturated) |

## 4.2 Internal Design Criteria

Internal design criteria are based on CIBSE guidelines and Part L of the Building Regulations, as summarised in the table below. Humidity control will not be provided in any spaces within each building structure.

| Space | Design Temperature |
|---|---|
| Circulation Spaces | Min. 18ºC |
| Living Areas | Min. 21ºC |
| Bedrooms | Min. 18ºC |
| WC's / Bathrooms | Min. 18ºC |
| Plant Areas | Not controlled |

## 4.3 Ventilation Design Criteria

Ventilation design criteria conditions shall be based on CIBSE guidelines, Part F of the Building Regulations and BS: EN standards. The ventilation design criteria will be largely dependent on the system selected, e.g. continuous mechanical extract (CME) ventilation or mechanical ventilation with heat recovery (MVHR). It is proposed to ventilate the apartments and occupied spaces using MVHR units.

## Noise Criteria

Internal noise criteria will be based on CIBSE guidelines, as follows:

| Space | Noise Rating |
|---|---|
| Circulation Spaces | NR40 |
| Living Areas | NR30 |
| Bedrooms | NR25 |
| WC's / Bathrooms | NR40 |
| Plant Areas | Not controlled |

External plant will be selected to ensure that the sound levels do not exceed those set as part of planning condition requirements.

# 5. Heating Strategies

During the design development, the heating and ventilation strategies were examined for their application to the Donore Project (please find attached Appendix A – Report STG-AEC-S1a-00-XX-RE-ME-0000002) and following further analysis and discussions it is proposed that a centralised heating system serve the development with the primary plant being housed within in Block DCC5 plantroom.

The main advantage of a centralised system is that all of the main heat generation plant is located centrally, which significantly reduces the quantity of plant that requires maintenance. However, in order to generate domestic hot water, the LTHW circulation temperatures typically need to be minimum of 70ºC to eliminate the risk of legionnaires disease in domestic hot water systems. In this situation standard heat pumps on their own are not a viable heating source and less efficient high temperature heat pumps or fossil fuel heating sources (e.g. gas boilers or CHP) are required. However, CIBSE have recently updated CP1: Heat Networks: Code of Practice for the UK (2020) which permits lower LTHW circulation temperatures in centralised systems while safely minimising the risk of Legionnaires disease in domestic hot water systems. This updated guidance has of yet not been applied to any projects in the Republic of Ireland.

It should be noted that a central management / ESCO company will be required to manage the centralised heating scheme. This is particularly important given the possible mix of proposed use/tenancy of the scheme, the management of the heat network and the billing of energy across a wide range of tenants (e.g. cost rental, social tenants and commercial units).

*Figure 7: Example Centralised Plantroom*

## 5.1 Centralised Systems

For centralised heating systems a single energy source will be provided for the blocks of apartments. Low Temperature Hot Water (LTHW) is provided to each apartment to distribute heat for space heating and domestic hot water generation.

The Low Temperature Hot Water (LTHW) is to be generated by a centralised system incorporating air to water heat pumps and a gas fired boiler system. The air to water heat pumps will operate as the lead heat generator producing LTHW at circa 50degC. The gas fired boiler will be used to raise the water temperature to circa 70degC for circulation to each residential unit. A heat interface unit (HIU) will be provided in each apartment to distribute the LTHW and domestic hot water. Heating will be provided via wall mounted radiators. A single centralised system is to be provided to serve the entire development. The heat supplied to each apartment and commercial unit will be metered and billed accordingly.

Advantages

- All plant located in a central location, so maintenance costs are generally reduced
- Plant replacement can be planned and completed easily
- Centralised / community heating systems facilitate the easier application of lower energy technologies in the future, as all the heat generation plant is in a central location
- At the time of plant replacement, it may be possible to connect this heating network to a newer, larger, more efficient district heating network

Disadvantages

- Only a proportion of heating and DHW energy is via renewable energy
- The blocks are to be separated by road networks below which heating pipework will need to pass
- Still relies on fossil fuels
- Central management company / ESCO required to manage heat network and bill tenants
- Less flexibility if a portion of the development is to be sold in the future
- Higher upfront capital costs
- More central plant and distribution space are required


***Figure 8: Apartment Heat Meter & Heat Interface Unit***

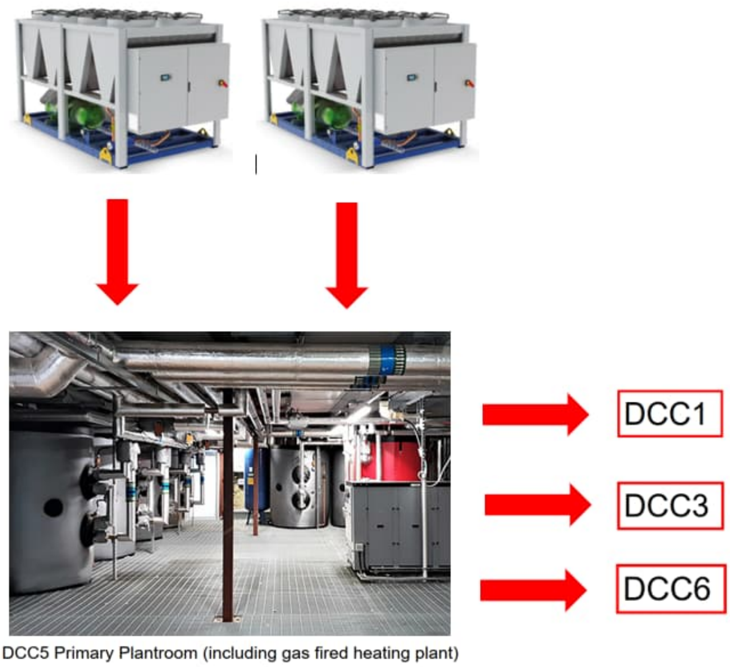


***Figure 9: Donore Centralised Heating System Diagram***

*Figure 10: Prefabricated Utility Cupboard – MVHR & HIU*

## 5.2 Heating Options Not Considered

1. Solar thermal technologies have not been considered as they are generally not practical on apartment schemes.
2. Decentralised with boilers, that is a boiler in each apartment has not been considered as the level of PV that would be required to comply with Part L would not be practical.
3. Decentralised heat pumps have not been considered as balcony space would be required for each apartment to place external condensers.
4. Centralised heat pumps with decentralised water-cooled heat pumps (ambient loop systems), for example, Dimplex Zeroth system, have not been considered as these systems are not in widespread use in Ireland at this point.
5. Ground water heat pumps have not been considered as the capital costs when boreholes etc. are included would make this option prohibitive.

