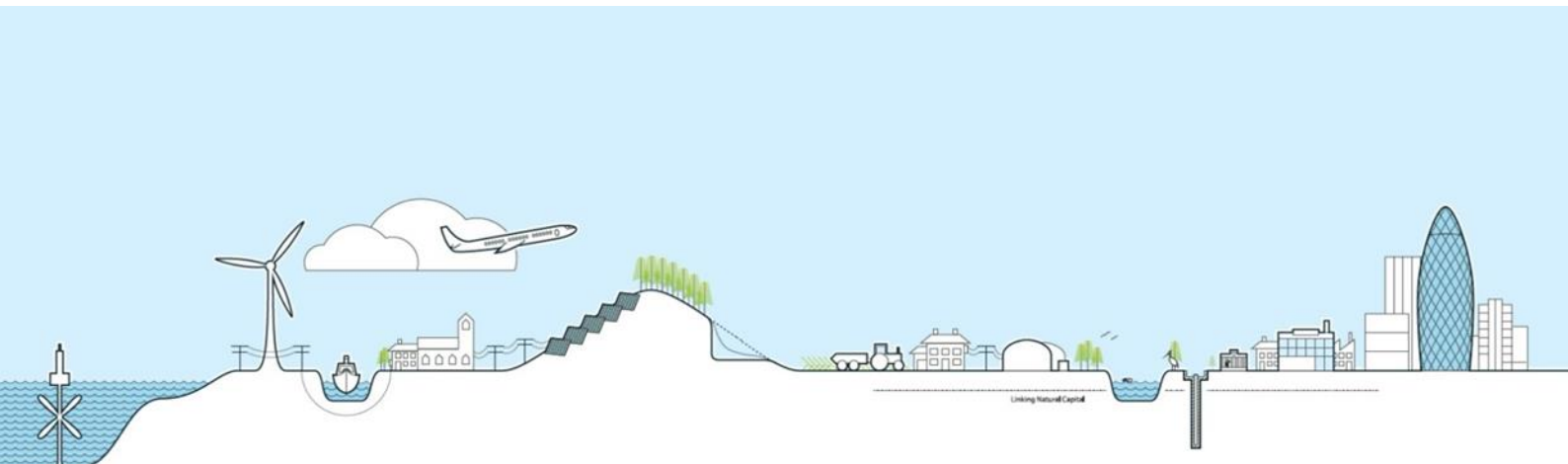





Lead Road Permit Application Best Available Techniques

December 2019

Prepared By



Project Quality Control Sheet

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Date	14/07/2020	16/07/2020	16/07/2020
Company	Aardvark EM Ltd	Aardvark EM Ltd	Aardvark EM Ltd

Location: Lead Road, Hedley, Gateshead, Northumberland, NE40 4BS
Grid Reference: NZ 12119 60577
Project Manager: Ross Malton BSc GradIEMA
Report Author: Jon Pettitt BSc MSc PIEMA
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Report Written and Produced By

Aardvark EM Limited, Higher Ford, Wiveliscombe, Taunton, Somerset, TA4 2RL

Telephone: 01984 624989, Facsimile: 01984 623912

Email: environment@aardvarkem.co.uk, Web: www.aardvarkem.co.uk

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1 Introduction

This Best Available Techniques (BAT) assessment has been prepared by Aardvark EM Ltd on behalf of ARL 019 Ltd, the application is for an environmental permit for the Lead Road Peaking Plant located at Lead Road, Hedley, Newcastle upon Tyne.

The proposed facility is defined as an installation in accordance with Schedule 1 of the Environmental Permitting (England and Wales) Regulations 2016 (EPR) and must operate in accordance with BAT for preventing pollution in order to ensure a high level of protection of the environment as a whole.

The Industrial Emissions Directive (IED) directs member states to ensure that installations employ the Best Available Techniques in undertaking of their permitted activities.

There is no definitive Best Available Techniques Reference Document (BREF) that covers this installation. However, there are two published sources of information from which applicable BAT standards could be derived, and their applicability is the focus of this report.

