3 Description of the Development

3.1 Introduction

This chapter of the EIS provides the background to the proposed development, and details all the elements of the power plant. It gives a description of the development site and surrounding area, describes the technology of the proposed development, and identifies the principal plant components, processes and materials consumed. It also describes both the construction and operational phases of the project and the provisions for decommissioning. This chapter is divided into the following sub-sections:

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3.2 Existing Environment

3.3 Principal Design Objectives

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3.6 Plant Components

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- *Large Combustion Plant Directive (LCPD) 2001/80/EC*
- *National Emissions Ceiling (NEC) Directive 2001/81/EC*
- *Kyoto Protocol*
- *Greenhouse Gas Emissions Trading Directive 2003/87/EC*

3.13 Decommissioning of Plant

3.2 Existing Environment

The proposed development site is located at Derrygreenagh, Co. Offaly approximately 2.2 km south of Junction 3 on the M6 motorway for Rhode and Rochfortbridge. The site is located on the R400 road as shown on Figure 1.1 *Site Location.* The proposed development site is located on a "mineral island" with the Drumman and Derryarkin cutaway peatlands to the east and west, respectively.

The mineral island consists primarily of the existing Bord na Móna Derrygreenagh works and Bord na Móna Energy Headquarters with a small area of privately owned agricultural land at the southern extent of the mineral island, which lies outside the proposed development boundary. The buildings and structures on the existing site are detailed in Figure 3.1 *Existing Site Layout*. The Bord na Móna Works operations consist primarily of the repair and modification of machinery used for the harvesting and transport of peat from the nearby bogs. There is a narrow gauge railway also traversing the site. The operations associated with the Bord na Móna Works have been scaled back over the last number of years due to reduced peat production in the areas surrounding the site following the closure of the Rhode peat fired power plant. The existing operations at the Derrygreenagh site will be relocated prior to the construction of the power plant. To the west of the R400 there is currently a pilot biofuel processing facility which will be removed prior to the commencement of the proposed development. All existing buildings on the site will be removed prior to the construction of the proposed power plant.

The topography of the site is generally flat, but to the south of the site beyond the current buildings, the ground level rises by *c.* 5m towards the cutting in which the narrow gauge railway is located. To the south of the cutting the ground level rises by a further 1m and the ground gently rises towards the south-west corner where a water storage tank is positioned.

Near the eastern boundary of the site the ground profile changes so that the cutting disappears and this is the location where the access road through the buildings crosses the railway line to reach the southern section of the site.

The majority of the site is comprised of made ground with sections of mixed acid grassland at the southern and western side of the site. The north-east corner of the site is the only significant area of peat where the ground is very soft.

All land to be used for the proposed development is in the full ownership of Bord na Móna. The proposed development occupies a total area of 25.4 ha. The site occupies an area of 22.8 ha with the main site occupying an area of 17.5 ha and the adjacent switchyard site on the western side of the R400 roadway, occupying 5.3 ha. The proposed discharge pipeline to the Yellow occupies an area of 2.6 ha. Refer to Figure 3.2 a-f *Site Layout* for the extent of the development area.

The nearest town to the proposed development site is Rochfortbridge, Co. Westmeath which is c. 4 km north east of the site whilst Rhode, Co. Offaly is c. 6 km south west of the site - see Figure 1.1 *Site Location.*

Derrygreenagh and the surrounding areas are characterised by very low density residential development mainly comprising of scattered one off housing and farmhouses. The closest dwelling is located approximately 1.1 km to the south east of the site on the Knockdrin road -see Figure 3.3 *Local Road Network and the Nearest Sensitive Receptors*. The one off housing on this roadway represents the most significant concentration of residents in proximity to the site. There are 7 residential houses on this road within a 2 km radius of the site. Further individual one off housing is also present along a link road from the Knockdrin Road to the R400, along the length of the R400, particularly in the vicinity of Rhode, and on the northern end of the road approaching the M6 motorway. In total there are 19 residential houses within 2 km of the proposed development site.

The main businesses in the vicinity of the proposed development are peat harvesting, which currently occurs to a limited extent on the bogs surrounding Derrygreenagh, with associated activity which occurs at the Derrygreenagh site as discussed above. There are also a number of quarries in the area with three quarries within 2 km of the site. Bord na Móna and Cement Roadstone Provinces have a joint venture company which operates a gravel quarry to the northwest and a sand quarry to the northeast of the site. The other quarry to the southwest of the site is privately owned. Coillte has leased a number of areas of cutaway peatlands from Bord na Móna which are planted with coniferous forestry. The other primary economic activity in the area is grazing based agriculture which occurs to the immediate south of the site and further a field on mineral based soils beyond the extent of the peat lands. See Figure 3.4 *Land Use in the Vicinity of the Proposed Development Site*.

The road network is dominated by the nearby M6 motorway, which is part of the major inter-urban route between Dublin and Galway. 2.2 km north of the site Junction 3 connects the M6 to the R400 road. Access to the proposed development site is via the R400 regional road which links Rochfortbridge to Rhode via the M6 intersection - see Figure 3.3 *Local Road Network and the Nearest Sensitive Receptors*. To the south of the site the Knockdrin road links the R400 road to Garr and Castlejordan.

3.3 Principal Design Objectives

BNME intends to develop a c. 430 MW Combined Cycle Gas Turbine (CCGT) unit and a c. 170MW Open Cycle Gas Turbine (OCGT) unit at the proposed power plant development at Derrygreenagh, Co. Offaly. The CCGT unit will be designed to operate on natural gas as the primary fuel. The back-up fuel will be 0.1% sulphur distillate with a 5 day on-site storage capacity equating to approximately 8,100 m^3 as required by the Secondary Fuelling Obligation which is a condition of the Licence to Generate issued by the Commission for Energy Regulation (CER).

