FALLON DESIGN
M&E ENGINEERING

MECHANICAL & ELECTRICAL DESIGN STRATEGY, ENERGY, SUSTAINABILITY & PART L COMPLIANCE

PRIORSLAND VILLAGE CENTRE & RESIDENTIAL DEVELOPMENT

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1. Introduction

This design strategy, energy, sustainability and compliance report was prepared to accompany the planning application for the proposed development at Priorsland, Cherrywood, Co. Dublin. This report will outline the proposed mechanical and electrical solutions to ensure an efficient and sustainable solution for the Priorsland Village Centre & Residential Development as part of the Cherrywood Strategic Development Zone (SDZ) planning scheme.

This report aims to show how the proposed Priorsland development will comply with the relevant legislation for each building and its surroundings. These policies including the following:

- European Performance of Buildings Directive (EPBD)
- Irish Regulations (Specifically TGD Part L (2011))
- Dun Laoghaire / Rathdown County Plan 2016-2022
- Cherrywood Planning Scheme Document

In addition to the policies above, the most suitable Mechanical & Electrical (M&E) solution for the development must meet several other criteria in the current climate;

- Meet the comfort needs of the residents and end users of the development.
- Achieve compliance with policies including the latest Part L NZEB regulations and an A2 Building Energy Rating (BER)
- Be an efficient and sustainable heating & hot water solution for the residents.
- Ensure buildability and construction detailing that can be delivered in accordance with the building's envelope and internal fabric.
- Ensure a quality product for the end user and resident for the life of the development.

2. Development Description

The development will comprise a mixed-use village centre and residential development of 443 no. units comprising 6 no. blocks (A-F) of apartments (up to 5 storeys with basement/undercroft parking) providing 402 no. apartments units (146 no. 1-beds; 218 no. 2-beds and 38 no. 3-beds), and 41 no. houses (19 no. 3-beds and 22 no. 4-beds). All apartments provided with private balconies/terraces. Provision of indoor residential facilities to serve apartment residents.

The Village Centre and non-residential elements will comprise a supermarket, local retail/retail service units, non-retail commercial units, creche, gym, community space, and offices (High Intensity Employment) use.

Provision of car/bicycle/motorcycle parking; ESB sub-stations; bin storages areas, and all associated plant areas.

Provision of the first phase of Priorsland Park (on lands within the applicant's ownership) and other public and communal open spaces.

Construction of Castle Street through the subject lands and two road bridges across the Carrickmines Stream, one to serve the future school site/ park, the second to provide pedestrian and cyclist access to the Carrickmines Luas station and future Transport Interchange to the north. Provision of an additional pedestrian bridge to the park. Provision of an acoustic barrier along the southern/western edge of the site.

All associated site development works, landscaping, boundary treatments and services provision.

3. Design Approach

Fallon Design has taken a holistic approach to meeting the energy needs of the proposed Priorsland development and has considered the particular planning scheme objective / requirements as set out in the relevant standards and policies. We have considered the latest systems and technologies for the M&E strategy in both the houses and apartments that can achieve compliance with future Part L 2020 and meet the needs of the development's future residents.

Following the Lean-Clean-Green Energy Hierarchy, the first stage of carbon emission reduction is through the design of "fabric first" i.e. achieving a reduction in the energy needed, the second stage is sustainable generation of the actual energy required. The final stage is to introduce energy from renewable sources.

Lean – Use less Energy - Use of energy efficient building fabric, good air tightness levels and reduced thermal bridging
Clean – Use of energy efficient heating and hot water system, as well as efficient ventilation system
Green – Renewable Energy Integration

The passive approach of "fabric first" has been adopted in terms of maximizing the thermal efficiencies of the building envelope to reduce the required thermal load before a heating system is considered. In addition to careful selection of the high performance building fabric, specifically insulation materials, regulation of the air infiltration will serve to reduce the heat load of the buildings.

