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1 INTRODUCTION

The Castlelost Flex Gen Ltd Plant will comprise five (5no.) open cycle gas turbine (OCGT) electrical generating units, totalling approximately 275MWe (megawatts electrical), ancillary plant, buildings and infrastructure. The Plant designed to operate intermittently and provide generating capacity during periods of high demand or when renewable energy cannot meet demand.

An OCGT unit consists of a turbine connected to an electric power generator and the five (5No.) turbines are designed to operate independently of each other. The turbines are designed to burn natural gas as their primary fuel. OCGT units are advantageous due to their operational flexibility and can be turned on quickly to provide peak load. Two bunded tanks will be provided on site for the storage of gas oil (diesel) as a secondary fuel in accordance with the Commission for Regulation of Utilities (CRU) requirements. The turbines will be capable of being converted to the combustion of green hydrogen as a fuel in the future which will allow for carbon free and climate-neutral plant operation.

2 PROCESS DESCRIPTION

The main components of the LEL Flexgen Castlelost project are as follows:

- 5no. open cycle gas turbine (OCGT) modules - complete with lube oil coolers, generators, air intake vents, continuous emissions monitoring technology, and c.30m high stacks,
- 1no. two-storey administration building (32.615m long x 13m wide x 9.33m high) which contains a control room, offices, storage, meeting room workshop and double height warehouse,
- 2no. 2,400m^3 capacity bunded secondary fuel storage tanks (each with a diameter of 17.6m and height of 10m),
- 1no. fuel pump and filter unit,
- 1no. containerised water treatment module (12.192m long x 2.438m wide x 2.896m high),
- 1no. 10m^3 purified water storage tank (2.75m high and 2.27m diameter),
- 2no. containerised black start diesel generators (2.438m wide x 12.192m long x 2.896m high) with integrated stacks (4.755m high),
- Fire pump skid building,
- 1no. 500m^3 capacity water tank,
- 1no. single storey IPP building,
- 1 no. low voltage (LV) bunded house transformer,
- 5no. LV/MV voltage (MV) bunded step-up transformers

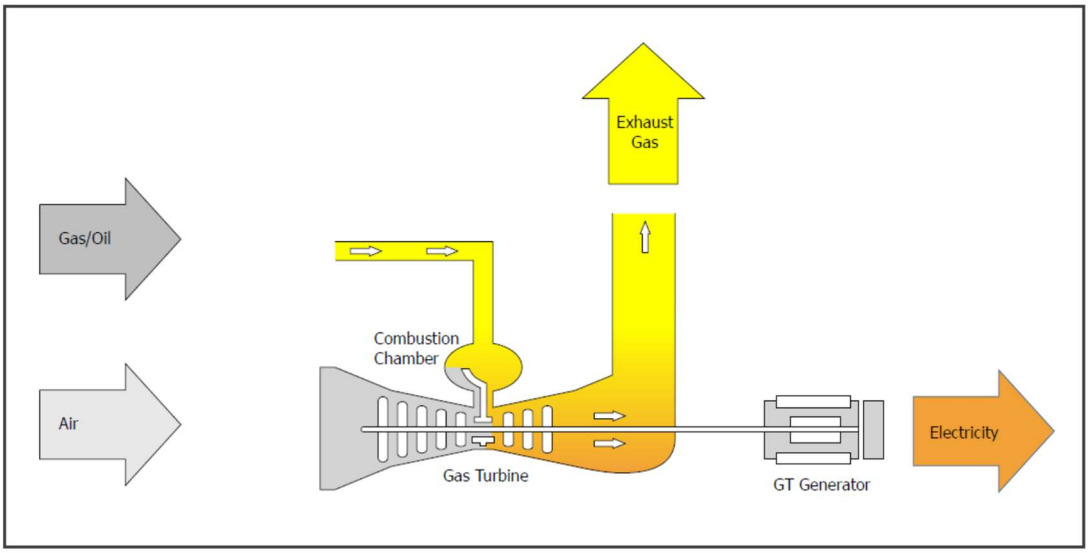
- 1no. high voltage (HV) customer compound containing 3no. bunded transformers connected to electrical equipment,
- 1no. air compressor building, and
- All ancillary engineering works to provide for the connection of site services and for the treatment and disposal of foul wastewater and surface water.