The OCGT unit will be designed to operate either on 0.1% sulphur distillate or on natural gas as the primary fuel. There will be a 3 day on-site storage capacity for distillate, equating to approximately 3,600 m^3 to meet secondary fuelling obligations. Total storage capacity for distillate fuel on the site, allowing for an operating margin, will be 15,000 m^3. The primary objectives of the proposed development are to:

- Sell electrical power through the EirGrid high voltage transmission system.
- Provide a flexible power plant capable of responding on a daily basis to variations in electricity demand and the variability of supply from wind based electricity generation.
- Provide a peaking plant in order to provide reserve capacity and also to meet peak electricity demand, with the capability to turn on and off at short notice.
- Increase the installed capacity of the electrical generating plant in Ireland by 2012, to meet the anticipated increase in system demand and the reduction in installed oil fired generation capacity resulting from the anticipated closure of aging plant on the system.
- Reduce the proportion of greenhouse gas emissions per MWh of electricity generated by the use of high efficiency plant, thus contributing to Ireland's objectives in complying with its obligations under the Kyoto protocol.
- Provide an efficient power generation facility at Derrygreenagh where efficiencies will result from significant synergies, in terms of the construction, operation, maintenance and the procurement of fuels, in operating two types of power generating units on a single site.

The new power plant development will use the latest technology gas turbine units to meet the above objectives. The OCGT unit will operate as a reserve/peaking plant with anticipated running of approximately 200 - 500 hours per annum and an expected long-term availability of 98%. The CCGT unit will typically operate on a two shift basis with anticipated annual running hours in the range 4,000 – 6,000 hours per annum and with an expected long-term availability of 92%.

The contract to supply and construct the plant will be by open international competition. The exact plant output and layout cannot be specified at this stage without prejudice or favour to a particular manufacturer. The result of a tendering process will be the award of a contract for a particular model of gas turbine. However, the performance of the chosen plant will be required to comply with the environmental objectives as presented in this EIS in order to ensure a minimal negative impact on the receiving environment. Consideration of the environmental impacts as presented in this EIS are on the basis of the largest size of plant envisaged for the site with an assumption that maximum emissions from the plant would occur.

3.4 Main Features of the Project

The plant layout has been designed in accordance with BAT Guidance Note: *Reference Document on Best Available Techniques for Large Combustion Plants, (adopted July 2006)* for the production of energy.

Natural gas supplied from the BGN pipeline will be the primary fuel for the CCGT unit with either natural gas or distillate being the primary fuel for the OCGT unit. The electrical power generated will be exported to the high voltage transmission grid.

Two configurations for the CCGT unit are possible. The "single shaft" arrangement consists of gas turbine, steam turbine and generator arranged on a single shaft or power train. The alternative "multi-shaft" option would comprise a gas turbine and steam turbine each with its own dedicated generator. It is anticipated that the smaller layout single shaft option will be employed for the proposed plant. Consequently, the layouts included with the planning application are based on a "single shaft" arrangement. However, it should be noted that the typical "single-shaft" layout and arrangement of CCGT units differs from the "multi-shaft" layouts only marginally in size and arrangement of smaller auxiliary components. See Figure 3.5 *Schematic of the CCGT Unit* for a schematic showing the elements of a CCGT unit.

The OCGT configuration for the plant will be a single turbine and generator arranged on a single shaft or power train. A schematic for the OCGT unit is presented in Figure 3.6 *Schematic of the OCGT Unit.*

3.5 Plant Design

The CCGT unit will incorporate the following process:

- A gas turbine burning natural gas will drive a generator for electricity production.
- Exhaust gases from the gas turbine will pass through a heat recovery steam generator (HRSG) to generate high-pressure steam.
- The steam generated in the HRSG will drive a steam turbine, which will also drive the generator to provide additional electrical power.

The proposed power plant development will employ the most recently developed CCGT technology in compliance with all relevant international codes.

The OCGT unit will incorporate the following process:

- A gas turbine burning gas or distillate will drive a generator for electricity production.
- Exhaust gases from the gas turbine will be released directly to atmosphere through an exhaust stack.

The proposed unit will employ the most recently developed OCGT technology in compliance with all relevant international codes.

3.6 Plant Components

The principal components in this project will include the items listed below. Reference to the location of each item on the site is detailed in the list below, by reference to Figure 3.2 a-f *Site Layout*. I.e. Gas Turbine Generators (GTC's): Item 2, refers to item 2 on Figure 3.2 a-f *Site Layout.*

- Gas Turbine Generators (GTGs): Item 2.
- Heat Recovery Steam Generator with exhaust stack (HRSG): Item 7.
- Steam Turbine Generator (STG): Item 4.
- Air Cooled Condenser (ACC): Item 8.

- Distillate storage tanks, (15,000 m^3): Item 30.
- Water treatment plant: Item 16.
- Chemical storage tanks: Items 15, 20, 21, 22 & 37.
- Water storage tanks: Items 17 &18.
- Process waste water discharge tank: Item 23.
- Surface water attenuation tank: Item 44.
- Foul water package treatment system: Item 51.
- Above Ground Gas Installation (AGI): Items 61 -65.
- Transformers: Item 11.
- Fire protection system: Item 40.
- Eirgrid substation: Item 14.
- Building structures to house main plant as described above.
- Workshop / stores building: Items 36, 37 & 38.
- Administration building: Item 39.
- Control buildings/ rooms: Item 43.
- Internal roads and parking (operational phase): Item 35 and roads throughout site.

3.7 Processes and Facilities

3.7.1 Combined Cycle Process

The combined cycle process consists of two thermodynamic cycles, the *Brayton* and *Rankine* cycles working together to produce electricity as efficiently as possible, hence the name combined cycle.

The first cycle comprises a gas turbine and an electrical generator coupled together on a single shaft, which rotates at high speed. The gas turbine consists of a compressor section, a combustion chamber and a turbine section. Air is drawn in through an intake filter, compressed and fed into the combustion chamber where fuel is injected and ignited. The resulting hot combustion gases (1,300^{o}C) passing through the turbine section rotate the shaft driving the compressor and the electrical generator to produce the rated electrical power output. The expansion of the hot gases through the turbine, and the extraction of mechanical work from them, via the turbine, reduces the temperature of the gases to approximately 600^{o}C at the exit of the gas turbine.

