Environment Agency

Review of an Environmental Permit for an Installation subject to Chapter II of the Industrial Emissions Directive under the Environmental Permitting (England & Wales) Regulations 2016

Decision document recording our decision-making process following review of a permit

The Permit number is: EPR/YP3930LZ
The Operator is: RWE Generation UK Plc
The Installation is: Didcot B Power Station
This Variation Notice number is: EPR/YP3930LZ/V011

What this document is about

Article 21(3) of the Industrial Emissions Directive (IED) requires the Environment Agency to review conditions in permits that it has issued and to ensure that the permit delivers compliance with relevant standards, within four years of the publication of updated decisions on best available techniques (BAT) conclusions.

We have reviewed the permit for this installation against the revised BAT Conclusions for large combustion plant published on 17th August 2017. This is our decision document, which explains the reasoning for the consolidated variation notice that we are issuing.

It explains how we have reviewed and considered the techniques used by the Operator in the operation and control of the plant and activities of the installation. This review has been undertaken with reference to the decision made by the European Commission establishing best available techniques (BAT) conclusions ('BAT Conclusions') for large combustion plant as detailed in document reference IEDC-7-1. It is our record of our decision-making process and shows how we have taken into account all relevant factors in reaching our position. It also provides a justification for the inclusion of any specific conditions in the permit that are in addition to those included in our generic permit template.

As well as considering the review of the operating techniques used by the Operator for the operation of the plant and activities of the installation, the consolidated variation notice takes into account and brings together in a single document all previous variations that relate to the original permit issued. It also modernises the entire permit to reflect the conditions contained in our current generic permit template.

The introduction of new template conditions makes the Permit consistent with our current general approach and philosophy and with other permits issued to installations in this sector. Although the wording of some conditions has changed, while others have been removed because of the new regulatory approach, it does not reduce the level of environmental protection achieved by the Permit in any way. In this document we therefore address only our determination of substantive issues relating to the new BAT Conclusions.

Throughout this document we will use a number of expressions. These are as referred to in the glossary and have the same meaning as described in “Schedule 6 Interpretation” of the Permit.

We try to explain our decision as accurately, comprehensively and plainly as possible. We would welcome any feedback as to how we might improve our decision documents in future. A lot of technical terms and acronyms are inevitable in a document of this nature: we provide a glossary of acronyms near the front of the document, for ease of reference.

How this document is structured

Glossary of acronyms used in this document

(Please note that this glossary is standard for our decision documents and therefore not all these acronyms are necessarily used in this document.)

APC	Air Pollution Control
BAT	Best Available Technique(s)
BAT-AEEL	BAT Associated Energy Efficiency Level
BAT-AEL	BAT Associated Emission Level
BATc	BAT conclusion
BREF	Best available techniques reference document
CCGT	Combined Cycle Gas Turbine
CEM	Continuous emissions monitor
CHP	Combined heat and power
CV	Calorific value
DAA	Directly associated activity – Additional activities necessary to be carried out to allow the principal activity to be carried out
DLN	Dry Low NOx burners
DLN-E	Dry Low NOx effective
EIONET	European environment information and observation network is a partnership network of the European Environment Agency
ELV	Emission limit value derived under BAT or an emission limit value set out in IED
EMS	Environmental Management System
EPR	Environmental Permitting (England and Wales) Regulations 2016 (SI 2016 No. 1154)
EWC	European waste catalogue
FSA	Food Standards Agency
IC	Improvement Condition
IED	Industrial Emissions Directive (2010/75/EU)
IPPCD	Integrated Pollution Prevention and Control Directive (2008/1/EC) – now superseded by IED
LCP	Large Combustion Plant subject to Chapter III of IED
MSUL/MSDL	Minimum start up load/minimum shut-down load
NOx	Oxides of nitrogen (NO plus NO_2 expressed as NO_2)
NPV	Net Present Value
OCGT	Open Cycle Gas Turbine
PHE	Public Health England
SAC	Special Area of Conservation
SGN	Sector guidance note
TGN	Technical guidance note
TNP	Transitional National Plan

1 Our decision

We have decided to issue the consolidated variation notice to the Operator. This will allow it to continue to operate the Installation, subject to the conditions in the consolidated variation notice.

We consider that, in reaching that decision, we have taken into account all relevant considerations and legal requirements and that the varied permit will ensure that a high level of protection is provided for the environment and human health.

The consolidated variation notice contains many conditions taken from our standard Environmental Permit template including the relevant Annexes. We developed these conditions in consultation with industry, having regard to the legal requirements of the Environmental Permitting Regulations and other relevant legislation. This document does not therefore include an explanation for these standard conditions. Where they are included in the Notice, we have considered the techniques identified by the operator for the operation of their installation, and have accepted that the details are sufficient and satisfactory to make those standard conditions appropriate. This document does, however, provide an explanation of our use of "tailor-made" or installation-specific conditions, or where our Permit template provides two or more options.

2 How we reached our decision

2.1 Requesting information to demonstrate compliance with BAT Conclusions for Large Combustion Plant

We issued a Notice under Regulation 61(1) of the Environmental Permitting (England and Wales) Regulations 2016 (a Regulation 61 Notice) on 1st May 2018 requiring the Operator to provide information to demonstrate how the operation of their installation currently meets, or will subsequently meet, the revised standards described in the large combustion plant BAT Conclusions document. The Notice also required that where the revised standards are not currently met, the operator should provide information that:

- Describes the techniques that will be implemented before 17th August 2021, which will then ensure that operations meet the revised standard, or
- Justifies why standards will not be met by 17th August 2021, and confirmation of the date when the operation of those processes will cease within the installation or an explanation of why the revised BAT standard is not applicable to those processes, or
- Justifies why an alternative technique will achieve the same level of environmental protection equivalent to the revised standard described in the BAT Conclusions.

Where the Operator proposed that they were not intending to meet a BAT standard that also included a BAT Associated Emission Level (BAT AEL) described in the BAT Conclusions Document, the Regulation 61 Notice requested that the Operator make a formal request for derogation from compliance with that AEL (as provisioned by Article 15(4) of IED). In this circumstance, the Notice identified that any such request for derogation must be supported and justified by sufficient technical and commercial information that would enable us to determine acceptability of the derogation request.

The Regulation 61 Notice response from the Operator was received on 13 November 2018.

We considered it was in the correct form and contained sufficient information for us to begin our determination of the permit review but not that it necessarily contained all the information we would need to complete that review.

2.2 Review of our own information in respect to the capability of the installation to meet revised standards included in the BAT Conclusions document

Based on our records and previous regulatory activities with the facility we have no reason to consider that the operator will not be able to comply with the conditions that we include in the permit.

3 The legal framework

The consolidated variation notice will be issued under Regulation 20 of the EPR. The Environmental Permitting regime is a legal vehicle which delivers most of the relevant legal requirements for activities falling within its scope. In particular, the regulated facility is:

- an *installation* as described by the IED;
- subject to aspects of other relevant legislation which also have to be addressed.

We consider that the consolidated variation notice will ensure that the operation of the Installation complies with all relevant legal requirements and that a high level of protection will be delivered for the environment and human health.

We explain how we have addressed specific statutory requirements more fully in the rest of this document.

4 The key issues

The key issues arising during this permit review are:

- Emissions to air and the emission limits applied to the plant.
- The energy efficiency levels associated with the Best Available Techniques (BAT-AEELs)

We therefore describe how we determined these issues in most detail in the relevant sections of this document.

4.1 Emissions to air and the emission limits applied to the plant

A number of general principles were applied during the permit review. These included:

- The upper value of the BAT AELs ranges specified were used unless use of the tighter limit was justified.
- The principle of no backsliding: where if existing limits in the permit were already tighter than those specified in the BREF, the existing permit limits were retained.
- Where a limit was specified in both IED Annex V and the BAT Conclusions for a particular reference period, the tighter limit was applied and in the majority of cases this was from the BAT Conclusions.
- Where AELs are indicative in the BAT Conclusions, these were applied unless adequate justification was provided by the operator to demonstrate that an alternative limit was more appropriate.
- For gas turbines where the IED specified that limits applied over 70% load and the BAT Conclusions specified that AELs applied when dry low NOx is effective (DLN-E), we have used DLN-E as a default across all monitoring requirements for NOx and CO.

LCP276 consists of two CCGT's (688.5 MWth each) and LCP277 consists of two CCGT's (646.5 MWth each) which vent via multiple flues within a common windshield at emission points A1, A2, A3 and A4. The units burn natural gas.

LCP397 consists of four OCGT's (98 MWth each), which vent via a 101m high combined single flue stack at emission point A7. The units burn gas oil.

The plant was put into operation before IED came into force and therefore the existing limits in the permit are from Part 1 of Annex V applicable to existing plant.

The ELVs and AELs are based on the following operating regime:
LCP276: Unlimited hours operation
LCP277: Unlimited hours operation
LCP397: <500 hours non-emergency plant

By the end of the TNP on 30 June 2020, as a minimum plant must meet the limits set out in Annex V of the Industrial Emission Directive subject to BAT assessment and the

principle of no backsliding. From the implementation date of the BAT Conclusion in 2021 the relevant AELs will also apply.

As part of their Regulation 61 Notice response, the Operator identified that they had not been able to finalise the chosen compliance route for LCP277 (unlimited hours or <1500 hours). Further information was therefore requested and subsequently supplied on 3rd October 2019. The Operator confirmed that works were now planned to upgrade some of the components within the gas turbines on LCP277 which, with tuning, will reduce NOx emissions and improve efficiency. The Operator stated that this is expected to enable the gas turbines on LCP277 to fully comply with the BREF limits for NOx without requiring constraints on operating hours. We have therefore permitted LCP277 for unlimited hours of operation.

For LCP276 and LCP277, the Operator has requested a limit for emissions of CO of 100 mg/m^3, this is higher than the indicative BAT-AEL of 30 mg/m^3. The higher emission limit value takes into account the technical characteristics of the gas turbines and the potential combustor degradation relating to combustor air in-leakage. It also provides scope for further combustion tuning to in order to reduce NOx emissions. The Operator stated that tuning the gas turbines to reduce NOx has the effect of increasing emissions of CO. We consider the technical justification provided by the Operator is adequate and we have set the annual emission limits for CO at 100 mg/m^3 in the revised and consolidated permit. The higher CO limit allows for a reduction of NOx whilst maintaining combustion stability and efficiency.

Also for LCP276 and LCP277, the Operator has requested a limit for daily CO of 440 mg/m^3 at MSUL/MSDL to base load. This is higher than the current permitted limit of 165 mg/m^3. The 440 mg/m^3 CO limit allows greater priority to be given for NOx reduction through tuning and is below the point where further assessment of formaldehyde is needed (*JEP13SGG14: Electrical Supply Industry – IED Compliance Protocol for Utility Boilers and Gas Turbines, Dec 2015, ref ETG/15/ERG/CT/1343/R*).
One of the main parameters that can be tuned is the amount of pilot gas. Higher pilot gas flow causes higher NOx values and lower CO values. By allowing higher CO values in the permit, the pilot gas can be decreased which reduces NOx formation. The benefit of a higher CO limit is in the reduction of NOx whilst maintaining combustion stability and efficiency. But there is a limit on how low the pilot gas can be tuned, and therefore a limit on how much NOx reduction can be achieved from tuning alone.
A higher CO limit allows more flexible operation. With the current CO limit of 165mg/m^3, the site struggles to reduce load on the gas turbines down to the MSUL/MSDL (Stable Export Limit) set in the permit. The current 165mg/m^3 limit for CO restricts how low each gas turbine can generate, as emissions of CO significantly increase at low loads. At present the stable export limit for each module has been increased to avoid conditions where CO above 165 mg/m^3 can be created. An increased limit of 440 mg/m3 CO will allow the gas turbines to be operated at lower loads, fitting in with the needs of National Grid to fill the gaps in generation from renewable sources and also the ability to offer an improved operating range for frequency response, providing grid stabilisation.
A higher CO limit also allows the plant to be operated in a more efficient mode at low loads. For example, the Operator explained that, to avoid CO production above the current limit of 165mg/m^3 at lower loads, it is often necessary to use the anti-icing on the air intake. This utilises some of the warm air from the gas turbine compressor and redirects back to the air inlet. However, this reduces efficiency of the plant by approximately 0.3%. Efficiency losses also have the effect of increasing CO_2 production

as more fuel is used to get the same output. By allowing a higher CO limit at low loads, the use of anti-icing can be minimised improving overall efficiency.
We have set the proposed limit of 440 mg/m^3 as an interim limit. However, we have also set an improvement condition (IC11) which requires the Operator to undertake the necessary tuning of the combustion plant and propose revised limits for CO emissions based on achievable emissions performance, when taking into account NOx emission levels and the technical characteristics of the gas turbines. The limit of 440 mg/m^3 will apply from the issue date of this variation.

LCP276

The following table outlines the limits that have been incorporated into the permit for LCP276, where these were derived from and the reference periods at which they apply. The emission limits refer to concentrations, expressed as mass of emitted substance per volume of flue-gas under the following standard conditions: dry gas at a temperature of 273,15 K, pressure of 101,3 kPa and 15% volume reference oxygen concentration of flue gases. The emission limits and monitoring requirements have been incorporated into Schedule 3 of the permit.

NOx limits (mg/Nm^3)							
Averaging	**Permit – Existing (non-IED limit)**	**IED (Annex V Part 1) - Existing**	**BREF**	**Permit review limits**	**Basis**	**Limits apply**	**Monitoring**
Annual	**None**	**None**	**40.8** Note 2	**40.8**	BREF	E-DLN	Continuous
Monthly	**75**	**75**	**None**	**75**	IED/Permit	E-DLN	Continuous
Daily	**75**Note 1	**82.5**	**51** Note 2	**51**	BREF	E-DLN	Continuous
95th %ile of hr means	**75**	**150**	**None**	**75**	Permit	E-DLN	Continuous

Note 1: This limit was introduced during the IED Chapter iii review, it is tighter than the IED annex V limit as the permit already set an hourly limit of 75mg/m^3. The daily and monthly limits cannot be higher than the hourly limit.

Note 2: Footnote 8 to table 24 of the BAT Conclusions allows a correction factor to be applied where electrical efficiency (EE) is greater than 55% ([limit] x EE/55), this limit takes the correction factor into account. This limit is rounded to one decimal place.

