enzygo environmental consultants

Best Available Techniques and Operational Techniques and Monitoring Plan EPR/XP3131VK

Deeside Power Station Permit Variation

Deeside Power (UK) Limited

CRM.343.005.PE.R.006

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For:	Deeside Power (UK) Limited
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1.0 Introduction

1.1 Introduction

1.1.1 This Best Available Techniques and Operational Techniques and Monitoring Plan (OTMP) has been prepared to support an application to Natural Resources Wales (NRW) for a variation to environment permit, reference EPR/XP3131VK/V002, at Deeside Power Station, Weighbridge Road, Deeside Industrial Park, Deeside, Flintshire, CH5 2UL (the 'Facility').

1.1.2 The Facility's Operator will remain unchanged from Deeside Power (UK) Limited (the 'Operator'), whose registered office address is now; Saltend Power Station, Saltend Chemicals Park, Hedon Road, Hull, East Riding of Yorkshire, England, HU12 8GA. The company registration number remains as 08887001.

1.1.3 The Operator is now proposing to operate 11no. gas reciprocating engines for a maximum of 2000 hours per annum to supply electricity to the National Grid. The total net rated thermal input of the previous plant was 927MWth. The new plant is proposed to have a total net rated thermal input of 109MWTh. The new plant will produce electricity only.

1.1.4 The permit for the Facility was originally for the combustion of natural gas in a Combined Cycle Gas Turbine (CCGT) process. The Facility originally consisted of two Alstom 13E2 gas turbines each with dry low NOx burners, two CMI Heat Recovery Steam Generators (HRSG) and an Alstom steam turbine. The HRSG's and Alstom steam turbine have not been operational since 2018 while the gas turbines have been converted into synchronous compensators which do not burn any fuel and are back powered from the overhead lines, providing inertia and reactive power to the National Grid since January 2020 under a 6 year contract. This activity will continue under this permit variation. The existing diesel generator used to provide backup power in the event of the full grid losing power will also remain.

1.1.5 Ancillary infrastructure will be constructed which includes a concrete hardstanding, a control room, fencing and a gas reception kiosk.

1.1.6 It is proposed that the generating plant could participate in the National Grid's Short Term Operating Reserve (STOR) programme. STOR provides balance to the National Grid during periods of high demand for electricity or where there are constraints on electricity generation available in England and Wales. National Grid can call upon an electricity generator such as the that proposed to generate electricity on demand under contract under this programme.

1.1.7 This document has been prepared to specifically fulfil the requirements set out within Parts B2 and B3 of the Environment Permit application form, to provide details of the operational techniques that will be used to seek to minimise and control emissions from the proposed facility and to demonstrate that the technology selection and control measures to be implemented follow Best Available Techniques (BAT).

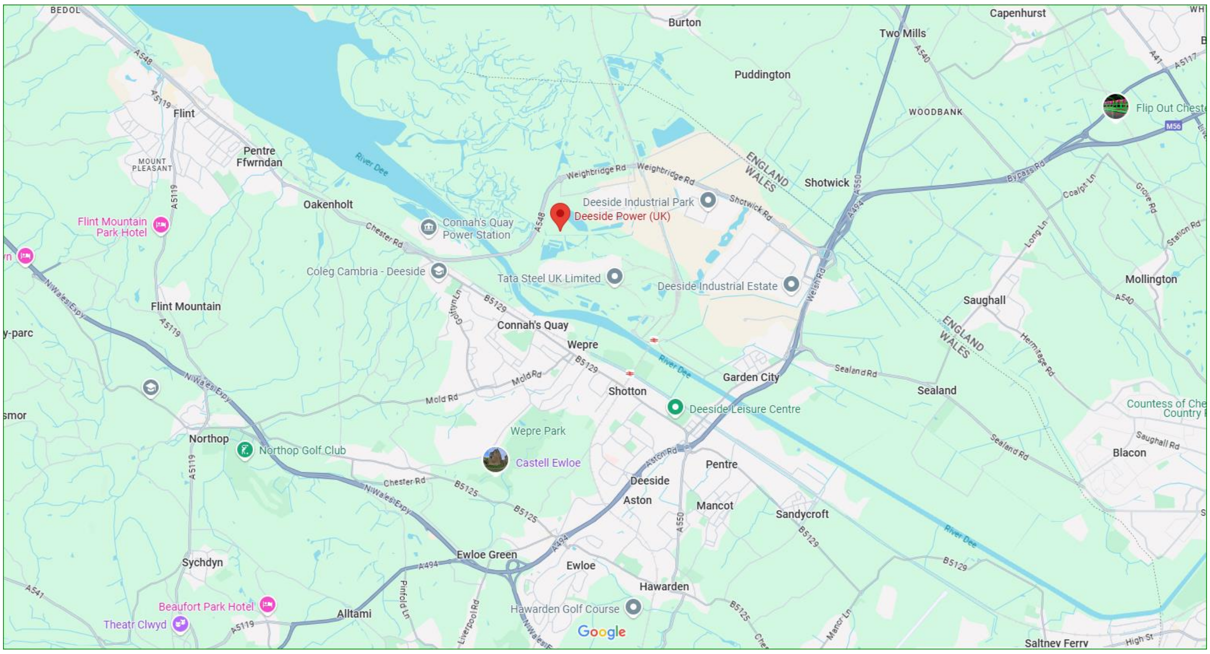
1.2 Environmental Setting

1.2.1 The full address for the Facility:

Deeside Power Station
Weighbridge Road
Deeside Industrial Park
Deeside
Flintshire

CH5 2UL

Figure 1.2.1: Facility Location



1.2.2 Deeside Power Station is located within Deeside Industrial Park on the northeast side of the Dee Estuary close to Fingerpost Gutter, a drainage ditch which feeds to River Dee. The site occupies approximately 1.8 hectares of land with an NGR at the centre of the site SJ 29703 71233.

1.2.3 The nearest residential property is approximately 1197m from the Facility boundary.

1.2.4 The nearest surface water feature and main river is the Fingerpost Gutter located 16m west of the Facility.

1.2.5 A review of the Flood Risk Map on the NRW website shows the Facility to have a low risk of flooding from the sea along the Facility's western and southern boundary edges. There are also four small areas across the Facility that are listed as having a low risk of flooding from surface water and small watercourses. Finally, the Flood Risk Map records a very low risk from rivers at the Facility.

1.2.6 A review of Defra's Magic website was undertaken and the Facility is not located within a Source Protection Zone.

1.2.7 The proposed Facility lies on a Secondary A aquifer within the bedrock geology and an undifferentiated secondary aquifer within the superficial geology.

1.2.8 The site is not located within a Nitrate Vulnerable Zone.

1.2.9 The Shotton Lagoons and Reedbeds Site of Special Scientific Interest (SSSI) and the Dee Estuary SSSI, Special Area of Conservation (SAC), Special Protection Area (SPA) and Ramsar Site lie approximately 110m from the southern boundary of the Facility at their nearest point.

1.2.10 The prevailing wind direction is from the west, west southwest, southwest and south southwest based on historic daily observation data sourced from Hawarden Airport weather station between June 2005 and December 2024. The weather station is located approximately 8.8km southeast of the Facility (based on data provided by www.windfinder.com).

1.3 Proposed Permitted Activities

1.3.1 The Operator is proposing to vary their Part A Installation Environmental Permit which currently permits the activities outlined with Table 1.3.1 below.

Table 1.3.1: Existing Activities

Activity	Description of Activity and WFD Annex I and Annex II operations	Limits of specified activity and waste types
Part A(1) Section 1.1 (a)	Burning of any fuel in an appliance with a net rated thermal input of 50 or more megawatts.	Combustion of natural gas in a combined cycle gas turbine
Directly Associated Activities		
DAA 1	Surface Water Treatment	Handling and storage of site drainage until discharge to the site surface water system.
DAA 2	Water Treatment	From receipt of raw materials to dispatch to chemical effluent and dirty water system.
DAA 3	Waste Management	Waste generation and handling -from generation of waste to despatch from the installation
DAA 4	Storage and Handling of raw materials and fuel	From receipt of raw materials to handling, storage and use to despatch from the installation
DAA 5	River water intake station	From receipt of the river water, use in the plant to dispatch to the site cooling water purge system.
DAA 6	Electricity transformers and 400kV banking compound	From generator to the connection to the National Grid
DAA 7	Standby emergency diesel generator	From generator to gas turbines

1.3.2 The listed activities to be carried out as part of this permit variation application are in accordance with the Environmental Permitting (England and Wales) Regulations 2016 (as amended 2023). Schedule 1 listed activities and Directly Associated Activities (DAA's) are summarised in Table 1.3.2 below.

Table 1.3.2: Proposed Activities

Activity	Description of Activity and WFD Annex I and Annex II operations	Limits of specified activity and waste types
Part A(1) Section 1.1 (a)	Burning of any fuel in an appliance with a net rated thermal input of 50 or more megawatts.	Combustion of natural gas in 11no gas reciprocating engines.
Directly Associated Activities		
DAA 1	Surface Water Treatment	Handling and storage of site drainage until discharge to the site surface water system.
DAA 2	Water Treatment	From capture in surface water system to discharge.

Activity	Description of Activity and WFD Annex I and Annex II operations	Limits of specified activity and waste types
DAA 3	Waste Management	Waste generation and handling - from generation of waste to despatch from the installation
DAA 4	Storage and Handling of raw materials and fuel	From receipt of raw materials to handling, storage and use to despatch from the installation
DAA 5	Electricity transformers and 400kV banking compound	From generator to the connection to the National Grid
DAA 6	Standby emergency diesel generator	From generator to old gas turbines

1.4 Relevant Legislation and Guidance

1.4.1 The proposed activities are subject to a number of National, European and International legislation and statutory and non-statutory guidance documents. Operators are required through the Environmental Permit application process, to demonstrate how they will comply with the relevant requirements of this legislation and guidance.

1.4.2 In relation to the proposed combustion operation, the following pieces of legislation and guidance are considered relevant:

- Environmental Permitting (England and Wales) Regulations 2016 (as amended 2023);
- Environment Agency Guidance: Develop a Management System: environmental permits, April 2023;
- Natural Resources Wales, Guidance to help you comply with your environmental permit, October 2023;
- Natural Resources Wales, How to comply with your environmental permit, October 2024;
- Industrial Emissions Directive (2010);
- Medium Combustion Plant Directive (2015); and
- European Commission – BAT Conclusions for Large Combustion Plants (2021).

2.0 Operational Techniques

2.1 Purpose of the Installation

2.1.1 As detailed above the proposed generating plant could operate within the Capacity Market, the Balancing Market and as Energy Trading Generation on the Energy Market.

2.1.2 Typically a service contract is for the provision of a STOR, which is a service to provide additional active power from generation and/or demand reduction.

2.1.3 The STOR programme provides balance to the National Grid during unexpected periods of high demand for electricity or where there are constraints on electricity generation available in England and Wales. National Grid can call upon an electricity generator such as the Operator to generate electricity under contract on demand under this programme.

2.1.4 The National Grid is tasked with operating the network of interconnecting cables that form the United Kingdom's power system in an efficient and effective manner. STOR is a vital component of the mechanism by which the National Grid 'balances' the network.

