

# **ENERGY STATEMENT for Farrankelly Development**

Greystones, Co. Wicklow

August 2019

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**Client Name:** Cairn Homes  
**Document Reference:** 17-117r.003  
**Project Number:** 17-117

## Quality Assurance – Approval Status

This document has been prepared and checked in accordance with  
Waterman Group's IMS (BS EN ISO 9001: 2015, BS EN ISO 14001: 2015)

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## 1. Introduction

The proposed development will consist of the construction of a residential development of 426 no. dwellings, a creche, a residential amenity building, active open space and a greenway pedestrian walkway.

This report identifies the energy standards with which the proposed development will have to comply and also sets out the overall strategy that will be adopted to achieve these energy efficiency targets.

The dwellings will be required to minimise overall energy use and to incorporate an adequate proportion of renewable energy in accordance with Building Regulations Part L 2019, Conservation of Energy & Fuel (hereinafter referred to as Part L) and anticipated future revisions.

The Creche and the Residential Amenity Building will be designed to meet the requirements of Building Regulations Part L 2017 (Buildings Other than Dwellings).

The Department of Environment has recently issued revisions to Part L of the Building Regulations which have been published as “Part L 2019”. This standard introduces the “Near Zero Energy Buildings” (NZEB) concept for dwellings. NZEB targets will require that the energy consumption of new dwellings be reduced by 25% from the previously compliant level.

The new standard comes into effect for buildings for which planning permission is applied for after November 2019 or which are commenced after this date and which are not substantially complete before November 2020. As such, it is expected that the new standard will apply to this scheme.

Equally, Part L 2017 for Buildings Other Than Dwellings came into effect for building for which planning permission is applied for after 1<sup>st</sup> January 2019 and which are not substantially complete before 1<sup>st</sup> January 2020. As such it is expected that this new standard will also apply to the creche and residential amenity building.

## 2. Building Regulations Part L 2011 (Dwellings)

Compliance with Building Regulations Part L 2011 is broken down into six distinct categories, known as Regulation L3 parts (a) to (f).

A summary of each of these parts as listed in Technical Guidance Document L 2011 is provided below together with a description of what is required to demonstrate compliance and suggested routes to meeting the required standards.

### 2.1 Regulation L3 Part (a)

The regulation requires that:

*Providing that the energy performance of the dwelling is such as to limit the calculated primary energy consumption and related carbon dioxide (CO<sub>2</sub>) emissions insofar as is reasonably practicable, when both energy consumption and carbon dioxide (CO<sub>2</sub>) emissions are calculated using the Dwelling Energy Assessment Procedure (DEAP) published by Sustainable Energy Authority of Ireland;*

Part (a) is the overarching compliance target which stipulates the required overall reduction in energy consumption and carbon emissions for new dwellings.

This requires that the energy consumption and carbon emissions of every dwelling is assessed using the DEAP software and that reductions of 60% in energy consumption and 54% in carbon emissions are achieved. The baseline against which this reduction is to be measured is considered to be a dwelling which is constructed to perfectly comply with the 2005 version of Building Regulations Part L.

Note: Complying with the 5 remaining elements (b) to (f) of these regulations will not guarantee compliance with Part (a). It is likely that the requirements of at least one of the remaining sections will need to be exceeded.

### 2.2 Regulation L3 Part (b)

The regulation requires that:

*Providing that, for new dwellings, a reasonable proportion of the energy consumption to meet the energy performance of a dwelling is provided by renewable energy sources;*

This requires that the all new dwellings are provided with a renewable energy source. The regulations state that 10kWHrs/m<sup>2</sup>/year must be provided from thermal sources (solar thermal, biomass, heat pumps) or 4kWHrs/m<sup>2</sup>/year from electrical sources (Photovoltaic, Micro-wind).

In practical terms, for a multiple unit development, this requirement is usually met by incorporating PV panels at roof level, incorporating air source heat pump technology or by adding an element of biomass or micro-CHP to a district heating scheme.

Where CHP is included, the renewable energy is considered to be the waste heat which is generated as a by-product of the electricity produced. Specific calculation methods are set out within TGD Part L 2011 which detail how compliance should be demonstrated.

