Castleforbes Residential
Sustainability & Energy Statement

20_D003 Castleforbes Residential

October 2020

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CURRENT ISSUE			
Issue No:	P0	Issue Date:	27th October 2020
Sign Off	Originator:	Checker:	Reason For Issue:
Print Name:	Abdulhamid Alrehaili	PJ Ryan	Issue for Planning

PREVIOUS ISSUES (Type Names)				
Issue No:	Date:	Originator:	Checker:	Reason For Issue:

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1. Introduction

This Energy Statement prepared by Ethos Engineering is to form part of the planning submission documentation to An Bord Pleanala for the proposed Castleforbes residential development.

Located at the address Castleforbes Road, East Road, East Wall, Co.Dublin, the development is subject to the planning requirements applicable to the Dublin City Council Development Plan 2016-2022.

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 2019 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 and all design parameter figures and assumptions stated are based on the current preliminary design received from the design team; these are subject to change during detailed design.

1.1. Site and Building Summary

The development will consist of the demolition of all structures on the site and the construction of a mixed use residential development set out in 9 no. blocks, ranging in height from 1 to 18 storeys, above part basement/upper ground level, to accommodate 702 no. build to rent residential units, retail/café/restaurant units, cultural building, creche and residential tenant amenity.

The site will accommodate car parking spaces, bicycle parking, storage, services and plant areas. The residential buildings are arranged around a central open space (at ground level) and raised residential courtyards at upper ground level over part basement level. Ground floor level uses located onto Sheriff Street and into the central open space include a cultural building, retail/restaurant/cafe units, and tenant amenity space. Two vehicular access points are proposed along Sheriff Street, and the part basement car parking is split into two areas accordingly, accommodating bicycle parking spaces, car parking spaces, plant, storage areas and other associated facilities. The main pedestrian access is located centrally along Sheriff Street with additional access points from East Rd and from the eastern end of Sheriff Street. The application also includes for a pocket park on the corner of Sheriff Street Upper and East Rd to be provided as a temporary development prior to additional future development on this part of the site. A detailed development description is set out in the Statutory Notices.

Figure1: Castleforbes Proposed Development

2. Legislative/Planning Requirements

2.1. Part L

Technical Guidance Document Part L 2019 – 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

In accordance with Part L 2019 Dwellings section 0.1.2.3, Live-work units within the residential development are treated as residential areas.

"0.1.2.3 Where a dwelling has an attached room or space that is to be used for commercial purposes (e.g. workshop, surgery, consulting room or office), such room or space should be treated as part of the dwelling if the commercial part could revert to domestic use on a change of ownership, e.g. where there is direct access between the commercial space and the living accommodation, both are contained within the same thermal envelope and the living accommodation occupies a substantial proportion of the total area of the building".

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 2019).

Table 1: Fabric U Values Comparison Part L 2011 vs Part L 2019

Element	U-value (W/m^2.K)	U-value (W/m^2.K)
	Part L 2011	Part L 2019 (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)

2.2.1. 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.

'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"

2.2.2. 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. Dublin City Development Plan 2016-2022

The energy strategy will consider the following council policies and objectives as outlined in the Dublin City Development Plan 2016-2022.

Apartment Living

It is the **policy** of Dublin City Council:

- QH18: To promote the provision of high quality apartments within sustainable neighbourhoods by achieving suitable levels of amenity within individual apartments, and within each apartment development, and ensuring that suitable social infrastructure and other support facilities are available in the neighbourhood, in accordance with the standards for residential accommodation.
- QH19: To promote the optimum quality and supply of apartments for a range of needs and aspirations, including households with children, in attractive, sustainable, mixed-income, mixed-use neighbourhoods supported by appropriate social and other infrastructure.
- QH20: To ensure apartment developments on City Council sites are models of international best practice and deliver the highest quality energy efficient apartments with all the necessary

infrastructure where a need is identified, to include community hubs, sports and recreational green open spaces and public parks and suitable shops contributing to the creation of attractive, sustainable, mixed-use and mixed-income neighbourhoods

Climate Change

It is the **policy** of Dublin City Council:

- CC1: To prioritise measures to address climate change by way of both effective mitigation and adaptation responses in accordance with available guidance and best practice.
- CC2: To mitigate the impacts of climate change through the implementation of policies that reduce energy consumption, reduce energy loss/wastage, and support the supply of energy from renewable sources.