2.1.5 To fulfil the requirements of a STOR contract, the principal requirements are that the STOR provider must be able to:

- Offer a minimum of 3MW or more of electrical generation or steady demand reduction (this can be from more than one Site);
- Deliver full contracted MW of electricity ideally with 20 minutes from receiving instruction but up to a maximum of 240 minutes from receiving instructions from National Grid;
- Provide full MW for at least 2 hours when instructed; and,
- Operate at a minimum of 90% of available capacity.

2.1.6 It should be noted that whilst the maximum start-up time is 240 minutes, operators who can generate electricity in the shortest timeframe are more likely to be selected to generate.

2.2 Operating Hours

2.2.1 The Facility will operate for a maximum of 2000 hours per year as a rolling average. It will operate when called on to supply electricity by the National Grid during periods of higher demand.

2.2.2 The Facility will therefore in general be on standby 24 hours a day, 7 days a week and every day of the year with the potential to run at any time. However, the peak times for the National Grid are typically between 08:00 and 22:00.

2.3 Operation of the Engines

2.3.1 The Operator is proposing to supply electricity to the National Grid via 11no. natural gas fuelled gas reciprocating engines. The gas engine technology chosen at the Facility is the Jenbacher J624 engine which is a two-stage turbocharged V24-cylinder engine. The natural gas used to fuel the engines will be supplied from the national grid.

2.3.2 Each of the new engines to be installed at the Facility will have a net rated thermal input of 9.896MWth, giving a total net rated thermal input of 108.856MWth for all 11no. engines combined. The engines will generate electricity only.

2.3.3 Each engine will be housed within an individual fully enclosed concrete sided structures which will be fitted with a waste heat radiator, ventilation air inlet, ventilation air outlet and an exhaust stack fitted with a silencer. The 11no. of engines will be housed on impermeable concrete hardstanding.

2.3.4 The plant is fitted with a DCS control system and any abnormal operation will trigger alarms within the 24 hour a day manned main control room.

2.3.5 The electricity produced will be routed to the pre-existing transformers at the Facility before being fed into the national grid.

2.4 Site Operative Training

2.4.1 Training will be provided to train all operations staff in the operation and maintenance of the works in accordance with an agreed training plan.

2.5 Maintenance

2.5.1 The Operator maintains critical plant and equipment, and service contracts will be put in place with equipment suppliers where maintenance tasks cannot be carried out by site staff.

2.5.2 Maintenance is a key component of operational control at the Facility. Maintenance activities may be either planned or reactive (i.e., in response to breakdowns or performance deterioration resulting from a fault).

2.5.3 The Operator has a robust programme of PPM in place for all critical plant and equipment which includes using a computerised system to schedule inspections and activity and record defects. Spare parts are maintained on-site. PPM is included in the overarching EMS.

2.5.4 All regular maintenance is completed to the timescales specified by the equipment manufacturer, as optimised by best industry practices and operating experience.

2.5.5 A high level of preventative maintenance is carried out to avoid unscheduled down time, maximising the plant availability and its ability to control emissions and maintain an efficient level of operation between overhauls.

2.6 Raw Materials Use (including water use)

2.6.1 There will be minimal use of raw material aside from natural gas fuel input. Natural gas is used as the fuel within the engines at a rate of 1.044 Nm^3/h. There will be no storage of natural gas at the Facility as the engines will receive the natural gas on demand from the national grid.

2.6.2 The antifreeze/coolant is used within each of the engines at the facility with additional antifreeze/coolant stored within bunded IBCs. Following initial filling of the cooling systems, they will only require small top ups annually to compensate for losses.

2.6.3 Engine oil is used within each engine at a rate of 0.92kg/hr and is stored within two 10,000l bunded steel tanks. One of the 10,000l tanks stores new engine oil and the second 10,000l tank stores the used engine oil, prior to off-site disposal. Replacement/top up of engine oil done automatically from main oil storage tank.

2.6.4 Details of the types and amounts of raw materials are provided within Table 2.6.1 below. The materials listed in the Table are used to ensure smooth functioning of the engines and ancillary infrastructure.

Table 2.6.1: Raw Material Use

Raw Material	Estimated Annual Throughput	Maximum Storage Quantity	Storage Arrangements	Secondary Containment Arrangements	Material Use
Antifreeze/coolant	1l	500l IBC 2 200l/engine	Stored within integrated bunds within the engines. IBC located on concrete hardstanding on bunded pallet.	Engines are located within fully enclosed concrete sided structures and are bunded. IBC located on concrete hardstanding on bunded pallet.	Used within the radiator fluid mix
Engine oil	22 000l	10 000l in clean oil tank 10 000 used oil in dirty oil tank 1 000l/engine	Stored within integrated bunds within the engines. Dirty and clean oil tanks are bunded steel tanks to BS 799 part 5 type J 2010 and located on concrete hardstanding.	Engines are located within concrete enclosures and are bunded. BS 799 complaint oil tanks located on concrete hardstanding for clean and dirty oil.	To lubricate the engines
Natural gas	22 968Nm^3	N/a fed directly from the national grid	No storage. Supplied directly by the mains gas supply.	N/A	Gas Engines
Potable water	N/A	N/A	No storage, the water will originate from a metered mains supply.	N/A	Welfare

2.6.5 The Operator will:

- take appropriate measures to ensure that raw materials and water are used efficiently in the activities;
- maintain records of raw materials and water used in the activities;
- review and record at least every 4 years whether there are suitable alternative materials that could reduce environmental impact or opportunities to improve the efficiency of raw material and water use; and
- take any further appropriate measures identified by a review.

3.0 BAT Assessment

3.1 Introduction

3.1.1 BAT is determined by the BAT Conclusions for Large Combustion Plants (BATc). This section addresses the specific BATc relevant to the Installation and compares the proposed techniques which will be employed on-site with the techniques described in the Large Combustion Plants BATc and provides an answer for question 3a on Application Form C3.

3.1.2 BAT is determined within the following documents:

- COMMISSION IMPLEMENTING DECISION (EU) 2021/2326 of 30th November 2021 establishing best available techniques (BAT) conclusions for waste treatment, under Directive 2010/75/EU of the European Parliament and of the Council, for large combustion plants ('LCP BAT')

3.2 Appraisal of Available Technologies

3.2.1 The Operator is proposing a facility capable of supplying the National Grid with electricity at short notice during peak periods under the National Grid's Balancing Services Mechanism.

3.2.2 The Facility will not be required to operate continuously but must be responsive to sudden peak demands for electricity, and therefore operate at full load within minutes of being called upon. The Facility will run for up to 2000 hours per year on a five year rolling average. It will be staffed all year-round and will benefit from a schedule of regular maintenance checks and remote monitoring.

3.2.3 The technology must possess the following characteristics and constitute BAT;

- Quick start up time and rapidly achieve full load
- Low emissions
- High thermal efficiency
- Low maintenance.

3.2.4 A comparison of the potential technology types suitable for the intended site activity is presented in Table 3.2.1 below. All start up, efficiency and emissions data contained within the table is obtained from the Department for Energy and Climate Change – Developing Best Available Techniques (BAT) for combustion plants operating in the balancing market (June 2016), unless otherwise stated. Figures are reported at oxygen reference values at 15%.

Table 3.2.1: Comparison of Technologies

	Combined Cycle Gas Turbines (CCGT)	Open Cycle Gas Turbines (OCGT)	Aero Derivative Gas Turbines	Gas Engines	Diesel Engines
Process Description	CCGT technology uses a primary gas turbine coupled to a secondary steam turbine. Air is compressed through a rotating compressor, then mixed with fuel and combusted before being expanded through a gas turbine, converting the thermal energy into rotation of the turbine blades. Some of the mechanical energy powers the compressor, with the majority turning a generator which converts the mechanical energy to electricity. The hot turbine exhaust gasses then pass through a boiler to generate steam. The steam is fed to a steam turbine which powers a second generator, producing further electricity.	OCGT consist of a compressor, combustion chamber and gas turbine. They differ from CCGT's in that they operate without the secondary component to recover heat. Air is fed into the compressor, pressurised and then passed to the combustion chamber where fuel is added and combusted. The hot exhaust turns the turbine blades and energy is converted into electricity.	Aero Derivative Gas Turbines are similar to OCGTs but have been derived from turbines used for aeronautical applications. As a result of the different requirements for use of as turbines in aircraft, they are more flexible than OCGT plant and are able to operate under wider ranges of load and start-up and shut down quicker than other turbines.	A gas engine consists of a bank of fixed cylinders inside which, pistons move, injecting air and fuel, compressing the mixture, igniting the mixture and then expanding the hot gas produced, converting the thermal energy into rotation of a crank shaft. The engine load is adjusted by controlling the amount of gas and air injected into the cylinder, which is controlled by an automated system. A generator connected to the crank shaft of the engine converts the mechanical energy into electricity for export to the grid.	Diesel engines work in a similar fashion to gas engines with the key difference being that diesel is injected into the cylinder after compression of the air has taken place and automatically ignites as a result of the high temperature of the compressed air.
Start-up Time	1->3.5 hours	15 -30 minutes	As low as 1 Minute	1 – 10 minutes	>10 minutes

	Combined Cycle Gas Turbines (CCGT)	Open Cycle Gas Turbines (OCGT)	Aero Derivative Gas Turbines	Gas Engines	Diesel Engines
Thermal Efficiency (LHV%)	58.8 – 60.7	38.3 – 39.9	35.0 – 39.0	35.0 – 45.0	35.0 – 37.0
Abatement Options	Dry Low NOx Burners, Wet Low Emissions systems	Dry Low NOx Burners, Wet Low Emissions systems	Dry Low NOx Burners, Wet Low Emissions systems. Potential for steam injection	Lean Burn, Enhanced Lean Burn	Exhaust Gas Recirculation, Water Injection, Engine Optimisation
Emissions with Abatement (mg/Nm^3)	**Dry Low NOx Abatement** NOx 19-34 PM <5 SO_2 10 CO 1.5- 1.9	**Dry Low NOx Abatement** NOx 33- 63 PM <5 SO_2 10 CO 4 - 5	**STIG Steam Abatement** NOx 31 – 51 PM <5 SO_2 10 CO 10-15	**Enhanced Lean Burn Abatement** NOx <95 PM <5 SO_2 10 CO 370	**Water Injection Abatement** NOx 1156 – 1807 PM 20 – 100 SO_2 85 – 2540 CO 25 - 185
Notes	The secondary steam turbines increase start-up time of the Facility, as it requires slow warming. The complexity and footprint of a combined cycle, combined with the efficiency of steam cycles only being high at relatively large capacities means that CCGT systems are only suitable for very large facilities.	The significant amount of heat lost in the exhaust gas makes OCGTs significantly less efficient than combined cycle systems	As with OCGTs, heat loss in exhaust gasses means these systems are not as efficient as other options. Certain enhancements can be added e.g. steam injection, but these are relatively novel and difficult to apply in a non-continuous scenario.		Engines are generally rated for continuous power output but can exceed this by stated amounts for shorter periods of time in modes named Standby (1hr maximum) and Prime (12 hr maximum). These higher outputs come at the cost of higher emissions and greater equipment costs.

