FORMER CHADWICKS SITE
GREENHILLS ROAD
WALKINSTOWN
DUBLIN 12

Project No.	Document Title	Rev.	Prepared by:	Issue Date:	Checked by:
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CONTENTS:

SECTION 1 INTRODUCTION

This sustainability report outlines the energy strategy, mechanical system and building regulation compliance criteria at planning stage for Chadwicks Site, Greenhills Road, Dublin 12. This report has been prepared as a compliance requirement for planning applications made in accordance with DCC Guidelines. The proposed development will consist of the following:

(i) The demolition of the former Chadwicks Builders Merchant development comprising 1 no. two storey office building and 9 no. storage/ warehouse buildings ranging in height from 3 m – 9.9 m as follows: Building A (8,764 sq.m.), Building B (1,293 sq.m.), Building C (two-storey office building) (527 sq.m.), Building D (47 sq.m.), Building E (29 sq.m.), Building F (207 sq.m.), Building G (101 sq.m.), Building H (80 sq.m.), Building I (28 sq.m.), and Building J (44 sq.m.), in total comprising 11,120 sq.m.;

(ii) the construction of a mixed-use Build-Rent residential and commercial development comprising 633 no. build-to-rent apartment units (292 no. one-beds, 280 no. two-beds and 61 no. three-beds), 1 no. childcare facility and 10 no. commercial units in 4 no. blocks (A-D) ranging in height from 5 to 12 storeys as follows:

(a) Block A comprises 209 no. apartments (102 no. 1 bed-units, 06 no. 2 bed-units and 1 no. 3-bed units) measuring 5 - 10 storeys in height. (b) Block B comprises 121 no. apartments (53 no. 1 bed-units, 45 no. 2 bed-units and 23 no. 3 bed-units) measuring 8 - 10 storeys in height. (c) Block C comprises 130 no. apartments (38 no. 1-bed units, 71 no. 2-bed units and 21 no. 3-bed units) measuring 8-12 storeys in height. (d) Block D comprises 173 no. apartments (99 no. 1 bed-units, 58 no. 2 bed-units and 16 no. 3 bed-units) measuring 6 - 10 storeys in height. All apartments will be provided with private balconies/terraces;

(iii) provision of indoor communal residential amenity/management facilities including a co-working space, communal meeting room/work space, foyer, toilets at ground floor of Block A; gym, changing rooms, toilets, resident's lounge, studio, laundry room, communal meeting room/ work space, multi-function space with kitchen at ground floor of Block B; games room with kitchenette, media room, co-working space, resident's lounge, communal meeting room/ work space, reception area, management office with ancillary staff room and toilets, toilets, parcel room at ground floor of Block C;

(iv) the construction of 1 no. childcare facility with dedicated outdoor play area located at ground floor of Block A;

(v) the construction of 8 no. commercial units at ground floor level of Blocks A, B and D, and 2 no. commercial units at second floor level (fronting Greenhills Road) of Block C as follows: Block A has 3 no. units at ground floor comprising 79.46 sq.m., 90.23 sq.m., and 121.39 sq.m., Block B has 1 no. unit at ground floor comprising 127.03 sq.m., Block C has two units at second floor comprising 120.85 sq.m. and 125.45 sq.m., and Block D has 4 no. units at ground floor comprising 84.45 sq.m., 149.77 sq.m., 155.48 sq.m. and 275.59 sq.m.;

(vi) the construction of 3 no. vehicular entrances; a primary entrance via vehicular ramp from the north (access from Greenhills Road) and 2 no. secondary entrances from the south for emergency access and services (access from existing road to the south of the site) with additional pedestrian accesses proposed along Greenhills Road;

(vii) provision of 424 no. car parking spaces comprising 398 no. standard spaces, 21 no. mobility spaces and 5 no. car club spaces located at ground floor level car park located within Block A and accessed via the proposed entrance at Greenhills Road, a two-storey car park located within Blocks C and D also accessed from the proposed entrance at Greenhills Road and on-street parking at ground floor level adjacent to Blocks A and C. Provision of an additional 15 no. commercial/ unloading/ drop-off on-street parking spaces at ground floor level (providing for an overall total of 439 car parking spaces). Provision of 4 no. dedicated motorcycle spaces at ground floor level parking area within Blocks C and D;

(viii) provision of 1363 no. bicycle parking spaces comprising 1035 no. residents' bicycle spaces, 5 no. accessible bicycle spaces and 7 no. cargo bicycle spaces in 9 no. bicycle storerooms in ground and first floor parking areas within Blocks A, C and D, and 316 no. visitors' bicycle spaces located externally at ground floor level throughout the development;

(ix) provision of outdoor communal amenity space (5,020 sq.m.) comprising landscaped courtyards that include play areas, seating areas, grass areas, planting, and scented gardens located on podiums at first and second floor levels; provision of a communal amenity roof garden in Block C with seating area and planting (176 sq.m.); and inclusion of centrally located public open space (3,380 sq.m.) adjacent to Blocks B and C comprising grassed areas, planting, seating areas, play areas, water feature, flexible use space; and incidental open space/public realm;

(x) development also includes landscaping and infrastructural works, foul and surface water drainage, bin storage, ESB substations, plant rooms, boundary treatments, internal roads, cycle paths and footpaths and all associated site works to facilitate the development. This application is accompanied by an Environmental Impact Assessment Report (EIAR).

1.1 Compliance Criteria

The residential units will be designed to comply with Building Regulations TGD L 2021 – Conservation of Fuel and Energy – Dwellings.

This new version of TGD L includes the requirements for Nearly Zero Energy Building (NZEB).