It is an **objective** of Dublin City Council:

- CCO1 (as amended by Variation 7): To implement Dublin City Council's Climate Change Action Plan (CCAP) in consultation and partnership with stakeholders including the Climate Action Regional Office (CARO) and Codema.
- CCO2: To support the implementation of the forthcoming 'Climate Change Strategy for Dublin and Climate Change Action Plan for Dublin City.
- CCO3: To support the implementation of the national level 'Strategy for Renewable Energy 2012-2020' and the related National Renewable Energy Action Plan (NREAP) and National Energy Efficiency Action Plan (NEEAP)
- CCO4: To support the implementation of the 'Dublin City Sustainable Energy Action Plan 2010-2020' and any replacement plan made during the term of this Development Plan.

Sustainable Energy / Renewable Energy

It is the **policy** of Dublin City Council:

- CCO5: To support and collaborate on initiatives aimed at achieving more sustainable energy use, particularly in relation to the residential, commercial and transport sectors.
- CCO6: To promote the concept of sustainable communities throughout the city and to seek to initiate and support carbon neutral demonstration projects in conjunction with local communities.
- CCO7: To actively promote and facilitate the growth of the new emerging green industries to contribute both to the reduction of the city's energy consumption levels and to the role of the city as a leader in environmental sustainability.
- CCO8: In conjunction with Codema, to complete a comprehensive spatial energy demand analysis to help align the future energy demands of the city with sustainable energy solutions
- CCO9: To encourage the production of energy from renewable sources, such as from BioEnergy, Solar Energy, Hydro Energy, Wave/Tidal Energy, Geothermal, Wind Energy, Combined Heat and Power (CHP), Heat Energy Distribution such as District Heating/Cooling Systems, and any other renewable energy sources, subject to normal planning considerations, including in particular, the potential impact on areas of environmental sensitivity including Natura 2000 sites
- CCO10: To support renewable energy pilot projects which aim to incorporate renewable energy into schemes where feasible
- CCO11: To support and seek that the review of the National Building Regulations be expedited with a view to ensuring that they meet or exceed the passive house standard or equivalent, with particular regard to energy performance and other sustainability considerations, to alleviate poverty and reduce carbon reduction targets

Sustainable Building Design/Quality

It is the **policy** of Dublin City Council:

- QH12: To promote more sustainable development through energy end-use efficiency, increasing the use of renewable energy, and improved energy performance of all new development throughout the city by requiring planning applications to be supported by information indicating how the proposal has been designed in accordance with the development standards set out in the development plan.

Energy Efficiency and the Built Environment

It is the **policy** of Dublin City Council:

- CC3: (as amended by Variation 7): To promote energy efficiency, energy conservation and the increased use of renewable energy in existing and new developments. All new buildings will be required to achieve the Nearly Zero-Energy Buildings (NZEB) standard in line with the Energy Performance of Buildings Directive (EPBD).
- CC4: To encourage building layout and design which maximises daylight, natural ventilation, active transport and public transport use.

It is an **objective** of Dublin City Council:

- CCO12: To ensure high standards of energy efficiency in existing and new developments in line with good architectural conservation practice and to promote energy efficiency and conservation in the design and development of all new buildings in the city, encouraging improved environmental performance of building stock.
- CCO13: To support and encourage pilot schemes which promote innovative ways to incorporate energy efficiency into new developments.

