TOUCAN ENVIRONMENT LIMITED

Appendix B: Best Available Techniques (BAT) Assessment

Environmental Permit Application for a Bespoke Installation at

Avonmouth Gas Generation Plant
Land off Severn Road
Hallen
South Gloucestershire
BS10 7RZ

Prepared for

Spango Generation Limited
Registered Company: SC573852

Prepared by

Rachael Chambers CEnv MIEnvSc PIEMA MSc BSc
Toucan Environment Limited
Registered Company: 13522900

Version Control

Version	Date	Comments
1	30/07/2023	Draft issued for client review.
2	21/11/2023	Updates to efficiency data

Contents

1. Introduction

This Best Available Techniques (BAT) assessment has been prepared in support of a bespoke installation environmental permit application on behalf of Spango Generation Limited "the Operator" for Avonmouth Gas Generation Plant at Land off Severn Road, Hallen, South Gloucestershire, BS10 7RZ "the Installation".

The Installation is carrying out an activity covered by Annex I of the Industrial Emissions Directive (IED), "Combustion of fuels in installations with a total rated thermal input of 50 MW or more". Chapter II of the IED sets out that the Operator must demonstrate it is using the best available techniques (BAT) for any Annex I activity to obtain an environmental permit from the relevant authority.

The generators have a net rated thermal input of less than 15MWth so the Installation is not subject to Chapter III of the IED, "Large Combustion Plant". However, it is considered that the European Commission (2017) Best Available Techniques (BAT) Reference document for Large Combustion Plants (LCP BREF)[1] is the best guidance to use in assessing BAT for peaking plant. The techniques utilised by the Installation have therefore been assessed against the BAT conclusions within the LCP BREF in Section 2.

The EA produced a working draft document "BAT guidance for >50 MWth gas and liquid fuel combustion plant exporting electricity under commercial arrangements for <1500 hrs per annum"[2] in August 2018. The plant has also been assessed against the criteria given within that document in Section 3.

2. LCP BREF BAT Conclusions

The compliance measures in place at the Installation for each of the relevant BAT conclusions of the LCP BREF are summarised in Table 1 for Section 10.1 "General BAT Conclusions", and Table 2 for Section 10.4.1 "BAT conclusions for the combustion of natural gas".

[1] European Commission (2017) Best Available Techniques (BAT) Reference document for Large Combustion Plants https://eippcb.jrc.ec.europa.eu/sites/default/files/2019-11/JRC_107769_LCPBref_2017.pdf

[2] EA (August 2018) BAT guidance for >50 MWth gas and liquid fuel combustion plant exporting electricity under commercial arrangements for <1500 hrs per annum (Working draft v1.0) https://consult.environment-agency.gov.uk/psc/permit-reviews-for-large-combustion-plant-lcp/supporting_documents/BAT%20for%20balancing%20plant%20guidance%20working%20draft%20ver%201.pdf

Table 1: General BAT Conclusions

BAT Ref.	BAT Conclusion	Compliance Measures	Status
2.1. Environmental Management Systems			
BAT 1	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; 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 (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; vi. review, by senior management, of the EMS and its continuing suitability, adequacy and effectiveness;	The Operator will develop an Environmental Management System (EMS) prior to commencement of operations that will be compliant with all relevant legislation.	Compliant

	vii. following the development of cleaner technologies; 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; 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; x. quality assurance/quality control programmes to ensure that the characteristics of all fuels are fully determined and controlled (see BAT 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); 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; 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; 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; 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;		

<table>
<tr><td></td><td>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.

Where an assessment shows that any of the elements listed under items x to xvi are not necessary, a record is made of the decision, including the reasons.</td><td></td><td></td></tr>
</table>

2.2. Monitoring

<table>
<tr><td>BAT 2</td><td>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.</td><td>The generators will be performance tested during the commissioning process in line with relevant standards to confirm the net electrical efficiency.</td><td>Compliant</td></tr>
<tr><td>BAT 3</td><td>BAT is to monitor key process parameters relevant for emissions to air and water including those given below.