CO limits (mg/Nm^3) – indicative in *italics*							
Averaging	**Permit – Existing (non-IED limit)**	**IED (Annex V Part 1) - Existing**	**BREF**	**Permit review limits**	**Basis**	**Limits apply**	**Monitoring**
Annual	**None**	**None**	***30*** Note 1	**100** Note 1	Operator proposed limit	E-DLN	Continuous
Monthly	**100**	**100**	**None**	**100**	IED/Permit	E-DLN	Continuous
Daily	**110**	**110**	**None**	**110**	IED/Permit	E-DLN	Continuous
Hourly	**200**	**200**	**None**	**200**	IED/Permit	E-DLN	Continuous
Note 1: The annual CO emission level is indicative only. We have set an emission level in the revised and consolidated permit notice at 100 mg/Nm^3 based on the technical justification supplied by the Operator. See above for further information.							

LCP277

The following table outlines the limits that have been incorporated into the permit for LCP277, where these were derived from and the reference periods at which they apply. The emission limits refer to concentrations, expressed as mass of emitted substance per volume of flue-gas under the following standard conditions: dry gas at a temperature of 273,15 K, pressure of 101,3 kPa and 15% volume reference oxygen concentration of flue gases. The emission limits and monitoring requirements have been incorporated into Schedule 3 of the permit.

NOx limits (mg/Nm^3)							
Averaging	**Permit – Existing (non-IED limit)**	**IED (Annex V Part 1) - Existing**	**BREF**	**Permit review limits**	**Basis**	**Limits apply**	**Monitoring**
Annual	**None**	**None**	**40.6** Note 1	**40.6**	BREF	E-DLN	Continuous
Monthly	**90**	**75**	**None**	**75**	IED	E-DLN	Continuous
Daily	**90**	**82.5**	**50.8** Note 1	**50.8**	BREF	E-DLN	Continuous
Hourly	**90**	**150**	**None**	**90**	Permit	E-DLN	Continuous
Note 1: Footnote 8 to table 24 of the BAT Conclusions allows a correction factor to be applied where electrical efficiency (EE) is greater than 55% ([limit] x EE/55), this limit takes the correction factor into account. This limit is rounded to one decimal place.							

CO limits (mg/Nm^3) – indicative in *italics*							
Averaging	**Permit – Existing (non-IED limit)**	**IED (Annex V Part 1) - Existing**	**BREF**	**Permit review limits**	**Basis**	**Limits apply**	**Monitoring**
Annual	**None**	**None**	***30***	**100** Note 1	BREF	E-DLN	Continuous
Monthly	**100**	**100**	**None**	**100**	IED	E-DLN	Continuous
Daily	**110**	**110**	**None**	**110**	IED	E-DLN	Continuous
Hourly	**200**	**200**	**None**	**200**	IED	E-DLN	Continuous
Note 1: The annual CO emission level is indicative only. We have set an emission level in the revised and consolidated permit notice at 100 mg/Nm^3 based on the technical justification supplied by the Operator. See above for further information.							

LCP397

Under Chapter III gas turbines and gas engines operating for less than 500 hours per year were considered to be emergency plant and therefore were not covered by the emission limits set out in IED Annex V. However, for the purposes of the LCP BAT review, plants operated for emergency use may only be defined as plants which operate for the sole purpose of providing power at a site during an onsite emergency and/or during a black start and which do not provide balancing services or demand side response services. As this site runs commercially on an intermittent basis to support the Grid it is not considered emergency plant.

The following table outlines the limits that have been incorporated into the permit for LCP397, where these were derived from and the reference periods at which they apply. The emission limits refer to concentrations, expressed as mass of emitted substance per volume of flue-gas under the following standard conditions: dry gas at a temperature of 273,15 K, pressure of 101,3 kPa and 15% volume reference oxygen concentration of flue gases. The emission limits and monitoring requirements have been incorporated into Schedule 3 of the permit.

NOx limits (mg/Nm^3)					
Averaging	**BREF**	**Expected permit limits**	**Basis**	**Limits apply**	**Monitoring**
Annual	**None**	**None**	None	N/A	Note 2
Monthly	**None**	**None**	None	N/A	
Daily	**Note 1**	**330** Note 1	Note 1	JEP report UTG/18/PMP/774/R Note 1	
Hourly	**None**	**None**	None	N/A	
Note 1: BATc 38 provides an indicative emission level of 250 mg/Nm^3 for combustion of gas oil in dual fuel gas turbines operating less than 500 hours per year. However this indicative figure is not strictly applicable to LCP 397, because gas turbines within LCP 397 are not dual fuel. We have therefore set a benchmark emission level in the revised and consolidated permit notice at 330 mg/m^3, based on justification supplied by the Operator and supported by the JEP report UTG/18/PMP/774/R. Note 2: Footnote 2 to BAT conclusion 4 specifies that continuous monitoring does not apply where plant operation would be for the sole purpose of performing an emission measurement.					

BATc 38 provides an indicative emission level of 250 mg/Nm^3 for combustion of gas oil in dual fuel gas turbines operating less than 500 hours per year. However this indicative figure is not strictly applicable to LCP 397, because gas turbines within LCP 397 are not dual fuel. We have therefore set a benchmark emission level in the revised and consolidated permit notice at 330 mg/m^3, this is based on justification supplied by the Operator and supported by the JEP report UTG/18/PMP/774/R '*BAT assessment for existing natural gas, gas oil and dual fuel fired OCGTS and CCGTs with a thermal rating of 50MWth or greater operating <500 hours per year*' dated October 2018.

SO_2 limits (mg/Nm^3)					
Averaging	**IED (Annex V Part 1) - Existing**	**BREF**	**Permit review limits**	**Basis**	**Monitoring**
Annual	**None**	**None**	**None**	N/A	Concentration by calculation, every 2 years Notes 1, 2
Monthly	**None**	**None**	**None**	N/A	
Daily average or average over the sampling period	**None**	**66**	**66**	BREF	
95th %ile of hr means	**None**	**None**	**None**	N/A	
Note 1: Footnote 2 to BAT conclusion 4 specifies that continuous monitoring does not apply where plant operation would be for the sole purpose of performing an emission measurement.					
Note 2: Footnote 8 to BAT conclusion 4 specifies that, as an alternative to the continuous measurement, in the case of plants combusting oil with a known sulphur content and where there is no flue- gas desulphurisation system, periodic measurements at least once every three months and/or other procedures ensuring the provision of data of an equivalent scientific quality may be used to determine the SO_2 emissions.					

Dust limits (mg/Nm^3)						
Averaging	**Permit – Existing (non-IED limit)**	**IED (Annex V Part 1) - Existing**	**BREF**	**Permit review limits**	**Basis**	**Monitoring**
Annual	**None**	**None**	**None**	**None**	N/A	Concentration by calculation, every 2 years Note 1
Monthly	**None**	**None**	**None**	**None**	N/A	
Daily average or average over the sampling period	**None**	**None**	**10**	**10**	BREF	
95th %ile of hr means	**None**	**None**	**None**	**None**	N/A	
Note 1: Footnote 2 to BAT conclusion 4 specifies that continuous monitoring does not apply where plant operation would be for the sole purpose of performing an emission measurement.						

4.2 The energy efficiency levels associated with the Best Available Techniques Conclusions

An energy efficiency level associated with the best available techniques (BAT-AEEL) refers to the ratio between the combustion unit's net energy output(s) and the combustion unit's fuel/feedstock energy input at actual unit design. The net energy output(s) is determined at the combustion unit boundaries, including auxiliary systems (e.g. flue-gas treatment systems), and for the unit operated at full load.

For LCP397, Table 21 of the BAT Conclusions specifies that the AEELs for this type of plant are not applicable to plant operating less than 1500 hours per year. We have therefore not assessed this operational aspect of the plant for LPC 397. We have however included a process monitoring requirement in table S3.4 of the consolidated variation notice. This is required to demonstrate that efficiency levels are maintained following any significant overhauls of equipment in order to fulfil the requirement of BAT Conclusion 2.

For LCP276 and LCP277, the table below sets out the AEELs specified in the BAT Conclusions for the large combustion plant on the site and the energy efficiency levels confirmed through the Regulation 61 notice response. The efficiency of LCP267 is confirmed as 56.1% at ISO conditions and with fuel gas preheaters in service. LCP276 had a full load performance test conducted in accordance with ISO2314 during March 2014. The efficiency of LCP277 is confirmed as 55.87% at ISO conditions and with fuel gas preheaters in service. LCP277 had a full load performance test conducted in accordance with ISO2314 during July 1998.

We consider this plant is BAT in relation to the AEELs.

BAT AEELs (%)			Plant efficiency (%)		
Net electrical efficiency	Net total fuel utilisation	Net mechanical efficiency	Net electrical efficiency	Net total fuel utilisation	Net mechanical efficiency
LCP276: CCGT ≥ 600 MWth					
50-60	None	None	56.1	NA	NA
LCP277: CCGT ≥ 600 MWth					
50-60	None	None	55.87	NA	NA

4.3 The review and assessment of BAT for gas turbines operating < 500 hours per year

Joint Environmental Programme (JEP) produced a document *'BAT Assessment for Existing Gas and Liquid Fuel Fired OCGTs, CCGTs and Dual-fuel GTs with a Thermal Input Rating of 50MWth or Greater Operating <500 Hours Per Year'* dated October 2018. The content of this document has been agreed in principle by the Environment Agency and we have therefore taken the document into account during our determination of this variation.

In order to prevent or reduce NOx emissions to air from the combustion of gas oil in gas turbines, BAT is to use one or a combination of the techniques given in BAT 37. The Operator has considered the following techniques as those potentially applicable to gas turbines firing gas oil and operating less than 500 hours per year:

a. Water/Steam injection;
b. Use of Dry Low NOx burners.

The JEP cost benefit analysis (Appendix A to *BAT Assessment for Existing Gas and Liquid Fuel Fired OCGTs, CCGTs and Dual-fuel GTs with a Thermal Input Rating of 50MWth or Greater Operating <500 Hours Per Year*) concludes that retrofitting Dry Low NOx (DLN) or Wet Low Emissions (WLE) to existing OCGTs firing natural gas or gas oil, and operating for less than 500 hour per year, is not justified from a cost-benefit perspective. Meaning there is insufficient environmental benefit in reducing the already low annual mass emission, when considering the high conversion costs.

We agree that the techniques reported under BAT conclusion 37 are not applicable to LCP 397.

In all cases, the minimum BAT requirements are considered to be: i) the continued compliance with any permit requirements already in place to protect air quality and ii) the demonstration of an appropriate maintenance regime to maintain plant emissions performance.

5 Decision checklist regarding relevant BAT Conclusions

BAT Conclusions for large combustion plant, were published by the European Commission on 17th August 2017. There are 75 BAT Conclusions. Only the BAT Conclusions relevant to the particular fuel type used on site have been replicated below.

This annex provides a record of decisions made in relation to each relevant BAT Conclusion applicable to the installation. This annex should be read in conjunction with the Consolidated Variation Notice.

The conditions in the permit through which the relevant BAT Conclusions are implemented include but are not limited to the following:

BAT Conclusion requirement topic	Permit condition(s)	Permit table(s)
Environmental Management System	1.1.1	S1.2
BAT AELs	3.1.1 and 3.5.1	S3.1b
Monitoring	2.3, 3.5 and 3.6	S1.2, S1.4, S1.5, S3.1b
Energy efficiency	1.2 and 2.3	S3.4
Noise	3.4 and 2.3	S1.2
Other operating techniques	2.3	S1.2

The overall status of compliance with the BAT conclusion is indicated in the table as:

NA Not Applicable
CC Currently Compliant
FC Compliant in the future (within 4 years of publication of BAT conclusions)
NC Not Compliant
PC Partially Compliant

BAT Concn. Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement
General			
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 of an environmental policy that includes the continuous improvement of the installation by the management; iii. planning and establishing the necessary procedures, objectives and targets, in conjunction with financial planning and investment; iv. implementation of procedures (a) Structure and responsibility (b) Training (c) Communication (d) Employee involvement (e) Documentation (f) Efficient process control (g) 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 Reference Document on the General Principles of Monitoring) (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 of the EMS and its continuing suitability, adequacy and effectiveness by senior management; 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; 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; ix. application of sectoral benchmarking on a regular basis. Etc - see BAT Conclusions	CC	The station operates a local EMS which is fully integrated with the RWE Generation UK EMS which is accredited to ISO14001: 2015. The requirements of ISO14001:2015 are consistent with the requirements of BAT 1.

<table>
<tr><th>BAT Concn. Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th></tr>
<tr><td></td><td>Applicability. The scope (e.g. level of detail) and nature of the EMS (e.g. standardised or non-standardised) will generally be related to the nature, scale and complexity of the installation, and the range of environmental impacts it may have.</td><td></td><td></td></tr>
<tr><td>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 (1), 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>CC</td><td>LCP276 had a full load performance test during March 2014. The efficiency of this module is 56.1% at ISO conditions and with fuel gas preheaters in service.

LCP277 had a full load performance test during July 1998. The efficiency of this module is 55.87% at ISO conditions and with fuel gas preheaters in service.

LCP397 (OCGTs) The installed GTs are of the Avon Mk1533 design installed in the 1960s. These have a name plate efficiency of 25.5% (JEP report UTG/18/ERG/CT/773/R - October 2018). The Operator has confirmed that there have been no modifications with the potential to significantly affect efficiency and no recent performance test data is available. The BAT-AEELs are not applicable to plant operating <1500 hours.

A process monitoring requirement has been set in table S3.4 which requires energy efficiency monitoring after an overhaul.</td></tr>
<tr><td>3</td><td>BAT is to monitor key process parameters relevant for emissions to air and water including those given below.
<table>
<tr><th>Stream</th><th>Parameter(s)</th><th>Monitoring</th></tr>
<tr><td>Flue-gas</td><td>Flow</td><td>Periodic or continuous determination</td></tr>
<tr><td></td><td>Oxygen content, temperature, and pressure</td><td>Periodic or continuous measurement</td></tr>
<tr><td></td><td>Water vapour content (3)</td><td></td></tr>
<tr><td>Waste water from flue-gas treatment</td><td>Flow, pH, and temperature</td><td>Continuous measurement</td></tr>
</table></td><td>CC</td><td>For LCP276 and LCP277, the station continuously monitors flue gas emissions for flow, oxygen content, temperature and pressure as required by BAT 3.

Water content is not monitored as the extracted gas sample is dried prior to analysis.

The OCGTs of LCP397 operate for less than 500 hours per year, therefore emissions monitoring and reporting requirements are based on calculation, as opposed to direct measurement of flue gas parameters (refer to BAT 4). As specified in Note 2 to BAT 4, the specified</td></tr>
</table>

<table>
<tr><th>BAT Concn. Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th></tr>
<tr><td></td><td></td><td></td><td>monitoring frequency does not apply where plant operation would be for the sole purpose of performing an emission measurement. We therefore consider the flue-gas monitoring requirements of BAT 3 not applicable to LCP397.

