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Lismore Homes Ltd. – Baldoyle GA2

Sustainability & Residential Energy Statement

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Lismore Homes

CURRENT ISSUE			
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1. Introduction

This Energy Statement prepared by Ethos Engineering is submitted in support of a Strategic Housing Development application to An Bord Pleanálá on lands at Baldoyle, Dublin 13.

The scheme consists of a mix of uses comprising of Crèche, Amenity spaces and Residential. This report deals with residential areas only. Please refer to Lismore Homes Baldoyle Commercial Energy Statement for details of energy strategy for the commercial areas.

Located at the address Stapolin, Baldoyle, Dublin 13, the development is subject to the planning requirements applicable to the Fingal County Development Plan 2017-2023.

This report aims to satisfy the legislative planning requirements by addressing how the overall energy strategy of the proposed development has been approached in a holistic manner, striving to meet the highest standards of sustainable building design such as passive solar design, high efficiency systems and use of renewable energy technologies.

This report also addresses how the proposed development will comply with NZEB (Part L 2021 Dwellings). The principles underpinning Part L compliance are energy demand reduction through passive measures and increased supply from renewable and efficient sources. The proposed design will follow this principle.

Assessments carried out in this report are based on latest floor plans and elevations received from the architect.

1.1. Site and Development Summary

A Strategic Housing Development for the construction of 1,007 residential apartments (consisting of 58 no. studio units, 247 no. 1 bedroom units, 94 no. 2 bedroom 3 person units, 563 no. 2 bedroom 4 person units, and 45 no. 3 bedroom units), communal residential community rooms, and a ground floor Crèche in 16 no. buildings with heights varying from 4 to 12 storeys, basement and surface level car parking, secure bicycle parking, landscaping, water supply connection at Red Arches Road, and all ancillary site development works on a site located in the townland of Stapolin, Baldoyle, Dublin 13.

Figure 1: Baldoyle Proposed Development

2. Legislative/Planning Requirements

2.1. Part L

Technical Guidance Document Part L 2021 – Conservation of Fuel and Energy – Dwellings (public consultation edition)' (referred to in this document as "Part L or NZEB") stipulates requirements on, minimum fabric and air permeability requirements, maximum primary energy use and carbon dioxide (CO_2) emissions as calculated using the DEAP (Domestic Energy Assessment Procedure) methodology. This is a national standard and compliance is compulsory for all new dwellings. Three design aspects demonstrate compliance:

1. The limitation of primary energy use and CO_2 emissions
2. Building fabric
3. The use of renewable energy sources

2.1.1. Limitation of Primary Energy Use and CO_2 Emissions

In order to demonstrate that an acceptable primary energy consumption rate has been achieved, the calculated Energy Performance Coefficient (EPC) will be no greater than the Maximum Energy Performance Coefficient (MEPC). The MPEPC is 0.30.

To demonstrate that an acceptable CO_2 emission rate has been achieved, the calculated Carbon Performance Coefficient (CPC) of the dwellings being assessed will be no greater than the Maximum Carbon Performance Coefficient (MPCPC). The MPCPC is 0.35.

2.1.2. Building fabric

In order to limit the heat loss through the building fabric the thermal insulation for each of the plane elements of a new dwelling must meet or better the area weighted average elemental U-Values (Um) as specified by Part L, listed in Table 1 (column; Part L 2021).

Table 1: Fabric U Values Comparison Part L 2011 vs Part L 2021

Element	U-value (W/m².K)	U-value (W/m².K)
	Part L 2011	Part L 2021 (NZEB)
Pitched Roof (Insulated on slope or ceiling)	0.16	0.16
Flat Roof	0.20	0.20
Walls	0.21	0.18
Ground Floors	0.21	0.18
Exposed floors	0.21	0.18
External doors, windows and roof lights	1.60	1.40

2.1.3. Use of Renewable Energy Sources

In order to comply with NZEB, dwellings must conduct a comparative analysis for specified renewable technologies to demonstrate compliance with Regulation L3 (b).

Renewable Energy Ratio (RER) is the ratio of the primary energy from renewable energy sources to total primary energy as defined and calculated in DEAP. The following represents a very significant level of energy provision from renewable energy technologies in order to satisfy Regulation L3 (b).

Where the MPEPC of 0.3 and MPCPC of 0.35 are achieved, a RER of 0.20 represents a very significant level of energy provision from renewable energy technologies

2.2. Nearly Zero Energy Buildings (NZEB)

2.2.4. About NZEB Standard

The European Energy Performance of Buildings Directive Recast (EPBD) requires all new buildings to be Nearly Zero - Energy Buildings (NZEB) by 31st March 2020. This means that any building completed after these dates must achieve the standard irrespective of when they were started. This is quite different to the transitional arrangements for previous building regulations revisions.

'Nearly Zero - Energy Buildings' means a building that has a very high energy performance, Annex 1 of the Directive and in which "the nearly zero or very low amount of energy required should be covered to a very significant extent by energy from renewable sources, including energy from renewable sources produced on-site or nearby"

2.2.5. Implementation of NZEB in Ireland

Each member Government has discretion in how the standard is applied nationally. To comply with the NZEB requirement, the Irish Government has amended the 2011 Part L to include the following paragraphs:

'In order to achieve the acceptable primary energy consumption rate for a nearly zero energy dwelling, the calculated energy performance coefficient (EPC) of the dwelling being assessed should be no greater than the Maximum Permitted Energy Performance Coefficient (MPEPC). The MPEPC for a nearly zero energy dwelling is 0.30.

To demonstrate that an acceptable CO2 emission rate has been achieved for a nearly zero energy dwelling, the calculated carbon performance coefficient (CPC) of the dwelling being assessed should be no greater than the Maximum Permitted Carbon Performance Coefficient (MPCPC). The MPCPC for a nearly zero energy dwelling is 0.35.'