These are:-

- 1.) The BAT Conclusion published in the Large Combustion Plant BAT Reference Document (LCP BREF)¹; and
- 2.) The Working Draft document on BAT for Combustion equipment used in the Balancing Market²

1.1 Large Combustion Plant (LCP) Reference Document

Under the terms described in Chapter III of the Industrial Emissions Directive (pertaining to the Large Combustion Plant), individual combustion units below 15MWth are excluded from the scope of the LCP.

As the capacity of the individual combustion units in this case is 6MWth only, the installation is not covered from Chapter III of the Industrial Emission Directive, and of the LCP BREF.

Therefore the site is defined as a Part A(1) installation by Chapter II of the IED, but does not fall within Chapter III as a Large Combustion Plant, or the scope of the Large Combustion Plant BAT Reference document.

1.2 The Working Draft document on BAT for Combustion equipment used in the Balancing Market

The Environment Agency has published a working draft document on the BAT for combustion equipment used in the Balancing Market. This document only extends to plants that operate up to 1,500 hours per year (calculated as a five year rolling average), which consequently fall outside of the scope of the Large Combustion Plant BREF. The report follows the publication of the Amec

¹ Best Available Techniques (BAT) Reference Document for Large Combustion Plants, 2017

² BAT Guidance for >50MWth gas and liquid fuel combustion plant exporting electricity under commercial arrangements for <1500 hr per annum

Foster Wheeler report, titled “Developing Best Available Techniques for combustion plants operating in the balancing market”³ in June 2016.

This report only considers operations up to 1,500 hours per year within its scope. The report acknowledges that there is a pay-off between start-time and environmental performance and a negative correlation between start-up time and environmental performance. Therefore the highest polluting, or least efficient technologies, should only be permitted where they deliver a fast response time to the National grid, which could not be achieved by technologies with a better environmental performance. In such instances it is recommended that conditions are implemented on any permit granted to restrict the hours of operation to ensure that they are only used for fast response balancing services. Balancing services which are designed to operate for longer timeframes should be limited to technologies with better environmental performance.

The advantage of utilising gas engines at this particular site is to ensure the fast start-up times required to meet grid demand are met, compared to the higher levels of energy efficiency, and lower NO_x emissions that can be achieved by Combined Cycle Gas T.

1.3 Approach to determining BAT

Where no BAT Reference document exists for the permitted activities it is for the Environment Agency to set emission limit values (ELVs) and other permit conditions, based on its own determination of BAT, following consideration of the criteria listed in Annex III off the IED.

Article 14 of the Industrial Emissions Directive states that “*Where an activity or a type of production process carried out within an installation that is not covered by any of the BAT conclusions or where those conclusions do not address all of the potential environmental impacts of the activity or process, the competent authority shall, after prior consultations with the operator, set the permit conditions on the basis of the best available techniques that it has determined for the activities or processes concerned, by giving special consideration to the criteria listed in Annex III.*”

Annex III sets out the criteria for the determination of Best Available Techniques, as below:-

- 1.) The use of low-waste technology
- 2.) The use of less hazardous substances
- 3.) The furthering of recovery and recycling of substances generated and used in the process and of waste, where appropriate
- 4.) Comparable processes, facilities or methods which have been tried with success on an industrial scale;
- 5.) Technological advances and changes in scientific knowledge;
- 6.) The nature, effects and volume of the emissions concerned
- 7.) The commissioning dates for new or existing installations;
- 8.) The length of time needed to introduce the best available technique;
- 9.) The consumption and nature of raw materials (including water) used in the process and energy efficiency;

³ Department of Energy & Climate Change, Developing Best Available Techniques for combustion plants operating in the balancing mark, June 2016

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- 10.) The need to prevent or reduce to a minimum the overall impact of the emission on the environment and the risks to it;
- 11.) The need to prevent accidents and to minimise the consequences for the environment;
- 12.) Information published by public international organisations.

Of particular importance to this application are numbers 6 and 10 regarding emissions, and number 9 regarding energy efficiency.