<table>
<tr><td>Stream</td><td>Parameter (s)</td><td>Monitoring</td></tr>
<tr><td rowspan="3">Flue-gas</td><td>Flow</td><td>Periodic or continuous determination</td></tr>
<tr><td>Oxygen content, temperature and pressure</td><td rowspan="2">Periodic or continuous determination</td></tr>
<tr><td>Water vapour content (1)</td></tr>
<tr><td>Waste water from flue-gas treatment</td><td>Flow, pH, and temperature</td><td>Continuous measurement</td></tr>
<tr><td colspan="3">(1) The continuous measurement of the water vapour content of the flue-gas is not necessary if the sampled flue-gas is dried before analysis.</td></tr>
</table>
</td><td>Emissions to air will be monitored periodically to MCERTS standards including the parameters flow, oxygen content, temperature, pressure and water vapour content.

There are no emissions to water.</td><td>Compliant</td></tr>
</table>

<table>
<tr>
<td>BAT 4</td>
<td>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.
<table>
<tr><td>Substance/ Parameter</td><td>Fuel/Process/Type of combustion plant</td><td>Combustion plant total thermal input</td><td>Standard (s)</td><td>Minimum monitoring frequency</td><td>Monitoring associated with</td></tr>
<tr><td>NOx</td><td>Natural-gas-fired boilers, engines, and turbines</td><td>All sizes</td><td>Generic EN Standards</td><td>Continuous (1) (2)</td><td>BAT 42
BAT 43</td></tr>
<tr><td>CO</td><td>Natural-gas-fired boilers, engines, and turbines</td><td>All sizes</td><td>Generic EN Standards</td><td>Continuous (1) (2)</td><td>BAT 49
BAT 56</td></tr>
<tr><td>CH4</td><td>Natural-gas-fired boilers, engines, and turbines</td><td>All sizes</td><td>EN ISO 25139</td><td>Once every year</td><td>BAT 45</td></tr>
<tr><td colspan="6">(1) In the case of plants with a rated thermal input of < 100 MW operated < 1 500 h/yr, the minimum monitoring frequency may be at least once every six months. For gas turbines, periodic monitoring is carried out with a combustion plant load of > 70 %.
(2) In the case of natural-gas-fired turbines with a rated thermal input of < 100 MW operated < 1 500 h/yr, or in the case of existing OCGTs, PEMS may be used instead.</td></tr>
</table>
</td>
<td>Each generator has a net rated thermal input of > 1MWth and < 50MWth individually so are subject to the Medium Combustion Plant Directive (MCPD) monitoring requirements.

Air emissions for NOx and CO will be monitored periodically using MCERTS methodology to the following standards:
• NOx: BS EN 14792
• CO: BS EN 15058</td>
<td>Compliant</td>
</tr>
<tr>
<td>BAT 5</td>
<td>BAT is to monitor emissions to water from flue-gas treatment with at least the frequency given in the table 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>
<td>No flue gas treatment will be used in the generators so there will be no emissions to water that would require monitoring.</td>
<td>N/A</td>
</tr>
</table>

2.3. General Environmental and Combustion Performance

<table>
<tr>
<td>BAT 6</td>
<td>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 optimised combustion and to use an appropriate combination of the techniques given below:
<table>
<tr><td>Technique</td><td>Description</td><td>Applicability</td></tr>
</table>
</td>
<td></td>
<td></td>
</tr>
</table>

	a	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	As natural gas is fuelled directly from the National Transmission System, there will be no fuel blending or mixing on site.	N/A
	b	Maintenance of the combustion system	Regular planned maintenance according to suppliers' recommendations		The Operator will ensure all equipment is kept maintained in line with suppliers recommendations.	Compliant
	c	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 Operator will use a computer-based control system to ensure combustion efficiency.	Compliant
	d	Good design of the combustion equipment	Good design of furnace, combustion chambers, burners and associated devices	Generally applicable to new combustion plants	All design of all plant and equipment installed on site is considered to be the most appropriate for it's intended operations.	Compliant
	e	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. For existing combustion plants, the type of fuel chosen may be limited by the configuration and the design of the plant	Although non-renewable, natural gas is considered to be a low carbon fuel choice and the cleanest for combustion.	Compliant