The site does not carry out flue-gas treatment.</td></tr>
<tr><td>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><th>Substance/Parameter</th><th>Fuel/Process/Type of combustion plant</th><th>Combustion plant total rated thermal input</th><th>Standard(s) (4)</th><th>Minimum monitoring frequency (5)</th><th>Monitoring associated with</th></tr>
<tr><td>NH_3</td><td>— When SCR and/or SNCR is used</td><td>All sizes</td><td>Generic EN standards</td><td>Continuous (6) (7)</td><td>BAT 7</td></tr>
<tr><td>NO_X</td><td>— Coal and/or lignite including waste co-incineration
— Solid biomass and/or peat including waste co-incineration
— HFO- and/or gas-oil-fired boilers and engines
— Gas-oil-fired gas turbines
— Natural-gas-fired boilers, engines, and turbines
— Iron and steel process gases
— Process fuels from the chemical industry</td><td>All sizes</td><td>Generic EN standards</td><td>Continuous (6) (8)</td><td>BAT 20
BAT 24
BAT 28
BAT 32
BAT 37
BAT 41
BAT 42
BAT 43
BAT 47
BAT 48
BAT 56
BAT 64
BAT 65
BAT 73</td></tr>
</table></td><td>CC</td><td>For LCP276 and LCP277, the site monitors CO and NOx continuously in accordance with EN14181, this meets the requirements of BAT 4 for natural gas fired turbines.

For LCP397, the monitoring frequencies described in BAT 4 do not apply where plant operation would be for the sole purpose of performing an emission measurement.

There is no SCR/SNCR on site and therefore no requirement to monitor ammonia or SO_3.</td></tr>
</table>

BAT Concn. Number	Summary of BAT Conclusion requirement						Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement
		— IGCC plants						
		— Combustion plants on offshore platforms	All sizes	EN 14792	Once every year [9]	BAT 53		
	N_2O	— Coal and/or lignite in circulating fluidised bed boilers — Solid biomass and/or peat in circulating fluidised bed boilers	All sizes	EN 21258	Once every year [10]	BAT 20 BAT 24		
	CO	— Coal and/or lignite including waste co-incineration — Solid biomass and/or peat including waste co-incineration — HFO- and/or gas-oil-fired boilers and engines — Gas-oil-fired gas turbines — Natural-gas-fired boilers, engines, and turbines — Iron and steel process gases — Process fuels from the chemical industry — IGCC plants	All sizes	Generic EN standards	Continuous [6] [8]	BAT 20 BAT 24 BAT 28 BAT 33 BAT 38 BAT 44 BAT 49 BAT 56 BAT 64 BAT 65 BAT 73		
		— Combustion plants on offshore platforms	All sizes	EN 15058	Once every year [9]	BAT 54		
	SO_2	— Coal and/or lignite incl waste co-incineration	All sizes	Generic EN standards and EN 14791	Continuous [6] [11] [12]	BAT 21 BAT 25 BAT 29 BAT 34		

BAT Concn. Number	Summary of BAT Conclusion requirement						Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement
		— Solid biomass and/or peat incl waste co-incineration — HFO- and/or gas-oil-fired boilers — HFO- and/or gas-oil-fired engines — Gas-oil-fired gas turbines — Iron and steel process gases — Process fuels from the chemical industry in boilers — IGCC plants				BAT 39 BAT 50 BAT 57 BAT 66 BAT 67 BAT 74		
	SO_3	— When SCR is used	All sizes	No EN standard available	Once every year	—		
	Gaseous chlorides, expressed as HCl	— Coal and/or lignite — Process fuels from the chemical industry in boilers	All sizes	EN 1911	Once every three months [6] [13] [14]	BAT 21 BAT 57		
		— Solid biomass and/or peat	All sizes	Generic EN standards	Continuous [15] [16]	BAT 25		
		— Waste co-incineration	All sizes	Generic EN standards	Continuous [6] [16]	BAT 66 BAT 67		
	HF	— Coal and/or lignite — Process fuels from the chemical industry in boilers	All sizes	No EN standard available	Once every three months [6] [13] [14]	BAT 21 BAT 57		
		— Solid biomass and/or peat	All sizes	No EN standard available	Once every year	BAT 25		
		— Waste co-incineration	All sizes	Generic EN standards	Continuous [6] [16]	BAT 66 BAT 67		

BAT Concn. Number	Summary of BAT Conclusion requirement						Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement
	Dust	— Coal and/or lignite — Solid biomass and/or peat — HFO- and/or gas-oil-fired boilers — Iron and steel process gases — Process fuels from the chemical industry in boilers — IGCC plants — HFO- and/or gas-oil-fired engines — Gas-oil-fired gas turbines	All sizes	Generic EN standards and EN 13284-1 and EN 13284-2	Continuous (6) (17)	BAT 22 BAT 26 BAT 30 BAT 35 BAT 39 BAT 51 BAT 58 BAT 75		
		— Waste co-incineration	All sizes	Generic EN standards and EN 13284-2	Continuous	BAT 68 BAT 69		
	Metals and metalloids except mercury (As, Cd, Co, Cr, Cu, Mn, Ni, Pb, Sb, Se, Tl, V, Zn)	— Coal and/or lignite — Solid biomass and/or peat — HFO- and/or gas-oil-fired boilers and engines	All sizes	EN 14385	Once every year (18)	BAT 22 BAT 26 BAT 30		
		— Waste co-incineration	< 300 MW_{th}	EN 14385	Once every six months (13)	BAT 68 BAT 69		
			≥ 300 MW_{th}	EN 14385	Once every three months (19) (13)			
		— IGCC plants	≥ 100 MW_{th}	EN 14385	Once every year (18)	BAT 75		
	Hg	— Coal and/or lignite including waste co-incineration	< 300 MW_{th}	EN 13211	Once every three months (13) (20)	BAT 23		
			≥ 300 MW_{th}	Generic EN standards and EN 14884	Continuous (16) (21)			
		— Solid biomass and/or peat	All sizes	EN 13211	Once every year (22)	BAT 27		

<table>
<tr><th>BAT Concn. Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th></tr>
<tr><td></td><td>
<table>
<tr><td></td><td>— Waste co-incineration with solid biomass and/or peat</td><td>All sizes</td><td>EN 13211</td><td>Once every three months (13)</td><td>BAT 70</td></tr>
<tr><td></td><td>— IGCC plants</td><td>≥ 100 MW_{th}</td><td>EN 13211</td><td>Once every year (23)</td><td>BAT 75</td></tr>
<tr><td>TVOC</td><td>— HFO- and/or gas-oil-fired engines
— Process fuels from chemical industry in boilers</td><td>All sizes</td><td>EN 12619</td><td>Once every six months (13)</td><td>BAT 33
BAT 59</td></tr>
<tr><td></td><td>— Waste co-incineration with coal, lignite, solid biomass and/or peat</td><td>All sizes</td><td>Generic EN standards</td><td>Continuous</td><td>BAT 71</td></tr>
<tr><td>Formaldehyde</td><td>— Natural-gas in spark-ignited lean-burn gas and dual fuel engines</td><td>All sizes</td><td>No EN standard available</td><td>Once every year</td><td>BAT 45</td></tr>
<tr><td>CH_4</td><td>— Natural-gas-fired engines</td><td>All sizes</td><td>EN ISO 25139</td><td>Once every year (24)</td><td>BAT 45</td></tr>
<tr><td>PCDD/F</td><td>— Process fuels from chemical industry in boilers
— Waste co-incineration</td><td>All sizes</td><td>EN 1948-1, EN 1948-2, EN 1948-3</td><td>Once every six months (13) (25)</td><td>BAT 59
BAT 71</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>5</td><td>BAT is to monitor emissions to water from flue-gas treatment 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><th>Substance/Parameter</th><th>Standard(s)</th><th>Minimum monitoring frequency</th><th>Monitoring associated with</th></tr>
<tr><td>Total organic carbon (TOC) (26)</td><td>EN 1484</td><td>Once every month</td><td>BAT 15</td></tr>
</table>
</td><td>NA</td><td>The site does not carry out flue-gas treatment.</td></tr>
</table>

BAT Concn. Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement
	Chemical oxygen demand (COD) ([26]) — No EN standard available Total suspended solids (TSS) — EN 872 Fluoride (F^-) — EN ISO 10304-1 Sulphate (SO_4^{2-}) — EN ISO 10304-1 Sulphide, easily released (S^{2-}) — No EN standard available Sulphite (SO_3^{2-}) — EN ISO 10304-3 Metals and metalloids: As, Cd, Cr, Cu, Ni, Pb, Zn — Various EN standards available (e.g. EN ISO 11885 or EN ISO 17294-2) Hg — Various EN standards available (e.g. EN ISO 12846 or EN ISO 17852) Chloride (Cl^-) — Various EN standards available (e.g. EN ISO 10304-1 or EN ISO 15682) — — Total nitrogen — EN 12260 — —		
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 optimised combustion and to use an appropriate combination of the techniques given below. **Technique** / **Description** / **Applicability** a. Fuel blending and mixing — Ensure stable combustion conditions and/or reduce the emission of pollutants by mixing — Generally applicable	CC	For LCP276 and LCP277 the following techniques given in BAT6 are undertaken: b) Maintenance of the combustion system c) Advanced control system d) Good design of the combustion equipment; and e) Fuel choice

BAT Concn. Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement
			For LCP397, the OCGTs optimise the environmental performance of combustion plant through techniques b, d, and e.

		different qualities of the same fuel type	
b.	Maintenance of the combustion system	Regular planned maintenance according to suppliers' recommendations	
c.	Advanced control system	See description in Section 8.1	The applicability to old combustion plants may be constrained by the need to retrofit the combustion system and/or control command system
d.	Good design of the combustion equipment	Good design of furnace, combustion chambers, burners and associated devices	Generally applicable to new combustion plants
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

BAT Concn. Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement
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 NO_X emissions, BAT is to optimise the design and/or operation of SCR and/or SNCR (e.g. optimised reagent to NO_X ratio, homogeneous reagent distribution and optimum size of the reagent drops). **BAT-associated emission levels** 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. In the case of plants combusting biomass and operating at variable loads as well as in the case of engines combusting HFO and/or gas oil, the higher end of the BAT-AEL range is 15 mg/Nm^3.	NA	Not applicable - no SCR or SNCR on site.
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.	NA	Not fitted with emissions abatement systems
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 8.1)). ***Description*** 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(s)** | **Substances/Parameters subject to characterisation**	CC	LCP276 and LCP277 are fired on Natural Gas only. This gas has to meet a nationally agreed specification for all the parameters listed. We consider that for plant which burns natural gas from the National Grid as a fuel it is not necessary for the operator to replicate the testing carried out by the National Grid. The fuel gas supplied to the site is continuously monitored. Measurement of LHV, CH4, C2H6, C3, C4+, CO_2, N_2 and Wobbe index is carried out continuously using an online gas chromatograph, which carries out calculations in accordance with ISO6976. The gas chromatograph is calibrated annually in accordance with ISO17025. The data supplied from the gas monitoring system is used to assess the performance of the plant. LCP397 is fired on gas-oil. The permit limits the sulphur content of the gas oil to <0.1% sulphur. Fuel supplied to the OCGTs is assessed in accordance with technique (i) and is periodically surveyed in accordance with technique (ii) given in BAT 9.

BAT Concn. Number	Summary of BAT Conclusion requirement		Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement
	Biomass/peat	— LHV — moisture		
		— Ash — C, Cl, F, N, S, K, Na — Metals and metalloids (As, Cd, Cr, Cu, Hg, Pb, Zn)		
	Coal/lignite	— LHV — Moisture — Volatiles, ash, fixed carbon, C, H, N, O, S		
		— Br, Cl, F		
		— Metals and metalloids (As, Cd, Co, Cr, Cu, Hg, Mn, Ni, Pb, Sb, Tl, V, Zn)		
	HFO	— Ash — C, S, N, Ni, V		
	Gas oil	— Ash — N, C, S		
	Natural gas	— LHV — CH_4, C_2H_6, C_3, C_4+, CO_2, N_2, Wobbe index		
	Process fuels from the chemical industry ([27])	— Br, C, Cl, F, H, N, O, S — Metals and metalloids (As, Cd, Co, Cr, Cu, Hg, Mn, Ni, Pb, Sb, Tl, V, Zn)		
	Iron and steel process gases	— LHV, CH_4 (for COG), C_XH_Y (for COG), CO_2, H_2, N_2, total sulphur, dust, Wobbe index		
	Waste ([28])	— LHV — Moisture — Volatiles, ash, Br, C, Cl, F, H, N, O, S — Metals and metalloids (As, Cd, Co, Cr, Cu, Hg, Mn, Ni, Pb, Sb, Tl, V, Zn)		

<table>
<tr><th>BAT Concn. Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th></tr>
<tr><td>10</td><td>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.</td><td></td><td>For LCP276, LCP277 and LCP397 the Operator confirms that the requirements of BAT 10 are met by the existing site documentation and procedures.

LCP276 and LCP277 gas turbine starts are optimised based on plant condition (i.e warmth category) to minimise emissions during start-up.
All plant components are included within the site specific preventative maintenance programmes. Emissions during start-up and shutdown operations are monitored and reviewed to identify if corrective actions are required. Emissions to air and water are assessed as part of the annual environmental performance report. In the event of an accident or environmental incident, the operator would review elements such as the emissions and the cause as part of their incident investigation process and ensure any relevant corrective and/or preventive action is implemented.</td></tr>
<tr><td>11</td><td>BAT is to appropriately monitor emissions to air and/or to water during OTNOC.
Description
The monitoring can be carried out by direct measurement of emissions or by monitoring of surrogate parameters if this proves to be of equal or better scientific quality than the direct measurement of emissions. Emissions during start-up and shutdown (SU/SD) may be assessed based on a detailed emission measurement carried out for a typical SU/SD procedure at least once every year, and using the results of this measurement to estimate the emissions for each and every SU/SD throughout the year.</td><td>CC</td><td>For LCP276 and LCP277, the monitoring equipment for emissions to air and water is fully operable when the stations are discharging to the environment, this includes during OTNOC events.

