RENAISSANCE ENGINEERING

Energy Statement

Colp Residential Development, Mill Road, Drogheda

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Executive Summary

This report prepared by Renaissance Engineering demonstrates how the energy performance and the sustainability of construction of the proposed Development at Colp Residential Development, Mill Road, Drogheda will meet or exceed legislative and planning requirements.

The energy strategy has been approached in a holistic manner using the energy hierarchy “Be Lean, Be Clean, Be Green” in order to comply with Part L 2017 requirements for energy performance and greenhouse gas emissions. The development is targeting to reach Technical Guidance Document L – Conservation of Fuel & Energy 2017 performance and NZEB.

The design has placed high emphasis on passive solar design, combining external local shading with high performance glazing in order to minimise solar heat gain in accordance with the Part L solar overheating criteria while maximising natural daylight access.

Key features of the energy efficient design of Colp Residential Development, Mill Road, Drogheda include enhanced building fabric performance, heat pump systems and high efficacy lighting with occupancy and daylight control where applicable. The proposed energy strategy as detailed in this report is compliant with the requirements of Part L and achieves NZEB.

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1 Introduction

This report prepared by Renaissance Engineering demonstrates how the energy performance and the sustainability of design and construction of the proposed development Colp Residential Development, Mill Road, Drogheda will meet or exceed legislative/planning requirements. This report is to form part of the planning submission documentation to An Bord Pleanala.

The proposed development offers a building which meets current development space design and standards whilst working within the constraints and opportunities offered by the site.

The proposed design will comply with national building regulations for energy performance and carbon emissions set out in 'Technical Guidance Document Part L - Conservation of Fuel and Energy 2011 - Buildings other than Dwellings'. A provisional Building Energy Rating (BER) will also be produced in line with the EU Directive on Energy Performance in Buildings (EPBD).

Colp Residential Development, Mill Road, Drogheda is subject to the MCC Development Plan 2013-2019.

The overall energy strategy of the proposed design has been approached in a holistic manner using the adopted energy hierarchy "Be Lean, Be Clean, Be Green". Energy performance has been assessed in accordance with the Domestic Energy Assessment Procedure (DEAP) methodology to demonstrate the systematic improvement in energy performance.

1.1 Draft Development Description

The proposed development consists of a residential development comprising of 357 no. residential units and a childcare facility and associated play area, road infrastructure , a pedestrian bridge over the railway line and associated pathways, all associated open space, cycle and pedestrian infrastructure, services and all other associated development on a site of c. 13.44 hectares at Colp West, Drogheda, Co Meath.

The 357 no. residential units proposed consist of 169 no. houses, 52 no. duplex units and 136 no. apartments. The 169 no. houses will consist of 65 no. 4 bedroom units and 104 no. 3 bedroom units. The 52-no. duplex and apartment units will consist of 52 no. 3 bedroom units. The 136 Apartments will consist of 78 no. 2 bedroom units and 58 no. 1 bedroom units.

The proposed childcare facility has a GFA of 439 sq. mt.

The proposed houses are 2/3 storeys in height and the duplex/apartment blocks are 3 - 6 storeys in height.

The development includes associated site and infrastructural works including all associated road infrastructure, foul and surface / storm water drainage(including upgrading of water services on Mill Road) , surface water management including attenuation and storage features, a pumping station, watermains and utilities, 592 no. car parking spaces, 532 no. cycle parking spaces, public open space including a linear park, bin and bike stores, 2 no. substations, public lighting, landscaping consisting of new tree planting , hedges, berms and grass planting, boundary treatments, public lighting, and all ancillary works.

2 Renaissance Engineering's Approach

2.1 Energy Strategy Methodology

The proposed development will aim to exceed where feasible the requirements of Part L; achieving Nearly Zero Energy Building (NZEB) performance.

As defined by the 'Interim Nearly Zero Energy Building Performance Specification'

- Basis of Part L 2017 came into effect on the 1st of January 2019.
- This will require approximately 60% primary energy use reduction over the Part L requirement and the use of renewable energy technologies to reduce primary energy by 10-20%.

2.2 Energy Hierarchy

In order to achieve these objectives, the following energy hierarchy (referred to as "Be Lean, Be Clean & Be Green") has been used to identify and prioritise effective means of reducing carbon emissions.

