Clonburris Phase One

Energy, Sustainability & Part L Compliance

South Dublin County Council

Project number: 60650394
CLON-ACM-XX-XX-RP-BS-300001

March 2022

Delivering a better world

Quality information

Prepared by	Checked by	Verified by	Approved by
Sinead Muldoon Senior Mechanical Engineer	Eoin Doohan Associate Director	Raymond Reilly Regional Director	Raymond Reilly Regional Director

Revision History

Revision	Revision date	Details	Authorized	Name	Position
1	02/03/2022	Draft Part 8 Issue	RR	Raymond Reilly	Regional Director
2	13/04/2022	Part 8 Submission	RR	Raymond Reilly	Regional Director

Distribution List

# Hard Copies	PDF Required	Association / Company Name
0	Yes	South Dublin County Council

Prepared for:

Comhairle Contae
Átha Cliath Theas
South Dublin County Council

Prepared by:

Sinead Muldoon,
Senior Mechanical Engineer
T: +353 1 238 3100
E: sinead.muldoon@aecom.com

AECOM Ireland Limited
4th Floor
Adelphi Plaza
Georges Street Upper
Dun Laoghaire
Co. Dublin A96 T927
Ireland

T: +353 1 238 3100
aecom.com

Table of Contents

1. Introduction..... 5
2. Design Solutions 6
Approach..... 6
Energy and Sustainability 6
Passive Energy Reduction 6
Heating and Domestic Hot Water Systems..... 6
Ventilation Strategies 7
Domestic Water Usage..... 8
Lighting..... 8
Smart Technologies..... 8
Electric Vehicle Charging..... 8
Drainage..... 8
3. Part L (Dwellings) 8
Nearly Zero Energy Buildings (NZEB) and Part L of Building Regulations (Dwellings)..... 8
Part L Calculations 8
Calculation Methodology 8
Compliance Methodology 8
Heating and Ventilation specification..... 9
Fabric Specification..... 9
4. Results 9
DEAP Results 9
5. Conclusion..... 10
Appendix A Document copies ..... **Error! Bookmark not defined.**

Figures

Figure 1: Proposed Development 5

Tables

Table 1: DEAP Compliance Calculations – Apartment Variations..... 9
Table 2: Fabric specification 9

1. Introduction

This report outlines the Part L compliance methodology and results for the Clonburris Residential Development. The report summarises the heating, ventilation, renewable and fabric specification in order to achieve preliminary Part L compliance. DEAP calculations for a selection of the worst case residential units are provided to demonstrate compliance with Building Regulations.

The Clonburris Phase One project is a proposal for to develop new dwellings, new community facilities and the development of three large open green spaces within the Clonburris Strategic Development Zone (SDZ).

The Phase One site of approximately 10 hectares is located to the south-west of the overall SDZ. The site benefits from close proximity to Kishoge railway station to the north with direct links into Dublin city centre and good access to existing cycle routes and bus networks. A large open space to the west pf the development will form a green spine running north-south providing wider connection to Griffeen Valley Park to the west of the site and the Grand Canal to the south.

The proposed works will comprise 263 residences. This will be a mix of apartments, duplexes and houses and new community facilities in a mix of two, three four and five storey buildings. The scheme is set within a series of three large strategic open spaces providing local recreation and amenity spaces with links to existing and surrounding communities. Refer to Figure 1 below.

Figure 1: Proposed Development

2. **Design Solutions**

Approach

Building energy efficiency and sustainability involves all designers and stakeholders from the start of the design process. The most successful sustainable sites are those which keep energy efficiency and sustainability at the core of project from design through to construction.
The 4 main principles to achieve energy efficient buildings are:

Reduce: Reduce energy consumption by passive and active means, for example improving building fabric and utilising low energy equipment.

Reuse: Reuse energy where possible by recovering waste energy where possible.

Renewables: Utilise renewable technologies to offset energy from fossil fuel technologies.

Rethink: Constantly rethink and refine the energy strategy and approach.

The potential strategies outlined in this report are based around these principles.

Energy Efficient Design (EED) will be at the centre of the design process throughout the proposed residential development. The design process for this project should broadly follow the process set out in I.S. 399:2014 'Energy Efficient Design Management –Requirements with Guidance and Use' section 8.