This report highlights the relevant BAT Conclusion from the LCP BREF and includes the comparable standards provided in the Working Draft BAT Guidance for installations below 1,500 hours.

A summary table is provided below:-

Category	LCP BREF BAT Conclusion	Working Draft <1,500 hour plants
Environmental Management System	BAT 1	No BAT requirement specified
Monitoring	BAT 2 BAT 3 BAT 4 BAT 5 – N/A	Annual monitoring requirements in-lines with requirement of the Medium Combustion Plant Directive.
General Environmental and Combustion Performance	BAT 6 BAT 7 – N/A	N/a
BAT Associated Emission Levels	BAT 8 BAT 9 –N/A BAT 10 – N/A BAT 11	Table 1
Energy Efficiency (General)	BAT 12	Table 2
Water usage and emissions to water	BAT 13 – N/A BAT 14 – N/A BAT 15 – N/A	N/a
Waste management	BAT 16	N/a
Noise emissions	BAT 17	N/a
Energy Efficiency (for the combustion of natural gas)	BAT 40 BAT 41 BAT 42 BAT 43	Table 2

Table 1: Applicable BAT Standards

The BAT Conclusion relevant to water usage are not relevant as no water is required for by the installation. Therefore these are not considered further in this report.

2 Best Available Techniques (BAT) Assessment >50MWth gas combustion plant

2.1 BAT Standards

The relevant indicative BAT entries are referenced in the tables below, for which an assessment is provided of the proposed activity subject to this application.

The report structure follows the heading used in the conclusions for the Best Available Techniques (BAT) Reference Document for Large Combustion Plants, 2017.

The following headings are used:-

- Environmental Management System
- Monitoring
- General Environmental and Combustion Performance
- Emissions Levels
- Energy Efficiency

A comparison with the standards included in the Working Draft⁴ document are included where relevant.

⁴ BAT Guidance for >50MWth gas and liquid fuel combustion plant exporting electricity under commercial arrangements for <1500 hr per annum

3 Environmental Management System

BAT Ref.	BAT Standard	BAT Status	Compliance Measure
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;	✓	To be included in EMS documentation
(ii)	Definition, by the management, of an environmental policy that includes the continuous improvement of the environmental performance of the installation;	✓	Environmental policy to be a part of the EMS
(iii)	Planning and establishing the necessary procedures, objectives and targets, in conjunction with financial planning and investment;	✓	To be included in EMS documentation
(iv)	Implementation of procedures paying particular attention to: <ul style="list-style-type: none"> (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 	✓	To be included in EMS documentation

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BAT Ref.	BAT Standard	BAT Status	Compliance Measure
	(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 Reference Report on Monitoring of Emissions to Air and Water – 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.	✓	To be included in EMS documentation
(vi)	Review, by senior management, of the EMS and its continuing suitability, adequacy and effectiveness;	✓	To be included in EMS documentation
(vii)	Following the development of cleaner technologies;	✓	To be included in EMS documentation
(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	✓	To be included in EMS documentation

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BAT Ref.	BAT Standard	BAT Status	Compliance Measure
	<p>dismantling</p> <p>c) Choosing surface finishes that are easily decontaminated</p> <p>d) Using an equipment configuration that minimises trapped chemicals and facilitates drainage or cleaning</p> <p>e) Designing flexible, self-contained equipment that enables phased closure</p> <p>f) Using biodegradable and recyclable materials where possible;</p>		
(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	✓	To be included in EMS documentation
(x)	Quality assurance/quality control programmes to ensure that the characteristics of all fuels are fully determined and controlled (see BAT 9)	✓	Fuel supplied for the National Gas Grid only.
(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);	N/A	There will be no emissions to water from the installation.
(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	✓	Very little waste to be generated from the facility, but specific procedures for collection of any waste materials such as oil and spent components will be incorporated into the EMS.

