RENAISSANCE ENGINEERING

ENERGY & SUSTAINABILITY REPORT

FOR

THE LYREEN VIEW APARTMENTS
MILL STREET
MAYNOOTH
Co. KILDARE

Rev 01

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1. Introduction

1.1 Description of Development

Ladas Property Company intend to apply for planning permission to construct a mixed-use development in 4 No. separate blocks.

The development will consist of the provision of a total of 115no. apartments in 4no. separate blocks incorporating provision of a crèche and restaurant/café, 1no. office unit and provision of a basement to provide for car parking, bicycle storage and ancillary bin storage areas. Particulars of the development comprise as follows:

a) Replacement of 2no. existing vehicular entrances onto Mill Street with 1no. single access point onto Mill Street to incorporate the proposed vehicular entrance works along with associated pedestrian and cyclist connections onto Mill Street and associated works to provide for a bus stop and realignment of existing footpath in accordance with planned Part VIII works for this section of Mill Street.

(b) Site excavation works to facilitate the proposed development to include levelling, excavation and general site preparation works.

(c) Block A: A four-storey building comprising a creche and restaurant/café at ground floor level and upper floors incorporating 1no. office unit, provision of 7no. 1bed apartments and 10no. 2bed apartments with associated civic space fronting onto Mill Street and external play area to the rear to serve the creche. A basement will be provided under Block A for parking and bin storage.

(d) Block B1: An apartment block ranging from three to five storeys comprising a total of 32no.residential apartments to consist of 6no. 1bed apartments, 19no. 2 bed apartments and 7no. 3 bed apartments. A basement will be provided under Block B1 which will incorporate an access ramp, parking and bin storage.

(e) Block B2: A six storey apartment block comprising a total of 48no. residential apartments to consist of 13no. 1bed apartments and 35no. 2 bed apartments.

(f) Block C: An apartment block ranging from four to five storeys comprising a total of 18no. residential apartments to consist of 1no. 1bed apartments, 13no. 2 bed apartments and 4no. 3bed apartments along with a ground level storage room for bicycles and bins. Block C will be raised on stilts with a flood storage area provided at ground level beneath this Block.

(g) Provision of a basement car parking area to comprise a total of 74no. car parking spaces (incorporating infrastructure for electric vehicle charge points), along with bicycle storage and bin storage areas.

(h) Provision of bicycle and bin storage facilities at surface level.

(i) Provision of internal access roads and footpaths/cycle paths.

(j) Provision of residential communal open space areas (including formal play areas) to include internal walkway along the Lyreen River and pedestrian bridges within the site and including all associated landscape works with public lighting, planting and boundary treatments.

(k) Provision of an ESB substation adjacent to Block B1.

(l) Associated site works and attenuation systems to include a hydrocarbon and silt interceptor to facilitate site drainage as well as all ancillary site development/construction works with provision of a foul pump station and internal foul, storm and water networks for connection to the existing foul, storm and public water networks.

1.2 Building Energy Rating

This report outlines the Energy Analysis and Part Compliance undertaken for the proposed Residential Development, at The Lyreen View Apartments, Mill Street, Maynooth, Co. Kildare. The report identifies how a strategy utilising exhaust air heat pumps in each apartment to provide ventilation, heating and hot water was developed, in order to ensure compliance to Part L 2011 of the Building Regulations in both significantly reducing Primary Energy and providing the requisite contribution of renewable energy.

The introduction of the Building Energy Rating system for evaluating the energy performance of all buildings has led to an increased focus on the energy usage of developments currently being constructed.

The design shall place high emphasis on the Mechanical and Electrical services, All works shall be in full compliance with all current statutory regulations, Irish and British standards and be fully compliant with the requirements of Part L and the newly implemented (NZEB) Near Zero Energy Building regulations.

1.3 Energy Efficient & Sustainable Technologies Considered

The following energy systems were considered for this development in terms of capital costs, energy performance, maintenance requirements & Part L Compliance.

- Gas Boilers & PV Panels
- Air to Water Heat Pump with External Condenser on Balcony
- Exhaust Air Heat Pump
- Centralised System

1.4 Description of Systems

1.4.1 Gas Boiler & PV

With this option, a high efficiency condensing boilers is used to provide LPHW heating to all areas via low surface temperature radiators or an underfloor heating system, as well as hot water via a calorifier. Condensing boilers have a very high efficiency as outlined below.

Condensing Boilers

	Seasonal Efficiency
Condensing Boilers	90% – 95%
High Efficiency Boilers	70% - 82%
Older Boilers	50% - 70%

Condensing boilers have a higher efficiency than standard boilers due to a secondary heat exchanger, which condenses water vapour out of the combustion products which would otherwise be lost in the flue.