Operation of a gas turbine as described above is referred to as open or simple cycle mode. However, it is possible to generate approximately 50% more electricity from the hot exhaust gases by using them to produce steam which is used in a steam turbine generator. The steam is raised by passing the hot gases through a Heat Recovery Steam Generator (HRSG), where the heat is transferred to water flowing in the HRSG wall tubes. This process reduces the temperature of the exhaust gases down to approx 100 ^{o}C on exiting the HRSG. The gases are discharged to the atmosphere via an exhaust gas stack located at the outlet of the HRSG.

The high pressure steam produced in the HRSG is supplied through inter-connecting pipework to the steam turbine which is coupled to the same generator as the gas turbine, hence the term 'single shaft', further driving the generator to produce more electricity. The steam is expanded in the steam turbine down to vacuum conditions to extract as much energy as possible and is then fed to the Air Cooled Condenser (ACC) where it is condensed back to water and fed back to the HRSG to generate more steam thus conserving water in a closed cycle. This is the Rankine thermodynamic cycle and the two cycles working together form the 'Combined Cycle Process' to convert as much energy as possible from the fuel input into electrical energy. The electricity generated is fed to a transformer where the voltage is stepped up to transmission voltage.

High purity demineralised water, used as feed water for the HRSG / Steam Turbine water-steam cycle, is produced in the water treatment plant, and stored on site prior to use in three tanks with a combined storage capacity of 21,000 m^3. This capacity is sufficient to provide for injection water to the gas turbines for NO_x emissions control purposes while firing on distillate. Raw untreated water will be stored in a storage tank with a capacity of 3,500 m^3 prior to being fed to the water treatment plant.

The low-pressure steam exiting from the steam turbine is condensed before returning to the HRSG where it is converted to high pressure and temperature steam. This low-pressure steam must be cooled and converted back to water or "condensate" in the ACC in order to pump it back to the HRSG, as it is not possible to pump steam. Therefore the condensing process requires large quantities of cold air to cool the steam to condensate.

Air Cooled Condensers do not include a cooling water circuit. In the air cooled configuration the steam is ducted to a large array of tubes located at some distance from the steam turbine. Air is forced through the finned condenser tubes by an array of electrically driven forced draught fans. Heat is transferred from the steam to the air, effectively condensing the steam to hot water or "condensate". Air cooled condensers are typically arranged in "A" frames and occupy a considerable amount of the site area. They have the significant advantage over wet or hybrid cooling towers of not requiring any cooling water consumption and not giving rise to visible water vapour plumes.

3.7.2 Open Cycle Process

The open cycle gas turbine process operates on the Brayton thermodynamic cycle in order to produce electricity. Air for the gas turbine is drawn in from the atmosphere across an intake filter where it enters the compressor. The air is then compressed through a number of compressor stages to the final pressure required for combustion. Upon exiting the compressor the compressed air enters the combustion chamber where it is mixed with fuel, either natural gas or distillate. The energy contained in the fuel-air mixture is released through the process of combustion with the resulting hot combustion gases expanding through a turbine. This provides the mechanical power to drive the turbine compressor section and the attached electrical generator, where it is converted to electrical energy. The exhaust gases exiting the gas turbine are discharged to atmosphere via an exhaust stack.

The OCGT unit may run on distillate fuel for a significant proportion of the time, depending on the availability of natural gas at an economically viable price for the operating regime of this unit. Firing the unit on distillate raises the issue of controlling Nitrogen Oxide (NO_x) emissions to atmosphere as stipulated in the *Large Combustion Plant Directive* (88/609/EC) as amended by *Directive 2001/80/EC*. The control of NO_x emissions is discussed in detail in the next section.

3.7.3 Nitrogen Oxide (NO_X) control

Combustion in gas turbines has traditionally employed a diffusion flame where fuel is sprayed into the centre of an air stream. Fuel mixes with the air by turbulent diffusion and the flame temperatures can exceed 1,400 ^oC. The hot combustion gases are cooled by dilution with excess air to temperatures acceptable to the combustor walls and turbine blading.

Nitrogen oxides (NO_x) are formed at high temperature by the dissociation of the oxygen (O_2) molecule and the action of the monoxide ($O^\cdot$) radical on molecules of nitrogen. At temperatures above 1,500^oC, NO_x is formed from nitrogen in the atmospheric air used in the combustion process, the product being denoted *Thermal* NO_x. Initial attempts to reduce NO_x introduced a heat sink in the flame by injecting water, with the aim of reducing average combustion temperature to below the threshold for thermal NO_x formation. However, the process required large quantities of pure water to avoid corrosion of the turbine blading or deposition and blocking of cooling air holes by impurities.

The high costs of the systems detailed above provided the incentive for equipment suppliers to explore the use of non-stoichiometric mixtures to reduce flame temperature in so-called dry low-NO_x (DLN) systems. If fuel and air are mixed before combustion in a "*pre-mix flame*", the combustion temperature, and therefore the NO_x formed, is a strong function of the fuel–air ratio. By using a lean fuel / air mixture the rate of NO_x formation can be significantly reduced.

For low NO_x production the primary fuel / air mixture is very lean. Therefore, in order to ensure stable and efficient combustion, a pilot flame and various geometric arrangements are employed to maintain ignition of the main mixture. This Dry Low NO_X technology can only be employed when the unit is fired on natural gas. Given that the unit can be dual fuelled; a diffusion flame is employed with water injection when it is fired on distillate.

3.7.4 Plant Efficiency

The efficiency of a power plant is defined as the proportion of primary energy input which is converted to electricity. Typical efficiencies for OCGT units range from 33% to 36%, and from 54% - 58% for CCGT units. Most of the losses for the OCGT unit will be through heat rejection through the emission stack to the ambient air. Most of the heat loss for the CCGT unit will be via the ACC from the low-pressure steam to the ambient air. The remainder of the overall cycle losses can be accounted for as both mechanical and electrical losses within the plants.

The units will employ Best Available Technique (BAT) technology recognised as being the most advanced for power production at the scale proposed. The high overall efficiency of the CCGT unit will lead to lower specific emissions to the environment generally compared to any other form of conventional thermal power plant.

3.7.5 Plant Facilities

(i) Above Ground Installation (AGI)

Natural gas will be supplied from the Bord Gáis Networks (BGN) gas network at a minimum guaranteed pressure of 19 barg and 15°C. The design maximum pressure of the BGN gas pipeline is 70 barg. The gas will pass through a gas conditioning plant located in the AGI compound on the site which will comprise:

- Liquid and dust separator.
- Dew point heater / boiler unit.
- Gas compressor.
- Filter separator.
- Pressure reducing station.
- Electrical switch room / control room.