The TGD L2021 standard will apply to all dwellings that commence on or after on or after 1st November 2021.

There are five main criteria that this report aims to demonstrate compliance with

- Building Energy Rating
- Energy Performance Coefficient (EPC)
- Carbon Performance Coefficient (CPC)
- Renewable contribution
- Maximum elemental U-Values

Building Energy Rating (BER)
There is no specific BER rating that is required to comply with Part L. However, dwellings compliant with NZEB will usually achieve a BER of A2-A3. The majority of all residential units at Chadwicks Site will achieve a BER of A2.

Energy Performance Coefficient (EPC) & Carbon Performance Coefficient (CPC)
The EPC and CPC are the two figures that are used to determine whether the dwelling complies with Part L on an overall basis.

The EPC is the calculated primary energy consumption of the proposed dwelling, divided by that of a reference building of the same size. To comply with Part L and NZEB requirements, the EPC must be better than the Maximum Energy Performance Coefficient (MPEPC) which is 0.30.

The CPC is the calculated carbon dioxide emissions of the proposed dwelling, divided by that of a reference building of the same size. To comply with Part L and NZEB requirements, the CPC must be better than the Maximum Carbon Performance Coefficient (MPCPC) which is 0.35.

Renewable Contribution
To satisfy the new part L, 20% of the building energy must be provided via renewable technologies. This is measured in the form of a renewable energy ratio (RER).

Maximum Elemental U-Values

Technical Guidance Document Part L 2021 sets out maximum U-Values for each construction type, however, we are proposing to improve on those "U" Values in Chadwicks Site as below.

Fabric Element	Part L 2021 requirement	Proposed	% Improvement
Wall	0.18	0.16	11.11%
Window	1.4	0.08-1.2	94.28% - 14.28%
Door	1.4	1.4	0%
Ground Floor	0.18	0.14	22.2%
Roof	0.20	0.12	40%

Table 1	Maximum elemental U-value (W/m²K)[1, 2]	
Column 1 Fabric Elements	**Column 2 Area-weighted Average Elemental U-value (Um)**	**Column 3 Average Elemental U-value – individual element or section of element**
Roofs Pitched roof - Insulation at ceiling - Insulation on slope Flat roof	 0.16 0.16 0.20	0.3
Walls	0.18	0.6
Ground floors[3]	0.18	0.6
Other exposed floors	0.18	0.6
External doors, windows and rooflights	1.4[4,5]	3.0

Notes:
1. *The U-value includes the effect of unheated voids or other spaces.*
2. *For alternative method of showing compliance see paragraph 1.3.2.3.*
3. *For insulation of ground floors and exposed floors incorporating underfloor heating, see paragraph 1.3.2.2.*
4. *Windows, doors and rooflights should have a maximum U-value of 1.4 W/m²K.*
5. *The NSAI Window Energy Performance Scheme (WEPS) provides a rating for windows combining heat loss and solar transmittance. The solar transmittance value g_{perp} measures the solar energy through the window.*

SECTION 2.0 ENERGY STRATEGY APPROACH

At Homan O'Brien, we believe a multi-faceted approach is required to achieving the best practice in sustainability, Key themes considered with respect to sustainability of the proposed development is as follows:

Operational energy

Operational energy is the energy consume by a building associated with heating, hot water, cooling, ventilation, and lighting systems, as well as equipment such as fridges, washing machines, TVs, computers, lifts, and cooking. Reducing operational energy is key to achieving a scalable zero carbon neighbourhood.

Embodied carbon

The term embodied carbon refers to the 'upfront' emissions associated with building construction, including the extraction and processing of materials and the energy and water consumption in the production, assembly, and construction of buildings. It also includes the 'in-use' stage (the maintenance, replacement, and emissions associated with refrigerant leakage) and the 'end of life' stage (demolition, disassembly, and disposal of any parts of product or building) and any transportation relating to the above. Embodied carbon is a topic that is becoming more relevant and important as we reduce operational carbon. It is intended that the proposed Chadwicks Site will implement measure to minimise the embodied carbon associated with the development to best practice standards.

Future of heat

The decarbonisation of heating and hot water will have a huge impact on carbon emission reductions and is a crucial step in the net zero pathway. Section 3 & 4 of this report outlines the process undertaken in the selection to identify the most appropriate low carbon heating system for the development and the key features which will be implemented.

Demand response

Integrating demand response and energy storage into buildings allows buildings to be flexible with their demand on the grid for power. This is fundamental to allow the grid to harness renewable energy sources that allows it to decarbonise to a level that is needed to meet our low carbon targets. Section 4 outlines key features which will be incorporated to improve the proposed building's energy flexibility.

Data disclosure

Unless we can gain a good understanding of how our buildings are performing in-use through post occupancy evaluation, we cannot achieve net zero carbon. There is also a huge 'performance gap' between how we estimate the energy consumption of new buildings and how they perform in-use. The Chadwicks Site will incorporate energy monitoring and targeting features such that it can be understood how the development performs in-use by better measuring and monitoring energy consumption.

The strategy to sustainable design at Chadwicks site will be to use robust, passive, cost effective measures to create an efficient and healthy environment within the planned spaces.

The development provides an opportunity to create environmentally sound and energy efficient community living neighbourhood by using an integrated approach to design, planning, construction and operation.

Sustainable development promotes resource conservation of our limited natural resources. The design strategies employed will include a whole life cycle approach to management and planning of the development, energy efficiency with specific focus on reducing the carbon footprint, improving the environmental quality of the building spaces, material selection and use, waste management, water management and conservation and enhancing the ecological value of the site.