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BAT Ref.	BAT Standard	BAT Status	Compliance Measure
(xiii)	<p>A systematic method to identify and deal with potential uncontrolled and or/unplanned emissions to the environment, in particular:</p> <ul style="list-style-type: none"> a.) Emissions to soil and groundwater from the handling and storage of fuels, additives, by products and waste b.) Emissions associated with self-heating and/or self-ignition of fuel in the storage and handling activities 	✓	<p>Part a.) Will be dealt with by way of Standard Operating Procedure to be incorporated into the EMS.</p> <p>Part b.) is not relevant to this operation.</p>
(xiv)	<p>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;</p>	N/A	<p>Not required due to very low risk of dust emissions from any of the activities associated with the operation of the site.</p>
(xv)	<p>A noise management plan where a noise nuisance at sensitive receptors is expected or sustained, including:</p> <ul style="list-style-type: none"> 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 action and dissemination of noise incident knowledge to the affected parties; 	N/A	<p>It is not envisaged that a Noise Management Plan will be required based on the findings of the Noise Impact Assessment. However this requirement will be reviewed should any contrary evidence be received, such as the receipt of substantiated noise complaints and/or at the request of the Environment Agency.</p>
(xvi)	<p>For the combustion, gasification or co-incineration of</p>	N/A	<p>No Odour Management Plan considered necessary for this</p>

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BAT Ref.	BAT Standard	BAT Status	Compliance Measure
	malodorous substances, and odour management plan including: <ul style="list-style-type: none"> a.) A protocol for conducting odour management 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. 		installation

Table 2: Environmental Management Systems

4 Monitoring

BAT Ref.	BAT Standard	BAT Status	Compliance Measure
BAT 2	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 the performance test at full load, accordance 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 internal standards that ensure the provision of data of an equivalent scientific quality.	✓	The actual net electrical efficiency of the proposed units will be determined and compared against the reported by the manufacturer once the engines are installed. This performance test will be undertaken as part of the commissioning process and be in undertaken in-line with the relevant ISO standards.
BAT 3	BAT is to monitoring key process parameters relevant for emissions to air and water	✓	Flow, oxygen content, temperature, pressure and water vapour will be recorded periodically during monitoring visits. There are no emissions to water.
BAT 4	BAT is to monitor emission to air with at least the frequency given in BAT 4 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. Natural-gas-fired boilers, engines, and turbines	No	No continuous monitoring system provided. As stated in the response to BAT 3, the monitoring of the plant will be undertaken in line with the requirements laid out in the MCPD using methods that meet the requirements of MCERTs. Emissions of NO _x and CO from the proposed peaking plant will be monitoring using the following standards: <ul style="list-style-type: none"> • NO_x – BS EN 14792

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BAT Ref.	BAT Standard	BAT Status	Compliance Measure
			<ul style="list-style-type: none"> • CO – BS EN 15058 <p>If alternative methods are to be used these will be agreed in writing with the Environment Agency in advance.</p>
BAT 5	<p>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 that provision of data of an equivalent scientific quality.</p>	N/A	<p>Not applicable. The proposed peaking plant will comprise of reciprocating engines operating for 2,500 hours annual, fuelled by natural gas. No flue gas treatment will be used in the proposed engine units</p>

Table 3: Monitoring

5 General Environmental and Combustion Performance

BAT Ref.	BAT Standard	BAT Status	Compliance Measure
BAT 6	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 in BAT 6.	✓	<p>The fuel choice for the proposed peaking plant (natural gas) is considered to be the cleanest non-renewable fuel used for combustion. No blending of fuel is proposed to be undertaken at site as the engines are configured to use the natural gas supplied from the national grid.</p> <p>The proposed reciprocating engines are considered to be the most appropriate and suitable combustion equipment for the site, having an electrical efficiency in line with that specified within the BAT conclusions.</p> <p>All installed plant and equipment will be maintained in line with manufacturer's guidelines and site procedures.</p>
BAT 7	In order to reduce emissions of ammonia to air from the use of selective catalytic reduction (SCR) and/or selective non-catalytic (SNCR) for the abatement of NOx emissions, BAT is to optimise the design and/or operation of SR and/or SNCR (e.g. optimised reagent for NOx ratio, homogenous reagent distribution and optimum size of the reagent drops).	N/A	No SCR/ SNCR is proposed at the installation

Table 4: General Environmental Combustion Performance

6 Emission Levels

BAT Ref.	BAT Standard	BAT Status	Compliance Measure
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 availability.	✓	Enhanced lean burn achieved through use advanced engine controls.
BAT 9	<p>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):</p> <ul style="list-style-type: none"> 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 	N/A	Fuel will be provided by the National Gas Grid.

