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CONSULTING ENGINEERS

Proposed development at Nancy's Lane, Clane.

Compliance Report on Part L, HC 12 Building Energy Rating Assignment incorporating Energy Efficiency and Climate Change Adaptation Design Statement

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INVESTORS IN PEOPLE

www.semplemckillop.com

Belfast
T +44 (0)28 9033 1700

Monaghan
T +353 (0)42 974 9570

Glasgow
T +44 (0)141 433 0219

London
T +44 (0)20 3328 5088

E admin@semplemckillop.com

info@semplemckillop.com

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1 INTRODUCTION

The EU Directive on the Energy Performance of Buildings (EPBD) contains a range of provisions aimed at improving energy performance of residential and non-residential buildings, both new-build and existing. This Directive was adopted into Irish law as Regulation in 2006.

The EPBD obliges specific forms of information and advice on energy performance to be provided to building purchasers, tenants and users. This information and advice provides consumers with information regarding the energy performance of a building and enables them to take this into consideration in any decisions on property transactions.

As part of the Directive, a Building Energy Rating (BER) certificate, which is effectively an energy label, will be required at the point of sale or rental of a building, or on completion of a new building. As such the Dwellings Energy Assessment Procedure (DEAP) was created a base procedure in which the BER can be calculated. The Dwelling Energy Assessment Procedure (DEAP), which is the Irish official procedure for calculating and assessing the energy performance of dwellings. The procedure takes account of the energy required for space heating, ventilation, water heating and lighting, less savings from energy generation technologies. For standardized occupancy, it calculates annual values of delivered energy consumption, primary energy consumption, carbon dioxide emissions and costs, both totals and per square meter of total floor area of the dwelling.

The report sets out to demonstrate a number of methodologies in Energy Efficiency, Conservation and Renewable Technologies that will be employed in part or in combination with each other. These techniques will be employed to achieve compliance with both the building regulations Part L and the local Strategic Environmental Plan (HC 12). Some examples of these techniques are provided on one of the house types to demonstrate this, as examples.

We have also reviewed the “Energy Efficiency and Climate Change Adaptation Design Statement” and have addressed the relevant objectives.

2 STRUCTURE AND BUILDING ELEMENTS

While the construction works will incur an initial investment, the lifetime running cost of the units must be considered to reduce water, fuel and electrical energy consumption. To that end methods will be explored to further improve the building's energy rating and reduce the carbon emissions. This includes decreasing the thermal conductivity (heat losses) of the building fabric, take advantage of passive solar gain to reduce the heating demand in the space and increase day lighting to reduce artificial lighting. Natural ventilation may be employed or if deemed as a requirement mechanical ventilation and heat recovery techniques will be employed to recover energy in the exhausted air.

2.1 FABRIC 'U' VALUES EMPLOYED FOR EXEMPLAR STUDY

- Walls - 0.15 W/m2.K
- Window - 0.8 W/m2.K (solar fraction (g factor) of 0.65 or greater, Frame factor of 0.7 or better)
- Roof - 0.12 W/m2.K (Insulation on ceiling)
- Doors - 1.1 W/m2.K (This is to include frame)
- Ground Floor slab - 0.13 W/m2.K
- Thermal Bridging - Factor of 0.08, with junctions details to conform with "Limiting Thermal Bridging and Air Infiltration – Acceptable Construction Details"

2.2 AIR PERMEABILITY (AIR TIGHTNESS AGAINST INFILTRATION)

One of the most significant heat loss factors in any buildings is through controlled and uncontrolled ventilation through the introduction of ambient/outside air into the heated space. The dwellings are to be constructed with a high degree of air tightness to a possible value of 4 m3/m2/hr. with a permeability test conducted post construction to demonstrate this level.

3 POSSIBLE BUILDING SERVICES (M&E) COMBINATIONS

Figure 1: Typical Photovoltaic Arrangement

Use of energy efficient technologies Heat pumps, solar thermal panels, energy efficient boiler plant, photovoltaics (PV) and Mechanical heat recovery ventilation will be considered. In addition, temperature and zone controls will be used to reduce fuel and electricity demand.

