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BUILDING ENERGY REPORT
FOR THE
RESIDENTIAL DEVELOPMENT
AT
STONEY HILL ROAD, RATHCOOLE, CO DUBLIN

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TABLE OF CONTENTS

1.0 INTRODUCTION

The purpose of the report is to provide a building energy statement outlining the energy performance of the proposed development and identifying the services and renewable design strategy for the proposed development to demonstrate compliance with the building regulations.

2.0 DESCRIPTION OF THE DEVELOPMENT

The development comprises of the demolition of 5 no. existing residential properties and associated outbuildings and will consist of the construction of a residential development of 204 no. units, comprising 151 no. houses (including duplexes) and 53 no. apartments. The houses comprise of 7 no. typologies with a total of 123 no. units with a mix of semi-detached and terrace units and with a breakdown of 111 no. 3 bed units and 12 no. 4 bed units. Typologies F, H, L and M are two storey, typologies D, G and K are two storey plus dormer windows. The duplex units comprise a total of 28 no. 3 storey units in a terrace arrangement with 10 no. two bed house units and 18 no. 3 bed house units, all below apartments at second floor level. The apartments above the duplex units comprise of 10 no. 2 bed units and 4 no. 3 bed units.

There are an additional 39 no. apartments in a single block to the north-west comprising of 10 no. 1 bed units, 23 no. 2 bed units and 6 no. 3 bed units located in a single four storey over basement/undercroft parking block (with a setback top floor) to the north-west of the application site. The basement for the apartment block includes 49 no. car parking spaces, 87 no. bicycle parking spaces, circulation, plant areas, refuse storage areas and other associated facilities. There are an additional 12 no. visitor bicycle parking spaces for the apartment block provided at surface level. Access to the apartment block is directly from Stoney Hill Road via a new access from an existing dropped kerb.

The development also includes 306 no. surface car parking spaces (total car parking provision of 355 no. spaces including 49 no. spaces at the apartment block), 169 no bicycle parking spaces (comprising of 99 no. spaces at basement and surface for the apartment block, 60 no. secure spaces for the apartments in the duplex units, and 10 no. visitor parking spaces at surface level), communal open space for the apartments, public open space including a children's playground and a linear park to the south of the site new vehicular entrances from Stoney Hill Road (one to the apartment building to the north of the site at Stoney Hill Road and a second to the remainder of the development further south on Stoney Hill Road), a separate pedestrian and cycle access adjacent to the existing roundabout on Stoney Hill Road to the north-west of the site, internal vehicular routes to include footpaths and cycleways, 3 no. ESB substations (including 1 no. integral to the apartment building), refuse/bin stores, public lighting, boundary treatment, provision of potential pedestrian/cycle linkages to Rathcoole Park to the north, drainage and civils works to facilitate the development, and all other associated and ancillary development/works. The total gross floorspace of the development described above is circa 23,042.73 sqm.

The proposed development also includes a 2 no. storey creche building of 639.2 sq.m plus an outdoor play area of 624.31 sq.m located on an existing undeveloped portion of the Peyton site located to the west of Stoney Hill Road. The creche includes 10 no. car parking spaces and 20 no. bicycle parking spaces. The crèche development includes all associated and ancillary works.

2.1 ENERGY STRATEGY

This report outlines the energy performance of the proposed new development and compare with the standards prescribed in the building regulations TGD Part L 2019. Based on the results of the provisional BER assessments it has been determined that the residential units shall achieve a minimum BER rating of 'A2'.

This is achieved through high levels of insulation and low fabric u values in the building design coupled with energy efficient lighting, good air tightness and a highly efficient heating system and renewables in each dwelling.

The apartment units have also been designed to meet the requirements set out in the "Sustainable Urban Housing: Design Standards for New Apartments" published in March 2018.

3.0 LEGISLATIVE BACKGROUND

3.1 BUILDING REGULATIONS – PART L

Technical Guidance Document Part L – Conservation of Fuel and Energy – Dwellings sets out the requirements for the minimum fabric and air permeability requirements, maximum primary energy use and carbon dioxide (CO_2) emissions as well as the minimum amount of energy derived from renewable sources, as calculated using the Domestic Energy Assessment Procedure (DEAP) methodology. The compliance with the requirements of this document is compulsory for all new dwellings.

Three design aspects demonstrate compliance:
1. The quality of building fabric
2. The limitation of primary energy use and CO_2 emissions
3. The use of energy from renewable sources

The current edition of the Building regulations "TGD-L 2019" was published in July 2019 and sets out the design requirements for Nearly Zero Energy Buildings (NZEB). In accordance with the requirements of The European Energy Performance of Buildings Directive Recast (EPBD) all new buildings must achieve the Nearly Zero Energy Building (NZEB) standard by 1st November 2019.

