Varming Consulting Engineers Ltd.

ENERGY STATEMENT

PROPOSED RESIDENTIAL DEVELOPMENT AT TRUSKEY EAST, TRUSKEY WEST, FREEPORT AND AHAGLUGGER, BEARNA, CO. GALWAY

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PROPOSED DEVELOPMENT AT BEARNA

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1. Introduction

This report was produced to accompany a Strategic Housing Development Application and outlines the approaches being considered with regards to conservation of fuel and energy within the proposed development. Burkeway Homes Ltd are applying for planning permission to develop a site in Truskey East, Truskey West, Freeport and Ahaglugger, Bearna, Co. Galway, adjacent to the existing 'Cnoc Fraoigh' residential estate. The scheme comprises of residential dwellings along with a crèche facility. The residential element comprises of a combination of detached, semi-detached & terraced houses, duplex units and apartments. The breakdown of proposed dwellings are 52 No. houses, 36 No. duplex units and 33 No. apartments.

The proposed development will comply with TGD Part L 2017 *''Conservation of Fuel and Energy – Buildings other than Dwellings''* and TGD Part L 2019 *''Conservation of Fuel and Energy – Dwellings''* (NZEB). All buildings in the proposed development shall be designed and constructed so as to ensure that the energy performance of each building is such as to limit the amount of energy required for the operation of the building and the amount of carbon dioxide emissions associated with this energy use insofar as is reasonably practicable.

Detailed energy rating analysis will be performed on each of the dwelling houses in addition to the Crèche and internal landlord common areas. The range of measures & technologies being considered and intended energy efficiency targets are outlined in the following sections in order to achieve compliance with building regulations.

2. Building

In order to limit heat loss from the buildings, reasonable provision will be made to limit transmission heat loss through the building fabric itself. The energy performance of the structure will firstly be optimised through the selection of the components and materials making up the building envelope.

2.1. Opaque Elements

Proposed target levels of thermal insulation for each of the opaque elements of the building are specified in terms of area weighted average U-values in Table 1 for each element type. In order to demonstrate compliance with building regulations maximum backstop values from building regulations are also identified in this table for domestic and non-domestic building types.

Fabric Element	TGD L 2019 Domestic U-value (W/m^2K)	TGD L 2017 Non-Domestic U-value (W/m^2K)	Minimum Target U-value (W/m^2K)	Compliant
Pitched Roof	0.16	0.16	0.11	✓
Flat Roof	0.20	0.20	0.15	✓
Walls	0.18	0.21	0.18	✓
Ground Floors	0.18 (0.15 with underfloor heating)	0.21 (0.15 with underfloor heating)	0.14	✓
Other Exposed Floors	0.18	0.21	0.16	✓

Table 1: Opaque Element Area Weighted Average Elemental U-value Targets

2.2. Windows & Doors

Proposed target levels of window and door thermal performance are specified in terms of area weighted average U-values in Table 2 for each element type. In addition solar transmittance values of glazing will be selected to avail of heat gain where practical without incurring overheating issues. In order to demonstrate compliance with building regulations maximum backstop values from building regulations are also identified in this table for domestic and non-domestic building types. The use of high performance triple glazed windows will also be considered in any buildings with large ratios of glazing.

Fabric Element	TGD L 2019 Domestic U-value (W/m²K)	TGD L 2017 Non-Domestic U-value (W/m²K)	Minimum Target U-value (W/m²K)	Compliant
External doors	1.4	1.6	1.2	✓
Windows	1.4	1.6	1.3	✓
Roof lights	1.4	1.6	1.3	✓

Table 2: Window & Door Area Weighted Average Elemental U-value Targets

2.3. Thermal Bridging

To avoid excessive heat losses at building junctions, reasonable care will be taken by the design team to ensure continuity of insulation and to limit local thermal bridging at key junctions, e.g. around windows, doors, other wall openings and at junctions between elements.

Both the residential and commercial elements of the development will be designed to achieve low thermal bridging values throughout. It is intended that thermal bridging values will be determined from the results of numerical modelling carried out by a member of an approved thermal modellers scheme or equivalent for all key junctions. A minimum Y-value of ≤ 0.08 W/m²K is to be achieved for all dwellings.

