

West Burton C (Gas Fired Generating Station)

Appendix 15A: Greenhouse Gas Assessment

EDF Energy (Thermal Generation) Limited

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1. Introduction

1.1 General

- 1.1.1 The purpose of this greenhouse gas (GHG) assessment is to benchmark the potential GHG emissions from the operation of the Proposed Development against emissions from the current UK electricity generating mix, and also an equivalent currently operational open cycle gas fired power station in the UK.
- 1.1.2 This appendix covers the assessment methodology, the data used, the estimated GHG emissions (known as a 'carbon footprint'), and a comparison to other power stations.

2. Methodology

2.1 Overview

- 2.1.1 National planning policy (National Policy Statements (NPS) EN-1 (Ref 15A-1) and EN-2 (Ref 15A-2)), places value on the importance of a diverse mix of energy generating technologies. The National Planning Policy Framework (NPPF) (Ref 15A-3) also encourages the transition to a low carbon future, and planning new development to reduce GHG emissions. This section details the methodology used to calculate GHG emissions associated with the operation of the Proposed Development and how it compares with the other power stations in the UK.
- 2.1.2 The Greenhouse Gas Protocol (Ref 15A-4) has been used to calculate the Proposed Development's carbon footprint. A widely used standard for emissions reporting, the Protocol has become the basis for many other reporting standards around the world. It provides a methodology for calculating the carbon footprint of a project or a business entity and was developed by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD).
- 2.1.3 Where possible, design values for the Proposed Development have been used within this assessment; however, some assumptions have been made where data is not yet available or where exact values are not known at this stage. The assumptions made are set out in this assessment including a justification for their selection (see **Section 4**).

3. Lifecycle Greenhouse Gas Emissions

3.1 Approach

- 3.1.1 The Institute for Environmental Management and Assessment (IEMA) has published guidance on '*Assessing Greenhouse Gas Emissions and Evaluating their Significance*' (Ref 15A-5) to accompany for the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the 2017 EIA Regulations) (Ref 15A-6). The guidance recommends that project lifecycle emissions should be considered including embodied carbon of materials as well as operational/in-use emissions of the lifetime. The guidance confirms that it may only be possible or relevant to quantify some of the GHG emissions impacts where the relative size of impacts and availability of data is an issue.
- 3.1.2 For the Proposed Development, potential GHG emissions have been calculated for the operation of the open cycle gas turbine (OCGT) generating station only. This includes gas consumption and raw materials and waste transport.
- 3.1.3 The GHG assessment has not considered construction emissions. There is a demand for increased power infrastructure in the UK. The emissions associated with the construction of power infrastructure are assumed to be already factored into the national inventory, regardless of the fuel type or capacity of the infrastructure. Therefore, the GHG emissions associated with construction of the Proposed Development will not be an additional impact on the national inventory for the power sector. The type of fuel selected to power the Proposed Development, along with the proposed design of the facility and its resulting operational efficiency will, however, impact the quantity of emissions arising and is, therefore, measured for operation.
- 3.1.4 Emissions associated with demolition and decommissioning have not been estimated at this time, as future demolition techniques are unknown and estimation of any emissions is likely to have a high level of uncertainty.

4. Assumptions

4.1 General

4.1.1 Several broad assumptions have been developed to enable the current assessment:

- the Proposed Development is a gas fired OCGT generating station and is assumed to operate for 1,500 hours per annum;
- the generation capacity is assumed to be 299 megawatts electrical output (MWe);
- the assumed electrical efficiency is between 36.1% and 43.5% and the estimated carbon footprint is presented as a range using these efficiencies; and
- no additional electricity supply is needed for operation of the OCGT generating station.

5. Emission Conversion Factors

5.1 Overview

5.1.1 The emission conversion factors used in the assessment for the Proposed Development were derived from factors published annually by Defra (Ref 15A-7) and are summarised here:

- natural gas: 0.20437 kgCO₂e per kWh (Net CV) gas for scope 1, plus the scope 3 well to tank factor for natural gas 0.02841 kgCO₂e per kWh (Net Calorific Value (CV)) for scope 3; and
- transport by heavy goods vehicle (HGV) (all diesel), average laden (57%), per tonne-kilometre plus well to tank factor): 0.14538 kgCO₂e per tonne-kilometre.