Energy and Sustainability

An energy and sustainability assessment looks at a range of elements throughout the life span of the building ranging from the materials used to construct the building right through to the final running costs of the equipment installed e.g. heat pumps, cookers etc.

Regarding materials every effort will be made to use locally sourced products to reduce the carbon footprint associated with their production and transportation. The lifespan and maintenance costs of each material will also be considered.

The same principle applies to the sourcing of the plant items such as heat pumps and water tanks with a local supplier being the ideal choice as it lowers the carbon emissions associated with delivery and potentially maintenance.

The supply and installation costs and the life span of the chosen Heating, Hot Water and Ventilation installations also require careful consideration. If a more efficient but more expensive heating system is chosen, then the associated payback period must be assessed. If the payback period is greater than the economic life span of the system, then it may not be the correct solution.

The choice of lighting and lighting control is also another area which requires careful consideration as the price of LED light fittings has reduced since they were first introduced to the market. They also have a greater lifespan. The associated lighting control system can reduce the running costs even further.

Passive Energy Reduction

The first step to implementing a low energy design on the proposed residential development will be to reduce the energy required to heat the dwellings using passive means. The main passive energy reduction measure will be specification of a high-performance building fabric including high specification u values for building elements such as walls, glazing, roof and floors. Infiltration losses account for a significant proportion of the total heat loss of buildings and the air tightness details of the development will be carefully developed to minimise infiltration losses. Thermal bridges also contribute a significant proportion of building heat loss and thermal bridges at junctions will be carefully detailed to reduce these losses.

Careful design of glazing (particularly on south facing facades) has the potential to reduce the heating consumption of the dwellings by maximising solar heat gain. The glazing specification shall maximise solar gain while minimising heat loss. While maximising solar gain can reduce heating consumption it can cause overheating issues. In recognition of this overheating assessments will be carried out during the design and mitigation measures (for example blinds) will be provided where required to prevent overheating.

Heating and Domestic Hot Water Systems

The heating and renewable energy strategy will have the most significant impact on the energy conservation approach for the proposed residential development. Heating and renewable energy systems will be provided in a decentralised fashion (with dedicated heating and renewable systems per dwelling). Given the size of the site and the projected use decentralised heating and renewable systems will be most appropriate for this development.

The decentralised systems that have been considered for the proposed residential development were:

1. Electric space heating, domestic hot water air to water heat pump and photovoltaics - Space heating would be provided by wall mounted electric radiators. DHW would be generated by an exhaust or outside air heat pump. These systems use packaged heat pumps integrated with calorifiers to generate DHW. Electric immersions would be provided for back up and sterilisation. The heat pumps can use exhaust air (and provide some / all the ventilation requirements) or outside air. Smart storage heaters could also be used to maximise the renewable energy of the grid.

Figure 2: Electrical Space Heating, Domestic Hot Water Air to Water Heat Pump and Photovoltaics

2. Air to water heat pump for space heating, domestic hot water and extract ventilation. -This system uses an Exhaust Air Heat Pump providing heating, domestic hot water and extract ventilation for dwellings on a modular basis via an integrated, packaged unit located in the dwelling. Exhaust air is used in the heat pump to generate hot water. The hot water is used for space heating via water-based outlets (e.g. radiators or underfloor heating) and for DHW generation. For this option, exhaust air heat pumps would provide extract ventilation with fresh being brought into the apartment via permanent background ventilation (e.g. wall or trickle vents). In this application the unit extracts air from wet rooms on a continual basis for use in the heat pump. For the system to be compliant with Part F of the Building Regulations (Ventilation) permanent background ventilation is required.

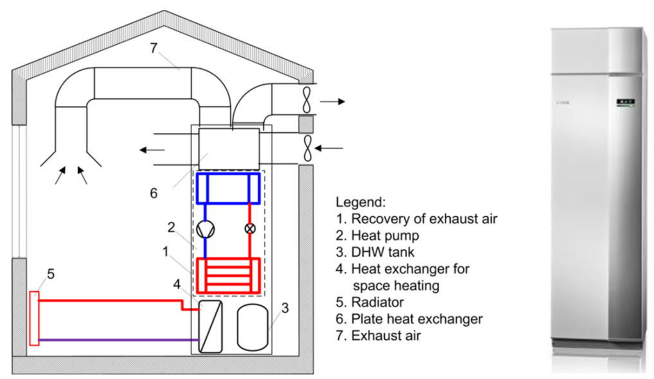

Figure 3: Air to water heat pump for space heating, domestic hot water and extract ventilation