3.3 Technology Selection

Gas Turbines

3.3.1 As per Table 3.2.1 above CCGT's are not considered BAT for Balancing Services operation due to their lengthy start-up times, their size limitations, the efficiency of steam cycles being relatively low at small capacity, and the overall system complexity being conducive to only large installations.

3.3.2 OCGTs have a much better start up time however the large scale OCGTs which would be required to provide the required capacity on the site are not capable of supplying electricity within the time periods required. Larger turbines typically take up to 30 minutes to achieve stable operating status as a result of the need to warm through the turbine before load can be applied. OGCTs also have relatively high capital investment, operating and maintenance costs and lower thermal efficiencies than can be achieved by CCGTs and gas engines, which impacts viability and therefore suitability for short period of use.

3.3.3 The long start-up times for CCGTs and OCGTs mean they are unsuitable for use at the proposed Facility

3.3.4 Aero Derivative gas engines are able to achieve suitable short start-up times as low as 1 minute however they have relatively low efficiencies in comparison to engines. The enhancements which have recently become available to improve these are relatively unproven, especially for the non-continuous operation required by the Facility, where steam or water injection may become a problem as a result of potential condensation within the turbine sections.

Reciprocating Engines

3.3.5 Reciprocating engines perform well in terms of their thermal efficiencies across a wide range of size. At the upper end of their efficiency range, gas engines have higher thermal efficiencies than diesel engines and OCGTs. CCGTs have higher thermal efficiencies, however as mentioned above they are unable to respond to load demands in the short period required by the Facility and the Balancing Market Service.

3.3.6 Reciprocating engines have shorter start-up times and are thus more suitable for STOR purposes which are required by the Facility. They are also available at smaller capacities than gas turbines, making them more suited to this sector where the provision of multiple units provide greater flexibility and resilience to operators.

3.3.7 Diesel engines can provide electricity within the timeframe required by the National Grid. They can also benefit from dual fuel configuration (if included at project inception), making them potentially more versatile in terms of fuel supply. However, the technology is more suitable for longer periods of operation than is typically required for STOR Plant. Under the standby operating conditions, a greater level of emissions including NOx, SO_2 and particulate matter would potentially be emitted. As the plant will be in standby mode for the majority of the year, it is considered that diesel engines are less suitable than gas engines for use in the Balancing Market Services market. In addition, diesel to supply the engines would have to be stored in bulk on site in quantities which have associated environmental risks in the event of a leak or a spill.

3.3.8 Gas engines benefit from lower NOx emissions than diesel engines and are able to utilise gas delivered by the National Grid, avoiding the transportation and storage of fuel which would be required in diesel fuelled engines. Gas engines are capable of supplying electricity within 7 minutes for STOR purposes.

Final Choice

3.3.9 Given the requirements of the Deeside Facility and taking into account all of the aspects required for the effective energy generation by plant suitable for Balancing Services, Gas engines have been determined as BAT for the proposed Facility. They have fast start-up times, low emissions, and the highest thermal efficiency within the reciprocating engine category.

3.3.10 The Operator has chosen natural gas as the most suitable fuel for the facility as it is available directly from the mains gas supply from the National Grid. This provides the site with the flexibility it needs to operate under Balancing Service conditions and removes the need for storing fuel on site and reduces the associated environment risks on site, such as leaks and spills, and fuel deliveries.

3.4 Justification for 2000 Hours Operation

3.4.1 The configuration of the engines and the application of enhanced lean burn technology will ensure sufficient primary abatement measures are in place to maximise combustion efficiency and minimise the production of NOx.

3.4.2 The main emission of concern associated with gas engines is NOx. It is not considered that Selective Catalytic Reduction (SCR) or Non-Selective Catalytic Reduction (SNCR) are suitable for use due to the intermittent nature of the proposed operations. Both of these technologies require engines and downstream catalysts and reaction chambers to reach a steady operating temperature and flow rate of gas to operate effectively. This state is usually reached after circa 15-30 minutes of operation, and therefore for plant of this nature, significant periods of operation would be unabated.

3.4.3 As the emissions of NOx are low without secondary abatement, the benefit gained from this additional abatement would be relatively minimal and would not justify the cost of the additional equipment required. In addition, the injection of urea or ammonia into the exhaust as is required for both abatement options, ammonia slip in the exhaust gasses is inevitable and therefore emissions of ammonia would be likely to become a more significant issue than NOx.

3.4.4 Therefore, the use of secondary abatement techniques is not considered justified and therefore the use of primary abatement is BAT for the proposed Facility.

3.4.5 The Facility will comply with all relevant BAT requirements for a Facility of its size and nature operating in the Balancing Market. The site will have primary abatement designed into the technology, through implementation of optimised combustion and enhanced lean burn. Furthermore, the engines will run at an efficiency of at least 40% and will comply with the <95mg/Nm^3 NOX emission limit.

3.5 BAT 1 Environmental Management System

3.5.1 BAT 1 requires Operators to ensure that the sector specific features listed within this BATc are incorporated into the Facility's EMS.

3.5.1 The Operator will operate under their existing Environmental Management Policy, which will be updated in line with the change in activities at the Facility.

3.5.2 The outline of the EMS in Appendix A of this report demonstrates how the key elements required in an EMS meet standard Permit Condition 1.1.1:

1.1.1 The operator shall manage and operate the activities:

(a) *in accordance with a written management system that identifies and minimises risks of pollution, including those arising from operations, maintenance, accidents, incidents, non-conformances, closure and those drawn to the attention of the operator as a result of complaints; and*

(b) *using sufficient competent persons and resources.*

3.5.3 The BAT reference document for Large Combustion Plants 2017 (BREF) established what constitutes BAT with regards to management systems. Table 3.5.1 below outlines the requirements of BAT 1 and details of how this has been implemented at the Facility.

Table 3.5.1: BAT 1 EMS Requirements

Technique	Details	Facility meets BAT?
i. Commitment of the management, including senior management.	Deeside Power (UK) Limited are responsible for the overall effectiveness of the EMS and through clear leadership and commitment will promote continual improvement in all aspects of the EMS. Top Management will define the environmental policy and strategy and ensure that it is appropriate to the nature and scale of the organisations activities, products and services.	Yes
ii. Definition, by the management, of an environmental policy that includes the continuous improvement of the environmental performance of the installation.	The Environmental Policy outlines management commitments. The Policy is reviewed at least annually to maintain its relevance and it provides a strategy for environmental objectives.	Yes
iii. Planning and establishing the necessary procedures, objectives and targets, in conjunction with financial planning and investment.	Setting objectives and performance indicators are incorporated into the EMS as core components of the ISO14001:2015 standard.	Yes
iv. Implementation of procedures paying particular attention to: (a) structure and responsibility (b) recruitment, training, awareness and competence (c) communication (d) employee involvement (e) documentation (f) effective process control (g) planned regular maintenance programmes (h) emergency preparedness and response (i) safeguarding compliance with environmental legislation.	These elements are incorporated into the EMS as core components of the ISO14001:2015 standard. A PPM system is in place with a maintenance contract with the Original Equipment Manufacturer (OEM). An AMP are in place with emergency protocols for identified accident scenarios. These elements are incorporated into the EMS as core components of the ISO14001:2015 standard. The Operator has in place environmental operating controls at its facility; they are suitable and sufficient to minimise the environmental impact from plant activities. The Operator has established and implemented the processes required to prepare for and respond to, potential emergencies. The Operator will respond in such a way as to prevent or mitigate the	Yes

Technique	Details	Facility meets BAT?
	environmental impact of any such event should it occur.	
v. Checking performance and taking corrective action, paying particular attention to: (a) monitoring and measurement (see also the JRC Reference Report on monitoring of emissions to air and water from IED-installations – ROM) (b) corrective and preventive action (c) maintenance of records (d) independent (where practicable) internal and external auditing in order to determine whether or not the EMS conforms to planned arrangements and has been properly implemented and maintained.	These elements are incorporated into the EMS as core components of the ISO14001:2015 standard. The Operator has suitable arrangements in place to identify and address deviations from the expected norm which may compromise the overall effectiveness of the EMS or which may lead to an impact upon the environment. All incidents will be recorded. The Operator will carry out annual audits to monitor and evaluate all key activities undertaken that fall within the scope of the EMS. Records of such audits will be maintained within the EMS system as controlled documents.	Yes
vi. Review, by senior management, of the EMS and its continuing suitability, adequacy and effectiveness.	The EMS is reviewed at least annually to maintain its relevance and it provides a strategy for environmental objectives.	Yes
vii. Following the development of cleaner technologies.	The EMS includes an obligation to strive for continual improvement, which includes sectoral benchmarking.	Yes
viii. Consideration for the environmental impacts from the eventual decommissioning of the installation at the stage of designing a new plant, and throughout its operating life including; (a) avoiding underground structures (b) incorporating features that facilitate dismantling (c) choosing surface finishes that are easily decontaminated (d) using an equipment configuration that minimises trapped chemicals and facilitates drainage or cleaning (e) designing flexible, self-contained equipment that enables phased closure (f) using biodegradable and recyclable materials where possible	These elements are incorporated into the EMS as core components of the ISO14001:2015 standard. Closure plan in place, which will be updated to include new raw materials.	Yes
ix. Application of sectoral benchmarking on a regular basis. Specifically for this sector, it is also important to consider the following features of the EMS, described where appropriate in the relevant BAT.	The EMS includes an obligation to strive for continual improvement, which includes reviewing new technologies.	Yes
x. Quality assurance/quality control programmes to ensure that the characteristics of all fuels are fully determined and controlled.	See BAT 9.	Yes

Technique	Details	Facility meets BAT?
xi. A management plan in order to reduce emissions to air and/or to water during other than normal operating conditions, including start-up and shutdown periods.	See BAT 10 and BAT 11.	Yes
xii. A waste management plan to ensure that waste is avoided, prepared for reuse, recycled or otherwise recovered, including the use of techniques given in BAT 16.	See BAT 16	Yes
xiii. A systematic method to identify and deal with potential uncontrolled and/or unplanned emissions to the environment, in particular: (a) emissions to soil and groundwater from the handling and storage of fuels, additives, by-products and wastes (b)emissions associated with self-heating and/or self-ignition of fuel in the storage and handling activities.	The Operator has established and implemented the processes required to prepare for and respond to, potential emergencies and incidents. AMP in place with emergency protocols for identified accident scenarios.	Yes
xiv. A dust management plan to prevent or, where that is not practicable, to reduce diffuse emissions from loading, unloading, storage and/or handling of fuels, residues and additives.	A dust management plan is in place at the Facility and will be updated to include the changes to the site.	Yes
xv. A noise management plan where a noise nuisance at sensitive receptors is expected or sustained, including; (a) a protocol for conducting noise monitoring at the plant boundary (b) a noise reduction programme (c) a protocol for response to noise incidents containing appropriate actions and timelines (d) a review of historic noise incidents, corrective actions and dissemination of noise incident knowledge to the affected parties.	Noise management plan is in place at the Facility and will be updated to include the changes to the site.	Yes
xvi. for the combustion, gasification or co-incineration of malodourous substances, an odour management plan including: (a) a protocol for conducting odour monitoring (b)where necessary, an odour elimination programme to identify and eliminate or reduce the odour emissions (c) a protocol to record odour incidents and the appropriate actions and timelines (d) a review of historic odour incidents, corrective actions and the dissemination of odour incident knowledge to the affected parties.	Not applicable, natural gas will be used within the process with no storage at the Facility.	Yes

3.5.4 The Site will be operated in accordance with its EMS, an outline of this is included in Appendix A. The EMS adheres to the BAT 1 requirements for management systems.