Once the energy consumption has been reduced, a portion of the remaining electrical and thermal (hot water + heating) demand will be met by renewable sources. Not all renewables may be suitable to employ but it is intended to evaluate effectiveness of technologies such as heat pumps, solar panels and on site generation from or photovoltaic panels.

Solar and Photovoltaic panels are apt due to the unobstructed southerly and south easterly elevations. PV is particularly suitable due to a simultaneous requirement for heating, hot water and electrical demand. The on-site generation of electricity will supplement the electrical requirement for lighting, motors, etc & reduce the electrical demand and from the grid.

Applying this to each dwelling would considerable reduce the demand from the grid and consequently reduce losses and emissions from power stations. Such is the benefit of on site or distributed generation, the DEAP model determines that each kWh offset from PV equates to 2.5 times the thermal equivalent.

Where there is little demand, excess electricity can be diverted via an immersion in the Hot water cylinder. It is our intention that should this technology be employed, the housing will be ‘future proofed’ for this eventuality and that the design will incorporate this facility without the requirement to revisit the installation in the future.

3.1 HEATING SYSTEMS

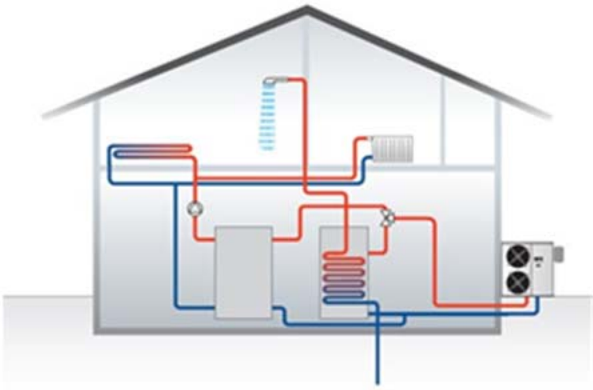

Figure 2: Typical Air Source HP arrangement

The Heating System may consist of an air- water heat pump serving radiators and hot water. Heat pumps take advantage of this by transferring the heat/Energy from the outside air. Through compression, heat pumps can 'pump up' heat at low temperature and release it at a higher temperature so that it may be used again. A heat pump looks similar and can perform the same functions as a conventional gas or oil boiler, i.e. Space heating and sanitary hot water production. For every unit of electricity used to operate the heat pump, up to four to five units of heat are generated. Therefore for every unit of electricity used to pump the heat, 4-5 (400-500%) units of heat are produced. Efficiencies in order of 600% may also be achieved depending on ambient conditions. Air/water heat pumps collect heat from the outside air.

Alternatively, while a fossil fuel, Gas heating will be explored with the Gas Fired Condensing Boiler serving the Heating and Hot Water systems separately. The boiler will be required to operate at high efficiency 90.8% or greater and include weather compensation. A central time clock and separate time and temperature controls to each zone is too provided (e.g. via 2-port valves). Such zones may consist of;

- Ground floor living areas,
- Bedrooms
- Domestic Hot water

While natural gas maybe considered a finite fossil fuel resource at present, studies have indicated that there is the potential to meet 33.2% of Ireland's current natural gas demand from renewable biogas in the future. Overall this will result in positive impacts to climate change & renewable commitments in addition to improving security of supply1.

The employment of Gas maybe such that additional renewable technologies will have to be considered to offset this as the heating source initially. It the review undertaken as outlined further, it has been determined that Photovoltaics' may be the only measure to meet Part L and the councils own renewables requirement (HC 12).

