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Belcamp SHD

FCC Lands / Conroy Crowe Kelly Architects

# 5000 PART L and ENERGY / CARBON DIOXIDE ANALYSIS REPORT

Residential Development

**Belcamp,**
**Malahide Road,**
**Dublin 17**

Gerard Gannon Properties

Project file no
**DKP-L00-5000-1P**
2022-05-04

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# Contents

# 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.

## 1.1 Instruction

DKPartnership (DKP) have been commissioned by Gerard Gannon Properties, to carry out the analysis and report for the proposed development at Belcamp, Malahide Road, Dublin 17.

## 1.2 Development description

The following is a brief summary of the proposed development; *"A 10-year planning permission is sought by Gerard Gannon Properties for a proposed Strategic Housing Development on lands at Belcamp Hall (protected structure), MalahideRoad, the R139 road and Carr's Lane, Belcamp, Dublin 17. The proposed development will consist of the construction of 2,527 no. residential units comprising houses, apartments and duplex units, 2 no. childcare facilities; 1 no. sports changing facilities building; 3 no. cafés/restaurants; 18 no. retail/commercial units; and all associated engineering and site works necessary to facilitate the development."*

## 1.3 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.

## 1.4 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 and targets

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 unit data, the to be achieved for compliance data and the currently achieved data of the average residential unit 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 measure and alternative energy supply combatting not only the global climate change but also the inflation on grid energy cost.

| ELEMENT | UNIT | REFERENCE | TO BE ACHIEVED | FACTOR | ACHIEVED | FACTOR |
|---|---|---|---|---|---|---|
| Primary Energy | kWh/y | 17,308 | <= 5,192 | 0.30 | **4,673** | 0.27 |
| Carbon Dioxide | kg/y | 3,949 | <= 1,382 | 0.35 | **1,027** | 0.26 |
| Renewable energy | kWh/y | 0 | >= 1,038 | 20% | **1,542** | 33% |

DEVELOPMENT TOTALS

Number of units : **1297**

| ELEMENT | UNIT | BASE LINE | ACHIEVED | FACTOR | REDUCTION | % |
|---|---|---|---|---|---|---|
| Primary Energy | kWh/y | 22,448,476 | **6,061,089** | 0.27 | **16,387,387** | 73.0% |
| Carbon Dioxide | kg/y | 5,121,853 | **1,331,682** | 0.26 | **3,790,171** | 74.0% |
| | UNIT | BASE LINE | ACHIVED | FACTOR | CONTRIBUTION | % |
| Renewable energy | kWh/y | 0 | **2,000,159** | 33% | **2,000,159** | 33% |

From the table above we note that the development covering 1297 units achieved a significant reduction in energy usage of 16,387 MWh per year, A carbon dioxide emission reduction of 3,790 ton CO2 per year and a renewable energy contribution of 2,000,159 kWh per year which is a huge benefit to the global environment. The average unit achived a BER rating of 44.8 kWh/m2/y with all units achieving a BER rating of between 43.1 kWh/m2/y and 48.9 kWh/m2/y. All units achived an A2 label.

## 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 0.27 was achieved which is lower then 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 0.26 was achieved which is lower then 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 33% was achieved which is higher then the minimum 20% and is therefore compliant . |

## 2.5 Conclusion

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

All units achieved a BER rating of < 50kWh/m2/y and an A2 label.

As mentioned in the above sections the energy calculations and compliance data has been executed using certain thermal parameters and air source heat pump technology but this can also be achieved by an other number of methods listed in section 4.7 in and section 4.8.

## 2.6 Mitigation measures / actions

Mitigation is not anticipated as the reductions to be achieved are for the greater part statutory.

# 3 Geographical overview

## 3.1 Project overview

Image 3.1 the (google arial) site map below indicates the location of the site, approximately outlined.


Image 3.1 Google maps arial view – with approximate proposed development on FCC lands site location.

# 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 average across all of the proposed units taking the average unit size , average exposure, orientation, glazing etc.

| *Council* | *Type* | *1 bed unit* | *2 bed unit* | *3 bed unit* | *4 bed unit* | *Total type* | *Subtotal Phase* |
|---|---|---|---|---|---|---|---|
| Phase SHD 1 | Houses | 0 | 9 | 194 | 40 | 243 | 774 |
| | Duplex units | 4 | 0 | 112 | 0 | 116 | |
| | Apartments | 174 | 233 | 8 | 0 | 415 | |
| Phase SHD 2 | Houses | 0 | 7 | 117 | 18 | 142 | 345 |
| | Duplex units | 0 | 0 | 68 | 0 | 68 | |
| | Apartments | 55 | 75 | 5 | 0 | 135 | |
| Phase SHD 3 | Houses | 0 | 0 | 74 | 14 | 88 | 178 |
| | Duplex units | 20 | 40 | 30 | 0 | 90 | |
| | Apartments | 0 | 0 | 0 | 0 | 0 | |
| ***Total*** | | | | | | | **1297** |

There are a total of 1297 units with the overall average unit floor area of 104.2 m2.