(ii) Gas Turbine Generator (GTG)

The GTGs for the two units will essentially comprise a multi-stage axial-flow compressor section with movable inlet guide vanes, a combustion chamber with several burners, and a multi-stage axial-flow turbine section. Distillate and natural gas will be burned using air from the air compressor. The hot gases will pass through the turbine blades. Mechanical energy will be converted to electrical energy in the electrical generator coupled to the gas turbine. The exhaust gases will pass to the HRSG in the CCGT unit, and will exit to atmosphere in the OCGT unit.

(iii) Heat Recovery Steam Generator (HRSG)

The CCGT unit will utilise a heat recovery steam generator (HRSG). Exhaust gases from the gas turbine will be used to produce the high-pressure steam which will feed a steam turbine. The cooled exhaust gas will then be expelled to the atmosphere via a 50 metre high stack. The HRSG is typically of a multi-pressure type, which allows the maximum mechanical energy to be extracted from the steam in the steam turbine.

(iv) Exhaust Gas Stack

For the CCGT unit a 50 metre high stack will be provided to release the exhaust gases to the atmosphere. The OCGT unit will be provided with a 40m high stack. Chapter 8 *Air Quality and Climate* provides an assessment of the impact from exhaust stack emissions.

(v) Back-up fuel

The CCGT unit will use natural gas as its primary fuel. The OCGT unit will be fuelled either by natural gas or by distillate depending on the relative costs of the delivered fuels and the commercial conditions prevailing in the electricity market. There is a condition in the Licence to Generate issued by the Commission for Energy Regulation, which requires certain generators to maintain a minimum quantity of back-up fuel on the site. This condition is known as the Secondary Fuel Obligation. This obligation applies to all gas turbine generating units.

The Secondary Fuel Obligation for a peaking plant requires the plant operator to maintain a quantity of secondary fuel equivalent to 72 hours running at maximum output. This equates to approximately 3,600 m^3 of distillate for the OCGT unit in the proposed development.

The Secondary Fuel Obligation for a unit that will operate more than 2,630 hours per annum requires the plant operator to maintain a quantity of secondary fuel equivalent to 120 hours running at 90% of maximum output. This equates to approximately 8,100 m^3 of distillate for the CCGT unit in the proposed development.

Total storage capacity for distillate fuel on the site, allowing for an operating margin, will be 15,000 $m^{3.}$ Distillate will be stored in three vertical cylindrical steel tanks, within a 110% capacity bund to comply with IPPC licence requirements. The bund will be constructed in accordance with *CIRIA Report 163 "Construction of bunds for oil storage tanks" and BS8007:1987, Code of practice for design of concrete structures for retaining aqueous liquids*). The distillate will be delivered to site by road tankers.

The quantity of distillate to be stored on site accords it a lower tier Seveso designation under Council Directive 96/82/EC on the control of major accident hazards involving dangerous substances as amended by Directive 2003/105/EC, commonly referred to as the Seveso II Directive. The Seveso II Directive has been brought into force in Ireland by the *European Communities (Control of Major Accident Hazards Involving Dangerous Substances) Regulations 2006 (S.I. No. 74/2006),* In accordance with the requirements of this regulation, in regard to a lower tier site, the Health & Safety Authority (HSA) will be notified at least six months prior to commencing construction of the facility and a Major Accident Prevention Policy (MAPP) will be prepared prior to commencement of operation of the facility. The requirements of the Seveso II Directive are described in *Section 3.12.2 - Seveso II Directive.*

(vi) Steam Turbine Generator (STG)

The steam turbine will be of a multiple cylinder type suitable for direct coupling to the two-pole generator for power generation at 50 Hz. The thermal energy of the steam generated by the HRSG will be converted to mechanical energy in order to drive a generator to produce electrical power. The low-pressure exhaust steam will flow radially out of the steam turbine to the air cooled condenser. The generator will be a synchronous unit, and will comply with all conditions of the all-island Grid Code.

(vii) Air Cooled Condenser (ACC)

The low pressure exhaust steam will pass through the finned condenser tubes over which cooling air is passed via forced draught fans. Heat is transferred from the low-pressure steam to the air by forced convection, condensing the steam to water or condensate.

(viii) Mechanical Auxiliary Plant

Condensate from the ACC is pumped through a series of feed-heaters to a de-aerator vessel, from where it is pressurised using high-pressure pumps, and returned to the HRSG where the overall cycle restarts.

(ix) Water Treatment Plant

An on site water treatment plant will be required, where water for use in the HRSG will be demineralised to achieve a high purity. The water treatment process will consist of filtration, and either a resin based or a Reverse Osmosis and Electro De-ionisation (EDI) based treatment system. pH adjustment will be provided by acid or alkali addition as required.

(x) Boiler Feedwater Chemical Treatment

The feedwater used in the HRSG will be thermally de-aerated to remove oxygen and chemically treated to prevent corrosion of the tubes and components of the water/steam cycle. Chemical dosing for pH control essentially alters the pH of the boiler water to a pH that prevents corrosion reactions. Oxygen scavenging and de-aeration combine to remove the dissolved oxygen from the boiler water which again prohibits corrosion.

A range of specialist chemical treatment options are available for boiler feedwater. These include the use passivation chemicals for pH control and the use of oxygen scavengers. Examples of the specialist chemicals typically used include Ammonia (NH_3), Sodium Hydroxide (NaOH) and Tri Sodium Phosphate (Na_3PO_4). Ammonia is the preferred treatment option however as Sodium Hydroxide and Tri Sodium Phosphate use can cause operational inefficiencies in the HRSG. Consequently, NaOH and Na_3PO_4 are generally only used in emergency situations, for example, if poor quality untreated feed-water has entered the system.

(xi) Electrical Transformer

The electricity generated will be fed to a generator transformer where the voltage will be stepped up to the transmission system voltage. The design and layout of the electrical plant will comply with the technical requirements of the Transmission System Operator, EirGrid.

