Orchard Gate

Proposed Residential Development

ENERGY / CLIMATE IMPACT ANALYSIS REPORT

PART 2021 and ENERGY COMPLIANCE STATEMENT

Kennelsfort Road Upper
Palmerstown
Co. Dublin

AAI Palmerstown 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 AAI Palmerstown Ltd to carry out the analysis and report for the proposed Orchard Gate residential development described below.

1.3 Development detail

The development is located at the former warehouse facility at units 64 & 65, Cherry Orchard Industrial Estate. The site presents a gateway location at the Western junction of Kennelsfort Road Upper and the eastern industrial estate. This location represents the start of the lands zoned REGEN continuing to the east.
The proposal is for 127 build to sell apartments and associated facilities with a mix of 55 no. one bedroom apartments, 41 no. two bedroom apartments and 31 no. three bedroom apartments . the scheme incorporates incubator employment use with block A.
The development is set out in 3 no. five storey buildings and 1 no. 4 storey building enclosing a raised podium courtyard with the eastern junction building having an 8 storey gateway feature element. On site parking of 62 spaces is contained within a landscaped podium element with 1 on street go-car space provided. Extensive public realm upgrades are incorporated with an upgraded cycle way provided on Kennelsfort road upper.

Site Area : 8,888m²

1.4 Policy and building regulation requirements

The project is subject to the following statutory and policy energy usage and CO2 emission target requirements:
a) TGD Part L 2021

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 and climate impact.

2.2 Policy and building regulations applied

Given its time frame currently known the new development's requires compliance (energy) to new Part L 2021. Compliance to the above 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 Compliance target and achieved calculation data

For the purpose of this report the calculation data provided covers the Primary energy, Carbon dioxide and Renewable energy. The calculation data given is based on the average apartment size, occupation, configuration, orientation, etc. For compliance, the apartment needs to achieve energy/carbon reductions on a reference apartment and to provide a fraction (20%) of the primary energy to come from a renewable source. This reference apartment is identical to the proposed apartment but with standard basic Part L calculation parameters, U-values/insulation levels, energy conversion efficiency, controls etc. The table below represents are the average data / results of all the proposed apartments in the development. The achieved compliance data was achieved by using an air source heat pump for both space heating and hot water heating in combination with photovoltaic panels.

ELEMENT		MEPC / MCPC	REFERENCE	EPC / CPC	ACHIEVED
Primary energy	kWh	0.30	11,233	0.265	2,977
Carbon dioxide	Kg	0.35	2,681	0.255	684
Renewable energy (pe)	kWh	na	0	151%	1,336

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 2021 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 2021 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 31% was achieved with the heat pump renewable energy element.

2.5 Conclusion

Compliance to part L 2021 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. The compliance calculation results where achieved by the application of the suggested façade parameters in combination with an air source heat pump for space & hotwater heating and photovoltaic panels. However as mentioned in the technical sections compliance can 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. We note that, until the moment we can construct at actual zero carbon emissions, any new construction will increase the global carbon output however key to this is minimising the impact as demonstrated above.

3 Geographical overview

3.1 Project overview

Image 3.1 the (google maps) site is an overview of the site area with the proposed development approximately outlined in red.

Image 3.1: Proposed development site boundary

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 2021. Calculations have been conducted on all the developments apartment units with the given data in this report representing the averages across all of the apartment units.

4.2 Building regulations requirements

Building regulation (residential) Part L : 2021 will apply as the development has not commenced before November 1st not has planning be applied for before November the 1st to avail of the transition period of Part L 2011.

4.3 Part L 2021 general approach

Part L requires a new apartment (actual 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 actual 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 but uses fixed pre-set (by the SEAI) basic standard Part L calculation parameters, U-values/insulation levels, energy conversion efficiency, controls etc. to enable the actual apartment to make substantial reductions. The reference apartment has no renewable energy element.

4.4 Reduction targets

The following are the reference building or target values.

ITEM	UNIT	REFERENCE	TO BE ACHIEVED	
Primary energy	kWh/y	11,233	0.30	3,370
Carbon dioxide	kg/y	2,681	0.35	938
Renewable energy (pe)	kWh/y	0	+ 20%	923

4.5 Building minimum elemental parameters

The following are the main building minimum target values for Part L 2021 ;

Element	Unit	2021	Proposed
External walls	U (W/m2K)	0.18	0.14
Windows/glazing	U (W/m2K)	1.40	1.20
Solar transmittance		High g factor note	--------
Light transmittance			--------
Pitched roof horizontal	U (W/m2K)	0.16	0.11
Pitched roof pitched	U (W/m2K)	0.16	0.11
Flat roof	U (W/m2K)	0.20	0.11
Ground floor	U (W/m2K)	0.18	0.12
Cold bridging	U (W/m2K)	0.15 / 0.08	0.06
Air tightness	M3/m2*h	3	2.5

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

- 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= 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<=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<=1.0 W/m2/K,
Double or triple glazed Argon filled insulated frame
Solar transmittance 0.55
Light transmittance : 0.72
Frame factor : 0.7

- 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<=0.06 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.

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 (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 and photovoltaic panels..

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.

ELEMENT		MEPC / MCPC	REFERENCE	EPC / CPC	ACHIEVED
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Renewable energy (pe)	kWh	na	0	151%	1,336

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 2021 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.
The compliance calculation results where achieved by the application of the suggested façade parameters in combination with an air source heat pump for space & hotwater heating and photovoltaic panels.

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.

We note that, until the moment we can construct at actual zero carbon emissions, any new construction will increase the global carbon output however key to this is minimising the impact as demonstrated in the sections above.