2.3. Fingal Development Plan 2017-2023

The development is subject to the Fingal Development Plan 2017-2023. The following council policies have been considered as part of the proposed Energy strategy:

Statement of Policy

Ensure adequate power capacity for the future needs of the County by co-operating and liaising with statutory and other energy providers, facilitating the development of enhanced sustainable energy supplies, encouraging in particular renewable energy sources and energy efficiency

Energy Efficiency

Fingal will support the Government Programme for the development of Energy Policy and Legislation through the implementation of supporting policies in the Plan. Ireland is committed to a range of renewable energy and efficiency targets. At European Level the '20/20/20' commitments agreed under the EU 'Climate Change and Energy Package' set three targets for 2020:

- A minimum 20% reduction in greenhouse gas emissions based on 1990 levels.
- 20% reduction in primary energy use compared with projected levels, to be achieved by improving energy efficiency.
- 20% of final energy consumption to be produced by renewable energy resources.

In addition, EU countries have agreed on a new 2030 Framework for climate and energy as outlined by the European Commission. The targets aim to help the EU achieve a more competitive, secure and sustainable energy system. The targets include:

- 40% cut in greenhouse gas emissions compared to 1990 levels.
- At least 27% share of renewable energy consumption.
- At least 27% energy savings compared with the business-as-usual scenario.

Energy Efficient Design

It is the objective of the Fingal Development Plan:

- Objective EN01: Support International, National and County initiatives for limiting emissions of greenhouse gases through energy efficiency and the development of renewable energy sources using the natural resources of the County in an environmentally sustainable manner where such development does not have a negative impact on the surrounding environment, landscape or local amenities.
- Objective EN02: Support and encourage pilot schemes which promote innovative ways to incorporate energy efficiency
- Objective EN03: Consider the adaptability of buildings over time and seek to improve the efficiency of existing building stock and promote energy efficiency and conservation in the design and development of all new buildings in the County.
- Objective EN04: Encourage development proposals that are low carbon, well adapted to the impacts of Climate change and which include energy saving measures and which maximise energy efficiency through siting, layout and design.

Renewable Energy

It is the objective of the Fingal Development Plan:

- Objective EN05: Prepare a Climate Change Mitigation and Adaptation Strategy and a Local Authority Renewable Energy Strategy (LARES), Spatial Energy Demand Analysis (SEDA) and a Sustainable Energy Action Plan (SEAP).
- Objective EN06: Encourage and facilitate the development of renewable energy sources, optimising opportunities for the incorporation of renewable energy in large scale commercial and residential development.
- Objective EN07: Support the implementation of the 'Strategy for Renewable Energy 2012-2020' Department of Communications, Energy and Natural Resources (now Department of Communications, Climate Action and Environment) and the related National Renewable Energy Action Plan (NREAP) and National Energy Efficiency Action Plan (NEEAP).

- Objective EN08: Work with relevant stakeholders to carry out a Spatial Energy Demand Analysis (SEDA) of the County within the Plan period as resources permit.
- Objective EN09: Require details of the requirements for alternative renewable energy systems, for buildings greater than 1000sq m or residential schemes above 30 units, under SI 243 of 2012 European Communities (Energy Performance of Buildings) to be submitted at pre planning stage for consideration. These should take the form of an Energy Statement or Feasibility Study carried out by qualified and accredited experts.

Wind Energy

It is the objective of Fingal Development Plan:

- Objective EN10: Support Ireland's renewable energy commitments outlined in national policy by facilitating the exploitation of wind power where such development does not have a negative impact on the surrounding environment, landscape or local amenities including offshore sites that may be designated under the Birds and Habitats Directive in the lifetime of this Plan.
- Objective EN11: Require that all new wind energy developments in the County comply with the Wind Energy Development Guidelines for Planning Authorities, DoEHLG (2006) and guidelines contained within Draft Fingal County Council Wind Energy Strategy or any subsequent strategy or associated guidelines applicable within the lifetime of the Plan.

Solar

It is the objective of Fingal Development Plan:

- Objective EN12: Support Ireland's renewable energy commitments outlined in national policy by facilitating the exploitation of solar power where such development does not have a negative impact on the surrounding environment, landscape, historic buildings or local amenities.
- Objective EN13: Encourage and support the development of solar energy infrastructure, including solar PV, solar thermal and seasonal storage facilities.
- Objective EN14: Promote and encourage the development of suitable sites within the County for use as Solar PV farms where such development does not have a negative impact on the surrounding environment, landscape, historic buildings, biodiversity or local amenities.

Geothermal

It is an objective of Fingal Development Plan:

- Objective EN15: Support Ireland's renewable energy commitments outlined in national policy by facilitating the exploitation of geothermal energy where such development does not have a negative impact on the surrounding environment, landscape, biodiversity or local amenities.
- Objective EN16: Ensure that any proposal for geothermal technologies or any other subsurface exploration does not impact on groundwater quality.

Hydro Energy

It is an objective of Fingal Development Plan:

- Objective EN17: Support Ireland's renewable energy commitments outlined in national policy by facilitating the exploitation of hydro energy where such development does not have a negative impact on the surrounding environment, landscape, biodiversity or local amenities.

Bioenergy Energy

It is an objective of Fingal Development Plan:

- Objective EN18: Support Ireland's renewable energy commitments outlined in national policy by facilitating the exploitation of biomass technology energy while ensuring that a balance is met that such development does not have a negative impact on the surrounding environment, landscape, biodiversity or local amenities, nor on the environment nor food production elsewhere either directly or through indirect land use change.
- Objective EN19: Encourage the production of bio-crops for biomass in the generation of renewable energy.
- Objective EN20: Support and facilitate the integration of local bioenergy into gas and electricity networks and its use as a transport fuel.

Low Carbon District Heating

It is an objective of Fingal Development Plan:

- Objective EN21: Support Ireland's renewable energy commitments outlined in national policy by promoting the use of district heating systems in new residential and commercial developments where such

development does not have a negative impact on the surrounding environment, landscape, biodiversity or local amenities.

Energy Networks

It is an objective of Fingal Development Plan:

- Objective EN22: Facilitate energy infrastructure provision at suitable locations, so as to provide for the further physical and economic development of Fingal.