(xii) Process Water Discharge Tank

Process waste water comprises water from the demineralisation plant and boiler “blow-down”. Waste water from the demineralisation plant comprises water containing the salts removed from the raw water or neutralised backwash of the resins from the demineralisation process. Boiler blow-down comprises water which has been circulating in the water / steam cycle. In order to remove the build up of salts from the HRSG drum, which remain in the drum once the water has evaporated off, it is necessary to continually “blow-down” approximately 1% of the total 470m^3/hr (i.e. 4.7 m^3/hr) of circulating water. With regard to boiler blow down, this water should be cooled down to 50°C-60°C by closed circuit cooling water after the flash vessel, i.e.

- Be blown down from the boiler to the flash vessel
- Be cooled down by finfan coolers to 50-60°C (possibilities are direct finfan or via closed cooling water (and there via finfan)
- Enter drain collecting sump
- Be transferred with collecting sump drain water via oil/water separator to the Waste Water Attenuation Tank

The process waste water will be collected and treated in a 1200m^3 below ground concrete discharge tank from where its quality and temperature will be monitored prior to discharge. The tank comprises of a number of chambers. Waste water is fed into the inlet chamber via process drains. The waste water is pumped from the inlet chamber into two aeration chambers where air is bubbled up through the process waste water in order to reduce the temperature. The waste water overflows from these chambers into a small treatment chamber where an agitator mixes the waste water. pH is measured and controlled by automated dosing with either acid or base, as required, to regulate the pH within a range of 6 to 9. The water then overflows from this chamber into the final main discharge chamber. Dissolved oxygen, pH, conductivity and temperature will be continuously monitored and, if the wastewater falls outside of the thresholds set by the Environmental Protection Agency (EPA) in the Integrated Pollution Prevention and Control (IPPC) Licence the water will be fed back to the aeration chambers. If the wastewater is within the prescribed limits the waste water will be pumped to the discharge point.

The process water discharge outlet will also be fitted with an automatic sampler which will sample water discharges on a continuous basis over a given period as directed by the EPA under the IPPC regime. An on site laboratory will also be provided to facilitate monitoring of specific parameters on site.

The quantity of process wastewater to be discharged from the power plant development is estimated to be 250 m^3/day on average. Process waste water discharge is discussed in detail in Chapter 6 *Water Quality.*

(xiii) Surface Water Attenuation Tank

Surface water arising from the main site (location of power plant) will be collected in a below ground 2,600m^3 concrete attenuation tank, whilst any surface water generated from the adjacent western site (Eirgrid Substation) will be collected in a below ground concrete attenuation tank with a minimum capacity of 400m^3. All surface water runoff will be discharged to the tank via a hydrocarbon interceptor and silt trap. Surface water run-off will be discharged to the Mongagh River in accordance with Sustainable Urban Drainage System (SUDs) guidance. Surface water discharge is discussed in detail in Chapter 6 *Water Quality.*

(xiv) Foul Water Package Treatment System

Foul water, which consists of waste water other than process waste water and surface water, will be treated in a proprietary secondary treatment system prior to discharge. It is considered that the treated wastewater will be discharged to the Yellow river. However the option of percolating to ground will also be considered at detailed design stage on foot of a site suitability assessment, including percolation testing, which will be undertaken to determine the suitability of the topsoil and subsoil layers for this purpose. The system will be designed to serve *c.* 70 persons in accordance with *BS6297: Code of Practice for Design and Installation of Small Sewage Treatment Works*, guaranteeing treatment of the treated waste water to 25 mg/l Biological Oxygen Demand and 35 mg/l Suspended Solids. Treated foul water discharge is discussed in detail in Chapter 6 *Water Quality.*

3.7.6 Plant Structures

The development will comprise of the main structures listed below. Dimensions outlined in Table 3.1 *Dimensions of Main Enclosures* are regarded as the maximum likely dimensions and may be reduced depending on the plant and equipment specification of the successful Tender.

Table 3.1: Dimensions of Main Enclosures

Name	Length	Width	Height
OCGT			
Turbine Building	33	15	19
Exhaust Stack	-	5.5 diameter	40
CCGT			
Turbine Building	81	48	30
Heat Recovery Steam Generator	36	30	40
Electrical/Control Building	45	17	20
ACC	60	46	35
Air Cooled Condenser Control Building	25	11	7
Exhaust Stack	-	7 diameter	50
Auxiliary Boiler Building	19	15	16 (40m stack)
Boiler Feed Pump Building	23	12	7
Boiler Dosing Building	17	8	7.5
Tanks			
Stormwater Tank	41	41	
Bunded Fuel Oil Storage Tanks	146	71	8.5m tanks
Other			
Workshop & Stores	52	29	14.5

Name	Length	Width	Height
Administration Building	35	25	10
Water Treatment Plant	43	20	7.5
Fire Pump House	17	9	8
Fuel Oil supply pumps canopy	5	5	4
Gas Plant Boilerhouse	8	3.7	3.2
Eirgrid Substation (indicative – to be decided by EirGrid)	97	77	
Lubrication Oil Storage Building	12	10	9

Some of these buildings may be subdivided depending on the final choice of plant. Figure 3.7 *Site Elevations* presents the elevations of the buildings and structures on the proposed site.

The structural design of the main buildings will be conventional structural steel supported on reinforced concrete foundations. Steel columns will be fire protected as necessary to comply with the building regulations. Floors will be concrete. The administration building and some of the smaller buildings will be of fair-faced block work construction on concrete strip foundations. Profiled metal cladding will be used for external walls. The finished colour of the plant structures will be designed to favour the reduction of potential visual impacts. Non reflective finishes will be used in order to reduce or avoid impacts relating to sunlight reflection or glare. Finished colours will be determined at the detailed design stage and agreed with the Local Authority, to blend as much as possible with the surrounding landscape.

Roofs will be constructed of profiled metal decking on purlins spanning between rafters and will be flat or shallow pitched. Buildings will be single or two storeys with access gantries and walkways for access to plant and equipment. These will be constructed of stainless / galvanised steel open grating type flooring supported on steel beams and columns. The stack will be fabricated from painted insulated carbon steel.