## 5.3 Commentary on Heating Systems

1. In terms of future energy upgrades the centralised option offers the most opportunity for reducing energy use as new technologies become available.
2. Based on the analysis we've carried out to date the Centralised C1 option has both a lower CAPEX (Capital Expenditure) and OPEX (Operational Expenditure) than the decentralised options. The centralised option has a high upfront cost at the early stage of the project (largely due to the central plantroom) but a lower total cost.
3. It is preferable to eliminate the requirement for fossil fuels on site to reduce the carbon impact of the development, now and in the future. Therefore, it is preferable to not use gas. It should be noted that CIBSE have recently updated CP1: Heat Networks: Code of Practice for the UK (2020) which permits lower LTHW circulation temperatures in centralised systems while safely minimising the risk of Legionnaires disease in domestic hot water systems. With this in mind centralised systems could operate without a fossil fuel input.
4. In terms of plant space, a centralised system requires the least amount of apartment floor space for secondary components e.g. HIUs and pumps. It does however require a large plantroom, placed either within an apartment block or as a standalone building.

# 6. Ventilation Strategies

During design development the ventilation strategies were examined further for their application to the Donore Project and following further analysis and discussions it is proposed that localised MVHR (mechanical ventilation with heat recovery) systems serve the majority of occupied areas within the Donore Development.

For clarity all initial ventilation strategies studied are outlined below.

## 6.1 Mechanical Ventilation with Heat Recovery (MVHR)

Mechanical ventilation with heat recovery (MVHR) utilises a high efficiency heat exchanger to recover heat from extract air and heat the incoming ventilation air. As the incoming air is heated, it reduces the overall heating load in the space. MVHR works best in airtight buildings. Supply air is ducted to each habitable room (e.g. bedroom, living area) and extract air is ducted from each wet room (e.g. bathroom, kitchen).

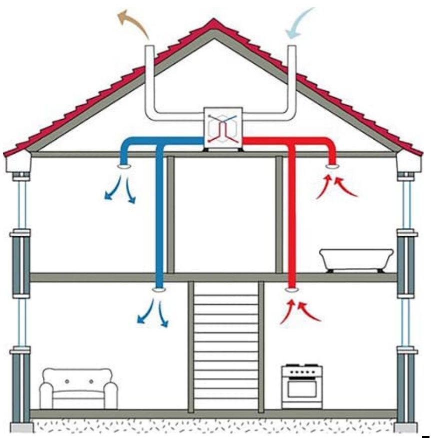


***Figure 11: Typical MVHR Unit & Layout***

<u>Advantages</u>

- Most energy efficient ventilation system, as inlet air is tempered
- No background ventilation required

- No risk of draughts

Disadvantages

- Higher capital cost vs. other ventilation systems
- Significantly more duct routes required
- Filter requires regular (typically annually) cleaning
- Cannot be used with Exhaust Air Heat Pumps (Option D2)

Plant Space Allocations

- Cupboard required for MVHR unit (approx. 600mm x 600mm x 300mm)
- Duct routes from each room to MVHR unit and 2 no. ducts from MVHR unit to outside are required
-

## 6.2 Continuous Mechanical Systems Extract (CME)

A continuous mechanical extract (CME) system continuously extracts air from wet rooms (e.g. bathroom, kitchen) via a single extract unit. The extract unit could be installed in a high-level cupboard in each residential unit. Each wet room is ducted to the extract unit and a single extract duct discharges air to outside via a wall mounted grille. The unit generally operates at low speed and uses integrated humidistats to 'Boost' ventilate when required.

For the system to be compliant with Part F of the Building Regulations (Ventilation), permanent background ventilation (e.g. wall or trickle vents) would be required. Automatic demand control humidity sensitive inlets could also be used.

## 6.3 Commentary on Ventilation Systems

CME systems rely on trickle / wall vents remaining unblocked at all times. It must be noted that there is risk of tenants blocking the vents. MVHR systems remove this risk but have greater capital and maintenance costs.

# 7. Domestic Cold Water Storage and Distribution

Domestic cold-water storage and distribution can be provided on a centralised or decentralised basis.

## 7.1 Centralised System

For a centralised system a central cold-water storage tank, central cold-water booster pump, mains water break tank and mains water booster pump are provided in each block at ground floor level. From here domestic cold and mains water is pumped to each residential unit.

Advantages

- No maintainable equipment in each apartment

Disadvantages

- Large plant space required at ground floor in each apartment block.
- Maintenance of cold-water booster pumps critical to supplying water to the apartments.
- Less flexibility for end-use (e.g. social and cost-rental units/homes) as bulk storage is located / managed centrally.
- More complex to install and operate.

## 7.2 Decentralised Systems

With a decentralised system a mains water break tank and mains water booster pump are provided in each block at ground floor level. From here mains water is boosted to each residential unit. An integrated cold-water storage tank and booster pump is provided in each residential unit.

Advantages

- Maximises flexibility for end use (e.g. social and cost-rental units/homes) as bulk storage is within each apartment.
- Simple to install and operate.

Disadvantages

- Booster pump in each apartment requires maintenance. Pump will make low level noise during operation.
- Space required in apartment for tank and booster. High risk of leaks from tanks in apartments.

## 7.3 Commentary on Domestic Cold-Water Storage and Distribution

A centralised domestic cold-water storage and distribution is the preferred option and all plant and riser space has be planned for the purpose of installing centralised systems.

