PROGRESSIVE ENGINEERING

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1 INTRODUCTION

The intention of this report is to identify energy efficiency strategies associated with the design, construction and building services of this LRD Application regarding the mixed-use development at Clongriffin.

1.1. Proposed Development

The development will consist of the construction of a residential development set out in 3 no. blocks (identified as Zone 7, 8 & 9), ranging in height from 5 to 10 storeys, to accommodate 711 no. apartments including café/restaurant/retail units, community/cultural spaces, a standalone creche building and the completion of Market St.

The 3 no. residential buildings are arranged around podium courtyards accommodating communal amenity spaces for future residents. Zone 7 is a 5 to 7 storey block onto Main St, Friar's St, Park St and Market St containing 280 apartments. Zone 8 is a 6 to 8 storey block between Main St and Market Street containing 263 apartments. Zone 9 is a 6 to 10 storey block located on Main St, Station Square and Market Street containing 168 units.

Car and cycle parking for both residents and visitors is provided below podium and at surface level throughout the scheme. The proposed development includes all site landscaping works, open space, green roofs, lighting, servicing and utilities, signage, and associated and ancillary works, including site development works above and below ground.

The proposed development sits as part of a Masterplan for a wider Clongriffin landbank which includes the under-construction Block 5 & 6 to the north of Market Street.



Figure 1 – Proposed Site Layout

2 TGD PART L – THE REQUIREMENTS

Technical Guidance Document Part L (Conservation of Fuel and Energy) of the Building Regulations sets the energy and carbon performance requirements to achieve Nearly Zero Energy Buildings (NZEB) performance as required by the EU Energy Performance in Buildings Directive 2010/31/EU of 19 May 2010 and the amending directive 2018/844 of May 2018.

2.1 Dwellings

L1 A building shall be designed and constructed so as to ensure that the energy performance of the building is such as to limit the amount of energy required for the operation of the building and the amount of Carbon Dioxide (CO_2) emissions associated with this energy use insofar as is reasonably practicable.

For new dwellings, the requirements of L1 shall be met by:

(a) Providing that the energy performance of the dwelling is such as to limit the calculated primary energy consumption to a value no greater than the Maximum Permitted Energy Performance Coefficient (MPEPC), when calculated using the Dwelling Energy Assessment Procedure (DEAP) published by the Sustainable Energy Authority of Ireland (SEAI).

(b) Providing that the energy performance of the dwelling is such as to limit the calculated carbon dioxide (CO_2) emissions to a value no greater than the Maximum Permitted Carbon Performance Coefficient (MPCPC).

(c) Providing that a portion of the energy consumption is provided by renewable energy sources. This is demonstrated by achieving a Renewable Energy Ratio (RER) of at least 20%.

(d) Limiting the heat loss and, where appropriate, availing of heat gains through the fabric of the building.

(e) Providing and commissioning energy-efficient space heating systems, water heating systems, and ventilation systems, with effective controls.

(f) Providing to the building owner sufficient information about the building, the fixed building services, controls, and their maintenance requirements so that the building can be operated in such a manner as to use no more fuel and energy than is reasonable.

2.2 Other Key Regulations

Regulation 5

(a) A new building shall, where technically and economically feasible, be equipped with self-regulating devices for the separate regulation of the temperature in each room or, where justified, in a designated heated zone of the building unit.

(e) A new residential development with more than 10 car parking spaces shall have at least one recharging point installed. It must also have ducting infrastructure (for electric cables) for at least one in every five car parking spaces to enable the future installation of recharging points for electric vehicles.

Regulation 3

The minimum levels of energy from renewable sources may be fulfilled through efficient district heating and cooling that uses a significant share of renewable energy and waste heat and cold.

3 DUBLIN CITY DEVELOPMENT PLAN 2022-2028

This study addresses the policy objectives outlined in the "Dublin City Development Plan 2022-2028 – written statement". The development plan sets out the following policies in relation to energy in use and the use of district heating networks:

Policy CA4 – Climate Mitigation and Adaption in Strategic Growth Areas: To ensure that new development in strategic growth areas (including Strategic Development and Regeneration Areas) integrates appropriate climate mitigation and adaptation measures.