## 2.3 Regulation L3 Part (c)

The regulation requires that:

*Limiting heat loss and, where appropriate, availing of heat gain through the fabric of the building;*

This requires that the fabric of the building is designed to minimise heat loss from the building and that the air permeability of the structure limits the unwanted passage of air into the building.

Typical compliant U-Values are as follows.

Pitched roof	0.16 W/m <sup>2</sup> K
Flat roof	0.20 W/m <sup>2</sup> K
Walls	0.21 W/m <sup>2</sup> K
Floor	0.21 W/m <sup>2</sup> K
Windows	1.6 W/m <sup>2</sup> K

The u-values of individual elements can be relaxed if required provided that compensatory measures are taken on other elements and that the overall area weighted u-value for the entire dwelling is the same as it would have been if all individual elements had complied.

The thermal bridging details of junctions in the envelope of the building (floor-wall; wall-window; wall-roof, etc) must also be designed and constructed in accordance with the guidance set out in Limiting Thermal Bridging and Air Infiltration – Acceptable Construction Details

Every dwelling must also be subjected to an air pressure test to determine the air tightness. All dwellings must achieve an air tightness of less than 7m<sup>3</sup>/m<sup>2</sup>/hour when tested at 50 Pascals. In multiple dwelling developments with repeating house/apartment types, testing can be conducted on a representative sample of units in accordance with Table 1.5.4.3 of TGD Part L 2011

## 2.4 Regulation L3 Parts (d & e)

The regulation requires that:

*Providing and commissioning energy efficient space and water heating systems with efficient heat sources and effective controls;*

*Providing that all oil and gas fired boilers shall meet a minimum seasonal efficiency of 90%;*

These require that gas or oil fired boilers are at least 90% efficient and that heating controls allow independent time control of the heating (2 zones for dwellings larger than 100m<sup>2</sup>) and hot water. Heating in each zone should also be controlled by room thermostats (in the case of heating) and cylinder stats (in the case of hot water).

## 2.5 Regulation L3 Parts (f)

The regulation requires that:

*Providing to the dwelling owner sufficient information about the building, the fixed building services and their maintenance requirements so that the building can be operated in such a manner as to use no more fuel and energy than is reasonable.*

This requires that information is provided to the dwelling owner which relates to the effective and efficient operation of the systems installed in that house. Instructions on how to control the heating & hot water systems based on time and temperature requirements.



### 3. Building Regulations Part L 2017 (Building Other than Dwellings)

Compliance with Building Regulations Part L 2017 is broken down into seven distinct categories, known as Regulation L4 parts (a) to (i).

A summary of each of these parts as listed in Technical Guidance Document L 2017 is provided below together with a description of what is required to demonstrate compliance and suggested routes to meeting the required standards.

#### 3.1 Regulation L4 Parts (a)

The regulation requires that:

*providing that the energy performance of the building is such as to limit the calculated primary energy consumption and related Carbon Dioxide (CO<sub>2</sub>) emissions to a Nearly Zero Energy Building level insofar as is reasonably practicable, when both energy consumption and Carbon Dioxide emissions are calculated using the Non-domestic Energy Assessment Procedure (NEAP) published by Sustainable Energy Authority of Ireland;*

Part (a) is the overarching compliance target which stipulates the required overall reduction in energy consumption and carbon emissions for new commercial buildings.

This requires that the energy consumption and carbon emissions of every dwelling is assessed using the SBEM software and that the energy consumption and carbon emissions associated with the building being assessed are in line with the required standards.

#### 3.2 Regulation L4 Parts (b)

The regulation requires that:

*providing that, the nearly zero or very low amount of energy required is covered to a very significant extent by energy from renewable sources produced on-site or nearby;*

This requires that Renewable Energy Technologies are provided. This to be reflected by Renewable Energy Ratio (RER) which is the ratio of the primary energy from renewable energy sources to total primary energy as defined and calculated in NEAP. RER for commercial buildings was set at 20% of the total energy consumption.

#### 3.3 Regulation L4 Parts (c)

The regulation requires that:

*limiting the heat loss and, where appropriate, availing of the heat gains through the fabric of the building;*

This requires that the fabric of the building is designed to minimise heat loss from the building and that the air permeability of the structure limits the unwanted passage of air into the building.