To provide for the development, a new entrance to the licensed site from the R446 will be constructed. The new private laneway will serve the Castlelost Flex Gen Power Plant (subject licensable activity), an above ground gas receiving station and a gas insulated switchgear (GIS) substation. Gas Networks Ireland (GNI), as the designated competent authority, will separately manage the process of delivering the underground gas transmission pipeline to the proposed AGI (including route selection) The GIS substation will be owned by ESB Networks in their role as Transmission Asset Owner (TSO).

2.1 OCGT units

Combustion turbines in open cycle (or simple cycle) configuration utilise a single thermodynamic cycle called the Brayton cycle. In the Brayton cycle, the working fluid (e.g., air) is compressed, heated, expanded through a turbine to turn the shaft (rotor) and then be discharged. The shaft drives the generator to produce electricity and the compressor to provide a continuous source of compressed air to the combustor. The combustion turbine exhaust gas, at slightly above atmospheric pressure, flows through an emissions control system before discharging into the atmosphere.

Figure 2.4 Open Cycle Process



OCGT units are advantageous due to their operational flexibility and can be turned on quickly to provide peak load. The LEL Flexgen Castlelost reserve generator is designed to

get to full load in less than 10 minutes. OCGTs exhaust residual heat to atmosphere at a temperature of approximately 544°C, i.e., unlike combined cycle gas turbines (CCGTs) where exhausted heat is recycled to generate steam and ultimately additional electricity. The OCGT units have a typical energy efficiency of >39%.

The main emissions from the combustion of natural gas in the OCGT units are oxides of nitrogen (NO and NO_2, collectively referred to as NOx), carbon monoxide (CO), and particulate matter (PM). The proposed OCGT units are fitted with dry low NOx combustion (DLN), a technology that uses staged combustion and lean-premixed fuel-air mixtures. Particulate emissions (PM_{10} and $PM_{2.5}$) is controlled through the use of best combustion practices and the sole use of natural gas fuel. Best available control technology for particulate emissions from combustion sources is the use of natural gas. In addition, particulate emissions would be further limited by the use of a high-efficiency inlet air filtration system, which would remove particulates in the ambient air prior to entering the combustion turbine generator processes. The exhaust stacks will be fitted with continuous emissions monitoring systems (CEMS) which continuously sample the stack concentrations of controlled emissions to assure that the exhaust parameters remain within permitted parameters (EPA licence). Following air dispersion modelling it was determined that these should be c.30m in height to facilitate emissions dispersion.

2.2 Secondary Fuel (gas oil)

The proposed OCGT units are dual fuel units which, in accordance with CRU requirements, are capable of also operating on gas oil (diesel). In the highly unlikely event of an outage to the natural gas supply and its availability on site, the plant needs to be able to run for 72 hours continuously on secondary fuel. Therefore, the project design includes for storage of secondary fuel in two above ground tanks (capacity of 4,800m^3) within a bunded structure enabling the plant to run on at least 90% of rated capacity for three days.

2.3 Black Start Generators

The secondary fuel store will also be used to serve two black start generators. The black start generators are provided to mitigate a system wide electricity outage. In this instance the black start generators are provided to serve house load so that the OCGT units can be started-up and fired and quickly provide electricity to the transmission system. One OCGT unit would be fired first (on gas) and this would then provide electrical output (including house load or parasitic load) and assist with starting the other 4no, OCGT units, if required.

The plant itself will consume approximately 10-15MW of the total output (house load) depending on operating configuration. Power is required to power auxiliaries such as gas

compressors, pumps and fans, cooling units, control systems, and general facility loads including lighting, heating, and air conditioning.

2.4 Transformers

Transformers will be located outdoors and will be the oil immersed design type. All transformers will be bunded and the high voltage (HV) transformers will be blast protected. It is proposed to install medium voltage (MV) and low voltage (LV) transformers Administration /Control Room.

From the control room, the plant operator monitors and operate the facility, via the plant's 'Distributed Control System'. The system gives operators both audible and visual signals to keep them informed of plant conditions at all times and to determine when preventative maintenance is required.