Electric Vehicles

It is an objective of Fingal Development Plan:

- Objective MT10: Facilitate the provision of electricity charging infrastructure for electric vehicles both on street and in new developments in accordance with car parking standards.
- Objective MT11: Support the growth of Electric Vehicles and EBikes, with support facilities, through a roll-out of additional electric charging points in collaboration with relevant agencies at appropriate locations.

3. Part L Compliance

The proposed development will meet or exceed where feasible the requirements of Part L. Apartments have been assessed using the Sustainable Energy Authority of Ireland (SEAI) DEAP 4.2 software which demonstrates Part L compliance. Software inputs and outputs are summarised in section 5 of this report.

3.1. Building Fabric

In order to limit the heat loss through the building fabric of the proposed apartments the thermal insulation for each of the plane elements of the development will meet or better the area weighted average elemental U-Values (Um) as specified by Part L. Table 1 lists the Part L area weighted average elemental U-Values and the targeted U-Values of the proposed design.

Table 2: Fabric U Values

Element	U value (W/m².K)	
	Part L 2021 (NZEB)	Targeted
Pitched Roof	0.16	0.16
Flat Roof	0.20	0.12
Walls	0.18	0.18
Ground Floors	0.18	0.15
Exposed floors	0.18	0.15
External doors, windows and roof lights	1.40	1.30
Glazing gv (EN410)		*0.5

* pending overheating calculation

3.2. Thermal Bridging

To avoid excessive heat losses and local condensation problems, consideration will be given to ensure continuity of insulation and to limit local thermal bridging, e.g. around windows, doors and other wall openings, at junctions between elements and other locations.

Acceptable Construction Details will be adopted for all key junctions where appropriate (i.e. typical/standard junctions). For all bespoke key junctions certified details which have been certified by a third party certification body (such as Agrément or equivalent) will be used or calculated by an NSAI registered thermal modeller.

Heat loss associated with thermal bridges is taken into account in the DEAP methodology and can heavily impact the calculated energy use and CO_2 emissions. In general this is done by including an allowance for additional heat loss due to thermal bridging, expressed as a multiplier (Ψ, psi) applied to the total exposed surface area or

by the calculation of the transmission heat loss coefficient H_{TB}. A default Ψ value of 0.15 is applied in DEAP; the proposed design is targeting a Ψ value of at least 0.08 or equivalent H_{TB} value.

However, it should be noted that condensation risk assessments will be carried out on key junctions as this is a requirement of Part L

3.3. Building Envelope Air Permeability

In addition to fabric heat loss/gain, considerable care will be taken during the design and construction to limit the air permeability (Infiltration). High levels of infiltration can contribute to uncontrolled ventilation.

Part L requires an air permeability level no greater than $5m^3/m^2/hr$ @ 50Pa for a new dwelling; which represents a reasonable upper limit of air tightness. The design intent for the proposed apartments and houses will be to target an air permeability of $3m^3/m^2/hr$ @ 50Pa.

Air permeability testing will be carried out by a person certified by an independent third party (National Standards Authority of Ireland or equivalent certification body) in accordance with I.S. EN 13829: 2000 "Thermal performance of buildings: determination of air permeability of buildings: fan pressurisation method". All apartments will be tested in this way.

3.4. Building Services

3.4.1. Heating Appliance Efficiency

Regulation L3 (d) requires that space heating and water heating systems in dwellings are energy efficient, with efficient heat sources and effective controls. More specifically, Regulation L3 (e) provides that oil and gas fired boilers must achieve a minimum seasonal efficiency of 90%.

The proposed design for the apartments are to generate heat for space heating using direct electric panel radiators and to generate domestic hot water (DHW) by using an Air Source Heat Pump.

3.4.2. Space Heating and Hot Water Supply System Control

Space and water heating systems should be effectively controlled so as to ensure the efficient use of energy by limiting the provision of heat to that required to satisfy the user requirements.

The design intent is to provide the following minimum level of control;

- Automatic control of space heating on the basis of room temperature
- Automatic control of heat input to stored hot water on the basis of stored water temperature
- Separate and independent automatic time control of space heating and hot water
- Shut down of boiler or other heat source when there is no demand for either space or water heating from that source

We propose to use a control system with *full time and temperature control*. It must be possible to program the heating times of at least two space heating zones independently in addition to two or more independent temperature controls (room thermostat) per zone.

3.4.3. Insulation of Hot Water Storage Vessels, Pipes and Ducts

All hot water storage vessels, pipes and ducts (where applicable) will be insulated to prevent heat loss. Adequate insulation of hot water storage vessels will be achieved by the use of a storage vessel with factory applied insulation tested to BS 1566, part 1:2002 Appendix B. Water pipes and storage vessels in unheated areas will be insulated for the purpose of protecting against freezing. Technical Guidance Document G and Risk report BR 262, Thermal insulation avoiding risks, published by the BRE will be followed.

3.4.4. Low Flow Sanitary Ware

DEAP 4.2 for assessing the building energy rating now gives credit for water efficient showers, taps, wash hand basins and baths.

Hot water usage in DEAP can be reduced by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (this includes all water use, hot and cold). This will benefit part L/BER calculations. From a singular DEAP entry however, the presence of baths and the flow rate for showers have the largest impact to the DEAP calculations in terms of water use.

The 125 per person per day target can be achieved by using water efficient sanitary fittings and fixed low-flow restrictors which can be availed of through manufacturer's product information to determine the consumption of each appliance. In relation to water efficiency the following targets in table below will need to be met.

Table 3: Sanitary Ware - Water Efficiency Targets

Sanitary Fitting	Target Capacity/ Flow Rate	Unit of Measure
WC's (Dual Flush)	6	Full Flush - Volume (litres)
	4	Part Flush - Volume (litres)
Taps (excluding Kitchen/utility taps)	≤3.75	Flow Rate (Litres/min) @ 3 Bar
Taps (Kitchen/Utility Sink taps)	≤ 5	Flow Rate (Litres/min) @ 3 Bar
Bath	180	Capacity to Overflow (Litres)
Dishwasher	≤1	Litres/Place Setting
Washing Machine	≤ 6	Litres/Kg dry Load
Shower	≤ 6	Flow Rate (Litres/min) @ 3 Bar

3.4.5. Lighting Design

Based on DEAP 4.2 there is a more focused emphasis on lighting in which credit will be given for an appropriate for an appropriate LED lighting design in relation to the dwelling. In the case of a deprived or over-elaborated lighting design spec, there will be a penalty for the building energy rating. A full lighting design analysis using appropriate software i.e. Dialux or Relux can help create a balanced lighting design.