The development is being designed to achieve an 'A Rating' BER (Building Energy Rating) for the community living building accommodation.

There are many significant drivers for sustainable design:-

The increasing cost required to provide services such as energy and water.

a. Stricter energy targets set under the Building Regulations now and into the future.

b. Objective to take account of the impacts of climate change.

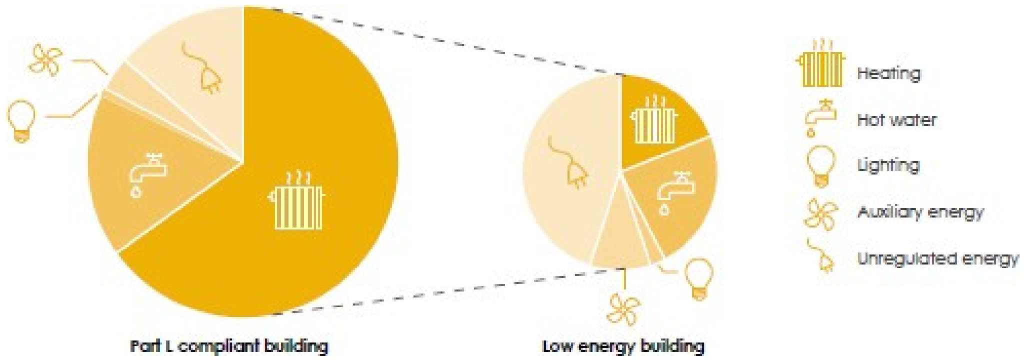
c. The desire to provide energy efficient building development to demonstrate energy awareness and efficiency of use.

In developing the vision for the 'Sustainability/Energy Strategy' for the development, the incorporation of sustainable strategies into the project deliverables has encouraged the commitment to sustainable design at a very early stage with the Client and Design Team to ensure a 'best in class' development.

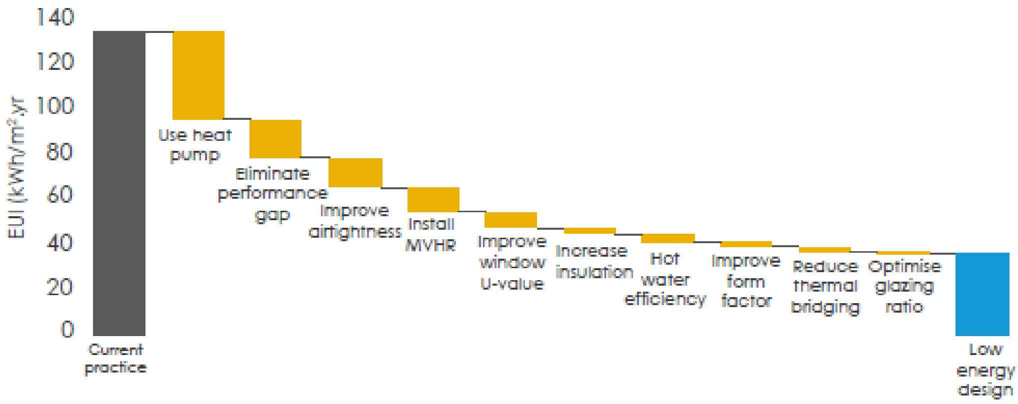
This approach seeks to ensure that the development meets the principles of the Government's 'National Climate Change Policy' and maximises the reduction in Carbon Dioxide (CO2) emissions thus demonstrating the Client's commitment to Climate Change.

SECTION 3.0 ENERGY EFFICIENCY & SUSTAINABILITY

What does a 'Best Practice' residential building look like?



For residential buildings, space heating & domestic hot water generation tends to require most energy due to relatively poor fabric & water use efficiency standards. A highly efficient fabric & low water use fittings reduces this significantly. The diagrams below show how the proposed best-practice design features affect the overall amount and breakdown of the energy demand in a typical dwelling at the proposed development.



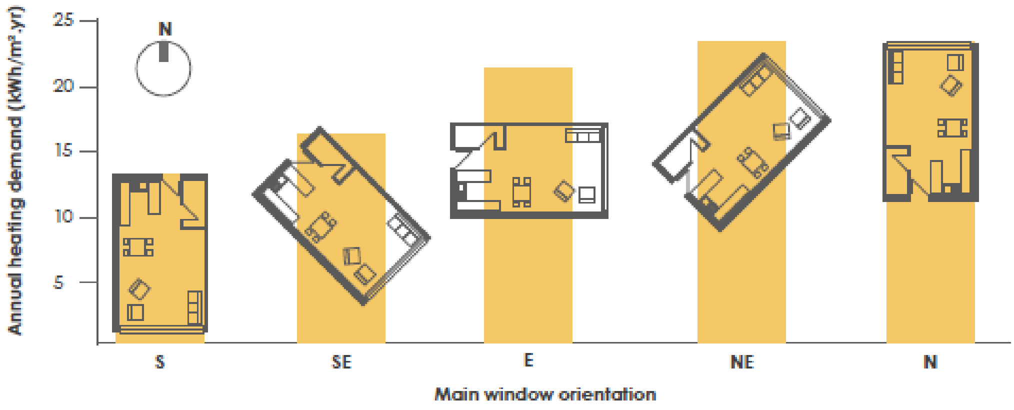
3.1 Reducing Energy Consumption – Building Fabric

In order to reduce the energy consumption of the heating and lighting systems integration between the architects, services engineer and structural engineer is required. This approach ensures the form of the building seeks to minimise heat gains in summer and heat loss in winter and also ensures that the choice of heating and ventilation systems will complement the building design and vice versa.