6. Data Inputs

6.1 Overview

6.1.1 **Table 1** and **Table 2** detail all other assumptions and data required for the carbon footprint calculation.

Table 1: Data inputs

Area of Footprint	Assessment Details	Annual Quantity Consumed
Natural Gas Consumption	Annual quantity of natural gas used on site in normal operation.	1,242GWh

6.1.2 Predicted annual quantities of major raw materials consumed and waste streams generated during the operation of the Proposed Development are included within **Chapter 15: Sustainability, Waste and Climate Change** (ES Volume I).

Table 2: Annual raw material consumption and waste generation

Aspect of Footprint	Annual Quantity (rounded to the nearest tonne)
Raw materials transported: Oil	27.61
Raw materials transported: Carbon dioxide	2
Raw materials transported: Detergent	2
Raw materials transported: Antifreeze monopropylene glycol (MPG)	4
Water use for offline wash with detergent	12
Water use for online without detergent	1
Raw Water tank	900
Waste material: General waste	1.5

6.1.3 The distances assumed for fuel, raw material and waste transportation for the purposes of this assessment are currently unknown due to early design stage. The actual distances will depend on the selected supplier and award of contracts, but have been assumed to be 8km.

6.1.4 Sensitivity testing has been conducted for the transport distances and their impact on the total emissions from the Proposed Development. The overall contribution of

transport emissions to the total footprint is insignificant (less than 0.01% operational emissions).

- 6.1.5 The Proposed Development may also provide a 'black-start' capability to National Grid, to help restart the national transmission system in the event of a total or partial shutdown of the UK transmission system. It is not possible to accurately predict the likely frequency or duration of black-start events. However, historically black-start events have been very infrequent in the UK.
- 6.1.6 If required to help restart the national transmission system, a small (anticipated to be circa 2MW output) diesel generator (hereafter referred to as emergency diesel generator) is used to start a small (anticipated to be between 15 and 60MW output) gas turbine (hereafter referred to as the black-start auxiliary power unit). The black-start auxiliary power unit is used to start a main gas turbine unit at either WBB Power Station or WBC Power Station.
- 6.1.7 Environmental impacts of the black-start auxiliary power unit have been considered within the overall <299MW envelope.
- 6.1.8 The emergency diesel generator is expected to run for less than 50 hours per year. The emergency diesel generator would be fired on liquid fuel.

7. Carbon Footprint of the Proposed Development

7.1 Results

7.1.1 Carbon footprints have been calculated for the operational phase of the Proposed Development. A breakdown is shown in **Table 3**.

Table 3: Carbon footprint of the Proposed Development

Emissions Source	Annual GHG emissions by Source (tCO ₂ e)	
	36.1% Efficiency	43.5% Efficiency
Emissions from fossil fuel (natural gas) combustion	253,906	210,713
Transport of raw materials	1	1
Transport of waste materials	0.002	0.002
Gas combusted (well to tank emissions)	35,296	29,292
Total annual GHG emissions (tCO₂e)	289,203	240,004
Carbon Intensity of generated electricity all scopes (tCO₂e/GWh)	566	470

7.1.2 Using the data described above, the total annual carbon footprint of the Proposed Development is between 240 kilotonnes and 289 kilotonnes CO₂e (rounded to the nearest thousand tonnes). Assuming the Proposed Development exports 449GWh per year (based on generating capacity for 299MWe for 1,500 hours) this is equivalent to between 470 and 566 tonnes CO₂e per GWh electricity generation.

8. Comparison of Proposed Development Carbon Footprint

8.1 Findings

8.1.1 **Table 4** presents the carbon intensity of the Proposed Development along with national averages for 2017 for other UK power stations sourced from the ‘*Digest of United Kingdom Energy Statistics*’ (Ref 15A-8). It should be noted that the intensity figures stated below comprise carbon intensity associated with the combustion of the primary fuel source (e.g. coal, natural gas, refuse derived fuel) for power stations (i.e. they do not include other elements of the carbon footprint such as transmission losses of natural gas). Therefore, results are presented compared to the OCGT intensity of the natural gas combustion and transport of waste and materials only.