Electric Vehicles and e-bikes

It is an **objective** of Dublin City Council:

- CCO14 To support the Government's target of having 40% of electricity consumption generated from renewable energy sources by the year 2020.
- CCO15 (as amended by Variation 7): To facilitate the provision of electricity charging infrastructure for electric vehicles in all new development and in the public realm.
- CC016 (as inserted by Variation 7): All new parking for new (or extensions to) housing, apartments and places of employment that provide car parking shall be electric charge enabled. Dublin City Council shall work closely with the ESB and other stakeholders to increase the number of EV charge points across the city. All new (or upgraded) commercially operated car parking developments shall be required to provide a minimum of 50% of spaces with EV charging facilities.

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/m^2.K)	
	Part L 2019 (NZEB)	Targeted
Flat Roof	0.20	0.15
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 considered 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.

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 $2m^3/m^2/hr$ @ 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 is to generate heat for space heating and domestic hot water (DHW) by using a heating system consisting of heat pump technology.

In relation to apartments and houses, heating will be provided to the space by appropriately sized radiators or low temperature radiators which operate at lower flow and return temperature.

3.4.2. Space Heating and Hot Water Supply System Control

Space and water heating systems should be effectively controlled 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 proposed that Full Time and Temperature Zone Control to be provided to each dwelling unit.

It must be possible to program the heating times of at least two space heating zones independently in addition to one or more independent temperature controls (room thermostat) per zone.

In the case of using a wet system, separate plumbing circuits are required, either with its own programmer, or separate channels in the same programmer. Conventional TRVs provide only independent temperature control. If a TRV can be time controlled, and provides the same functionality as a room thermostat, it is considered as part of a fully zoned system subject to above zone criteria being met.

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

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.

This can be done by using water efficient sanitary fittings which can be availed of through manufacturer's product information to determine the consumption of each appliance. The Architect will need to confirm the following can 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)
Taps (Kitchen/Utility Sink taps)	≤ 5	Flow Rate (Litres/min)
Bath	180	Capacity to Overflow (Litres)
Dishwasher	≤1	Litres/Place Setting
Washing Machine	≤ 6	Litres/Kg dry Load
Shower	≤ 6	Flow Rate (Litres/min)

3.4.5. Lighting Design

A focus on lighting design is a new aspect of the DEAP4 software where it is expected that credit will be given 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 could be included for this development where sufficient roof area is made available.

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

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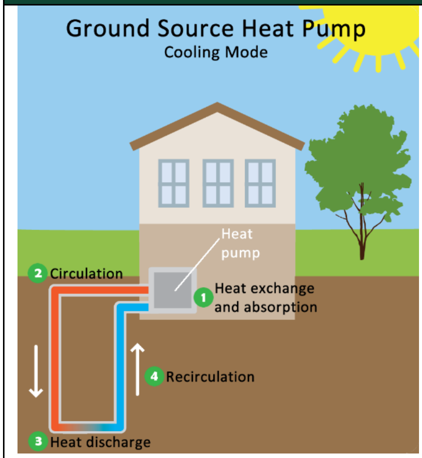
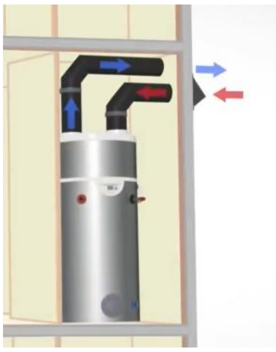
Technology	Feasibility			Comments
	High	Medium	Low	
				investigation during detailed design and will depend on a favourable ground Thermal Response Test. Additionally capital costs are high and ideally, there should be a good balance between heating and cooling loads to allow for high COPs and reasonable 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.