The table below outline the minimum fabric U value for each element for the construction of the houses and apartments as outlined in the Building regulations TGD-L 2019:

Maximum Building Fabric U-values

Building Fabric Element	**TGD-L 2019 / NZEB**
	U-value (W/m²K)
- Pitched Roof	0.16
- Flat Roof	0.20
- External Walls	0.18
- Ground Floor / Exposed Floor	0.18
- External doors, Windows, Rooflights	1.40
Air Permeability (Air Tightness)	5.0 $m^3/h\ m^2$ @ 50Pa

The table below outline the minimum energy values for the dwelling and apartments as outlined in the Building regulations TGD-L 2019:

Energy / Carbon Performance Targets

Element	**TGD-L 2019 / NZEB**
Maximum Permitted Energy Performance Coefficient (MPEPC)	0.300
Maximum Permitted Carbon Performance Coefficient (MPCPC)	0.350

Renewables	TGD-L 2019 / NZEB
Minimum Amount of Energy from Renewable Sources	20%

In addition, TGD-L 2019 set out the minimum requirements in relation to:

- Heating Appliance Efficiency
- Space Heating and Hot Water Supply System Control
- Insulation of Hot Water Storage Vessels, Pipes and Ducts
- Mechanical Ventilation systems

3.2 SOUTH DUBLIN COUNTY COUNCIL – DEVELOPMENT PLAN 2016 - 2022

The development is subject to the South Dublin County Council Development Plan 2016-2022. The following council policies have been considered as part of the proposed Energy strategy:

Climate Change

It is the **policy** of South Dublin County Council:

CORE STRATEGY (CS) Policy 8: It is the policy of the Council to support the implementation of the National Climate Change Strategy and the National Climate Change Adaption Framework Building Resilience to Climate Change 2012 through the County Development Plan and through the preparation of a Climate Change Adaptation Plan in conjunction with all relevant stakeholders.

Housing

It is the **policy** of South Dublin County Council:

HOUSING (H) Policy 11 - It is the policy of the Council to promote a high quality of design and layout in new residential development and to ensure a high quality living environment for residents, in terms of the standard of individual dwelling units and the overall layout and appearance of the development.

HOUSING (H) Policy 14 - It is the policy of the Council to ensure that all new housing provides a high standard of accommodation that is flexible and adaptable, to meet the long term needs of a variety of household types and sizes.

It is an **objective** of South Dublin County Council:

H11 Objective 1: To promote a high quality of design and layout in new residential development and to ensure a high quality living environment for residents, in terms of the standard of individual dwelling units and the overall layout and appearance of the development in accordance with the standards set out in Chapter 11 Implementation.

H11 Objective 2: To promote new residential developments taking account of energy efficiency, prioritising passive house construction standards, as well as renewable energy opportunities, including solar energy where appropriate, in accordance with Part L of the Building Regulations.

H14 Objective 1: To ensure that all residential units and residential buildings are designed in accordance with the relevant quantitative standards, qualitative standards and recommendations contained in Sustainable Urban Housing: Design Standards for New Apartments (2015), the Guidelines for Planning Authorities on Sustainable Residential Development in Urban Areas (2009), the companion Urban Design Manual and have regard to the standards and targets contained in Quality Housing for Sustainable Communities (2007), particularly the standards and recommendations that relate to internal amenity/layout, overall unit size, internal room sizes, room dimensions, aspect, sound insulation, communal facilities, storage, sustainability and energy efficiency.

H14 Objective 2: To support adaptable housing layouts that can accommodate the changing needs of occupants, through extension or remodelling.

Energy

It is the **policy** of South Dublin County Council:

Energy E Policy 1. It is the policy of the Council to respond to the European and National Energy Programme through the County Development Plan – with policies and objectives that promote energy conservation, increased efficiency and the growth of locally based renewable energy alternatives, in an environmentally acceptable and sustainable manner.

Energy E Policy 2. It is the policy of the Council to implement the recommendations of the South Dublin Spatial Energy Demand Analysis (SEDA) in conjunction with all relevant stakeholders, promoting energy efficiency and renewable energy measures across the County.

Energy E Policy 2. It is the policy of the Council to promote high levels of energy conservation, energy efficiency and the use of renewable energy sources in existing buildings.

ENERGY (E) Policy 4. It is the policy of the Council to ensure that new development is designed to take account of the impacts of climate change, and that energy efficiency and renewable energy measures are considered in accordance with national building regulations, policy and guidelines.