This system does not use any renewable energy sources however and if used alone would not achieve Part L compliance and would result in higher energy bills and a larger carbon footprint. The proposal considered also incorporates PV panels serving each apartment.

Solar PV

- Solar Photovoltaic Panels – once installed – provide free electricity for decades
- Predictable – unlike wind power, annual solar irradiation can be estimated using historical weather data
- Tried and tested, proven technology. There are systems installed in the 1980's, still operating today
- Long performance warranties on Solar PV panels – generally 25 years as standard
- Life expectancy of PV panels are 30 years +
- No moving parts – minimal maintenance or servicing
- Versatile – multiple methods of roof and ground installation – as well as car ports, awnings, facades, etc.
- Economical – prices of PV panels have fallen by 40% since 2014
- Efficient – PV panel outputs have more than doubled since 2010, and the physical sizes of 60 cell panels have not changed
- Responsible – PV panel manufacturers invest in low carbon manufacturing techniques and offsetting, and commit to recycling products at end-of-life
- PV panels help homes and businesses reduce their carbon footprint
- PV panels are an investment, and future-proof homes and businesses from rising electricity prices
- Sell electricity back to the grid – business users can sell their excess electricity back to the grid

- Solar PV systems can be coupled with battery technology to store electricity for night-time usage
- Solar power improves grid security – it is more efficient to use electricity on the same site where it is produced, if more PV systems are installed then the grid can better cope with peak daytime demands

1.4.2 Air Sourced Heat Pump

This system consists of an external air to water heat pump which uses a refrigerant cycle to extract energy from the external air and convert it to high grade heat for use in space heating and hot water systems. Advantages of this type of system are as follows:

- System will achieve an A2-A3 rated dwelling without the addition of another renewable source.
- One standalone system so reduced installation costs.
- Suited for apartment developments as there is a standalone system per dwelling and no centralised plant. This reduces management fees for developer.
- Can be supplied with a factory pre-plumbed & pre-wired cylinder which simplifies installation and eradicates potential installer error.
- Due to simplified design a standard domestic plumber can install. No specialised heat pump engineer needed.
- Compliance can be met with or without heat recovery ventilation.
- South orientation is not a factor when meeting compliance. This can be the case if using solar as your renewable source.
- Adequate roof area is not always available for a solar installation.
- The heat pump only gives you hot water when it's needed. Solar thermal gives you hot water when sun is available.
- The system works on a lower operating temperature therefore drastically reduced running costs are achieved.
- Throughout the year, the heat pump will run at efficiencies of 250-450% depending on ambient temperature.
- The system works best in conjunction with underfloor heating and aluminium radiators but can also be installed with suitably sized steel radiators.

The only drawback with this type of system is that the heat pump needs to be located on an external balcony. The units are not the most aesthetically pleasing and may not suit some developments.

1.4.3 Centralised System

This system consists of a centralised plant room typically using a combination of condensing boilers alongside a renewable technology such as air sourced or geothermal heat pumps. Combined Heat & Power (CHP) units can also be utilised as part of a centralised system. Low pressure hot water is distributed to each apartment via a piping network and is controlled via a heat interface unit located within each apartment. Advantages/Disadvantages of this type of system are as follows:

- In theory ESCO can operate at a profit by buying fuel in bulk and selling to end user at a higher rate. In practice it is difficult to achieve and there are a lot of pitfalls.
- Efficiency of central plant is poor due to circulation losses. Typically 65%.
- Landlord is responsible for collecting payment from each tenant and needs to set up an energy supply company.
- Expensive installation with centralised plant and pipework distribution network.
- Additional professional fees associated with design of centralised system.
- Large gas connection required.

- Metering and billing system required.
- Central heating plant still needs to be supplemented with a renewable technology such as air or geothermal heat pumps or a CHP plant.
- Construction of plant room & associated civil works need to be considered.
- Overheating can occur in landlord areas as hot water circulation is required 24/7 to serve instantaneous hot water demand in each apartment.
- Maintenance requirement for central plant can be very costly.

