McElligott

CONSULTING ENGINEERS

Energy Statement
for
Whitehaven
at
Northwood Avenue, Santry, Dublin 9

Document No:	**21050-M-RP-100**
Issue:	**B**
Date:	**10TH June 2021**
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1. ENERGY STATEMENT

1.1 Introduction

Cosgrave Developments UC are applying for planning to develop the "Whitehaven" site at Northwood Avenue. The scheme consists of 288 apartments distributed across 3 Blocks over a common basement. All of the apartments will be subject to the Nearly Zero Energy Building (NZEB) requirements of the 2019 Part L (Conservation of Fuel and Energy) Regulations, as amended in 2019, that are in effect. In terms of energy ratings all of the units on site will have a Building Energy Rating (BER) rating A2.

Over the last 10 years Cosgrave Developments have refined and improved the implementation of district heating solutions for sites of this scale and density. With the fabric performance of the materials to be used in construction there are no more gains to be achieved in this area. Improvements in performance to get from the current Combined Heat & Power (CHP) and boiler district heating solution are to be delivered by integrating air to water heat pumps as the lead contributor to the district heating network. This solution has been implemented by Cosgrave Developments to deliver the first NZEB social and affordable apartments in Pappen Grove in Northwood, Santry.

The measure of compliance with Part L of the Regulations is demonstrated using the Dwelling Energy Assessment Procedure (DEAP) software. The latest DEAP software, version 4.2 of the software is used, to allow assessors to confirm the NZEB standard has been achieved. In addition to this we will be undertaking a design methodology for the assessment of overheating risk in homes developed by the Chartered Institution of Building Services Engineers (CIBSE) referred to as TM 59. Carbon generation and energy consumption figures for all new dwellings have been revised downwards with the net result that these apartments will have to use 30% of the energy that the equivalent unit, built to the prevailing 2005 standard would have used. The renewables contribution in each house is now a percentage, 20%, of the overall energy density that the dwelling requires. This is rather than the flat rate of 10 kWh/m^2 per year but based on the simulations run to date this appears to be working out to the same level.

The primary aim of Part L 2019 is to further reduce the energy used in homes. After transport the residential sector is the biggest energy sector in the country. In 1990 domestic units accounted for 31% of the energy demand in the country but by 2016 this had dropped to 23% and over the next 10 years between new builds and deep retro fits this figure could drop by the same again.

2. BUILDING FABRIC

The building fabric elements that will be used in the construction of the apartments will achieve the following performance

- Walls 0.15 W/m^{2}K
- Roof 0.16 W/m^{2}K
- Windows 1.4 W/m^{2}K
- Floors 0.14 W/m^{2}K

The specified air tightness for the apartments is to achieve an air tightness level of 3 air changes an hour or better. Based on previous project experience with Cosgrave Developments we know this figure will be comfortably exceeded. With the heat recovery ventilation systems to be fitted in each unit the gains in thermal performance become quiet marginal below this level. In a similar vein the approved construction details will achieve a minimal thermal bridging factor of 0.08. The net impact of these combined criteria is that the heat losses associated with the apartments will be below 25% of the total thermal demand.

Passive Solar

The scheme in Whitehaven has good exposure to daylight and this feeds in to the setting out and extent of the windows to be provided. There are a number of confliction aspects to daylight that needs to be balanced by the architect. Adequate daylight needs to penetrate the apartment to support the wellness of the environment and this needs to be balanced against the U value (thermal transmittance) impact of the openings. At the same time there is a growing awareness of the level of solar gain that windows allow into the space and while solar gain is welcome in reducing the energy needed for space heating, during the summer can, over a prolonged period, lead to of overheating internally. The quality and performance of the glass will be looked at the optimise its performance against these different variables.

Lighting

Currently there is a bias, encouraged by the DEAP software to fit low energy bulbs, but this is revised in the new 4.2 version to reward the installation of LED light fittings. This is one of the more accessible routes to gaining NZEB compliance. An LED light source will last at least twice as long as a low energy bulb and use about half of the energy. Another advantage of the LED bulbs is that their low energy demand correlates with less heat rejected to the space and adding to the potential of overheating.