Policy CA7 – Climate Mitigation Actions in the Built Environment: To promote low carbon development in the city which will seek to reduce carbon dioxide emissions, and which will meet the highest feasible environmental standards during construction and occupation. New development should generally demonstrate/provide for:

a) building layout and design which maximises daylight, natural ventilation, active transport and public transport use.

b) sustainable building/services/site design to maximise energy efficiency.

c) sensitive energy efficiency improvements to existing buildings.

d) energy efficiency, energy conservation, and the increased use of renewable energy in existing and new developments.

e) on-site renewable energy infrastructure and renewable energy.

f) minimising the generation of site and construction waste and maximising reuse or recycling.

g) the use of construction materials that have low to zero embodied energy and CO2 emissions; and

h) connection to (existing and planned) decentralised energy networks including the Dublin District Heating System where feasible.

Policy CA9 – Climate Action Energy Statements: All new developments involving 30 residential units and/or more than 1,000 sq. m. of commercial floor space, or as otherwise required by the Planning Authority, will be required to submit a Climate Action Energy Statement as part of the overall Design Statement to demonstrate how low carbon energy and heating solutions, have been considered as part of the overall design and planning of the proposed development.

Policy CA10 – Energy from Renewable Sources: To support the production of energy from renewable sources, such as from 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 and environmental considerations.

Policy CA14 – Waste Heat, District Heating and Decentralised Energy: To actively encourage the development of low carbon and highly efficient district heating and decentralised energy systems across the city utilising low carbon heat sources such as renewable energy and waste heat recovery and to promote the connection of new developments to district heating networks where such systems exist/can be developed in a given area.

Policy CA15 – The Dublin District Heating System (DDHS): To support the development and expansion of any necessary energy infrastructure which will deliver the low carbon Docklands and Poolbeg catchment of the Dublin District Heating System (DDHS) project including, its pipeline infrastructure and its energy centre with energy storage and back-up heat production.

Policy CA16 – Supporting the Potential of District Heating in Dublin City: To support the potential of district heating in Dublin City, all Climate Action Energy Statements submitted to the Council (see Policy CA9) shall include an assessment of the technical, environmental and economic feasibility of district or

block heating or cooling, particularly where it is based entirely, or partially on energy from renewable and waste heat sources. In addition:

• Climate Action Energy Statements for significant new residential and commercial developments in Strategic Development and Regeneration Areas (SDRAs), will assess the feasibility of making the development 'district heating enabled' in order to facilitate a connection to an available or developing district heating network in the area.

• Climate Action Energy Statements for significant new residential and commercial developments in the Docklands SDRA will assess the feasibility of making the development 'district heating enabled' in order to facilitate a connection to the Dublin District Heating System.

In line with Dublin City's development plan policies CA4, CA7, CA9 & CA10, this Climate Action Energy statement was prepared to promote a low-carbon development. A heating strategy comparison will be developed to determine the optimum heating and energy strategy for the development. These calculations will demonstrate the developments estimated primary energy consumption, carbon emissions, delivered energy consumption and running costs for a range of centralised and decentralised systems.

Third-party district heating outside the curtilage of the proposed development cannot be considered for this development as there is no infrastructure in the close vicinity. Figure 2 below shows the SEAI's district heating network map and confirms the proposed development is not located near a district heating zone.

