



5240

ENERGY ANALYSIS REPORT

ENERGY USE ANALYSIS and PART L COMPLIANCE STATEMENT

Phase 1 - The Meadows - Bessborough

Proposed Residential Development

**Bessborough,
Ballinure,
Blackrock,
Co. Cork**

Estuary View Enterprises 2020 Ltd

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1 Introduction

1.1 Report purpose

This report gives information on the projects energy status and carbon dioxide emissions, the statutory compliance requirements and energy/CO2 reduction achievements based on the proposed building / construction specifications.

1.2 Instruction

DKPartnership (DKP) have been commissioned by Estuary View Enterprises 2020 Ltd, to carry out the analysis and report for the proposed development at Bessborough, Co. Cork.

1.3 Development description

The development consists of 280 build to sell apartments , associated supporting uses , a 25 child creche facility , communal open space areas, landscaping, under-podium and car parking spaces (99 spaces), bicycle parking spaces, bin stores, public lighting and all ancillary site development works.

The development also consists of a new pedestrian and cycle way bridge connecting the site to the passage west greenway to the Eastern boundary. The development is arranged around 4 main L-shaped blocks ,Builds A,B,C,& D with a central spine public route running East-West. A raised landscape podium is located to the South of this route .Building Heights range form 1 - 10 storeys at varying locations.

1.4 Policy and building regulation requirements.

The project is subject to the following statutory and policy energy usage and CO2 emission target requirements: TGD Part L 2019 for the residential element and Part L 2017 for the non residential element.

1.5 Approach

The energy usage and carbon emissions are calculated using the DEAP software and approached using the basic DKP energy reduction steps in the following order :

- a) Reduce energy usage
- b) Produce energy efficiently
- c) Provide on-site energy

2 Executive summary

2.1 Analysis conducted

In this report the primary energy usage and carbon dioxide emissions have been analysed to provide an energy efficient building in compliance with the current standards and regulations.

2.2 Policy and building regulations applied

Given its time frame currently known the new development's requires compliance (energy) to Part L 2019 for the residential element and Part L 2017 for the non residential element . Compliance to both the above noted Part L would deem the development and developments residential units to be "Nearly Zero Energy Buildings" (NZEB) in accordance to the EU Energy performance of Buildings Directive Recast 2013/31/EU.

2.3 Calculation data, targets and achievements.

For the purpose of this report as the residential element dominates the few non residential facilities the calculation data provided in the tables below is based on Part L 2019 and covers the main criteria ; a) Primary energy, b) Carbon dioxide, c) Renewable energy. The calculation data given is the average residential unit size, occupation, configuration, orientation, etc. To comply to Part L the residential unit(s) requires to achieve a primary energy reduction of 70% (0.30 MEPC factor), a carbon emission reduction of 65% (0.35 MCPC factor) and a 20% renewable energy contribution on the reference residential unit. The reference residential unit is the proposed residential unit but by the SEIA stipulated standard (poorer) Part L calculation parameters, U-values/insulation levels, boiler efficiency, controls etc. The table below represents the reference residential unit data, the to be achieved data and the current achieved data of the average residential type across the development using the applied reduction measures and technologies listed in section 4.

In essence passive reduction measures and on-site produced renewable energy are most beneficial as they are a permanent reduction measures and alternative energy supply combatting not only the global climate change but also the inflation on energy cost.

SINGLE UNIT

ELEMENT	UNIT	REFERENCE	TO BE ACHIEVED	FACTOR	ACHIEVED	FACTOR
Primary Energy	kWh/y	13,122	3,937	0.30	3,412	0.26
Carbon Dioxide	kg/y	2,684	939	0.35	671	0.25
Renewable energy	kWh/y	0	787	20%	1,058	31%

Overall development achievements

Number of residential units : **280**

ELEMENT	UNIT	BASE LINE	ACHIEVED	FACTOR	REDUCTION	%
Primary Energy	kWh/y	3,674,160	955,282	0.26	2,718,878	74.0%
Carbon Dioxide	kg/y	751,520	187,880	0.25	563,640	75.0%
Renewable energy	UNIT	BASE LINE	ACHIVED	FACTOR	CONTRIBUTION	%
Renewable energy	kWh/y	0	296,137	31%	842,852	31%

We note the significant reduction in carbon dioxide of 564 ton CO2 per year and the renewable energy contribution of 842,852 kWh per year which is a huge benefit to the global environment

We note that for this report we have applied the air source heat pump option for the calculation results and TGD Part L compliance. However whereas PV panels are not a requirement with the air source heat pump option they have been shown on the roofs of buildings on the architects drawings to allow for flexibility from a planning perspective in the case that alternative energy / renewable energy solutions are to be considered.

