KEADBY
NEXT GENERATION
POWER STATION
Hydrogen-enabled flexible power

Keadby Next Generation Power Station

Environmental Permit Application

Appendix E1 - Assessment of Best Available Techniques for Large Combustion Plant

The Environmental Permitting (England and Wales) Regulations 2016

Applicant: Keadby Next Generation Limited

Date: October 2025

Document Version Control

Version	Date	Author	Approver	Changes
Draft	23/07/2025	Helen Watson		SSE Review
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GLOSSARY

Abbreviation	Description
BAT	Best Available Techniques
BAT-AELs	Best Available Techniques - Achievable Emission Levels
BAT-AEEL	Best Available Techniques - Achievable Energy Efficiency Levels
BATc	Best Available Techniques Conclusions
BRef	BAT Reference Document
CCGT	Combined Cycle Gas Turbine
CEMS	Continuous Emissions Monitoring System
CHP	Combined Heat and Power
CO	Carbon monoxide
DCS	Distributed Control System
DLN	Dry Low NOx burners
EMS	Environmental Management System
EA	Environment Agency
ELV	Emission Limit Values
GT	Gas Turbine
HRSG	Heat Recovery Steam Generation
IED	Industrial Emissions Directive
JEP	Joint Environmental Programme
LCP	Large Combustion Plant
LCP-BRef	Large Combustion Plant BAT Reference Document
LCP-BATc	Large Combustion Plant BAT Conclusions
MWth	megawatts thermal
NH_3	Ammonia
NOx	Oxides of nitrogen
NTS	National Transition System
OTNOC	Other Than Normal Operating Conditions
SCR	Selective Catalytic Reduction
ST	Steam Turbine
WMP	Waste Management Procedure

Contents

TABLES

1. Introduction

This Appendix provides an assessment of the operational techniques applied to the Large Combustion Plant (LCP) for the Keadby Next Generation Power Station (the 'Proposed Installation'). The purpose of this Appendix is to demonstrate that the Proposed Installation will be designed and operated in accordance with Best Available Techniques (BAT) for LCP.

The EU's Industrial Emissions Directive (IED) (European Commission, 2010) provides operational limits and controls to which regulated plant must comply, including Emission Limit Values (ELV) for pollutant releases into the air from plant combusting various fuel types, including gaseous fuels such as natural gas, hydrogen-containing gas and syngas. The Combined Cycle Gas Turbine (CCGT) of the Proposed Development falls under the Large Combustion Plant (LCP) requirements (Chapter III) of the IED, since it will have a capacity of greater than 50MW thermal input.

The United Kingdom (UK) is no longer a member of the European Union (EU). Most EU legislation as it applied to the UK on 31st December 2020 is now a part of UK domestic legislation, under the control of the UK's Parliaments and Assemblies as a form of domestic legislation known as 'retained EU legislation'. This is set out in Sections 2 and 3 of the European Union (Withdrawal) Act 2018. Section 4 of the European Union (Withdrawal) Act 2018 ensures that most remaining EU rights and obligations, including directly effective rights within EU treaties, continue to be recognised and available in domestic law after exit.

The assessment has been prepared using concept engineering information related to the initial design parameters of the Proposed Installation, available information about the local environment and the existing standards and guidelines presented in published guidance, including:

- Best Available Techniques (BAT) Reference Document for Large Combustion Plants[1] (LCP BRef);
- BAT Conclusions for Large Combustion Plants[2] (LCP BATc).

The Main Supporting Document provides an overall view of the Environmental Permit application being made for the Proposed Installation. A BAT assessment has also been prepared for the cooling techniques that will be applied at the Proposed Installation (Appendix E2), recognising that the overall integration of this aspect will determine BAT for the Proposed Installation.

The CCGT electricity generating station will include a single high-efficiency gas turbine (GT), heat recovery steam generator (HRSG), steam turbine (ST), steam condensation

[1] Best Available Techniques (BAT), Reference Document for Large Combustion Plants Industrial Emissions Directive 2010/75/EU of the European Parliament and of the Council, July 2017. Available at: Large Combustion Plants | EU-BRITE

[2] Commission Implementing Decision Establishing Best Available Techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for Large Combustion Plants, European IPPC Bureau, November 2021. Available at: Large Combustion Plants | EU-BRITE

and condensate recovery systems and exhaust gas treatment, as well as ancillary plant, including cooling infrastructure, and flue gas stack.

The Proposed Installation will be designed to run on 100% hydrogen, and capable of operating on 100% natural gas from the start of operation. When hydrogen becomes available and operation with hydrogen firing is commercially viable, the Proposed Installation will be upgraded to operate on a blend on natural gas and hydrogen or 100% hydrogen, dependent on its availability.