The ground around external plant components such as the stock yard and HV transformer compound will be covered with stone chippings to facilitate natural drainage. Internal roads within the licensable site will be paved with asphalt /tarmac.

2.5 Process Wastewater

No significant process wastewater will be generated during the operational stage. Any process effluent arising will be minimal (e.g., waste oils during maintenance activities) and will therefore be contained locally prior to be disposed of at an appropriately licensed facility.

2.6 Chemicals Storage

Small volumes of chemicals will be stored on site during the operational stage of the project. These chemicals (stored in volumes of less than 1,000 litres) will be secured and stored in a designated bunded area within the administration /warehouse building (e.g., lubricants, coolant oils for transformers and chemicals for the water treatment. However, given the technology (DLE) and low demand requirements of process water required, it is expected that <1,000 litres of each of sulphuric acid (96%) and sodium hydroxide (30%) volumes will be stored within the administration /warehouse building.

2.7 Fire Fighting Water

In case of fire the firefighting water will be supplied to the system (ring main) via the above-ground water storage tank (500m^3 capacity). In the event of a fire, firefighting

wastewater will drain and be held in below ground tank. The contaminated water will be subsequently tested and appropriately disposed of.

2.8 Surface Water Treatment

Large external areas/compounds at the site will be surfaced with stone to allow rainwater to percolate to the underlying soils (e.g., HV transformer compound, stock yard and AGI).

Surface water collected from impermeable areas will be delivered to the site stormwater drainage system. Surface water will be routed via the fire wastewater retention tank and an oil/water interceptor which provides for attenuation before being infiltrated to ground. During times when chemicals are handled, isolation valves will be closed. This is to assure that accidently spilled chemicals do not enter the storm water drain. The isolation valves will only be opened again once it has been assured that contamination of the downstream system can be excluded. The drainage system on site will be further developed as part of detailed design stage works.

2.9 Demin Water Treatment Unit

A package solution for the treatment of water to produce demineralised water will be located on site. The OCGT technology proposed is dry low emission (DLE) and therefore process water requirements are very low. A limited volume of process water (mainly for cleaning) will be required.

2.10 Foul Wastewater

Foul wastewater, which comprises wastewater other than process wastewater and surface water, will be treated in a proprietary package treatment system and infiltrated to ground.

2.11 Emissions

2.11.1 Air (Stack)

The principal sources of emissions to atmosphere are the Gas Turbines which will burn natural gas to generate electricity. Minor sources of emissions are the diesel generators which will provide emergency energy needs and which will also be used when cold-starts of the turbines are required. There are five gas turbines and 2 emergency generators.

The most significant potential impacts are emissions of combustion gases such as CO, SO_2 and NO_2 from the gas turbines and associated back up and emergency units.

Sulphur dioxide emissions originate from the sulphur in the fuel used in the combustion process. Since natural gas is the principal fuel to be used sulphur dioxide emissions will be negligible for normal operating conditions. Nitrogen oxides are also present in the emission stream as a result of the combustion process. Much of the emissions are in the form of nitrogen oxide (NO) which is expected to be substantially oxidised to nitrogen dioxide in the atmosphere. Nitrogen oxide emissions from sources using natural gas as fuel are significantly lower than the emissions associated with other fuels. For the Flexgen project, low emission DLE burners will be employed which reduces the nitrogen oxide emissions.

Particulate matter and carbon monoxide may also arise from the combustion process in the emission stream but only in minor amounts. Again, natural gas is a very clean fuel and particulate emissions are predicted to be very low.

There is the potential for a number of greenhouse gas emissions to atmosphere which may give rise to CO_2 emissions.

There is a requirement to run the turbines using gas oil to ensure that there is always a guaranteed energy supply and emissions to atmosphere from the use of gas oil are the same as those associated with natural gas combustion. Emissions when using gas oil will be slightly higher for sulphur dioxide since there is a higher sulphur content in the fuel.

The potential emissions to atmosphere include particulates (including fine particulate matter PM_{10} and $PM_{2.5}$), nitrogen oxides (NO_x), nitrogen dioxide (NO2), sulphur dioxide (SO_2), carbon monoxide (CO), carbon dioxide (CO_2), water vapour. The pollutants of particular concern include NO_2 and NO_x, and SO_2 all of which have specific standards to be achieved, and it is these pollutants that are modelled to assess the impact of emissions from the combustion plant on air quality in the vicinity of the development.