ENERGY (E) Policy 7 Solar. It is the policy of the Council to promote the development of solar energy infrastructure in the County, in particular for on-site energy use, including solar PV, solar thermal and seasonal storage technologies. Such projects will be considered subject to environmental safeguards and the protection of natural or built heritage features, biodiversity and views and prospects.

It is an **objective** of South Dublin County Council:

E2 Objective 2: To seek to reduce reliance on fossil fuels in the County by reducing the energy demand of existing buildings, in particular residential dwellings

E2 Objective 3: To promote the generation and supply of low carbon and renewable energy alternatives, having regard to the opportunities offered by the settlement hierarchy of the County and the built environment.

E2 Objective 7: To require, where feasibly practical and viable, the provision of PV solar panels in new housing and apartment builds, for electricity generation/storage and/or water heating, so as to reduce the long term energy/heating costs of residents living in such dwellings, to minimise carbon emissions and to reduce Ireland's dependency on imported energy derived from fossil fuels.

E3 Objective 1: To ensure that medium to large scale residential and commercial developments are designed to take account of the impacts of climate change, including the installation of rainwater harvesting systems and that energy efficiency and renewable energy measures are incorporated in accordance with national building regulations, policy and guidelines

E4 Objective 1: To ensure that medium to large scale residential and commercial developments are designed to take account of the impacts of climate change, including the installation of rainwater harvesting systems, and that energy efficiency and renewable energy measures are incorporated in accordance with national building regulations, policy and guidelines. E4

E4 Objective 2: To support the passive house standard or equivalent for all new build in the County.

E7 Objective 1: To encourage and support the development of solar energy infrastructure for on-site energy use, including solar PV, solar thermal and seasonal storage technologies. E7

E7Objective 2: To encourage and support the development of solar energy infrastructure for local distribution, including solar PV, solar thermal and seasonal storage technologies.

4.0 SUITABILITY OF ENERGY TECHNOLOGIES

TRADITIONAL HEATING TECHNOLOGIES		
Traditionally the following technologies were used to provide space heating and hot water for residential developments:		
<u>Direct Electric Heating</u> Direct acting electric heaters, with or without storage element, is used to provide space heating. Domestic hot water is generated in a hot water cylinder fitted with an electric immersion heater. While the capital cost of this solution is low, it cannot satisfy the requirements of the current Building Regulations – Part L. However, this solution may still be viable in certain applications (e.g. in a small, well insulated, mid-floor apartment), if supplemented with a suitable Renewable Technology as listed in the next section.	✘	Not deemed suitable as it would require a large amount of energy to be generated from renewable sources to offset poor primary energy efficiency of direct electric heating.
<u>Hydronic Heating using Boilers</u> Hydronic heating utilises water as the medium for transporting the heat energy from the heat source (boiler) to heat emitters (radiators). The boiler is fired with the fuel available on site, i.e. natural gas, LPG, heating oil, coal, wood. While this solution used to be the most widespread through the industry, it has its limitations in meeting the requirements of the current Building Regulations – Part L. Generally, it must be supplemented with one or more of the Renewable Technologies listed in the next section.	✘	Not deemed suitable as it would require a large amount of energy to be generated from renewable sources to offset relatively poor primary energy efficiency of individual gas fired boilers.
<u>Warm Air Heating</u> Combined heating and mechanical ventilation system using air as the medium for transporting heat. Rarely used in Ireland and more suitable for houses than apartments.	✘	Not deemed suitable for apartments.
<u>Communal Heating</u> A variation of the hydronic heating with the individual boiler in each replaced with a centrally located boiler(s) serving all dwellings. A Heat Interface Unit (HIU) installed in each dwelling provides control and metering of heat energy used in the dwelling. Communal heating benefits from improved efficiency of the central boilers over individual, often oversized boilers. It also creates an opportunity to introduce Renewable Energy Technologies that would not be viable at small scale, e.g. Biomass or CHP (Refer to the next Section).	✘	Not deemed suitable for a project of this scale.

RENEWABLE ENERGY TECHNOLOGIES

The use of renewable energy technologies is promoted and required by the Building Regulations Part L since 2005, gradually increasing with each revision of the Regulations, i.e. 2011 and 2019. The most current TGD-L 2019 for nearly Zero Energy Buildings (nZEB) require that at least 20% of building energy is derived from renewable sources.

There is a number of low & zero carbon technologies available that may be suitable for a development of this type.