3.5.5 In conclusion, an EMS is in place at the Facility which meets the requirements of the LCP BAT.

3.6 BAT 2 Net Electrical Efficiency

3.6.1 The net electrical efficiency and/or the net total fuel utilisation and/or the net mechanical energy efficiency of the combustion units will be determined by carrying out a performance test at full load, according to EN standards or ISO national standards if not available, after the commissioning of the unit. The net electrical efficiency will also be tested again after each modification that could significantly affect the net electrical efficiency and/or the net total fuel utilisation and/or the net mechanical energy efficiency of the unit.

3.6.2 If the net electrical efficiency and/or the net total fuel utilisation and/or the net mechanical energy efficiency of the unit is reduced following any works then the Original Equipment Manufacturer will carry out maintenance and checks under the contract in place with the Operator.

3.6.3 In conclusion, net electrical efficiency testing will be carried out during the commissioning of the engines which will meet the requirements of the LCP BAT.

3.7 BAT 3 Monitoring Process Parameters

3.7.1 A range of key process parameters will be monitored by the routine periodic air emission monitoring undertaken at the Facility. These will include but not limited to the following parameters listed within BAT 3:

- Flue gas flow
- Flue gas oxygen content
- Flue gas temperature
- Flue gas pressure
- Flue gas water vapour content

3.7.2 There are 11no. of new release points to air associated with the new plant and equipment covered by this application comprising the individual stacks from each engine, designated A9 to A19.

3.7.3 Whilst the combined thermal input to the installation combustion systems is >50MWth, the thermal input of each individual unit is <15MWth. Due to the individual thermal input of the engines being equal to or greater than 1MW and less than or equal to 20MW, the monitoring requirements of the Medium Combustion Plant Directive (MCPD) apply to the emissions from the Facility.

3.7.4 The MCPD requires that extractive monitoring is carried out every three years in the first instance. However, due to the infrequent operation of the plant, MCPD indicates an alternative frequency of monitoring following a period of operation that is three times the maximum average annual operating hours. Where this is applied, monitoring should be carried out at least every 5 years.

3.7.5 The new combustion plant will be maintained to ensure optimum thermal and electrical efficiency and to minimise emissions generation. It is therefore envisaged that process parameter monitoring will be carried out every 6,000 hours operation on each engine, or every five years, as appropriate.

3.7.6 All monitoring will be undertaken using appropriate sample methods and standards aligned with the requirements of MCERTS and will include monitoring of Flow, Oxygen content, Temperature, Pressure, and Water vapour content.

3.7.7 No flue gas wastewater from flue gas treatment will be produced by the engines and these parameters will therefore not need to be monitored.

3.8 BAT 4 Monitoring Emissions to Air

3.8.1 BAT 4 requires the Operator to monitor the emissions to air from the Facility in accordance with EN standards or ISO national standards if not available.

3.8.2 The BREF provides a table listing the required parameters that must be monitored for each fuel, process and type of combustion plant. For natural gas fired engines, as proposed at the Facility, the parameters required to be monitored are as follows:

- Nitrogen Oxides (NOx);
- Carbon Monoxide (CO); and
- Non-Methane Volatile Organic Compounds (NMVOC) and Methane (CH_4).

3.8.3 The monitoring of the plant will be undertaken to comply with the requirements of the MCPD as discussed within section 3.7 above.

3.8.4 Emissions of NOx and CO from the proposed plant will be monitored using an MCERTS approved laboratory who will obtain and analyse stack emissions monitoring samples

3.8.5 If alternative methods are to be used these will be agreed in writing with the Environment Agency in advance.

3.9 BAT 5 Emissions to Water and Monitoring

3.9.1 There are no emissions to water from flue gas treatment resulting from activities at the Facility and as such BAT 5 is not applicable. Only surface water drainage is discharged from the Facility.

3.10 BAT 6 Combustion Optimisation

3.10.1 In order to reduce the emissions to air of CO and unburnt substances BAT 6 requires the use of an appropriate combination of the techniques provided within Table 3.10.1 below.

Table 3.10.1: Combustion Optimisation Techniques

Technique	Description	Facility meets BAT 6 requirement?
Fuel blending and mixing	Ensure stable combustion conditions and/or reduce the emission of pollutants by mixing different qualities of the same fuel type.	Yes. The facility will use natural gas supplied by the national grid network. Any mixing of fuels (e.g. addition of biomethane) is handled by the national grid and delivered to site ready to use.
Maintenance of the combustion system	Regular planned maintenance according to suppliers' recommendations.	Yes. A Planned Preventative Maintenance programme is in place at the Facility and maintenance is carried out in line with the manufacturers recommendations.

Technique	Description	Facility meets BAT 6 requirement?
Advanced control system	System meeting the requirement of Section 10.8.1 of the BREF.	Yes. a DCS control system is in place at the Facility that control combustion efficiency and monitors efficiency parameters in line with Table 10.8.1 of the BREF.
Good design of the combustion equipment	Good design of furnace, combustion chambers, burners and associated devices.	Yes. The engines will be new and the configuration has been specifically designed for this engine.
Fuel choice	Select or switch totally or partially to another fuel(s) with a better environmental profile (e.g. with low sulphur and/or mercury content) amongst the available fuels, including in start-up situations or when back-up fuels are used.	Yes. Natural gas has low levels of sulphur and mercury. No other more fuel types exist for this installation to make any switch in fuels viable.

3.10.2 In conclusion, the measures in place at the Facility to increase combustion optimisation meet the requirements of the LCP BAT.

3.11 BAT 7 and BAT 8 Emission Abatement System

3.11.1 No abatement system is fitted to any of the engines at the Facility, as such BAT 7 and BAT 8 are not applicable.

3.12 BAT 9 Quality Control Programme

3.12.1 BAT 9 requires the Facility to have a quality assurance or quality control programme for all the fuels used, as part of the EMS.

3.12.2 The engines at the facility will be fuelled by natural gas supplied by the national grid. The national grid has a strict criteria that gas must meet before being injected into the grid and includes analysis for all of the parameters listed within BAT 9.

3.13 BAT 10 OTNOC Management

3.13.1 In order to reduce emissions to air and/or to water during Other Than Normal Operating Conditions (OTNOC), BAT is to set up and implement a management plan as part of the Facility's EMS.

3.13.2 Table 3.13.1 describes how the Facility will meet these requirements.

Table 3.13.1: Requirements of BAT 10: OTNOC Management

Requirement	Measures Proposed by Operator	Facility meets BAT 10 requirement?
Appropriate design of the systems considered relevant in causing OTNOC that may have an impact on emissions to air, water and/or soil.	The engines are new and the configuration has been specifically designed for this engine. The engine is also selected during to its reduced start up time as it will be used in the STOR scheme or similar.	Yes
Set-up and implementation of a specific preventive maintenance plan for these relevant systems.	A programme of planned preventative maintenance is carried out non site in line with the manufacturers recommendations. A service and	Yes

Requirement	Measures Proposed by Operator	Facility meets BAT 10 requirement?
	maintenance contract is also in place with the technology provider.	
Review and recording of emissions caused by OTNOC and associated circumstances and implementation of corrective actions if necessary.	The DCS control system fitted to the plant will monitor and record any abnormal operation, which will be alerted to the manned control room.	Yes
Periodic assessment of the overall emissions during OTNOC and implementation of corrective actions if necessary.	The DCS control system will record all periods of OTNOC. Any periods of OTNOC (outside of standard start up and shut downs) will be investigated and root cause identified. Remedial actions will be implemented following any investigation.	Yes, additional spot sampling of emissions will be commissioned if required as discussed in section 3.14 below.

3.14 BAT 11 Emissions Monitoring During OTNOC

3.14.1 BAT 11 requires monitoring of emissions to air during OTNOC at least once every year. All emissions from the new peaking plant will be monitored during commissioning and periodically as advised in the response to BAT 3 to ensure that the plant does not lead to pollution of the receiving environment.

3.14.2 Given the nature of the equipment installed and the adherence to the manufacturer advised maintenance programme OTNOC events are considered unlikely. Should such events occur, additional spot sampling of emissions could be commissioned if required. The additional sampling would only be carried out on the engine or engines that are experiencing the OTNOC events

3.15 BAT 12 Energy Efficiency

3.15.1 BAT 23 requires Operators to use energy efficiently. Table 3.15.1 describes how the Facility will meet these requirements.

Table 3.15.1: Requirements of BAT 12: Energy Efficiency

Technique	Description	Facility meets BAT 12 requirement?
Combustion optimisation	Optimising the combustion minimises the content of unburnt substances in the flue-gases and in solid combustion residues.	Yes. The engines are new and the configuration has been specifically designed for this engine.
Optimisation of the working medium conditions	Operate at the highest possible pressure and temperature of the working medium gas.	Yes. Each engine will be run at 100% load when needed.
Optimisation of the steam cycle	Operate with lower turbine exhaust pressure by utilisation of the lowest possible temperature of the condenser cooling water, within the design conditions.	N/a. Gas engines are to be used at the Facility.
Minimisation of Energy consumption	Minimising the internal energy Consumption.	Yes. The engines new and the configuration has been specifically

Technique	Description	Facility meets BAT 12 requirement?
		designed for this engine and its use within a STOR scheme or similar.
Preheating of combustion air	Reuse of part of the heat recovered from the combustion flue-gas to preheat the air used in combustion.	N/A for gas engines
Fuel preheating	Preheating of fuel using recovered heat.	N/a. Gas engines are to be used at the Facility.
Advanced control system	Computerised control of the main combustion parameters enables the combustion efficiency to be improved.	Yes. a DCS control system is in place at the Facility that control combustion efficiency and monitors efficiency parameters in line with Table 10.8.1 of the BREF.
Feed-water preheating using recovered heat	Preheat water coming out of the steam condenser with recovered heat, before reusing it in the boiler.	N/a. Gas engines are to be used at the Facility.
Heat recovery by cogeneration (CHP)	Recovery of heat (mainly from the steam system) for producing hot water/steam to be used in industrial processes/activities or in a public network for district heating. Additional heat recovery is possible from flue-gas, grate cooling and circulating fluidised bed.	N/a. The operator will continue to explore commercial options for heat recovery but given the unpredictable and very limited periods of operation of the engines it is unlikely the heat will be viable for any nearby use.
CHP readiness	The measures taken to allow the later export of a useful quantity of heat to an off-site heat load in a way that will achieve at least a 10 % reduction in primary energy usage compared to the separate generation of the heat and power produced.	N/a. The operator will continue to explore commercial options for heat recovery but given the unpredictable and very limited periods of operation of the engines it is unlikely the heat will be viable for any nearby use.
Flue-gas condenser	A heat exchanger where water is preheated by the flue-gas before it is heated in the steam condenser.	N/a. The operator will continue to explore options for heat recovery but given the unpredictable and very limited periods of operation of the engines it is unlikely the heat will be viable for any nearby use.
Heat accumulation	Heat accumulation storage in CHP mode.	N/a. The operator will continue to explore options for heat recovery but given the unpredictable and limited operation of the engines it is unlikely the heat will be viable for any nearby use.
Wet stack	The design of the stack in order to enable water vapour condensation from the saturated flue-gas and thus to avoid using a flue-gas reheater after the wet FGD.	N/a. Natural gas fuelled engines are to be used at the Facility and no wet FGD is required.
Cooling tower discharge	The release of emissions to air through a cooling tower and not via a dedicated stack.	N/a. Natural gas fuelled engines are to be used at the Facility and no cooling tower required.