# 8. Sprinklers

## 8.1 Commentary on Sprinkler Plant Areas and Distribution

A number of options were considered during the design development. As Blocks DCC3 & DCC5 contain commercial units (as well as residential) European Standard BS EN 12485 was used as to guide to planning the systems. As Blocks DCC1 and DCC6 only contain residential units BS 9251 was used as to guide to planning the systems. Following consultation with the fire consultant the options below were explored further to minimise the amount of plant and plant space required;

1. All blocks to have separate sprinkler systems to meet BS EN 12485 and BS 9251 accordingly.
2. Blocks 3 & 5 to have a shared system (within a DCC3 plant room) meeting both BS EN 12485 and BS 9251. Blocks 1 & 6 still to have individual systems meeting BS 9251.
3. Blocks 1, 3 & 5 to have a shared system meeting both BS EN 12485 and BS 9251. Block 6 still to have an individual system meeting BS 9251 as it does not have a covered car park.

Option 3 was chosen in order to minimise the risk of further updates to BS 9251 or BS EN 12485 which may request that any residential or commercial block containing a carpark must have a commercial system installed.

It should be noted that a central management company will be required to manage a centralised heating sprinkler system.

# 9. Electrical Engineering

The works at the Donore Project will comprise of the following electrical services.

- Incoming MV/LV electrical supply,
- Incoming telecommunications,
- Low voltage distribution switchgear, including sub-distribution centres
- Standby Generators
- Small power installation,
- Public and external lighting,
- Energy metering,
- General and emergency lighting, and associated control system,
- Specialist feature lighting,
- Renewable technologies,
- Fire detection and alarms systems,
- Security systems,
- Electrical Vehicle Chargers
- Vertical Transportation
- Lightning surge protection,
- Mechanical plant, and
- Earthing and bonding

## 9.1 Incoming Electrical Supply

Dedicated LV meter rooms will be provided at each apartment block, designed to provide external access to the meters. LV supplies will run from the meter rooms to dedicated electrical risers within the block. The cabling will rise and supply each apartment consumer unit individually.

A separate landlord metered distribution board will be provided at each block for communal services (lighting, small power, boosted water, sprinkler systems, lifts etc)

- The LV supply to each residential building will be at 400/230 V (+10%/-6%).
- The frequency of the supply will be 50 Hz (± 1%).

## 9.2 Telecommunication Services

Telecommunications connections will be provided to the building by an internet service provider (ISP) chosen by the tenants. Ducting and routes will be provided for the ISP’s to install and terminate their incoming supplies to each apartment via the Comms room on the Ground Floor and risers.

A tenants will need to make an application to their preferred internet service provider. Any Civil works that may be required will need to be confirmed by the ISP’s. Further discussion will be carried out with EIR and Virgin Media. A total end to end category 6A Customer Premises Cabling solution shall be installed.

A complete Data & Telephone Services installation will be provided. Comms room on the Ground Floor of the building will host all the ISP’s ICT equipment, all access control and intruder alarm hubs shall be installed within this space. All data and communications cabling will extended from a centralised Comms room and will be segregated from power cabling to eliminate interference.

## 9.3 Low Voltage Distribution

One main LV electrical distribution centre (MDC) will be positioned in the respective main electrical switch room at each residential block while sub-distribution centres (SDC) will be provided in assigned cupboards at respective floor level. An additional consumer unit (CU) will be provided in each residential unit. The electrical wiring installations for the tenant fit-out will be designed to comply with the new IS:10101 (2020); National Rules for Electrical Installations

Each MDC will be of Form 4 Type 2 construction, with internal segregation to enable safe working for connection of spare outgoing ways while SDCs and CUs will be Form 3. Type 1, 2 and 3 surge protection will be provided at all sub-distribution centres.

Sub-mains cabling will be provided from the SDCs and CUs to serve mechanical plant, lighting and small power distribution boards, and other fixed equipment. All outgoing ways will be provided with meters to meet the requirements of Building Regulations Part L. The sub-main cabling will generally comprise XLPE/SWA/LSF cables installed on heavy duty cable ladders/trays. All distribution centres will incorporate 20% spare ways.

Final circuits from all distribution boards will comprise either LSF insulated single-core cables in steel conduit/trunking or alternatively XLPE/SWA/LSF armoured cables installed within designated floor and ceiling voids. All cables used shall be from a BASEC licensed supplier and meet minimum Euroclass cabling standards. MCBs will comply with BS EN 60898 with a short circuit capacity of 15KA minimum

## 9.4 Standby Emergency Generation

Diesel type standby generators will be provided at each block for the life safety systems. The exact location of the generator and flue route to be confirmed.

The Life Safety Services are deemed critical to their operation and shall have dual supplies. All life safety systems shall be supplied via local ATS switches where the primary supply is delivered from the non-essential section of the Landlords Main LV switch panel and the secondary supply emanating from the generator LV Switchboards. These systems shall include:

- Fire Fighting Lifts
- Sprinkler Pumps
- Staircase Cores Smoke Extract
- Lobby Smoke Extract Fans
- Fire Fighting Lift Sump Pumps
- Car Park impulse fans (where required)

ATS switches shall be in accordance with BS 8519 incorporating an integral maintenance bypass. Each ATS shall facilitate an adjustable timer delay. ATS switches shall be constructed to a minimum of IP65 or housed within a minimum of IP65 rated enclosure

Firefighting lift supplies shall be monitored via a lift indicator panel located adjacent to the main fire alarm panels across the development. The panel shall incorporate an integral 3 Hour battery and indicator LEDs. The indication LED's shall illuminate when the lift is in use and when the primary or secondary supply is live.

All cabling carried out to life safety systems shall be carried out in fire resistant cabling to PH120 classification and in accordance with BS 8519.

The secondary life safety cabling shall be installed in a diverse route from the primary supply to the end load that is being supplied.

## 9.5 General Lighting and Control

General lighting will form part of the works and will consist of recessed and surface LED modular fittings to suit the proposed ceiling. The design will conform to CIBSE LG7, CIBSE LG09: Lighting for Communal Residential Buildings and IS EN 12464; (2011); Lighting of Workplaces.

To ensure that the latest LED lighting technology is installed, the procurement of the light fittings should be delayed as close to the installation date as possible. During the detailed design of the works, AECOM will work with Metropolitan Workshop to define a fitting that meets the aesthetic and technical requirements of the development.

The lighting installation will be served from lighting services section of the respective electrical distribution centres and consumer units located strategically in electrical risers and cupboards.