External doors and escape doors will generally comprise of metal flush doors and mild steel frames. Fire doors will comply with *BS 476-22:1987 - Fire tests on building materials and structures*.

3.7.7 Materials Used

The principal materials used will be as follows:

(i) Natural Gas

Natural gas will be delivered to the power plant development via a new below ground high-pressure pipeline from the existing Bord Gáis Network.

(ii) Distillate Oil

Distillate oil will be stored in bulk storage tanks contained within a 110% capacity bund. Distillate will be delivered by road tankers.

(iii) Hydrogen

The generator is filled with hydrogen as a closed circuit cooling medium. The hydrogen is continually topped up by small amounts via a bottle storage system.

(iv) Water

Water for use in the HRSG will be stored in bulk storage tanks filled from water abstraction and treatment on site. This storage will also serve as the supply for fire fighting purposes and to provide for injection water to the gas turbine for NO_X emissions control purposes while firing on distillate. Refer to Chapter 6 *Water Quality* for a description of the water supply.

(v) Bulk Chemicals

Processes in the water treatment plant will utilise acid and alkali, both of which will be delivered by road tanker and stored on site in bunded storage tanks. A range of specialist chemical treatment options are available for boiler feedwater. These include the use of passivation chemicals for pH control and the use of oxygen scavengers. These chemicals will be stored on site in bunded designated areas in the Boiler Dosing Building.

(vi) Oils and Greases

Oils and greases used for the lubrication of the main mechanical components will be changed on a regular basis. Oils and greases will be delivered in drums by HGV and will be stored in a designated bunded oil store.

3.8 Design Constraints

3.8.1 Water Supply

A full assessment was undertaken of the possible sources of water for the operation of the power plant development. An assessment of the nearby surface water resources, the Yellow and Mongagh Rivers, determined that there was not sufficient flow within these watercourses to allow for the extraction of the required quantities of water without negatively impacting on the integrity of each stream. Both Offaly Co. Co. and Westmeath Co. Co. were approached in regard to the potential for sources of water arising from local water supply schemes. Neither local authority had sufficient water capacity from their current water supply schemes to allow for the required quantity of water to be supplied from these sources. Finally a detailed geotechnical and hydrogeological assessment was undertaken at the site which included an assessment of the groundwater resource in the locality. This assessment detailed that there was sufficient water resources at the site to allow for the extraction of water from the groundwater reserve without having a significant impact on the ground water resource or on surrounding wells and rivers. Full details of this assessment are given in Chapter 7 *Soils Geology and Hydrogeology.*

3.8.2 Noise

Following identification of the nearest sensitive receptor it was decided that the loudest components, the Turbine Hall & Air Cooled Condenser, (ACC), would be located as far within the site as possible to minimise the impacts of noise. In particular, the power train was oriented so that the ACC was located on the site as far from sensitive receptors as possible. Full details of this issue are given in Chapter 9 *Noise and Vibration.*

3.8.3 Cooling

Due to the site being inland with no proximity to a suitable watercourse or large water body, it was decided to use a method of cooling which required the minimum amount of water. Therefore an Air Cooled Condenser (ACC) was selected rather than a wet or hybrid cooling tower. While the ACC has a higher profile than alternative options, it consumes no water and does not give rise to a visible water vapour plume.

3.9 Construction Activities

3.9.1 Construction Phase Description and Duration

It is expected that construction will commence in early 2011. Civil, mechanical, electrical works and commissioning of plant are expected to last for *c.* 38 months. Construction activities are expected to peak from January 2011 to October 2011.

Expected timelines for civil construction works, some of which overlap, are described in Table 3.2 *Construction Timelines* below.

Table 3.2: Construction Timelines

Construction Activity	Expected Duration
Site clearance and Demolition of Current Structures	4 months
Civil Works Period (including Excavation, Pilling, and Pouring Foundations)	10 Months
Plant Installation (including backfilling, Excavation and Structural Steelwork)	10 Months
Mechanical and Electrical Works	10 Months
Testing and Commissioning	4 Months

Construction activities will gradually phase over from predominantly civil activities to predominantly mechanical and electrical installation activities. Mechanical and electrical works are expected to extend for 10 months.

Construction activities on the site will comprise of the following main elements:

- OCGT turbine generator.
- CCGT gas turbine generator
- OCGT Stack

- Heat recovery steam generator (HRSG) with exhaust stack.
- Steam turbine generator (STG).
- Distillate water storage tank and associated bund.
- Water treatment plant and water storage tanks.
- Chemical storage tanks and associated bunds.
- Below ground storm water attenuation tank.
- Process water discharge tank.
- Air cooled condenser (ACC).
- Above ground gas installation (AGI) and piping to supply the new plant.
- Transformers.
- Fire protection system.
- Connection and access to the Eirgrid substation.
- Building structures to house main plant and associated structures.
- Workshop / stores building
- Administration building.
- Internal roads and parking.
- Connection to the Bord Gáis Networks (BGN).
- Piping & cabling.
- Control buildings/ rooms

Many component parts are modular in design and will be delivered whole and assembled on-site.

3.9.2 Construction Staff and Facilities

During the peak construction period it is anticipated that 450 construction workers will be employed on site. However, this figure is dependent on the phasing of the development and could reach 600 employees if the peak employment associated with the construction of each unit occurs simultaneously. Temporary facilities will be provided on site during the construction period including portacabins, welfare facilities, car parking and laydown areas.

Normal working hours during the construction period are expected to be Monday to Friday 07.00 to 19.00 and Saturday 08.00 to 16.30. During certain stages of the construction phase it is expected that some work will have to be carried out outside of normal working hours, however this will be kept to a minimum. Construction works with a significant noise impact will be avoided outside of normal working hours.

3.9.3 Site Preparation

Prior to the commencement of construction activities the area for development will be fenced off. The demolition of existing buildings and the removal of all other structures will be necessary. The footprint of the proposed facility will require clearing and levelling after the initial works. There is a difference in level of approximately 8m across the proposed development site. It is estimated that the proposed development site will be levelled to 88.5m above Ordnance Datum Malin Head for the OCGT unit, and 85m for the CCGT unit and fuel storage tanks to the North of the existing rail line. A preliminary geotechnical investigation has been carried out, as detailed in Chapter 7 *Soils, Geology and Hydrogeology,* and based on the findings it is not envisaged that blasting will be required on site.