The ability to run on either fuel type will enable the Proposed Installation to facilitate the earliest possible decarbonisation of the electricity system, by ensuring that the technology is hydrogen-enabled, and switchover from natural gas to hydrogen can occur with minimal outage time as soon as the fuel is available, rather than awaiting fuel availability to commence development.

The LCP BRef and LCP BATc do not cover hydrogen firing and therefore the Environment Agency (EA) has developed Guidance on Emerging Technologies (GET): Hydrogen Combustion: comply with emission limit values, which derives emission limits for hydrogen fired plant. No other specific BAT with regards to hydrogen firing is currently available.

A detailed description of the Proposed Installation is provided in Section 4.2 of the Main Supporting Document.

2. General BAT Conclusions for Large Combustion Plant

Table 2.1 BAT Conclusions for the LCP Process

BAT No.		BATc Requirements	Demonstration of BAT - Operator Response	Operating to BAT?
1	**Environmental Management Systems** In order to improve the overall environmental performance, BAT is to implement and adhere to an environmental management system (EMS) that incorporates all of the following features:			
	(i)	Commitment of the management, including senior management.	The Proposed Installation will be operated under an ISO14001:2015 accredited Environmental Management System (EMS). The EMS will comprise an environmental policy and other relevant management documents. The site-specific procedures will define the roles and responsibilities for applicable site personnel. The EMS will include all elements listed under BATc 1.	Yes
	(ii)	Definition, by the management, of an environmental policy that includes the continuous improvement of the environmental performance of the installation.		
	(iii)	Planning and establishing the necessary procedures, objectives and targets, in conjunction with financial planning and investment.		
	(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.		
	(v)	Checking performance and taking corrective action, paying particular attention to: (a) monitoring and measurement (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.	**a. Monitoring and Measurement** • Emissions to Air: The Proposed Installation will have an operational procedure document describing the monitoring of emissions to air as required by the LCP BRef. This procedure will also cover the procedures for monitoring emissions to air during periods of abnormal operation. The document shall include the responsibilities of site personnel with regards to emissions monitoring, applicable daily, monthly and annual emission limits for each pollutant, control measures applied for each pollutant, and reporting methods and requirements.	Yes

BAT No.		BATc Requirements	Demonstration of BAT - Operator Response	Operating to BAT?
			The operator will ensure that all equipment on site is appropriately maintained and calibrated as required to ensure monitoring and reporting of emissions for regulatory compliance and other requirements; including equipment used for the continuous and discontinuous monitoring of emissions to air and water. • Emissions to Water: The Proposed Installation operation will not include any direct discharge of untreated process waters that could be harmful to the environment to controlled waters. Any emissions to controlled waters will be controlled and monitored appropriately, in line with written procedures developed prior to commencement of operations. • Maintenance Plan: All plant and equipment at the Proposed Installation will be regularly maintained by qualified maintenance staff and contractors. **b. Corrective and Preventative Actions** • The Proposed Installation will be controlled and operated via a Distributed Control System (DCS) to continuously monitor the operation of the plant and equipment at the site. Any non-conformance or deviation in normal operating parameters will be identified by the DCS to allow the operator to take action to avoid a breach of permitted emission levels. **c. Records** • The EMS will clearly define the requirements for maintaining and storing records. **d. Auditing** • The EMS will be subject to periodic review and update and will be subject to internal audits as well as external certification audits (when certified).	
	(vi)	Review, by senior management, of the EMS and its continuing suitability, adequacy and effectiveness.	Regular Management Review of the EMS will be undertaken at the Site.	Yes
	(vii)	Following the development of cleaner technologies.	See 1ix. below.	-
	(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;	The Proposed Installation will be regulated under the Environmental Permitting Regulations 2016 (as amended) which requires sites to have a decommissioning plan in place to	Yes