3. Air to air heat pump with integrated MVHR providing space heating, domestic hot water and ventilation. - This system utilises a packaged air to air heat pump, which provides the full heating and ventilation requirements of the residential unit. The air to air

heat pump uses the exhaust air from the MVHR to heat the supply air to the unit. Warm supply air is supplied typically at low level to heat the dwelling. The integrated heat pump also generates domestic hot water via an integral calorifier.

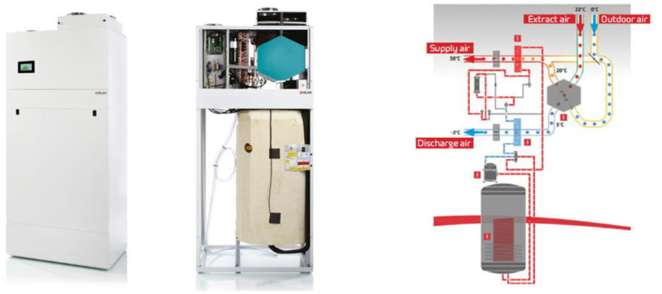

Figure 4: Air to air heat pump with integrated MVHR providing space heating, domestic hot water and ventilation

4. Split block air to water system with condenser providing heating, domestic hot water with a separate ventilation system (houses only) - A split-bloc air to water heat pump would provide heating and domestic hot water for the houses via a system incorporating an outdoor unit (condenser) and indoor unit located in the house. The indoor unit would generate the heating water and domestic hot water. Refrigerant pipework is passed between the indoor and outdoor units.

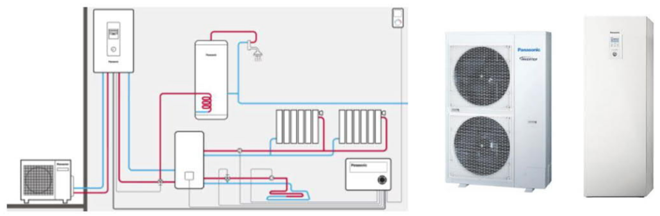

Figure 5: Split block air to water system with condenser providing heating and domestic hot water

5. Mono-bloc air to water heat pump with external heat pump providing heating, domestic hot water with a separate ventilation system. - A mono-bloc air to water heat pump would generate low temperature hot water which is circulated to the dwelling via underground pipework. The pipework would directly serve the heating system. Domestic hot water would be provided indirectly via a hot water storage cylinder served by the heating pipework. No refrigerant pipework enters the dwelling if a Mono-Bloc heat pump is installed. The only internal heating / domestic hot water plant required is the hot water cylinder.

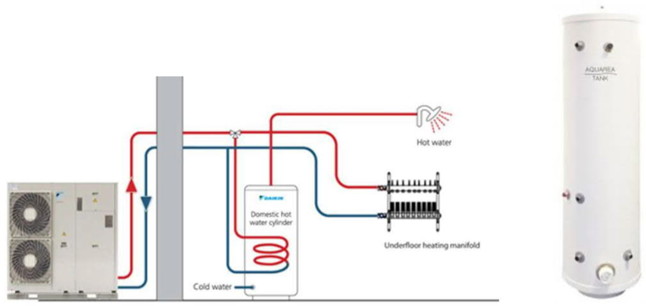

Figure 6: Mono-bloc air to water heat pump providing heating and domestic hot water

Following a design analysis an Exhaust Air Heat Pump (option 2) providing heating, domestic hot water and extract ventilation on a modular basis via an integrated, packaged unit located in the dwelling was selected as the preferred option for the apartments. A split bloc air to water system (option 4) or mono block air to water heat pump (option 5) with an external condenser/heat pump providing heating and domestic hot water with a separate ventilation system was selected as the preferred option for the houses in the Clonburris residential development.