Switching of the circulation areas in each of the residential blocks will be provided by multi-sensors to provide occupation/absence control and daylight linking. The lighting control system will also facilitate a signal to the respective BMS out-station subject to the agreed heating and ventilation strategy.

External lighting (public realms, building perimeter, street, roof terraces, podium, etc) will be specified to suit the architectural treatment and controlled by means of local PIR detectors/switches. The lighting control system will be commissioned to take cognisance of the occupant requirements set out in lighting control strategy document.

## 9.6 Emergency Lighting

Emergency and escape lighting will be installed throughout all areas inc. roof terraces & podium, to comply with IS 3217: 2013 and IS EN 1838. The emergency lighting system will be designed to maintain the specified lighting level for a minimum duration of 3-hours in communal.

All emergency luminaires will generally be self-contained emergency packs within dedicated luminaires. Self-contained illuminated exit signs will be provided along exit routes; the emergency lighting will form an integral part of the lighting control system.

## 9.7 Small Power

Dedicated sub distribution centres (SDC) and consumer units (CUs) will be provided in strategic locations in the residential blocks to serve small power outlets, socket outlets and fixed equipment.

Above kitchen worktops high level isolators shall be provided to control low level single sockets outlets positioned under kitchen worktop for appliances. The position of all power outlets shall be in accordance with IS 10101 (2020).

## 9.8 Fire Detection and Alarm System

A fire detection and alarm system (FDAS) will be provided as part of the works in compliance with IS 3218: 2013 Code of Practice for fire detection and alarm systems for buildings.

An analogue / addressable fire alarm system will be installed to an L2/L3 standard (subject to Fire Safety Certificate requirements) throughout the residential blocks. The main fire alarm panel will be located in the ground floor entrance with repeater panels located adjacent to the main fire access point at each residential block, where required.

The system will incorporate automatic detectors and manual break-glass call points to activate automatic sound warning and flashing beacons.

The fire detection system will be interfaced with various systems to initiate shut down, activation, opening and closing of the system in accordance with the fire cause and effect strategy.

In addition, the fire detection system will automatically release access-controlled doors to enable safe evacuation from the buildings to facilitate egress in the event of fire evacuation.

## 9.9 Security Systems, CCTV and Access Control

The security services requirement will be articulated in a security strategy document developed by AECOM in conjunction with the Applicant, and will include the following systems;

- Door access control at the entrances to entrance lobby on each block
- Dedicated CCTV system externally and internally in circulation areas.

## 9.10 ICT Structured Cabling

If required, a specification will be prepared based around passive infrastructure in the residential blocks, enabling the Applicant to install active Local Area Network hardware and software to support their day-to-day business requirements (additionally subject to the adoption of a centralised heating system).

The infrastructure shall comprise the following.

- Pathways (i.e. the routes and containment between residential spaces)
- Cabinets/Racks/Frames (i.e. to house cable terminations and equipment)
- Infrastructure (i.e. the physical structured cabling)

The requirement for such systems will require further development and coordination.

## 9.11 Electric Vehicle Charging

50% of the parking bays provide with Electric Vehicle Charging (EVC) points will be provided throughout the development. Wall mounted robust charging stations will be provided in within the covered car parking spaces and pole type for on-street carpark with an energy demand of 7kW single phase and 22kW three phase chargers or as agreed with the Applicant.


*Figure 12: Electric Vehicle Charging Point*

Building regulation Document L 2021 requires for a new building (containing one, or more than one, dwelling), where there are more than 10 car parking spaces, ducting infrastructure, consisting of conduits for electric cables, should be provided for every parking space, to enable the subsequent installation of recharging points for electric vehicles.

For this development, the containment system within the covered car park will be designed accordingly to accommodate EVC infrastructure for every parking spaces. The containment will be running at a high level from the LV room and drop to the charger locations. The ducting and manholes will also be provided from the LV room to the on-street car park.

For the Low Voltage system requirement, the dynamic load management system will be used to monitor the electrical usage between multiple chargers. The system allows chargers to manage simultaneously in a most efficient way their individual and total charging load within the limits of pre-set fixed supply. Each charger will de-rate as necessary to prevent overload to the mains feed.

The dedicated LV panel and the load management system controller will be located within the LV rooms with a separate meter from ESB. It will allow the owner/landlords to have a third-party entity to manage the EVC system separately.

## 9.12 Television Distribution Services

A complete television distribution system shall be installed throughout the building. All equipment shall be located in the comms room or in the risers. The system will include a triple screened RG6 coax cable to install in each unit; to the tv outlets in back boxes with white PVC plates fitted.

The satellite dish, aerial and mass feed to be provided. The system shall distribute all Free to Air channels available including Saor View channels, all operating over the one system, i.e 14 channels of UK TV, Saorview and etc

## 9.13 Disabled Refuge

A disabled refuge alarm system will be required to each of the residential core staircases and shall comply with BS5588 Part 8, BS5839-Part 9:2003, BS5588 part 11 and Building Bulletin 100.

## 9.14 Lightning Protection

A lightning protection system shall be required to each of the residential blocks. The system shall consist of 25 x 3mm PVC covered copper / aluminium tape run at roof level with either 25 x 3mm tape down drops or bonded to the structure of the building.

Ground buried electrodes within inspection pits shall be provided around the perimeter of the building.

It is assumed an LPL1 (20 x 10m grid) will be required but this will be subject to detailed calculations during the next design stages.

## 9.15 Home Performance Index

The development is to be monitored and assessed with a HPI award issued on completion.

# Appendix A

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STG-AEC-S1a-00-XX-RE-ME-0000002
Heating & Ventilation Services Optioneering

**Date:**
08th June 2021

# Heating & Ventilation Services Optioneering Report

**Subject:** Mechanical Services - Centralised Vs Decentralised

## 1. Introduction

Following preliminary discussions with the project team, AECOM have examined both centralised and decentralised heating services options.

A typical north facing *(worst case orientation)* top floor 2-bed apartment has been taken as an example for the purposes of this report.

Continuous Mechanical Extract (CME) ventilation systems utilising trickle vents have been adopted as a ventilation option in a number of the systems outlined below.