Typical compliant U-Values are as follows.

Pitched roof	0.16 W/m <sup>2</sup> K
Flat roof	0.20 W/m <sup>2</sup> K

Walls	0.21 W/m <sup>2</sup> K
Floor	0.21 W/m <sup>2</sup> K
Windows	1.6 W/m <sup>2</sup> K

The u-values of individual elements can be relaxed if required provided that compensatory measures are taken on other elements and that the overall area weighted u-value for the entire dwelling is the same as it would have been if all individual elements had complied.

The thermal bridging details of junctions in the envelope of the building (floor-wall; wall-window; wall-roof, etc) must also be designed and constructed in accordance with Acceptable Construction Details and/or certified details for all key junctions.

Building must also be subjected to an air pressure test to determine the air tightness and must achieve an air tightness of less than 5m<sup>3</sup>/m<sup>2</sup>/hour when tested at 50 Pascals.

### 3.4 Regulation L4 Parts (d)

The regulation requires that:

*providing and commissioning energy efficient space heating and cooling systems, heating and cooling equipment, water heating systems, and ventilation systems, with effective controls;*

This requires that heat- generators should be designed and installed so that they operate efficiently over the range of loading likely to be encountered. This means that gas or oil-fired boilers are at least 86% efficient for output less than 70kW and 93% efficient for output over 70kW. Space and water heating systems should be effectively controlled so as to limit energy use by these systems.

Additionally, buildings should be designed and constructed in such way that there is no requirement for excessive installed capacity of Air Conditioning and Mechanical Ventilation for cooling purposes and the ventilating and cooling systems installed are energy efficient and are capable of being controlled to achieve optimum energy efficiency.

### 3.5 Regulation L4 Parts (e)

The regulation requires that:

*ensuring that the building is appropriately designed to limit need for cooling and, where air-conditioning or mechanical ventilation is installed, that installed systems are energy efficient, appropriately sized and adequately controlled;*

This requires that the glazed elements of the proposed building are design to limit solar gain to acceptable levels. Design approaches that are often adopted to address this requirement include reducing total glazing areas, introducing internal or external shading devices or using specifically selected solar control glazing to reduce the solar gain.

### 3.6 Regulation L4 Parts (f)

The regulation requires that:

*limiting the heat loss from pipes, ducts and vessels used for the transport or storage of heated water or air;*

this requires that hot water storage vessels, pipes and ducts associated with the provision of heating and hot water in a building should be insulated to limit heat loss, except where the heat flow through the wall of the pipe, duct or vessel is always useful in conditioning the surrounding space.

### **3.7 Regulation L4 Parts (g)**

The regulation requires that:

*limiting the heat gains by chilled water and refrigerant vessels, and by pipes and ducts that serve air conditioning systems;*

this requires that storage vessels for chilled water and refrigerant, and pipes and ducts that serve air-conditioning systems should be insulated to limit heat gain from the surrounding environment.

### **3.8 Regulation L4 Parts (h)**

The regulation requires that:

*providing energy efficient artificial lighting systems and adequate control of these systems;*

this requires that artificial lighting systems shall be designed and controlled so as to ensure the efficient use of energy for this purpose. Lighting controls should encourage the maximum use of daylight and help avoiding unnecessary artificial lighting.

### **3.9 Regulation L4 Parts (i)**

The regulation requires that:

*providing to the building owner or occupants sufficient information about the building, the fixed building services, controls and their maintenance requirements so that the building can be operated in such a manner as to use no more fuel and energy than is reasonable;*

This requires that information is provided to the dwelling owner which relates to the effective and efficient operation of the systems installed in that house. Instructions on how to control the heating & hot water systems based on time and temperature requirements;

## 4. Building Fabric

Before considering efficient building services or renewable energy systems, the form and fabric of a building must be assessed and optimised so as to reduce the energy demand for heating, lighting and ventilation. Target performance levels have been identified by the design team and are presented below.