3. Ventilation

Appropriate ventilation improves the air quality in a building which is important for both the building and occupant's health. As airtightness levels of buildings are constantly improving due to newer more stringent regulations, ensuring that there is adequate purpose designed ventilation is vitally important in order to maintain indoor air quality and minimise the risk of condensation or mould growth.

3.1. Ventilation Method

In order to provide sufficient controlled ventilation the following ventilation system technologies are being considered for use in the dwelling units of the proposed development:

Balanced Whole House Mechanical Ventilation with Heat Recovery

A mechanical ventilation with heat recovery system continuously extracts moist, stale and polluted air from the wet rooms of a dwelling such as bathrooms, utility rooms and kitchens. This air passes through a heat exchanger which recovers and retains the heat that would otherwise be lost from the extracted air. This heat is then transferred to incoming fresh, filtered air that the unit is resupplying back into habitable rooms such as bedrooms and living rooms, resulting in minimal heat losses and a more comfortable indoor environment. To meet increased extract requirements from time to time the system has a boost function which increases the air flow in the system as necessary. On activation of the boost function the system shall go into boost mode for a set period of time and reverts back to general ventilation mode automatically once this time has elapsed. MVHR systems will be complete with high efficiency plate heat exchangers. Figure 1 shows a basic graphic representation of a MVHR system.

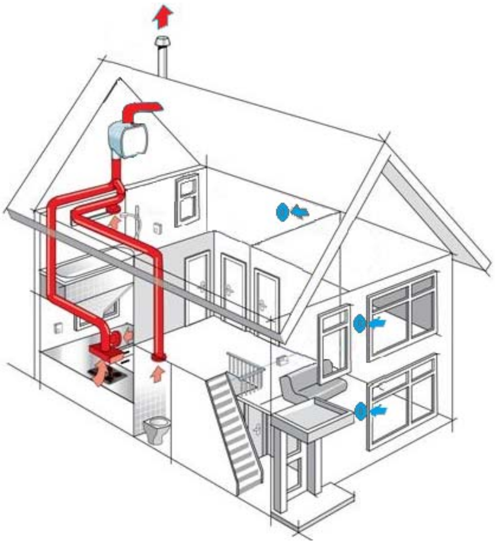
Whole House Mechanical Extract Ventilation

A centralised mechanical extract system continuously extracts moist, stale and polluted air from the wet rooms of a dwelling such as bathrooms, utility rooms and kitchens. This air is exhausted directly to external via a centralised extract fan. Supply air is provided via wall vents into habitable rooms such as bedrooms and living rooms. To meet increased extract requirements from time to time the system has a boost function which increases the air flow in the system as necessary. On activation of the boost function the system shall go into boost mode for a set period of time and reverts back to general ventilation mode automatically once this time has elapsed. Demand controlled variations of this system are also available which regulate the amount of airflow through the system based on humidity levels within a dwelling. Figure 1 shows a basic graphic representation of a MEV system.

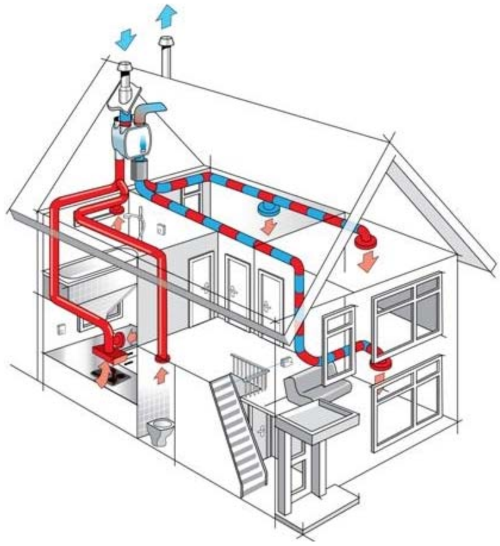
In order to provide sufficient controlled ventilation the following ventilation system is being considered for use in the crèche and internal landlord common areas of the proposed development:

Natural Ventilation

The crèche and internal landlord common areas are intended to be naturally ventilated at this stage. Appropriate background and purge ventilation facilities will be provided as outlined in TGD Part L 2017.