BAT 7	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).	There will be no SCR fitted as the generators achieve the BAT Emission Limit Values (ELVs) by using lean burn technology as a primary abatement measure.	N/A
BAT 8	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.	The Operator will ensure the lean burn technology is kept well maintained to ensure optimal capacity and availability.	Compliant
BAT 9	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 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 chosen from the table 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 (see description in Section 10.8.1)). 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. Fuel: Natural gas — Substances/Parameters subject to characterisation: • LHV • CH4, C2H6, C3, C4+, CO2, N2, Wobbe index	Natural gas to fuel the plant will come from the National Transmission Network via a regulated transporter.	N/A
BAT 10	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:	Prior to the commencement of the plant, a management plan in relation to OTNOC will be developed which captures the	Compliant

	• 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.	design elements relevant to OTNOC, a preventative maintenance plan and recording and assessment programme.	
BAT 11	BAT is to appropriately monitor emissions to air and/or to water during OTNOC.	Emissions will be sampled appropriately during the unlikely event of an OTNOC.	Compliant

2.4. Energy Efficiency

BAT 12	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 in the table.	The plant is intended to operate for < 1,500 hours per year.	N/A

2.5. Water Usage and Emissions to Water

BAT 13	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.	There will be a negligible amount of water used on site as operational purposes would be limited to replacement of water within the cooling system and welfare facilities. All efforts will be made by the Operator to reduce and recycle water where it is reasonably practicable.	Compliant

	Technique	Description	Applicability
a	Water recycling	Residual aqueous streams, including runoff 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
b	Dry bottom ash handling	Dry, hot bottom ash falls from the furnace onto a mechanical conveyor system and is cooled	Only applicable to plants combusting solid fuels. There may be technical restrictions that

<table>
<tr><td></td><td><table><tr><td></td><td></td><td>down by ambient air. No water is used in the process.</td><td>prevent retrofitting to existing combustion plants</td></tr></table></td><td></td><td></td></tr>
<tr><td>BAT 14</td><td>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.</td><td>The waste water streams on site would be limited to surface water and sewage as there are no processes that produce waste water. Sewage will be handled by a dedicated system and run off will be handled by the surface water drainage system.</td><td>Compliant</td></tr>
<tr><td>BAT 15</td><td>In order to reduce emissions to water from flue-gas treatment, BAT is to use an appropriate combination of techniques, and to use secondary techniques as close as possible to the source in order to avoid dilution.</td><td>Flue-gas treatment will not be carried out on site.</td><td>N/A</td></tr>
</table>

2.6. Waste Management

<table>
<tr><td>BAT 16</td><td>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 implementing an appropriate combination of techniques.</td><td>There will be a negligible amount of waste produced during normal operations.
Waste will be managed using the waste hierarchy and disposed of by appropriately licensed facilities.</td><td>Compliant</td></tr>
</table>

2.7. Noise Emissions

<table>
<tr><td>BAT 17</td><td>In order to reduce noise emissions, BAT is to use one or a combination of the techniques given below.<table><tr><td colspan="2">Technique</td><td>Description</td><td>Applicability</td></tr><tr><td>a</td><td>Operational measures</td><td>These include:
• improved inspection and maintenance of equipment
• closing of doors and windows of enclosed areas, if possible</td><td>Generally applicable</td></tr></table></td><td>Noise generating equipment will be housed in appropriately attenuated enclosures or buildings to minimise the amount of noise being released.
A noise impact assessment is included within Appendix G and</td><td>Compliant</td></tr>
</table>

			• equipment operated by experienced staff • avoidance of noisy activities at night, if possible • provisions for noise control during maintenance activities		concludes the Installation is unlikely to result in an adverse impact on the nearest residential receptors (which are over 650m away), or the neighbouring industrial estate.	
	b	Low-noise equipment	This potentially includes compressors, pumps and disks	Generally applicable when the equipment is new or replaced		
	c	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. In the case of existing plants, the insertion of obstacles may be restricted by lack of space		
	d	Noise-control equipment	This includes: • noise-reducers • equipment insulation • enclosure of noisy equipment • soundproofing of buildings	The applicability may be restricted by lack of space		
	e	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. In the case of existing plants, the relocation of equipment and production units may be restricted by lack of space or by excessive costs		