Technique	Description	Facility meets BAT 12 requirement?
Fuel pre-drying	The reduction of fuel moisture content before combustion to improve combustion conditions.	N/a. Natural gas fuelled engines are to be used at the Facility.
Minimisation of heat losses	Minimising residual heat losses, e.g. those that occur via the slag or those that can be reduced by insulating radiating sources	N/a. Natural gas fuelled engines are to be used at the Facility.
Advanced materials	Use of advanced materials proven to be capable of withstanding high operating temperatures and pressures and thus to achieve increased steam/combustion process efficiencies.	Yes. The engines are new and are designed to handle operation.
Steam turbine upgrades	This includes techniques such as increasing the temperature and pressure of medium-pressure steam, addition of a low-pressure turbine, and modifications to the geometry of the turbine rotor blades.	N/a. Natural gas fuelled engines are to be used at the Facility.
Supercritical and ultra-supercritical steam conditions	Use of a steam circuit, including steam reheating systems, in which steam can reach pressures above 220.6 bar and temperatures above 374 °C in the case of supercritical conditions, and above 250 – 300 bar and temperatures above 580 – 600 °C in the case of ultrasupercritical conditions.	N/a. Natural gas fuelled engines which only operate for 2,000 hours per annum are to be used at the Facility.

3.15.2 In conclusion, the measures proposed at the Facility for energy efficiency meet the requirements of the LCP BAT.

3.16 BAT 13, BAT 14 and BAT 15 Water Usage and Emissions to Water

3.16.1 There are no emissions to water from flue gas treatment resulting from activities at the Facility and water is not used within the engines. Therefore BAT 13, BAT 14 and BAT 15 are not applicable.

3.16.2 Only surface water drainage is discharged from the Facility.

3.17 BAT 16 Waste Management

3.17.1 BAT 16 requires the Operator to organise operations to maximise, in order of priority, the following in regards to waste:

- waste prevention;
- waste preparation for reuse;
- waste recycling; and
- other waste recovery.

3.17.2 Wastes produced at the Facility will comprise waste oil and the occasional wastes from maintenance activities. Oil usage will be minimised by regular servicing and maintenance of the engines and any waste oil will be taken off site for recovery at a suitably permitted facility.

3.17.3 General waste from the existing offices and welfare facilities will be collected under contract with a local waste disposal contractor for recycling where possible.

3.17.4 In conclusion, the waste procedures in place at the Facility meet the requirements of BAT 16 of the LCP BAT.

3.18 BAT 17 Noise Emissions

3.18.1 BAT 17 requires the Operator to reduce the noise emissions from the Facility using one or a combination of the techniques within Table 3.18.1 below.

Table 3.18.1: BAT 17 Noise Reduction Techniques

Technique	Description	Techniques in use at the Facility?
Operational Measures	These include: • improved inspection and maintenance of equipment; • closing of doors and windows of enclosed areas, if possible; • equipment operated by experienced staff; • avoidance of noisy activities at night, if possible; • provisions for noise control during maintenance activities.	A programme of planned preventative maintenance is carried out on the engines at the Facility. The engines are housed within fully enclosed concrete sided structures with no windows. Doors will be kept closed except during access and egress.
Low-noise equipment	This potentially includes compressors, pumps and disks.	The engines have comparable noise ratings as similar engines of this type.
Noise attenuation	Noise propagation can be reduced by inserting obstacles between the emitter and the receiver. Appropriate obstacles include protection walls, embankments and buildings.	The engines are housed within fully enclosed concrete sided structures with no windows. Doors will be kept closed except during access and egress.
Noise-control equipment	This includes: • noise-reducers • equipment insulation • enclosure of noisy equipment • soundproofing of buildings	The engines are housed within fully enclosed concrete sided structures with no windows. Doors will be kept closed except during access and egress. Exhaust stacks are also fitted with silencers.
Appropriate location of equipment and buildings	Noise levels can be reduced by increasing the distance between the emitter and the receiver and by using buildings as noise screens	The engines are located approximately 97m from the nearest human receptor and 1600m from the nearest non-industrial receptor.

3.18.2 In conclusion, the noise reduction techniques employed at the Facility meet the requirements of BAT 17 of the LCP BAT.

3.19 BAT 40 Energy Efficiency for the Combustion of Natural Gas

3.19.1 In order to increase the energy efficiency of natural gas combustion, BAT 40 is to use an appropriate combination of the techniques given in BAT 12 and in Table 3.19.1 below.

Table 3.19.1: Energy Efficiency for the Combustion of Natural Gas

Technique	Description	Techniques in use at the Facility?
Combined cycle	Combination of two or more thermodynamic cycles, e.g. a Brayton cycle (gas turbine/combustion engine) with a Rankine cycle (steam turbine/boiler), to convert heat loss from the flue-gas of the first cycle to useful energy by subsequent cycle(s).	N/a to gas engines

3.19.2 BAT 40 also states that gas engines should meet the BAT-Associated Energy Efficiency Levels (BAT-AEELs) outlined with Table 3.19.2 below. The energy efficiency levels provided by the manufacturer are also shown in Table 3.19.2 for comparison.

Table 3.19.2: BAT-Associated Energy Efficiency levels

Parameter	BAT-AEEL	Engine used at Facility
NET electrical efficiency	39.5 – 44%	45.5%

3.19.3 BAT 12 is discussed within section 3.12 above and it is concluded that the techniques mentioned above meet the requirements of BAT 40.

3.20 BAT 41 and BAT 42 NOx Emissions to Air

3.20.1 BAT 41 only applies to boilers and BAT 42 only applies to gas turbines, these are therefore not applicable to the Facility.

3.21 BAT 43 NOx Emissions to Air

3.21.1 BAT 43 requires that the Operator prevents or reduces NOx emissions to air from the combustion of natural gas in engines. This should be achieved by using one or a combination of the techniques given in Table 3.21.1 below.

Table 3.21.1: NOx Reduction Techniques for Gas Engines

Technique	Description	Techniques in use at the Facility?
Advanced Control System	Computerised control of the main combustion parameters enables the combustion efficiency to be improved.	Yes. A DCS control system is in place at the Facility that control combustion efficiency and monitors emission parameters in line with Table 10.8.1 of the BREF.
Lean-burn concept Advanced lean-burn concept	Lean combustion decreases the fuel to air ratio in the zones where NOx is generated so that the peak flame temperature is less than the stoichiometric adiabatic flame temperature, therefore reducing thermal NOx formation. The optimisation of this concept is called the 'advanced lean-burn concept'.	Yes. Advanced lean burn concept will be in place for the engines at the Facility.
Selective catalytic reduction (SCR)	Selective reduction of nitrogen oxides with ammonia or urea in the presence of a catalyst. The technique is based on the reduction of NOX to nitrogen in a catalytic bed by reaction with	No. It is not considered that Selective Catalytic Reduction (SCR) or Non-Selective Catalytic Reduction are suitable for use due to the intermittent nature of the proposed operations.

Technique	Description	Techniques in use at the Facility?
	ammonia (in general aqueous solution) at an optimum operating temperature of around 300–450 °C. Several layers of catalyst may be applied. A higher NOX reduction is achieved with the use of several catalyst layers. The technique design can be modular, and special catalysts and/or preheating can be used to cope with low loads or with a wide flue-gas temperature window. 'In-duct' or 'slip' SCR is a technique that combines SNCR with downstream SCR which reduces the ammonia slip from the SNCR unit.	

3.21.2 In conclusion, the NOx reduction techniques employed at the Facility meet the requirements of BAT 43.

3.22 BAT 44 and BAT 45 CO Emissions to Air

3.22.1 BAT 44 requires that the Operator prevents or reduces CO emissions to air from the combustion of natural gas in engines. BAT 45 requires the reduction of Non-Methane Volatile Organic Compounds (NMVOC) and methane emissions to air from the combustion of natural gas in spark-ignited gas engines.

3.22.2 This should be achieved by using one or a combination of the techniques given in Table 3.22.1 below.

Table 3.22.1: CO, NMVOC and CH_4 Reduction Techniques for Gas Engines

Technique	Description	Techniques in use at the Facility?
Optimised combustion	Optimising the combustion minimises the content of unburnt substances in the flue-gases and in solid combustion residues.	Yes. The engines are new and the configuration has been specifically designed for this engine. A programme of planned preventative maintenance is carried out on the engines.
Oxidised catalysts	The use of catalysts (that usually contain precious metals such as palladium or platinum) to oxidise carbon monoxide and unburnt hydrocarbons with oxygen to form CO2 and water vapour.	No, oxidised catalysts are not used at the Facility.

3.22.3 In conclusion, the CO reduction techniques employed at the Facility meet the requirements of BAT 44 of the LCP BAT.

4.0 Monitoring

4.1 Overview

4.1.1 The Environmental Permit will confirm the required monitoring schedule for the Facility. However, the proposed monitoring arrangements are as follows.

4.2 Emissions to Air

4.2.1 There are 11no. main point source emissions to air at the Facility from 11no. 9.896MWth gas engines under normal operating conditions. The existing emission point from the emergency generator will also remain at the Facility but will only be required in the event of a mains power failure to the site.

4.2.2 The proposed emission limits have been included in Table 4.2.1 in line with the values set out in the Medium Combustion Plant Directive. No limit is proposed for carbon monoxide as there are a high level of automated controls to ensure combustion efficiency is optimised.

4.2.3 There are two oil storage tanks (clean and dirty) which are vented. These are also listed on Table 4.2.1 below however no limits or monitoring are proposed as emissions will be minimal and will only be released during filling operations.

Table 4.2.1: Emissions to Air

Emission Point Reference	Parameter	Emission Limit Value
A1 – A11	NOx as NO_2	95mg/Nm^3
	Carbon Monoxide	No limit set
	Oxygen	No limit set
	Water Vapour	No limit set
	Sulphur Dioxide	No limit set
Clean oil tank vent	No parameters set	n/a
Dirty oil tank vent	No parameters set	n/a

4.3 Emissions to Surface Water

4.3.1 There will be one point source emission to surface water from the Facility following this permit variation. The point source emission will be from the existing River Dee outfall, designated W1 within the existing permit. The outfall will discharge the clean surface water drainage from the Facility only and will no longer discharge any cooling waters.