3.4.6. User Information

After the completion of the proposed Development the end user(s) will be provided with sufficient information about the building, its installed services and their maintenance requirements so that the Apartments can be operated in line with their optimum operation for energy efficiency.

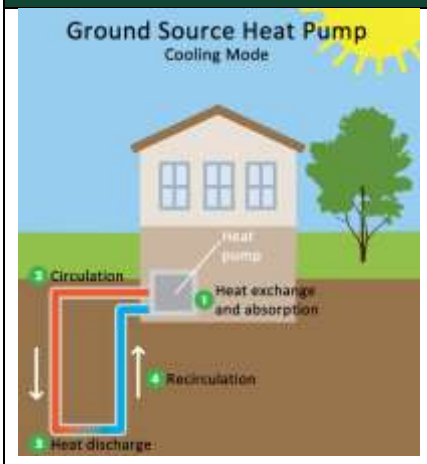
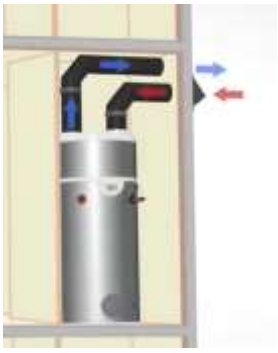
3.5. Use of Renewable Energy Sources

The following low & zero carbon technologies were reviewed in terms of their applicability for this development;

- Wind Power
- Photovoltaic Cells (PV)
- Solar Thermal Collectors
- Biomass Heating
- Ground Source Heat Pumps (GSHPs)
- Air Source Heat Pumps (ASHPs)
- Exhaust Air Heat Pumps (EAHPs)
- Combined Heat & Power (CHP)

Technology	Feasibility			Comments
	High	Medium	Low	
Micro Wind 			√	Technology Description: Micro wind turbines can be fitted to the roof of a building but would contribute a negligible amount of energy to the development. Applicability to this Development: Due to the suburban nature of the development site, this renewable has not been deemed viable. Vertical axis wind turbines may be more suited to this building, but there would still be the obvious aesthetic and potential noise issues.
Wind Power 			√	Technology Description: Mast-mounted wind turbines can be located in an open area away from obstructions such as buildings and tall trees. Applicability to this Development: Due to the suburban location of the site and its location close to other residential buildings it is deemed that a large wind turbine installation is not feasible.
Solar Photovoltaic (roof mounted) 	√			Technology Description: Photovoltaic (PV) Cell technology involves the conversion of the sun's energy into electricity. PV panels can be discrete roof-mounted units or embedded in conventional windows, skylights, atrium glazing, façade cladding etc. Applicability to this Development: Residential developments can be suitable locations for the installation of PV depending on orientation roof pitch and over-shading while also being virtually maintenance free. PV should be included for this development and assessed further at detailed design.

Technology	Feasibility			Comments
	High	Medium	Low	
Solar hot water systems 			√	Technology Description: Active solar hot water technology uses the sun's thermal radiation energy to heat fluid through a collector in an active process. Applicability to this Development: Due to the maintenance factor surrounding solar panels a solar hot water system is not considered feasible at this site.
Biomass Heating 			√	Technology Description: Biomass boilers work on the principle that the combustion of wood chip or pellets can create heat for space heating and hot water loads. Applicability to this Development: This technology requires substantial space allowance in a boiler room, access for delivery trucks, a thermal accumulator tank and considerable space for fuel storage of wood chips or pellets. The system also requires regular maintenance to remove ash etc. The use of biomass calls for a continuous local supply of suitable fuel to be truly sustainable. Concerns exist over the level of NOx and particulate emissions from biomass boiler installations, particularly in urban areas.
Ground source heat pump (GSHP)			√	Technology Description: GSHP technologies exploit seasonal temperature differences between ground and air temperatures to provide heating in the winter and cooling in the summer. GSHP systems use some electricity to run the heat pump, but as most of the energy is taken from the ground, they produce less greenhouse gas than conventional heating systems. Ground source heat systems deliver low temperature heat and high temperature cooling, suitable for underfloor heating or chilled beams. Applicability to this Development: Site restrictions would require the use of vertical boreholes as opposed to horizontal ground loops. GSHP technology would need further investigation during detailed

Technology	Feasibility			Comments
	High	Medium	Low	
				design and will depend on a favourable ground Thermal Response Test. Additionally capital costs are high and ideally, there should be a good balance between heating and cooling loads to allow for high COPs and reasonable capital payback. While a well-designed GSHP system operating under favourable conditions can achieve good efficiencies, the capital cost difference may still outweigh potential energy savings. As there is no cooling load, this investment is not deemed viable
Air source heat pump (ASHP)  Air source heat pump for DHW 	√			Technology Description: ASHP technologies exploit seasonal temperature differences between external air and refrigerant temperatures to provide heating in the winter and cooling in the summer. ASHP systems use more electricity to run the heat pump when compared to GSHP, but as most of the energy is taken from the air, they produce less greenhouse gas than conventional heating systems over the heating season. Their COP can reduce to below 2.0 when outside air temperatures are ≤0°C and they can require additional energy for a defrost cycle. Applicability to this Development: Heat pumps are generally safer than the combustible based heating systems and have a relatively low carbon footprint. Heat pumps can deliver heat at low outside temperatures which can be considered suited to the Irish climate. For this reason ASHP has been deemed suitable for the proposed development for the provision of space heating and/or DHW demand. This heat source will be part of this energy strategy for the development.