Be Lean

Energy efficiency through design and use

Be Clean

Optimise energy supply infrastructure for efficiency through 'Low Carbon' strategies

Be Green

Utilise renewable energy resources where appropriate

Renaissance Engineering considers the above a hierarchy proposed and/or endorsed internationally by many local authorities - to be well considered and an appropriate set of principles to adhere to in tackling climate change. In adopting the hierarchy, the CO_2 savings at each stage are maximised before strategies at the next stage are considered.

3 Legislative and Planning Requirements

Any new developments need to comply with two things;

1. National Legislation to meet requirements of the EU Directive on Energy Performance in Buildings (EPBD) – Part L 2011.
2. Local planning requirements as determined by the local authority.

3.1 European Union Legislative Initiatives

The Directive on Energy Performance in Buildings (EPBD), adopted in 2002, primarily affects energy use and efficiency in the building sector in the EU. Ireland transposed the EPBD through the Energy Performance of Buildings Regulations 2003 (S.I. 666 of 2006) which provided for the Building Energy Rating (BER) system to be administered and enforced by the Sustainable Energy Authority of Ireland (SEAI).

The Recast EPBD, adopted in May 2010, states that reduction of energy consumption and the use of energy from renewable sources in the buildings sector constitute important measures needed to reduce the EU's energy dependency and greenhouse-gas emissions. The directive aims to have the energy performance of buildings calculated on the basis of a cost-optimal methodology. Member states may set minimum requirements for the energy performance of buildings.

The recast EPBD requires Ireland to ensure, among other obligations, that:

- Building energy ratings are included in all advertisements for the sale or lease of buildings;
- Display Energy Certificates (DECs) are displayed in public and privately-owned buildings frequently visited by the public;
- Heating and air-conditioning systems are inspected;
- Consumers are advised on the optimal use of appliances, their operation and replacement;
- Energy Performance Certificates and inspection reports are of a good quality, prepared by suitable qualified persons acting in an independent manner, and are underpinned by a robust regime of verification; and
- A national plan is developed to increase the number of low or nearly zero energy buildings (NZEB), with the public sector leading by example.

The directive was transposed by the European Union (Energy Performance of Buildings) Regulations 2012 (S.I. 243 2012).

Part 2 of the EPBD deals with Alternative Energy Systems and applies to the design of any large new building, where a planning application is made, or a planning notice is published, on or after 1st of January 2007. This calls for a report into the economic feasibility of installing alternative energy systems to be carried out during the design of the building. Systems considered as alternative energy systems are as follows:

- Decentralised energy supply systems based on energy from renewables.
- Cogeneration i.e. Combined heat and power systems.
- District or block heating or cooling, if available, particularly where it is based entirely or partially on energy from renewable sources.
- Heat pumps.

3.2 Building Regulations Part L

The Technical Guidance Documents Part L – Conservation of Fuel and Energy 2017 – Dwelling (referred to in this document as 'Part L') stipulates the following requirements on new dwelling:

1. Limitation of Primary Energy Use and CO_2 Emissions.
2. Renewable Energy Technologies.
3. Building Fabric.
4. Building Services.
5. Construction quality and commissioning of services.

3.2.1 Limitation of Primary Energy Use and CO_2 Emissions

Maximum energy use and CO_2 emissions are calculated using the Domestic Energy Assessment Procedure (DEAP) methodology. DEAP takes into consideration a range of factors that contribute to annual energy usage and associated CO_2 emissions for the provision of space heating, cooling, water heating, ventilation and lighting of buildings.

The DEAP is set out to fulfil the requirements of the EU Directive on Energy Performance in Buildings (EPBD) and compliance is compulsory for all new buildings. The framework considers:

1. Thermal characteristic of the building, including air tightness.
2. Heating installation and hot water supply, including their thermal characteristics.
3. Air conditioning installation.
4. Natural and mechanical ventilation.
5. Built-in lighting installation.
6. Position and orientation of buildings, including outdoor climate.
7. Passive solar systems and solar protection.
8. Indoor climatic conditions, including the designed indoor climate.
9. Active solar, and other heating and electricity systems based on renewable energy sources.
10. Electricity produced by combined heat and power.
11. District or block heating or cooling systems.
12. Natural lighting.

Domestic Energy Assessment Procedure (DEAP)

In order to demonstrate that an acceptable primary energy consumption rate has been achieved, the ratio between the calculated Energy Performance Coefficient (EPC) should not be greater than the Maximum Permitted Energy Performance Coefficient (MPEPC), with a value of 0.30. Similarly, the ratio between the calculated Carbon Performance Coefficient (CPC) should not be greater than the Maximum Permitted Carbon Performance Coefficient (MPCPC), with a value of 0.35.