Other sustainable design elements to be included during detailed design are

- High performance glazing to harness solar gains
- Energy efficient heating systems to minimise running costs while also reducing carbon emissions.
- Heat recovery on ventilation systems
- High efficiency low watt DC motors
- Energy efficient lighting
- A-rated white goods
- Water efficient fittings to reduce water consumption

5. Cherrywood Planning Scheme Document Compliance Matrix

The following matrix confirms conceptual design compliance with the objectives contained within the Cherrywood Planning Scheme Document – Chapter 4 "Energy".

Chapter 4.4	Objective	Conceptual Design Considerations	Met
PI 27	Within this framework it is an objective to encourage locally generated renewable and low emission energy to supply a proportion of Cherrywood's energy demand. This could include a range of energy options such as district biomass, solar thermal collectors, ground thermal energy storage, and integrated energy/'heating systems such as Combined Heat and Power (CHP) at development area, neighbourhood and/or block scales, and the possible establishment of one or more Energy Service Companies (ESCO).	The amount of electricity locally produced using Photovoltaic (PV) in Priorsland will be determined by the latest edition of Part L of the building regulations. All renewable contributions as required in Part L to achieve compliance will be adhered to for landlord and circulation spaces. Central Plant heating with a biomass installation has been considered and deemed not the most suitable solution for this development. The primary reason is there is no large anchor tenant with a stable commercial load in the development. Priorsland is predominately an apartment residential scheme with a village centre of light retail and commercial units, i.e. there is no Hotel Spa & Leisure centre to generate a base load for a biomass plantroom incorporating a wood storage and delivery facility. Exhaust Air Heat Pumps (EAHP) have been selected for the developments energy centre in the apartments as opposed to a centralized Combined Heat and Power plant (CHP). The actual heating demand in NZEB A rated apartments is comparatively very low and hot water is the largest thermal load. No Energy Service Company (ESCO) is required for EAHP's as each individual residential unit benefits directly from low heating demand and moderate hot water consumption on their own ESB utility bill.	Y
PI 28	It is an objective to comply with all the objectives of the current County Development Plan in relation to energy.	The use of electrification in residential heating is seen as an important contributor to replacing fossil fuels and moving to a low-carbon model. This achieves the County Developments plans for reducing the carbon footprint of the development.	Y
PI 29	It is an objective to embrace new and innovative technologies in this field, and to support their provision within the Planning Scheme.	This report shall outline the advantageous of an innovative technology called Exhaust Air Heat Pumps (EAHP) used across Europe for many years and have come to the fore in Ireland.	Y

Chapter 4.4	Objective	Conceptual Design Considerations	Met
PI 30	It is an objective to support technologies and end-user behaviour to drive high levels of energy efficiency in end-uses.	Air source heat pumps have been proven to perform in Ireland delivering low energy costs. This technology is capable of achieving a high seasonal coefficient of performance (SCoP), typically between 3 & 5 depending on the system selection. These high levels of energy efficiency can be expected for the Priorsland development. Operating the heating system through the design of usable controls is a key element in delivering energy savings. The proposed design and the implementation of a practicable and usable interface for the end users is part of the design intent.	Y
PI 31	It is an objective to support and encourage sustainable energy initiatives.	Sustainability in housing design begins with reduction of the energy requirement by maximizing the buildings passive and active thermal performance. This sustainable design policy will be a key component of the detailed design process in Priorsland. Use of energy efficient M&E systems will also meet this objective.	Y

6. Dun Laoghaire Rathdown County Development Plan 2016 – 2022 Policy Compliance Matrix

The following matrix confirms conceptual design compliance with the relevant policies and objectives within the Dun Laoghaire Rathdown County Development Plan