Technology	Feasibility			Comments
	High	Medium	Low	
Exhaust Air source heat pump (EAHP) 	√			Technology Description: The exhaust air heat pump uses otherwise wasted heat in the warm air areas of your home (bathrooms, kitchen, utility..) and transfers that heat to hot water using the same principles as air source and ground source heat pumps. An Exhaust Air Heat Pump (EAHP) extracts heat from the exhaust air and transfers the heat to domestic hot water and/or hydronic heating system (underfloor heating, radiators).This type of heat pump requires a certain air exchange rate to maintain its output power. Since the inside air is approximately 20-22 degrees Celsius all year round, the maximum output power of the heat pump is not varying with the seasons and outdoor temperature. Applicability to this Development: Exhaust Air Heat Pumps are best suited to apartments which will have low fabric heat losses. The latest units with inverter controlled compressors also have a ducted outside air supply which means the unit can draw on outside air when extract rates are low but without the need for an external condenser unit. This can be a suitable option for the development.

4. Passive Design

A focus for this project is to operate the building with low energy consumption. The building will be designed to minimise/avoid the requirements for mechanical ventilation and/or air conditioning. This will be done with the use of passive systems to control the internal environment, where possible. This will be further developed with the client, architect, structural engineer and cost consultant as the scheme develops. The passive systems will aim to reduce external noise and pollution, reduce heat loss (in winter), reduce solar gains (in summer), and maximum daylight while maintaining comfort conditions.

4.1. Natural Ventilation

Natural ventilation will be incorporated wherever possible via either single sided or cross ventilation. Where natural ventilation cannot provide the comfort and air quality needs of the occupants or the space and mechanical ventilation cannot be avoided, these systems will incorporate energy efficient solutions to maximise the efficiency of the systems through the use of heat recovery and the efficient controls. This will be fully assessed during detailed design in accordance with procedures in CIBSE TM59 – 'Design methodology for the assessment of overheating risk in homes'.

For dwellings that incorporate mechanical solutions as in paragraph 4.2 below, it should be noted that these systems will not be sufficient to prevent summertime overheating alone. CIBSE TM59 states that 'homes that are predominantly naturally ventilated, including homes that have mechanical ventilation with heat recovery (MVHR), with good opportunities for natural ventilation in the summer should assess overheating using the adaptive method'. This will involve detailed consideration of openable windows and doors and testing the design for a number of typical worst-case apartments using dynamic simulation software.

4.2. Mechanical Extract Ventilation (MEV)

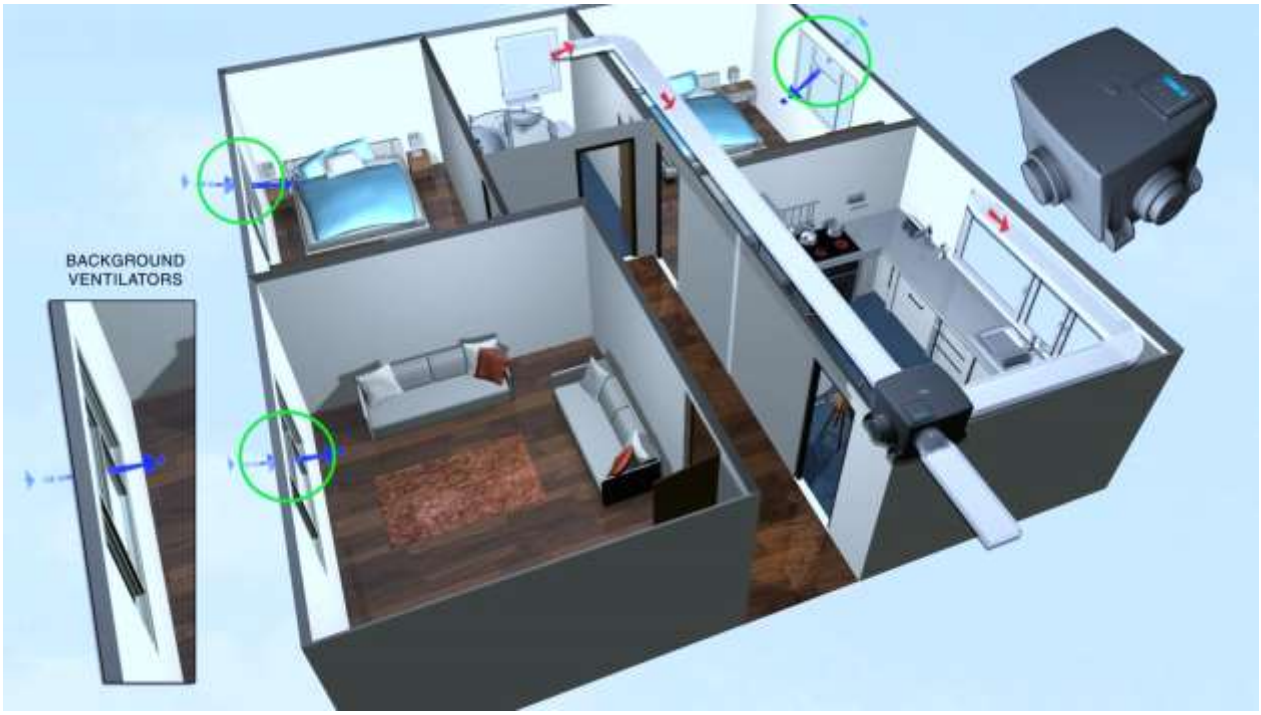


Figure 2: Continuous centralised Mechanical Extract Ventilation drawing fresh air through incorporated background ventilators.

Another option which may be installed in houses in lieu of a full MVHR system is the use of either a centralised mechanical extract ventilation system. This will use background ventilators, usually trickle ventilators, which can be fitted within the windows and/or within the walls while using either a centralised or decentralised, continuously running, mechanical extract fan(s). The background ventilators will provide whole building

ventilation while the centralised mechanical extract fans, located in the kitchen and wet rooms run continuously to remove odours and excessive humidity. There is also the option of a boost facility which can provide rapid extraction when necessary to remove higher levels of pollutants.

The ventilation system should be listed on SAP appendix Q (PCDB) in order to comply with SEAI requirements. Ducting type must be certified in the SAP appendix Q (PCDB) and should match the selected unit.