Whole House Extract Ventilation



Balanced Whole House Mechanical Ventilation with Heat Recovery

Figure 1: Dwelling Ventilation Methods under Consideration

3.2. Structural Air Tightness

To avoid excessive heat losses, reasonable care will be taken by the design team to limit the air permeability of the envelope of each building. High levels of infiltration can contribute to uncontrolled ventilation, therefore infiltration does not provide adequate ventilation. Appropriate details and performance specification will be developed by the design team to ensure continuity of the air barrier.

Building Type	TGD L 2019 Domestic Airtightness $m^3/(hr/m^2)$	TGD L 2017 Non-Domestic Airtightness $m^3/(hr/m^2)$	Minimum Target Airtightness $m^3/(hr/m^2)$	Compliant
Houses	< 5	-	3	✓
Apartments	< 5	-	2 – 3	✓
Crèche	-	< 5	3	✓
Landlord Common Areas	-	< 5	3	✓

Table 3: Upper Limit Air Permeability Targets

It is intended that air pressure testing will be performed on all buildings throughout the proposed development site. Proposed target levels for structural air permeability are specified in Table 3 for each building type. In order to demonstrate compliance with building regulations upper limit values from building regulations are also identified in this table for domestic and non-domestic building types. Air permeability pressure tests for each building will be carried out by a member of an approved air tightness testers scheme or equivalent.

3.3. Cooking

Mechanical extract cooker hoods will generally be provided above the hob surface in each dwelling. Proposed hoods will be recirculation type which are fitted with charcoal filters in order to eliminate unwanted cooking odours. Correct maintenance procedures will be provided to home owners.

4. Space Heating

Efficient space heating systems & controls will ensure greater levels of comfort for occupants and reduced energy use. As the thermal performance of building envelopes is constantly improving due to newer stringent regulations, space heating system loads are reducing which subsequently requires careful consideration and selection of appropriate systems to meet these requirements sufficiently.

4.1. Heat Source

Space heating sources will be selected on the basis of their suitability to provide efficient space heating while supporting the transition away from reliance on fossil fuels.

The following space heating technologies are being considered for use in the Houses:

Air Source Heat Pumps

An air source heat pump extracts heat from the external air, increases it to a higher temperature via a compressor and then transfers this heat to the hydronic space heating system via a heat exchanger. The heat pump system uses a refrigeration cycle which has a very low boiling point and therefore heat can be extracted from external ambient air even at extremely low external air temperatures. Heat pump systems are designed to run for extended periods of time to ensure that they perform well and operate most economically. Figure 2 shows a basic graphic representation of an air source heat pump system.

Electric Fires

Wall mounted electric fires are proposed for living rooms in order to provide a secondary heat source in dwelling houses. Fires will be capable of providing a flame effect only or a heat output if required.

The following space heating technologies are being considered for use in the Apartments:

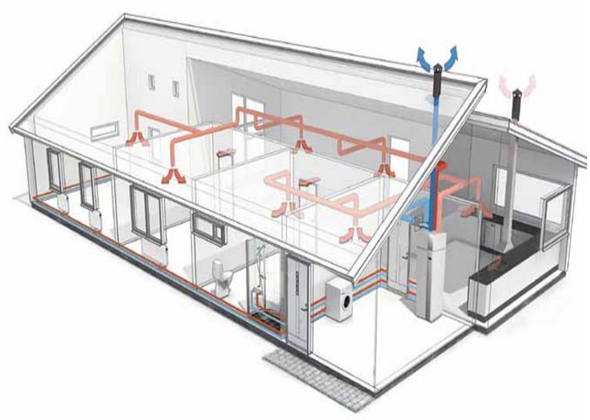
Electric Panel Heaters

Direct electric wall mounted panel heaters provide heat by means of convection. Each heater incorporates a user interface with integrated time control function and a room thermostat to control the heat output.