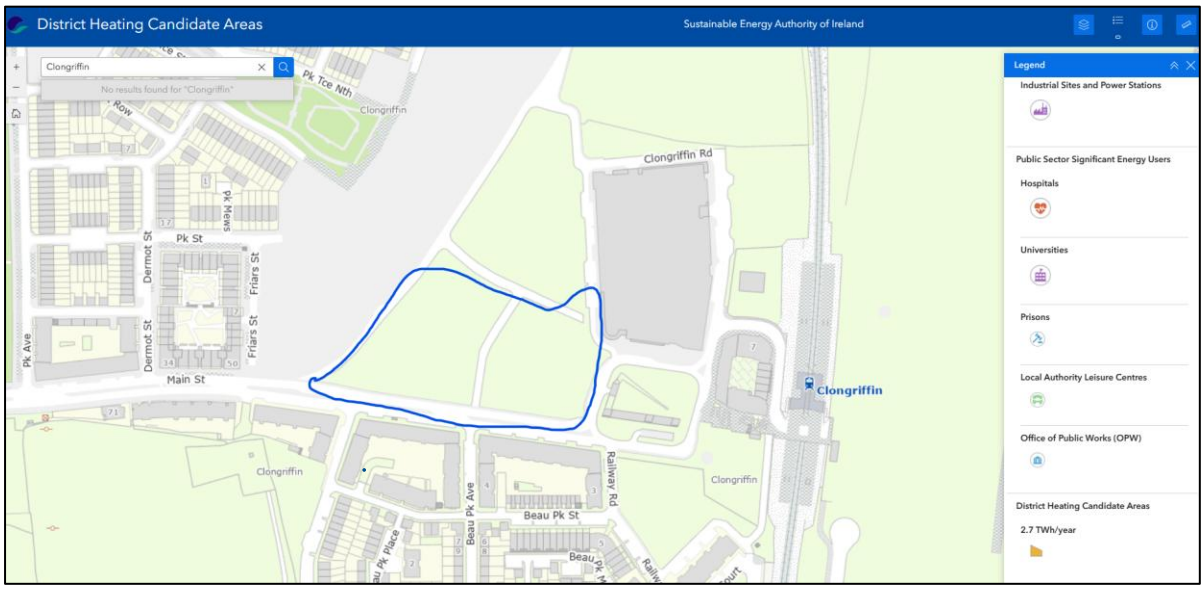


Figure 2 - SEAI District Heating Network Map

4 THE ENERGY HIERARCHY PLAN

The energy hierarchy plan has been adopted for this development. Its aim is to reduce energy before it can be consumed. This can be achieved by implementing passive design strategies across the development, such as maximising building fabric performance, optimising building orientation, optimising HVAC systems, and Optimising Lighting design. The key steps in the Energy Hierarchy Plan are outlined as follows:

- **BE LEAN** - The first step of this plan is the most important; its aim is to first reduce energy demand by improving the building's thermal envelope, increasing air tightness, improving thermal transmittance, and applying passive design techniques.
- **BE CLEAN** - The second step is to utilise energy in the most efficient way through the selection and installation of energy efficient plant and equipment.
- **BE GREEN** - The final step is to introduce energy from renewable sources to reduce the burden on fossil fuels.

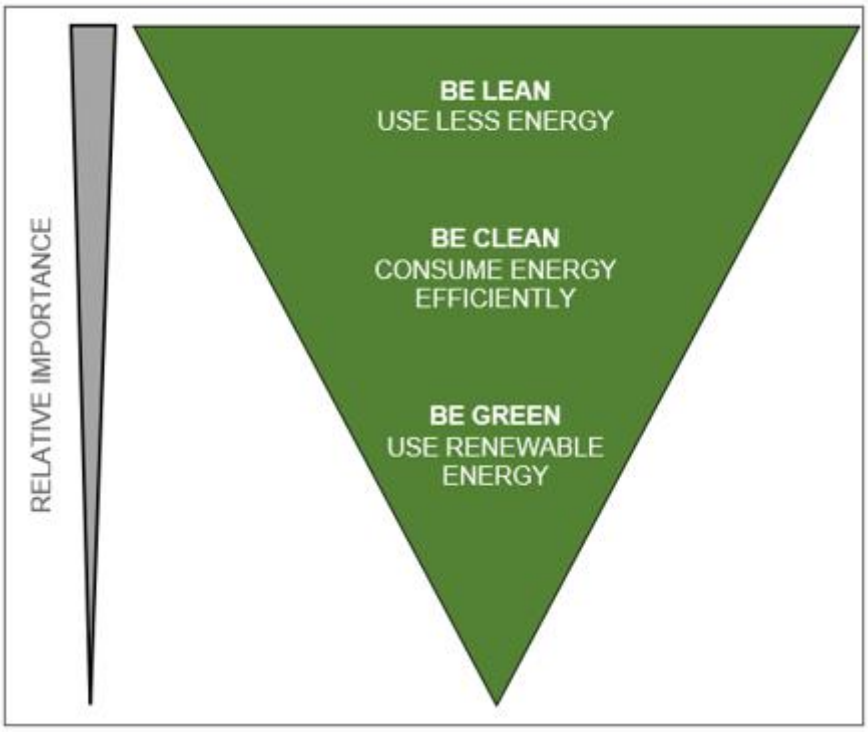


Figure 3 - Energy Hierarchy Plan

4.1 Be Lean – Use Less Energy

The design team will aim to improve upon the building fabric performance's set out in *TGD Part L 2021* as much as technically, functionally, and economically feasible. This will help reduce heat losses and optimise solar gain through the building envelope, in turn reducing energy consumption and carbon emissions.