The topsoil layer, including any superficial peats, will be cleared across the development site. Where possible this material will be reused on site. If the material is considered unsuitable for reuse on site an outlet for off site reuse will be sought. If reuse is not possible the material will be removed to a licensed facility by licensed waste contractors for composting or disposal as appropriate.

Bulk soil, sub-soils or other material will be stored in designated areas only. Only uncontaminated material will be used onsite for the purpose of fill and site levelling. During the civil construction works, the site boundary will be clearly marked with high visibility tape and the appointed contractor will not be permitted to use any areas outside the identified site boundary for any activity relating to construction.

In order to mitigate against the contamination of water by soil and sediment run-off it is proposed that a sediment trap will be installed on site during the construction phase. Water from the sediment trap will be discharged to the Mongagh River via a discharge pipe and a local field drain.

3.9.4 Construction Phase Site Management

BNME will ultimately be responsible for the management of all commercial, operational and regulatory issues associated with the site during both the construction and operational phases.

During the construction phase BNME will employ a technically competent Contractor who will have responsibility for all aspects of day to day operations on site. Construction activities have the potential to create a nuisance and cause disruption. In order to minimise the disruption caused, a Construction Environmental Management Plan (CEMP) will be developed and implemented during the construction phase. The CEMP will provide a framework for the management and implementation of construction activities incorporating the mitigation measures identified in the relevant chapters of this EIS. The CEMP will be reviewed regularly and revised as necessary to ensure that the measures implemented are effective.

3.10 Operational Phase Site Management

Prior to commencement of operations BNME will recruit and train a suitably qualified and technically competent operations and maintenance team who will have responsibility for the manning and day to day operation and maintenance of the site as well as monitoring and reporting on emissions. The management team will be experienced in the day to day operations and maintenance of power generation plants similar to the proposed development and will report directly to the BNME Power Generation business unit senior management. All major items of power generating plant will be covered by long term service agreements to ensure safe and efficient plant operations.

3.11 Regulatory Control of the Facility

During the operational phase of the proposed development the facility will be regulated by the following authorities, as detailed below:

- Environmental Protection Agency (EPA).
- Health and Safety Authority (HSA).
- Commission for Electricity Regulation (CER).

The facility will also have to operate within the provisions of a number of codes applicable to the electricity sector, such as the transmission system Grid Code and Single Electricity Market Trading and Settlement Code.

3.11.1 Environmental Protection Agency (EPA)

The facility will operate under an Integrated Pollution Prevention and Control (IPPC) licence regulated by the EPA. The licence will set operational, monitoring and reporting conditions which BNME will be obliged to comply with. The EPA is also responsible for issuing Greenhouse Gas Emission Permits and regulating the monitoring reporting and verification of emissions from facilities which come under the *European Union Emissions Trading Scheme (EU ETS)* .

3.11.2 Commission for Energy Regulation (CER)

The following licences, granted by the CER, are required and the facility will be required to comply will all of the conditions set out in each licence:

- Authorisation to Construct; and
- Licence to Generate Electricity.

This power plant will participate in the Single Electricity Market, (SEM), the new wholesale electricity market for the island of Ireland, which started on the 1st November 2007. The rules of the market require that all of the output from the two generating units is traded through the market pool. The market rules also encapsulate the structures by which generators bid their cost of operation, and get paid for producing electricity, and providing reserve capacity to the system.

The market is administered by the Single Electricity Market Operator, (SEMO), and regulated by the Single Electricity Market Committee, (SEMC). This committee includes representatives of the energy Regulatory Authorities in both jurisdictions, namely the Commission for Energy Regulation, CER, in the Republic of Ireland, and the Northern Ireland Authority for Utility Regulation, NIAUR, in Northern Ireland, as well as independent members.

The market rules require that each unit bids into the market on a daily basis its cost of production. Bids must be based on the short run marginal cost of production, and include the costs of performing a start, which may vary depending on the warmth state of the unit, and the cost associated with operation that is independent of the unit output, termed no load cost. Each unit must also declare technical data such as the length of time it takes to start or change load, its minimum stable generation and maximum available output. The bids must be submitted by 10:00am on the day preceding the trading day to which they apply, and apply across the duration of the trading day. The trading day runs from 6:00am on the first day to 6:00am on the following day.

The market price paid to generators varies on a half hourly basis, and is based on the marginal cost of production in a half hour period to meet demand for that trading period, such that the total cost of production across the trading day is minimised. The price is based on the commercial bids submitted by generators, the out-turn wind generation, unit availability profiles and the technical capabilities of all the generating units in the portfolio. A forecast production schedule is prepared by the central market computer system on the day prior to the trading day, to guide the dispatch of plant in real time. However, the out-turn data in terms of actual demand, unit availability and wind generation is used after the production day to set the market price. As the variability in the balance between supply and demand increases with increased penetration of wind generation, the availability of more flexible plant will act to lower the total cost of production across the trading day. This will result in lower wholesale prices of electricity.

A significant feature of the new market structure is that generators are centrally dispatched, which means that individual plant operators do not decide when to operate their plants, but must be instructed, or dispatched, by the Transmission System Operator (TSO). The TSO will dispatch units that are scheduled to produce electricity according to the forecast market schedule produced by the central market system. The TSO must also make provision for reserve, which provides the capability of rapidly increasing output to the electricity system if required. The TSO will also adjust the dispatch schedule to meet variations in the real time demand, wind generation and unit availability profile, compared to those values used in the forecast. It should be noted therefore, that whilst the expected running profile of a generator unit can be projected one day in advance, a power plant operator has to be prepared to start his unit at any time. The unit may required at short notice, if dispatched by the TSO, and hence the actual running profile of a unit can vary significantly from the day ahead forecast schedules.

3.11.3 Health and Safety Authority (HSA)

The HSA has responsibility for the regulatory control of facilities which come under the Seveso II Directive requirements.