BAT No.		BATc Requirements	Demonstration of BAT - Operator Response	Operating to BAT?
		(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.	manage such considerations. As such, the Proposed Installation will be designed with consideration to decommissioning aspects.	
	(ix)	Application of sectoral benchmarking on a regular basis.	The Proposed Installation will be regulated under the Environmental Permitting Regulations 2016 (as amended), which requires the application of BAT for the operation of the Installation; this includes the requirement to undertake sectoral benchmarking as and when revised sector guidance is issued (e.g. BRef documents) and to implement compliance with the sector guidance within 4 years of issue. This is implemented through the Regulation 61 notice process.	Yes
	Specifically for this sector, it is also important to consider the following features of the EMS, described where appropriate in the relevant BAT:			
	(x)	Quality assurance/ quality control programmes to ensure that the characteristics of all fuels are fully determined and controlled (see BAT 9).	See response under BATc 9.	-
	(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).	See response to BATc 10 and 11.	-
	(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.	The Proposed Installation will include dedicated appropriate waste storage areas on site; additionally, a waste procedure that includes the implementation of the waste hierarchy will be developed prior to commencement of operations.	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 potential for fugitive emissions will be reviewed as part of the EMS environmental aspect and impact identification procedure and on a regular basis through on-going site observations. The site operations will include a procedure describing the processes to be followed with respect to the monitoring and reporting of emissions for regulatory compliance (outside of those required under the Environmental Permitting Regulations 2016 (as amended)). Additionally, the Proposed Installation will have a site-specific emergency preparedness and response plan and accident management plan to cover management of potential uncontrolled and/ or unplanned emissions to the environment and accidents.	Yes

BAT No.		BATc Requirements	Demonstration of BAT - Operator Response	Operating to BAT?
	(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.	Due to the inherent nature of the site operations, the potential for dust generation at the site will be minimal. Therefore, no specific dust management plan is proposed to be developed for the Proposed Installation.	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.	An assessment of potential noise sources at the Proposed Installation and impact on the sensitive receptors in the vicinity of the site has been undertaken as part of the Environmental Permit application (Appendix I of the Main Supporting Document). The assessment concluded that no significant noise or vibration effects are expected to occur at any identified sensitive receptor.	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.	The CCGT at the Proposed Installation is likely to use unodorised natural gas directly from the National Transmission System (NTS) as a fuel, therefore is not likely to generate odour. Hydrogen provided to the site would also be unodorised. There will be no storage of natural gas or hydrogen fuel on site.	Yes
2		**Monitoring** BAT is to determine the net electrical efficiency and/ or the net total fuel utilisation and/ or the net mechanical energy efficiency of the gasification, IGCC and/ or combustion units by carrying out a performance test at full load, according to EN standards, after the commissioning of the unit and 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. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.	Full performance testing will be carried out on commissioning of the Proposed Development. Periodic Operational Performance tests measuring the load, fuel used, and power output will be undertaken in accordance with applicable BS EN standards. SSE have existing procedures for monitoring and reporting of fuel consumption (both natural gas and other fuels used on site), and the energy output from their Power Station sites, which will be amended as required to include the Proposed Installation. The data will be regularly reviewed and reported (as required under relevant regulations).	Yes
3		**Monitoring** BAT is to monitor key process parameters relevant for emissions to air and water including those given below.		
		(a) Flue gas – Flow – Periodic or continuous determination.	Flue gases will be monitored using MCERTS certified Continuous Emissions Monitoring system (CEMs) in accordance with BS EN 14181.	Yes
		(b) Flue gas – oxygen content, temperature and pressure - Periodic or continuous determination.		

<table>
<tr><th>BAT No.</th><th>BATc Requirements</th><th>Demonstration of BAT - Operator Response</th><th>Operating to BAT?</th></tr>
<tr><td></td><td>(c) Flue gas – Water vapour content - Periodic or continuous measurement.
(d) Waste water from flue-gas treatment – Flow, pH, and temperature – Continuous measurement.</td><td>To facilitate the conversion of measured CEMS pollutant emissions data to standard reference conditions, continuous monitoring of stack temperature, pressure, oxygen and water vapour will be provided, as required for the type of CEMS systems installed. Continuous flow monitoring will be provided, or as per the EA agreed Joint Environmental Programme (JEP) IED/ BRef Monitoring Protocol for LCP, an agreed calculation method may be used instead.
Continuous monitoring of emissions to wastewater will be carried out for flow, pH and temperature, and as required under the Environmental Permit.</td><td></td></tr>
<tr><td>4</td><td colspan="3">Monitoring
BAT is to monitor emissions to air with at least the frequency given below and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.</td></tr>
<tr><td></td><td><table>
<tr><th>Parameter</th><th>Standard</th><th>Minimum frequency</th><th>Monitoring associated with</th></tr>
<tr><td>NO_x</td><td>Generic EN standards</td><td>Continuous(1)</td><td>BAT 42, BAT 43</td></tr>
<tr><td>CO</td><td>Generic EN standards</td><td>Continuous(1)</td><td>BAT 49, BAT 56</td></tr>
<tr><td>NH_3</td><td>Generic EN standards</td><td>Continuous(1)</td><td>BAT 7</td></tr>
<tr><td colspan="4">(1) For gas turbines, periodic monitoring is carried out with a combustion plant load of >70 %.</td></tr>
</table></td><td>The flue gases from the CCGT will be monitored using MCERTS certified Continuous Emissions Monitoring systems (CEMs) in accordance with BS EN 14181.
This system will continuously monitor NOx, CO and NH_3 (associated with SCR use, if required).
It should be noted that there are no emissions of CO associated with hydrogen firing.
Further detailed on the monitoring of emissions to air to be carried out at the Proposed Installation are provided in Section 6.2 of the Main Supporting Document.</td><td>Yes</td></tr>
<tr><td>5</td><td>Monitoring
BAT is to monitor emissions to water from flue-gas treatment in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.</td><td>The Proposed Installation may use SCR for the control of NOx emissions in the flue gas if required to meet the BAT-AELs, however this will not result in any emissions to water.</td><td>Not applicable.</td></tr>
<tr><td>6</td><td colspan="3">General Environmental and Combustion Performance
In order to improve the general environmental performance of combustion plants and to reduce emissions to air of CO and unburnt substances, BAT is to ensure an optimised combustion and to use an appropriate combination of the techniques given below:</td></tr>
</table>