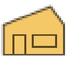
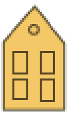
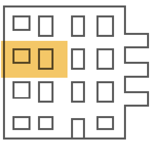
Why concept design is critical

The specification of the fabric & materials will all have a significant impact on the energy demand of a building. However, even more fundamental are some key design decisions which are typically shaped very early on. These are orientation, form factor and glazing ratio. A building's orientation combined with its glazing ratio is key to minimising energy demand. In Ireland over the course of a year, North facing windows nearly always lead to net heat loss, whereas south facing ones can normally be designed to achieve a net heat gain. However, the amount of South facing glazing should also be optimised to prevent the risk of summer overheating. Although East/West windows can provide useful gains, they can often lead to overheating due to the low angle of the sun at the start/end of the day. The optimum glazing ratios for the Irish climate are up to 25% glazed on the southern elevation, no more than 20% on the East/West elevations and as little as possible on the Northern elevation. The diagram below shows the impact on space heating demand as the same building is rotated to place its originally south facing glazing in a northerly direction. It shows that purely by changing the building's orientation, the space heating demand increases from 13kWh/m2.yr to 24kWh/m2.yr.

The orientation and glazing ratios of this development have been carefully assessed to minimise space heating demand, potential overheating and to ensure good levels of daylight are achieved within the apartments.



A building's form factor is the ratio of its external surface area (i.e. the parts of the building exposed to outdoor conditions) to the internal floor area. The greater the ratio, the less efficient the building and the greater the energy demand. Detached dwellings will have a high form factor, whereas apartment blocks will have a much lower form factor and thus will tend to be more energy efficient. The table below shows the typical form factors associated with different design configurations. If a building is designed with a poor form factor, then the fabric efficiency will need to be increased significantly to achieve the optimum levels of performance.
This will increase costs as more insulation and more efficient systems will be required. The form factor of this development has been optimised as far as reasonably practical to minimise energy consumption.

Type		Form factor	Efficiency
	Bungalow house	3.0	Least efficient
	Detached house	2.5	
	Semi-detached house	2.1	
	Mid-terrace house	1.7	
	End mid-floor apartment	0.8	Most efficient

3.2 Elemental U-Values

The U-Value of a building element is a measure of the amount of heat energy that will pass through the constituent element of the building envelope. Increasing the insulation levels in each element will reduce the heat lost during the heating season and this in turn will reduce the consumption of fuel and the associated carbon emissions and operating costs.

It is the intention of the design team to meet & exceed the requirements of the relevant current building regulations (Part L 2021). Target U-Values are identified below.

CHADWICKS SITE TARGET "U" VALUES

Fabric Element	Part L 2021 requirement	Proposed	% Improvement
Wall	0.18	0.16	11.1%
Window	1.4	0.08-1.2	94.28% - 14.28%
Door	1.4	1.4	0%
Ground Floor	0.18	0.14	22.2%
Roof	0.20	0.12	40%

3.3 Air Permeability

A major consideration in reducing the heat losses in a building is the air infiltration. This essentially relates to the ingress of cold outdoor air into the building and the corresponding displacement of the heated internal air. This incoming cold air must be heated if comfort conditions are to be maintained. In a traditionally constructed building, infiltration can account for 30 to 40 percent of the total heat loss; however, construction standards continue to improve in this area.

With good design and strict on-site control of building techniques, infiltration losses can be significantly reduced, resulting in equivalent savings in energy consumption, emissions and running costs.

In order to ensure that a sufficient level of air tightness is achieved, air permeability testing will be specified in tender documents, with the responsibility being placed on the main contractor to carry out testing and achieve the targets identified in the tender documents.

A design air permeability target of ***2.0 m3/m^2/hr at 50 Pascals*** has been identified.
Air testing specification will require testing to be carried out in accordance with

- BS EN 13829:2001 'Determination of air permeability of buildings, fan pressurisation method'
- CIBSE TM23: 2000 'Testing buildings for air leakage"

3.4 Low Carbon & Renewable Energy Solutions

The building services design on any project is ultimately responsible for how a building will consume energy and the resultant carbon intensity. The design of heating, ventilation and lighting systems will determine the energy consumption characteristics of the building.

The approach that has been adopted to delivering a development which is both highly efficient and sustainably designed has been to involve all members of the design team from the earliest possible stage in the design process. This integrated design approach will be continued throughout the design process.

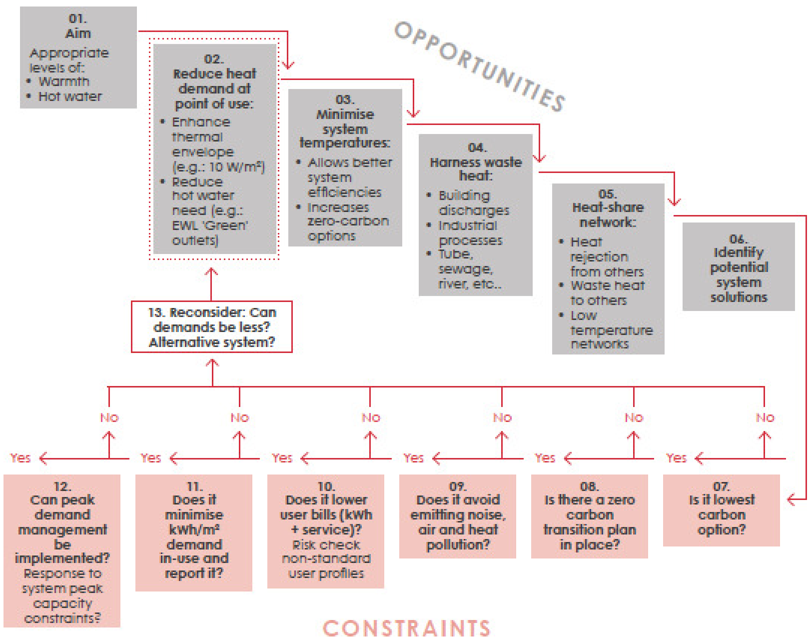
This approach ensures that the knowledge and expertise of each member of the design team was available from the outset. The goals for sustainable design were identified at this early stage and each element of the design was progressed accordingly.