Policy	Objective	Conceptual Design Considerations	Met
CC7: Energy Performance in New Buildings.	It is Council policy to promote and support new development that is low carbon development, is well adapted to the impacts of climate change and that energy conservation is considered and designed at the earliest stages through the use of energy efficiency management systems.	The Priorsland development has been detailed with a fabric first approach to reduce the carbon requirements from first principles. Reducing heat loss and maximizing glazing performance the built environment will generate a lower carbon foot print for its lifetime.	Y
Policy CC8: Excellence in the Built Environment.	It is Council policy to lead by example by developing a strategy for effective climate protection within its building stock.	The design and specification of high efficiency renewable technology inherently includes effective climate protection for buildings in Priorsland.	Y
Policy CC9: Sustainability in Adaptable Design.	It is Council policy to promote sustainable approaches to the improvement of standards for habitable accommodation, by allowing dwellings to be flexible, accessible and adaptable in their spatial layout and design.	The quality of the habitable accommodation has been delivered by the design team in Priorsland through the connections to the Luas, Linear Park and rich landscaping surrounding the built environment. This has been a key design focus for the development for the residents and users of the village centre.	Y

7. Houses: Heating & Hot Water Solution

The proposed heating solution for the houses in Priorsland shall use an air source heat pump due to their superior high efficiency hot water generation capacity. Under Part L the extraction of heat from the ambient outside air and released inside the building to both heat radiators as well as providing Domestic Hot Water (DHW) is considered a renewable technology, thus addressing both the clean & green elements of the energy hierarchy.

The outdoor unit shall be located discreetly in the landscaped rear gardens and mounted on a concrete plinth. As the outdoor units are fan assisted units, sensitivity in locating them is required so as not to disrupt any patio area with the cold air stream.

7.1 Space Heating

The houses will be heated with steel, horizontal panel radiators in each room and designed for the operating temperature of the air heat pump.

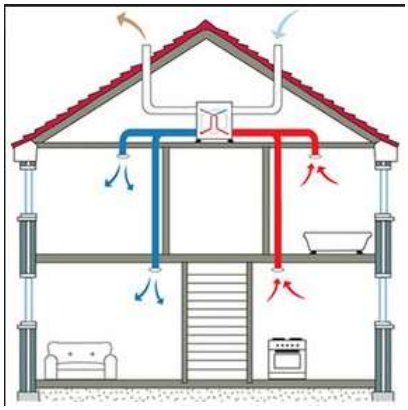
Each unit shall have two heating zones, the first zone will be the main open plan kitchen / living room and the second zone will be the bedrooms upstairs. Hot water will be on priority in all cases.

7.2 Mechanical Heat Recovery Ventilation (MVHR)

An independent system for mechanical ventilation will be used in the houses. The principle behind mechanical heat recovery ventilation is to continuously supply fresh air & extract stale air, so that the air in the house is changed around ten times per day. Air is supplied to living areas like bedrooms, the living room and extracted from service or wet rooms, i.e. bathrooms, kitchen and utility.

Schematic of typical MVHR System:

- Fresh air taken in at roof level
- Cold air warmed up by exhaust air
- Stale and moist air taken for WC's
- Warmed fresh air distributed
- Extract air discharged at roof level



8. Apartments – Mechanical Solution

8.1 Exhaust Air Heat Pump (EAHP) & Mechanical Extract Ventilation (MEV)

The heating and hot water strategy shall be used for the apartments in the development in accordance with current Part L of the building regulations and compliance demonstrated in accordance with SEAi requirements.

8.2 Element 51 – Heating Centre

The proposed heating and hot solution for the apartments shall be designed as an exhaust air heat pump. An Exhaust Air Heat Pump (EAHP), is an energy recycling system. It extracts energy from the warm air as it leaves the home via the ventilation system and uses it to heat the radiators and Domestic Hot Water (DHW).

The installation of an EAHP is self-contained within each apartment and only requires an ESB connection and standard mains water connection.

An exhaust air heat pump can satisfy the heating requirements of a well-insulated apartment in some of the coldest conditions. When working efficiently, it can reduce energy consumption of heating by up to 50% when compared to conventional heating systems.

If there is an extended period of cold weather the heat pump will call on a suitably sized back up heater to assist in meeting the apartments heating requirement.