1.4.4 Exhaust Air Heat Pumps

An exhaust air heat pump extracts air via ventilation ducts positioned in the wet rooms of the house such as bathrooms, kitchens and utility rooms.On its way out of the house, heat is extracted from the old air and transferred into the heat pump's refrigerant circuit. The cooled air is then discharged. 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 warm the domestic hot water or heat the building, or both. For the purpose of this analysis the NIBE Exhaust air heat pump has been considered. Advantages of this system are as follows:

- Efficiency of 570%. For every kW of electricity consumed 5.7kW of heat can be produced.
- Full part L compliance in a single unit from one manufacturer that does, heating, hot water and ventilation.
- Integrated control system with large, easy to read multi-colour display.
- Easily connects to wireless network to provide remote access from mobile devices for control and monitoring of heating & hot water.
- Similar cost to boiler & PV but far more efficient and cost effective for end user.
- Simple clean installation with electrical connection. Stylish free standing unit incorporated into kitchen design that fits in a 600 x 625mm space.
- More storage space in apartment as no need for additional hot press to house cylinder.
- Excellent ventilation throughout apartment to ensure no issues with condensation which can occur with modern air tight units.
- No requirement for solar, gas pipework, civil works or central plant.
- No requirement for metering or billing.

1.6 Cost Analysis

The following capital costs per apartment type have been calculated for each proposed system.

Description	1 bed	2 bed	3 bed
1. Gas Boiler & PV Panels	€10,200.00	€11,800.00	€12,600.00
2. Air To Water Heat Pump	€9,600.00	€10,900.00	€11,800.00
3. Centralised System	€12,000.00	€13,300.00	€14,100.00
4. NIBE Exhaust Air Heat Pump	€10,400.00	€11,700.00	€12,400.00

The proposal for a centralised system is the most expensive option and coupled with the disadvantages outlined above this is not considered to be a viable option for the development.

1.7 Energy Analysis

The remaining three systems have been analysed in terms of their energy performance and the results are outlined below. The calculations were carried out using the DEAP software for a typical 3-bedroom apartment.

Description	Proposed System		
	Exhaust Air HP	Air Sourced Air HP	Boiler & PV
BER Rating	A2	A2	A2
Energy Value kWh/m2/year	48.03	44.2	47.75
CO2 Emissions CO2/m2/year	9.45 kg	8.69 kg	8.67 kg
EPC (Max)	0.398 (0.40)	0.366 (0.40)	0.395 (0.40)
CPC (Max)	0.385 (0.460)	0.354 (0.460)	0.353 (0.460)
Renewable Energy Contribution (Min) kWh/m2y	11.65 (10.0)	14.64 (10.0)	28.4 (10.0)
Part L Compliant	Yes	Yes	Yes

It can be seen from the above comparison that all three options are Part L compliant and achieve an A2 rating. The Diakin Air Source Heat Pump has been chosen as been chosen as it has the lowest energy use.

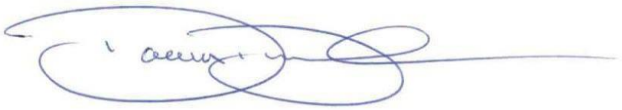
1.8 **Schedule of Proposed Systems & Building Fabric** Details

Item	**Specification**
Primary Heat Source	Daikin ERGA06DV3 Air to Water Heat Pump.
Secondary Systems	None
Chimneys	None
Heating element	Radiators – Design flow temperature of 40° max.
Central Heating Pump	1no. central heating pumps – Energy Label Category A
Heating controls	Individual time and temperature zone control (A minimum of two heating zones and one hot water zone)
Hot Water Storage Tank	180 Litre Daikin EHVH04S18D6W with a declared loss factor of 1.10 kWh/day
Lighting	All lamps must be A-Rated low energy type.
Ventilation Heat	Natural Ventilation with Mechanical extract in Bathroom & Kitchen
Air Tightness Results	Max. Result of air tightness test of 3 $m^3/m^2/hr$ @ 50 Pascals
Thermal Bridging Factor	0.08 W/m2K (All new construction details shall be in compliance with Acceptable Construction Details as set out in “Limiting Thermal Bridging & Air Infiltration – Acceptable Construction Details”)
Thermal Mass	Medium High
Floor	U-value 0.18 W/m2K or better
Flat Roof	U-value 0.20 W/m2K or better
Wall	U-value 0.18 W/m2K or better
Window, Glazed Doors	U-value 1.4 W/ m2K, Solar Trans – 0.64, Frame Factor – 0.7

1.9 Recommendation

A Daikin/NIBE or equivilant Air to Water Heat Pump will be installed in each apartment to cater for all hot water and space heating. Radiators shall be installed throughout and selected for a MWT of 40oC. The system shall provide individual time and temperature control over heating and hot water. A-rated low energy lamps shall be used throughout. Air tightness values and building fabric details shall be as outlined in 1.8 above. Please refer to Appendix A for full Part L specification.

Signed:



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