It should be noted at this point that in order for a new dwelling to be Part L 2019 compliant their calculated energy performance coefficient (EPC) should be no greater than 0.3 and the dwelling must have a renewable energy factor of 0.2 (20%) or better. With that in mind the traditional gas/oil fired heating systems are no longer the market leader as any dwelling which utilises a fossil fuel energy source requires some form of renewable energy input to run alongside it e.g. PV panels.

Heat pump systems however, which can provide both heating and hot water, are themselves a renewable energy source and since the introduction of Part L 2019 they have become increasingly more attractive as they do not require any further renewable energy input e.g. PV panels. With that in mind if the heating system for residential blocks such as St Teresa’s Gardens were to use a fossil fuel as their primary energy source in most cases it would not have the roof plant space available to fit the required amount of PV to achieve the minimum renewable energy input of 20%.

In terms of billing and management of a centralised system. Typically a central management company / ESCO would be required to manage a centralised / community heating scheme. A heat meter is fitted on the heating supply to each unit to calculate energy being used by that unit.

# 2. Glossary Terms

| Term | Meaning |
| --- | --- |
| Centralised | A centralised heating system providing heating to a development via heating network. Heat is generated in a central plantroom. |
| Decentralised | A decentralised heating system is a system which does not require any form of primary heat from a heat network. All heat is generated within the Apartment / House / Retail Unit. |
| CME | Continuous Mechanical Extract. This system uses an extract fan to continuously extract low volumes of air from a fan unit. Make-up/fresh drawn in via trickle wall/window vents. |
| Air to Water Heat Pump | A heat pump which uses a refrigerant cycle to transfer heat from external air and to a water cycle e.g. heating and/or domestic hot water. |
| EAHP | Exhaust Air Heat Pump |
| ASHP | Air Source Heat Pump |
| PV | Photovoltaic Panels. Roof mounted panels transferring daylight (photons) to electricity. |
| MVHR | Mechanical Ventilation with Heat Recovery. The fan system uses a heat exchanger to transfer heat from the extract air back into incoming fresh air. |
| HIU | Heat Interface Unit. A packaged unit installed within a home which allows heat from a central plant source to be transferred into the homes heating and domestic hot water network. |
| kWh | Kilowatt-hour. Standard unit of measurement used by energy suppliers for both electricity and gas. |
| OPEX | Operating Expenses |
| CAPEX | Capital Expenditure |
| ACDs | Acceptable Construction Details |
| DEAP | Dwelling Energy Assessment Procedure |
| DHW | Domestic Hot Water |
| LTHW | Low Temperature Hot Water (Heating) |
| NZEB | Nearly Zero Energy Building |
| CHP | Combined heat and power also known as cogeneration. The concurrent production of electricity or mechanical power and useful thermal energy (heating and/or cooling) from a single source of energy. |
| CIBSE | The Chartered Institution of Building Services Engineers |
| EPC | Energy Performance Coefficient |
| MV | Medium Voltage Substation |
| BMS | Building Management System |

# 3. Heating System Analysis

## 3.1 Heating Options

The decentralised heating options under consideration are:

1. **Option D1:** Electric Space Heating, Domestic Hot Water Packaged Air to Water Heat Pump and Photovoltaics. Ventilation provided by CME system. MVHR could also be utilised.

2. **Option D2:** Heat Pump providing CME ventilation with inlet air via trickle vents *(standard exhaust air heat pump arrangement)*. See figure 1 below.

*Figure 1*

3. **Option D3:** Heat Pump using exhaust air and inlet air is provided by a supplementary ventilation unit with fan and hot water coil. Outside air is heated up by the ventilation unit and supplied to living spaces (similar to MVHR) and extracted from wet rooms by the heat pump.

The centralised system under consideration is:

4. **Option C1:** A central plant room serving the development with a primary heating source of heat pumps supported by fossil fuel (gas/oil) heat sources e.g. boilers or CHP. The system would include central support plant (pumps, buffer vessels etc.) as well as apartment HIUs and MVHR. See figure 2 below for HIU and MVHR in a typical prefabricated cupboard assembly.

*Figure 2*

## 3.2 Comparative Analysis

### Table 1. Heat Options Comparative Analysis – Typical Top Floor 2 Bed Apartment, North Facing

| Item | Option D1 | Option D2 | Option D3 | Option C1 |
|---|---|---|---|---|
| **Specification Details** | | | | |
| Wall U Value (W/m$^2$.K) | 0.17 | 0.18 | 0.17 | 0.18 |
| Roof U Value (W/m$^2$.K) | 0.13 | 0.20 | 0.11 | 0.20 |
| Floor U Value (W/m$^2$.K) | 0.13 | 0.18 | 0.11 | 0.18 |
| Glazing U Value (W/m$^2$.K) | 1.22 | 1.4 | 1.22 | 1.4 |
| LTHW Design Temp. | NA | 45$^o$C | 45$^o$C | 75$^o$C |
| Effective efficiency % | 100 | 445 | 445 | 214 |
| Hot Water Heating Efficiency % | 304 | 252 | 252 | 214 |
| No. Photovoltaics Required[4] | ~3 | NA | NA | NA |
| Ventilation Method | CME | CME by Heat Pump | Separate Vent Unit + Heat Pump | MVHR |
| Internal Noise | 42dB(A) SPL | 44dB(A) SPL | 44dB(A) SPL | 42dB(A) SPL |
| Internal Space Required (mm) | 800x800x2400 | 800x800x2400 | 800x800x2400 + 600x400x700 | 600x400x700 |
| Central Plant Space Required (m) | NA | NA | NA | 18 (w) x 10 (d) x 3m (h) |
| External Plant Space Required for Central Plant Condensers (m) | NA | NA | NA | 15 (l) x 9.5 (w) x 2 (h) |
| Ventilation Energy KWh | 52 | 80 | 80[5] | 101 |
| No. of manufacturers available[6] | ~5 | 2 | 1[7] | 5+ |
| | | | | |
| **Capital Cost Figures[7]** | | | | |
| Apartment Costs (720 Units) | | | | |
| Heating Equipment Costs € | 1,656,000 | 7,560,000 | 7,560,000 | 6,120,000 |
| Ventilation Equipment Costs € | 1,224,000 | 936,000 | 2,880,000 | 2,200,000 |
| Fabric Uplift Costs[8] € | 2,037,600 | NA | 2,674,800 | NA |
| Joinery € | 324,000 | 324,000 | 324,000 | NA |
| Additional Costs for Louvres € | NA | NA | 108,000 | 108,000 |
| Additional Costs for BWIC € | NA | NA | 44,640 | 44,640 |
| Additional Costs for MV € | NA | NA | NA | 60,000 |
| Additional Costs for riser space € | NA | NA | NA | 37,680 |
| Additional Cost for Heat Pump Internal Space (circa 1m2) € | 1,356,480 | 1,356,480 | 1,356,480 | NA |
| Additional Elec Costs[9] € | 3,960,000 | NA | NA | NA |
| Apartment - Install (excl. common items) € | 10,558,080 | 10,176,480 | 14,947,920 | 8,570,320 |
| | | | | |
| Central Costs | | | | |
| Plant and distribution € | 1,155,600 | 1,155,600 | 1,155,600 | 2,847,220 |
| **Total €** | 11,713,680 | 11,332,080 | 16,103,520 | 11,417,540 |