4.3. Passive Solar

Daylight in buildings creates a positive environment by providing connectivity with the outside world and assisting in the wellbeing of the building inhabitants. Daylight also represents an energy source; it reduces the need for artificial lighting, particularly in dwellings where natural light alone is often sufficient throughout the day. The design intent is to maximise the use of natural daylight to enhance visual comfort and not compromise thermal performance. The proposed development will have glazing specified that will minimise thermal conduction (u-value) while allowing for sufficient daylight levels and the maximisation of solar gain. Maximising solar gain within the limitations of thermal comfort will allow for a portion of the space heating load to be met passively during the day.

4.4. Water Conservation

During the detailed design stage for the proposed development the consumption of potable water in sanitary applications will be strongly considered and where possible low water use fittings and dual flush WCs will be specified.

A rainwater harvesting system will also be considered for this project and during the detailed design stage; calculations will be carried out to evaluate the suitability of this type of system. Reclaimed rainwater can be used for a range of applications such as toilet flushing, washing machines and irrigation. There are three main types of rainwater recovery systems: indirectly pumped, directly pumped, and gravity fed. The benefits of rainwater harvesting is twofold as not only does it help to reduce the use of treated mains water for non-potable use, it can also help reduce water run –off and risk of flooding.

5. DEAP Calculation Summary

DEAP calculations have been carried out using SEAI DEAP 4.2 software in order to demonstrate compliance with Part L 2021 for a sample apartment. The DEAP calculations are based on the following provisional inputs:

5.1. SEAI DEAP 4.2 Inputs – Apartment

- Fabric U Values
  - Wall U value = 0.18 W/m²K
  - Semi exposed walls = 0.23 W/m²K (walls to unheated voids)
  - Floor = 0.15 W/m²K
  - Flat Roof = 0.12 W/m²K
  - Doors = 1.30 W/m²K
  - Glazing/Balcony door = 1.30 W/m²K (whole window unit inclusive of frame)
  - Glazing gv (EN410) = 0.5 (subject to overheating study)
    - Frame Factor = 0.7 (i.e. 30% frame)
- Air permeability = 3 m³/m²/hr at 50 Pa
- Thermal bridging = 0.15 W/m².K (ACDs)
- Ventilation = MEV (Unit must be listed in PCDB)
  - Ducting type must be certified in the PCDB and should match the selected unit.
- Specific Fan Power = 0.32 W/l/s (SAP Appendix Q – 2012)
- Lighting = 100% Low energy LED
- Heating system = Exhaust Air source Heat pump
- Distribution system loss and gains;
  - Heating system category: Central heating systems with radiators
  - Sub-category: Heat Pumps
  - Heating system: Air-Water heat pump (electric)
  - Heat Emitter Type: low temperature radiators only
  - Design Flow temperature: Must be equal or less than 45°C
  - Heating System Controls: Full Time and temperature zone control
    - It must be possible to program the heating times of at least two space heating zones independently in addition to two or more independent temperature controls (room thermostat) per zone.
  - Space heating system also supplies DHW: Yes
  - DHW Supplied by heat pump: All
- Sanitary Ware - Low water usage (Less than 125 l/p/d): Yes

5.2. Conclusions

5.2.1. Part L 2021 - Apartment compliance:

This report confirms that the proposed Baldoyle apartments will comply with Part L regulations (NZEB). The report highlights that Part L will be achieved if applied as the report suggests. The strategies adopted for the Baldoyle apartments are outlined here:

- U-values for floor and roof will exceed the building regulation backstops
- Using Glazing U-Value target outlined in this report
- Better performance air permeability than the backstop, adding to building air tightness and ventilation effectiveness
- Continuous Decentralised Mechanical Extract Ventilation
- High performance thermal bridging
- Exhaust Air Source Heat Pump to provide Space Heating (via radiators) and Domestic Hot Water

Appendix 1: DEAP Part L Compliance Reports

Part L Specification

BER IS NOT PUBLISHED

Property Details

Dwelling Type	Mid-floor apartment	**Type of BER rating**	New Dwelling - Provisional
Address line 1	Lismore Homes Baldoyle	**Year of Construction**	2021
Address line 2		**Date of Assessment**	17/11/2021
Address line 3		**Date of Plans**	
County	Dublin 13	**Planning Reference**	
Eircode		**Building Regulations**	2019 TGD L
BER Number		**MPRN No.**	0
Purpose of Rating	Sale	**Is MPRN shared with another dwelling?**	N/A
Assessor Name	Marcos Jimenez	**Assessor Number**	107249
Comment		**BER number assigned to shared dwelling**	N/A

Dimension Details

	Area [m^2]	Height [m]	Volume [m^3]
Ground Floor	49.03	2.70	132.38
First Floor	0.00	0.00	0.00
Second Floor	0.00	0.00	0.00
Third and other floors	0.00	0.00	0.00
Room in roof	0.00	0.00	0.00
Total Floor Area	49.03		132.38

Living Area [m^2]	38.28	**Living area percentage [%]**	78.07
No of Storeys	1		

Ventilation Details

	Number		
Chimneys	0	**Has permeability test been carried out?**	Yes
Open Flues	0	**Structure type**	N/A
Fans & Vents	1	**Is there a suspended wooden ground floor?**	No
Number of flueless combustion room heaters	0	**Percentage windows/doors draught stripped [%]**	N/A
Is there a draught lobby on main entrance?	Yes	**Number of sides sheltered**	3
Ventilation method	Exhaust Air Heat Pump	**Mechanical Ventilation Manufacturer**	N/A
Specific fan power [W/(L/s)]	0.320	**Mechanical Ventilation Model Name**	N/A
Heat exchanger efficiency [%]	N/A	**How many wetrooms (incl. kitchen)?**	N/A

Building Elements - Floor Details

Type	Description	Underfloor heating	U-Value [W/m^{2}K]	Area [m^2]
Non-Heat Loss Floor	Mid floor	N/A	0	49.03

Building Elements - Roof Details

Type	Description	U-Value [W/m^{2}K]	Area [m^2]

Building Elements - Wall Details

Type	Description	U-Value [W/m^{2}K]	Area [m^2]
425 mm Cavity Wall	External wall	0.18	10.33