BAT No.	BATc Requirements			Demonstration of BAT - Operator Response	Operating to BAT?
	Technique	**Description**	**Applicability**		
	Fuel blending and mixing	Ensure stable combustion conditions and/ or reduce the emission of pollutants by mixing different qualities of the same fuel type.	Generally applicable.	When firing on natural gas, the Proposed Installation will use the existing natural gas supply to the Keadby Power Station site and will be subject to a fuel management and monitoring procedure. The site has a contractual agreement to receive natural gas from the NTS which includes the requirement for the gas to comply with specified quality criteria. Equipment such as a gas chromatograph (GC) will be put in place to test the quality of the fuel and the parameters listed under BATc 9 for natural gas are recorded. When firing on hydrogen equivalent provisions to those provided for natural gas will be in place. Performance tests measuring the load, fuel used, and power output to calculate overall efficiencies will be undertaken in accordance with applicable industry standards and site procedures.	Yes
	Maintenance of the combustion system	Regular planned maintenance according to supplier's recommendations.	Generally applicable.	All plant and equipment at the Proposed Installation will be regularly maintained, including the combustion system, by qualified maintenance staff or contractors, as per site procedures.	Yes
	Advanced control system	The use of a computer-based automatic system to control the combustion efficiency and support the prevention and/ or reduction of emissions. This also includes the use of high-performance monitoring.	The applicability to old combustion plants may be constrained by the need to retrofit the combustion system and / or control command system.	The Proposed Installation's operations will be monitored and operated by suitably trained site personnel and managed via a DCS to continuously monitor the operation of the plant and equipment at the site. Any non-conformance or deviation in normal operating parameters will be identified by the DCS to allow operators to take action to avoid a breach of permitted emission levels.	Yes
	Good design of the combustion equipment	Good design of furnace, combustion chambers, burners and associated devices.	Generally applicable to new combustion plants.	The CCGT plant will be a new high efficiency unit offering leading performance in its class and compliant with all relevant and most recent regulatory requirements, in addition to design features to optimise performance in terms of emissions and efficiency.	Yes

BAT No.	BATc Requirements			Demonstration of BAT - Operator Response	Operating to BAT?
	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.	Applicable within the constraints associated with the availability of suitable types of fuel with a better environmental profile as a whole, which may be impacted by the energy policy of the Member State, or by the integrated site's fuel balance in the case of combustion of industrial process fuels.	Natural gas from the NTS will result in minimal sulphur dioxide and particulate emissions from the CCGT. There will be no sulphur or particulates in the hydrogen. The switch to hydrogen will eliminate emissions of CO_2 associated with the operation of the Installation, although there may be a slight increase in NOx emissions as a result. If required to ensure that NOx emissions meet the Hydrogen GET ELVs, SCR will be installed.	Yes
7	**General Environmental and Combustion Performance** In order to reduce emissions of ammonia to air from the use of selective catalytic reduction (SCR) and/ or selective non-catalytic reduction (SNCR) for the abatement of NOx emissions, BAT is to optimise the design and/or operation of SCR and/or SNCR (e.g. optimised reagent to NOx ratio, homogeneous reagent distribution and optimum size of the reagent drops). The BAT-associated emission level (BAT-AEL) for emissions of NH_3 to air from the use of SCR and/ or SNCR is < 3–10 mg/Nm^3 as a yearly average or average over the sampling period. The lower end of the range can be achieved when using SCR and the upper end of the range can be achieved when using SNCR without wet abatement techniques.			The Proposed Installation may be able to comply with the NOx BAT-AELs without the use of secondary abatement, however this will not be confirmed until the CCGT plant to be installed is selected. If this is not the case, the Proposed Installation will include an SCR plant for NOx control, using ammonia or urea as a reagent. The SCR plant will be appropriately designed and operated to maintain optimum ammonia injection rate and minimise ammonia slip emissions to air. Further information on the control of ammonia emissions is provided in Section 5.1 of the Main Supporting Document. Ammonia emissions will comply with the annual BAT-AEL of 3 – 10 mg/Nm^3 and are expected to be at the lower end of the range.	Yes
8	**BAT Associated Emission Levels** In order to prevent or reduce emissions to air during normal operating conditions, BAT is to ensure, by appropriate design, operation and maintenance, that the emission abatement systems are used at optimal capacity and availability.			If an SCR is required, this will be designed, operated and maintained to ensure use at optimal capacity and availability, as described in response to BAT 7.	Yes
9	**BAT Associated Emission Levels** In order to improve the general environmental performance of combustion and/ or gasification plants and to reduce emissions to air, BAT is to include the following elements in the quality assurance/ quality control programmes			A contractual agreement to receive natural gas from the NTS is in place, which will include the requirement for the gas to comply with specified quality criteria. Equipment such as a gas chromatograph (GC) would be put in place to periodically test	Yes