Space Heating and Controls

Demand associated with space heating is now a minor aspect of energy demand, especially in apartments. In order to effectively and accurately manage these losses while still maintaining comfort conditions it is necessary to have accurate and fast acting heating controls. The controls will be at a level to get the highest DEAP rating (time and temperature control) and we expect with the systems to be used on site that this will be achieved on a room by room basis.

3. Renewable Energy

Since 2008 and the introduction of the European Performance of Building Directive it has been mandated that each dwelling unit must generate a portion of their energy demand. From that time to this the proportion of energy to be delivered has been at a fixed rated of 10 kWh/m^2 per year. For the standard of build and resulting energy rating this equated to about 10 to 15% of the DEAP assessed energy demand of the house. In 2021 this fixed deliverable now represents over 20% of the energy needed in a dwelling. With this in mind the new NZEB Regulations being issued are calling up a percentage of the primary energy used in a dwelling and this will reward the better built houses.

In reality designers and builders will still need to over supply the renewable energy contribution in order to meet the Energy Performance Criteria of 0.3 as compliance hinges around either the ability to generate hot water (for sanitary purposes) using a heat pump with a related Coefficient of Performance (COP) of over 230% or providing sufficient photovoltaic capacity to lower the imported energy into the unit. A summary of the various renewable solutions available is:

- Solar Thermal
- Solar Photovoltaic (PV)
- Wind power
- Biomass
- Combined Heat and Power
- Heat pumps

4. WINDOWS

When assessing the energy efficiency of a window the frame has a bigger impact on the U value than the glass, effectively it is the weakest link in the thermal performance of the overall assembly. PVC framing material performs better than aluminium, having improved insulation qualities. At the point of manufacture the embodied energy of uPVC is 80 MJ/kg whereas the equivalent aluminium figure is 170 MJ/kg, a reduction of over 50%.

Both aluminium and uPVC windows have similar U values but on a like for like basis uPVC is better, this is related to the previous point about energy efficiency performance. A typical uPVC window will have a U value of 1.2 W/mK and its aluminium equivalent will be 1.33 W/mK. Another consideration is the impact of the window system on the overall building is sound. uPVC frames have a better noise attenuation property than aluminium. The Whitehaven site is adjacent to the M50 road and Dublin Airport, where required laminated glass panes will be fitted that reduce noise transfer. The party walls in the apartments need to comply with acoustic criteria in Part E of the Building Regulations and it makes sense that the windows should contribute to the quiet ambience within. uPVC frames will facilitate less sound transfer into the apartment than the equivalent aluminium frame.

The lifespan of both aluminium and PVC is similar at circa 35 years but Whitehaven is within 5km of the sea and therefore deemed a coastal location, which is more aggressive on exposed materials. Aluminium frames depend on their paint cover, minimum of 70 microns, for protection whereas the PVC frame material is designed to be exposed and does not require an outer protective layer.

There is an initial cost differential between aluminium and PVC windows. The aluminium units are more costly but this is compounded over the lifetime of the units. It is important, especially this close to the coast, that the paint on the aluminium frames is kept intact and the colour as initially selected. Realistically the frames will have to be painted every 10 years. This maintenance cost is not associated with the PVC frames. PVC is genuinely maintenance free and the colour of the frames is ingrained through the material.

5. UTILITY INFRASTRUCTURE

A significant component to developing the setting out of large scale residential schemes is accommodating the requirements of the ESB. There are a number of ESB parameters which are well established and influence the initial site development in tandem with this there are two other aspects that directly impact the sub-station configuration. Over the last couple of years the ESB have adjusted and settled upon how they want electrical meters located and isolated. Basements are not acceptable and it is not always possible to accommodate the meter clusters adjacent to the Core entrances in a manner that meets all the criteria (clearances, throwback distances, fire man's isolation, etc.).

More fundamentally the ESB are planning their sub stations to accommodate the electrical loads and profiles associated with new schemes. With electric car charging the associated power demand is greater than the internal domestic load and with the majority of cars being charged at night the profile is much less diversified. The net result of this is the ESB will require a double sub-station housing for Whitehaven and this will need to have an adjoining switch room to provide the isolation and distribution needed to serve the scheme.