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BAT Ref.	BAT Standard	BAT Status	Compliance Measure				
	<p>the fuel and an assessment of the relevance of pollutant releases (e.g. concentration in fuel, flue-gas treatment employed);</p> <p>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).</p> <p>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.</p> <table border="1" data-bbox="362 794 1010 1037"> <thead> <tr> <th data-bbox="362 794 517 895">Fuel</th> <th data-bbox="517 794 1010 895">Substances/parameters subject to characterisation</th> </tr> </thead> <tbody> <tr> <td data-bbox="362 895 517 1037">Natural Gas</td> <td data-bbox="517 895 1010 1037"> <ul style="list-style-type: none"> - LHV - CH₄, C₂H₆, C₃, C₄₊, CO₂, N₂, Wobbe index </td> </tr> </tbody> </table>	Fuel	Substances/parameters subject to characterisation	Natural Gas	<ul style="list-style-type: none"> - LHV - CH₄, C₂H₆, C₃, C₄₊, CO₂, N₂, Wobbe index 		
Fuel	Substances/parameters subject to characterisation						
Natural Gas	<ul style="list-style-type: none"> - LHV - CH₄, C₂H₆, C₃, C₄₊, CO₂, N₂, Wobbe index 						
BAT 10	<p>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:</p> <ul style="list-style-type: none"> • Appropriate design of the systems 	✓	To be included in EMS documentation				

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BAT Ref.	BAT Standard	BAT Status	Compliance Measure
	<p>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);</p> <ul style="list-style-type: none"> • 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; <p>Periodic assessment of the overall emissions during OTNOC (e.g. frequency of events, duration, emissions quantification/estimation) and implementation of corrective actions if necessary.</p>		
BAT 11	BAT is to appropriately monitor emissions to air and/or to water during OTNOC.	✓	All emissions from the new peaking plant will be monitored during commissioning and periodically to ensure the plant does not lead to pollution of the receiving environment. Given the nature of the equipment installed and the adherence to the manufacturer's maintenance programme OTNOC events are considered unlikely. Should an event occur additional spot sampling of emissions could be scheduled, if required.
BAT 43	In order to prevent or reduce NOx emissions to air from the combustion of natural gas engines, BAT is to use one or a combination of the techniques given		

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BAT Ref.	BAT Standard	BAT Status	Compliance Measure
	below.		
(a)	Advanced control system	✓	
(b)	Lean-burn concept	✓	See below
(c)	Advanced lean-burn concept	✓	The engines are able to meet 95mg/Nm ³ using advanced lean burn concept.
(d)	Selective catalytic reduction (SCR)	No	Use of SCR not appropriate due to approx. 30 min start-up time of SCR system not compatible with operating mode of plant.
BAT 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	✓	No oxidation catalyst is proposed. CO emission restricted to <800/Nm ³ at 5% O ₂ through primary emission controls.
BAT-AELS (Table 25)	BAT-associated emission levels (BAT-AELs) for NOx emission to air from the combustion of natural gas in boiler and engines. New spark-ignition engines:- Yearly average: 20-75 mg/Nm ³ Daily average: 55-85 mg/Nm ³	No	The site is unlikely to meet yearly or daily averages

Table 5: BAT Associated Emission Levels

6.1 Working Draft

Performance			Constraints		BAT Status	Compliance Measure
Category	NOx emissions compared to 500 mg/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 – 1,500 plant	1,500	✓	The NOx emissions levels achievable by primary measures (enhanced lean burn) are 95mg/Nm ³ NOx.
B	Below	Above	None	500	N/A	
C	Below	Below	None	100-500	N/A	
D	Above	Any	None	100	N/A	

