Condition 33

Generator and Fuel Technology

Colt Hayes, London

Glasgow
April 3, 2025

Prepared By: Alison Campbell

Edited By: Hannah Lawson

Authorised By: Neil Spence

Document Control

Issue	Date	Status	HDR Author	HDR Approval	Notes
0.1	06/02/2025	Draft	08/01/2025_AC	17/01/2025_NS	Draft for comment
0.2	14/02/2025	Draft	06/02/2025_HL	14/02/2025_NS	Minor updates following review
1	03/04/2025	Issue	03/04/2025_HL	03/04/2025_NS	First issue

Contents

This page is intentionally left blank.

1 Introduction

The purpose of this Technical Note is to partially discharge Planning Condition 33 of the Original Permission (ref. 38421/APP/2021/4045) as quoted below.

This technical note pertains to the partial discharge of Buildings 1 & 2 generators only. Separate submissions will be submitted for each development phase (as applicable).

Planning Condition 33 wording:

> *Prior to operation of the development, or each development phase, evidence that the cleanest backup emergency generators and cleanest fuel available to service the generators in the market will be deployed for the development, or each development phase, shall be submitted to and approved in writing by the Local Planning Authority. This should include a note explaining why alternative cleaner types of backup generators and fuel have not been chosen as emergency engines. Thereafter the development shall be implemented and operated in accordance with these details.*

1.1 Background

This report seeks to present evidence that the cleanest backup emergency generators and cleanest fuel available to service the generators in the market has been deployed.

As part of the application to the Environment Agency (EA) for an Environmental Permit a Best Available Technique (BAT) assessment was completed and submitted. This report assessed both the selected generator technology and the way the installation is designed, built, maintained, operated, and decommissioned.

The BAT assessment was prepared in accordance with the EAs BAT guidance document produced specifically for Data Centres: '*Data Centre FAQ Headline Approach v21*' (November 2022).

The following sections provide a summary of this BAT assessment in relation to this condition.

2 BAT assessment

2.1 Methodology

At the time of writing Emergency Standby Generators (ESGs) capable of operating on diesel or HVO have been selected to provide emergency power to the installation in the event of grid failure. A BAT assessment considering alternative technologies and why ESGs are considered BAT is presented in the following sections.

In assessing each technology, key criteria were used in the selection of the BAT to fulfil the backup power requirements. These are split into two categories:

1. Operational requirements
2. Environmental risks

The criteria for both categories have been chosen based on the main risks posed in accordance with the EAs risk assessment guidelines for bespoke Environmental permits.

2.1.1 Operational requirements

Table 2.1 - Operational requirements

Criteria	Considerations	Weighting
Cost benefit analysis	The initial capital cost of the technology being considered, and the potential cost of potential mitigation measures need to be considered to ensure they are not disproportionately high compared to the environmental benefits. Otherwise, the operator will cease to be competitive.	High – impacts competitiveness
Proven as a reliable technology	The resilience requirements of data centres are such that the key operational criterion is for the technology used to be a proven and reliable technology. An indication of reliability of a technology can be taken from the number of instances that the technology in question has been successfully utilised in the industry, i.e., whether this is a tried and tested technology or is it new and emerging. The technology also needs to suit the prevailing model of the industry.	High – if technology is not proven it presents a risk to the operator
Cold start capability	The technology will need to have the ability to start operating quickly in the event of a sudden loss of power. A warm start configuration would necessitate 24/7 operation of generators at the site: creating unnecessary fuel costs and environmental impacts. A slow start technology would necessitate additional energy storage UPS capacity (in the form of batteries or flywheels), taking up additional space and creating additional cost.	High – the ability to provide instant power is critical to business functions
Space requirements	Space requirements are relevant as an environmental consideration as a technology that requires excessive use of space (in the form of generator units, energy storage UPS capacity, and fuel storage) will reduce the amount of space available at the data centre for the IT equipment it is designed to host. This will necessitate a larger site area or construction of additional sites to provide the same level of service.	High/Medium – space limitations often dictate the technologies that can be considered
Fuel suitability	The fuel used needs to be capable of being stored/transported to and across the site without excessive risks to operations e.g., low risk of combusting.	Medium – low volatility and low risk is vital
Lifetime of stored fuel	The fuel will need to be stored onsite potentially over a long period of time as mains failure events are rare and as such the generators are not routinely operated, other than for maintenance and testing purposes. The fuel stored onsite may remain unused for a long period of time and should therefore be of a type that will remain useable under these conditions – rather than becoming a waste product in need of disposal.	Medium to low – whilst an added cost it is not top priority