The sub-station needs to adjacent to a carriageway to allow the ESB to drive up to it in the event there was a catastrophic transformer failure. Incorporating the sub station into the building is not viable as it would have a very adverse impact on the elevation, sterilise a corresponding footprint below it in the basement and unsettle occupier of units adjoining it.

6. PROPOSED SYSTEMS OUTLINE.

Measure Proposed	Description	Benefit
Space Heating	For the apartments on the scheme there are a number of low energy solutions being assessed and will be either: • Connected to a centralised district heating. The primary heat input will come from air to water heat pumps and the secondary heat input from backup boilers. • Install local exhaust air heat pumps for the generation of hot water supply (HWS). This is the majority energy burden in the apartments as space heating losses have almost been designed out. • Incorporate CHP engines into the district heating scheme. Units would be sized to achieve a balance between heat demand to the apartments and the extent of electricity that can be used efficiently on site by Landlord services and car charging.	The district heating plant to be installed will be the most efficient of its type. The heat load can be diversified and therefore lower installed capacity provide. This means the heating plant is better able to modulate to the load and operate at maximum efficiency. Gas distribution is removed from the apartments and there is no carbon monoxide risk to the occupants. The local exhaust air heat pump would have the lowest operating cost, negligible transmission losses and can be incorporated fully within each unit. On site generation of electricity is more efficient than pulling off the grid and would lower the maximum import capacity (MIC) needed off the ESB.

Measure Proposed	Description	Benefit
Heat Recovery Ventilation	With the current best practise building methodology to be used at Northwood, the units will achieve an air tightness level of $3m^3/m^2.hr$ or better. While this is advantageous for limiting heat loss it is still important to ensure a supply of fresh air and removal of stale and humid air. The heat recovery ventilation (HRV) unit does this by extracting air from the “wet” rooms and supplying fresh air to the living spaces via a ducting network. Each system is dedicated to the apartment it serves.	Ventilation has a significant bearing on well being and the sustained ventilation rates delivered by a HRV system give quantifiable air flow rates to rooms and this ensures humidity is controlled and carbon dioxide levels are low. The most obvious benefit is that the outgoing stale air heats up the incoming fresh air, reducing the heat load of the apartment. The importance of controlled ventilation by mechanical systems is now being reflected in the proposed new Part F (Ventilations) Building Regulations but the solution proposed for the Northwood units will be at the top end of this scale.

Measure Proposed	Description	Benefit
Heat pumps	Air to water heat pumps are being considered and they have gained significant traction in the last 5 years in the Irish market. Heat pump operation would be optimise to improve seasonal efficiency and selected to have generate HWS at the top end of the scale to ensure NZEB targets are met.	As heat pumps are an all electrical solution they can utilise the sustainable electrical energy delivered to the grid by wind power. Occupiers are advised to have their heat pumps on standby all of the time, trickle charging the house, and this allows them to use electricity at night, when at a lower rate and may otherwise go to waste.
CHP	If the whole of the scheme is to be connected to a district heating solution the network would be strengthened by the addition of a Combine Heat and Power unit. This is like a local power station and burns gas to run the engine that generates heat and electrical energy. The heat output is delivered into the district heating network and holds out the boilers from running. The electrical output is used to drive the district heating system and other landlord loads. This local CHP	The proposed condensing CHP units will ensure the maximum efficiency is extracted from the gas consumed. As the power off the CHP will run the district heating system and landlord loads, this offsets a considerable demand off the electrical grid and lowers the management running costs.

		has a marginal efficiency improvement over a remote (large scale) power station and this margin in deemed a renewable and when multiplied by the run hours gives a total renewable contribution to the system.	
E Car charging		The adoption of electric cars is now in the main stream and with the proximity of this site to work and leisure destinations the occupiers are more likely to opt for electric cars. Please refer to the separate outline issued with this package on the e car charging strategy	Please refer to the separate outline issued with this package on the e car charging strategy .