| Item | Option D1 | Option D2 | Option D3 | Option C1 |
|---|---|---|---|---|
| **CO2 & Running Cost (per apartment)** [11] | | | | |
| CO2 emissions kg / yr | | 672 | | 691 |
| Running Costs kWh / yr | | 408 | | 350 |
| **OPEX Costs for development (15 years)** | | | | |
| Energy Use | | €4,467,600 | | €3,832,500 to €4,024,125 |
| Maintenance Cost | | €1,095,000 | | €565,650 |
| **TOTAL (excluding management)** | | €5,562,600 | | €4,398,150, to 4,589 ,775 |
| | | | | |
| **OPEX Costs for development (30 years)** | | | | |
| Energy Use | | €8,935,200 | | €7,665,00 to €8,048,250[13] |
| Maintenance Cost | | €2,190,000 | | €1,131,300 |
| Central Plant Replacement | | 0 | | €3,212,000[14] |
| EAHP Replacement | | €4,380,000 | | 0 |
| **TOTAL** | | €14,505,200 | | €12,008,300 to €12,391,550 |

Notes

1. All options utilise an air permeability of $3m^3/m^2/hr$ @ 50Pa.
2. All options utilise a thermal bridge factor of 0.08. As ACD's will not be appropriate for this development thermal bridge modelling will need to be completed by the Contractor to validate this figure.
3. Lighting provisions are assumed for the purposes of the analysis.
4. The quantities of PV's could be reduced by using MVHR.
5. The ventilation energy for Option D3 is for the heat pump exhaust ventilation system only.
6. It should be noted that the market for heat pumps, particularly packaged heat pumps for apartments, is growing since the introduction of Part L 2019. This number represents the primary suppliers currently available, however other manufacturers may enter the market.
7. The capital cost figures are for system comparative purposes only and do not include Contractor's mark up, builders works, preliminaries and other costs.
8. The fabric uplift costs are over the lowest cost fabric specification (Option D2).
9. The additional electrical infrastructure costs are included for Option D1 only (i.e. electric infrastructure for heating and PV's), as the electrical infrastructure cost difference between the heat pump options would be negligible.
10. For options D1, D2 and D3 the fabric specifications have been adjusted to achieve minimum Part L compliance. Therefore, the CO2 & cost figures are all the same as these options all electricity only.
11. All of the above figures are based on DEAP v4 calculations from similar projects and may not be reflective of actual conditions / running costs. Running costs are based on an electricity rate of 25c/kWh and gas rate of 6c/kWh (lowest gas and electricity tariff bands from SEAI commercial comparison of energy costs Jan-21). Inflation is excluded however it should be noted that gas will likely see higher inflation vs. electricity due to the application of carbon taxes.

12. The manufacturers available for the above systems are as follows:

    a. Option D1: Dimplex, Kronotherm, Climer, Atlantic / Ideal, Panasonic (other manufacturers likely available also). Multiple suppliers available for electric heaters. DEAP analysis based on Kronotherm unit.

    b. Option D2: Nibe, Comfortzone. DEAP analysis based on Comfortzone unit.

    c. Option D3: Comfortzone (see note 7 above).

    d. Option C1: Multiple manufacturers for all equipment.

13. An assessment carried out by the UKs Department of Energy & Climate Change has indicated that losses of up to 43% have been recorded in communal heat networks. The overall sample average of 14no. heat networks was 28%. DEAP assumes losses of 5% which is achievable with good design and management of the system.

14. This figure does not include the future costs associated with the replacement of the below ground pipework between the centralised plantroom and Blocks DCC01, DCC03, DCC05 and DCC06.

15. The centralised plantroom would require a plant space of approximately 180m$^2$ e.g. 18m (wide) x 10m (deep) x 3m (high).

16. The centralised heating system would have an approximate flue size of 650 outside diameter. The associated shaft size would be 1500mm wide x 1200mm deep.

17. All of the above efficiencies and fabric specifications are preliminary and subject to optimisation at the next stage of the design.

## 3.3 Pros / Cons of Options

### Pros / Cons of Heating Options

| Option | Pros | Cons |
|---|---|---|
| Option D1: Electric Space Heating, Packaged Internal *(Exhaust)* Air to Water Heat Pump for Domestic Hot Water and PV | Lowest CO2 emissions.<br>Low capital cost for heating equipment<br>Simple to install and operate<br>Some provision of renewable energy via heat pump<br>Multiple manufactures available<br>Does not utilise fossil fuels | No renewable space heating<br>Higher fabric specification required to achieve Part L compliance<br>Requires PV on roof<br>PV needs to be wired individually to each apartment<br>Highest electrical demand (MIC)<br>Maintenance and plant replacement more difficult vs. centralised systems as plant is distributed and access required to apartments. |
| Option D2: Packaged Internal *(Exhaust)* Air to Water Heat Pump for Space Heating and Domestic Hot Water | Lowest CO2 emissions.<br>Packaged, integrated unit providing heating, DHW and ventilation<br>Lowest fabric specification to achieve Part L compliance<br>Provides renewable space heating and DHW<br>Does not utilise fossil fuels | Higher installation cost than option D1<br>Higher maintenance requirements than option D1<br>Relies on trickle vents to be open to operate<br>Less manufacturers available vs. Option D1<br>Maintenance and plant replacement more difficult vs. centralised systems as plant is distributed and access required to apartments. |
| Option D3: Packaged Internal *(Exhaust)* Air to Water Heat Pump for Space Heating and Domestic Hot Water plus separate ventilation supply unit | Lowest CO2 emissions.<br>Packaged, integrated unit providing heating, DHW and ventilation albeit with a supplementary supply fan unit<br>Provides renewable space heating and DHW | Higher installation cost than both options D1 and D2<br>Highest fabric specification to achieve Part L compliance<br>Supply ventilation unit required<br>Maintenance and plant replacement more difficult vs. centralised systems as plant is |