Table 4: Comparison of carbon intensities for the Proposed Development with other existing power stations

Nature of Power Station	Carbon Intensity of Electricity Supplied (tCO ₂ e/GWh) Scope 1 only
Average UK power station 2017 – coal	918
Average UK power station 2017 - fossil fuels only	460
Average UK power station 2017 - all fuel types (including nuclear & renewable)	225
UK gas fired power station 2017	357
Proposed Development (36.1% thermal efficiency)	566
Proposed Development (43.5% thermal efficiency)	470

8.1.2 In comparison with UK average fossil fuel power stations, the Proposed Development produces an additional 10-106 tonnes of CO₂e per GWh of electricity generated, depending on the efficiency level of the Proposed Development. This is to be expected however as the Proposed Development is a peaking plant to be used for short periods of time, only operating for approximately 1,500 hours per annum, and is therefore likely to be less efficient than the grid average. Despite this, the Proposed Development will perform favourably compared to existing average UK coal power stations by between 352 - 448 tonnes of CO₂e per GWh. Whilst the UK is moving towards decarbonising the grid, efficient gas-fired power stations are required as an important part of the overall transition fuel mix in order to ensure the UK’s energy security.

9. Carbon Reduction and Mitigation Measures

9.1 Overview

- 9.1.1 **Chapter 15: Sustainability, Waste and Climate Change** (ES Volume I), discusses further how the Proposed Development has been designed to reduce its environmental impact.
- 9.1.2 As the output capacity of the Proposed Development is less than 300MW, it does not fall under the provisions of the Carbon Capture Readiness (Electricity Generating Stations) Regulations 2013 (the CCR Regulations) (Ref 15A-9). Therefore, no space allocation for future retrofit of carbon capture technology has been included within the Site.

10. Conclusions

10.1 Overview

- 10.1.1 National planning policy (National Policy Statements) places value on the importance of a diverse mix of energy generating technologies. The NPPF also encourages the move to a low carbon future, and planning new development to reduce greenhouse gas emissions. The Proposed Development will contribute to providing a secure energy supply to the national grid.
- 10.1.2 The Proposed Development will perform favourably compared to existing average UK coal power stations by between 352 - 448 tonnes of CO₂e per GWh of electricity generated. When compared to average fossil fuel power stations, the Proposed Development would produce an additional 10-106 tonnes of CO₂e per GWh of electricity generated, depending on the efficiency level of the Proposed Development. The Proposed Development is a peaking plant to be used for short periods of time, only operating for approximately 1,500 hours per annum, and is therefore likely to be less efficient than the grid average.

11. References

- Ref 15A-1 Department for Energy and Climate Change (2011) *Overarching National Policy Statement (NPS) for Energy (EN-1)*.
- Ref 15A-2 Department for Energy and Climate Change (2011) *National Policy Statement for Fossil Fuel Electricity Generating Infrastructure (EN-2)*.
- Ref 15A-3 Ministry of Housing Communities & Local Government (2019) *National Planning Policy Framework*.
- Ref 15A-4 World Resources Institute (WRI) and World Business Council for Sustainable Development (WBCSD) (2005) *Greenhouse Gas Protocol for Project Accounting*.
- Ref 15A-5 Institute of Environmental Management & Assessment (2017) *Assessing Greenhouse Gas Emissions and Evaluating their Significance*.
- Ref 15A-6 HM Government (2017) *The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017*.
- Ref 15A-7 DEFRA (2018) *UK Government GHG Conversion Factors for Company Reporting*.
- Ref 15A-8 Department for Energy and Climate Change (2017) *Digest of United Kingdom energy statistics' (DUKES)*. [Online] Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/643414/DUKES_2017.pdf (Accessed 27 February 2019)
- Ref 15A-9 HM Government (2013) *The Carbon Capture Readiness (Electricity Generating Stations) Regulations 2013*.