2.4 Policy and building regulation compliance overview

The table below summarises the requirements of Part L for primary energy, CO2 and renewable energy ;

POLICY/REGULATION	REQUIREMENT	ACHIEVEMENTS
Primary Energy	To achieve a primary energy reduction factor (EPC) of 0.30 or less over the 2019 energy reference building.	An EPC of 0.26 was achieved which is lower than the maximum MEPC of 0.30 and is therefore compliant.
Carbon Dioxide	To achieve carbon dioxide emission reduction factor of 0.35 or less over the 2019 energy reference building.	An CPC of 0.25 was achieved which is lower than the maximum MCPC of 0.35 and is therefore compliant.
Renewable energy	To achieve at least a 20% renewable primary energy equivalent contribution.	An overall contribution of (primary energy) renewable energy of 44% was achieved with the heat pump renewable energy element.

2.5 Conclusion

Compliance to part L 2019 was achieved using proposed measures achieving a primary energy reduction in excess of the minimum required a 70% (or < 0.30), a carbon dioxide reduction in excess of the minimum required 65% (or < 0.35) and a renewable energy contribution in excess of 20%. As mentioned compliance could also be achieved by a number of other methods listed in section 4.8 in combination with proposed passive reduction measures outlined in section 4.7.

2.6 Mitigation measures / actions

There are no mitigation measures anticipated.

3 Geographical overview

3.1 Project overview

Image 3.1, the (google maps) site map below is a basic overview of the site with proposed development approximately outlined in the area site map.



Image 3.1: approximate proposed phase 1 (Meadows) development site area outlined

4 Approach, methodology and calculation results

4.1 General approach

The target of the building's energy usage and carbon dioxide emissions is to comply to the current building regulations and to design the building and building services in line with the "Nearly Zero Energy Building" energy policy adapted in Part L 2019. Calculations have been conducted on all the developments apartment units with the given data in this report representing the averages across all of the **280** no units with the average unit size to be **64m²**. The average unit (size) has been applied for these initial Part L calculations.

4.2 Building regulations requirements

Building regulation (residential) Part L : 2019 or any subsequent editions current at the time of completion.

4.3 Part L 2019 general approach

Part L 2019 requires a new residential unit to make primary energy and carbon dioxide emission reductions on a reference apartment by applying improved calculation parameters and technologies.

Part L 2019 also requires the apartment to provide at least 20% of its primary energy usage by means of renewable energy. The reference apartment is exactly the same as the actual apartment albeit with standard basic Part L calculation parameters, U-values/insulation levels, boiler efficiency, controls etc. and has no renewable energy which the new apartment has to improve upon.

4.4 Reduction targets

The following are the reference building or target values.

SINGLE UNIT

ELEMENT	UNIT	REFERENCE	TO BE ACHIEVED	FACTOR
Primary Energy	kWh/y	13,122	3,937	0.30
Carbon Dioxide	kg/y	2,684	939	0.35
Renewable energy	kWh/y	0	787	20%

4.5 Building minimum elemental parameters

The following are the main building minimum target values for Part L 2011 and Part L 2019 ;