De-carbonising heat energy is a multifaceted challenge and must be considered within a wider context than has previously been the case.

Heat for buildings can be derived from a wider range of alternative energy carriers and sources than is the case for many other energy-requiring sectors. This includes the use of waste heat, much of which is often produced within the building requiring the heat or heat available from other buildings close by.

Having investigated the 'opportunities' offered by the site, by harnessing building fabric enhancement, and by using all possible waste heat sources from the building and from the locality beyond the immediate site, a shortlist of possible heat systems should be tested against the constraints identified in the below Heat Decision Tree. For net zero carbon, systems fully dependant on natural gas and other fossil fuels are expected to be unsuitable.

The Heat Decision Tree below was utilized in the selection of appropriate heat generation technologies and highlights the broad range of issues that the heating system selection must address, including such non-carbon issues as avoiding higher energy bills for those least able to pay. Similarly, air quality issues, particularly in urban areas, are likely to preclude using predominantly combustion processes.



Several renewable and low carbon technologies were considered during the preliminary design process. Life cycle costing analysis and technical feasibility studies were conducted.

3.5 Combined Heat & Power

The inclusion of combined heat and power plant in any building scheme must be given very careful consideration due to the large capital costs involved and the potential risk of higher running costs than would be incurred if separate heating plant and grid electricity were used.

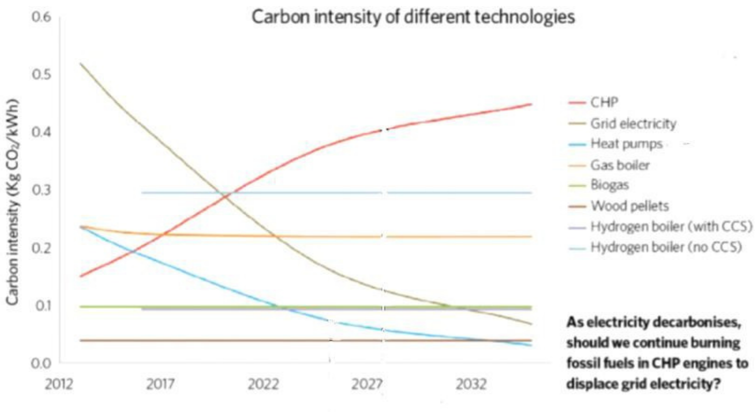
The most important consideration when designing CHP plant is to carefully assess both the heat load and the electrical load. A CHP installation will typically operate at approximately 80% combined efficiency. Approximately 60% of the useful output will be thermal energy with the remaining 40% being available as electric energy.

E.g. a CHP plant which consumes 100kWhrs of gas will produce approximately 80kWhrs of useful output. 50 kWhrs of this output will be available as thermal energy while the electric energy output will be 30kWhrs.

Given the proportion of thermal energy and electricity produced it is essential that the CHP plant is selected to meet the heat load of the building and not necessarily to meet base electrical loads.

The current electricity grid carbon intensity in Ireland (according to SEAI data available) is 330 gCO2/kWh. The ESB is currently targeting a 50% reduction in carbon intensity from 2020 status in 2030 and a carbon intensity of 38 gCO2/kWh is projected by SEAI for 2050.

As the grid carbon intensity decreases below approximately 300 gCO2/kWh, gas CHP leads to a net increase in carbon emissions as compared with heating using grid electricity / heat pumps. Given that the plant will operate for at least 20 years, it is important to account for the likely development of the grid carbon intensity over the lifetime of the plant. As noted above, Ireland's electricity grid is on a significant trend of decarbonisation over the period to 2030 and beyond, due to increased use of renewable sources (such as wind and bioenergy), meaning that a gas CHP plant installed in 2020 may lead to a net increase in carbon emissions for its lifetime.



Considering the above, CHP technology will not be included in this development.

3.6 Heat Pump Technology

The general principal of heat pump technology is the use of electrical energy to drive a refrigerant cycle capable of extracting heat energy from one medium at one temperature and delivering this heat energy to a second medium at the desired temperature. The basic thermodynamic cycle involved is reversible which allows the heat pump to be used for heating or cooling.

The efficiency of any heat pump system is measured by its coefficient of performance (CoP). This is a comparison between the electrical energy required to run the heat pump and the useful heat output of the heat pump, e.g. a heat pump requiring 1kW of electrical power in order to deliver 3kW of heat energy has a CoP of 3.0.

This operating principle can be applied to different situations, making use of the most readily available heat source on any given site. The most common types are:

- Ground Source
- Water Source
- Air Source

Water source heat pumps generally offer the highest CoP however they can be expensive to install and maintain and must have a source of water from a well, lake or river.

An initial technical and financial analysis of the technology has shown that they will not be suitable for use within the building. There are also concerns regarding the potential practical difficulties and programming implications of incorporating vertical boreholes on this specific site.
On a financial level, the significant increase in capital costs associated with the heat pumps and the associated boreholes is not considered to be justified by the potential savings that would be achieved.