| Option | Pros | Cons |
|---|---|---|
| | Does not rely on trickle vents for space heating to operate<br>Does not utilise fossil fuels | distributed and access required to apartments. |
| Option C1: A central plant room serving the development with a primary heating source of heat pumps supported by fossil fuel (gas/oil) heat sources e.g. boilers and / or CHP. The system would include central support plant (pumps, buffer vessels etc.) as well as apartment HIUs and MVHRs. | Cheapest to run based on current utility rates.<br>Does not rely on trickle vents for space heating to operate as it can utilise multiple ventilation methods.<br>Limited maintenance required in apartments and maintenance is generally done centrally<br>Plant replacement is done centrally<br>Multiple manufacturers available for all equipment<br>The system can serve communal spaces if required<br>The centralised plant can be upgraded much easier with newer technologies as they become available.<br>Can better utilise off site prefabrication for utility cupboards than decentralised options | High upfront capital costs<br>Management Company Required for metering, billing and collection.<br>Utilises fossil fuels<br>As the electricity grid CO2 emissions reduce (through higher use of renewable energy generation) the CO2 emissions of this option will reduce proportionally less than the decentralised options which solely use grid electricity<br>Gas prices will be subject to higher inflation than electricity as carbon taxes increase.<br>More riser space required in each block and extensive below ground network required.<br>Less economical on smaller scale (if separate systems provided in phases)<br>A medium to large flue will be required to serve to centralised plantroom boilers. This flue would ideally be routed to roof level via a dedicated riser. At roof level the flue will need to be a minimum of 1m above the roof structure. If the flue is within 2.5m of a nearby structure at roof level it will need to be 1m higher than that structure.<br>Ventilation (natural or mechanical) will be required to serve the centralised plantroom which will require louvres on the façade. |

## 3.4 Additional Commentary on Option D2

Option D3 (Packaged Internal *Exhaust* Air to Water Heat Pump for Space Heating and Domestic Hot Water) relies on open trickle vents for the system to operate. User guides / training should be provided to occupants so they understand the system and ensure trickle vents are left open.

## 3.5 Benchmark Projects

<u>Centralised</u>

We have worked on a number of projects in the UK which have utilised Centralised Heating Systems.

One such project is the Hounslow High Street Quarter scheme which uses a CHP unit (Combined Heat and Power) as the lead heat generator (alternative option to Heat Pumps) and gas fired boilers as the secondary source of heat. We brought this project to Stage 4a. The scheme serves approximately 527no. apartments and 19no. retail units. The primary circuits consist of multiple plate heat exchangers which allow the retail unit heat loads to be sub-metered separately from the apartment blocks. With that in mind each of the 4no. blocks at St Teresa's Gardens could be served by separate plate heat exchangers (as one option) to allow the central plant and network to continue to run and serve the Phase 1 block whilst the Phases 2/3/4 are being constructed. Please find figure 03 below of the Hounslow High Street Quarter scheme and figure 04 of an example centralised plantroom layout.

*Figure 3 Hounslow Development Apartments and Retail Units*

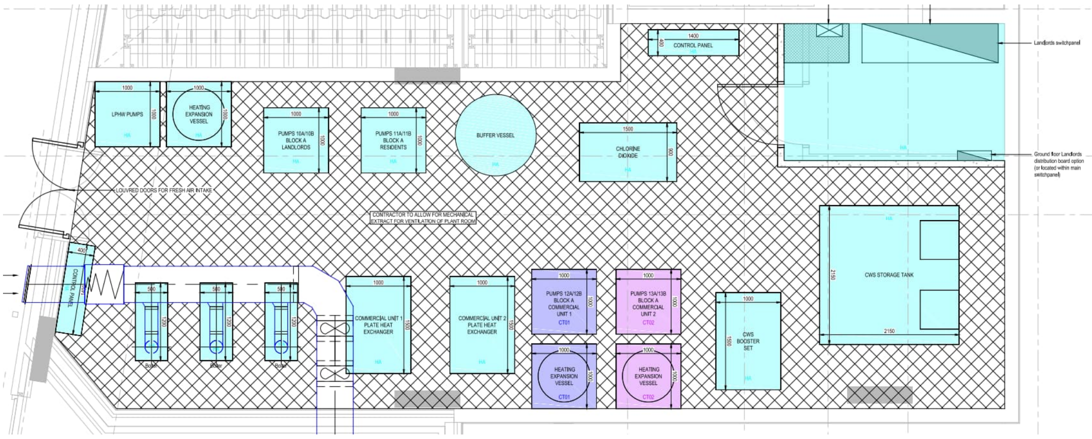


*Figure 4 Typical Plantroom Layout*

<u>Decentralised</u>

Exhaust Air Heat Pumps (Option D2) have become attractive for use in Ireland since Part L 2019 came into effect. Unfortunately, however they are relatively new to the Irish market and at present we do not have access to any example benchmark projects.

## 3.6 Market Soundings

The majority of schemes we have observed going through planning and construction since the revised Part L 2019 regulations came into force utilise decentralised systems, with exhaust air heat pumps typically the preferred option. However, we have noted an increased use of centralised systems in recent months on a number of schemes, some of which are outlined below.