Where a building contains more than one dwelling, every individual dwelling or alternative, the average of the dwellings within the development's Energy and Carbon performance coefficients should not exceed the maximum permitted coefficients.

Simplified Building Energy Model (SBEM)

The Simplified Building Energy Model (SBEM) is a calculation engine designed for the purpose of indicating compliance with building regulations Part L in regards to primary energy usage from buildings other than dwellings. SBEM has certain limitations and is explicitly for benchmarking purposes; not a design tool.

3.2.2 Nearly Zero Energy Buildings (NZEB)

The EPBD requires all new buildings to be NZEB by 31st December 2020 and all buildings acquired by public bodies by 31st December 2018; defining NZEB as:

''A building that has a very high energy performance, as determined in accordance with SBEM/BER. 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 'Interim Nearly Zero Energy Building Performance Specification' for new buildings owned and occupied by Public Authorities was launched in January 2017. It is intended that this specification will define NZEB in Ireland in the interim period until Part L 2017 for Buildings other than Dwellings takes effect in 2019, replacing Part L 2011.

N.B. NZEB is not separate to the building regulations, it is merely a term used to define the targeted performance of building regulations in the near future; i.e. buildings compliant with the requirements of Part L 2017, which is set to become mandatory in 2019, will be NZEB.

3.3 Renewable Energy Technologies

New dwellings are obligated to install some form of renewable energy technologies in the premise to comply with regulations. The permissible technologies refer to equipment that supply energy derived from renewable energy sources, e.g. solar thermal, on-site solar photovoltaic, biomass, biogases, biofuels, heat pumps. Combined heat and power, aerothermal, geothermal, hydrothermal, wind, and other on-site renewable energy systems.

The minimum level of energy provision required to satisfy regulations are presented below. For developments with more than one dwelling, every individual dwelling or the average of the development would collectively be required to contribute:

- 10 kWh/m^2/annum to energy use for domestic hot water heating, space heating/ cooling; or
- 4 kWh/m^2/annum of electrical energy; or
- A combination of these which would have equivalent effect.

3.4 Building Fabric

Building Regulations Part L outlines the acceptable levels of provisions necessary to ensure that heat loss through the fabric of a building is minimised. The technical document discusses various aspects, including:

- Insulation levels to be achieved by the plane fabric elements.
- Thermal bridging.
- Limitations of air permeability.

3.4.1 Fabric Insulation

The new development will be designed and constructed to limit heat loss and where appropriate, limit heat gains through the fabric of the building. In order to limit the heat loss through the building fabric the thermal insulation for each of the plane elements of the development will meet or exceed the area weighted average elemental U-Values as specified in Part L.

Fabric Elements	NZEB
Pitched Roof	0.15
Flat Roof	0.15
Walls	0.18
Ground Floors	0.18
Other Exposed Floors	0.18
External Personnel Doors, Windows and Rooflights	1.4

Table 1: Maximum elemental area weighted average U-value (W/m²K) for dwellings

3.4.2 Thermal Bridging

To avoid excessive heat losses and local condensation problems, consideration will be given to ensure continuity of insulation and to limit local thermal bridging, e.g. around windows, doors and other wall openings, at junctions between elements and other locations. Heat loss associated with thermal bridges is considered in calculating primary energy use and CO_2 emissions using DEAP methodologies.

Acceptable Construction Details will be adopted for all key junctions where appropriate (i.e. typical/standard junctions). For all bespoke key junctions, certified details which have been certified by a third-party certification body will be used.

The default values for thermal bridging as set out in table D2, Appendix D of TGD – Part L 2017, will be used or the certified details for any bespoke key junctions.

3.4.3 Air Permeability

In addition to fabric heat loss, reasonable care will be taken during the design and construction to limit the air permeability (Infiltration). High levels of infiltration can contribute to uncontrolled ventilation. Part L requires an air permeability level no greater than $5m^3/h/m^2$ at 50 Pascals for Part L 2017. Where lower levels of air permeability are achieved, it is important that purpose provided ventilation is maintained. The design intent will be to achieve an air permeability of 3m3/m2/hr @ 50Pa (TBC) which represents a reasonable upper limit of air tightness.

4 Energy Efficient and Sustainable Technologies Considered

4.1 Traditional Gas/ Oil Boiler

With this option, a boiler will be used to provide heating via low surface temperature radiators or an underfloor heating system, as well as hot water via a water cylinder. This system does not use any renewable energy sources, and so would result in higher energy bills and a larger carbon footprint. They are useful, however, supplementing other, more energy efficient, systems described below. The energy efficiency of these systems can be greatly improved by considering a high efficiency condensing boiler.