Air source heat pump technology is a viable solution for this project. Locations for external condensers / central air to water heat pump have been located at roof level of the respective blocks. Heat pump technology being electrically driven is considered to be a compatible technology with a future net zero carbon considering the projected carbon intensity of the national electricity grid.

Heat Pump technology will be included in the development.

3.7 Bio-Mass Boilers

The use of bio-fuel in the form of wood chip or wood pellet can provide a realistic alternative to conventional fuels such as oil or gas. In terms of heat output, biomass boilers operate in exactly the same manner as conventional oil or gas fired boilers. There are, however, important differences to be considered.

The major drawback of a biomass heating system is the inconvenience associated with supply and storage of fuel, the increased maintenance of the boiler plant when compared to gas or oil-fired systems and the increased capital costs.

The advantage of the system, however, is the practically zero net carbon emissions associated with the combustion of wood products and the marginal cost savings which can be achieved.

When natural gas is available as a potential fuel source it is always very difficult to make a sound financial argument for the inclusion of biomass heating systems. The unit cost of wood pellet or indeed wood chip (although slightly cheaper than pellet) is generally only marginally less than the unit of cost of natural gas (less than 10%).

This marginal saving is typically offset by the increase in maintenance costs and is never sufficient to offset the increase in capital costs associated with this installation of the biomass systems.

Biomass technology will not be included in the development.

3.8 Solar Water Heating

Solar thermal collection uses of the sun's energy and transfers the heat generated to the building's domestic hot water supply. Two distinct types of collection panel are available. The evacuated tube array and the flat panel collector. The evacuated tube array is the more effective of the two as it is capable of generating approximately twice as much hot water from the same surface area of flat panel.

Solar thermal collection can deliver up to 50% of the total annual hot water load of a building but does require extensive roof area. Considering the form factor of the proposed buildings, there is limited roof area available to mount solar thermal arrays, as such solar thermal technology will not be included in the development.

3.9 Photovoltaic (PV) Panels

PV Panels are capable of generating direct current electricity from the sun's energy, which can then be converted to alternating current and used within the building. They are generally a "maintenance free" technology as there are no moving parts.

They also typically have a 20-year manufacturer's guarantee on electrical output and can be expected to operate effectively of 30 years or more. With the renewable energy requirement being achieved using heat pump technology additional renewables in the form of PVs will not be included.

3.10 Wind Turbines

Due to the urban nature of the site wind energy has not been considered.

3.11 Conclusions

Having identified heat pump technology as the preferred option for onsite renewable energy generation, site specific mechanisms for incorporating these technologies were evaluated and determined as outlined in Section 4 of this report.

SECTION 4.0 HEATING SYSTEM SOLUTIONS

4.1 Introduction

The use of current heat pump technology in different applications can maximize the renewable energy content of the development, in turn deliver heat at the lowest carbon intensity and minimise energy costs for occupants.

The following system has been used to obtain the results in this report.

4.2. DECENTRALISED – AIR TO WATER DOMESTIC HOT WATER HEAT PUMP, ELECTRIC HEATING, HEAT RECOVERY VENTILATION (DIMPLEX) + MVHR

4.2.1 Hot Water Generation

The heat pump unit has an integrated hot water cylinder incorporated in the frame and casing. The cylinder is heated by the Heat Pump. The cylinder is also fitted with an electrical immersion heater that is used to carry out timed high temperature purges to stop possible legionella growth in the cylinder. The cylinder is 630mm dia x 1460mm H with intake and exhaust duct connections required on top of the unit.

Figure 2. – Typical DHW Air to water Heat Pump

4.2.2 Ventilation

The ventilation to each apartment would be provided through a Mechanical Ventilation Heat Recovery unit, providing fresh air to normally occupied rooms and extract stale air for "wet" rooms.

4.2.3 Space Heating

Space heating is offset by direct electric radiators within each apartment.

4.2.4 Billing

Each apartment individually powers the heat pump unit contained therein and pay directly for energy consumed.

SECTION 5.0 BUILDING REGULATIONS & BER

5.1 Compliance Criteria

The residential units will be designed to comply with Building Regulations TGD L 2021 – Conservation of Fuel and Energy – Dwellings.

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Walls	0.18	0.6
Ground floors[3]	0.18	0.6
Other exposed floors	0.18	0.6
External doors, windows and rooflights	1.4[4,5]	3.0

Notes:
1. *The U-value includes the effect of unheated voids or other spaces.*
2. *For alternative method of showing compliance see paragraph 1.3.2.3.*
3. *For insulation of ground floors and exposed floors incorporating underfloor heating, see paragraph 1.3.2.2.*
4. *Windows, doors and rooflights should have a maximum U-value of 1.4 W/m^2K.*
5. *The NSAI Window Energy Performance Scheme (WEPS) provides a rating for windows combining heat loss and solar transmittance. The solar transmittance value g_{perp} measures the solar energy through the window.*

SECTION 6.0 INPUT DATA

It should be noted that this report and the accompanying calculations are based on preliminary information and a number of assumptions have had to be made at this stage. As the project progresses, the model will be refined when HOB is advised of changes to criteria set out in this report, and the results will be advised accordingly.

The DEAP software is used to calculate the BER of the building. Similar to the calculation to demonstrate compliance with Part L. This report and the accompanying calculations are based on the design information and the input data as detailed below.