Ventilation Strategies

While not strictly prohibiting natural ventilation systems Part F (Ventilation) 2019 places more emphasis on mechanical ventilation systems. Mechanical ventilation systems deliver significantly greater indoor air qualities, particularly in air tight buildings. Systems that were considered include:

1. Natural Ventilation with Intermittent Extract - A typical natural ventilation system utilises passive inlets, such as wall / trickle vents and intermittent extract fans in wet rooms (bathrooms, kitchens etc) to provide ventilation. Extract fans would be ceiling mounted and ducted to grilles on the external fabric. Under the revised Part F of the Building Regulations, this system is only compliant for airtightness levels of between 3 and 5 m3/m2/hr @ 50Pa.

2. Continuous Mechanical Extract Systems (CME) - A continuous mechanical extract (CME) system continuously extracts air from wet rooms (e.g. bathroom, kitchen) via a single extract unit. The extract unit could be installed in a high-level cupboard in each residential unit. Each wet room is ducted to the extract unit and a single extract duct discharges air to outside via a wall mounted grille. The unit generally operates at low speed and uses integrated humidistats to 'Boost' ventilate when required. For the system to be compliant with Part F of the Building Regulations (Ventilation), permanent background ventilation (e.g. wall or trickle vents) would be required. Automatic demand control humidity sensitive inlets could also be used. Note that the exhaust air heat pump can also operate as a CME system providing the full ventilation requirements of the dwelling.

Figure 7: Typical CME layout in a dwelling and typical CME extract unit

3. Mechanical Ventilation with Heat Recovery (MVHR) - Mechanical ventilation with heat recovery (MVHR) utilises a high efficiency heat exchanger to recover heat from extract air and heat the incoming ventilation air. As the incoming air is heated, it reduces the overall heating load in the space. MVHR works best in airtight buildings. Supply air is ducted to each habitable room (*e.g. bedroom, living area*) and extract air is ducted from each wet room (*e.g. bathroom, kitchen*).

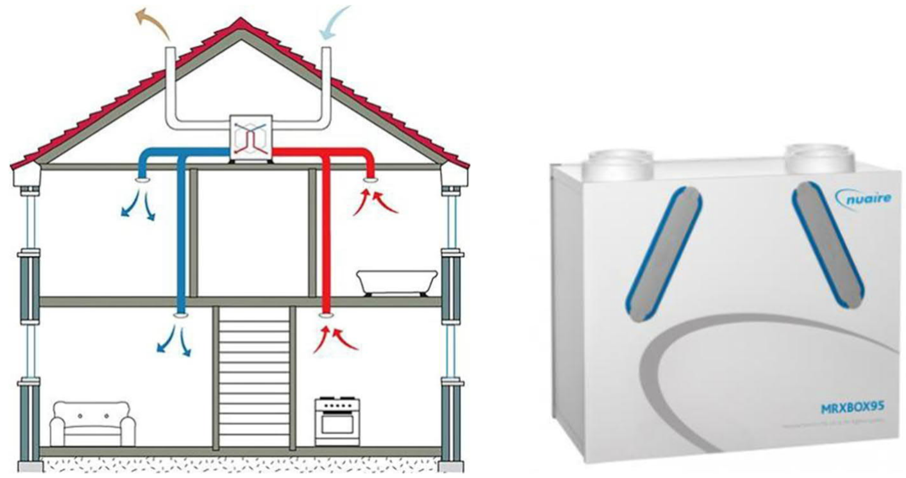

Figure 8: Typical MVHR layout in a dwelling and typical MVHR unit

The proposed Exhaust Air Heat Pump heating system will provide ventilation as a CME system (option 2) in the apartments. While a dedicated CME (option 2) system will be installed in the houses.

Domestic Water Usage

One of the notable characteristics of modern high efficiency homes is that domestic hot water use now accounts for a much larger proportion of total heating consumption of dwellings as fabric heating requirements reduce. Therefore, there is significant energy saving potential by implementing strategies to reduce domestic hot water usage. The design for the proposed residential development will seek to reduce hot water consumption insofar as possible. Some of the measures that will be considered include minimising domestic hot water storage losses, the use of low use water fittings and the reduction of circulation losses.

Lighting

Lighting also accounts for a significant proportion of energy consumption in buildings. The strategies that will be employed in the design of proposed residential development to reduce the energy consumption from lighting will be:

- Careful lighting design in dwellings and common areas to provide adequate lux levels while eliminating over provision / over design of lighting
- Selection and specification of low energy use light fittings through including LED's where practical
- Careful specification of lighting controls which may include occupancy sensing, daylight sensing and smart lighting control systems.