For LCP397, monitoring of emissions to air is not applicable to OCGTs operating for <500 hours. The requirements described in BAT 11 should not apply where plant operation would be for the sole purpose of performing emissions measurement.</td></tr>
<tr><td>12</td><td>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 colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Combustion optimisation</td><td>See description in Section 8.2.</td><td>Generally applicable</td></tr>
</table></td><td>CC</td><td>For LCP276 and LCP277 the following techniques given in BAT12 are undertaken:
a) Combustion optimisation
b) Optimisation of the working medium conditions
c) Optimisation of the steam cycle
d) Minimisation of energy consumption
f) Fuel preheating</td></tr>
</table>

BAT Concn. Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement
			g) Advanced control system h) Feed-water preheating using recovered heat Not applicable for LCP397 as BAT is only applicable to plant which operates more than 1500 hours per year.

		Optimising the combustion minimises the content of unburnt substances in the flue-gases and in solid combustion residues	
b.	Optimisation of the working medium conditions	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 NO_X emissions or the characteristics of energy demanded	
c.	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	
d.	Minimisation of energy consumption	Minimising the internal energy consumption (e.g. greater efficiency of the feed-water pump)	
e.	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 NO_X emissions
f.	Fuel preheating	Preheating of fuel using recovered heat	Generally applicable within the constraints associated with the boiler design and the need to control NO_Xemissions
g.	Advanced control system	See description in Section 8.2. Computerised control of the main combustion parameters enables the combustion efficiency to be improved	Generally applicable to new units. The applicability to old units may be constrained by the need to retrofit the combustion system and/or control command system
h.	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

BAT Concn. Number	Summary of BAT Conclusion requirement				Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement
	i.	Heat recovery by cogeneration (CHP)	Recovery of heat (mainly from the steam system) for producing hot water/steam to be used in industrial processes/activities or in a public network for district heating. Additional heat recovery is possible from: — flue-gas — grate cooling — circulating fluidised bed	Applicable within the constraints associated with the local heat and power demand. The applicability may be limited in the case of gas compressors with an unpredictable operational heat profile		
	j.	CHP readiness	See description in Section 8.2.	Only applicable to new units where there is a realistic potential for the future use of heat in the vicinity of the unit		
	k.	Flue-gas condenser	See description in Section 8.2.	Generally applicable to CHP units provided there is enough demand for low-temperature heat		
	l.	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		
	m.	Wet stack	See description in Section 8.2.	Generally applicable to new and existing units fitted with wet FGD		
	n.	Cooling tower discharge	The release of emissions to air through a cooling tower and not via a dedicated stack	Only applicable to units fitted with wet FGD where reheating of the flue-gas is necessary before release, and where the unit cooling system is a cooling tower		
	o.	Fuel pre-drying	The reduction of fuel moisture content before combustion to improve combustion conditions	Applicable to the combustion of biomass and/or peat within the constraints associated with spontaneous combustion risks (e.g. the moisture content of peat is kept above 40 % throughout the delivery chain). The retrofit of existing plants may be restricted by the extra calorific value that can be obtained from the drying operation and by the limited retrofit possibilities offered		

<table>
<tr><th>BAT Concn. Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th></tr>
<tr><td></td><td>
<table>
<tr><td></td><td></td><td></td><td>by some boiler designs or plant configurations</td></tr>
<tr><td>p.</td><td>Minimisation of heat losses</td><td>Minimising residual heat losses, e.g. those that occur via the slag or those that can be reduced by insulating radiating sources</td><td>Only applicable to solid-fuel-fired combustion units and to gasification/IGCC units</td></tr>
<tr><td>q.</td><td>Advanced materials</td><td>Use of advanced materials proven to be capable of withstanding high operating temperatures and pressures and thus to achieve increased steam/combustion process efficiencies</td><td>Only applicable to new plants</td></tr>
<tr><td>r.</td><td>Steam turbine upgrades</td><td>This includes techniques such as increasing the temperature and pressure of medium-pressure steam, addition of a low-pressure turbine, and modifications to the geometry of the turbine rotor blades</td><td>The applicability may be restricted by demand, steam conditions and/or limited plant lifetime</td></tr>
<tr><td>s.</td><td>Supercritical and ultra-supercritical steam conditions</td><td>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</td><td>Only applicable to new units of ≥ 600 MW_{th} 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</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>13</td><td>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.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Water recycling</td><td>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</td><td>Not applicable to waste water from cooling systems when water treatment chemicals and/or high concentrations of salts from seawater are present</td></tr>
</table>
</td><td>CC</td><td>For LCP276 and LCP277, the operator confirms that water usage is optimised and minimised where plant design allows. The boiler water drainage, together with the on-site surface water run-off, is collected and pumped to the cooling water system. This reduces river water abstraction rates.
Water from the cooling water system is not of suitable quality to be re-used in other processes on site. The quality of the water recovered would have an adverse</td></tr>
</table>

BAT Concn. Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement
	b. Dry bottom ash handling — Dry, hot bottom ash falls from the furnace onto a mechanical conveyor system and is cooled down by ambient air. No water is used in the process. — Only applicable to plants combusting solid fuels. There may be technical restrictions that prevent retrofitting to existing combustion plants		impact on the operation of the water treatment plant and may lead to increased chemical and energy usage. Water usage within the cooling water system is optimised through management of cooling tower cycles of concentration. Process water usage including boiler feedwater is optimised through minimisation of blowdown from the water steam cycle. For LCP397, no process waters are generated. Any on-site surface water run-off is collected and pumped to the surface water system of LCP276 and LCP277, which is normally transferred to the cooling water system of LCP276 and LCP277.
14	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. ***Description*** Waste water streams that are typically segregated and treated include surface run-off water, cooling water, and waste water from flue-gas treatment. ***Applicability*** The applicability may be restricted in the case of existing plants due to the configuration of the drainage systems.	CC	For LCP276 and LCP277, all discharges to water are directed to emission point W1. If this is unavailable surface water is discharged via a separate discharge point W2. All waste water streams are segregated. For example, higher risk drains go to the oily water pit and through an oil separator before discharge to normal surface water drains. Surface water drains have settlement in the Balance Pond and further oil separation before discharge to the cooling water system (or discharge point W2 if cooling water system unavailable). Effluent from the water treatment plant is neutralised and monitored prior to and during discharge to the cooling water system purge (W1). The purge from the cooling water system is continuously monitored during discharge at discharge point W1. For LCP397, no process waters are generated. any on-site surface water run-off is collected and pumped to the surface water system of LCP276 and LCP277, which is normally transferred to the cooling water system of LCP276 and LCP277.
15	In order to reduce emissions to water from flue-gas treatment, BAT is to use an appropriate combination of the techniques given below, and to use secondary techniques as close as possible to the source in order to avoid dilution.	NA	No flue gas treatment equipment installed at the site.

BAT Concn. Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement

	Technique	Typical pollutants prevented/abated	Applicability
	Primary techniques		
a.	Optimised combustion (see BAT 6) and flue-gas treatment systems (e.g. SCR/SNCR, see BAT 7)	Organic compounds, ammonia (NH_3)	Generally applicable
	Secondary techniques [29]		
b.	Adsorption on activated carbon	Organic compounds, mercury (Hg)	Generally applicable
c.	Aerobic biological treatment	Biodegradable organic compounds, ammonium (NH_4^+)	Generally applicable for the treatment of organic compounds. Aerobic biological treatment of ammonium (NH_4^+) may not be applicable in the case of high chloride concentrations (i.e. around 10 g/l)
d.	Anoxic/anaerobic biological treatment	Mercury (Hg), nitrate (NO_3^-), nitrite (NO_2^-)	Generally applicable
e.	Coagulation and flocculation	Suspended solids	Generally applicable
f.	Crystallisation	Metals and metalloids, sulphate (SO_4^{2-}), fluoride (F^-)	Generally applicable
g.	Filtration (e.g. sand filtration, microfiltration, ultrafiltration)	Suspended solids, metals	Generally applicable
h.	Flotation	Suspended solids, free oil	Generally applicable
i.	Ion exchange	Metals	Generally applicable
j.	Neutralisation	Acids, alkalis	Generally applicable
k.	Oxidation	Sulphide (S^{2-}), sulphite (SO_3^{2-})	Generally applicable
l.	Precipitation	Metals and metalloids, sulphate (SO_4^{2-}), fluoride (F^-)	Generally applicable
m.	Sedimentation	Suspended solids	Generally applicable

<table>
<tr><th>BAT Concn. Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th></tr>
<tr><td></td><td>
<table>
<tr><td>n.</td><td>Stripping</td><td>Ammonia (NH_3)</td><td>Generally applicable</td></tr>
</table>
The BAT-AELs refer to direct discharges to a receiving water body at the point where the emission leaves the installation.
BAT-AELs for direct discharges to a receiving water body from flue-gas treatment
<table>
<tr><th colspan="2" rowspan="2">Substance/Parameter</th><th>BAT-AELs</th></tr>
<tr><th>Daily average</th></tr>
<tr><td colspan="2">Total organic carbon (TOC)</td><td>20–50 mg/l [30] [31] [32]</td></tr>
<tr><td colspan="2">Chemical oxygen demand (COD)</td><td>60–150 mg/l [30] [31] [32]</td></tr>
<tr><td colspan="2">Total suspended solids (TSS)</td><td>10–30 mg/l</td></tr>
<tr><td colspan="2">Fluoride (F^-)</td><td>10–25 mg/l [32]</td></tr>
<tr><td colspan="2">Sulphate (SO_4^{2-})</td><td>1,3–2,0 g/l [32] [33] [34] [35]</td></tr>
<tr><td colspan="2">Sulphide (S^{2-}), easily released</td><td>0,1–0,2 mg/l [32]</td></tr>
<tr><td colspan="2">Sulphite (SO_3^{2-})</td><td>1–20 mg/l [32]</td></tr>
<tr><td rowspan="8">Metals and metalloids</td><td>As</td><td>10–50 µg/l</td></tr>
<tr><td>Cd</td><td>2–5 µg/l</td></tr>
<tr><td>Cr</td><td>10–50 µg/l</td></tr>
<tr><td>Cu</td><td>10–50 µg/l</td></tr>
<tr><td>Hg</td><td>0,2–3 µg/l</td></tr>
<tr><td>Ni</td><td>10–50 µg/l</td></tr>
<tr><td>Pb</td><td>10–20 µg/l</td></tr>
<tr><td>Zn</td><td>50–200 µg/l</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>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 such as:
<table>
<tr><th>Technique</th><th>Description</th><th>Applicability</th></tr>
</table>
</td><td>CC</td><td>There are no waste products as identified by BAT 16 caused directly by the combustion process in a CCGT or OCGT plant. The Operator confirms that the other waste arising from site activities are dealt with according to the waste hierarchy.

Specific techniques of BAT16 are not applicable to the installation because no waste is produced as a by-product of combustion and there is no flue gas treatment used on site.</td></tr>
</table>

<table>
<tr><th>BAT Concn. Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th></tr>
<tr><td></td><td>
<table>
<tr><td>a.</td><td>Generation of gypsum as a by-product</td><td>Quality optimisation of the calcium-based reaction residues generated by the wet FGD so that they can be used as a substitute for mined gypsum (e.g. as raw material in the plasterboard industry). The quality of limestone used in the wet FGD influences the purity of the gypsum produced</td><td>Generally applicable within the constraints associated with the required gypsum quality, the health requirements associated to each specific use, and by the market conditions</td></tr>
<tr><td>b.</td><td>Recycling or recovery of residues in the construction sector</td><td>Recycling or recovery of residues (e.g. from semi-dry desulphurisation processes, fly ash, bottom ash) as a construction material (e.g. in road building, to replace sand in concrete production, or in the cement industry)</td><td>Generally applicable within the constraints associated with the required material quality (e.g. physical properties, content of harmful substances) associated to each specific use, and by the market conditions</td></tr>
<tr><td>c.</td><td>Energy recovery by using waste in the fuel mix</td><td>The residual energy content of carbon-rich ash and sludges generated by the combustion of coal, lignite, heavy fuel oil, peat or biomass can be recovered for example by mixing with the fuel</td><td>Generally applicable where plants can accept waste in the fuel mix and are technically able to feed the fuels into the combustion chamber</td></tr>
<tr><td>d.</td><td>Preparation of spent catalyst for reuse</td><td>Preparation of catalyst for reuse (e.g. up to four times for SCR catalysts) restores some or all of the original performance, extending the service life of the catalyst to several decades. Preparation of spent catalyst for reuse is integrated in a catalyst management scheme</td><td>The applicability may be limited by the mechanical condition of the catalyst and the required performance with respect to controlling NO_X and NH_3 emissions</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>17</td><td>In order to reduce noise emissions, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></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
— equipment operated by experienced staff</td><td>Generally applicable</td></tr>
</table>
</td><td>CC</td><td>Noise emissions are reduced by the application of the techniques a, b, c, d and e identified in BAT 17.</td></tr>
</table>

<table>
<tr><th>BAT Concn. Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th></tr>
<tr><td></td><td>
<table>
<tr><td></td><td></td><td>— avoidance of noisy activities at night, if possible
— provisions for noise control during maintenance activities</td><td></td></tr>
<tr><td>b.</td><td>Low-noise equipment</td><td>This potentially includes compressors, pumps and disks</td><td>Generally applicable when the equipment is new or replaced</td></tr>
<tr><td>c.</td><td>Noise attenuation</td><td>Noise propagation can be reduced by inserting obstacles between the emitter and the receiver. Appropriate obstacles include protection walls, embankments and buildings</td><td>Generally applicable to new plants. In the case of existing plants, the insertion of obstacles may be restricted by lack of space</td></tr>
<tr><td>d.</td><td>Noise-control equipment</td><td>This includes:
— noise-reducers
— equipment insulation
— enclosure of noisy equipment
— soundproofing of buildings</td><td>The applicability may be restricted by lack of space</td></tr>
<tr><td>e.</td><td>Appropriate location of equipment and buildings</td><td>Noise levels can be reduced by increasing the distance between the emitter and the receiver and by using buildings as noise screens</td><td>Generally applicable to new plant</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td colspan="4">Combustion of liquid fuels</td></tr>
<tr><td>Table 13</td><td>BAT-associated energy efficiency levels (BAT-AEELs) for HFO and/or gas oil combustion in boilers
<table>
<tr><th rowspan="3">Type of combustion unit</th><th colspan="4">BAT-AEELs ([99]) ([100])</th></tr>
<tr><th colspan="2">Net electrical efficiency (%)</th><th colspan="2">Net total fuel utilisation (%) ([101])</th></tr>
<tr><th>New unit</th><th>Existing unit</th><th>New unit</th><th>Existing unit</th></tr>
<tr><td>HFO- and/or gas-oil-fired boiler</td><td>> 36,4</td><td>35,6–37,4</td><td>80–96</td><td>80–96</td></tr>
</table>
</td><td>NA</td><td>Not applicable to gas turbines.</td></tr>
</table>