Building Elements - Door Details

Description	Number of Doors	U-Value [W/m^{2}K]	Area [m^2]
	1	1.3	1.630

Building Elements - Window Details

Glazing type	User defined u-value	U-Value [W/m^{2}K]	Area [m^2]
Double-glazed, air filled (low-E, en = 0.15, hard coat)	Yes	1.300	10.640

Other Details

Thermal bridging factor [W/m²k]	0.1500	**Thermal mass category of dwelling**	Medium

Heating System - Solar Water Heating

Solar Water Heating Present?	No	**Aperture area of solar collector [m²]**	N/A
Type, manufacturer, model	N/A		
Zero loss collector efficiency, n0	N/A	**Collector heat loss coefficient, a1 [W/m²>K]**	N/A
Annual Solar Radiation [kWh/m²] (Refer to Appendix H in DEAP)	N/A	**Overshading factor**	N/A
Dedicated storage volume [Litres]	N/A	**Combined Cylinder**	N/A
Solar fraction [%]	0.000		

Heating System - Hot Water System

Distribution Losses	171.48	**Combi boiler present?**	No
Supplementary electric water heating	N/A	**Water Storage Volume [L]**	194
Hot water storage manufacturer and model name	Joule Viktorum	**Declared loss factor [kWh/d]**	2.06
Temperature factor unadjusted	0.6	**Temperature Factor Multiplier**	0.9
Primary Circuit loss type	Boiler and thermal store within a single casing (cylinder thermostat present)		
Is hot water storage indoors or in group heating system?	Yes	**Insulation type**	None
Insulation thickness [mm]	0		

Heating System - Dist. system losses and gains

Temperature adjustment [°C]	0	**Control Category**	1	**Responsiveness category**	1
Central heating pumps	1	**Oil Boiler Pump**	0	**Oil boiler pump inside dwelling**	No
Gas boiler flue fan	0	**Warm air heating or fan coil radiators present**	No		

Heating System - Energy Requirements (Individual)

Main space heating system efficiency [%]	481.36	**Space heating efficiency adjustment factor**	1.0000	**Main space heating fuel**	Electricity
Main water heating system efficiency [%]	296.86	**Water heating efficiency adjustment factor**	1.0000	**Main water heating fuel**	Electricity
Secondary heating system efficiency [%]	N/A	**Fraction of heating from secondary heating system**	N/A	**Secondary space heating system fuel**	None
Fraction of main space and water heat from CHP	N/A	**Electrical efficiency of CHP**	N/A	**Heat efficiency of CHP**	N/A
CHP Fuel type	N/A				

Summary for Part L Conformance (Applies to TGD L 2008/2011/2019 for new dwellings only)

BER Number		**Building Regulations**	**2019 TGD L**
BER Result	A2	**Energy Value kWh/m^2/yr**	**45.33**
CO_2 emissions [kg/m^2/yr]	8.91		
EPC	0.261	**EPC Pass/Fail**	**Pass**
CPC	0.260	**CPC Pass/Fail**	**Pass**

Part L Conformance - Fabric

Conformity with Maximum avg U-value requirements	**U-value [W/m^{2}K]**	**Pass/Fail**	**Conformity with Maximum U-value requirements**	**U-Value [W/m^{2}K]**	**Pass/Fail**
Pitched roof insulated on ceiling	0.00	Pass	**Roofs**	0	Pass
Pitched roof insulated on slope	0	Pass	**Walls**	0.18	Pass
Flat Roof	0	Pass	**Floors**	0	Pass
Floors with no underfloor heat	0.00	Pass	**External doors / windows / rooflights**	1.30	Pass
Floors with underfloor heat	0.00	Pass			
Walls	0.18	Pass			
Percentage of opening areas [%]	25.03				
Average U value of openings	1.30	Pass			

Permeability test carried out and meets guidelines in TGD L 0.15 | Pass

Part L Conformance - Renewables (applies to TGD L 2019)

	Source	Renewables Primary Energy	Total Primary Energy	RER
+ Delivered energy	PV/Wind	0.00	0.00	
+ Delivered energy	Other	0.00	0.00	
+ Delivered energy	Solar	0.00	0.00	
+ Delivered energy	Biomass	0.00	0.00	
+ Delivered energy	Biodiesel	0.00	0.00	
+ Delivered energy	Bioethanol	0.00	0.00	
+ Environmental energy	HP	821.32	821.32	
+ Saved energy	CHP	0.00	0.00	
+ District heating	District Heating	0.00	0.00	
+ Delivered energy	Grid	0.00	2222.57	
+ Delivered energy	Thermal	0.00	0.00	
SUBTOTAL		821.32	3043.90	0.27 - Pass
Energy not used in Regulated Loads	PV/Wind/CHP	0.00	0.00	
TOTAL		821.32	3043.90	0.27

Part L Specification

BER IS NOT PUBLISHED

Property Details

Dwelling Type	Top-floor apartment	**Type of BER rating**	New Dwelling - Provisional
Address line 1	Lismore Homes Baldoyle	**Year of Construction**	2021
Address line 2		**Date of Assessment**	17/11/2021
Address line 3		**Date of Plans**	
County	Dublin 13	**Planning Reference**	
Eircode		**Building Regulations**	2019 TGD L
BER Number		**MPRN No.**	0
Purpose of Rating	Sale	**Is MPRN shared with another dwelling?**	N/A
Assessor Name	Marcos Jimenez	**Assessor Number**	107249
Comment		**BER number assigned to shared dwelling**	N/A

Dimension Details

	Area [m^2]	Height [m]	Volume [m^3]
Ground Floor	81.36	2.70	219.67
First Floor	0.00	0.00	0.00
Second Floor	0.00	0.00	0.00
Third and other floors	0.00	0.00	0.00
Room in roof	0.00	0.00	0.00
Total Floor Area	81.36		219.67