The extracted air from the wet rooms is passed through the ducting into the heat pump. At this point, if there is a heat or hot water demand, the air passes through the heat pumps evaporator, which transfers the heat into the heat pump's refrigerant circuit.

The cooled air is then discharged from the unit and exhausted outside. Meanwhile, the vapour compression cycle of the heat pump raises the temperature of the refrigerant and transfers the extracted heat into a water-based system that can either heat the domestic hot water via a coil in an indirect cylinder or heat the building via radiators.

The EAHP is controlled with a touchscreen wall controller in each apartment with a phone app function as standard.

Typically, a local 250 litre hot water storage cylinder shall be located in a hot press of each apartment and meets the demands of the resident's hot water. An electric immersion shall be installed for boost and fast recovery of the cylinder if required.

8.2.1 Element 56 – Space Heating

The units will be heated with steel, horizontal panel radiators in each room of the units and designed for the operating temperature of the heat pump.

Each unit shall have two heating zones, the first zone will be the main open plan kitchen / living room and the second zone will be the bedrooms.

Heating control in the kitchen / living room will be with a 2-port valve and the room thermostat. Heating control in the master bedroom will be with a 2-port valve and thermostat. TRV's will control the space temperature in all other bedrooms.

8.2.2 Element 57 – Ventilation

The ventilation for the apartments shall be provided by the EAHP and be classed as mechanically ventilated. The central extract shall operate on the principle of mechanical extract ventilation (MEV).

MEV will be commissioned with two dedicated extract flow rates for the unit, one for background ventilation and one for boost ventilation.

- The background ventilation rate will be maintained 24/7 in order to ventilate the unit and maintain the heat pump operation volume flow rate.
- The boost ventilation will be activated by a drop-in air or water temperature and raise the volume flow rate to a maximum pre-set value.
- Passive wall inlet vents are required in all habitual rooms.

8.3 Landlord Circulation & Common Areas

The Part L compliance for the landlord circulation and amenity areas shall be satisfied with small Photovoltage (PV) panels as required locally to each stair core to meet the renewable contribution and reduce the lift and common area running costs.

8.4 Part L PBER Compliance - Apartment: Exhaust Air Heat Pump & PV

A provisional apartment BER has been included to demonstrate how exhaust air heat pumps can achieve NZEB Part L compliance in a typical 2-bed unit within the Priorsland development. See Fig 8.4a below.

Fig 8.4a: Draft PBER – Apartment

Priorsland Apartment : Provisional Part L Compliance Review - DRAFT	REV: A	Feb 2019	1830

Exhaust Air To Water Heat Pump and MEV Ventilation
Apartment Type 1 - Provisional BER - A2 NZEB Compliant (Draft Part L: Compliance)
Exhaust Air to Water Heat Pump Space heating & Hot Water
Cylinder heat loss 1.15 kWh/day
Mechanical Extract Ventilation
Radiator System
Time and temperature zone control.
A rated central heating pump
Secondary heating system: N/A
Photovoltage (PV): N/A

Results: Pass
EPC: 0.28 - (Control 0.3)
CPC: 0.237 - (Control 0.35)
Renewable Energy Ratio - 0.43 - (Control 0.2)

Notes:

The above fabric assumptions have been made to show compliance with an exhaust air heat pump installation.

One apartment has been assessed for the purpose of this exercise, the worst case and a full analysis on all types in all orientations will be completed at detailed design stage

	Proposed Fabric	U Value	Details
Apartment Type: 80 m2 / 2 Bed			
1	Floors	N/A	200mm EPS Graphite insulation Thermal Conductivity 0.031
2	Roofs	0.15	150mm Rigid Insulation Thermal Conductivity 0.022
3	Sloped Roof	N/A	N/A
4	Block Walls	0.16	Thermal Conductivity 0.018 or equivalent
5	Doors	1.2	TBC
6	Windows - Double Glazed	1.2	Windows TBC with solar transmittance of 0.73.
7	Thermal Bridge Factor	0.08	
8	Air Leakage	$3m^3/hr/m^2$	0.15ach
9	Thermal Mass	High	

9. Car Park Ventilation

The design of the basement and podium level car park ventilation will be a mix of both natural and mechanical ventilation. The developments car park design is a balance between achieving the required louvre area for naturally ventilated car parks and the quality of the public amenity circulation spaces with the high level of landscaping.