Exhaust Air Heat Pumps

An exhaust air heat pump extracts heat from the exhaust air of a building through a ducted system, increases it to a higher temperature via a compressor and then can transfer this heat to the hydronic space heating system or ducted supply air system as necessary. The heat pump element of the system uses a refrigeration cycle which has a very low boiling point and therefore heat can be extracted from air even at low temperatures. Heat pump systems are designed to run for extended periods of time to ensure that they perform well and operate most economically. Figure 2 shows a basic graphic representation of an exhaust air heat pump system.

Air Source Heat Pump System



Exhaust Air Heat Pump System

Figure 2: Dwelling Space Heating Methods under Consideration

The following space heating technologies are being considered for use in the landlord common areas:

Electric Panel Heaters

Direct electric wall mounted panel heaters provide heat by means of convection. Each heater incorporates a user interface with integrated time control function and a room thermostat to control the heat output.

4.2. Controls

Space heating temperature control will generally be provided on the basis of a minimum of two independent zones in dwellings. Room thermostats will be located in each zone in conjunction with a seven day time control facility.

4.3. Heat Emitters

Heat emitter types which are deemed suitable for the space heating systems outlined have been assessed. The following heat emitter types, are being considered for use in the Houses of the proposed development:

- Underfloor Heating
- Steel Panel Radiators

The following heat emitter types are being considered for use in the Apartments of the proposed development:

- Electric Panel Heaters
- Steel Panel Radiators

The following heat emitter types are being considered for use in the internal landlord common areas of the proposed development:

- Electric Panel Heaters

4.4. Pumps and Fans

All pumps and fans used in the heating & ventilation systems outlined will be low energy consumption type. Circulator pumps will have energy efficiency index ratings as per EU regulations.

5. Water Heating

Efficient water heating systems & controls will ensure availability of hot water on demand for occupants and reduced energy use. As the thermal performance of building envelopes is constantly improving due to newer stringent regulations, water heating system loads are increasingly becoming the most significant portion of a dwellings heating demand. This subsequently requires careful consideration and selection of appropriate systems to meet these requirements sufficiently.

5.1. Heat Source

Water heating sources will be selected on the basis of their suitability to provide efficient hot water production while supporting the transition away from reliance on fossil fuels. Hot water storage vessels shall have minimal standing losses.

The following water heating technologies are being considered for use in the Houses:

Air Source Heat Pumps

An air source heat pump extracts heat from the external air, increases it to a higher temperature via a compressor and then transfers this heat to the domestic hot water cylinder system via a heat exchanger. The heat pump system uses a refrigeration cycle which has a very low boiling point and therefore heat can be extracted from external ambient air even at extremely low external air temperatures. Heat pump systems are designed to run for extended periods of time to ensure that they perform well and operate most economically.

The following heat source technologies are being considered for use in the Apartments:

Heat Pump Cylinder

A heat pump cylinder is an air source heat pump that extracts energy from the external air via an intake duct, increases it to a higher temperature via a compressor and then transfers this heat to the domestic hot water cylinder system via a heat exchanger. The resulting cooled air is returned to external via an exhaust duct. Heat pump systems are designed to run for extended periods of time to ensure that they perform well and operate most economically.

Exhaust Air Heat Pumps

An exhaust air heat pump extracts heat from the exhaust air of a building through a ducted system, increases it to a higher temperature via a compressor and then can transfer this heat to the domestic hot water cylinder. The heat pump element of the system uses a refrigeration cycle which has a very low boiling point and therefore heat can be extracted from air even at low temperatures. Heat pump systems are designed to run for extended periods of time to ensure that they perform well and operate most economically.

5.2. Controls

The domestic hot water system will have independent time and temperature control, including a hot water cylinder thermostat and time control to optimise the time taken to heat the water. Controls will include an auxiliary heating regime to 60°C or more for disinfection purposes.

5.3. Water Usage

In order to reduce water usage and subsequent hot water demand the use of low-flow water services fittings (push- type percussion spray taps and aerated shower heads) and low consumption sanitary fittings will be reviewed. In addition the use of flow restrictors where available for water services fittings will be considered.