It should be noted that the technology and infrastructure associated with centralised systems is tried and tested in Ireland and elsewhere, particularly on schemes of this scale. The preferred configuration has changed since the revised Part L 2019 regulations came into force as heat pumps are now required to meet efficiency / renewable energy targets, but ultimately all of the technology is tried and tested.

| Developer | Scheme | Stage | No. of Units | Description | Type of System |
|---|---|---|---|---|---|
| Confidential | City Centre - South Quays | In construction | 220 | Centralised | ASHPs, CHP & Boilers |
| Confidential | Dublin 18 | In construction | 370 | Centralised | ASHPs & CHP & Boilers |
| Eastwise | Hartfield Place, Swords Road | Commenced | 374 | Decentralised | EAHP |
| Cosgrave | Fairway, Dun Laoghaire | Complete | 214 | Centralised | ASHPs & CHP & Boilers |
| Ballymore | Royal Canal Park | In Design | 435 | Centralised | ASHPs & Boilers |
| Kennedy Wilson | Clancy Quay - Phase 3 | Complete | 250 | Decentralised | EAHP |
| DCC | Cromcastle - Phase 1 | In Design | 152 | Decentralised | EAHP + Supply Ventilation |
| Carrey Issuer | New Market Square | Planning | 419 | Centralised | ASHPs, CHP & Boilers |
| Hines | Player Wills | Planning | 492 | Decentralised | ASHPs for domestic hot water & Electric Heating |

In terms of the management of centralised plant and billing of energy supplies for residential schemes there are an abundance of options available. Regarding the maintenance of central plant an agency will typically table a number of options with respect to frequency of maintenance visits, future planning of plant replacement, the costs associated with maintenance and how these costs could be apportioned between the various parties (Building Owners, Tenants etc).

Regarding the billing of energy supplies again the management agency can apportion the costs associated with gas and electricity between the various parties to suit the Client. Regarding the centralised heat supply (which will also subsequently generate domestic hot water in the apartments), a central building management system would typically be used to take readings from each apartment heat meter which are then used to calculate what portion of the total centralised energy supply each apartment is using. Each apartment would also have its own dedicated electricity supply which would be metered separately. The final tariff charged to each tenant can be a total of all of the above or split into the various categories e.g. thermal energy (heating and hot water water), electricity, maintenance, management and sink fund payment.

It should be noted that at present the vast majority of centralised systems utilise a fossil fuel input to generate water at sufficient temperatures for domestic hot water generation (circa 75 – 80ºC) to minimise the risk of legionella. High temperature heat pumps could be used but are generally not cost effective. The CO2 emissions of electricity will reduce over time as the electricity grid utilises more renewable energy and becomes less reliant on fossil fuels. Therefore heating options solely using electricity (including decentralised options) will benefit more from this in the future and see lower overall CO2 emissions vs. a centralised system which uses fossil fuels for a proportion of the heating demand.

## 3.7 Recommendation

All of the options put forward have their individual advantages and disadvantages.

While the decentralised systems are technically more efficient based on the DEAP methodology and are not reliant on fossil fuels, the centralised system offers more potential to manage the system centrally to maximise operational efficiencies. The centralised system also facilitates the future integration of higher efficiency plant and new, lower emission technologies as they emerge.

In terms of capital costs, the centralised option has the highest upfront capital cost (largely due to the central plantroom) but a lower total cost. The decentralised options have lower upfront costs as the installations can be procured on a block by block basis. They do however have higher total capital costs.

In terms of future energy upgrades the centralised option offers the most opportunity for reducing energy use as new technologies become available.

In terms of plant space, a centralised system requires the least amount of apartment floor space for secondary components e.g. HIUs and pumps. It does however require a large plantroom, placed either within an apartment block or as a standalone building.

There are some options that could be considered at the next stage of the design to mitigate this:

1. CIBSE updated their code of practice 'CP1: Heat networks: Code of Practice for the UK' in 2020 to allow heat networks utilise lower operation temperatures for domestic hot water generation while still minimising the risk of legionella. As this is a very new standard it has not yet been applied to any projects in Ireland. Even were this standard not applied to Saint Teresa's Gardens initially, the heating infrastructure could be designed to operate at lower heating temperatures to allow for the gas boilers / CHP to be removed in the future. This would likely require additional plant space for heat pumps and buffer vessels.

2. The centralised heating configuration could be changed to provided dedicated hot water generation in each apartment. This configuration would lose some of the main advantages of the centralised system.

It should be noted that option D1 would require a significant amount of roof space for the PV panels associated with each apartment. With that in mind recent discussions have indicated that a large amount of roof space has already been allocated to communal amenity areas and as a result there may not be enough area for the required amount of PV.

With all of the above taken into account it is feasible that either a centralised or a decentralised system could be proceeded with. Were this a Private Residential Scheme (PRS) managed over a 30-year term the analysis supports the use of a centralised system due to the lower running, capital and total ownership costs. The higher CO2 emissions could be mitigated by futureproofing for future energy upgrades to the centralised system. However the choice of centralised or decentralised may largely be governed by the proposed use/tenancy of the scheme, how the heat network will be managed and how energy will be billed across a potential wide range of tenants (e.g. private owner, private rental and social) and entities. The phasing of the project should also be considered as there will be a high upfront cost associated with a centralised system.

## 3.8 Additional Commentary following LDA / DCC discussions

Following the previous issue of this report AECOM were asked by the LDA and DCC to carry out separate reviews of additional heating and ventilation options and how they might achieve Passivhaus certification. The LDA requested AECOM review an Option C2 - similar to option C1 but with all heating within apartments provided by a duct mounted LTHW heating coil instead of perimeter radiators. DCC requested AECOM review a further decentralised option (Option D4), consisting of an air to air heat pump incorporating heat recovery within a packaged unit. DCC have noted this D4 system being termed as a "double ducted exhaust air heat pump" but is also more commonly known as an air to air heat pump. As both systems have limited heating capacity the buildings would require improved u-values, air tightness's and the windows would need to change from double to triple glazing in order to for them to reach the required comfort levels and achieve Passivhaus certification. AECOM have also found that (a) Option C2 is significantly more expensive than Option C1, the LDAs closest preferred option and (b) Option D4 is significantly more expensive than either D3 or C1, the closest preferable DCC options.