### 4.1 Elemental U-Values

The U-Value of a building element is a measure of the amount of heat energy that will pass through the constituent element of the building envelope. Increasing the insulation levels in each element will reduce the heat lost during the heating season and this in turn will reduce the consumption of fuel and the associated carbon emissions and operating costs.

It is the intention of the design team to exceed the requirements of the building regulations. Target U-Values are identified below.

U-Values	Range of Target Values Proposed	Part L 2019 (Residential) Compliant Values	Part L 2017 (Commercial) Compliant Values
Floor	0.15 to 0.18 W/m <sup>2</sup> K	0.18W/m <sup>2</sup> K	0.21W/m <sup>2</sup> K
Roof (Flat)	0.12 to 0.18 W/m <sup>2</sup> K	0.20 W/m <sup>2</sup> K	0.20 W/m <sup>2</sup> K
Roof (Pitched)	0.10 to 0.16 W/m <sup>2</sup> K	0.16 W/m <sup>2</sup> K	0.16 W/m <sup>2</sup> K
Walls	0.15 to 0.18 W/m <sup>2</sup> K	0.18 W/m <sup>2</sup> K	0.21 W/m <sup>2</sup> K
Windows	0.9 to 1.4 W/m <sup>2</sup> K	1.4W/m <sup>2</sup> K	1.6W/m <sup>2</sup> K

### 4.2 Air Permeability

A major consideration in reducing the heat losses in a building is the air infiltration. This essentially relates to the ingress of cold outdoor air into the building and the corresponding displacement of the heated internal air. This incoming cold air must be heated if comfort conditions are to be maintained. In a traditionally constructed building, infiltration can account for 30 to 40 percent of the total heat loss, however construction standards continue to improve in this area.

With good design and strict on-site control of building techniques, infiltration losses can be significantly reduced, resulting in equivalent savings in energy consumption, emissions and running costs.

In order to ensure that a sufficient level of air tightness is achieved, air permeability testing will be specified in tender documents, with the responsibility being placed on the main contractor to carry out testing and achieve the targets identified in the tender documents.

A design air permeability target of **3 m<sup>3</sup>/m<sup>2</sup>/hr** has been identified for the apartments and houses on the site. As set in Part L 2017 target air tightness for the residential amenity building and creche is **5 m<sup>3</sup>/m<sup>2</sup>/hr**.

The air permeability testing will be carried out in accordance with BS EN 13829:2001 'Determination of air permeability of buildings, fan pressurisation method' and CIBSE TM23: 2000 'Testing buildings for air leakage'

### 4.3 Thermal Bridging

Thermal bridges occur at junctions between planar elements of the building fabric and are typically defined as areas where heat can escape the building fabric due to a lack of continuity of the insulation in the adjoin elements.

Careful design and detailing of the manner in which insulation is installed at these junctions can reduce the rate at which the heat escapes. Standard good practice details are available and are known as Acceptable Construction Details (ACDs). Adherence to these details is known to reduce the rate at which heat is lost.

The rate at which heat is lost is quantified by the Thermal Bridging Factor of the dwelling and measured in  $W/m^2K$ . The Thermal Bridging Factor is used in the overall dwelling Part L calculation, this value can be entered in three different ways:

0.15 $W/m^2K$	Used where the ACDs are not adhered to
0.08 $W/m^2K$	Used where the ACDs are fully adhered to
< 0.08 $W/m^2K$	Used where the thermal details are thermally modelled and considered to perform better than the ACDs

It is intended that thermal modelling will be carried out for all thermal bridges on the dwellings within proposed development and that the resultant Thermal Bridging Factor will be in the range of 0.04 $W/m^2K$  to 0.08 $W/m^2K$ .

## 5. Heat Sources & Renewable Energy Options.

All new dwellings and commercial buildings must have a portion of their annual energy demand provided by renewable energy sources. This can be thermal energy such as **solar thermal collection, biomass boilers** or **heat pumps** or it can be electrical energy as generated by **photovoltaic solar panels** or **wind turbines**.

The minimum renewable energy contributions for dwellings defined in Part L 2011 Part (b) are 10kWhrs.m<sup>2</sup>/yr of thermal energy or 4kWhrs.m<sup>2</sup>/yr of electrical energy. This minimum contribution generally has to be exceeded in order to meet Part L 2011 Part (a) which relates to the overall energy performance of the dwelling.

