RENAISSANCE ENGINEERING

ENERGY & SUSTAINABILITY REPORT

FOR

SOUTHGATE NORTH STRATEGIC HOUSING DEVELOPMENT PARK CRESCENT DROGHEDA CO. LOUTH

Rev 2
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1. Introduction

1.1 Description of Development

Rockmill Ltd, intends to apply to An Bord Pleanála (the Board) for permission for a strategic housing development (SHD) on a site to the northwest of the Dublin Road, to the north of the existing Southgate Centre, and to the southwest of the existing Grange Rath residential development in Drogheda, Co. Meath.

The proposed development consists of a residential development comprising 201 no. residential units on a site of 1.74 hectares.

The 201 no. residential units proposed are located within 5 no. proposed apartment buildings of 5 no. storeys in height over basement.
The proposed units comprise 53 no. 1 bedroom apartments, 132 no. 2 bedroom apartments, and 16 no. 3 bedroom apartments.

The development includes associated site and infrastructural works including all associated road infrastructure, cycle and pedestrian facilities, foul and surface / storm water drainage, surface water management features, 181 no. car parking spaces, public open space, bin and bike stores, landscaping and boundary treatments, 1 No. ESB Substation and all ancilliary works.

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1.2 Building Energy Rating

This report outlines the Energy Analysis and Part Compliance undertaken for the proposed Residential Development, at Southgate North, Park Crescent, Drogheda, Co. Louth, 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 2019 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.

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 boiler 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 budget capital costs per apartment type have been calculated for each proposed system.

Description	1 bed	2 bed	3 bed
1. Gas Boiler & PV Panels	€11,220.00	€12,980.00	€13,860.00
2. Air To Water Heat Pump	€10,560.00	€11,990.00	€12,980.00
3. Centralised System	€13,200.00	€14,630.00	€15,510.00
4. NIBE Exhaust Air Heat Pump	€11,440.00	€12,870.00	€13,640.00

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	39.22	37.15	40.91
CO2 Emissions CO2/m2/year	7.71	7.3	7.48
EPC (Max)	0.286 (0.30)	0.271 (0.30)	0.299 (0.30)
CPC (Max)	0.28 (0.35)	0.266 (0.350)	0.272 (0.35)
Renewable Energy Ratio	0.322	0.405	0.233
Part L Compliant 2019	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 NIBE exhaust air heat pump has been chosen as the preferred option due to the fact it is a self-

contained unit with no need for an external unit on a balcony or PV panels on the roof. The single unit will provide all the heating, hot water and ventilation requirements for each apartment.

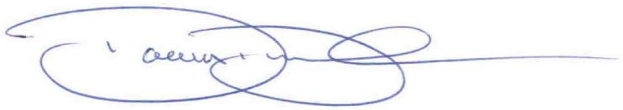
1.8 Schedule of Proposed Systems & Building Fabric Details

Item	Specification
Primary Heat Source	Nibe F730 - Exhaust Air Heat Pump
Secondary Systems	None
Chimneys	None
Heating element	Radiators – Design flow temperature of 40° max.
Central Heating Pump	1no. central heating pumps – Energy Efficiency Index (EEI)$\leq$ 0.2
Heating controls	Individual time and temperature zone control
Hot Water Storage Tank	180 Litre Nibe F730 with a declared loss factor of 2.02 kWh/24hr (Part of EAHP Unit)
Lighting	All lamps must be A-Rated low energy type.
Ventilation Heat	Nibe F730 - Exhaust Air Heat Pump with whole house extract ventilation system (Local Mechanical Extract in 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 1.60 W/ m2K, Solar Trans – 0.73, Frame Factor – 0.7

1.9 Recommendation

A Daikin 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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