BAT No.	BATc Requirements	Demonstration of BAT - Operator Response	Operating to BAT?
	for all the fuels used, as part of the environmental management system (see BAT 1): i. Initial full characterisation of the fuel used including at least the parameters listed below and in accordance with EN standards. ISO, national or other international standards may be used provided they ensure the provision of data of an equivalent scientific quality; ii. Regular testing of the fuel quality to check that it is consistent with the initial characterisation and according to the plant design specifications. The frequency of testing and the parameters below are based on the variability of the fuel and an assessment of the relevance of pollutant releases (e.g. concentration in fuel, flue-gas treatment employed); iii. Subsequent adjustment of the plant settings as and when needed and practicable (e.g. integration of the fuel characterisation and control in the advanced control system). Initial characterisation and regular testing of the fuel can be performed by the operator and /or the fuel supplier. If performed by the supplier, the full results are provided to the operator in the form of a product (fuel) supplier specification and/or guarantee. Natural gas — LHV Natural gas — CH4, C2H6, C3, C4+, CO2, N2, Wobbe index	the quality of the fuel if required and the parameters listed under BATc 9 for natural gas are recorded. When firing on hydrogen equivalent provisions to those provided for natural gas will be in place. Performance tests measuring the load, fuel used, and power output to calculate overall efficiencies shall be undertaken in accordance with applicable industry standards.	
10	**General Environmental and Combustion Performance** 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 environmental management system (see BAT 1), commensurate with the relevance of potential pollutant releases, that includes the following elements: • appropriate design of the systems considered relevant in causing OTNOC that may have an impact on emissions to air, water and/or soil (e.g. low-load design concepts for reducing the minimum start-up and shutdown loads for stable generation in gas turbines); • set-up and implementation of a specific preventive maintenance plan for these relevant systems; • review and recording of emissions caused by OTNOC and associated circumstances and implementation of corrective actions if necessary; • • periodic assessment of the overall emissions during OTNOC (e.g. frequency of events, duration, emissions quantification/estimation) and implementation of corrective actions if necessary.	The plant and associated control systems will be designed to minimise the potential for OTNOC events to occur. The Proposed Installation will be operated using a DCS to continuously monitor the operation of the plant and equipment at the Site. Any non-conformance or deviation in normal operating parameters is expected to be identified by the automated control system to allow operators to take action to avoid OTNOC events. Site operators will be trained to monitor plant operation and take appropriate action(s) in the event of a potential OTNOC event being identified. Start up and Shutdown procedures will be put in place with the aim to minimise the time during which the plant is operating at non-optimal conditions and operators shall be trained in the appropriate actions required should the potential for an OTNOC event be identified.	Yes