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

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

4.2 Heat Pumps

4.2.1 Air to Water Heat Pumps (ASHP)

Air to Water Heat Pump Systems are a standalone system suited for a house or an apartment development. For large developments, ASHP don't require a centralised plant which reduces the installation costs. ASHP will achieve an A2-A3 rated house without the addition of another renewable source.

ASHPs have a small footprint and can be located either in the back garden or on balcony. Also, the are supplied with a factory pre-plumbed & pre-wired cylinder which simplifies installation and eradicates potential installer error. Due to its simplified design a standard domestic plumber can install. No specialised heat pump engineer needed. Another benefit is that unlike solar PV or solar thermal, adequate roof area and south orientation is not a factor when meeting compliance.

The system works on a lower operating temperature which drastically reduced running costs. 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 main advantage of ASHP is that its compliance can be met with or without heat recovery ventilation. Finally, the heat pump only gives you hot water when its needed. Solar thermal gives you hot water when sun is available.

4.2.2 Exhaust Air Heat Pump

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.

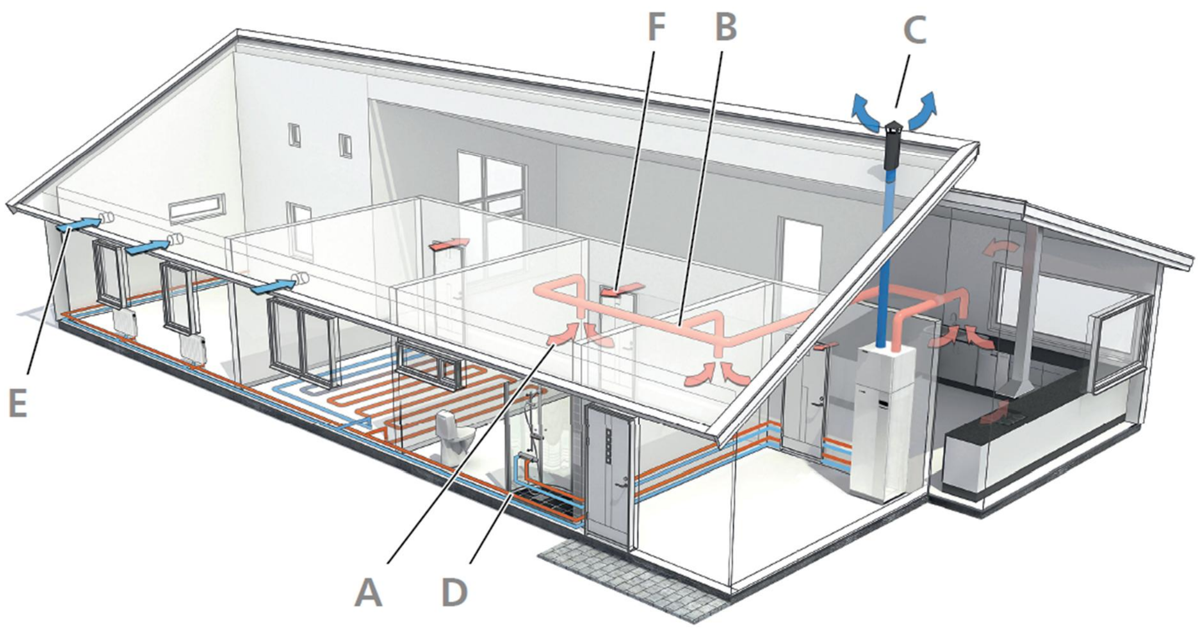


Figure 1: A) The warm air is drawn into the air duct system. B) The warm air is fed to Nibe. C) The room air is released when it has passed Nibe. The air temperature has then been reduced as Nibe has extracted the energy in the room air. D) Nibe supplies the house with hot water and room heading. E) Outdoor air is drawn into the house. F) Air is transported from rooms with outdoor air devices to rooms with exhaust air valves.

For an exhaust air heat pump to work, the necessary ventilation system has to be constructed at the same time as the house itself. It is neither cost-effective nor practical to install an exhaust air system after the house has been built.

For the purpose of this analysis, THE NIBE Exhaust air heat pump has been considered. Advantages of this system are as follows:

Advantages

- Efficiency of 570%. For every kW of electricity consumed, 5.7 kW of heat can be produced.
- Full part L compliance in a single unit from one manufacture 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.