<table>
<tr><th>BAT Concn. Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th></tr>
<tr><td>28</td><td>In order to prevent or reduce NO_X emissions to air while limiting CO emissions to air from the combustion of HFO and/or gas oil in boilers, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Air staging</td><td rowspan="5">See descriptions in Section 8.3</td><td rowspan="4">Generally applicable</td></tr>
<tr><td>b.</td><td>Fuel staging</td></tr>
<tr><td>c.</td><td>Flue-gas recirculation</td></tr>
<tr><td>d.</td><td>Low-NO_X burners (LNB)</td></tr>
<tr><td>e.</td><td>Water/steam addition</td><td>Applicable within the constraints of water availability</td></tr>
<tr><td>f.</td><td>Selective non-catalytic reduction (SNCR)</td><td></td><td>Not applicable to combustion plants operated < 500 h/yr with highly variable boiler loads.
The applicability may be limited in the case of combustion plants operated between 500 h/yr and 1 500 h/yr with highly variable boiler loads</td></tr>
<tr><td>g.</td><td>Selective catalytic reduction (SCR)</td><td rowspan="3">See descriptions in Section 8.3</td><td>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.
Not generally applicable to combustion plants of < 100 MW_{th}</td></tr>
<tr><td>h.</td><td>Advanced control system</td><td>Generally applicable to new combustion plants.
The applicability to old combustion plants may be constrained by the need to retrofit the combustion system and/or control command system</td></tr>
<tr><td>i.</td><td>Fuel choice</td><td>Applicable within the constraints associated with the availability of different types of fuel, which may</td></tr>
</table></td><td>NA</td><td>Not applicable to gas turbines.</td></tr>
</table>

<table>
<tr><th>BAT Concn. Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th></tr>
<tr><td></td><td>
<table>
<tr><td></td><td></td><td></td><td>be impacted by the energy policy of the Member State</td></tr>
</table>
BAT-associated emission levels (BAT-AELs) for NO_X emissions to air from the combustion of HFO and/or gas oil in boilers
<table>
<tr><th rowspan="2">Combustion plant total rated thermal input (MW_{th})</th><th colspan="4">BAT-AELs (mg/Nm^3)</th></tr>
<tr><th colspan="2">Yearly average</th><th colspan="2">Daily average or average over the sampling period</th></tr>
<tr><th>New plant</th><th>Existing plant ([102])</th><th>New plant</th><th>Existing plant ([103])</th></tr>
<tr><td>< 100</td><td>75–200</td><td>150–270</td><td>100–215</td><td>210–330 ([104])</td></tr>
<tr><td>≥ 100</td><td>45–75</td><td>45–100 ([105])</td><td>85–100</td><td>85–110 ([106]) ([107])</td></tr>
</table>
As an indication, the yearly average CO emission levels will generally be:
— 10-30 mg/Nm^3 for existing combustion plants of < 100 MW_{th} operated ≥ 1 500 h/yr, or new combustion plants of <100 MW_{th},
— 10–20mg/Nm^3 for existing combustion plants of ≥ 100 MW_{th} operated ≥ 1 500 h/yr, or new combustion plants of ≥ 100 MW_{th}.
</td><td></td><td></td></tr>
<tr><td>29</td><td>
In order to prevent or reduce SO_X, HCl and HF emissions to air from the combustion of HFO and/or gas oil in boilers, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Duct sorbent injection (DSI)</td><td rowspan="4">See description in Section 8.4</td><td rowspan="3">Generally applicable</td></tr>
<tr><td>b.</td><td>Spray dry absorber (SDA)</td></tr>
<tr><td>c.</td><td>Flue-gas condenser</td></tr>
<tr><td>d.</td><td>Wet flue-gas desulphurisation (wet FGD)</td><td>There may be technical and economic restrictions for applying the technique to combustion plants of < 300 MW_{th}.
Not applicable to combustion plants operated < 500 h/yr.</td></tr>
</table>
</td><td>NA</td><td>Not applicable to gas turbines.</td></tr>
</table>

BAT Concn. Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement

			There may be technical and economic restrictions for retrofitting existing combustion plants operated between 500 h/yr and 1 500 h/yr
e.	Seawater FGD		There may be technical and economic restrictions for applying the technique to combustion plants of < 300 MW_{th}. 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
f.	Fuel choice		Applicable within the constraints associated with the availability of different types of fuel, which may be impacted by the energy policy of the Member State

BAT-associated emission levels (BAT-AELs) for SO_2 emissions to air from the combustion of HFO and/or gas oil in boilers

Combustion plant total rated thermal input (MW_{th})	BAT-AELs for SO_2 (mg/Nm^3)			
	Yearly average		Daily average or average over the sampling period	
	New plant	Existing plant ([108])	New plant	Existing plant ([109])
< 300	50–175	50–175	150–200	150–200 ([110])
≥ 300	35–50	50–110	50–120	150–165 ([111]) ([112])

BAT Concn. Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement
30	In order to reduce dust and particulate-bound metal emissions to air from the combustion of HFO and/or gas oil in boilers, BAT is to use one or a combination of the techniques given below.	NA	Not applicable to gas turbines.

Technique		Description	Applicability
a.	Electrostatic precipitator (ESP)	See description in Section 8.5	Generally applicable

BAT Concn. Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement

b.	Bag filter		
c.	Multicyclones	See description in Section 8.5. Multicyclones can be used in combination with other dedusting techniques	
d.	Dry or semi-dry FGD system	See descriptions in Section 8.5. The technique is mainly used for SO_X, HCl and/or HF control	
e.	Wet flue-gas desulphurisation (wet FGD)	See description in Section 8.5. The technique is mainly used for SO_X, HCl and/or HF control	See applicability in BAT 29
f.	Fuel choice	See description in Section 8.5	Applicable within the constraints associated with the availability of different types of fuel, which may be impacted by the energy policy of the Member State

BAT-associated emission levels (BAT-AELs) for dust emissions to air from the combustion of HFO and/or gas oil in boilers

Combustion plant total rated thermal input (MW_{th})	BAT-AELs for dust (mg/Nm^3)			
	Yearly average		Daily average or average over the sampling period	
	New plant	Existing plant ([113])	New plant	Existing plant ([114])
< 300	2–10	2–20	7–18	7–22 ([115])
≥ 300	2–5	2–10	7–10	7–11 ([116])

<table>
<tr><th>BAT Concn. Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th></tr>
<tr><td>31</td><td>In order to increase the energy efficiency of HFO and/or gas oil combustion in reciprocating engines, BAT is to use an appropriate combination of the techniques given in BAT 12 and below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Combined cycle</td><td>See description in Section 8.2</td><td>Generally applicable to new units operated ≥ 1 500 h/yr.
Applicable to existing units within the constraints associated with the steam cycle design and the space availability.
Not applicable to existing units operated < 1 500 h/yr</td></tr>
</table>
BAT-associated energy efficiency levels (BAT-AEELs) for the combustion of HFO and/or gas oil in reciprocating engines
<table>
<tr><th rowspan="2">Type of combustion unit</th><th colspan="2">BAT-AEELs (119)</th></tr>
<tr><th colspan="2">Net electrical efficiency (%) (120)</th></tr>
<tr><th>New unit</th><th>Existing unit</th></tr>
<tr><td>HFO- and/or gas-oil-fired reciprocating engine — single cycle</td><td>41,5–44,5 (121)</td><td>38,3–44,5 (121)</td></tr>
<tr><td>HFO- and/or gas-oil-fired reciprocating engine — combined cycle</td><td>> 48 (122)</td><td>No BAT-AEEL</td></tr>
</table></td><td>NA</td><td>Not applicable to gas turbines.</td></tr>
<tr><td>32</td><td>In order to prevent or reduce NO_X emissions to air from the combustion of HFO and/or gas oil in reciprocating engines, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Low-NO_X combustion concept in diesel engines</td><td rowspan="4">See descriptions in Section 8.3</td><td>Generally applicable</td></tr>
<tr><td>b.</td><td>Exhaust-gas recirculation (EGR)</td><td>Not applicable to four-stroke engines</td></tr>
<tr><td>c.</td><td>Water/steam addition</td><td>Applicable within the constraints of water availability.
The applicability may be limited where no retrofit package is available</td></tr>
<tr><td>d.</td><td>Selective catalytic reduction (SCR)</td><td>Not applicable to combustion plants operated < 500 h/yr.</td></tr>
</table></td><td>NA</td><td>Not applicable to gas turbines.</td></tr>
</table>

<table>
<tr><th>BAT Concn. Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th></tr>
<tr><td></td><td>
<table>
<tr><td></td><td></td><td></td><td>There may be technical and economic restrictions for retrofitting existing combustion plants operated between 500 h/yr and 1 500 h/yr.
Retrofitting existing combustion plants may be constrained by the availability of sufficient space</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>33</td><td>
In order to prevent or reduce emissions of CO and volatile organic compounds to air from the combustion of HFO and/or gas oil in reciprocating engines, BAT is to use one or both of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Combustion optimisation</td><td></td><td>Generally applicable</td></tr>
<tr><td>b.</td><td>Oxidation catalysts</td><td>See descriptions in Section 8.3</td><td>Not applicable to combustion plants operated < 500 h/yr.
The applicability may be limited by the sulphur content of the fuel</td></tr>
</table>
BAT-associated emission levels (BAT-AELs) for NO_X emissions to air from the combustion of HFO and/or gas oil in reciprocating engines
<table>
<tr><th rowspan="3">Combustion plant total rated thermal input (MW_{th})</th><th colspan="4">BAT-AELs (mg/Nm^3)</th></tr>
<tr><th colspan="2">Yearly average</th><th colspan="2">Daily average or average over the sampling period</th></tr>
<tr><th>New plant</th><th>Existing plant (123)</th><th>New plant</th><th>Existing plant (124) (125)</th></tr>
<tr><td>≥ 50</td><td>115–190 (126)</td><td>125–625</td><td>145–300</td><td>150–750</td></tr>
</table>
As an indication, for existing combustion plants burning only HFO and operated ≥ 1 500 h/yr or new combustion plants burning only HFO,

— the yearly average CO emission levels will generally be 50–175 mg/Nm^3,
— the average over the sampling period for TVOC emission levels will generally be 10–40 mg/Nm^3.

</td><td>NA</td><td>Not applicable to gas turbines.</td></tr>
<tr><td>34</td><td>
In order to prevent or reduce SO_X, HCl and HF emissions to air from the combustion of HFO and/or gas oil in reciprocating engines, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th>Technique</th><th>Description</th><th>Applicability</th></tr>
</table>
</td><td>NA</td><td>Not applicable to gas turbines.</td></tr>
</table>

<table>
<tr><th>BAT Concn. Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th></tr>
<tr><td></td><td>
<table>
<tr><td>a.</td><td>Fuel choice</td><td rowspan="3">See descriptions in Section 8.4</td><td>Applicable within the constraints associated with the availability of different types of fuel, which may be impacted by the energy policy of the Member State</td></tr>
<tr><td>b.</td><td>Duct sorbent injection (DSI)</td><td>There may be technical restrictions in the case of existing combustion plants
Not applicable to combustion plants operated < 500 h/yr</td></tr>
<tr><td>c.</td><td>Wet flue-gas desulphurisation (wet FGD)</td><td>There may be technical and economic restrictions for applying the technique to combustion plants of < 300 MW_{th}.
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</td></tr>
</table>
BAT-associated emission levels (BAT-AELs) for SO_2 emissions to air from the combustion of HFO and/or gas oil in reciprocating engines
<table>
<tr><th rowspan="2">Combustion plant total rated thermal input (MW_{th})</th><th colspan="4">BAT-AELs for SO_2 (mg/Nm^3)</th></tr>
<tr><th colspan="2">Yearly average</th><th colspan="2">Daily average or average over the sampling period</th></tr>
<tr><th>New plant</th><th>Existing plant ([127])</th><th>New plant</th><th>Existing plant ([128])</th></tr>
<tr><td>All sizes</td><td>45–100</td><td>100–200 ([129])</td><td>60–110</td><td>105–235 ([129])</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>35</td><td>In order to prevent or reduce dust and particulate-bound metal emissions from the combustion of HFO and/or gas oil in reciprocating engines, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Fuel choice</td><td rowspan="3">See descriptions in Section 8.5</td><td>Applicable within the constraints associated with the availability of different types of fuel, which may be impacted by the energy policy of the Member State</td></tr>
<tr><td>b.</td><td>Electrostatic precipitator (ESP)</td><td rowspan="2">Not applicable to combustion plants operated < 500 h/yr</td></tr>
<tr><td>c.</td><td>Bag filter</td></tr>
</table>
</td><td>NA</td><td>Not applicable to gas turbines.</td></tr>
</table>

<table>
<tr><th>BAT Concn. Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th></tr>
<tr><td></td><td>

BAT-associated emission levels (BAT-AELs) for dust emissions to air from the combustion of HFO and/or gas oil in reciprocating engines

<table>
<tr><th rowspan="3">Combustion plant total rated thermal input (MW_{th})</th><th colspan="4">BAT-AELs for dust (mg/Nm^3)</th></tr>
<tr><th colspan="2">Yearly average</th><th colspan="2">Daily average or average over the sampling period</th></tr>
<tr><th>New plant</th><th>Existing plant (130)</th><th>New plant</th><th>Existing plant (131)</th></tr>
<tr><td>≥ 50</td><td>5–10</td><td>5–35</td><td>10–20</td><td>10–45</td></tr>
</table>

</td><td></td><td></td></tr>
<tr><td>36</td><td>

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

<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Combined cycle</td><td>See description in Section 8.2</td><td>Generally applicable to new units operated ≥ 1 500 h/yr.
Applicable to existing units within the constraints associated with the steam cycle design and the space availability.
Not applicable to existing units operated < 1 500 h/yr</td></tr>
</table>

BAT-associated energy efficiency levels (BAT-AEELs) for gas-oil-fired gas turbines

<table>
<tr><th rowspan="3">Type of combustion unit</th><th colspan="2">BAT-AEELs (132)</th></tr>
<tr><th colspan="2">Net electrical efficiency (%) (133)</th></tr>
<tr><th>New unit</th><th>Existing unit</th></tr>
<tr><td>Gas-oil-fired open-cycle gas turbine</td><td>> 33</td><td>25–35,7</td></tr>
<tr><td>Gas-oil-fired combined cycle gas turbine</td><td>> 40</td><td>33–44</td></tr>
</table>

</td><td>CC</td><td>

Not applicable to LCP276 and LCP277 as they only burn natural gas.