The minimum renewable energy contributions for the residential amenity building and creche defined in Part L 2017 Part (b) are

Reflected by Renewable Energy Ratio (RER) which is the ratio of the primary energy from renewable energy sources to total primary energy and to be of minimum 20% of the total energy consumption.

In order to determine the most efficient and effective means of complying with the requirements of Part L 2011 Part (b) and Part L 2017 Part (b) a detailed assessment of the various renewable energy systems available will be conducted during the detailed design stage. A range of possible solutions will be assessed in terms of their technical suitability; ease of operation for end-users; operating costs to be borne by end users and capital costs of the plant and equipment required.

The most common approach to a meeting the required standards are set out below.

### 5.1 Individual Gas Fired Boilers with Solar Panels.

The use of natural gas to provide heating and hot water to dwellings and commercial buildings is very common due to its convenience and to low fuel prices. There is existing Gas Networks Ireland infrastructure in the vicinity of the proposed development and Gas Networks Ireland are aware of the proposed extent of development on the subject lands and have confirmed that there is adequate capacity in the network. High efficiency gas fired condensing boilers convert gas to heat energy with an efficiency of over 90%.

Both Solar PV and Solar Thermal Collection harvest the sun's energy to provide a renewable energy source for the dwelling. In the case of PV the sun's energy is converted into electrical energy which offsets the use of grid electricity while in the case of solar thermal collection it is converted into thermal energy which is used to heat domestic hot water within the building.

Since the introduction of Part L 2011 the use of PV panels has become the most common approach for achieving Part L compliance as the quantity of panels provided on each dwelling can be tailored specifically to ensure that both the minimum renewable energy requirements and the overall dwelling energy performance coefficient (EPC) are compliant with regulations L3 (a) and (b).

### 5.2 Air Source Heat Pumps

Air source heat pumps (ASHPs) utilise grid supplied electricity to extract thermal energy from a heat source, in this case, the external ambient air. While the electricity consumed is obviously not renewable energy, the efficiency at which a heat pump operates allows a significant portion of the heat delivered to be considered as renewable energy. The amount of heat considered to be renewable is determined by the efficiency of the heat pump and the "primary energy conversion factor" for grid supplied electricity. Typically, approximately 40% to 50% of the heat supplied is considered to be renewable energy.

Air source heat pumps require an indoor and an outdoor component. The outdoor unit is the evaporator which extracts the thermal energy from the ambient air while the indoor unit typically includes the heating buffer tanks and the hot water cylinder for the dwelling. The outdoor unit is typically located in the back garden of a dwelling.

In recent years, the design of ASHPs has improved bringing about higher efficiencies and reduced costs. This, in turn, has led to an increase in the use of this technology in large scale housing developments. Certified seasonal efficiencies of some models can exceed 500% meaning that the use of this technology can easily deliver compliance with current Part L requirements.

For apartments, there is an increasing number of manufacturers offering products which incorporate air source heat pump technology but which do not require the traditional “outdoor unit” making them suitable for apartments, these are generally referred to as “Exhaust Air Heat Pumps” and are capable of extracting air from both the air within the apartment and from the outdoor air through a ducting system.

### **5.3 Other Discounted Technologies – District Heating**

The inclusion of a district heating scheme was considered for the site but was discounted at an early stage in the preliminary design. This approach would involve the generation of heat in a central location in the basement of the block and the distribution of this heat to each dwelling via a network of heating pipework. The central plant used to generate the heat could include gas boilers and a renewable energy contribution such as a combined heat and power plant or a biomass boiler.

This approach is often considered to be suitable for high density developments such as large apartment complexes (100+ dwellings), it becomes inefficient both in terms of capital cost and operational cost on smaller apartment schemes and as such would not be considered to be a viable approach on a project of this scale.

### **5.4 Ventilation Design**

The provision of a well-designed ventilation for dwellings and commercial buildings is vitally important in order to control the odours and moisture levels and to provide an adequate supply of fresh air to the dwelling.