Wind Power (micro turbines) Micro wind turbines are normally fitted to the roof of the building. They convert energy of wind into electricity. Typically, they provide small amounts of electrical energy.	✘	Not deemed suitable for a suburban location due to aesthetical and noise implications.
Wind Turbines A mast mounted wind turbine can generate significant amounts of electrical energy. However due to the physical size and clearances required from buildings or trees, they are suitable for sites with large open areas.	✘	Not deemed suitable for a suburban location due to size, aesthetical and noise implications.
Solar Photovoltaic Solar Photovoltaic (PV) collectors convert the energy of the sun into electricity that can be used within the household reducing the amount of electricity imported from the grid. PV collectors can be installed on the roof or integrated with external walls. While only up to 20% of the sun irradiation available is recovered, this energy form (electricity) comes with the flexibility of being suitable for many uses.	✓	Suitable. It is proposed to use Solar PV collectors on the roof for this project subject to further assessment at the detailed design stage.
Solar Thermal Solar Thermal collectors convert the energy of the sun into heat energy used to generate domestic hot water or/and contribute to the central heating. Typically, the collectors are installed on the roof, however certain types can be integrated with external walls without compromising on the solar energy yield. While the solar energy recovery rate of 70-80% is superior to that of PVs, the heat energy can only be used to heat water. Also, solar thermal systems require a certain level of maintenance in order to operate efficiently.	✘	Not deemed suitable due to complexity of the system and the required maintenance implications.
Biomass Fired Heating Biomass Fired Heating uses CO_2 neutral fuels (wood chips, wood pellets, straw) to generate heat energy for heating and domestic hot water. This technology requires a significant amount of space to accommodate boilers, fuel storage and transportation, fuel deliveries by trucks. It also required regular ash removal and a stepped-up maintenance regime. Generally suitable for large communal / district heating schemes only, where a frequent maintenance can be justified. To be fully sustainable, the fuel needs to be sourced locally. Also, while the CO_2 generated may be environmentally neutral, there are other emissions (NOx, smoke) that may not be suitable for urban sites.	✘	Not deemed suitable due to added complexity of the system, additional maintenance required. Also, implications in relation to the fuel deliveries and local emissions of CO_2, NO_x and particulates.

RENEWABLE ENERGY TECHNOLOGIES – CONTINUED		
<u>Combined Heat & Power</u> Combined Heat & Power (CHP) is a system that utilises an internal combustion engine to mechanically drive an electric generator and produce electricity. At the same time the waste heat emitted from the engine is utilised for space or hot water heating purposes, resulting in an improved overall energy efficiency over a traditional electricity generation in power plants. Generally suitable for communal / district heating schemes only.	✘	Not deemed suitable for a project of this scale.
<u>Geothermal / Ground Source Heat Pump</u> Ground Source Heat Pump (GSHP) utilise the natural heat of the ground. A refrigeration cycle is used to draw energy from the low-temperature medium (ground) and heat the higher-temperature medium (heating water). The amount of energy transferred is much higher than the amount of energy required to power the system. There are two general types of GSHP systems: with horizontal or with vertical collector. Horizontal collector comprises a large amount of piping installed below the ground, i.e. it may suitable for large open areas. Vertical collector comprises of piping coil in a deep borehole, i.e. it is more suitable where space comes at a premium.	✘	Not deemed suitable due to added complexity of the system and additional cost.
<u>Air Source Heat Pump</u> Air Source Heat Pump (ASHP) utilise the natural heat of the ambient air. A refrigeration cycle is used to draw energy from the low-temperature medium (air) and heat the higher-temperature medium (heating water). The amount of energy transferred is much higher than the amount of energy required to power the system. The energy efficiency of an ASHP is generally lower than that of a GSHP especially during the coldest weather, and it may require supplementation with electric heater at peak heat demand times, however such occurrences are not very often in the relatively mild climate in Ireland. The capital investment for an ASHP is lower than for a GSHP as the expensive ground collector required for the latter is not present.	✓	Suitable. It is proposed to use ASHP unit in individual heating systems subject to further assessment at the detailed design stage.
<u>Exhaust Air Heat Pump</u> Exhaust Air Heat Pump (EAHP) is a certain type of an ASHP which draws energy from the air being extracted from the house through the ventilation system. As the temperature of this air is constant throughout the year, the output and energy efficiency of an EAHP also stays constant, i.e. it is not affected by low ambient air temperatures. Another advantage of an EAHP is that it can help in ventilating the house with its constantly running fan. The downside of EAHPs is the limited output that is related to the ventilation requirements of the house – EAHPs are deemed suitable for relatively small and well insulated houses or apartments.	✓	Suitable. It is proposed to use EAHP unit in individual heating systems subject to further assessment at the detailed design stage.