Smart Technologies

The use of smart building technologies can significantly reduce the energy consumption of homes. The latest proposals from the EU for the revised Energy Performance of Buildings Directive (EPBD) recognise this and the revised EPBD will place much more emphasis on smart building technologies into the future. In recognition of this the design for the proposed residential development will consider smart building technologies where practical. This will include smart lighting control systems, smart heating systems and other home connected systems.

Electric Vehicle Charging

The development will facilitate the provision of charging infrastructure for electric vehicles in line with the requirements of the updated Part L of the Building Regulations. The exact number of EV chargers will be determined at the next phase of the design.

Drainage

The Clonburris scheme has been designed to take account of the recently published SDCC Sustainable Drainage Explanatory Design & Evaluation Guide 2022. Unlike conventional drainage which seeks to remove runoff from a development as quickly as possible, the SuDS features incorporated within the scheme aim to slow down and store water in both hard and soft landscape areas, thereby reducing the impact of large volumes of polluted water flowing from a development into the adjoining watercourses or river.

The treatment train approach aims to ensure that many contaminants are broken down naturally as runoff passes from one SuDS component to the next. The mufti SuDS feature approach not only prevents flooding either within and/or downstream of the development but also provides both amenity for residents and maximise the potential for wildlife and biodiversity.

3. Part L (Dwellings)

Nearly Zero Energy Buildings (NZEB) and Part L of Building Regulations (Dwellings)

The EU Energy Performance of Buildings Directive (EPBD), transposed into Irish Law from 2006 onwards, contains a range of provisions to improve the energy performance of new and existing buildings. It is the main European legislative instrument to improve energy performance of buildings within the EU. In 2010 the EPBD was recast to include the requirement that member states should ensure that all new buildings are 'Nearly Zero-Energy Buildings' by the 31st December 2020.

'Nearly Zero-Energy Buildings', or NZEB, means a building that has a very high energy performance, as determined in accordance with Annex I of the EPBD. 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. The actual energy performance to meet NZEB standards are set by the member states using cost optimal analyses and guidelines set by the EU Commission.

A revised Part L of the Building Regulations (to incorporate S.I. No. 292/2019 – European Union (Energy Performance of Buildings) for Dwellings was issued and transposed into Irish law in 2019. Some of the improvements over previous Part L Regulations include:

- For dwellings a reduction in the Energy Performance Coefficient (EPC) from 0.4 to 0.3 (an improvement in performance of 25%)
- For dwellings amendments to the renewable energy provisions
- Increased thermal performance of the building fabric (lower U values and air permeability)
- Changes in the Dwelling Energy Assessment Procedure (DEAP) including more emphasis on hot water efficiency
- More emphasis on energy efficient lighting design
- Increased requirements for renovation projects
- Amendments to the renewable energy provision calculations
- Improved Mechanical & Electrical Services and Lighting specifications.

The regulations represent a marked improvement in building standards with respect to energy efficiency. The revised Part L Regulations will heavily influence the design of the proposed residential development at Clonburris and will form the main design basis for the project. Where economically and practically feasible the design will aim to exceed the requirements of the revised Part L.

Part L Calculations

Calculation Methodology

Compliance to Part L regulation for dwelling is demonstrated using the Dwelling Energy Assessment Procedure (DEAP) published by SEAI. The Clonburris compliance calculations have been completed using DEAP version 4.2.0, the latest web-based software version.

Compliance Methodology

TGD Part L allows 2 no. compliance methods for multi occupancy apartment buildings:

1. All dwellings must achieve the Maximum Permitted EPC and Maximum Permitted CPC of 0.3 and 0.35 respectively.
2. The average EPC and CPC for each apartment block must achieve the Maximum Permitted EPC and Maximum Permitted CPC of 0.3 and 0.35 respectively.

Method 1 has been used for the Clonburris residential development to demonstrate compliance. 3 no. apartment types, 2 no. house types and 1 no. duplex have been selected as a representative sample of all dwellings in the development, with detailed DEAP

calculations completed on each of these variants. Typical accommodation types of 1 bed, 2 bed, 3 Bed and 4 bed units have been used in the DEAP study.
Where possible top floor units have been chosen as typical unit and the orientation of the typical unit is adjusted so that the largest glazed area faces North, as these provide the worst-case scenario for compliance.
These results have then been applied to each dwelling to determine the EPC and CPC for each apartment block. The apartment variants selected for each apartment block are as outlined in the table below.