Element	Unit	2011	2019
Primary energy	MPEPC *	0.40 - 60%	0.30 - 70%
Carbon emissions	MPCPC *	0.46 - 54%	0.35 - 65%
Renewable energy	RER (%) **	15% (estimated)	> 20%
External walls	U (W/m ² K)	0.21	0.18
Windows/glazing	U (W/m ² K)	1.60	1.40
Pitched roof horizontal	U (W/m ² K)	0.16	0.16
Pitched roof pitched	U (W/m ² K)	0.16	0.16
Flat roof	U (W/m ² K)	0.20	0.20
Ground floor	U (W/m ² K)	0.21	0.18
Cold bridging	U (W/m ² K)	0.15 / 0.08	0.15 / 0.08
Air tightness	M3/m ² *h	7	5 (3) ***
Air testing		Proportionally	All / every one
HRU/MVHR	W/l/s / %	1.5 + 66% efficient	1.2 + 70% efficient
DCV	W/l/s	0.8	0.6

4.6 Reduction hierarchy

To target the Part L minimum required reductions DKP use the following reduction hierarchy ;

- 1) Step 1 - Reduce energy usage
- 2) Step 2 – Produce energy efficiently
- 3) Step 3 – Provide on-site energy.

4.7 Step 1) Reducing energy usage

Energy use reduction is mainly achieved by reducing the actual heat loss of the building by :

- a - Lowering the heat loss through the floors, walls, roof by increasing the thermal resistance of the elements.
- b - Lowering the heat loss through the glazed elements by using windows with a higher thermal resistance.
- c - Lowering the heat loss by using insulated construction joints.
- d - Increasing the air tightness to minimise the involuntary air infiltration rate.

The following parameters have applied as a means to achieve compliance.

● Ground floors :

U = **0.10 – 0.13** W/m²K

120-150mm high density polyurethane foam board (HDPUF) floor insulation, $k \leq 0.022/0.021$ W/mK plus
12.5mm high density polyurethane foam board (HDPUF) edge insulation around the perimeter, $k \leq 0.022$ W/mK

● External walls + walls to unheated common spaces:

U= **0.12 - 0.14** W/m²K

135 - 160mm partial or full fill cavity high density polyurethane foam board wall insulation, $k \leq 0.022/0.021$ W/mK
Emissivity factor : ≤ 0.5

● Party walls :

U= x.x W/m²K where appropriate.

Solid plastered or skimmed both sides and sealed on all edges and joints.

● Roof :

U= **0.10 – 0.12** W/m²K

Flat : 100-125mm high density polyurethane (HDPUF), cold side (roof) insulation, $k \leq 0.022/0.021$ W/mK +
50-60mm density polyurethane (HDPUF), warm side insulated plasterboard, $k \leq 0.022/0.021$ W/mK

● Window & frame :

U ≤ 1.0 W/m²/K,

Double or triple glazed Argon filled insulated frame

Solar transmittance 0.55

Light transmittance : 0.72

● External door & frame :

U = **1.0** W/m²K

Insulated solid door or as above.

● Air tightness :

Design target **2.5** m³/m²*h

Design permeability is set at 2.5 m³/m²*h @ 50Pa or an approximate atmospheric exchange rate of 0.125 ach.

To be achieved with very good workmanship with taped and sealed construction joints and or purpose membrane.

- Cold bridging :

$U \leq 0.06 \text{ W/m}^2\text{K}$

All construction joints to be insulated. Approved Part L joints as per appendix D.

The actual linear coefficient will be applied using the Part L appendix D approved construction details with some (15%) recalculated better insulated joints as listed below using ;

- Ventilation.

Demand controlled 24 hour/365 operated central mechanical extract system (no heat recovery)

Requires +/- 60% natural ventilation openings typically 4,000mm² per habitable room. 100% permanent.

All wet rooms fully ducted from central location typically Ø80mm duct work.

or

Demand controlled 24 hour/365 operated central mechanical supply and extract system (with heat recovery)

No natural ventilation opening. Sealed building. All habitable / wet rooms fully ducted typically Ø100mm duct work.

with

Separate manual operated on/off kitchen extract with the 2 options above.

- Lighting ;

Low energy lighting. **100%**

All lighting point are either LED or compact fluorescent fittings or fittings with LED or compact fluorescent filaments.

- Heating / hot-water controls ;

1 no. 2 channel (space heating / hot-water) battery backed programmable time clock with 1 hour boost facility.

1 no. Room thermostat / 2 port control valve.+ thermostatic radiator valves or individual room thermostats.