Table 2.1 ELVs under Gas Operation

Source	Parameter	BAT ELV	
A2-1 A2-2	Carbon Monoxide	42mg/Nm^3 [Note 1]	Average Annual
A2-3 A2-4	Nitrogen oxides as NO_2	37mg/Nm^3	Average Annual
A2-5		50 mg/Nm^3	Max Daily

Air Emission Limits (ELVs) under back up Fuel Operation Mode (Gas Oil) are proposed in Attachment 7-4-1 (emission to air main)

[1] For plants with a net electrical efficiency (EE) greater than 39 %, a correction factor may be applied to the higher end of this range, corresponding to [higher end] × EE/39, where EE is the net electrical energy efficiency or net mechanical energy efficiency of the plant determined at ISO baseload conditions

2.11.2 Noise

A noise assessment was completed as part of the proposed planning application to Westmeath County Council and updated as part of this licence application. This survey indicated that the noise contribution of the facility will meet the limits set out in NG4, and no mitigation will be required. The plant design includes for noise abatement controls and measures in accordance with BAT. Control measures include the following:

- The plant has been designed to ensure the impacts of noise have been minimised.
- Equipment will be inspected and maintained per manufacturers requirements and is managed through the stations work management system.
- Nonessential activities are avoided during night-time.
- Plant doors will be kept shut where possible to limit the noise impact on nearby dwellings.
- The gas turbine enclosure will provide noise attenuation for the gas turbine.
- Air intake silencer will be included in the combustion air inlet system of the gas turbine.
- Exhaust silencer and ductwork is included in the exhaust stack.
- Sound attenuation will be applied in other areas where required.
- Appropriate location of equipment and buildings – equipment where possible is stored internally to prevent noise emissions during operation.
- An EMS Procedure in relation to Noise.

It is proposed to monitor noise at three sensitive receivers. Propose noise limit values are outlined in Table 2.1.

Table 2.2 Proposed Noise Limits

Monitoring point code	Easting	Northing	Monitoring point type	Proposed Noise Limit Criteria				Proposed monitoring frequency
				Max. noise level daytime dB $L_{Ar,T}$ (30 mins)	Max. noise level evening dB $L_{Ar,T}$ (30 mins)	Max. noise level night dB $L_{eq,T}$ (15-30 mins)	How was the noise limit derived?	
N1	245484	239152	Noise Sensitive Location	55	50	45	NG4	Annual
N2	245575	239629	Noise Sensitive Location	55	50	45	NG4	Annual

Monitoring point code	Easting	Northing	Monitoring point type	Proposed Noise Limit Criteria				Proposed monitoring frequency
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N3	244962	239250	Noise Sensitive Location	55	50	45	NG4	Annual

2.12 Operating Hours

The plant is designed to be operated as a reserve gas fired plant (open cycle gas turbine). The proposed hours of operation for the Castlelost Flex Gen Limited plant are 24-hours per day, seven days per week, subject to availability (unconstrained operation). Because the required expected numbers of operating hours is unknown (the plant is designed to react generate power during periods of high demand), modelling of emissions was undertaken under various scenarios. These included (i) normal (1,000 hours per year), (ii) worst case #1 (full time operation across an annual period on natural gas) and (iii) worst case #2 (full time operation across an annual period on gas oil (diesel). This was undertaken to demonstrate that unconstrained operation of the plant (as required by the grid operator) does not result in Air Quality Standards being exceeded. The emission modelling undertaken clearly demonstrates that unconstrained operation does not give rise to any significant adverse impact on human health or on ecosystems as a result of the emissions.

However, it is expected that the operational period for the plant will be non-continuous and it is expected the plant will operate during peak periods such as mornings and winter evenings (the plant is designed as OCGT rather than CCGT). The plant will normally be unmanned and will be remotely operated. Regular site visits and inspections will take place to ensure the site is appropriately managed and maintained in accordance with EPA requirements. The site will also seek ISO 14001 certification and will be regularly audited by external auditors.