4.3.2 It is proposed that the existing monitoring of this emission is no longer required as it will no longer discharge cooling waters from the previous operations. Instead, it is proposed that the monitoring of this emission is brought in line with the currently permitted W2a and W2b emission for surface water drainage.

4.4 Emissions to Land

4.4.1 There are no expected emissions to land from the Facility.

4.5 Emission to Sewer

4.5.1 There are no expected emissions to sewer from the Facility other than from the site welfare areas.

4.6 Process Monitoring Requirements

4.6.1 All tanks on site will be regularly inspected to ensure they remain integrally sound. When maintenance is required on any tanks on site, each tank can be isolated and emptied to allow for inspection and maintenance works to take place.

4.6.2 The Operator will have a computer based system in place to monitor all key aspects of operating the power plant to optimise efficiency and identify system failures. This software will operate continuously gathering and analysing real time data.

4.6.3 Data is downloaded continuously thus allowing the operator to generate monitoring data reports for all key elements of operating the generating plant.

4.6.4 The key parameters recorded by the control systems that are used to manage the operation of the engines are listed below:

- natural gas flowrate from the gas reception kiosk to each engine;
- natural gas delivery system pressures;
- cylinder temperatures and pressures;
- oil temperature and pressures; and;
- coolant temperature.

4.7 Fugitive Emissions

4.7.1 Fugitive emissions are not controlled by emission limits but the Facility has a duty to not cause pollution. Pollution prevention measures as detailed below will be employed at the Facility in order to prevent any fugitive emissions.

Fugitive Emissions to Air

4.7.2 Activities at the Facility are managed in accordance with the Operator's EMS, including regular inspections and maintenance of the engines. The Operator also has a maintenance contract in place with the OEM.

4.7.3 The gas engines will be monitored annually using MCERTS methods to ensure compliance with permitted limits. The plant is fitted with a DCS control system and any abnormal operation will trigger alarms within the 24 hour a day manned main control room. The plant also has an automatic gas supply shut off in the event of a fire. Fire alarms will be both local and in the control room and will comply with NFPA 85 regulations.

4.7.4 All vehicle movements will take place on areas of asphalt or concrete hardstanding. A strict site speed limit of 10mph will be maintained across the Facility.

Fugitive Emissions to Land and Water

4.7.5 Clean oil is stored within a bunded 10,000l tank and waste oil is stored within a separate bunded 10,000l tank. The waste oil tank is emptied when approaching capacity for off-site disposal. Oil collections and deliveries are made by road going tankers which travel along asphalt haul roads at the Facility. Replacement/top up of engine oil done automatically from main oil storage tank via below ground pipework.

4.7.6 The engine oil tanks are located on bunded concrete hardstanding constructed in accordance with The Water Resources (Control of Pollution) (Oil Storage) (Wales) Regulations 2016 and meet British Standard BS 799 Part 5:2010.

4.7.7 The transformers to be used at the Facility are pre-existing and pre-date the Water Resources (Control of Pollution) (Oil Storage) (Wales) Regulations 2016. The three transformers at the Facility are all contained within bunded compounds but the bunds are not impervious as required by the new regulations.

4.7.8 However, there are several stages of protection to prevent any oil in from being released from site, consisting of the following:

- Diverter Chamber and Oil Retaining Tank;
- Skimovex Oil Water Separator; and
- Wastewater Sump.

4.7.9 All of the transformer bunds are drained initially via the diverter chamber. The diverter chamber contains a float known as the ‘density valve’ which is lifted by water when there is sufficient volume in the chamber. When the density valve is raised it uncovers the outlet and allows discharge of the water contained within. In the event of an uncontrolled release of oil into the drains, caused by a loss of containment, the chamber fills with oil which is not dense enough to lift the density valve and the outlet remains closed. The chamber would continue to fill until it overflows into the oil retaining tank.

4.7.10 A float operated alarm in the chamber alerts the operational staff that the density valve has operated. This alarm is tested regularly for functionality.

4.7.11 Water from the diverter chamber flows through the Skimovex Oil Water Separator which only allows clean water to pass to the Wastewater Sump. The separator contains a skimming mechanism allowing any oil contamination to be skimmed off the surface and diverted into a separate waste tank.

4.7.12 Water from the Skimovex is collected in the wastewater Sump which can only be emptied manually by a pump from the bottom. The sump consists of three components, the first is a large settlement enclosure which captures the water to a certain level. The pipe in the second holding enclosure is under the surface of the first holding tank, ensuring any oil on the surface of the first holding tank cannot progress any further. The second holding tank has manually operated pumps which move the water into the outfall pit where it discharges to the Dee by gravity.

4.7.13 The wastewater sump is routinely inspected and emptied, if required, so only uncontaminated water is pumped into the outfall pit where it then decants via pipeline to the River Dee following inspection.

4.7.14 No other potentially polluting liquids are stored on site.

4.7.15 Surface watercourses in the vicinity of the Facility will act as both a receptor for potential pollution and as a pathway to mobilise pollutants to the River Dee. The nearest watercourse is Fingerpost Gutter adjacent to the Facility’s western boundary. Fingerpost Gutter is designated as a main river and feeds directly into the River Dee.

4.7.16 The site is located over a Secondary A aquifer within the bedrock geology and an undifferentiated secondary aquifer within the superficial geology. The Facility is designated as having a low risk of flooding from the sea along its western and southern boundary edges with the rest of the site having a very low risk.

4.7.17 There are also four small areas across the Facility that are listed as having a low risk of flooding from surface water and small watercourses with the rest of the site having a very low risk. Finally, the Flood Risk Map records a very low risk from rivers across the entire Facility.

4.7.18 The majority of the site area is covered by soft landscaping and aggregates with some limited areas of concrete hardstanding, associated with the former Facility use. The haul routes around the site are comprised of asphalt and are served by a drainage system.

4.7.19 The site drainage passes through oil/water separators before being pumped to the River Dee outfall off site (W1). The oil/water is inspected on a regular basis to check its integrity and the levels of oil contained within.

4.7.20 In the event of flooding and adverse weather, to mitigate the potential for the mobilisation of pollutants off site, all engine housing structures and the control rooms are suitably sealed to prevent water ingress. Coolant and oil in the transformers and engines are contained within sealed systems, monitored via the DCS control system. The Operator will subscribe to NRW's Flood warning system.

4.7.21 A programme of planned preventative maintenance is undertaken at the Facility with all engines and their containment systems regularly inspected. The Operator also has a maintenance contract in place with the OEM.

4.7.22 In the event of a leak, an OEM field engineer will be notified immediately and dispatched to the site. Spill kits will be available on site, with materials suitable for absorbing and containing minor spills and drain matts and booms to direct pollutants away from surface water channels. Site staff will be trained in their use and in the spill clean-up procedures detailed within the Facility's EMS.

4.7.23 The clean surface water drainage system is an enclosed system and is manually discharged after testing. So in case of emergencies the surface water can be sealed to prevent any contamination entering the River Dee.

5.0 Records and Reporting

5.1 Records

5.1.1 The Operator will ensure that the following information is recorded:

- Any changes to the as build design throughout the life of the Site;
- Hours of Operation;
- Emergencies;
- Complaints and actions taken;
- Plant/equipment failure;
- Any incidents/accidents on Site and actions taken;
- Security failures;
- Emissions monitoring;
- Natural Resources Wales Compliance Assessments Reports (CAR); and
- Reportable incidents in accordance with the Permit.

5.1.2 All records will be held in the Operator's main office and will be available on request. All records, which are required under the conditions of the Environmental Permit, will be maintained and kept secure from loss, damage or deterioration for at least 6 years. Any records held electronically will be backed up on a regular basis.

5.2 Reporting

5.2.1 As part of the Site's Management Systems, audits will be carried out on an annual basis to check that all activities are being carried out in line with the requirements of the Environmental Permit, Management Procedures and associated legislation.

5.2.2 Frequencies of reporting monitoring data to the Natural Resources Wales are summarised in Table 5.2.1 below. Reports will be submitted to the Natural Resources Wales using the appropriate reporting forms as required.

Table 5.2.1: Reporting Requirement

Parameter	Emission or Monitoring Point	Reporting Period
Emissions to Air Data	A9 - A19	Every 12 months (from 1st January)
Process Monitoring	Installation	Every 6 months (1st January and 1st July)
Power Generated (MWh)	Installation	Every 12 months (the performance of the previous year to be submitted by 31st January

Parameter	Emission or Monitoring Point	Reporting Period
Engine Operating Hours	Installation	Every 12 months (the performance of the previous year to be submitted by 31st January
Water Usage	Installation	Every 12 months (the performance of the previous year to be submitted by 31st January
Energy Usage	Installation	Every 12 months (the performance of the previous year to be submitted by 31st January
Oil Changes	Installation	Every 12 months (the performance of the previous year to be submitted by 31st January

Deeside Power Station

Overview of Environmental Management System (EMS)

The EMS is part of an Integrated Management System (IMS) as detailed below:

The scope of the IMS applies to all business activities associated with the Synchronous Compensation plant.

The Integrated Management System demonstrates our ability to operate to international standards for Quality, Health, Safety and the Environment (ISO 9001, 14001, OHSAS 18001 and transition to ISO 45001) and to meet corporate, customer and applicable statutory and regulatory requirements.

The IMS manual defines our processes, their effective application by users, expected conformance and the promotion of continuous improvement.

The IMS overview document is complementary to 3 compliance matrices which describe the individual elements of each standard and how they interact:

ISO 9001 Quality Compliance Matrix

ISO 14001 EMS Compliance Matrix

ISO 45001 H&SMS Compliance Matrix

These four documents together effectively comprise the IMS descriptive manual

EMS Compliance Matrix

Below is the index of the EMS component of the IMS to illustrate the coverage of it. The full document is available if required.

ISO 14001 INDEX

7.4.1 General
7.4.2 Internal communication
7.4.3 External communication

7.5 Documented information

7.5.1 General
7.5.2 Creating and updating
7.5.3 Control of documented information

8 Operation

8.1 Operational planning and control
8.2 Emergency preparedness and response

9 Performance evaluation

9.1 Monitoring, measurement, analysis and evaluation
9.1.1 General
9.1.2 Evaluation of compliance

9.2 Internal audit

9.2.1 General
9.2.2 Internal audit programme
9.3 Management review

10 Improvement

10.1 General
10.2 Nonconformity and corrective action
10.3 Continual improvement

Certification

Certification to all three standards was achieved in 2020 and since then annual audits (2 Surveillance and one Recertification) have not revealed any major non-conformances or improvement recommendations.