Table 2: BAT conclusions for the combustion of natural gas

<table>
<tr><th>BAT Ref.</th><th colspan="4">BAT Conclusion</th><th>Compliance Measures</th><th>Status</th></tr>
<tr><td colspan="7"><h2>2.8. Energy Efficiency</h2></td></tr>
<tr><td>BAT 40</td><td colspan="4">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 below.
<table>
<tr><td rowspan="3">Type of combustion unit</td><td>BAT-AEELs(1)</td></tr>
<tr><td>Net electrical efficiency (%)</td></tr>
<tr><td>New unit</td></tr>
<tr><td>Gas engine</td><td>39.5-44(2)</td></tr>
<tr><td colspan="2">(1) These BAT-AEELs do not apply to units operated < 1 500 h/yr.
(2) These levels may be difficult to achieve in the case of engines tuned in order to reach NOX levels lower than 190 mg/Nm3</td></tr>
</table></td><td>The Installation is planned to operate for less than 1,500 hours and produce NOx levels of 95mg/Nm3, which are much lower than 190mg/Nm3. Furthermore, the generators have a nameplate efficiency of 45.3% which is above the threshold listed in the table.</td><td>N/A but Compliant</td></tr>
<tr><td colspan="7"><h2>2.9. NO_x, CO, NMVOC and CH_4 Emissions to Air</h2></td></tr>
<tr><td>BAT 41</td><td colspan="4">In order to prevent or reduce NOX emissions to air from the combustion of natural gas in boilers, BAT is to use one or a combination of the techniques given in the table.</td><td>There are no boilers on site.</td><td>N/A</td></tr>
<tr><td>BAT 42</td><td colspan="4">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 in the table.</td><td>There are no gas turbines on site.</td><td>N/A</td></tr>
<tr><td rowspan="3">BAT 43</td><td colspan="4">In order to prevent or reduce NOX emissions to air from the combustion of natural gas in engines, BAT is to use one or a combination of the techniques given below.</td><td rowspan="2">NOx emissions will be minimised by design.</td><td rowspan="2">Compliant</td></tr>
<tr><td colspan="2">Technique</td><td>Description</td><td>Applicability</td></tr>
<tr><td>a</td><td>Advanced control system</td><td>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.</td><td>The applicability to old combustion plants may be constrained by the need to retrofit the combustion</td><td>The design of the plant incorporates an automated process control system to maintain combustion efficiency, minimising NOx emissions.</td><td>Compliant</td></tr>
</table>

			This technique is often used in combination with other techniques or may be used alone for combustion plants operated < 500 h/yr	system and/or control command system		
	b	Lean-burn concept	The control of the peak flame temperature through lean-burn conditions is the primary combustion approach to limiting NOX formation in gas engines. 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' Generally used in combination with SCR	Only applicable to new gas-fired engines	No SCR fitted	N/A
	c	Advanced lean-burn concept	The control of the peak flame temperature through lean-burn conditions is the primary combustion approach to limiting NOX formation in gas engines. 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'	Only applicable to new spark plug ignited engines	Using the advanced lean burn concept, the generators will meet the relevant ELV for NOx, 95mg/Nm^3 (15% O_2), set by the MCPD.	Compliant
	d	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 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	Retrofitting existing combustion plants may be constrained by the availability of sufficient space. Not applicable to combustion plants operated < 500 h/yr. There may be technical and economic restrictions for retrofitting existing combustion plants operated between 500 h/yr and 1 500 h/yr	No SCR fitted as the primary abatement measures are considered BAT for the proposed operational profile of the plant to provide balancing services for less than 1,500 hours per year.	N/A

<table>
<tr><td>BAT 44</td><td>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.</td><td>The combustion of the plant will be optimised to ensure efficiency and minimise the levels of CO emissions.</td><td>Compliant</td></tr>
<tr><td></td><td>BAT-associated emission levels (BAT-AELs) for NOX emissions to air from the combustion of natural gas in boilers and engines