4.3 Solar

4.3.1 Solar Thermal

Solar Water Heating uses solar collectors to transform sunlight into heat to provide water heating. A correctly sized solar water heating system can cover approximately 40% of a buildings annual hot water requirement with free solar energy. Solar collectors can collect energy on even dull days, albeit at a lower level.

When using solar panels to provide for the hot water requirements, a secondary system is required to provide space heating. This will also be used to "top up" the hot water system when required.

Advantages

- Low running costs.
- Low maintenance.

Disadvantages

- Large capital outlay and long payback periods
- Large space required
- Require south facing roof at appropriate pitch to be efficient
- Do not operate well in dull conditions
- Require a traditional gas or oil boiler to provide back up

There are two main types of solar collector in use in Ireland today, Vacuum Tube and Flat Plate. Their relative advantages are as follows:

Flat Plate

- More aesthetically pleasing.
- Slightly lower capital costs.
- Typical panel guarantee of 20 years.

Vacuum Tube

- Approximately 5% more efficient than flat plate, but has a higher maintenance cost.
- Typical panel guarantee of 5 to 10 years.
- Work better in dull conditions, so better winter performance

4.3.2 Solar Photovoltaic

Solar Photovoltaic (PV) systems generate electricity from sunlight. Typically, the PV panels are 1.65m × 1.0m and can generated around 250-275W each. The panels produce electricity in the form of direct current (DC). As this form cannot be utilised by household electronic equipment, an inverter is used to convert the electricity to alternating current (AC).

Inverters

String inverters connect a number of modules together in series (called strings) to provide a high enough voltage to operate the inverter.

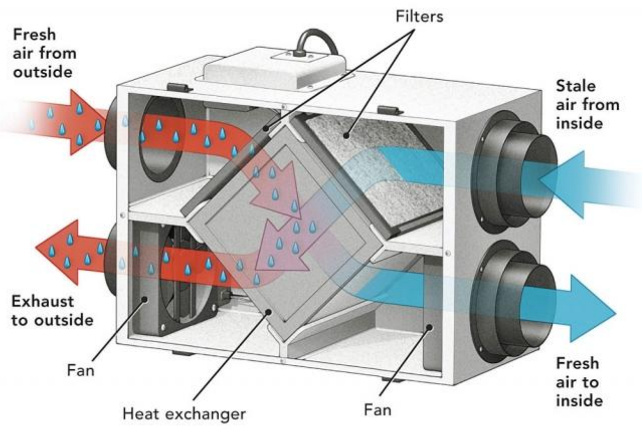
Micro Inverters convert the DC current to AC at module level meaning all cabling on the roof and internally is AC and results in lower losses due to volt drops etc. By controlling modules independently, it is possible to reduce any effects of shading as the modules are no longer wired in series but are operating individually. Monitoring can be done at a panel level, and not just the overall system, and each PV panel can be isolated – in the event of fire or maintenance.

Inverters vary in price and in quality but most reputable string inverters offer multiple choices of size and varying levels of communication and monitoring of the output.

Advantages

- Solar PV is a proven technology that once installed will provide free electricity for decades.
- Since there are no moving parts, PV panels require minimal maintenance. PV panels also generally have 25 years performance warranties, and a life expectancy in excess of 30 years.
- Annual solar irradiation can be estimated using historical weather data. Therefore, the electricity generated is predictable.
- Solar PV is versatile, offering multiple methods of roof, ground installations, as well as car ports, awnings, facades, etc.
- Prices of PV panels have fallen by 40% since 2014, and 75% since 2009.
- With a feed in tariff, excess electricity can be sold back to the grid. This is yet to be adopted.
- Solar PV systems can be coupled with battery technology to store electricity for night-time usage. However, the majority of systems are 'grid connected', not battery systems.

4.4 Mechanical Heat Recovery Ventilation



Mechanical ventilation with heat recovery (MHRV) is a whole-house ventilation system which supplies fresh air to dry rooms and extracts stale air from wet rooms. Both air flows are ducted and driven by two fans, one on the supply side and one on the extract side. The key element of this system is that it uses a heat exchanger to transfer heat from the warm exhaust air to the fresh air, achieving up to 85% heat recovery. The reduction in heat losses due to ventilation is significant and occupants' comfort is also increased as the air supply is warmed before entering the rooms. The HRV unit which houses the heat exchanger and the fans is also equipped with filters which prevent outside dust entering the system and internal air particles depositing within the unit.

Advantages

- Waste heat from extract air is recovered, reducing the heating load.