For LCP397:
- Combined cycle is not applicable to existing units operated less than 1,500 hours per year;
- BAT 12 is not applicable to plant which operates less than 1500 hours per year; and
- BAT-AEELs do not apply to units operated less than 1,500 hours per year.
- The installed GTs are of the Avon Mk1533 design installed in the 1960s. These have a name plate efficiency of 25.5% (*JEP report UTG/18/ERG/CT/773/R - October 2018*). The Operator has confirmed that there have been no modifications with the potential to significantly affect efficiency and no recent performance test data is available.

A process monitoring requirement has been set in table S3.4 which requires energy efficiency monitoring after an overhaul.

</td></tr>
<tr><td>37</td><td>

In order to prevent or reduce NO_X emissions to air from the combustion of gas oil in gas turbines, BAT is to use one or a combination of the techniques given below.

<table>
<tr><th>Technique</th><th>Description</th><th>Applicability</th></tr>
</table>

</td><td>NA</td><td>

Not applicable to LCP276 and LCP277 as they only burn natural gas.

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

<table>
<tr><th>BAT Concn. Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th></tr>
<tr><td></td><td>
<table>
<tr><td>a.</td><td>Water/steam addition</td><td rowspan="3">See description in Section 8.3</td><td>The applicability may be limited due to water availability</td></tr>
<tr><td>b.</td><td>Low-NO_X burners (LNB)</td><td>Only applicable to turbine models for which low-NO_X burners are available on the market</td></tr>
<tr><td>c.</td><td>Selective catalytic reduction (SCR)</td><td>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.
Retrofitting existing combustion plants may be constrained by the availability of sufficient space</td></tr>
</table>
</td><td></td><td>For LCP397, we consider that the techniques described by this BAT conclusion are not applicable to the OCGTs because:
- They operate less than 500 hours per year;
- There are currently no NOx emission reduction options available; and
- Selective catalytic reduction (SCR) is not applicable to combustion plants operated less than 500 hour year.

In making this assessment, we have considered the reference technical information available within the Joint Environmental Programme (JEP) report UTG/18/PMP/774/R. Further details are discussed in the key issues section.</td></tr>
<tr><td>38</td><td>In order to prevent or reduce CO emissions to air from the combustion of gas oil in gas turbines, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Combustion optimisation</td><td rowspan="2">See description in Section 8.3</td><td>Generally applicable</td></tr>
<tr><td>b.</td><td>Oxidation catalysts</td><td>Not applicable to combustion plants operated < 500 h/yr.
Retrofitting existing combustion plants may be constrained by the availability of sufficient space</td></tr>
</table>
As an indication, the emission level for NO_X emissions to air from the combustion of gas oil in dual fuel gas turbines for emergency use operated < 500 h/yr will generally be 145–250 mg/Nm^3 as a daily average or average over the sampling period.</td><td>CC</td><td>Not applicable to LCP276 and LCP277 as they only burn natural gas.

For LCP397, CO emissions are reduced as far as possible by optimising combustion. Oxidation catalysts are not applicable to combustion plants operated < 500 hours per year.

BAT 38 provides an indicative NOx emission level of 250mg/Nm^3 for combustion of gas oil in dual fuel gas turbines operating less than 500 hours per year. However, this indicative figure is not applicable to LCP397, because it is not a dual fuel gas turbine.
We accept that the current NOx emission levels, along with appropriate maintenance of the gas turbines, is BAT for LCP397. Accordingly, we have set an indicative emission level of 330 mg/m^3 in the varied and consolidated permit. This is based on justification supplied by the Operator and supported by the JEP report UTG/18/PMP/774/R 'BAT assessment for existing natural gas, gas oil and dual fuel fired OCGTS and</td></tr>
</table>

<table>
<tr><th>BAT Concn. Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th></tr>
<tr><td></td><td></td><td></td><td>CCGTs with a thermal rating of 50MWth or greater operating <500 hours per year' dated October 2018.</td></tr>
<tr><td>39</td><td>In order to prevent or reduce SO_X and dust emissions to air from the combustion of gas oil in gas turbines, BAT is to use the technique given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Fuel choice</td><td>See description in Section 8.4</td><td>Applicable within the constraints associated with the availability of different types of fuel, which may be impacted by the energy policy of the Member State</td></tr>
</table>
BAT-associated emission levels for SO_2 and dust emissions to air from the combustion of gas oil in gas turbines, including dual fuel gas turbines
<table>
<tr><th rowspan="3">Type of combustion plant</th><th colspan="4">BAT-AELs (mg/Nm^3)</th></tr>
<tr><th colspan="2">SO_2</th><th colspan="2">Dust</th></tr>
<tr><th>Yearly average (1 34)</th><th>Daily average or average over the sampling period (135)</th><th>Yearly average (1 34)</th><th>Daily average or average over the sampling period (135)</th></tr>
<tr><td>New and existing plants</td><td>35–60</td><td>50–66</td><td>2–5</td><td>2–10</td></tr>
</table></td><td>CC</td><td>Not applicable to LCP276 and LCP277 as they only burn natural gas.

For LCP397, The installation implements 'fuel choice' as a technique to prevent and reduce emissions of SOx and dust from combustion of liquid fuel.

LCP 397 is permitted to operate for no more than 500 hours per year. The yearly BAT-AELs for SO_2 and dust are not applicable to existing plants operating for less than 1500 hours per year. The daily (or average over sampling period) BAT-AELs for SO_2 and dust are indicative for existing plants operating for less than 500 hours per year. Dust emissions for LCP 397 are quantified in JEP report UTG/18/ERG/773/R and the levels are less than the indicative BAT AEL.</td></tr>
<tr><td colspan="4">Combustion of gaseous fuels</td></tr>
<tr><td>40</td><td>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><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Combined cycle</td><td>See description in Section 8.2</td><td>Generally applicable to new gas turbines and engines except when operated < 1 500 h/yr.
Applicable to existing gas turbines and engines within the constraints associated with the steam cycle design and the space availability.
Not applicable to existing gas turbines and engines operated < 1 500 h/yr.
Not applicable to mechanical drive gas turbines operated in discontinuous mode with extended load variations and frequent start-ups and shutdowns.
Not applicable to boilers</td></tr>
</table></td><td>CC</td><td>Not applicable to LCP397 as it only burns gas oil.

The station uses techniques a, b, c, d, f, g and h given in BAT 12 for LCP276 and LCP277.

LCP276 and LCP277, only operate in combined cycle mode.

The BAT-AEEL range for net electrical efficiency applicable to the CCGTs is 50-60%. The Operator has confirmed that the efficiency for LCP276 is 56.1% and for LCP277 is 55.87%. Therefore both are within the BAT-AEEL range for existing combined cycle gas turbines.</td></tr>
</table>

<table>
<tr><th>BAT Concn. Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th></tr>
<tr><td></td><td>
BAT-associated energy efficiency levels (BAT-AEELs) for the combustion of natural gas
<table>
<tr><th rowspan="2">Type of combustion unit</th><th colspan="5">BAT-AEELs [136] [137]</th></tr>
<tr><th colspan="2">Net electrical efficiency (%)</th><th rowspan="2">Net total fuel utilisation (%) [138] [139]</th><th colspan="2">Net mechanical energy efficiency (%) [139] [140]</th></tr>
<tr><th>New unit</th><th>Existing unit</th><th>New unit</th><th>Existing unit</th></tr>
<tr><td>Gas engine</td><td>39,5–44 [141]</td><td>35–44 [141]</td><td>56–85 [141]</td><td colspan="2">No BAT-AEEL.</td></tr>
<tr><td>Gas-fired boiler</td><td>39–42,5</td><td>38–40</td><td>78–95</td><td colspan="2">No BAT-AEEL.</td></tr>
<tr><td>Open cycle gas turbine, ≥ 50 MWth</td><td>36–41,5</td><td>33–41,5</td><td>No BAT-AEEL</td><td>36,5–41</td><td>33,5–41</td></tr>
<tr><td colspan="6">Combined cycle gas turbine (CCGT)</td></tr>
<tr><td>CCGT, 50–600 MW_{th}</td><td>53–58,5</td><td>46–54</td><td>No BAT-AEEL</td><td colspan="2">No BAT-AEEL</td></tr>
<tr><td>CCGT, ≥ 600 MW_{th}</td><td>57–60,5</td><td>50–60</td><td>No BAT-AEEL</td><td colspan="2">No BAT-AEEL</td></tr>
<tr><td>CHP CCGT, 50–600 MW_{th}</td><td>53–58,5</td><td>46–54</td><td>65–95</td><td colspan="2">No BAT-AEEL</td></tr>
<tr><td>CHP CCGT, ≥ 600 MW_{th}</td><td>57–60,5</td><td>50–60</td><td>65–95</td><td colspan="2">No BAT-AEEL</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>41</td><td>
In order to prevent or reduce NO_X emissions to air from the combustion of natural gas in boilers, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Air and/or fuel staging</td><td>See descriptions in Section 8.3. Air staging is often associated with low-NO_X burners</td><td>Generally applicable</td></tr>
<tr><td>b.</td><td>Flue-gas recirculation</td><td rowspan="2">See description in Section 8.3</td><td rowspan="2"></td></tr>
<tr><td>c.</td><td>Low-NO_X burners (LNB)</td></tr>
<tr><td>d.</td><td>Advanced control system</td><td>See description in Section 8.3. This technique is often used in combination with other techniques or may be used alone for</td><td>The applicability to old combustion plants may be constrained by the need to retrofit the combustion system and/or control command system</td></tr>
</table>
</td><td>NA</td><td>Not applicable to gas turbines.</td></tr>
</table>

<table>
<tr><th>BAT Concn. Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th></tr>
<tr><td></td><td>
<table>
<tr><td></td><td></td><td>combustion plants operated < 500 h/yr</td><td></td></tr>
<tr><td>e.</td><td>Reduction of the combustion air temperature</td><td>See description in Section 8.3</td><td>Generally applicable within the constraints associated with the process needs</td></tr>
<tr><td>f.</td><td>Selective non–catalytic reduction (SNCR)</td><td></td><td>Not applicable to combustion plants operated < 500 h/yr with highly variable boiler loads.
The applicability may be limited in the case of combustion plants operated between 500 h/yr and 1 500 h/yr with highly variable boiler loads</td></tr>
<tr><td>g.</td><td>Selective catalytic reduction (SCR)</td><td></td><td>Not applicable to combustion plants operated < 500 h/yr.
Not generally applicable to combustion plants of < 100 MW_{th}.
There may be technical and economic restrictions for retrofitting existing combustion plants operated between 500 h/yr and 1 500 h/yr</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>42</td><td>In order to prevent or reduce NO_X 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.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Advanced control system</td><td>See description in Section 8.3.
This technique is often used in combination with other techniques or may be used alone for combustion plants operated < 500 h/yr</td><td>The applicability to old combustion plants may be constrained by the need to retrofit the combustion system and/or control command system</td></tr>
<tr><td>b.</td><td>Water/steam addition</td><td>See description in Section 8.3</td><td>The applicability may be limited due to water availability</td></tr>
<tr><td>c.</td><td>Dry low-NO_X burners (DLN)</td><td></td><td>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</td></tr>
<tr><td>d.</td><td>Low-load design concept</td><td>Adaptation of the process control and related equipment to maintain good combustion efficiency when the demand in energy</td><td>The applicability may be limited by the gas turbine design</td></tr>
</table>
</td><td>CC</td><td>Not applicable to LCP397 as it only burns gas oil.

LCP276 and LCP277 use the following techniques from BAT 42:
a) Advanced control system; and
c) Dry low-NOX burners (DLN)</td></tr>
</table>

BAT Concn. Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement

		varies, e.g. by improving the inlet airflow control capability or by splitting the combustion process into decoupled combustion stages	
e.	Low-NO_X burners (LNB)	See description in Section 8.3	Generally applicable to supplementary firing for heat recovery steam generators (HRSGs) in the case of combined-cycle gas turbine (CCGT) combustion plants
f.	Selective catalytic reduction (SCR)		Not applicable in the case of combustion plants operated < 500 h/yr. Not generally applicable to existing combustion plants of < 100 MW_{th}. Retrofitting existing combustion plants may be constrained by the availability of sufficient space. There may be technical and economic restrictions for retrofitting existing combustion plants operated between 500 h/yr and 1 500 h/yr

43 — In order to prevent or reduce NO_X emissions to air from the combustion of natural gas in engines, BAT is to use one or a combination of the techniques given below.

NA — Not applicable to gas turbines

Technique		Description	Applicability
a.	Advanced control system	See description in Section 8.3. This technique is often used in combination with other techniques or may be used alone for combustion plants operated < 500 h/yr	The applicability to old combustion plants may be constrained by the need to retrofit the combustion system and/or control command system
b.	Lean-burn concept	See description in Section 8.3. Generally used in combination with SCR	Only applicable to new gas-fired engines
c.	Advanced lean-burn concept	See descriptions in Section 8.3	Only applicable to new spark plug ignited engines

<table>
<tr><th>BAT Concn. Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th></tr>
<tr><td></td><td>
<table>
<tr><td>d.</td><td>Selective catalytic reduction (SCR)</td><td></td><td>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</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>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.
Description - See descriptions in Section 8.3.

Table 24
BAT-associated emission levels (BAT-AELs) for NO_X emissions to air from the combustion of natural gas in gas turbines
<table>
<tr><th rowspan="2">Type of combustion plant</th><th rowspan="2">Combustion plant total rated thermal input (MW_{th})</th><th colspan="2">BAT-AELs (mg/Nm^3) (142) (143)</th></tr>
<tr><th>Yearly average (144) (145)</th><th>Daily average or average over the sampling period</th></tr>
<tr><td colspan="4">Open-cycle gas turbines (OCGTs) (146) (147)</td></tr>
<tr><td>New OCGT</td><td>≥ 50</td><td>15–35</td><td>25–50</td></tr>
<tr><td>Existing OCGT (excluding turbines for mechanical drive applications) — All but plants operated < 500 h/yr</td><td>≥ 50</td><td>15–50</td><td>25–55 (148)</td></tr>
<tr><td colspan="4">Combined-cycle gas turbines (CCGTs) (146) (149)</td></tr>
<tr><td>New CCGT</td><td>≥ 50</td><td>10–30</td><td>15–40</td></tr>
<tr><td>Existing CCGT with a net total fuel utilisation of < 75 %</td><td>≥ 600</td><td>10–40</td><td>18–50</td></tr>
<tr><td>Existing CCGT with a net total fuel utilisation of ≥ 75 %</td><td>≥ 600</td><td>10–50</td><td>18–55 (150)</td></tr>
<tr><td>Existing CCGT with a net total fuel utilisation of < 75 %</td><td>50–600</td><td>10–45</td><td>35–55</td></tr>
</table>
</td><td>CC

FC</td><td>Not applicable to LCP397 as it only burns gas oil.