6. Lighting

Each building will be fitted with high performance energy efficient light fittings, such as LEDs. LED lighting consumes the least amount of power while providing the highest light output, and is therefore the most efficient source of artificial light. Combined with a long lifespan this minimises whole life costs and reduces the carbon footprint of each home. LED technology results in 30-35% reduction in electrical energy usage over the CFL equivalent

Intelligent lighting controls in the form of presence detectors shall be used in internal landlord common areas to ensure that lighting is not in operation when areas are not in use.

The design of the building façades will allow high levels of natural daylight to enter into occupied zones.

7. Renewable

As outlined in building regulations it is intended that a significant portion of the energy consumption to meet the energy performance of each building, will be provided by renewable energy sources. For dwellings 20% of the total primary energy consumption must be provided from renewable energy technologies, in order to achieve compliance. For non-domestic buildings, if the BER target is achieved with no extra over margin than 20% of the building's energy use must be provided by renewable energy technologies. Alternatively if the BER target is achieved with a minimum of 10% margin, then only 10% of the building's energy use must be provided by renewable energy technologies. In order to achieve the 10% margin, the building envelope, lighting and M&E specification will likely have to be improved above minimum requirements outlined. This is known as the renewable energy ratio (RER).

7.1. Renewable Energy Source

The following renewable energy technologies are being considered for use in the Houses:

Air Source Heat Pumps

The air source heat pumps proposed for space & water heating systems are considered a renewable energy technology because they produce more energy than they consume. The renewable contribution is calculated based on the heating & hot water demand provided by the heat pump less the energy consumed by it.

The following renewable energy technologies are being considered for use in the Apartments:

Heat Pump Cylinder

The heat pump cylinder proposed for water heating systems are considered a renewable energy technology because they produce more energy than they consume. The renewable contribution is calculated based on the hot water demand provided by the heat pump cylinder less the energy consumed by it.

Exhaust Air Heat Pumps

The exhaust air heat pumps proposed for space & water heating systems are considered a renewable energy technology because they produce more energy than they consume. The renewable contribution is calculated based on the heating & hot water demand provided by the heat pump less the energy consumed by it.

The following renewable energy technologies are being considered for use in the landlord common areas:

Photovoltaic Panels

Photovoltaic systems utilise roof mounted panels to generate electricity which is either utilised in the building or exported to the grid. Photovoltaic panels convert solar radiation into electricity which in turn is connected into the main electricity system in a building. PV panels are used to either reduce the EPC and/or to provide the renewables contribution as necessary.

8. Building Energy Rating Results

8.1. Software Tool

In line with building regulations requirements an energy assessment procedure will be performed for each building in order to ensure compliance is achieved. A dwelling energy assessment procedure will be performed for each dwelling in the development. DEAP 4.2.0 is the web-based tool which will be used for carryout out this assessment and producing domestic building energy ratings. A non domestic energy assessment procedure will be performed for the crèche and landlord internal common areas in the development. IES Ltd, Virtual Environment v7.0.12, SBEMIE v5.5.h.1 is the software tool which will be used for carryout out this assessment and producing non-domestic building energy ratings. Provisional assessments will be carried out prior to commencement of the development on site in order to ensure full compliance is achieved for each building type.

8.2. BER Targets

Expected target results of the DEAP 4 assessment for typical building types are outlined in Table 4, based on the specifications outlined above. The exact specification, including technologies used, will be determined at detailed design stage. To demonstrate that an acceptable primary energy consumption rate has been achieved, the calculated Energy Performance Coefficient (EPC) of a building should be no greater than the Maximum Permitted Energy Performance Coefficient (MPEPC). To demonstrate that an acceptable CO2 emission rate has been achieved, the calculated Carbon Performance Coefficient (CPC) should be no greater than the Maximum Permitted Carbon Performance Coefficient (MPCPC).

Building Type	Rating	Energy (EPC)	Carbon (CPC)	Renewable (RER)	Compliant
Houses	BER A2	< 0.3	< 0.35	> 0.20	✓
Apartments	BER A2 BER A3	< 0.3	< 0.35	> 0.20	✓
Crèche	BER A3	< 1.0	< 1.15	> 0.20	✓
Landlord Common Areas	BER A2 BER A3	< 1.0	< 1.15	> 0.20	✓

Table 4: Target Building Energy Rating Results