4.1.1 High Performance U-Values

To limit heat loss through the façade, careful consideration will be shown when designing the external envelope. The specification of the insulation utilised, and the continuity of insulation are crucial. Insulation slows the rate at which heat is lost to the outdoors.

The maximum average elemental U-values from Part L 2021 are outlined in Table 1 below.

Table 3 - Maximum Building fabric U-values

Fabric Element	Dwellings TGD Part L (2021)	Buildings other than Dwellings TGD Part L (2021)
	Maximum Average Elemental U-Value (W/m^2.K)	Maximum Average Elemental U-Value (W/m^2.K)
Ground floor	U-Value = 0.18	U-Value = 0.21
Exposed floor	U-Value = 0.18	U-Value = 0.21
Wall (External)	U-Value = 0.18	U-Value = 0.21
Roof (pitched)	U-Value = 0.16	U-Value = 0.16
Flat roof	U-Value = 0.20	U-Value = 0.20
Windows and glazed doors	U-Value = 1.40	U-Value = 1.60
Curtain walling	-	U-Value = 0.18
Opaque doors	U-Value = 1.40	U-Value = 1.60
Vehicle access and similar large doors	-	U-Value = 1.50
High usage entrance doors	-	U-Value = 3.00
Swimming pool basin	-	U-Value = 0.25
Thermal bridging factor	0.08 W/m2k	0.08 W/m2k
Internal heat capacity	-	-
Air permeability	5m3/(hr.m2) @50pa	5m3/(hr.m2) @50pa

4.1.2 Air Tightness

One major contributing factor to unnecessary heat loss is infiltration. Infiltration is the air leakage of external air into a building due to the pressure difference between the internal and external environments.

Under the TGD Part L 2021 (Dwellings & Buildings other than Dwellings), a performance level of 5 m3/hr/m2 @ 50 Pa represents a reasonable upper limit for air permeability. By reducing the number of infiltration/external air changes per hour, the building's energy demand and carbon emissions will decrease, as its ability to retain conditioned fresh air increases; i.e., the HVAC equipment will not be required as often.

A design air permeability target of 5**m3/m2/hr** has been identified for the dwellings in this site. The air permeability testing will be carried out in accordance with BS EN 13829:2001 'Determination of air permeability of buildings, fan pressurisation method' and CIBSE TM23: 2000 'Testing buildings for air leakage".

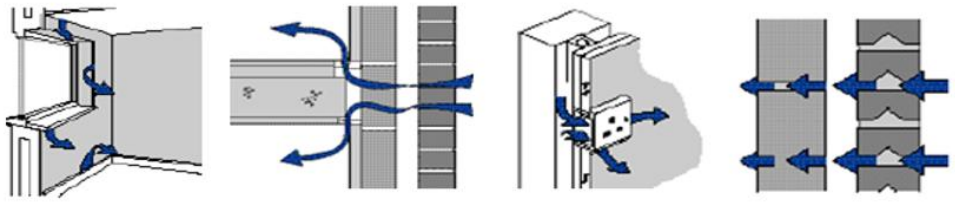


Figure 4 - Typical Air Leakage Paths

4.1.3 Thermal Transmittance

Thermal bridges occur at junctions between elements of the building fabric and are typically defined as areas where heat can escape the building fabric due to a lack of continuity of the insulation in the adjoining elements.

Careful design and detailing of how insulation is installed at these junctions can reduce the rate at which heat escapes. Standard good practice details are available and are known as Acceptable Construction Details (ACDs). Adherence to these details is known to reduce the rate of heat loss.

The rate at which heat is lost is quantified by the Thermal Bridging Factor of the dwelling and measured in W/m2K. The Thermal Bridging Factor is used in the overall dwelling Part L calculation, this value can be entered in three different ways:

- 0.15W/m2K Used where the ACDs are not adhered to
- 0.08W/m2K Used where the ACDs are fully adhered to
- <0.08 W/m2K Used where the thermal details are thermally modelled and considered.

It is intended that the ACDs will be adhered to where suitable benchmarks exist and/or that thermal modelling will be carried out for any non-standard junction details within the proposed development. It is intended to achieve a thermal bridging factor of 0.08 W/m2k.

Figure 5 below shows thermal images of typical details where thermal bridging occurs.