Table 1: DEAP Compliance Calculations – Apartment Variations

Dwelling Variant	Type	Position	Block
3B5P - H1-00-01	House	North Facing	Plot A
4B7P - H4-00-04	House	East Facing	Plot A
1B2P - C5a-02-01	Apartment	North Facing	Plot C
2B3P - C2-02-02	Apartment	North Facing	Plot C
2B4P - C5a-02-02	Apartment	North Facing	Plot C
3B5P - E3a-00-02	Duplex	East Facing	Plot E

The information regarding dimensions was taken from the architectural layouts, and input int DEAP along with fabric data, ventilation, heating, hot water and lighting specification.

Heating and Ventilation specification

For each apartment the following heating and ventilation specification is used in the DEAP study:

- Exhaust air heat pump (EAHP) generating space heating, hot water and extracting air from wet rooms.
- Wall vents.
- Radiators as heat emitters
- Data provided by the manufacturer is inputted for the ventilation specific fan power, volume and used within DEAP to calculate the space heating and hot water efficiencies. The efficiencies are in the order of 445% for space heating and 251% for domestic hot water generation.
- Renewable provision is from the EAHP

For each house the following heating and ventilation specification is used in the DEAP study:

- Split bloc heat pump generating space heating and hot water.
- Continuous Mechanical Extract (CMW) with wall vents.
- Radiators as heat emitters

Fabric Specification

The optimum fabric specification used in the earlier study carried out for determining heating options is used for this Part L compliance study. Part L compliance for each block can be achieved using the below fabric specification:

Table 2: Fabric specification – Houses

Item	Specification	Unit
Air tightness	3	$m^3/m^2/hr$ @ 50Pa
Thermal bridge factor[1]	0.08	-
Roof U value	0.15	W/m^2. K
Floor U value	0.12	W/m^2. K
Wall U value	0.18	W/m^2. K
Door U value (Opaque)	1.5	W/m^2. K
Glazing U value	1.22	W/m^2. K
Glazing Shading Coefficient	TBC	-
Glazing Frame Factor	0.7	-

Table 3: Fabric specification – Apartments

Item	Specification	Unit
Air tightness	3	$m^3/m^2/hr$ @ 50Pa
Thermal bridge factor[1]	0.08	-
Roof U value	0.2	W/m^2. K
Floor U value	0.12	W/m^2. K
Wall U value	0.18	W/m^2. K
Door U value (Opaque)	1.5	W/m^2. K
Glazing U value	1.4	W/m^2. K
Glazing Shading Coefficient	TBC	-
Glazing Frame Factor	0.7	-

[1] A thermal bridge factor of 0.08 may be used if 'Acceptable Construction Details, Technical Guidance Document Part L' are used or equivalent other compliance methods are followed as outlined in TGD Part L. It is recognised that for this development Acceptable Construction Details will not be appropriate, however as required thermal modelling of junctions will be carried out to demonstrate compliance with this factor.

4. Results

DEAP Results

Results summary for typical dwelling is given in the table below. DEAP output screenshots are included in the Appendix.

Table 4: Results - Typical units

Typical unit	EPC	CPC	RER	BER
3B5P - H1-00-01	0.237	0.227	0.454	A2
4B7P - H4-00-04	0.300	0.284	0.348	A3
1B2P - C5a-02-01	0.282	0.273	0.334	A3
2B3P - C2-02-02	0.273	0.263	0.327	A2
2B4P - C5a-02-02	0.275	0.266	0.325	A2
3B5P - E3a-00-02	0.268	0.256	0.327	A3

These results are applied to each block to obtain an area weighted average to comply with Part L requirements of maximum permitted EPC of 0.3 and CPC of 0.35.

5. Conclusion

The dwellings can be shown to comply to the Part L regulations using DEAP methodology with the specification detailed in this report. It should be noted that the above specifications are preliminary and to demonstrate that Part L compliance can be achieved. The final specifications will be confirmed at the next stage of the design.