## 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 requires a new apartment to make primary energy and carbon dioxide emission reductions on a reference apartment by applying improved calculation parameters and technologies. Part L 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 developments average unit DEAP/BER reference building and target (to be achieved) values.

SINGLE UNIT

| ELEMENT | UNIT | REFERENCE | TO BE ACHIEVED | FACTOR |
|---|---|---|---|---|
| Primary Energy | kWh/y | 17,308 | <= 5,192 | 0.30 |
| Carbon Dioxide | kg/y | 3,949 | <= 1,382 | 0.35 |
| Renewable energy | kWh/y | 0 | >= 1,038 | 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/m2K) | 0.21 | 0.18 |
| Windows/glazing | U (W/m2K) | 1.60 | 1.40 |
| Pitched roof horizontal | U (W/m2K) | 0.16 | 0.16 |
| Pitched roof pitched | U (W/m2K) | 0.16 | 0.16 |
| Flat roof | U (W/m2K) | 0.20 | 0.20 |
| Ground floor | U (W/m2K) | 0.21 | 0.18 |
| Cold bridging | U (W/m2K) | 0.15 / 0.08 | 0.15 / 0.08 |
| Air tightness | M3/m2*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 - Lowing 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 and near identical energy/carbon dioxide/renewable energy rates to all units.*

- Ground floors :

U = **0.10 – 0.13** W/m2K
120-150mm high density polyurethane foam board (HDPUF) floor insulation, k<=0.022/0.021 W/mK plus
12.5mm high density polyurethane foam board (HDPUF) edge insulation around the perimeter, k<=0.022W/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<=0.022/0.021 W/mK
Emissivity factor : <=0.5

- Party walls :

U= 0.0 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<=0.022/0.021 W/mK + 50-60mm density polyurethane (HDPUF), warm side insulated plasterboard, k<=0.022/0.021 W/mK

- Window & frame :

U<=1.1 – 1.2 W/m2/K,
Double or triple glazed Argon filled insulated frame
Solar transmittance 0.63
Light transmittance : 0.72

- External door & frame :

U = 1.2 – 1.4 W/m2K
Insulated solid door or as above.

- Air tightness :

Design target 2.0 – 2.2 m3/m2*h
Design permeability is set at 2.0 to 2.2 m3/m2*h @ 50Pa or an approximate atmospheric exchange rate of 0.10 – 0.11 ach. To be achieved with very good workmanship with taped and sealed construction joints and or purpose membrane.

- Cold bridging :

U<=0.08 W/m2K
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 4,000mm$^2$ per habitable room. 100% permanent.
All wet rooms fully ducted from central location typically Ø80mm duct work.

Other considerations;

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 / fire
Gas stove / fire
Electric heater / 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 (η>92%) + 5 PV 400Wp panels, or
b) LTHW (wet) Mains gas condensing hot-water storage boiler (η>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.**

## 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 to medium in accordance to CIBSE TM37. Overheating can also be addressed by applying glass with a higher solar reflection factor or lower emittance factor and/or increasing the ventilation rate of the mechanical ventilation system.

## 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 building part L parameters from items 4.6 reduction parameters and 4.7 energy & renewable energy options.

SINGLE AVERAGE UNIT 104.2 m2

| ELEMENT | UNIT | REFERENCE | TO BE ACHIEVED | FACTOR | ACHIEVED | FACTOR |
|---|---|---|---|---|---|---|
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Number of units : **1297**

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| | UNIT | BASE LINE | ACHIVED | FACTOR | CONTRIBUTION | % |
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From the table above we note that the development covering 1297 units achieved a significant reduction in energy usage of 16,387 MWh per year, A carbon dioxide emission reduction of 3,790 ton CO2 per year and a renewable energy contribution of 2,000,159 kWh per year which is a huge benefit to the global environment. The average unit achived a BER rating of 44.8 kWh/m2/y with all units achieving a BER rating of between 43.1 kWh/m2/y and 48.9 kWh/m2/y. All units achived an A2 label.

## 4.13 Part L compliance conclusion

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

All units achieved a BER rating of < 50kWh/m2/y and an A2 label.

As mentioned in the above sections the energy calculations and compliance data has been executed using certain thermal parameters and air source heat pump technology but this can also be achieved by an other number of methods listed in section 4.7 in and section 4.8.

Mitigation is not anticipated as the reductions to be achieved are for the greater part statutory.