The following input data was applied:

6.1. General Input Data

- Air permeability of 2.0 $m^3/m^2.h$
- Whole house mechanical ventilation with heat recovery
- SFP of 0.66 W/l/s
- 93% heat recovery efficiency
- Roof U-Value of 0.12 $W/m^2.K$ (on top floor apartments)
- Floor U value of 0.14 W/m2.k
- Wall U-Value of 0.16 $W/m^2.K$
- Glazing U-Value of 0.08 $W/m^2.K$ - 1.2 $W/m^2.K$
- Thermal bridging factor of 0.08
- 100% of lighting outlets to be low energy (LED)
- Medium thermal mass
- Landlord areas have been considered as heated (corridor & stair-core)
- Flow restrictor will be fitted to shower (flow rate: 6 liter/min)
- Low water usage – less than 125 liters/p/day

SECTION 7 RESULTS

[A] Below results are obtained by using detail from section 6.1 with a window U value of 0.08 W/m^2.K

Apartment Description	EPC	CPC	Rating	No. of PV Required
Block A				
A1-0002 – 2 bed- Level 00	0.26	0.252	A2	0
A1-0003 – 1 bed- Level 00	0.247	0.241	A3	0
A1-0005 – 1 bed- Level 00	0.287	0.278	A3	0
A1-0101 - 2 bed- Level 01	0.246	0.241	A2	0
A1-0103 – 2 bed- Level 01	0.249	0.248	A2	0
A1-0104 – 1 bed- Level 01	0.247	0.247	A2	0
A1-0106 – 2 bed- Level 01	0.252	0.247	A2	0
A1-0108– 2 bed- Level 01	0.231	0.225	A2	0
A1-0109 – 2 bed- Level 01	0.216	0.209	A2	0
A1-0110 – 1 bed- Level 01	0.218	0.214	A2	0
A1-0112 – 2 bed- Level 01	0.216	0.21	A2	0
A2-0103 – 1 bed- Level 01	0.235	0.231	A2	0
A2-0104 – 2 bed- Level 01	0.245	0.239	A2	0
A2-0109 – 3 bed- Level 01	0.217	0.209	A2	0
A2-0112 - 2 bed- Level 01	0.239	0.232	A2	0
A2-0113 – 2 bed- Level 01	0.246	0.241	A2	0
A2-0114 – 1 bed- Level 01	0.265	0.259	A2	0
A1-0401 – 2 bed- Level 04	0.258	0.252	A2	0
A1-0601 – 2 bed- Level 06	0.268	0.261	A2	0
A1-0603 – 2 bed- Level 06	0.288	0.281	A2	0
A1-0604 – 2 bed- Level 06	0.274	0.269	A2	0
A1-0605 – 2 bed- Level 06	0.236	0.232	A2	0
A1-0608 – 2 bed- Level 06	0.222	0.217	A2	0
A2-0702 – 1 bed- Level 07	0.24	0.237	A2	0
A2-0703 – 2 bed- Level 07	0.249	0.245	A2	0
A2-0714 – 2 bed- Level 07	0.244	0.238	A2	0
A2-0715 – 2 bed- Level 07	0.254	0.249	A2	0
A2-0716 – 2 bed- Level 07	0.285	0.279	A2	0
A2-0901 – 2 bed- Level 09	0.283	0.276	A2	0
Block B				
B1-0101 – 2 bed- Level 01	0.253	0.245	A2	0
B1-0102 – 3 bed- Level 01	0.289	0.278	A2	0
B1-0104 – 1 bed- Level 01	0.211	0.207	A2	0
B2-0101 – 2 bed- Level 01	0.226	0.22	A2	0
B2-0107 – 2 bed- Level 01	0.22	0.214	A2	0
*B2-0108 – 3 bed- Level 01	0.287	0.277	A2	0
B2-0109 – 1 bed- Level 01	0.256	0.251	A3	0
B1-0501 – 2 bed- Level 05	0.24	0.237	A2	0

B1-0502 – 3 bed- Level 05	0.238	0.232	A2	0
B1-0504 – 1 bed- Level 05	0.239	0.238	A2	0
B2-0501 – 2 bed- Level 05	0.237	0.235	A2	0
B2-0508 – 2 bed- Level 05	0.224	0.221	A2	0
B2-0509 – 3 bed- Level 05	0.265	0.258	A2	0
B2-0510 – 1 bed- Level 05	0.235	0.233	A2	0
B2-0609 – 2 bed- Level 06	0.27	0.266	A2	0
B2-0610 – 1 bed- Level 06	0.238	0.236	A2	0
B2-0701 – 2 bed- Level 07	0.231	0.226	A2	0
B2-0709 – 2 bed- Level 07	0.287	0.28	A2	0
B2-0710 – 1 bed- Level 07	0.259	0.255	A2	0
B1-0901 – 2 bed- Level 09	0.255	0.248	A2	0
B1-0902 – 3 bed- Level 09	0.286	0.276	A2	0
B1-0904 – 1 bed- Level 09	0.218	0.214	A2	0
Block C				
C1-0001 – 2 bed- Level 00	0.234	0.224	A2	0
C1-0002 – 1 bed- Level 00	0.218	0.213	A2	0
C1-0101 – 2 bed- Level 01	0.226	0.222	A2	0
C1-0102 – 1 bed- Level 01	0.237	0.236	A2	0
C1-0104 – 2 bed- Level 01	0.265	0.257	A2	0
C1-0105 – 3 bed- Level 01	0.285	0.275	A2	0
C2-0101 – 2 bed- Level 01	0.217	0.21	A2	0
C2-0102 – 2 bed- Level 01	0.237	0.229	A2	0
C2-0103 – 2 bed- Level 01	0.26	0.253	A2	0
C1-0204 – 2 bed- Level 02	0.242	0.238	A2	0
C1-0205 – 1 bed- Level 02	0.258	0.234	A2	0
C2-0201 – 2 bed- Level 02	0.228	0.224	A2	0
C2-0202 – 2 bed- Level 02	0.241	0.238	A2	0
C2-0203 – 2 bed- Level 02	0.247	0.245	A2	0
C2-0308 – 2 bed- Level 03	0.235	0.228	A2	0
C2-0310 – 3 bed- Level 03	0.283	0.273	A2	0
C2-0705 – 2 bed- Level 07	0.264	0.258	A2	0
C2-0706 – 2 bed- Level 07	0.259	0.253	A2	0
C2-0710 – 2 bed- Level 07	0.232	0.226	A2	0
C2-0714 – 1 bed- Level 07	0.268	0.262	A3	0
C2-0801 – 2 bed- Level 08	0.222	0.216	A2	0
C1-0801 – 2 bed- Level 08	0.226	0.219	A2	0
C1-1003 – 2 bed- Level 10	0.27	0.262	A2	0
C1-1102 – 3 bed- Level 11	0.288	0.278	A2	0
Block D				
D1-0103 – 2 bed- Level 01	0.237	0.231	A2	0
D1-0108 – 1 bed- Level 01	0.277	0.27	A3	0
D2-0102 – 1 bed- Level 01	0.215	0.211	A2	0
D1-0201 – 3 bed- Level 02	0.225	0.218	A2	0
D1-0204 – 2 bed- Level 02	0.243	0.24	A2	0