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 compressor 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.
Combined Heat and Power (CHP) 		√		**Technology Description:** Combined heat and power (CHP), also known as co-generation, is the simultaneous generation of both useable heat and electrical power from the same source. A CHP unit comprises of an engine (referred to as the prime mover) in which fuel is combusted. The mechanical power produced by the engine is used to generate electricity using an integral electrical generator. The heat emitted from the engine (waste heat) is used to provide space heating and domestic hot water **Applicability to this Development:** CHP systems can be used in applications where there is a significant year-round demand for heating in addition to the electricity generated. CHP has potential to be suitable for the proposed development for the provision of space heating and/or DHW demand due to annual hours of operation considering the nature of 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. Balanced Whole House Mechanical Ventilation with Heat Recovery

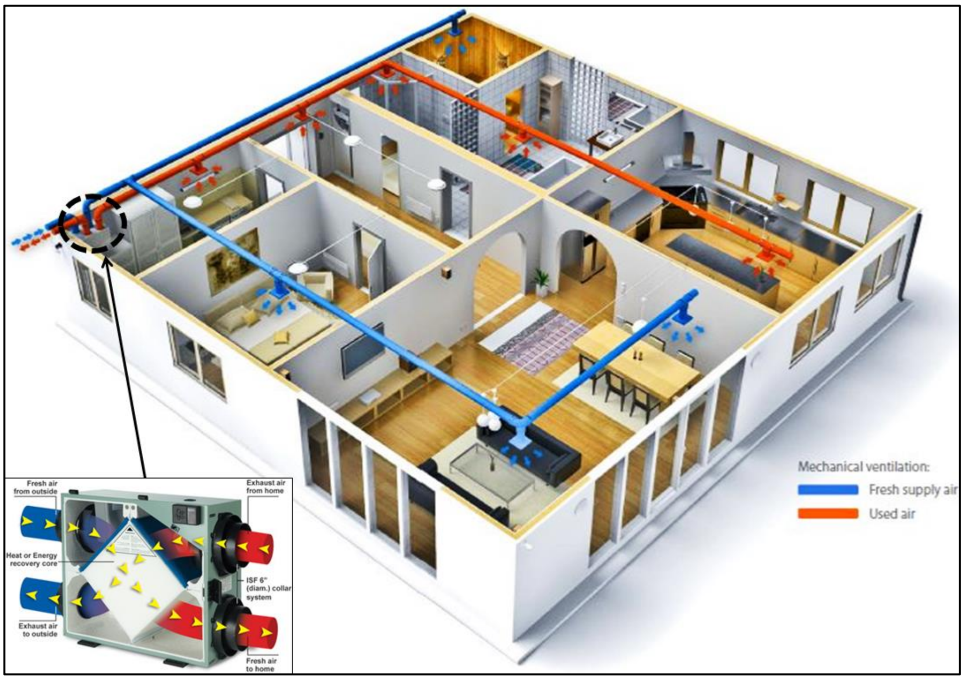


Figure 3: Balanced Whole house Mechanical Ventilation with heat recovery

The proposed system for apartments will use mechanical ventilation with heat recovery (MVHR), which is a whole-house ventilation system that generally supplies fresh air to dry rooms and extracts stale air from wet rooms.

Both air flows are to be ducted and driven by two fans, one on the supply side and one on the extract side. This will provide whole building ventilation as the mechanical extract fan will remove odours and excessive humidity to maintain a good air quality. A key component of the system is that a heat recovery unit is utilised to transfer heat from the warm exhaust air to the fresh air, achieving heat recovery.

The ventilation system should be listed on SAP appendix Q which ensures a suitable method of testing procedure for Irish use.

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 2019 for a sample apartment. The DEAP calculations are based on the following provisional inputs:

5.1. SEAI DEAP 4.2 Inputs – Apartments

- Fabric U Values
  - Wall U value = 0.18 W/m^2K
  - Semi exposed walls = 0.23 W/m^2K (walls to unheated voids)
  - Floor = 0.15 W/m^2K
  - Roof = 0.15 W/m^2K
  - Doors = 1.40 W/m^2K
  - Glazing/Patio door = 1.30 W/m^2K (whole window unit inclusive of frame)
  - Glazing gv (EN410) = 0.50 (pending overheating calculation)
    - Frame Factor = 0.70 (i.e. 30% frame)