<table>
<tr><td rowspan="3">Type of combustion plant</td><td colspan="2">BAT-AELs (mg/Nm^3)</td></tr>
<tr><td>Yearly average (1)</td><td>Daily average or average over the sampling period</td></tr>
<tr><td>New plant</td><td>New plant</td></tr>
<tr><td>Engine (2)</td><td>20-75</td><td>55-85</td></tr>
<tr><td colspan="3">(1) Optimising the functioning of an existing technique to reduce NOX emissions further may lead to levels of CO emissions at the higher end of the indicative range for CO emissions given after this table.
(2) These BAT-AELs only apply to spark-ignited and dual-fuel engines. They do not apply to gas-diesel engines.</td></tr>
</table>

As an indication, the yearly average CO emission levels will generally be 30–100 mg/Nm3 for existing engines operated ≥ 1 500 h/yr and for new engines.</td><td>As the generator units are less than 15MWth individually, they are exempt from achieving the ELVs set by the LCP BREF. As the units are larger than 1MWth but smaller than 50MWth, they need to meet the ELVs set by the MCPD instead, which is $95mg/Nm^3$ for NOx.</td><td>N/A</td></tr>
<tr><td>BAT 45</td><td>In order to reduce non-methane volatile organic compounds (NMVOC) and methane (CH4) emissions to air from the combustion of natural gas in spark-ignited leanburn gas engines, BAT is to ensure optimised combustion and/or to use oxidation catalysts.</td><td>The combustion of the plant will be optimised to ensure efficiency and minimise the levels of NMVOC and CH_4 emissions.</td><td>Compliant</td></tr>
</table>

3. EA Working Draft BAT Requirements

Table 3 gives a summary of the compliance measures in place at the Installation in line with the BAT requirements listed in the EA's working draft document, "BAT guidance for >50 MWth gas and liquid fuel combustion plant exporting electricity under commercial arrangements for <1500 hrs per annum".

Table 3: EA Working Draft BAT Requirements

BAT Requirements					**Compliance Measures**	**Status**
3.1. Plant Operational Constraints (Table 1)						
Performance			Constraints		NOx emissions achieved by primary abatement measures (advanced lean burn technology) are 95mg/Nm^3 (15% O2).	Compliant
Category	NOx emissions compared to 500mg/Nm^3 (dry, 15% O_2) threshold	Nameplate efficiency compared to threshold value in Table 2	ELV	Maximum period of commercial generation per annum (hours)		
A	Below	Above	IED/LCP BREF limits for 500-1500 plant	1500		
B	Below	Above	None	500		
C	Below	Below	None	100-500		
D	Above	Any	None	100		
3.2. Plant Efficiency (Table 2)						
Plant technology and fuel			Efficiency threshold (%)		Nameplate electrical efficiency of the Jenbacher JMS 624 GS-N.L. generators is 45.3%.	Compliant
			New plant[1]			
Engine & gas fuel			35.6			
(1) Efficiency is based on nameplate values, in line with the revised LCP BREF. low is 1% point below BREF value except for new plant which is the BREF value.						

4. Conclusion

This report has summarised the techniques utilised at the Installation against each of the applicable published BAT standards from the LCP BREF and the EA's working draft "BAT guidance for >50 MWth gas and liquid fuel combustion plant exporting electricity under commercial arrangements for <1500 hrs per annum".

This report finds that the Installation is compliant with all applicable LCP BREF BAT Conclusions and reasoning has been given for why this report considers any of the BAT Conclusions to be non-applicable.

Furthermore, the Installation exceeds the BAT requirements as detailed by the EA's working draft BAT guidance document. Through the use of primary abatement measures (advanced lean burn technology), the generators will meet the relevant ELV for NOx emissions set by the MCPD at 95mg/Nm^3 (15% O2). The nameplate efficiency of the Jenbacher engines is 45.3% which exceeds the efficiency threshold for new plant of 35.6%.

It is not considered that SCR would be an appropriate technology to utilise at the Installation due to the intended operational profile to provide balancing services for fewer than 1,500 hours per year.