Living Area [m^2]	29.62	**Living area percentage [%]**	36.41
No of Storeys	1		

Ventilation Details

	Number		
Chimneys	0	**Has permeability test been carried out?**	Yes
Open Flues	0	**Structure type**	N/A
Fans & Vents	1	**Is there a suspended wooden ground floor?**	No
Number of flueless combustion room heaters	0	**Percentage windows/doors draught stripped [%]**	N/A
Is there a draught lobby on main entrance?	Yes	**Number of sides sheltered**	3
Ventilation method	Exhaust Air Heat Pump	**Mechanical Ventilation Manufacturer**	N/A
Specific fan power [W/(L/s)]	0.320	**Mechanical Ventilation Model Name**	N/A
Heat exchanger efficiency [%]	N/A	**How many wetrooms (incl. kitchen)?**	N/A

Building Elements - Floor Details

Type	Description	Underfloor heating	U-Value [W/m^{2}K]	Area [m^2]
Non-Heat Loss Floor	Top floor	N/A	0	81.36

Building Elements - Roof Details

Type	Description	U-Value [W/m^{2}K]	Area [m^2]
Flat Roof	Exposed roof	0.12	81.36

Building Elements - Wall Details

Type	Description	U-Value [W/m^{2}K]	Area [m^2]
425 mm Cavity Wall	External wall	0.18	33
300mm Cavity	Wall to unheated lift	0.13	6.18

Building Elements - Door Details

Description	Number of Doors	U-Value [W/m^{2}K]	Area [m^2]
	1	1.3	1.960
	1	1.3	1.620
	1	1.3	0.650

Building Elements - Window Details

Glazing type	User defined u-value	U-Value [W/m^{2}K]	Area [m^2]
Double-glazed, air filled (low-E, en = 0.15, hard coat)	Yes	1.300	7.110
Double-glazed, air filled (low-E, en = 0.15, hard coat)	Yes	1.300	11.420
Double-glazed, air filled (low-E, en = 0.15, hard coat)	Yes	1.300	9.130

Other Details

Thermal bridging factor [W/m²k]	0.1500	**Thermal mass category of dwelling**	Medium

Heating System - Solar Water Heating

Solar Water Heating Present?	No	**Aperture area of solar collector [m²]**	N/A
Type, manufacturer, model	N/A		
Zero loss collector efficiency, n0	N/A	**Collector heat loss coefficient, a1 [W/m²>K]**	N/A
Annual Solar Radiation [kWh/m²] (Refer to Appendix H in DEAP)	N/A	**Overshading factor**	N/A
Dedicated storage volume [Litres]	N/A	**Combined Cylinder**	N/A
Solar fraction [%]	0.000		

Heating System - Hot Water System

Distribution Losses	217.33	**Combi boiler present?**	No
Supplementary electric water heating	N/A	**Water Storage Volume [L]**	194
Hot water storage manufacturer and model name	Joule Viktorum	**Declared loss factor [kWh/d]**	2.06
Temperature factor unadjusted	0.6	**Temperature Factor Multiplier**	0.9
Primary Circuit loss type	Boiler and thermal store within a single casing (cylinder thermostat present)		
Is hot water storage indoors or in group heating system?	Yes	**Insulation type**	None
Insulation thickness [mm]	0		

Heating System - Dist. system losses and gains

Temperature adjustment [°C]	0	**Control Category**	3	**Responsiveness category**	1
Central heating pumps	1	**Oil Boiler Pump**	0	**Oil boiler pump inside dwelling**	No
Gas boiler flue fan	0	**Warm air heating or fan coil radiators present**	No		

Heating System - Energy Requirements (Individual)

Main space heating system efficiency [%]	412.94	**Space heating efficiency adjustment factor**	1.0000	**Main space heating fuel**	Electricity
Main water heating system efficiency [%]	296.86	**Water heating efficiency adjustment factor**	1.0000	**Main water heating fuel**	Electricity
Secondary heating system efficiency [%]	N/A	**Fraction of heating from secondary heating system**	N/A	**Secondary space heating system fuel**	None
Fraction of main space and water heat from CHP	N/A	**Electrical efficiency of CHP**	N/A	**Heat efficiency of CHP**	N/A
CHP Fuel type	N/A				

Summary for Part L Conformance (Applies to TGD L 2008/2011/2019 for new dwellings only)

BER Number		**Building Regulations**	**2019 TGD L**
BER Result	A2	**Energy Value kWh/m^2/yr**	**44.71**
CO_2 emissions [kg/m^2/yr]	8.79		
EPC	0.267	**EPC Pass/Fail**	**Pass**
CPC	0.259	**CPC Pass/Fail**	**Pass**

Part L Conformance - Fabric

Conformity with Maximum avg U-value requirements	**U-value [W/m^{2}K]**	**Pass/Fail**	**Conformity with Maximum U-value requirements**	**U-Value [W/m^{2}K]**	**Pass/Fail**
Pitched roof insulated on ceiling	0.00	Pass	**Roofs**	0.12	Pass
Pitched roof insulated on slope	0	Pass	**Walls**	0.18	Pass
Flat Roof	0.12	Pass	**Floors**	0	Pass
Floors with no underfloor heat	0.00	Pass	**External doors / windows / rooflights**	1.30	Pass
Floors with underfloor heat	0.00	Pass			
Walls	0.18	Pass			
Percentage of opening areas [%]	39.20				
Average U value of openings	1.30	Pass			
Permeability test carried out and meets guidelines in TGD L				0.15 | Pass	

Part L Conformance - Renewables (applies to TGD L 2019)

	Source	Renewables Primary Energy	Total Primary Energy	RER
+ Delivered energy	PV/Wind	0.00	0.00	
+ Delivered energy	Other	0.00	0.00	
+ Delivered energy	Solar	0.00	0.00	
+ Delivered energy	Biomass	0.00	0.00	
+ Delivered energy	Biodiesel	0.00	0.00	
+ Delivered energy	Bioethanol	0.00	0.00	
+ Environmental energy	HP	1464.96	1464.96	
+ Saved energy	CHP	0.00	0.00	
+ District heating	District Heating	0.00	0.00	
+ Delivered energy	Grid	0.00	3637.61	
+ Delivered energy	Thermal	0.00	0.00	
SUBTOTAL		1464.96	5102.57	0.29 - Pass
Energy not used in Regulated Loads	PV/Wind/CHP	0.00	0.00	
TOTAL		1464.96	5102.57	0.29

ETHOS | sustainability

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