Bord Gais, The Future of renewable gas in Ireland,
http://www.bordgais.ie/corporate/media/15665_BG_RenewGas_Final1.pdf

3.2 WATER HEATING

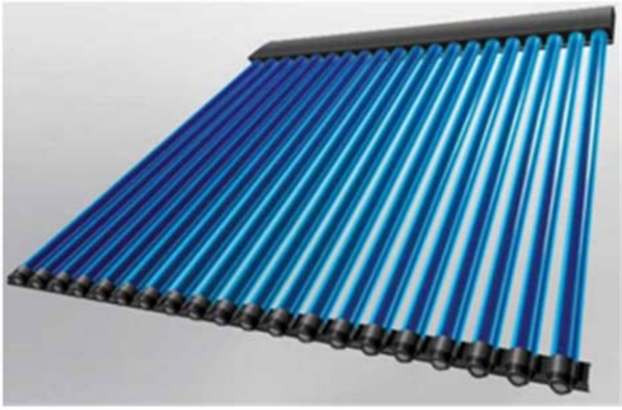

Figure 4: Typical Solar Thermal System

This will be served from the primary heating plant (heat pump or boiler) linked via a probe to the cylinder. The Hot Water will be generated via a time clock and as such heats the water on demand. If Heat pumps and/or PV is considered then hot water may also be generated via an immersion. The immersion will be required should the heat pump not be able to heat up the hot water to 60oC alone and bring it to the required temperature during the legionella cycle.

Solar thermal panels may also be employed to heat the Hot Water consisting of some 30no tubes for solar thermal (equating to aprox 2.5m long x 2m high) and located on a favorable orientation.

The cylinder as such maybe required to be twin coil, hence hot water could be generated via the Heat Pump/Boiler, Solar Thermal and PV via the immersion. A thermostatic blending valve is to be installed on the DHW outlet of the cylinder to ensure no risk of scalding at fixtures.

3.3 MECHANICAL VENTILATION HEAT RECOVERY (MVHR) SYSTEM OR DEMAND CONTROL VENTILATION

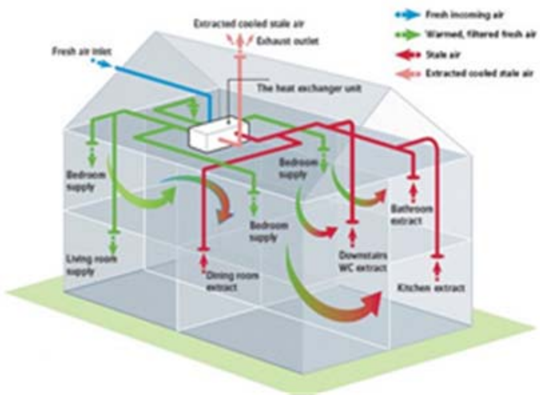

Figure 5: Typical MVHR Arrangement

Mechanical ventilations from wet areas e.g. toilets, utility rooms in accordance with Part F with supply air provided to habitable spaces (bedrooms, circulation and living spaces). Heat recovery ventilation or demand control ventilation provides a continuous supply of fresh air to the dwelling through special air valves or grilles located in each habitable room thereby eliminating the number of opening required in the structure. Continuous extract is also provided with the outgoing stale air and from wet areas with the exhausted air pre heating the incoming fresh air via a heat exchanger if the MVHR is employed. 90% of the heat can be recovered through this process that would otherwise be wasted. This has the impact of significantly reducing the heating demand to a greater extent than the electrical power to operate the unit. Mechanical heat recovery ventilation specification with fan power not greater than 0.56 w/l/s and an efficiency of 90% or greater. The Extract hood is not to be connected to the system and is to exhaust separately.

3.4 LIGHTING

All lighting to be energy efficient with provision made for low energy lamps such as LED which use 80% less electricity and last up to 10 times longer than ordinary light-bulbs in the dwellings.

4 RESULTS FOR AN INDICATIVE OPTIONS EXPLORED

Table 1 give the parameters of options explored. Table 2 show that the indicative solutions demonstrate that compliance with Part L is achievable in all options including the requirement for 25% renewable contribution as set out in HC 12. In all instances, various combinations of technologies have worked in conjunction with each other.