Review

The EMS has an Environmental Aspects and Impacts Evaluation as part of its scope with supporting management and control systems and procedures. This will be reviewed and updated to include any new plant and equipment as required.

afaq
AFNOR UK LIMITED

Certificate

Certificat

CERTIFICATE OF REGISTRATION

This is to certify that the Management System of

DEESIDE POWER STATION

for the following activity/activities:
OPERATION OF SYNCHRONOUS COMPENSATION PLANT

carried out in the following location

WEIGHBRIDGE ROAD, DEESIDE INDUSTRIAL PARK FLINTSHIRE, GB CH5 2UL

F 0956-1 / UK 11/23

Has been assessed by AFNOR UK, part of AFNOR Group,
certifying under AFAQ trademark,
and complies with the Management System requirements of

ISO 9001:2015 - ISO 14001:2015 - ISO 45001:2018

CERTIFICATE N°	CLIENT SINCE	DATE OF ISSUE	DATE OF EXPIRY
EA / Q 50107	**03/08/2021**	**03/08/2024**	**02/08/2027**

UKAS MANAGEMENT SYSTEMS
0022

APPROVED BY
Managing Director of AFNOR UK LIMITED

F. BONIN-BREE

Scan this QR code to check the validity of the certificate

The use of Accreditation Symbol indicates accreditation in respect of those activities covered by the Certificate Number 022

CONDITIONS OF ISSUE

This Certificate is issued under the authority of the AFNOR UK and is subject to the following conditions:

1. The Certificate holder shall maintain compliance with the criteria defined on the Certificate covering the requirements of the management system standard and the product/service or site usage.

2. The Certificate remains the property of AFNOR UK and shall be returned on demand or if the Certificate Holder discontinues the scope of work or type of product for which the Certificate is issued.

3. The Certificate Holder shall notify AFNOR UK of any changes in name, address, ownership, organiza¬tion, site boundary, site usage or any other significant aspects, and any significant incident or event.

4. The Certificate Holder shall allow access at all reasonable times to the place of work to enable AFNOR UK to monitor the effectiveness of the assessed management system and related certified activities.

5. Legally Binding Document ® AFAQ is a registered trademark.

6. AFNOR UK complies with the international standards in force (ISO 17021).

7. AFNOR UK Ltd reserves the right to modify, at any time and without any notice, the presentation of this certification document. This document and most specifically the logo featuring on this document can only be used by its holder in the frame of relevant legal requirements and a clear and sincere communication.

Enquiries relating to the Certificate shall be submitted, in writing, to the Technical Department at the address overleaf.

Appendix B – Engine Technical Specification

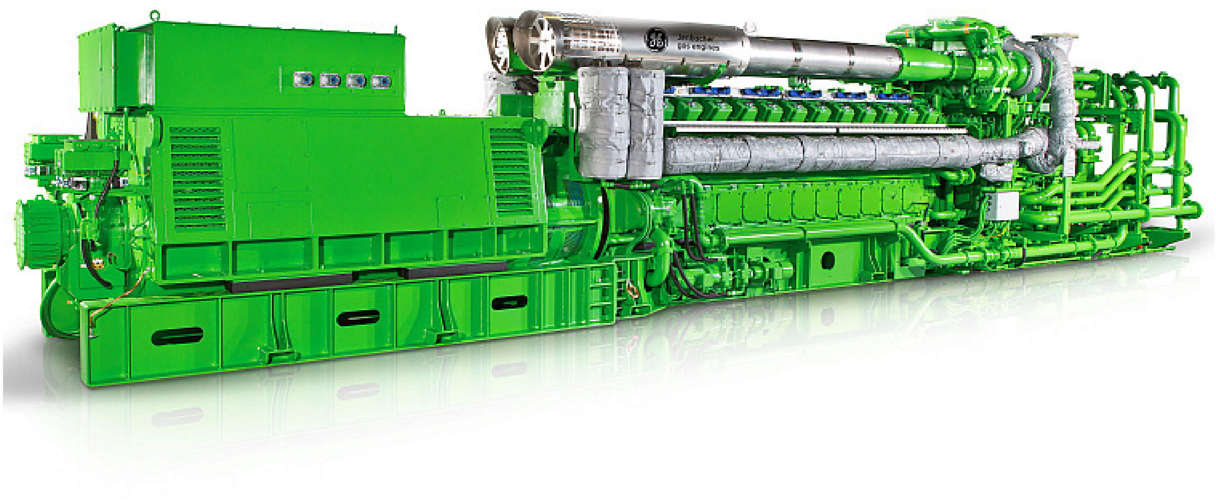
Technical Description

Cogeneration Unit

JMS 624 GS-N.L

dyn. GC Profile 1 (150ms/30%)

J624 – Version K12



Electrical output	4500	kW el.
Thermal output	2844	kW

Emission values

NOx < 250 mg/Nm³ (5% O_2) | < 95 mg/Nm³ (15% O_2)

0.01 Technical Data (at module)

			100%	75%	50%
Power input	[2]	kW	9.917	7.590	5.262
Gas volume	*)	Nm³/h	1.044	799	554
Mechanical output	[1]	kW	4.595	3.445	2.297
Electrical output	[4]	kW el.	4.500	3.367	2.230
Recoverable thermal output (calculated with Glykol 37%)					
~ Intercooler 1st stage	[9]	kW	1.863	1.235	552
~ Lube oil		kW	452	397	344
~ Jacket water		kW	529	436	389
~ Exhaust gas cooled to 348 °C		kW	~	~	~
Total recoverable thermal output	[5]	kW	2.844	2.069	1.285
Total output generated		kW total	7.344	5.437	3.515
Heat to be dissipated (calculated with Glykol 37%)					
~ Intercooler 2nd stage		kW	~	~	~
~ Lube oil		kW	~	~	~
~ Surface heat	ca. [7]	kW	236	~	~
Spec. fuel consumption of engine electric	[2]	kWh/kWel.h	2,20	2,25	2,36
Spec. fuel consumption of engine	[2]	kWh/kWh	2,16	2,20	2,29
Lube oil consumption	ca. [3]	kg/h	0,92	~	~
Electrical efficiency			45,4%	44,4%	42,4%
Thermal efficiency			28,7%	27,3%	24,4%
Total efficiency	[6]		74,1%	71,6%	66,8%
Hot water circuit:					
Forward temperature		°C	80,0	71,8	63,6
Return temperature		°C	50,0	50,0	50,0
Hot water flow rate		m³/h	91,3	91,3	91,3
Fuel gas LHV		kWh/Nm³	9,5		

*) approximate value for pipework dimensioning
[_] Explanations: see 0.10 - Technical parameters

All heat data is based on standard conditions according to attachment 0.10. Deviations from the standard conditions can result in a change of values within the heat balance, and must be taken into consideration in the layout of the cooling circuit/equipment (intercooler; emergency cooling; ...). In the specifications in addition to the general tolerance of ±8 % on the thermal output a further reserve of +5 % is recommended for the dimensioning of the cooling requirements.

Main dimensions and weights (at module)

Length	mm	~ 12.800
Width	mm	~ 2.500
Height	mm	~ 2.900
Weight empty	kg	~ 49.100
Weight filled	kg	~ 50.300

Connections

Hot water inlet and outlet [A/B]	DN/PN	100/10
Exhaust gas outlet [C]	DN/PN	600/10
Fuel Gas (at module) [D]	DN/PN	100/16
Water drain ISO 228	G	½"
Condensate drain	DN/PN	~
Safety valve - jacket water ISO 228 [G]	DN/PN	80/16
Safety valve - hot water	DN/PN	100/10
Lube oil replenishing (pipe) [I]	mm	28
Lube oil drain (pipe) [J]	mm	28
Jacket water - filling (flex pipe) [L]	mm	13
Intercooler water-Inlet/Outlet 1st stage	DN/PN	150/16
Intercooler water-Inlet/Outlet 2nd stage [M/N]	DN/PN	~

Output / fuel consumption

ISO standard fuel stop power ICFN	kW	4.595
Mean effe. press. at stand. power and nom. speed	bar	24,55
Fuel gas type		Natural gas
Based on methane number | Min. methane number	MZ	70 | 70 d)
Compression ratio	Epsilon	11,5
Min. fuel gas pressure for the pre chamber	bar	5,88
Min./Max. fuel gas pressure at inlet to gas train	bar	6 - 8 c)
Max. rate of gas pressure fluctuation	mbar/sec	10
Maximum Intercooler 2nd stage inlet water temperature	°C	50
Spec. fuel consumption of engine	kWh/kWh	2,16
Specific lube oil consumption	g/kWh	0,20
Max. Oil temperature	°C	80
Jacket-water temperature max.	°C	95
Filling capacity lube oil (refill)	lit	~ 1000

c) Lower gas pressures upon inquiry
d) based on methane number calculation software AVL 3.2 (calculated without N2 and CO2)

0.02 Technical data of engine

Manufacturer		GE Jenbacher
Engine type		J 624 GS-K12
Working principle		4-Stroke
Configuration		V 60°
No. of cylinders		24
Bore	mm	190
Stroke	mm	220
Piston displacement	lit	149,70
Nominal speed	rpm	1.500
Mean piston speed	m/s	11,00
Length	mm	9.533
Width	mm	2.111
Height	mm	2.564
Weight dry	kg	17.100
Weight filled	kg	18.100
Moment of inertia	kgm²	92,70
Direction of rotation (from flywheel view)		left
Radio interference level to VDE 0875		N
Starter motor output	kW	20
Starter motor voltage	V	24

Thermal energy balance

Power input	kW	9.917
Intercooler	kW	1.863
Lube oil	kW	452
Jacket water	kW	529
Exhaust gas cooled to 180 °C	kW	1.281
Exhaust gas cooled to 100 °C	kW	1.876
Surface heat	kW	122

Exhaust gas data

Exhaust gas temperature at full load [8]	°C	348
Exhaust gas temperature at bmep= 18,4 [bar]	°C	~ 385
Exhaust gas temperature at bmep= 12,2 [bar]	°C	~ 439
Exhaust gas mass flow rate, wet	kg/h	25.026
Exhaust gas mass flow rate, dry	kg/h	23.543
Exhaust gas volume, wet	Nm³/h	19.749
Exhaust gas volume, dry	Nm³/h	17.905
Max.admissible exhaust back pressure after y-pipe	mbar	50

Combustion air data

Combustion air mass flow rate	kg/h	24.310
Combustion air volume	Nm³/h	18.811
Max. admissible pressure drop at air-intake filter	mbar	10

Sound pressure level

Aggregate a)	dB(A) re 20µPa	103
31,5 Hz	dB	90
63 Hz	dB	97
125 Hz	dB	103
250 Hz	dB	101
500 Hz	dB	96
1000 Hz	dB	95
2000 Hz	dB	94
4000 Hz	dB	96
8000 Hz	dB	97
Exhaust gas b)	dB(A) re 20µPa	123
31,5 Hz	dB	109
63 Hz	dB	111
125 Hz	dB	121
250 Hz	dB	116
500 Hz	dB	117
1000 Hz	dB	113
2000 Hz	dB	113
4000 Hz	dB	120
8000 Hz	dB	103

Sound power level

Aggregate	dB(A) re 1pW	126
Measurement surface	m²	194
Exhaust gas	dB(A) re 1pW	131
Measurement surface	m²	6,28

a) average sound pressure level on measurement surface in a distance of 1m (converted to free field) according to DIN 45635, precision class 3.
b) average sound pressure level on measurement surface in a distance of 1m according to DIN 45635, precision class 2.
The spectra are valid for aggregates up to bmep=24 bar. (for higher bmep add safety margin of 1dB to all values per increase of 1 bar pressure).
Engine tolerance ± 3 dB

0.03 Technical data of generator

Manufacturer		AVK e)
Type		DIG 142 i/4 e)
Type rating	kVA	5.800
Driving power	kW	4.595
Ratings at p.f. = 1,0	kW	4.500
Ratings at p.f. = 0,8	kW	4.481
Rated output at p.f. = 0,8	kVA	5.601
Rated reactive power at p.f. = 0,8	kVar	3.361
Rated current at p.f. = 0,8	A	294
Frequency	Hz	50
Voltage	kV	11
Speed	rpm	1.500
Permissible overspeed	rpm	1.800
Power factor (lagging - leading)		0,8 - 0,95
Efficiency at p.f. = 1,0		97,9%
Efficiency at p.f. = 0,8		97,5%
Moment of inertia	kgm²	252,00
Mass	kg	13.600
Radio interference level to EN 55011 Class A (EN 61000-6-4)		N
Cable outlet		left
Ik'' Initial symmetrical short-circuit current	kA	2,44
Is Peak current	kA	6,20
Insulation class		F
Temperature (rise at driving power)		F
Maximum ambient temperature	°C	40

Reactance and time constants (saturated) at rated output

xd direct axis synchronous reactance	p.u.	2,02
xd' direct axis transient reactance	p.u.	0,17
xd'' direct axis sub transient reactance	p.u.	0,12
x2 negative sequence reactance	p.u.	0,13
Td'' sub transient reactance time constant	ms	20
Ta Time constant direct-current	ms	120
Tdo' open circuit field time constant	s	4,25

e) GE Jenbacher reserves the right to change the generator supplier and the generator type. The contractual data of the generator may thereby change slightly. The contractual produced electrical power will not change.