RENEWABLE ENERGY TECHNOLOGIES – CONTINUED		
<u>Electric Heaters & Exhaust Air Heat Pump for Hot Water plus heat recovery ventilation and solar PVs</u> Exhaust Air Heat Pump (EAHP) is a certain type of an ASHP which draws energy from the air being extracted from the house through the ventilation system. This system consists electrical panel radiant heating for space heating and EAHP for hot water heating, with heat recovery ventilation and solar PV panels on the roof. This solution is deemed suitable for relatively small and well insulated houses or apartments.	✓	Suitable. It is proposed to use this system for the individual heating systems subject to further assessment at the detailed design stage.

5.0 BUILDING DESIGN

The apartment building and houses will be designed and constructed in accordance with the building regulations and best practices summarised as follows:

Fabric Insulation Values

The following target U-values have been adopted for the project:

Fabric	Target U Value	Building Regulations (U value)
Floor	0.18W/m^{2}K	(TGD-L 2019 max. = 0.18W/m^{2}K)
External walls	0.18W/m^{2}K	(TGD-L 2019 max. = 0.18W/m^{2}K)
Flat roof	0.16W/m^{2}K	(TGD-L 2019 max. = 0.16W/m^{2}K)
External doors and windows	1.40W/m^{2}K	(TGD-L 2019 max. = 1.40W/m^{2}K)

Air permeability

The target air permeability of 5.0m^3/h/m^2 is consistent with the maximum air permeability allowed under TGD-L 2019. This level or air permeability should be achievable by adherence to the BR Part L Acceptable Construction Details and monitoring during the construction.

6.0 BUILDING SERVICES SYSTEMS DESIGN

Energy technologies for this development shall be selected on the following basis:

- Operation strategy: individual vs communal
- Compliance with the Building Regulations – Part L 2019 (NZEB)
- Life-cycle cost

The selection of technologies will be confirmed at the detailed design stage, however it is envisaged that a combination of technologies shall be required to achieve building regulation compliance on the apartment development as follows:

a) Apartment Development

Heating system

Individual Exhaust Air Heat Pump subject to detailed design.

The apartments shall be heated by means of either underfloor heating or low temperature radiators / fan coil units. In addition, electrical radiant panel heaters shall be considered during the detailed design.

Heating controls in the apartments consists of a heating zone with individual time and temperature controls.

Domestic hot water

Domestic hot water shall be generated in every apartment with individual time and temperature controls.

Renewable Technologies

In order to demonstrate the compliance with the Building Regulations Part L, each apartment is required to have a portion of its energy requirements provided from a source of renewable energy.

In addition to heat pumps, additional Solar PV panels on the roof of the apartment building could be provided to ensure building regulation compliance subject to detailed design.

Ventilation

The ventilation solutions considered for the development are as follows:

a) Natural Ventilation + Intermittent Extract Fans
b) Continuous (Centralised or Decentralised) Mechanical Extract Ventilation
c) Balanced Whole House Mechanical Ventilation (with or without Heat Recovery)

Cooker extract hoods shall be installed in the Kitchens, extracting min. 30l/s.

Lighting

All lamps in the dwellings shall be provided with high energy efficiency lamps Class A CFL or LED.

External Lighting will be energy efficient and provided with LED type with photocell technology.

b) Housing Development

The selection of technologies will be confirmed at the detailed design stage however it is envisaged that a combination of technologies shall be required to achieve building regulation compliance on the housing development as follows:

Heating system

Individual Air Source Heat Pump or Exhaust Air Heat Pump subject to detailed design.

The houses shall be heated by means of either underfloor heating or low temperature radiators / fan coil units.

Heating controls in the dwellings consists of a heating zone with individual time and temperature controls.

Domestic hot water

Domestic hot water shall be generated in every dwelling with individual time and temperature controls.

Renewable Technologies

In order to demonstrate the compliance with the Building Regulations Part L, each dwelling is required to have a portion of its energy requirements provided from a source of renewable energy.

It is envisaged that the heat pump shall provide the renewables to ensure building regulation compliance subject to detailed design.

Ventilation

The ventilation solutions considered for the development are as follows:

d) Natural Ventilation + Intermittent Extract Fans

e) Continuous (Centralised or Decentralised) Mechanical Extract Ventilation

f) Balanced Whole House Mechanical Ventilation (with or without Heat Recovery)

Cooker extract hoods shall be installed in the Kitchens, extracting min. 30l/s.

Lighting

All lamps in the dwellings shall be provided with high energy efficiency lamps Class A CFL or LED.

External Lighting will be energy efficient and provided with LED type with photocell technology.