Mechanical Ventilation:

The basement carpark under blocks A & B is mechanically ventilated achieving both 6 air changes (ach) for normal operation and 10 ach in fire conditions. The overriding factor for selecting a mechanical ventilation system was to limit louvre area at podium level. Louvre areas required to allow a naturally ventilated carpark were deemed too restrictive and would compromise an unacceptable proportion of the usable public village centre.

An amount of mixed mode ventilation openings has been incorporated into the Blocks A & B podium level to reduce the running cost of basement extract fans. These openings have been designed into public seating and do not impact the usability of the public space.

The basement mechanical ventilation shall be designed as a pulse fan system with one extract plantroom and one supply air plantroom. The long linear rectangle shape of the basement car park makes an efficient ventilation system reducing the amount and dead spots and irregular shaped corners.

Natural Ventilation:

The basement under block C is naturally ventilated achieving the required opening area in accordance with the building regulations. The open louvre area has been carefully integrated into the landscape design to reduce the impact on the quality of the public amenity space.

The podium car park in block E & block F are also naturally ventilated achieving the required opening area in accordance with the building regulations.

10. Electric Vehicle (EV):

With introduction of new guidelines from the Irish government and the growing demand for alternative sources of fuel, the publics need for EV charging options is ever increasing in popularity. The following allowance will be included in the development for EV charging.

EV charging shall be provided in Priorsland in accordance with the Dun Laoghaire County Council Development Plan 2016 – 2022. The number of EV points shall be as per 8.2.4.12 Electrically Operated Vehicles;

Houses:

Each house shall be pre-wired for EV to allow the home owner to install a car charging point to the front or side of their house easily. The 6.0 mm^2 cable and location shall be suitably selected and positioned relevant to their private car parking spaces.

Apartments:

Total apartment number across the scheme 404; 40 EV spaces to be provided; on the basis of the 1 per 10 residential units ratio described in the current DLRCC Development plan.

Public Spaces / Non-residential:

Total retail + Non residential parking 120 spaces provided; 12 EV spaces to be provided; on the basis of the 1 per 10 car parking spaces ratio described in the current DLRCC development plan.

11. Summary

The Priorsland design team have implemented a holistic fabric first approach for a sustainable and energy efficient development for its owners and occupants into the future.

The following is a summary of the proposed Mechanical and Electrical proposed heating, ventilation and hot water solutions for the Priorsland development:

- Houses:
    - Air Source Heat Pumps with
    - Mechanical Heat Recovery Ventilation (MVHR)

- Apartments:
    - Exhaust Air Heat Pump with integral Mechanical Extract Ventilation (MEV)

This report confirms compliance with the energy & sustainability sections of the Cherrywood Planning scheme and the Dun Laoghaire Rathdown County Development Plan 2016 – 2022.

The draft provisional Apartment BER in section 8.4 demonstrates compliance with Part L technical guidance document with a calculated Energy Performance Coefficient (EPC) less than the Maximum Permitted Energy Performance Coefficient (MPEPC) of 0.3 and a calculated Carbon Performance Coefficient (CPC) of less than the Maximum Permitted Carbon Performance Coefficient (MPCPC) of 0.35.

The passive approach of “fabric first” has been adopted in terms of maximizing the thermal efficiencies of the building envelope to reduce the required thermal heat load required internally by the residents.

Sustainable use of the energy required to satisfy thermal loads has been considered and renewable sources selected. This approach will guide the development from planning through to detailed design to satisfy the high standards of Nearly Zero Energy Buildings.