<table>
<tr><th>BAT No.</th><th>BATc Requirements</th><th>Demonstration of BAT - Operator Response</th><th>Operating to BAT?</th></tr>
<tr><td></td><td></td><td>All plant and equipment at the Site will be regularly maintained including those systems provided to minimise the potential for OTNOC conditions to occur.
The Proposed Installation will be managed according to an accident management plan (AMP) and emergency response procedures.
Appropriate procedures will also be put in place to review any OTNOC events with periodic assessment of associated aspects.
The records of OTNOC events will be retained on Site.
If the site is required to support a grid blackstart event to maximise generation/ response times/ grid support; this will be in accordance with the Black Start Response Plan.</td><td></td></tr>
<tr><td>11</td><td>General Environmental and Combustion Performance
BAT is to appropriately monitor emissions to air and/ or to water during OTNOC.</td><td>The flue gases from the Site will be monitored using MCERTS certified CEMs in accordance with BS EN 14181. This system will capture emissions data during all operating conditions, including OTNOC situations, and can be used to inform subsequent incident investigation.</td><td>Yes</td></tr>
<tr><td>12</td><td>Energy Efficiency
In order to increase the energy efficiency of combustion, gasification and/or IGCC units operated ≥ 1 500 h/yr, BAT is to use an appropriate combination of the techniques given below.
<table>
<tr><th>Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>Combustion optimisation</td><td>Optimising the combustion minimises the content of unburnt substances in the flue gases and in solid combustion residues</td><td rowspan="2">Generally applicable</td></tr>
<tr><td>Optimisation of the working medium conditions</td><td>Operate at the highest possible pressure and temperature of the working medium gas or steam, within the constraints associated with, for example, the control of NOX emissions or the characteristics of energy demanded</td></tr>
</table></td><td>The CCGT for the Proposed Installation is a new H/J Class unit which utilise a combination of techniques to provide the high electrical efficiency values.
The anticipated electrical efficiency of the CCGT plant will be greater than 61% for 100% natural gas, 100% hydrogen or blended fuel operation, which exceeds the required BAT-AEEL range of 57 – 60.5% for CCGTs having a thermal input of >600MWth.</td><td>Yes</td></tr>
</table>

BAT No.	BATc Requirements			Demonstration of BAT - Operator Response	Operating to BAT?
	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			
	Minimisation of energy consumption	Minimising the internal energy consumption (e.g. greater efficiency of the feed-water pump)			
	Preheating of combustion air	Reuse of part of the heat recovered from the combustion flue-gas to preheat the air used in combustion	Generally applicable within the constraints related to the need to control NOx emissions		
	Fuel preheating	Preheating of fuel using recovered heat	Generally applicable within the constraints associated with the boiler design and the need to control NOx emissions		
	Advanced control system	Computerised control of the main combustion parameters enables the combustion efficiency to be improved	Generally applicable to new units.		
	Feed-water preheating using recovered heat	Preheat water coming out of the steam condenser with recovered heat, before reusing it in the boiler	Only applicable to steam circuits and not to hot boilers. Applicability to existing units may be limited due to constraints associated with the plant configuration and the amount of recoverable heat		
	Heat recovery by cogeneration (CHP)	Recovery of heat (mainly from the steam system) for producing hot water/steam to be used in industrial			

BAT No.	BATc Requirements			Demonstration of BAT - Operator Response	Operating to BAT?
		processes/activities or in a public network for district heating. Additional heat recovery is possible from: • flue-gas • grate cooling • circulating fluidised bed			
	CHP readiness		Only applicable to new units where there is a realistic potential for the future use of heat in the vicinity of the unit		
	Flue-gas condenser		Generally applicable to CHP units provided there is enough demand for low temperature heat		
	Heat accumulation	Heat accumulation storage in CHP mode	Only applicable to CHP plants. The applicability may be limited in the case of low heat load demand		
	Wet stack				
	Cooling tower discharge				
	Fuel pre-drying				
	Minimisation of heat losses				
	Advanced materials				
	Steam turbine upgrades	This includes techniques such as increasing the temperature and pressure of medium pressure steam, addition of a low-pressure turbine, and	The applicability may be restricted by demand, steam conditions and/or limited plant lifetime		

BAT No.	BATc Requirements			Demonstration of BAT - Operator Response	Operating to BAT?
		modifications to the geometry of the turbine rotor blades			
	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 ultra-supercritical conditions	Only applicable to new units of ≥ 600 MWth operated > 4 000 h/yr. Not applicable when the purpose of the unit is to produce low steam temperatures and/or pressures in process industries. Not applicable to gas turbines and engines generating steam in CHP mode. For units combusting biomass, the applicability may be constrained by high temperature corrosion in the case of certain biomasses		
13	**Water Usage and Emissions to Water** In order to reduce water usage and the volume of contaminated waste water discharged, BAT is to use one or both of the techniques given below.			The Proposed Installation will be serviced by a closed-loop cooling system with hybrid cooling towers, where the cooling water will be recycled. There will be some evaporative losses and blowdown - typically four cycles of concentration, meaning that the ratio of mineral concentration in the source water to that in the circulating water that must be maintained. It would not be possible to reuse the blowdown in the LCP due to the build-up of contaminants over time in the recirculated water. As a hybrid cooling system, the amount of water used is lower than that for fully wet cooling system. As such, lower quantities of water treatment chemicals are expected to be used over a once-through system, primarily for prevention of scaling and corrosion, and biofouling. The volumes of surface water run-off are extremely low in comparison to overall water usage on site and opportunities for	Yes
	Technique	**Description**	**Applicability**		
	Water recycling	Residual aqueous streams, including run-off water, from the plant are reused for other purposes. The degree of recycling is limited by the quality requirements of the recipient water stream and the water balance of the plant.	Not applicable to waste water from cooling systems when water treatment chemicals and/or high concentrations of salts from seawater are present.		
	Dry bottom ash handling	Dry, hot bottom ash falls from the furnace onto a mechanical conveyor	Only applicable to plants combusting solid fuels.		