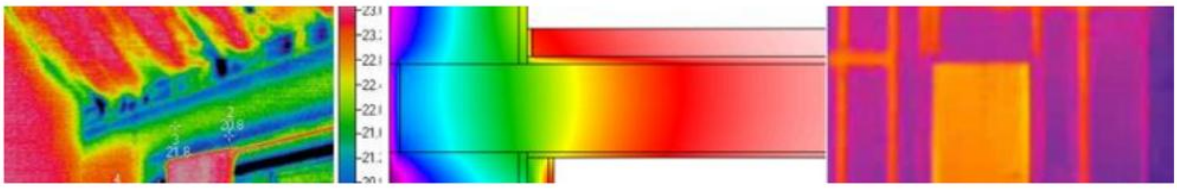


Figure 5 - Typical Thermal Bridging Junctions

4.2 Be Clean – Consume Energy Efficiently

To maximise the effectiveness of enhancing the building fabric, it is important to improve the overall energy efficiency of the development, plant will be selected based on performance and energy efficiency. A review of the different options will be undertaken prior to the selection of the plant.

Space Heating plant options are as follows:

- Air source heat pumps, or
- Electric panel heaters

Hot Water plant option are as follows:

- Air source heat pumps, or
- Hot water heat pump

Ventilation plant options are as follows:

- Mechanical ventilation and heat recovery, or
- Continuous mechanical extract ventilation

It is intended to utilize Variable Speed Drives (VSDs) for all fans and pumps servicing the HVAC systems. Standard fans and pumps operate at a constant speed to meet maximum demand even when a reduced demand is required. VSDs can ramp up and down depending on the buildings demand, reducing energy consumption.

4.2.1 Lighting

The Lighting design intent is to introduce artificial lighting in all applicable areas. Energy-efficient light fittings will be installed throughout.

4.3 Be Green – Use Renewable Technologies

The following renewable technologies will be considered for implementation, as far as is practical and feasible.

4.3.1 Air Source Heat Pumps

Heat pumps convert energy from the external air to provide space heating and domestic hot water services to a building. The air source heat pump is located externally, open to air. It uses electricity to operate a fan to draw air across a heat exchanger containing a refrigerant, this process turns the refrigerant from liquid to gas. This gas passes through a compressor, the increased gas pressure adds more heat to the system. The hot gases pass into a second heat exchanger where it transfers the heat to the space heating or domestic hot water system. As this happens the refrigerant condenses back into a liquid where the cycle starts again.

Heat pumps can provide renewable (thermal) energy through their operational efficiencies. They can produce four to six times the amount of energy that is put into the system, reducing the demand and energy requirements.

Figure 6 below shows the operational processes of an air source heat pump.

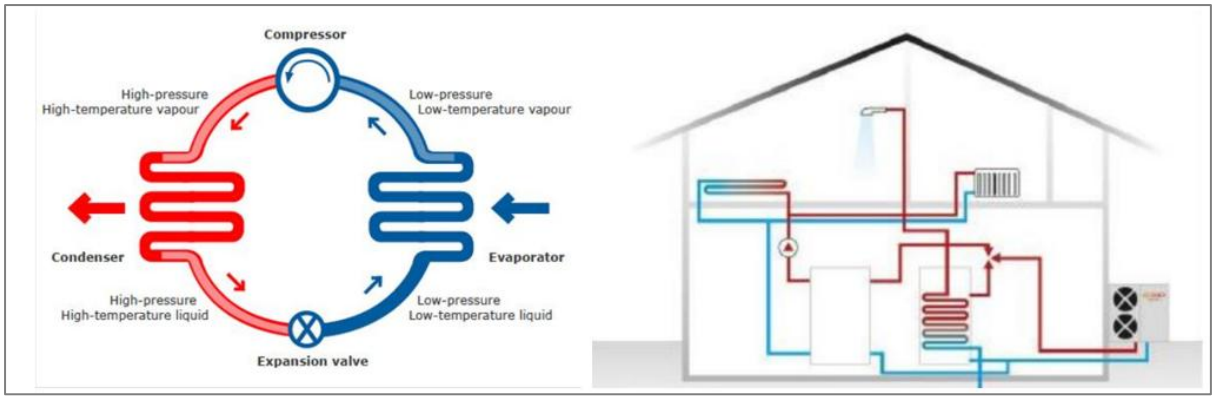


Figure 6 - Heat Pump Operational Diagram

4.3.2 Hot Water Heat Pump

Hot water heat pumps produce hot water very efficiently as it extracts heat from external air supplied via insulated ductwork. Unlike standard air-to-water heat pumps, this heat pump only provides domestic hot water for showers and sinks. Space heating is generally provided using direct acting electric radiators.