For LCP276 and LCP277, CO emissions are reduced as far as possible by optimising combustion.

CO: For LCP276 and LCP277, the Operator has requested a limit for emissions of CO of 100 mg/m^3, this is higher than the indicative BAT-AEL of 30 mg/m^3. The higher CO limit allows for a reduction of NOx whilst maintaining combustion stability and efficiency. We consider the technical justification provided by the Operator is adequate and we have set the annual emission limits for CO at 100 mg/m^3 in the revised and consolidated permit. further information is given in the key issues section of this Decision Document.

NOx: Footnote 8 to Table 24 says that 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. The EE for LCP276 and LCP277 are above 55%, we have therefore applied the correction factor and adjusted the limits accordingly. These limits are applicable when the DLN system is fully effective.

As part of their Regulation 61 Notice response, the Operator identified that they had not been able to finalise the chosen compliance route for LCP277 (unlimited hours or <1500 hours). Further information was therefore requested and subsequently supplied on 3rd</td></tr>
</table>

BAT Concn. Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement

Existing CCGT with a net total fuel utilisation of ≥ 75 %	50–600	25–50 (151)	35–55 (152)

Open- and combined-cycle gas turbines

Gas turbine put into operation no later than 27 November 2003, or existing gas turbine for emergency use and operated < 500 h/yr	≥ 50	No BAT-AEL	60–140 (153) (154)
Existing gas turbine for mechanical drive applications — All but plants operated < 500 h/yr	≥ 50	15–50 (155)	25–55 (156)

As an indication, the yearly average CO emission levels for each type of existing combustion plant operated ≥ 1 500 h/yr and for each type of new combustion plant will generally be as follows:

— New OCGT of ≥ 50 MW_{th}: < 5–40 mg/Nm^3. For plants with a net electrical efficiency (EE) greater than 39 %, a correction factor may be applied to the higher end of this range, corresponding to [higher end] × EE/39, where EE is the net electrical energy efficiency or net mechanical energy efficiency of the plant determined at ISO baseload conditions.

— Existing OCGT of ≥ 50 MW_{th} (excluding turbines for mechanical drive applications): < 5–40 mg/Nm^3. The higher end of this range will generally be 80 mg/Nm^3 in the case of existing plants that cannot be fitted with dry techniques for NO_x reduction, or 50 mg/Nm^3 for plants that operate at low load.

— New CCGT of ≥ 50 MW_{th}: < 5–30 mg/Nm^3. For plants with a net electrical efficiency (EE) greater than 55 %, a correction factor may be applied to the higher end of the range, corresponding to [higher end] × EE/55, where EE is the net electrical energy efficiency of the plant determined at ISO baseload conditions.

— Existing CCGT of ≥ 50 MW_{th}: < 5–30 mg/Nm^3. The higher end of this range will generally be 50 mg/Nm^3 for plants that operate at low load.

— Existing gas turbines of ≥ 50 MW_{th} for mechanical drive applications: < 5–40 mg/Nm^3. The higher end of the range will generally be 50 mg/Nm^3 when plants operate at low load.

In the case of a gas turbine equipped with DLN burners, these indicative levels correspond to when the DLN operation is effective.

BAT-associated emission levels (BAT-AELs) for NO_x emissions to air from the combustion of natural gas in boilers and engines

Type of combustion plant	BAT-AELs (mg/Nm^3)	
	Yearly average (157)	Daily average or average over the sampling period

October 2019. The Operator confirmed that works were now planned to upgrade some of the components within the gas turbines on LCP277 which, with tuning, will reduce NOx emissions and improve efficiency. The Operator stated that this is expected to enable the gas turbines on LCP277 to fully comply with the BREF limits for NOx without requiring constraints on operating hours. We have therefore permitted LCP277 for unlimited hours of operation.

We have agreed with the Operators request that the BAT-AELs will apply from the issue date of the variation.

<table>
<tr><th>BAT Concn. Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th></tr>
<tr><td></td><td>
<table>
<tr><th></th><th>New plant</th><th>Existing plant (158)</th><th>New plant</th><th>Existing plant (159)</th></tr>
<tr><td>Boiler</td><td>10–60</td><td>50–100</td><td>30–85</td><td>85–110</td></tr>
<tr><td>Engine (160)</td><td>20–75</td><td>20–100</td><td>55–85</td><td>55–110 (161)</td></tr>
</table>
As an indication, the yearly average CO emission levels will generally be:
— < 5–40 mg/Nm^3 for existing boilers operated ≥ 1 500 h/yr,
— < 5–15 mg/Nm^3 for new boilers,
— 30–100 mg/Nm^3 for existing engines operated ≥ 1 500 h/yr and for new engines.
</td><td></td><td></td></tr>
<tr><td>45</td><td>In order to reduce non-methane volatile organic compounds (NMVOC) and methane (CH_4) emissions to air from the combustion of natural gas in spark-ignited lean-burn gas engines, BAT is to ensure optimised combustion and/or to use oxidation catalysts.
Description
See descriptions in Section 8.3. Oxidation catalysts are not effective at reducing the emissions of saturated hydrocarbons containing less than four carbon atoms.
BAT-associated emission levels (BAT-AELs) for formaldehyde and CH_4 emissions to air from the combustion of natural gas in a spark-ignited lean-burn gas engine
<table>
<tr><th rowspan="4">Combustion plant total rated thermal input (MW_{th})</th><th colspan="3">BAT-AELs (mg/Nm^3)</th></tr>
<tr><th>Formaldehyde</th><th colspan="2">CH_4</th></tr>
<tr><th colspan="3">Average over the sampling period</th></tr>
<tr><th>New or existing plant</th><th>New plant</th><th>Existing plant</th></tr>
<tr><td>≥ 50</td><td>5–15 (162)</td><td>215–500 (163)</td><td>215–560 (162) (163)</td></tr>
</table>
</td><td>NA</td><td>Not applicable to gas turbines</td></tr>
<tr><td>46</td><td>In order to increase the energy efficiency of the combustion of iron and steel process gases, BAT is to use an appropriate combination of the techniques given in BAT 12 and below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Process gas management system</td><td>See description in Section 8.2</td><td>Only applicable to integrated steelworks</td></tr>
</table>
BAT-associated energy efficiency levels (BAT-AEELs) for the combustion of iron and steel process gases in boilers</td><td>NA</td><td>Not applicable</td></tr>
</table>

<table>
<tr><th>BAT Concn. Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th></tr>
<tr><td></td><td>
<table>
<tr><th rowspan="2">Type of combustion unit</th><th colspan="2">BAT-AEELs (164) (165)</th></tr>
<tr><th>Net electrical efficiency (%)</th><th>Net total fuel utilisation (%) (166)</th></tr>
<tr><td>Existing multi-fuel firing gas boiler</td><td>30–40</td><td>50–84</td></tr>
<tr><td>New multi-fuel firing gas boiler (167)</td><td>36–42,5</td><td>50–84</td></tr>
</table>
BAT-associated energy efficiency levels (BAT-AEELs) for the combustion of iron and steel process gases in CCGTs
<table>
<tr><th rowspan="2">Type of combustion unit</th><th colspan="3">BAT-AEELs (168) (169)</th></tr>
<tr><th colspan="2">Net electrical efficiency (%)</th><th>Net total fuel utilisation (%) (170)</th></tr>
<tr><th>New unit</th><th>Existing unit</th></tr>
<tr><td>CHP CCGT</td><td>> 47</td><td>40–48</td><td>60–82</td></tr>
<tr><td>CCGT</td><td>> 47</td><td>40–48</td><td>No BAT-AEEL</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>47</td><td>In order to prevent or reduce NO_X emissions to air from the combustion of iron and steel process gases in boilers, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Low-NO_X burners (LNB)</td><td>See description in Section 8.3. Specially designed low-NO_X burners in multiple rows per type of fuel or including specific features for multi-fuel firing (e.g. multiple dedicated nozzles for burning different fuels, or including fuels premixing)</td><td rowspan="4">Generally applicable</td></tr>
<tr><td>b.</td><td>Air staging</td><td rowspan="3">See descriptions in Section 8.3</td></tr>
<tr><td>c.</td><td>Fuel staging</td></tr>
<tr><td>d.</td><td>Flue-gas recirculation</td></tr>
<tr><td>e.</td><td>Process gas management system</td><td>See description in Section 8.2.</td><td>Generally applicable within the constraints associated with the</td></tr>
</table>
</td><td>NA</td><td>Not applicable</td></tr>
</table>

<table>
<tr><th>BAT Concn. Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th></tr>
<tr><td></td><td>
<table>
<tr><td></td><td></td><td></td><td>availability of different types of fuel</td></tr>
<tr><td>f.</td><td>Advanced control system</td><td>See description in Section 8.3.
This technique is used in combination with other techniques</td><td>The applicability to old combustion plants may be constrained by the need to retrofit the combustion system and/or control command system</td></tr>
<tr><td>g.</td><td>Selective non-catalytic reduction (SNCR)</td><td rowspan="2">See descriptions in Section 8.3</td><td>Not applicable to combustion plants operated < 500 h/yr</td></tr>
<tr><td>h.</td><td>Selective catalytic reduction (SCR)</td><td>Not applicable to combustion plants operated < 500 h/yr.
Not generally applicable to combustion plants of < 100 MW_{th}.
Retrofitting existing combustion plants may be constrained by the availability of sufficient space and by the combustion plant configuration</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>48</td><td>In order to prevent or reduce NO_X emissions to air from the combustion of iron and steel process gases in CCGTs, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Process gas management system</td><td>See description in Section 8.2</td><td>Generally applicable within the constraints associated with the availability of different types of fuel</td></tr>
<tr><td>b.</td><td>Advanced control system</td><td>See description in Section 8.3.
This technique is used in combination with other techniques</td><td>The applicability to old combustion plants may be constrained by the need to retrofit the combustion system and/or control command system</td></tr>
<tr><td>c.</td><td>Water/steam addition</td><td>See description in Section 8.3.
In dual fuel gas turbines using DLN for the combustion of iron and steel process gases, water/steam addition</td><td>The applicability may be limited due to water availability</td></tr>
</table>
</td><td>NA</td><td>Not applicable</td></tr>
</table>

<table>
<tr><th>BAT Concn. Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th></tr>
<tr><td></td><td>
<table>
<tr><td></td><td></td><td>is generally used when combusting natural gas</td><td></td></tr>
<tr><td>d.</td><td>Dry low-NO_X burners(DLN)</td><td>See description in Section 8.3.
DLN that combust iron and steel process gases differ from those that combust natural gas only</td><td>Applicable within the constraints associated with the reactiveness of iron and steel process gases such as coke oven gas.
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</td></tr>
<tr><td>e.</td><td>Low-NO_X burners (LNB)</td><td rowspan="2">See description in Section 8.3</td><td>Only applicable to supplementary firing for heat recovery steam generators (HRSGs) of combined-cycle gas turbine (CCGT) combustion plants</td></tr>
<tr><td>f.</td><td>Selective catalytic reduction (SCR)</td><td>Retrofitting existing combustion plants may be constrained by the availability of sufficient space</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>49</td><td>In order to prevent or reduce CO emissions to air from the combustion of iron and steel process gases, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Combustion optimisation</td><td rowspan="2">See descriptions in Section 8.3</td><td>Generally applicable</td></tr>
<tr><td>b.</td><td>Oxidation catalysts</td><td>Only applicable to CCGTs.
The applicability may be limited by lack of space, the load requirements and the sulphur content of the fuel</td></tr>
</table>
BAT-associated emission levels (BAT-AELs) for NO_X emissions to air from the combustion of 100 % iron and steel process gases
<table>
<tr><th rowspan="2">Type of combustion plant</th><th rowspan="2">O_2 reference level (vol-%)</th><th colspan="2">BAT-AELs (mg/Nm^3) ([171])</th></tr>
<tr><th>Yearly average</th><th>Daily average or average over the sampling period</th></tr>
<tr><td>New boiler</td><td>3</td><td>15–65</td><td>22–100</td></tr>
</table>
</td><td>NA</td><td>Not applicable</td></tr>
</table>

<table>
<tr><th>BAT Concn. Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th></tr>
<tr><td></td><td>
<table>
<tr><td>Existing boiler</td><td>3</td><td>20–100 [172] [173]</td><td>22–110 [172] [174] [175]</td></tr>
<tr><td>New CCGT</td><td>15</td><td>20–35</td><td>30–50</td></tr>
<tr><td>Existing CCGT</td><td>15</td><td>20–50 [172] [173]</td><td>30–55 [175] [176]</td></tr>
</table>
As an indication, the yearly average CO emission levels will generally be:
— < 5–100 mg/Nm^3 for existing boilers operated ≥ 1 500 h/yr,
— < 5–35 mg/Nm^3 for new boilers,
— < 5–20 mg/Nm^3 for existing CCGTs operated ≥ 1 500 h/yr or new CCGTs.
</td><td></td><td></td></tr>
<tr><td>50</td><td>
In order to prevent or reduce SO_X emissions to air from the combustion of iron and steel process gases, BAT is to use a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Process gas management system and auxiliary fuel choice</td><td>See description in Section 8.2.
To the extent allowed by the iron- and steel-works, maximise the use of:
— a majority of blast furnace gas with a low sulphur content in the fuel diet,
— a combination of fuels with a low averaged sulphur content, e.g. individual process fuels with a very low S content such as:
— Blast furnace gas with a sulphur content < 10 mg/Nm^3,
— coke oven gas with a sulphur content < 300 mg/Nm^3,
— and auxiliary fuels such as:
— natural gas,
— liquid fuels with a sulphur content of ≤ 0,4 % (in boilers).
Use of a limited amount of fuels with a higher sulphur content</td><td>Generally applicable within the constraints associated with the availability of different types of fuel</td></tr>
<tr><td>b.</td><td>Coke oven gas pretreatment at the iron- and steel-works</td><td>Use of one of the following techniques:
— desulphurisation by absorption systems,
— wet oxidative desulphurisation</td><td>Only applicable to coke oven gas combustion plants</td></tr>
</table>
</td><td>NA</td><td>Not applicable</td></tr>
</table>