BAT No.	BATc Requirements			Demonstration of BAT - Operator Response	Operating to BAT?
		system and is cooled down by ambient air. No water is used in the process.		reuse on site are limited due to the water quality requirements for on-site processes. CCGTs do not produce any ash from the combustion process; therefore, the techniques for dry bottom ash handling are not applicable.	
14	**Water Usage and Emissions to Water** In order to prevent the contamination of uncontaminated waste water and to reduce emissions to water, BAT is to segregate waste water streams and to treat them separately, depending on the pollutant content.			Waste water streams generated at the Proposed Installation are anticipated to comprise surface run-off water and cooling water blowdown (containing process waste waters); all waste water streams will be appropriately segregated, treated (if required) prior to discharge.	Yes
15	**Water Usage and Emissions to Water** In order to reduce emissions to water from flue-gas treatment, BAT is to use an appropriate combination of the techniques, and to use secondary techniques as close as possible to the source in order to avoid dilution.			The need for flue gas treatment is minimised by primary combustion controls identified in BAT 6 and appropriate control of the SCR system identified in BAT 7 above, which would minimise water usage. It is therefore considered that there would not be any emissions to water from flue-gas treatment.	Yes
16	**Waste Management** In order to reduce the quantity of waste sent for disposal from the combustion and/ or gasification process and abatement techniques, BAT is to organise operations so as to maximise, in order of priority and taking into account life-cycle thinking: (a) waste prevention, e.g. maximise the proportion of residues which arise as by-products; (b) waste preparation for reuse, e.g. according to the specific requested quality criteria; (c) waste recycling; (d) other waste recovery (e.g. energy recovery), by using appropriate techniques.			The Proposed Installation will develop a Waste Management Procedure (WMP) prior to commencement of Site operations, detailing the waste storage and handling procedures on Site. The WMP will outline identification of waste streams and how they must be handled, including appropriate segregation and storage within designated waste storage areas on Site. The Proposed Installation will apply the waste hierarchy for the management of any waste produced on Site. It is expected that due to the inherent nature of the Site operations and fuel used, the Site will only produce minor quantities of waste, primarily from maintenance activities. The main waste stream generated from the Site activities is likely to comprise used lubricating oil, which will be sent off site for appropriately management via licenced contractors. The operator will review and identify potential re-use of wastes on site, and spent catalysts, in line with the waste hierarchy. Anticipated quantities of waste streams from the Proposed Installation are provided in Table 3 of the Main Supporting Document.	Yes
17	**Noise emissions** In order to reduce noise emissions, BAT is to use one or a combination of the techniques given below.				

BAT No.	BATc Requirements			Demonstration of BAT - Operator Response	Operating to BAT?
	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.	Generally applicable	The Site will have a maintenance schedule in place to ensure optimum operation of all plant and equipment. The GT and ST will be situated within an enclosure; and all outdoor equipment will have noise attenuation enclosures, where required. Any maintenance work that is likely to cause significant noise that poses a nuisance risk will be undertaken during daylight hours, where feasible.	Yes
	Low-noise equipment	This potentially includes compressors, pumps and disks.		The Proposed Installation will be a new plant, and all equipment will be selected to avoid noise impacts either via inherent design qualities, or where a noise risk exists, via the installation of noise attenuation measures.	Yes
	Noise attenuation	Noise propagation can be reduced by inserting obstacles between the emitter and the receiver. Appropriate obstacles include protection walls, embankments and buildings	Generally applicable to new plants	The GT and ST will be situated within an enclosure. All equipment being installed is new and mitigation will be in place where necessary to ensure levels of noise below applicable lowest observed adverse effect level, so that residual effects are expected to be not significant.	Yes
	Noise-control equipment	This includes: • noise-reducers • vibration or acoustic insulation, or vibration isolation • enclosure of noisy equipment • soundproofing of buildings	The applicability may be restricted by lack of space		
	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.	Generally applicable to new plants		

BAT 18 – 27 are associated with the combustion of solid fuels only and therefore are not considered to be applicable to the Proposed Installation.