- Air permeability = 2 $m^3/m^2/hr$ at 50 Pa

- Thermal bridging = 0.15 $W/m^2.K$
- Ventilation = Centralised MEV with heat recovery
- Specific Fan Power = 0.29 W/l/s
- Lighting = 100% Low energy lighting
- 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: Fan coil/low temperature radiators only
  - Heating System Controls: Full Time and temperature zone control
  - Space heating system also supplies DHW: Yes
  - DHW Supplied by heat pump: All

5.2. Conclusions

5.2.1. Part L 2019 - Apartment compliance (Decentralised):

This report confirms that the proposed Castleforbes 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 Castleforbes 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
- High performance thermal bridging
- Mechanical Extract Ventilation with Heat Recovery via heat pump
- Exhaust Air Source Heat Pump to provide Space Heating (via radiators) and Domestic Hot Water
- Efficient sanitary fittings (water use target of not more than 125 litres per person per day)

Appendix 1 Part L Specification

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Part L Specification

BER IS NOT PUBLISHED

Property Details

Dwelling Type	Ground-floor apartment	**Type of BER rating**	New Dwelling - Provisional
Address line 1	1 Bed Apt	**Year of Construction**	2019
Address line 2	Ground - Joule Victorum	**Date of Assessment**	27/08/2020
Address line 3	Castleforbes Residential	**Date of Plans**	
County	Co. Dublin	**Planning Reference**	
Eircode		**Building Regulations**	2019 TGD L
BER Number		**MPRN No.**	0
Purpose of Rating	Private letting	**Is MPRN shared with another dwelling?**	N/A
Assessor Name	Abdulhamid Alrehaili	**Assessor Number**	107181
Comment		**BER number assigned to shared dwelling**	N/A

Dimension Details

	Area [m²]	Height [m]	Volume [m³]
Ground Floor	49.69	2.85	141.62
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	49.69		141.62

Living Area [m²]	29.40	**Living area percentage [%]**	59.17
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**	4
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/m²K]	Area [m²]
Ground Floor - Solid		No	0.15	49.69

Building Elements - Roof Details

Type	Description	U-Value [W/m²K]	Area [m²]

Building Elements - Wall Details

Type	Description	U-Value [W/m²K]	Area [m²]
300mm Filled Cavity	External Wall	0.18	6.67

Building Elements - Door Details

Description	Number of Doors	U-Value [W/m²K]	Area [m²]

Building Elements - Window Details

Glazing type	User defined u-value	U-Value [W/m²K]	Area [m²]
Double-glazed, argon filled (low-E, en = 0.05, soft coat)	Yes	1.300	12.190

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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	181.64	**Combi boiler present?**	No
Supplementary electric water heating	N/A	**Water Storage Volume [L]**	200
Hot water storage manufacturer and model name	Joule Victorum	**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	2	**Oil Boiler Pump**	0	**Oil boiler pump inside dwelling**	No
Gas boiler flue fan	0	**Warm air heating or fan coil radiators present**	No		

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Heating System - Energy Requirements (Individual)

Main space heating system efficiency [%]	657.06	**Space heating efficiency adjustment factor**	1.0000	**Main space heating fuel**	Electricity
Main water heating system efficiency [%]	251.8	**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	A3	**Energy Value kWh/m²/yr**	**52.65**
CO_2 emissions [kg/m²/yr]	10.35		
EPC	0.262	**EPC Pass/Fail**	**Pass**
CPC	0.257	**CPC Pass/Fail**	**Pass**