4.1 OPTIONS EXPLORED

	Option 1 Heat pump. No Secondary heating. No Solar PV or Solar Thermal, Natural Vent	Option 2 Gas Boiler. No secondary heating. PV, Natural Vent, no MVHR	Option 3 Gas Boiler. No Secondary heating. PV + MVHR
Floor [Max, Part L 2011= 0.21]	0.13	0.13	0.13
Roof [Max, Part L 2011= 0.16]	0.12	0.12	0.12
Wall [Max, Part L 2011= 0.21]	0.15	0.15	0.15
Door [Max, Part L 2011= 3]	1.1	1.1	1.1
Window [Max Av, Part L 2011=	0.8	0.8	0.8
Mechanical Plant	Air source heat pump. Heat pump efficiency 344%	Energy Efficient Gas fired Condensing Boiler >91%,	
Heating Controls	Time and temperature control of heating/hot water with 2 heating zones		
Heat Emitters	Aluminium radiators to	Standard radiators to be utilised	
Solar Requirements	None	8no 0.24kWp PV Panels, 9.8 m^2, Efficieny 0.15,	4 no 0.24kWp PV Panels, 65m^2, Efficieny 0.15, Immersion in Cylinder
Hot Water Cylinder	250 Litre, Single Coil		
Ventilation	Natural Vent	Natural Vent	MVHR
Additional Requirements			
Lighting	Energy Efficient LED Lighting		
Air Tightness/Permability	Air Permeabilityy @ 4m^3/m^2/hr		Air Permeabilityy @ 2m^3/m^2/hr
Thermal Bridgeing	Factor of 0.08, junctions details to conform with "Limiting Thermal Bridging and		
Secondary heating (Living room)	Not Applicable / Not Included		

Table 1: Summary of Inductive Combinations Explored

4.2 RESULTS

		Option 1	Option 2	Option 3
Energy Rating		A3	A3	A3
BER Results		58.28	54.68	73.44
EPC {MPEPC = 0.4}		0.378	0.354	0.476
CPC {MPCPC = 0.46}		0.391	0.286	0.426
Renewable Contribution				
Solar Thermal	kWh/yr	0	0	0
Heat Pump	kWh/yr	164.24	0	0
PV				
PV – Thermal Equivalent	kWh/yr	0	1536	768
Total Thermal	kWh/yr	2077.24	3840	1920

Table 2: Inductive Combinations Explored

While MVHR has the effect of reducing the energy demand (or increasing the energy efficiency) of the dwelling, renewable technologies such as heat pumps, solar thermal and solar PV offset can be seen to offset this demand if gas is employed

Overall however, the exercise demonstrates that the development has the opportunity to deliver a low cost solution for home owners through a number of energy efficient, low emission sustainable solutions.

At detailed design development stage, a feasibility study will be undertaken to determine the optimum solution and which meets the requirements as set out in part L and the local sustainable development plan.

5 Energy Efficiency and Climate Change Adaptation Design Statement

We have reviewed the "Energy Efficiency and Climate Change Adaptation Design Statement" and have addressed the relevant objectives as follows:

5.1 E2 Objective 7: To require, where feasibly practical and viable, the provision of PV solar panels in new housing and apartment builds

As can be seen in this report, we have reviewed the options of sustainable and renewable technologies most applicable to housing as a study. In this development we have included solar PV as a preferred solution and anticipate that this will form part of the final strategy for meeting Part L.

5.2 E4 Objective 1: To ensure that medium to large scale residential and commercial developments are designed to take account of the impacts of climate change, including the installation of rainwater harvesting systems.

In this residential development significant design elements have been incorporated to take account of climate change. These elements form part of the civil engineers drawings and reports included in this application. We anticipate that rainwater harvesting will be employed by individual tenants for use around the house and garden. There will be active encouragement for the tenants to use recycled rainwater.

5.3 E4 Objective 2: To support the passive house standard or equivalent for all new build in the County.

We have sought to support passive House standard in a number of measures specifically the proposed fabric U-Values, air tightness levels and thermal bridging. We will also be employing renewable technologies on this scheme such as solar PV, heat pumps, LED lighting or solar hot water in order to reduce the energy use of the development. It is proposed that energy provided from a fossil fuel source will be partially offset by renewable energy generated on site.