BAT 28 – 39 are associated with the combustion of liquid fuels only and therefore are not considered to be applicable to the Proposed Installation.

3. BAT Conclusions for the Combustion of Gaseous Fuels

Table 3.2 BAT Conclusions for the Combustion of Gaseous Fuels

BAT No.	BATc Requirements		Demonstration of BAT - Operator Response	Operating to BAT?
40	**Energy Efficiency & BAT-associated energy efficiency levels (BAT-AEELs)** In order to increase the energy efficiency of natural gas combustion, BAT is to use an appropriate combination of the techniques given in BAT 12 and combined cycle for new gas turbines operating over 1,500 hours per year. New CCGT >600MW_{th} BAT-AEEL = Net electrical efficiency 57 - 60.5%		The anticipated electrical efficiency of the CCGT plant will be greater than 61% when firing on 100% hydrogen, 100% natural gas or a blend of the two, which is compliant with or exceeds the required BAT-AEEL range of 57 – 60.5% for CCGTs having a thermal input of >600MWth.	Yes
41	**NOx, CO, NMVOC and CH_4 emissions to air**			
	Only applicable to boilers and therefore not applicable to the Proposed Installation.			
42	In order to prevent or reduce NOx emissions to air from the combustion of natural gas in gas turbines, BAT is to use one or a combination of the techniques given below:			Yes
	Technique	**Applicability**		
	Advanced Control System	The applicability to old combustion plants may be constrained by the need to retrofit the combustion system and/or control command system.	Operation of the CCGT unit will be controlled by trained site operators using a DCS, which will be used to control the operation of the plant and also record data on the plant performance, which can also be used by the operations team to identify potential issues.	
	Water / Steam Addition	The applicability may be limited due to water availability.	Water/ steam addition for NOx control is not applied as the plant will have Dry Low NOx burners (DLN) and SCR (if required) for NOx control.	
	Dry Low NOx Burners (DLN)	The applicability may be limited in the case of turbines where a retrofit package is not available or when water/steam addition systems are installed.	The CCGT will have DLN burners in place to ensure minimum emissions of NOx.	
	Low Load Design Concept	The applicability may be limited by the gas turbine design.	Not applicable as this is limited by the turbine design. Operational efficiency characteristics of the plant vary according to the load.	
	Low NOx Burners (LNB)	Generally applicable to supplementary firing for heat recovery steam generators (HRSGs) in the case of combined-cycle gas turbine (CCGT) combustion plants.	The CCGT will have DLN low NOx burners in place to ensure minimum emissions of NOx. No supplementary firing is undertaken in the HRSGs.	
	Selective Catalytic Reduction (SCR)	Not applicable in the case of combustion plants operated < 500 h/yr. Not generally	See Response to Table 2.1, BAT 7	

		applicable to existing combustion plants of < 100 MWth		
43	Only applicable to natural gas engines and therefore not applicable to the Proposed Installation.			
44	In order to prevent or reduce CO emissions to air from the combustion of natural gas, BAT is to ensure optimised combustion and/or to use oxidation catalysts			

Table 3.3 BAT Associated Emission Levels (BAT-AELs) for the Combustion of Natural Gas in New CCGTs >50MWth

Pollutant	Yearly Average	Daily average or average over the sampling period	Demonstration of BAT - Operator Response
NOx	10-30 mg/Nm^3	15-40 mg/Nm^3	The CCGT is expected to achieve the stated BAT-AELs, with energy efficiency uplifts applied as appropriate on confirmation of the CCGT supplier.
CO	5-30 mg/Nm^3 (indicative BAT-AEL)	-	Performance to be confirmed following commencement of operation. IED ELV of 100 mg/Nm^3 proposed in the Main Supporting Document.

In the case of a gas turbine equipped with DLN, these BAT-AELs apply only when the DLN operation is effective.

For plants with a net electrical efficiency (EE) greater than 55%, a correction factor may be applied to the higher end of the BAT-AEL range, corresponding to [higher end] x EE / 55, where EE is the net electrical efficiency of the plant determined at ISO baseload conditions.

4. Conclusions

On the basis of the assessment against the required BAT Conclusions, as shown in Sections 2 and 3 of the Appendix, it is considered that the CCGT for the Proposed Installation will be designed and operated in compliance with the LCP-BRef and therefore in accordance with BAT.