3.12 European Legislation and International Agreements

The following lists the main Directives, Regulations and Agreements which apply to the proposed development:

- The Integrated Pollution prevention and Control Directive 96/61/EC as amended by Directive 2003/87/EC
- Council Directive 96/82/EC of 9 December 1996 on the control of major accident hazards involving dangerous substances as amended by Directive 2003/105/EC
- The Large Combustion Plant Directive (LCPD) 2001/80/EC as amended by Directive 2001/80/EC
- The National Emissions Ceiling (NEC) Directive 2001/81/EC
- The Kyoto Protocol to the U.N. Framework Convention on Climate Change (UNFCCC) – Emissions Trading Scheme

- Greenhouse Gas Emissions Trading Directive 2003/87/EC

3.12.1 IPPC Directive (96/61/EC as amended by Directive 2003/87/EC)

The IPPC Directive aims to prevent or minimise pollution from new and existing installations which come under the regime through an integrated licensing system. The IPPC Directive was transposed into Irish law under the *Environmental Protection Agency Act 1992 as amended by the protection of the Environment Act 2003*. The First Schedule of the Act describes the activities that require an IPPC licence including:

"Energy: The operation of combustion installations with a rated thermal input equal to or greater than 50 MW."

Under the Act an IPPC licence is required to operate. Prior to issuing a licence the EPA must be satisfied that the installation does not cause adverse effects on the environment.

An IPPC licence sets conditions and requirements in order to prevent or reduce emissions to air, water and land and reduce waste and noise. Conditions on the prevention of accidents, efficient use of energy / resources and decommissioning of plant are also set. Under the regime the operator is obliged to employ Best Available Technique (BAT) technology and follow BAT guidance documents. The BAT guidance appropriate to the proposed development is BAT Guidance Note: *Reference Document on Best Available Techniques for Large Combustion Plants, (adopted July 2006).* The conditions of the licence include emission limit values (ELV's), monitoring and reporting requirements. In addition any significant changes to the facility must be notified to the EPA in advance of any change taking place.

3.12.2 Seveso II Directive

The Seveso II Directive is implemented through the *European Communities (Control of Major Accident Hazards Involving Dangerous Substances), Regulations 2006 (SI No 74 of 2006)* which gives effect to Council Directives 96/82/EC and 2003/105/EC. The regulations apply to facilities where dangerous substances are held in quantities above specified threshold limits as specified in Annex I Parts 1 and 2. Two thresholds apply: Lower-tier and Higher-tier. Operators of facilities which come under the regime are required to take all necessary measures to prevent and mitigate the effects of major accidents to human beings and the environment.

The Regulations define a major accident as:

" an occurrence such as a major emission, fire or explosion resulting from uncontrolled developments in the course of operation of any establishment, leading to a serious danger to human health or the environment"

Under the regulations the operator is required to do the following:

- Notify the HSA at least six months prior to commencement of construction activities providing clearly defined details in relation to the operator, relevant dangerous substances, inventories, description of the activity and details of the immediate environment of the activity. Any significant changes to the facility must also be notified in advance.
- Implement an Emergency Plan.
- Implement a Safety Management System.
- Develop Risk Assessments.
- Implement a Major Accident Prevention Plan (MAPP).

The HSA will advise the relevant planning authority (An Bord Pleanála) on the requirement for any planning restrictions required arising from Health and Safety concerns at and surrounding the proposed development site, thereby controlling development that is incompatible with operations.

Due to the quantity of distillate being stored on site (15,000 m^3), the proposed facility will be designated a Lower-tier Seveso site.

3.12.3 Large Combustion Plant Directive (LCPD), 2001/80/EC

The LCPD was adopted in 1988 and subsequently revised in 2001. The Directive applies to all plants with a rated fuel input greater than 50 MW imposing limits on emissions of Sulphur Dioxide (SO_2), Nitrogen Oxides (NO_x) and dust.

3.12.4 National Emissions Ceiling (NEC) Directive 2001/81/EC

The NEC Directive imposes limits on Member States regarding the emissions of Sulphur Dioxide (SO_2), Nitrogen Oxides (NO_x), Volatile Organic Compounds (VOC's) and Ammonia (NH_3) to the levels specified in the Directive by 2010.

3.12.5 The Kyoto Protocol

The Kyoto Protocol sets mandatory emission limits for the reduction of Greenhouse Gas Emissions (GHG). Ireland is committed to limiting its GHG emissions to 13% above its 1990 levels during the period 2008-2012. Current levels are more than 25% above 1990 levels. The EU Council of Ministers has recently committed to achieving a 20% reduction in emissions of 1990 levels by 2020. The Greenhouse Gas Emissions Trading Agreement facilitates the aims of the Kyoto Protocol.

3.12.6 Greenhouse Gas Emissions Trading Directive 2003/87/EC

The plant will be subject to the requirements of the EU Emissions Trading Scheme (EU ETS). Under Directive 2003/87/EC listed installations must have sufficient greenhouse gas emission allowances to cover their emissions. At present, emission allowances are allocated at the beginning of each period, based on Member State's National Allocation Plans, as approved by the EU Commission. If an installation does not have sufficient allowances to cover its emissions it can buy additional allowances from within the EU scheme or under the Kyoto Protocol flexible mechanisms. Combustion installations with a rated thermal input exceeding 20 MW are included in the scheme on a mandatory basis.

3.13 Decommissioning of Plant

The design life of the proposed units is estimated to be a minimum of 30 years, subject to the plant being maintained according to manufacturers' instructions. On cessation of activities the plant will either be redeveloped as a power generating facility or the site will be redeveloped for an alternative use.

In the event that the facility is decommissioned the following programme will be implemented:

- All plant equipment and machinery will be emptied and dismantled and stored under appropriate conditions until it can be sold. If a buyer cannot be found the material will be recycled or disposed of through licensed waste contractors and hauliers. If plant and machinery is required to be cleaned on site prior to removal all necessary measures will be implemented to prevent the release of contaminants.
- All chemicals, including oils and waste will be removed from the facility.
- The site and all associated buildings will be secured.
- All associated licences and permits will be surrendered.

Waste will be recycled wherever possible. All waste movement, recycling and disposal operations will be controlled by licensed waste contractors.

A detailed decommissioning plan will be submitted to the EPA as a condition of the IPPC licence.