Three different options are generally considered for schemes of this nature. These are as follows:-

#### **5.4.1 Traditional Natural Ventilation Approach**

This approach operates with intermittent extract fans in wet rooms and background ventilation provided in accordance with the guidance of Technical Guidance Document F (TGD-F)

In the DEAP calculation used for Part L compliance, the number of “intermittent fans and passive vents” entered in the calculation is typically one (fan) per wet room and one (passive vent) per habitable room.

## 5.4.2 Whole House Mechanical Heat Recovery Ventilation (MHRV)

Where MHRV are used, air is extracted from wet rooms and supplied to living spaces via a central unit which contains supply and extract fans and a heat exchanger. This system recovers the heat from the warm air being extracted from the dwelling and using the heat recovered to raise the temperature of the incoming air stream leading to improved overall efficiency.

The system also has the benefit of eliminating the requirement for trickle ventilation as it runs continuously, thereby increasing the benefits of an air tight construction. It is also possible to incorporate a humidity control function into the fans which will result in a system which is capable of varying supply and extract rates in accordance with the humidity levels in the dwelling.

In the DEAP calculation used for Part L compliance, the number of “intermittent fans and passive vents” entered in the calculation will only need to take account of the kitchen extract fan and therefore only 1 “intermittent fans and passive vents” will be entered in the software.

## 5.4.3 Mechanical Whole House Extract (MEV)

MEV systems are similar to MHRV systems in that they extract air from all wet rooms using a central extract fan which runs continuously however there is no supply air provided by the system and there is no heat recovery. In order to supply air to the dwelling trickle vents are required but the total free area required is typically 60% to 70% less than that which is required using the traditional ventilation approach. As with MHRV it is possible to incorporate a humidity control function into the fan which will result in a system which is capable of varying air extract rates in accordance with the humidity levels in the dwelling.

In the DEAP calculation used for Part L compliance, the number of “intermittent fans and passive vents” entered in the calculation will only need to take account of the kitchen extract fan and therefore only 1 “intermittent fans and passive vents” will be entered in the software. The trickle vents provided in the windows can be ignored since their area is less than 3,500mm<sup>2</sup>

Of the three systems discussed above, it is likely that either an MHRV system or an MEV System will be used.



## 6. Proposed Solutions for Farrankelly

The preceding sections of this report set out the regulatory requirements with which the scheme will have to comply while identifying a number of technologies and design approaches that may be utilised to achieve compliance.

The building fabric standards and the technology solutions discussed will all be assessed in greater detail during the detailed design stage of the project. A cost benefit analysis of all these available solutions will be carried out to determine the correct balance between an efficient building envelope and the most appropriate combination of technology and renewable energy systems.

### 6.1 Dwellings

To date, Cairn Homes preferred approach to achieving Part L Compliance for dwellings has been as follows:

- Exceed minimum U-Value standards by 20% to 30%,
- Achieve air tightness standards of  $3\text{m}^3/\text{m}^2/\text{hr}$
- Thermally model all thermal bridging details to achieve thermal bridging factors of less than  $0.08\text{W}/\text{m}^2\text{K}$
- Install high efficiency gas fired boilers and time and temperature zone control in all dwellings
- Install centralised mechanical ventilation systems to ensure adequate ventilation rates are achieved in the dwelling which maximising the benefits of the air tight construction
- Provide roof mounted PV panels to provide the required renewable energy contribution

However, the introduction of Part L 2018 (NZEB) may require that an alternative approach is adopted. Once the final issue of the TGD document and the updated DEAP software is available the strategy for compliance will be finalised.

### 6.2 Creche & Residential Amenity Building

The proposed approach to achieving Part L Compliance for the residential amenity building and creche will be as follows:

- Exceed minimum U-Value standards by 20% to 30%,
- Achieve air tightness standards of  $5\text{ m}^3/\text{m}^2/\text{hr}$
- Adopting Acceptable Construction Details in order to limit thermal bridging.
- Analyse the proposed glazing proportions and orientations and select appropriate solar control glazing and/or shading devices to reduce the solar gain to the spaces to an appropriate level.
- Provide roof mounted PV panels to provide the required renewable energy contribution

# UK and Ireland Office Locations