Table 6: Working draft Emission Levels

7 Energy Efficiency

BAT Ref.	BAT Standard	BAT Status	Compliance Measure
BAT 12	In order to increase the energy efficiency of combustion, gasification and/or IGCC units operated $\geq 1,500$ hr/yr, BAT is to use an appropriate combination of the techniques given below:		
(a)	Combustion optimisation	✓	Monitored by advanced control software
(b)	Optimisation of the working medium conditions	✓	Monitored by advanced control software
(c)	Optimisation of the steam cycle	N/A	
(d)	Minimisation of energy consumption	✓	Monitored by advanced control software
(e)	Preheating of combustion air	N/A	
(f)	Fuel preheating	N/A	
(g)	Advanced control system	✓	
(h)	Feed-water preheating using recovered heat	N/A	
(i)	Heat recovery by cogeneration (CHP)	No	No heat recovery is proposed.
(j)	CHP readiness	No	The installation is not CHP Ready
(k)	Flue-gas condenser	N/A	
(l)	Heat accumulation	N/A	

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BAT Ref.	BAT Standard	BAT Status	Compliance Measure
(m)	Wet stack	<i>N/A</i>	
(n)	Cooling tower discharge	<i>N/A</i>	
(o)	Fuel pre-drying	<i>N/A</i>	
(p)	Minimisation of heat losses	<i>N/A</i>	
(q)	Advanced materials	<i>N/A</i>	
(r)	Steam turbine upgrades	<i>N/A</i>	
(s)	Supercritical and ultra-supercritical steam conditions	<i>N/A</i>	
BAT 40	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:		
(a)	Combined cycle	No	Generally applicable to gas turbine and engines, except where operated <1,500 hours per year, but not applicable to operations below this threshold. However, the use of combined cycle technology is not proposed here as the use of steam turbine is not deemed compatible with combustion plant used in the balancing market where the technology is designed to meet response times of c.30 minutes.

Table 7: Energy Efficiency for combustion of gas

7.1 Working Draft

Plant technology & fuel	Efficiency threshold (%)		BAT Status	Compliance Measure
	Existing plant	New Plant		
Engine & liquid fuel	34.5	37.4	N/A	
Engine & gas fuel	31.5	35.6	✓	The 2.5 MWe MTU 20V4000 GS engines proposed to be installed at the site operate at an electrical efficiency of 42.6%.
OCGT & liquid fuel	25.7	29.7	N/A	
OCGT & gas fuel	29.7	35.1	N/A	

Table 8: Working Draft Energy Efficiency Level

8 Conclusion

This report presents a comparison of the techniques used at the proposed installation against the closest BAT reference source; the LCP BREF and the EA's working draft document for balancing plant operated below 1,500 hours. It is acknowledged that neither of the standards provided are directly applicable on the basis that the installation does fall within the definition of large combustion plant. , and is planned to operate for >1,500 hours per year.

Therefore, in accordance with the provisions set out in the Industrial Emission Directive, BAT for the installation must be determined on a basis specific to this application.

This report is prepared to give context for the determination against the applicable published standards.

In conclusion to this report:

- The installation exceeds minimum standards included in the Working Draft for both emissions and energy efficiency
- The installation exceeds the minimum standards for energy efficiency included in the LCP BREF for plants operated more than 1,500 hours per year, despite not utilising combined cycle technology
- The installation does not meet the NO_x emission standards included in the LCP BREF for plants operation >1,500 hours per year, or the requirement for Continuous Monitoring, or include provision for the continuous monitoring of NO_x.

The reduction of NO_x to the LCP BREF limits would require the addition of abatement technology which is not compatible with the operating regime of the proposed installation, which is to provide electricity to the grid under a balancing mechanism agreement. The use of SCR technology requires a start-up time in the region of 30 minutes, which for a balancing operation designed to start-up and shut-down relatively frequently would not be viable.