Disadvantages

- Increased capital outlay in comparison with mechanical extract, passive supply systems.
- Will require larger than normal ceiling voids and riser space to distribute ductwork.

4.5 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.

5 Analysis

5.1 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.

5.2 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.

		Proposed System	
Description	Exhaust Air HP	Air Sourced Air HP	Boiler & PV
BER	A2	A2	A2
Energy Value kWh/m^2/year	47.10	44.59	46.10
CO_2 Emissions CO_2/m2/year	9.26 kg	8.77 kg	8.47 kg
EPC (Max)	0.300 (0.30)	0.285 (0.30)	0.294 (0.30)
CPC (Max)	0.285 (0.35)	0.270 (0.35)	0.261 (0.35)
Renewable Energy Contribution (Min) kWh/m^2/y	11.65 (10.0)	14.64 (10.0)	28.4 (10.0)
Part L Compliance	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 for the apartments 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 the apartment. Boilers & PV or Air sourced heat pump will be more suited to the houses.

5.3 Schedule of Proposed Apartment 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°C max
Central Heating Pump	1 no. 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 Nibe F730 with a declared loss factor of 1.30 kWh/day
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 $5m^3/m^2/hr$ @ 50 Pascals
Thermal Bridging Factor	0.08 W/m^2K (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/m^2K or better
Flat Roof	U-value 0.15 W/m^2K or better
Wall	U-value 0.18 W/m^2K or better
Window, Glazed Doors	U-value 1.40 W/m^2K, Solar Trans – 0.64, Frame Factor – 0.7

5.4 Schedule of Proposed House Systems & Building Fabric Details

Item	Specification
Primary Heat Source	Boiler
Secondary Systems	Solar PV
Chimneys	One
Heating Element	Radiators – Design flow temperature of 80°C max
Central Heating Pump	1 no. 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	400 L with a declared loss factor of 2.3 kWh/day
Lighting	All lamps must be A-Rated low energy type
Air Tightness Results	Max. Result of air tightness test of $5m^3/m^2/hr$ @ 50 Pascals
Thermal Bridging Factor	0.08 W/m^2K (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/m^2K or better
Flat Roof	U-value 0.15 W/m^2K or better
Wall	U-value 0.18 W/m^2K or better
Window, Glazed Doors	U-value 1.40 W/m^2K, Solar Trans – 0.64, Frame Factor – 0.7

Or

Item	Specification
Primary Heat Source	Air Source heat pump
Secondary Systems	None
Chimneys	None
Heating Element	Radiators – Design flow temperature of 40°C max
Central Heating Pump	1 no. 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	400 L with a declared loss factor of 2.3 kWh/day
Lighting	All lamps must be A-Rated low energy type
Air Tightness Results	Max. Result of air tightness test of $5m^3/m^2/hr$ @ 50 Pascals
Thermal Bridging Factor	0.08 W/m^2K (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/m^2K or better

Flat Roof	U-value 0.15 W/m^{2}K or better
Wall	U-value 0.18 W/m^{2}K or better
Window, Glazed Doors	U-value 1.40 W/m^{2}K, Solar Trans – 0.64, Frame Factor – 0.7

5.5 Recommendation

A NIBE F730 Exhaust Air heat Pump will be installed in each apartment to cater for all hot water, space heating and ventilation requirements. Radiators shall be installed throughout and selected for a MWT of 40°C. A similar installation is applicable to the houses if an air source heat pump is used. For the boiler & PV setup, the water will be supplied at 80°C.

The system shall provide individual time and temperature control over the heating and hot water. A-rated low energy lamps shall be used throughout. Air tightness values and building fabric details shall be as outlined above.

6 Sustainability of Design and Constructions

The proposed development will meet the highest standards of sustainable design and construction in line with all applicable regulations and planning requirements. Where feasible the development will aspire to exceed these requirements. In line with the Meath County Development Plan 2015-2021 the following sustainability considerations will be inherently addressed during design and construction to ensure the overall development:

- Makes most efficient use of land and existing buildings
- Reduces carbon dioxide and other emissions that contribute to climate change
- Is designed for flexible use throughout its lifetime
- Minimises energy use,
- Supplies energy efficiently and incorporates decentralised energy systems such as District Heating and uses renewable energy where feasible
- Manages flood risk, including application of sustainable drainage systems (SuDS) and flood resilient design for infrastructure and property
- Reduces air and water pollution
- Is comfortable and secure for its users
- Promotes sustainable waste behaviour
- Reduces adverse noise impacts internally and externally