Hot water heat pumps can have a seasonal efficiency greater the 300%.

4.3.3 Solar Photovoltaics

Photovoltaic (PV) will be considered for areas that require an additional renewable energy contribution to meet TGD Part L.

PV panels convert the solar radiation into electricity, which can be connected to the mains supply of a building. Panels are typically arranged in arrays on a building roof, with the produced electricity fed directly into the building. Figure 7 below shows a diagram of how a PV system works.

The sun (1) provides solar radiation through sunlight that hits the PV cells (2), converting the solar energy into DC electricity. DC electricity passes through an inverter (3) which converts the electricity to AC making it ready to use. The current is then fed through a meter (4) before passing through the consumer unit. The dwelling will automatically use the PVs energy to power appliances (5), any electricity that is not used can be exported back to the national grid (6).

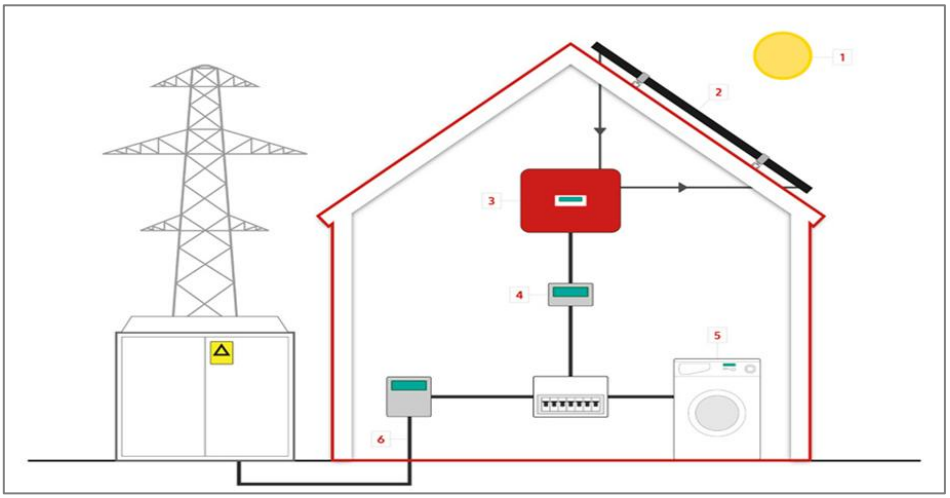


Figure 7 - Solar PV Diagram

5 DEVELOPING THE ENERGY PERFORMANCE STRATEGY

Works will be conducted in the detailed design stage to provide a coordinated energy strategy for the development. The proposed strategy will help to reduce energy consumption, carbon emissions and annual running costs throughout the development.

Dynamic Thermal Energy Modelling is intended to be used as the design progresses to enhance thermal comfort and wellbeing throughout the development. It is intended to perform provisional BER and compliance calculations and overheating risk assessments in the detailed design phase to ensure Part L compliance and best practice design.

5.1 DEAP (Dwellings)

DEAP calculations calculate the BER and demonstrate Part L compliance. DEAP considers space heating and cooling, water heating, ventilation, and lighting to calculate a building's energy consumption and carbon dioxide emissions. It also determines each building's building energy rating (BER).

5.2 Environmental Assessment Methodologies

Addressing operational energy use in a manner set out in the preceding sections of this report is a vital component of any construction project however consideration must also be given to other aspects of sustainable design such as water use, material selection and minimising pollutants.

Various assessment methodologies have been developed by organisations such as the Building Research Establishment (BREEAM Methodology) and the US Green Building Council (LEED Certification) to measure the performance of various environmental and sustainable aspects of the design, construction and operation of proposed developments.

5.3 Embodied Carbon

Recent advances in the energy efficiency of buildings have reduced operational energy use to such an extent that the life cycle carbon emissions of a building are influenced more by the carbon that is embodied in the materials and processes used during the construction than it is by the carbon emitted as a result of energy used in the buildings operation. As such, the embodied carbon of a building must now be considered if a construction project is to be considered low carbon or “net-zero” carbon.

Addressing the embodied carbon requires that all the key building element categories (substructure, structure, façade, MEP services) are assessed to identify the optimal solutions in terms of embodied carbon and assess them through a multidisciplinary and holistic approach, considering implications in different areas such as efficiency, cost, programme etc.