D1-0209 – 1 bed- Level 02	0.237	0.234	A2	0
D1-0210 – 2 bed- Level 02	0.225	0.219	A2	0
D2-0202 – 1 bed- Level 02	0.216	0.212	A2	0
D2-0207 – 2 bed- Level 02	0.221	0.214	A2	0
D2-0208 – 3 bed- Level 02	0.295	0.283	A2	0
D2-0212 – 1 bed- Level 02	0.283	0.276	A3	0
D2-0214 – 2 bed- Level 02	0.281	0.273	A2	0
D2-0508 – 3 bed- Level 05	0.268	0.258	A2	0
D2-0512 – 1 bed- Level 05	0.286	0.28	A3	0
D2-0514 – 2 bed- Level 05	0.26	0.255	A2	0
D1-0610 – 2 bed- Level 06	0.237	0.234	A2	0
D1-0613 – 1 bed- Level 06	0.2	0.198	A2	0
D2-0604 – 3 bed- Level 06	0.221	0.214	A2	0
D2-0605 – 1 bed- Level 06	0.277	0.271	A3	0
D2-0607 – 1 bed- Level 06	0.242	0.24	A2	0
D1-0701 – 2 bed- Level 07	0.24	0.233	A2	0
D1-0709 – 1 bed- Level 07	0.275	0.269	A3	0
D1-0710 – 2 bed- Level 07	0.23	0.225	A2	0
D1-0713 – 1 bed- Level 07	0.228	0.223	A2	0
D2-0705 – 1 bed- Level 07	0.283	0.278	A3	0
D1-0902 – 2 bed- Level 09	0.243	0.237	A2	0

*Note: Apartment B2-0108: North East window U value must be 0.08

[B] The Result below shows the apartments that are complaint with window U value 1.2 W/m^2.K (All other details are same as section 6.1)

Apartment Description	EPC	CPC	Rating	No. of PV Required
Block A				
A1-0112 – 2 bed- Level 01	0.225	0.215	A2	0
A1-0601 – 2 bed- Level 06	0.291	0.283	A2	0
A1-0604 – 2 bed- Level 06	0.295	0.290	A2	0
A2-0103 – 1 bed- Level 01	0.253	0.248	A2	0
A2-0715 – 2 bed- Level 07	0.267	0.262	A2	0
A2-0901 – 2 bed- Level 09	0.296	0.289	A2	0
Block B				
B1-0104 – 1 bed- Level 01	0.218	0.213	A2	0
B1-0904 – 1 bed- Level 09	0.224	0.22	A2	0
B2-0101– 2 bed- Level 01	0.24	0.234	A2	0
B2-0701 – 2 bed- Level 07	0.245	0.239	A2	0
Block C				
C1-0101 – 2 bed- Level 01	0.229	0.225	A2	0

C1-0104 – 2 bed- Level 01	0.259	0.255	A2	0
C1-0801 – 2 bed- Level 08	0.241	0.235	A2	0
C1-1003 – 2 bed- Level 10	0.29	0.281	A2	0
C2-0103 – 2 bed- Level 01	0.272	0.27	A2	0
C2-0203 – 2 bed- Level 02	0.262	0.259	A2	0
C2-0710 – 2 bed- Level 07	0.247	0.24	A2	0
C2-0801 – 2 bed- Level 08	0.234	0.228	A2	0
Block D				
D1-0108 – 1 bed- Level 01	0.295	0.287	A3	0
D1-0204 – 2 bed- Level 02	0.248	0.246	A2	0
D1-0210 – 2 bed- Level 02	0.237	0.231	A2	0
D1-0710 – 2 bed- Level 07	0.243	0.237	A2	0
D1-0902 – 2 bed- Level 09	0.26	0.254	A2	0
D2-0102 – 1 bed- Level 01	0.221	0.217	A2	0
D2-0514 – 2 bed- Level 05	0.278	0.273	A2	0

1. Minimum TGD L Requirements:

- EPC - 0.30
- CPC -0.35
- RER - 20%