Part L Conformance - Fabric

Conformity with Maximum avg U-value requirements	**U-value [W/m²K]**	**Pass/Fail**	**Conformity with Maximum U-value requirements**	**U-Value [W/m²K]**	**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**	0.15	Pass
Floors with no underfloor heat	0.15	Pass	**External doors / windows / rooflights**	1.30	Pass
Floors with underfloor heat	0.00	Pass			
Walls	0.18	Pass			
Percentage of opening areas [%]	24.53				
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	1513.64	1513.64	
+ Saved energy	CHP	0.00	0.00	
+ District heating	District Heating	0.00	0.00	
+ Delivered energy	Grid	0.00	2616.13	
+ Delivered energy	Thermal	0.00	0.00	
SUBTOTAL		1513.64	4129.77	0.37 - Pass
Energy not used in Regulated Loads	PV/Wind/CHP	0.00	0.00	
TOTAL		1513.64	4129.77	0.37

Part L Specification

BER IS NOT PUBLISHED

Property Details

Dwelling Type	Mid-floor apartment	**Type of BER rating**	New Dwelling - Provisional
Address line 1	1 Bed Apt	**Year of Construction**	2019
Address line 2	Mid Floor- Joule Victorum	**Date of Assessment**	27/08/2020
Address line 3	Castleforbes Residential	**Date of Plans**	
County	Co. Dublin	**Planning Reference**	
Eircode		**Building Regulations**	2019 TGD L
BER Number		**MPRN No.**	0
Purpose of Rating	Private letting	**Is MPRN shared with another dwelling?**	N/A
Assessor Name	Abdulhamid Alrehaili	**Assessor Number**	107181
Comment		**BER number assigned to shared dwelling**	N/A

Dimension Details

	Area [m²]	Height [m]	Volume [m³]
Ground Floor	49.69	2.85	141.62
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	49.69		141.62

Living Area [m²]	29.40	**Living area percentage [%]**	59.17
No of Storeys	1		

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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**	4
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/m²K]	Area [m²]
Non-Heat Loss Floor		N/A	0	49.69

Building Elements - Roof Details

Type	Description	U-Value [W/m²K]	Area [m²]

Building Elements - Wall Details

Type	Description	U-Value [W/m²K]	Area [m²]
300mm Filled Cavity	External Wall	0.18	6.67

Building Elements - Door Details

Description	Number of Doors	U-Value [W/m²K]	Area [m²]

Building Elements - Window Details

Glazing type	User defined u-value	U-Value [W/m²K]	Area [m²]
Double-glazed, argon filled (low-E, en = 0.05, soft coat)	Yes	1.300	12.190

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	181.64	Combi boiler present?	No
Supplementary electric water heating	N/A	Water Storage Volume [L]	200
Hot water storage manufacturer and model name	Joule Victorum	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	2	Oil Boiler Pump	0	Oil boiler pump inside dwelling	No
Gas boiler flue fan	0	Warm air heating or fan coil radiators present	No		

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Heating System - Energy Requirements (Individual)

Main space heating system efficiency [%]	657.06	**Space heating efficiency adjustment factor**	1.0000	**Main space heating fuel**	Electricity
Main water heating system efficiency [%]	251.8	**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/m²/yr**	**47.19**
CO_2 emissions [kg/m²/yr]	9.28		
EPC	0.275	**EPC Pass/Fail**	**Pass**
CPC	0.274	**CPC Pass/Fail**	**Pass**

Part L Conformance - Fabric

Conformity with Maximum avg U-value requirements	**U-value [W/m²K]**	**Pass/Fail**	**Conformity with Maximum U-value requirements**	**U-Value [W/m²K]**	**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 [%]	24.53				
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	1513.64	1513.64	
+ Saved energy	CHP	0.00	0.00	
+ District heating	District Heating	0.00	0.00	
+ Delivered energy	Grid	0.00	2345.09	
+ Delivered energy	Thermal	0.00	0.00	
SUBTOTAL		1513.64	3858.73	0.39 - Pass
Energy not used in Regulated Loads	PV/Wind/CHP	0.00	0.00	
TOTAL		1513.64	3858.73	0.39

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ISO 14001:2004 EQA ENVIRONMENTAL APPROVED SYSTEM
OHSAS 18001:2007 EQA OCCUPATIONAL, HEALTH & SAFETY APPROVED SYSTEM