1 no. Hot water thermostat / 2 port control valve.

- Circulation pumps.

Class A Variable speed circulating pump(s)

- Avoid.

Chimney / open fire,

Chimney / biomass stove

Biomass stove

Gas stove

Electric fire

4.8 Step 2 and 3) Provide energy efficiently and provide on-site renewable energy

Energy and renewable energy can be provided in numerous ways.

Given the location of the project and its accessibility to grid utilities the following options could be considered for the provision of energy and renewable energy.

- Energy and alternative renewable on-site energy source.

a) LTHW (wet) Mains gas condensing system or instantaneous hot-water boiler ($\eta > 92\%$) + 5 PV 400Wp panels, or

b) LTHW (wet) Mains gas condensing hot-water storage boiler ($\eta > 92\%$) + 4 PV 400Wp panels, or

c) LTHW (wet) Split or mono block air source heat pump (η heating $> 540\%$, η hot-water $> 245\%$), or

d) Electric space heating (dry) + Hot water heat pump (η hot-water $> 485\%$) (apartments up to +/- 80m² only), or

e) A communal form of heating system with any of the above options or a combination of any of the above options.

There are also other possible sources like city district heating networks CDHN, CHP heating networks, on site communal heating with CHP, geothermal heat or waste heat recovery from incineration or other industrial processes to be considered. As there are no city heating net works in close vicinity to the project site a local on-site energy source is to be applied.

CHP is not efficient as the projects base load is not sufficient to maintain viability on a CHP plant. The project, as it is relatively dense, may suit a communal heating system fed by a combination of mains gas boilers and heat pumps however this needs to be economically assessed for viability and if applied does bring the additional requirement of heat energy metering and invoicing to apartment occupiers.

For the report we have applied option c) the air source heat pump.

4.9 Renewable energy

This means producing on-site renewable energy by using;

- a - Thermal solar panels for hot water and/or space heating.
- b – Photovoltaic (PV) panels for electrical energy for all electrical requirements.
- c - Wind mill(s) for electrical energy for all electrical requirements.
- d - Biomass (wood, pellet, chip) plant for hot water and/or space heating.
- e - Incinerator(s) for waste heat production
- f – Heat pump renewable energy.

Given the configuration of the development and the urban location wind power has not been considered. Biomass, although theoretically a good renewable option, has given issue's in other project's with similar use due to maintenance problems with the actual plant giving rise to complaints from occupants / users. PV is generally a good and passive option to be considered.

For this report we have applied option (f) the heat pump renewable fraction. To maintain flexibility from a planning perspective PV panels have been included on the architects drawing allowing for alternative energy / renewable energy solutions.

4.10 Calculation software

Primary energy and carbon dioxide performance calculations are executed using the National Calculation Methodology government approved Domestic Energy Assessment Procedure (DEAP version 4).

4.11 Over heating

Over heating can be an issue and an over heating analysis was conducted using the Passive House PPH analysis software which concluded that the risk to overheating was minimal in accordance to CIBSE TM37. Overheating can also be addressed by applying glass with a higher solar reflection factor or lower emittance factor.

4.12 Calculation results

The table below shows the calculation results from the average size apartment with the average external wall area, glass area, orientation, floor * roof area etc. The table details the reference building primary energy, carbon dioxide and renewable energy data, the required reductions / contributions and what has been achieved using the more advanced building part L parameters from items 4.6 reduction parameters and 4.7 energy & renewable energy options.

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We note the significant reduction in carbon dioxide of 564 ton CO₂ per year and the renewable energy contribution of 842,852 kWh per year which is a huge benefit to the global environment

A decision on the final agreed energy supply solution will be made in due time after the proposed systems economical assessment.

4.13 Part L compliance conclusion

Compliance to part L 2019 is achieved by means of a 70% primary energy reduction on the reference dwelling or an EPC (primary energy) of 0.30 or less, a 65% carbon diode reduction or a CPC (carbon dioxide) of 0.35 or less and an equivalent primary renewable energy contribution of 20% or more.

As mentioned in the above sections this can be achieved by a number of methods listed in section 4.8 in combination with proposed passive reduction measures outlined in section 4.7.