2.1.2 Environmental Risks

Table 2.2 - Operational requirements environmental risks

Criteria	Considerations	Weighting
Air quality impact	Local air quality impacts from exhaust of combustion gases when operating the technology in combination with the fuel being combusted.	High – internal combustion engines perform poorly but they are run infrequently
Noise/odour	The technology should not incite regular Odour/Noise complaints from nearest sensitive receptors e.g., residences.	Low – complaints are unlikely due to infrequent operation
Global warming impact	The global warming impact of the fuel being combusted should compare favourably against the electrical output of the technology.	Medium – impact is high, but combustion of fuel is infrequent
Release to water (fuel spillage)	The risk of fuel escaping to the environment, e.g., local river course/ground should be low.	Low – fuel use is low due to infrequent operation
Fugitive emissions (leak of gaseous fuel)	The risk of fuel escaping to the air, e.g., gaseous escape should be low.	Low – fuel use is low due to infrequent operation

2.2 Technologies considered to provide emergency power

The following technologies were considered for the provision of emergency power to the Data Centre as part of this assessment:

- Emergency Standby Generators (ESGs) (includes operation on HVO / diesel / alternative liquid fuel)
- Diesel rotary uninterruptible power supply engines (DRUPS)
- Natural Gas (piped) Fuelled Generator – Spark Ignition Engine
- Natural Gas (piped) Fuelled Generator – Gas Turbine (CCGT or OCGT)
- Liquid Petroleum Gas (LPG) Fuelled Generator – Spark Ignition Engine
- Hydrogen Fuel Cell Technology: Polymer Electrolyte Membrane (PEM) Fuel Cells
- Hydrogen Fuel Cell Technology
- Standby Gas turbine Technology

2.3 Generator fuel

At the time of writing the fuels selected to operate the ESGs are Diesel and Hydrotreated Vegetable Oil (HVO). Other fuels have been considered in line with the technologies considered, but do not currently provide the same level of security.

Natural gas could not be stored in sufficient volumes and would be reliant on the National Transmission System. A contract for an uninterruptable supply would be viable given the low volumes required and the lack of an onsite connection. Due to the limited hours of operation, any potential benefits from the lower impacts associated with emissions from natural gas are reduced.

The ESGs selected are capable of operating on diesel or Hydrotreated Vegetable Oil (HVO) to provide emergency power to the installation in the event of grid failure. Current plans are to operate the ESGs on HVO to EN 15940, a standard which governs cleaner fuel use through production by hydrogenation processes.

The testing and commissioning of the ESG's performance is to be based HVO. The initial fuel fill provided by the contractor will be HVO. In instances where HVO is unavailable for delivery to the site, the ESG's will run on diesel.

HVO is generally a preferred option for ESG fuel as it is a low carbon fuel and is considered to improve NO_x, CO and particulates. However, the source availability, reliability of re-supply and during peak demand is a concern for HVO and it is deemed unreasonable to expect only HVO usage across the sector[1]. Hence, the ESGs can operate on both diesel and HVO.

A further benefit to operating on diesel/HVO is the ability to store sufficient volumes to ensure a security of supply. Diesel/HVO can remain unused for a long period of time and should therefore be of a type that will remain useable under these conditions, which is essential for a plant that provides emergency power and is not routinely operated.

For these reasons diesel/HVO is considered to be BAT and the cleanest fuel available for the current generators.

2.4 Generator emissions

2.4.1 Generator raw emissions

The ESGs selected are 'emissions optimised' variants. This means the raw untreated emissions (ie before any abatement, see Section 2.4.2 below) are lower than they would be if a 'fuel optimised' variant had been selected. This decision was made to prioritise air emissions over fuel consumption rates.

2.4.2 Selective Catalytic Reduction

To further reduce impacts to air quality, significant investment was made to fit all ESGs with Selective Catalytic Reduction (SCR) to provide NO_x abatement. All generators will be fitted with SCR to achieve a NO_x concentration of <250 mg/Nm^3 (5% O_2), equivalent to 95mg/m^3 at 15% O_2. This level surpasses what can generally be achieved by most gas engines available on the market at the time of writing.

Further details of the SCR systems are detailed in the report submitted to discharge Condition 34.

[1] *Data Centre FAQ v21 – Working Draft*

3 Conclusion

The conclusion of the assessment is that emissions optimised ESGs, fitted with SCR units and operating on HVO/diesel are regarded to be the cleanest option available at present.

This conclusion is based on the operational requirements and environmental risks associated with the provision of emergency power to the Data Centre. To summarise, these ESGs were chosen for the following reasons:

- Proven technology for providing reliable power supply
- Start-up time & cold start capability
- Space requirements
- Capital expenditure
- Environmental impact
- Fuel storage requirements