0.04 Technical data of heat recovery

General data - Hot water circuit

Total recoverable thermal output	kW	2.844
Return temperature	°C	50,0
Forward temperature	°C	80,0
Hot water flow rate	m³/h	91,3
Nominal pressure of hot water	PN	10
min. operating pressure	bar	3,5
max. operating pressure	bar	9,0
Pressure drop hot water circuit	bar	1,70
Maximum Variation in return temperature	°C	+0/-5
Max. rate of return temperature fluctuation	°C/min	10

The final pressure drop will be given after final order clarification and must be taken from the P&ID order documentation.

connection variant H2

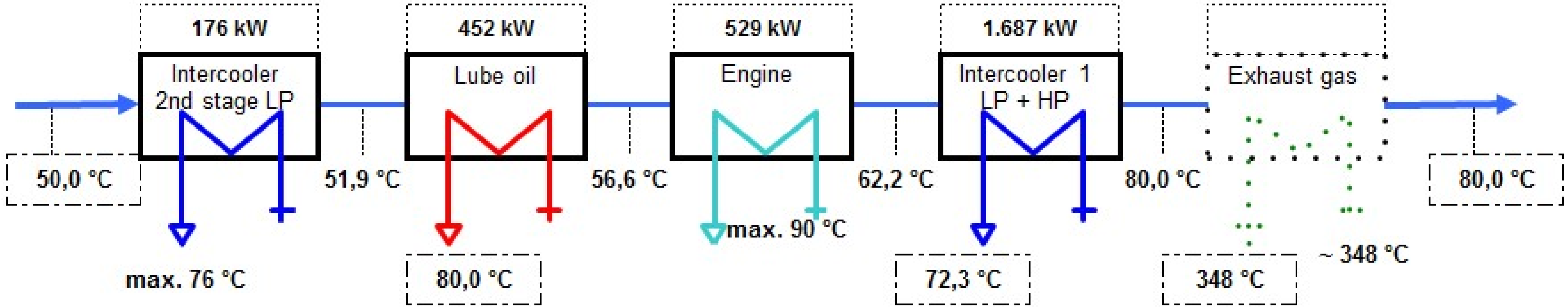
J 624 GS-K12

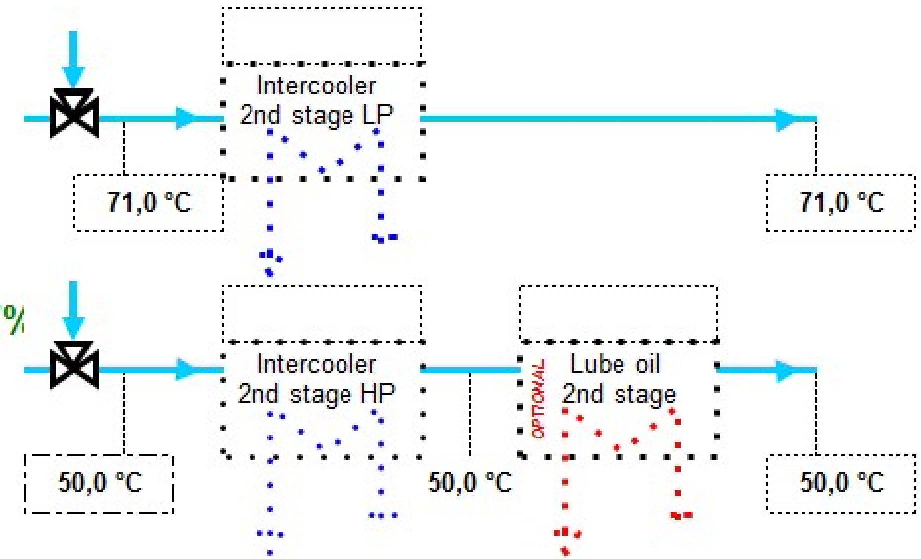
Hot water circuit (calculated with Glykol 37%)

Recoverable thermal output = 2.844 kW

(±8 % tolerance +5 % reserve for cooling requirements)

Hot water flow rate = 91,3 m³/h





Low temperature circuit (calculated with Glykol 37%

Heat to be dissipated = 0 kW

(±8 % tolerance +5 % reserve for cooling requirements)

Cooling water flow rate = 50,0 m³/h

0.10 Technical parameters

All data in the technical specification are based on engine full load (unless stated otherwise) at specified temperatures and the methane number and subject to technical development and modifications.

All pressure indications are to be measured and read with pressure gauges (psi.g.).

(1) At nominal speed and standard reference conditions ICFN according to DIN-ISO 3046 and DIN 6271, respectively
(2) According to DIN-ISO 3046 and DIN 6271, respectively, with a tolerance of +5 %.
Efficiency performance is based on a new unit (immediately upon commissioning).Effects of degradation during normal operation can be mitigated through regular service and maintenance work.
(3) Average value between oil change intervals according to maintenance schedule, without oil change amount
(4) At p. f. = 1.0 according to VDE 0530 REM / IEC 34.1 with relative tolerances, all direct driven pumps are included
(5) Total output with a tolerance of ±8 %
(6) According to above parameters (1) through (5)
(7) Only valid for engine and generator; module and peripheral equipment not considered (at p. f. = 0,8), (guiding value)
(8) Exhaust temperature with a tolerance of ±8 %
(9) Intercooler heat on:
*** standard conditions** - If the turbocharger design is done for air intake temperature > 30°C w/o de-rating, the intercooler heat of the 1st stage need to be increased by 2%/°C starting from 25°C. Deviations between 25 – 30°C will be covered with the standard tolerance.
*** Hot Country application (V1xx)** - If the turbocharger design is done for air intake temperature > 40°C w/o de-rating, the intercooler heat of the 1st stage need to be increased by 2%/°C starting from 35°C. Deviations between 35 – 40°C will be covered with the standard tolerance.

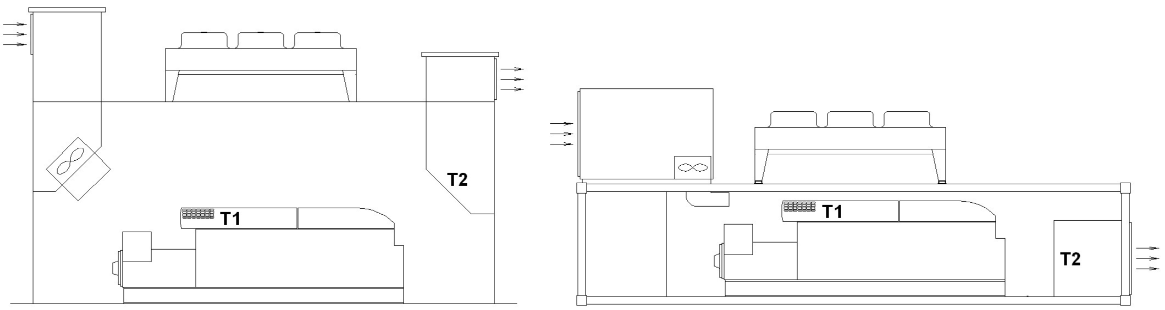
Radio interference level
The ignition system of the gas engines complies the radio interference levels of CISPR 12 and EN 55011 class B, (30-75 MHz, 75-400 MHz, 400-1000 MHz) and (30-230 MHz, 230-1000 MHz), respectively.

Definition of output
- ISO-ICFN continuous rated power:
  Net break power that the engine manufacturer declares an engine is capable of delivering continuously, at stated speed, between the normal maintenance intervals and overhauls as required by the manufacturer. Power determined under the operating conditions of the manufacturer’s test bench and adjusted to the standard reference conditions.
  - Standard reference conditions:

Barometric pressure:	1000 mbar (14.5 psi) or 100 m (328 ft) above sea level
Air temperature:	25°C (77°F) or 298 K
Relative humidity:	30 %

- Volume values at standard conditions (fuel gas, combustion air, exhaust gas)
  Pressure: 1013 mbar (14.7 psi)
  Temperature: 0°C (32°F) or 273 K

Output adjustment for turbo charged engines
Standard rating of the engines is for an installation at an altitude ≤ **500 m** and combustion air temperature ≤ **30 °C** (T1)
Engine room outlet temperature: **50°C** (T2) -> engine stop



If the actual methane number is lower than the specified, the knock control responds. First the ignition timing is changed at full rated power. Secondly the rated power is reduced. These functions are carried out by the engine management system.
Exceedance of the voltage and frequency limits for generators according to IEC 60034-1 Zone A will lead to a derate in output.

Parameters for the operation of GE Jenbacher gas engines
The genset fulfils the limits for mechanical vibrations according to ISO 8528-9.
The following "Technical Instruction of GE JENBACHER" forms an integral part of a contract and must be strictly observed: **TA 1000-0004, TA 1100 0110, TA 1100-0111**, and **TA 1100-0112.**
Transport by rail should be avoided. See **TA 1000-0046** for further details

Failure to adhere to the requirements of the above-mentioned TA documents can lead to engine damage and may result in loss of warranty coverage.

Parameters for the operation of control unit and the electrical equipment
Relative humidity 50% by maximum temperature of 40°C.
Altitude up to 2000m above the sea level.

0.20 Mode of Operation

Grid Parallel Mode
The genset is running in parallel to the utility. The unit load can be adjusted via its power control set point or designated option.
Procedure in the event of mains failure:
When the mains monitor relay (protective relay ANSI No. 27, 59, 81, 78- provided either by GE or the customer) is activated due to a mains failure, the engine is isolated from the mains by opening the generator breaker. The module is shut down without any cool-down run.

Island operation is not available in this case!
The module can be restarted following the restoration of mains power after a 5-minute mains stabilization period.

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