<table>
<tr><th>BAT Concn. Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th></tr>
<tr><td></td><td>BAT-associated emission levels (BAT-AELs) for SO_2 emissions to air from the combustion of 100 % iron and steel process gases
<table>
<tr><th rowspan="2">Type of combustion plant</th><th rowspan="2">O_2 reference level (%)</th><th colspan="2">BAT-AELs for SO_2 (mg/Nm^3)</th></tr>
<tr><th>Yearly average ([177])</th><th>Daily average or average over the sampling period ([178])</th></tr>
<tr><td>New or existing boiler</td><td>3</td><td>25–150</td><td>50–200 ([179])</td></tr>
<tr><td>New or existing CCGT</td><td>15</td><td>10–45</td><td>20–70</td></tr>
</table></td><td></td><td></td></tr>
<tr><td>51</td><td>In order to reduce dust emissions to air from the combustion of iron and steel process gases, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Fuel choice/management</td><td>Use of a combination of process gases and auxiliary fuels with a low averaged dust or ash content</td><td>Generally applicable within the constraints associated with the availability of different types of fuel</td></tr>
<tr><td>b.</td><td>Blast furnace gas pretreatment at the iron- and steel-works</td><td>Use of one or a combination of dry dedusting devices (e.g. deflectors, dust catchers, cyclones, electrostatic precipitators) and/or subsequent dust abatement (venturi scrubbers, hurdle-type scrubbers, annular gap scrubbers, wet electrostatic precipitators, disintegrators)</td><td>Only applicable if blast furnace gas is combusted</td></tr>
<tr><td>c.</td><td>Basic oxygen furnace gas pretreatment at the iron- and steel-works</td><td>Use of dry (e.g. ESP or bag filter) or wet (e.g. wet ESP or scrubber) dedusting. Further descriptions are given in the Iron and Steel BREF</td><td>Only applicable if basic oxygen furnace gas is combusted</td></tr>
<tr><td>d.</td><td>Electrostatic precipitator (ESP)</td><td rowspan="2">See descriptions in Section 8.5</td><td rowspan="2">Only applicable to combustion plants combusting a significant proportion of auxiliary fuels with a high ash content</td></tr>
<tr><td>e.</td><td>Bag filter</td></tr>
</table></td><td>NA</td><td>Not applicable</td></tr>
</table>

<table>
<tr><th>BAT Concn. Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th></tr>
<tr><td></td><td>BAT-associated emission levels (BAT-AELs) for dust emissions to air from the combustion of 100 % iron and steel process gases
<table>
<tr><th rowspan="2">Type of combustion plant</th><th colspan="2">BAT-AELs for dust (mg/Nm^3)</th></tr>
<tr><th>Yearly average ([180])</th><th>Daily average or average over the sampling period ([181])</th></tr>
<tr><td>New or existing boiler</td><td>2–7</td><td>2–10</td></tr>
<tr><td>New or existing CCGT</td><td>2–5</td><td>2–5</td></tr>
</table></td><td></td><td></td></tr>
<tr><td>52</td><td>In order to improve the general environmental performance of the combustion of gaseous and/or liquid fuels on offshore platforms, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Techniques</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Process optimisation</td><td>Optimise the process in order to minimise the mechanical power requirements</td><td rowspan="6">Generally applicable</td></tr>
<tr><td>b.</td><td>Control pressure losses</td><td>Optimise and maintain inlet and exhaust systems in a way that keeps the pressure losses as low as possible</td></tr>
<tr><td>c.</td><td>Load control</td><td>Operate multiple generator or compressor sets at load points which minimise emissions</td></tr>
<tr><td>d.</td><td>Minimise the ‘spinning reserve’</td><td>When running with spinning reserve for operational reliability reasons, the number of additional turbines is minimised, except in exceptional circumstances</td></tr>
<tr><td>e.</td><td>Fuel choice</td><td>Provide a fuel gas supply from a point in the topside oil and gas process which offers a minimum range of fuel gas combustion parameters, e.g. calorific value, and minimum concentrations of sulphurous compounds to minimise SO_2 formation. For liquid distillate fuels, preference is given to low-sulphur fuels</td></tr>
<tr><td>f.</td><td>Injection timing</td><td>Optimise injection timing in engines</td></tr>
</table></td><td>NA</td><td>Not applicable</td></tr>
</table>

<table>
<tr><th>BAT Concn. Number</th><th>Summary of BAT Conclusion requirement</th><th>Status NA/ CC / FC / NC</th><th>Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement</th></tr>
<tr><td></td><td>
<table>
<tr><td>g.</td><td>Heat recovery</td><td>Utilisation of gas turbine/engine exhaust heat for platform heating purposes</td><td>Generally applicable to new combustion plants.
In existing combustion plants, the applicability may be restricted by the level of heat demand and the combustion plant layout (space)</td></tr>
<tr><td>h.</td><td>Power integration of multiple gas fields/oilfields</td><td>Use of a central power source to supply a number of participating platforms located at different gas fields/oilfields</td><td>The applicability may be limited depending on the location of the different gas fields/oilfields and on the organisation of the different participating platforms, including alignment of time schedules regarding planning, start-up and cessation of production</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>53</td><td>In order to prevent or reduce NO_X emissions to air from the combustion of gaseous and/or liquid fuels on offshore platforms, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a.</td><td>Advanced control system</td><td rowspan="4">See descriptions in Section 8.3</td><td>The applicability to old combustion plants may be constrained by the need to retrofit the combustion system and/or control command system</td></tr>
<tr><td>b.</td><td>Dry low-NO_X burners (DLN)</td><td>Applicable to new gas turbines (standard equipment) within the constraints associated with fuel quality variations.
The applicability may be limited for existing gas turbines by: availability of a retrofit package (for low-load operation), complexity of the platform organisation and space availability</td></tr>
<tr><td>c.</td><td>Lean-burn concept</td><td>Only applicable to new gas-fired engines</td></tr>
<tr><td>d.</td><td>Low-NO_X burners (LNB)</td><td>Only applicable to boilers</td></tr>
</table>
</td><td>NA</td><td>Not applicable</td></tr>
<tr><td>54</td><td>In order to prevent or reduce CO emissions to air from the combustion of gaseous and/or liquid fuels in gas turbines on offshore platforms, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th>Technique</th><th>Description</th><th>Applicability</th></tr>
</table>
</td><td>NA</td><td>Not applicable</td></tr>
</table>

BAT Concn. Number	Summary of BAT Conclusion requirement	Status NA/ CC / FC / NC	Assessment of the installation capability and any alternative techniques proposed by the operator to demonstrate compliance with the BAT Conclusion requirement

a.	Combustion optimisation	See descriptions in Section 8.3	Generally applicable
b.	Oxidation catalysts		Not applicable to combustion plants operated < 500 h/yr. Retrofitting existing combustion plants may be constrained by the availability of sufficient space and by weight restrictions

BAT-associated emission levels (BAT-AELs) for NO_x emissions to air from the combustion of gaseous fuels in open-cycle gas turbines on offshore platforms

Type of combustion plant	BAT-AELs (mg/Nm^3) ([182])
	Average over the sampling period
New gas turbine combusting gaseous fuels ([183])	15–50 ([184])
Existing gas turbine combusting gaseous fuels ([183])	< 50–350 ([185])

As an indication, the average CO emission levels over the sampling period will generally be:

— < 100 mg/Nm^3 for existing gas turbines combusting gaseous fuels on offshore platforms operated ≥ 1 500 h/yr,

— < 75 mg/Nm^3 for new gas turbines combusting gaseous fuels on offshore platforms.

6. Review and assessment of derogation requests made by the operator in relation to BAT Conclusions which include an associated emission level (AEL) value

The IED enables a competent authority to allow derogations from BAT AELs stated in BAT Conclusions under specific circumstances as detailed under Article 15(4):

By way of derogation from paragraph 3, and without prejudice to Article 18, the competent authority may, in specific cases, set less strict emission limit values. Such a derogation may apply only where an assessment shows that the achievement of emission levels associated with the best available techniques as described in BAT conclusions would lead to disproportionately higher costs compared to the environmental benefits due to:

(a) the geographical location or the local environmental conditions of the installation concerned; or

(b) the technical characteristics of the installation concerned.

As part of their Regulation 61 Note response, the Operator has not requested a derogation from compliance with any AEL values.

7. Emissions to Water

The consolidated permit incorporates the ten current discharges to controlled waters identified as W1, W2 and W4.

There are no BAT AELs specified in the BAT Conclusions for this type of plant. There are also no additional treatment options identified as BAT for the installation. We have therefore not carried out any additional assessment of the emissions to water as part of this review.

8 Additional IED Chapter II requirements:

Plant efficiency:
The BAT for balancing plant guidance (Draft V9, 2017) sets out additional restrictions on hours for <1500 hour non-emergency plant which are low efficiency. Table 1 of the guidance sets out categories for LCP peaking plant. LCP 397 falls into category C because it's NOx emissions are below 500mg/m^3 and its efficiency at 25.5% is below that set out in table 2 of the guidance (25.7%).

Footnote 1 to Table 1 states that the operational hours must be reduced by 50 hours per year for every 1% that the plant is below the efficiency threshold given in Table 2.

As the plant is only 0.2% below the efficiency threshold given in Table 2, no additional restrictions have been applied to the hours of operation.

Black start:
In the event of a black out National Grid would call on combustion plant to operate and may require them to do so outside their permitted conditions. We have dedicated black start plant and they are permitted to run as such, but this scenario is relevant to the rest of the large combustion plant which could be called depending on the circumstances.

A risk assessment will be carried out by Energy UK/Joint Environmental Programme on behalf of Large Combustion Plant connected to the National Transmission System. Air emissions modelling will be based on generic black start scenarios to establish whether they have the potential to have local impact on the environment or not (on a national basis). If the modelling demonstrates that no significant impacts are likely, the plant can operate under condition 2.3.8. This conditions allows the hourly ELVs for plants operating under a black start instruction to be discounted for the purpose of reporting. We would also require there to be a procedure in place for minimisation of emissions in the case of a black start event and for reporting in the event of a black start. This modelling and the procedures have not been agreed in advance of the issue of the permit review and therefore a condition linking back to an improvement condition have been included in the permit.

Review and assessment of changes that are not part of the BAT Conclusions derived permit review.

This document should be read in conjunction with the application, supporting information and notice.

Aspect considered	Decision
Receipt of application	
Confidential information	A claim for commercial or industrial confidentiality has not been made. The decision was taken in accordance with our guidance on confidentiality.
Identifying confidential information	We have not identified information provided as part of the application that we consider to be confidential.
The facility	
The regulated facility	We considered the extent and nature of the facility at the site in accordance with RGN2 'Understanding the meaning of regulated facility', Appendix 2 of RGN 2 'Defining the scope of the installation' and Appendix 1 of RGN 2 'Interpretation of Schedule 1'. We have moved the operation of the <1MWth combustion plant into the main 1.1 activity in table S1.1 because Regulatory Guidance Note RGN2 has been updated to remove the de minimis for aggregation of combustion plant.
The site	
Biodiversity, heritage, landscape and nature conservation	The application is within the relevant distance criteria of a site of heritage, landscape or nature conservation, and/or protected species or habitat. A full assessment of the application and its potential to affect the site(s)/species/habitat has not been carried out as part of the permit review process. We consider that the review will not affect the features of the site(s)/species/habitat as the conditions will provide at least the same level of protection as those in the previous permit and in some cases will provide a higher level of protection to those in the previous permit. We have not consulted Natural England on the application. The decision was taken in accordance with our guidance.

Aspect considered	Decision
Operating techniques	
General operating techniques	We have reviewed the techniques used by the operator where they are relevant to the BAT Conclusions and compared these with the relevant guidance notes. The permit conditions ensure compliance with the relevant BREF, BAT Conclusions. The ELVs deliver compliance with the BAT-AELs.
Permit conditions	
Updating permit conditions during consolidation	We have updated permit conditions to those in the current generic permit template as part of permit consolidation. The conditions will provide at least the same level of protection as those in the previous permit and in some cases will provide a higher level of protection to those in the previous permit.
Changes to the permit conditions due to an Environment Agency initiated variation	We have varied the permit as stated in the variation notice.
Improvement programme	Based on the information on the application, we consider that we need to impose an improvement programme. We have imposed an improvement programme to ensure that: • the Operator proposes achievable and appropriate emission limit values (ELV) for CO expressed as a daily mean of validated hourly averages from Minimum start-up load (MSUL) to baseload. these will replace the interim limit of 440mg/m^3 we have set in the permit. We have added Improvement Condition 12 (IC12), this condition concerns black start operation. See section 8 for further information. We have also removed the completed improvement conditions from the permit.
Emission limits	We have decided that emission limits should be set for the parameters listed in the permit. These are described in the relevant BAT Conclusions in Section 5 of this document. It is considered that the ELVs/equivalent parameters or technical measures described above will ensure that significant pollution of the environment is prevented and a high level of protection for the environment is secured.

Aspect considered	Decision
Monitoring	We have decided that monitoring should be carried out for the parameters listed in the permit, using the methods detailed and to the frequencies specified. These are described in the relevant BAT Conclusions in Section 5 of this document. Table S3.4 Process monitoring requirements was amended to include the requirement to monitor energy efficiency after overhauls on site in line with BAT2. Based on the information in the application we are satisfied that the operator's techniques, personnel and equipment have either MCERTS certification or MCERTS accreditation as appropriate.
Reporting	We have specified reporting in the permit for the following parameters: • Nitrogen dioxide • Carbon monoxide • Sulphur dioxide • Dust These are described in the relevant BAT Conclusions in Section 5 of this document.
Operator competence	
Management system	There is no known reason to consider that the operator will not have the management system to enable it to comply with the permit conditions.
Growth Duty	
Section 108 Deregulation Act 2015 – Growth duty	We have considered our duty to have regard to the desirability of promoting economic growth set out in section 108(1) of the Deregulation Act 2015 and the guidance issued under section 110 of that Act in deciding whether to grant this permit. Paragraph 1.3 of the guidance says: "The primary role of regulators, in delivering regulation, is to achieve the regulatory outcomes for which they are responsible. For a number of regulators, these regulatory outcomes include an explicit reference to development or growth. The growth duty establishes economic growth as a factor that all specified regulators should have regard to, alongside the delivery of the protections set out in the relevant legislation." We have addressed the legislative requirements and environmental standards to be set for this operation in the body of the decision document above. The guidance is clear at paragraph 1.5 that the growth duty does not legitimise non-compliance and its purpose is not to achieve or pursue economic growth at the expense of necessary protections. We consider the requirements and standards we have set in this permit are reasonable and necessary to avoid a risk of an

Aspect considered	Decision
	unacceptable level of pollution. This also promotes growth amongst legitimate operators because the standards applied to the operator are consistent across businesses in this sector and have been set to achieve the required legislative standards.