The embodied carbon from the existing building will be considered and offset against the new building during the design phase. This is due to the inefficiency/unsuitability of the existing building for the proposed student accommodation.

The process of design and of material and product selection must include an analysis of the final embodied carbon and comparison with benchmarks to identify the areas that need to be optimised. This process allows the building designers and procurement managers to focus on how to eliminate the impact of the key identified hotspots, through comparative assessments and specification of products that demonstrate low embodied carbon and facilitate the production of the final embodied carbon assessment at the end of the detailed design to identify the expected impact of the Development.

5.3.1 Overheating Risk/ Thermal Comfort Assessment

It is intended to preform dynamic thermal modelling during early detailed design, using the building energy simulation software, IESVE, to analyse selected worst case dwellings for overheating risk, and to propose design changes to mitigate that risk, if required.

CIBSE TM59 sets the design performance guidelines for overheating risk in residential building. CIBSE TM52 sets the design recommendations for reguratrly occupied spaces in commercial buildings.

Figure 8 below represents the factors which affect thermal comfort.

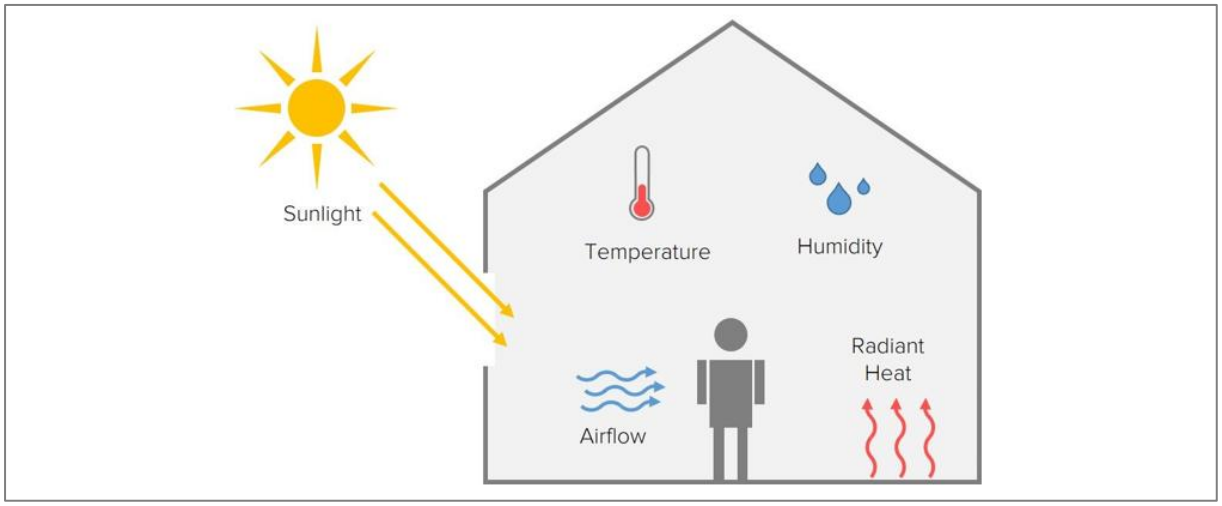


Figure 8 - Factor Influencing Thermal Comfort

6 CONCLUSION

The design team will adopt a holistic, sustainable approach for the proposed development. It is intended to identify several energy efficiency measures through the development of the energy strategy, to minimise the energy consumption and carbon emissions of this development. These energy efficiency measures will be based on the Hierarchy Plan, Be Lean, Be Clean, Be Green.

Be Lean

- High performance U-values.
- Improved air tightness.
- Improved thermal transmittance and thermal bridging design.

Be Clean

- High efficiency space and water heating will be specified.
- Low energy lighting system will be installed.
- VSD's will be used were appropriate.

Be Green

- Renewable energy technologies such as heat pumps or solar PV will be considered for implementation.

This Climate Action Energy statement was prepared to promote a low-carbon development. A heating strategy comparison will be developed to determine the optimum heating and energy strategy for the development. These calculations will demonstrate the developments estimated primary energy consumption, carbon emissions, delivered energy consumption and running for a range of centralised and decentralised system. Third part district heating outside the curtilage of the proposed development were not considered for this development as there is no existing or proposed networks in the area

This report confirms that energy and sustainability have been a key focus in the design to date and will remain a key factor throughout the detailed design of the development.

