The Drax Power (Generating Stations) Order

Land at, and in the vicinity of, Drax Power Station, near Selby, North Yorkshire

Environmental Statement
15 – Climate

The Planning Act 2008
The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 – Regulation 5(2)(a)

Drax Power Limited

Drax Repower Project

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15 CLIMATE

15.1 Introduction

15.1.1. This Chapter reports the outcome of the assessment of likely significant effects arising from the Proposed Scheme upon climate change. The assessment considers the key sources of greenhouse gas emissions (which contribute to climate change) throughout the lifespan of the Proposed Scheme and the extent to which those emissions may increase or decrease in comparison to the evolving baseline scenario.

15.1.2. The vulnerability of the Proposed Scheme to climate change (climate change resilience and adaptation) is discussed in Chapter 3 (Site and Project Description).

15.1.3. The Chapter describes the assessment methodology, the baseline conditions at the Site and in the surrounding area, any primary and tertiary mitigation adopted for the purposes of the assessment, a summary of the likely significant effects taking into account international and national legislation and policy and the further mitigation opportunities which may be considered to prevent, reduce or offset any significant negative effects.

15.1.4. This Chapter (and its associated figures and appendices) is intended to be read as part of the wider ES.

15.2 Policy, Legislation and Guidance

Policy

15.2.1. The applicable policy framework is summarised as follows:

15.2.2. The UK is a signatory of the United Nations Framework Convention on Climate Change (UNFCCC) which drives international action on climate change. The UK has pledged to reduce greenhouse gas emissions (GHG) under the Paris Agreement, as a part of a joint pledge by members of the European Union (EU). This provides an overarching commitment by the UK.

15.2.3. The government's Overarching National Policy Statement for Energy, EN-1 (Ref. 15.1) sets out the government's overall energy and climate change strategy including the following objectives of particular relevance to the impacts of the Proposed Scheme on climate change (see paragraph 2.1 of EN-1):

- To help deliver the UK's obligation to reduce GHG emissions by 80% by 2050 and work to carbon budgets stemming from the Climate Change Act 2008, within the context of the EU Emissions Trading System.
- To ensure that investment provides security of energy supply through a diverse and reliable mix of fuels and low carbon technologies – renewables, nuclear and fossil fuel plants fitted with carbon capture and storage.
- To contribute to sustainable development by seeking energy infrastructure development that helps reduce climate change while also minimising negative impacts on the local environment.

15.2.4. Despite projected increases in household and non-household energy efficiency, the NPS (EN-1) also sets out the need for a major increase in electricity generation capacity in order to meet the energy demand from industry, transport and building heating which will

increasingly switch to electricity. Renewable electricity generation will play an ever more important part in providing this capacity, however, some capacity will always need to be provided by non-renewable sources in order to cope with the intermittency of most renewable generation technologies (e.g. wind, solar).

15.2.5. The government has consulted on its plans for an end to unabated coal generation by 2025 (see 'Government response to unabated coal closure consultation' (Ref. 15.2). It is intended that no coal-powered generation will be allowed after October 2025 unless a reduced concentration-based limit on GHG emissions can be met; 450gCO2/kWh.

Legislation

15.2.6. The applicable legislative framework is summarised as follows:

- The Climate Change Act 2008 (Ref. 15.3) established the world's first long term legally binding framework to tackle the dangers of climate change. A key provision was the setting of legally binding targets for GHG emission reductions in the UK of at least 80% by 2050 and at least 26% by 2020, against a 1990 baseline. The Act also created the Committee on Climate Change, with responsibility for setting five year Carbon Budgets covering successive periods of emissions reduction to 2050, advising and scrutinising the UK Government's associated climate change adaptation programmes and producing a National Adaptation Plan for the UK Government to implement.

Guidance

15.2.7. The following guidance documents have been used during the preparation of this Chapter:

- IEMA (2017) EIA Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance (Ref. 15.4).
- RICS (2017) 'Whole life carbon assessment for the built environment' (Ref. 15.5)

15.3 Scoping Opinion and Consultation

Consultation

15.3.1. Consultation was undertaken in connection with the preparation of this Chapter as part of the scoping process (detailed below), and further as part of the statutory consultation exercise which includes consultation on the PEIR.

Scope of the Assessment

15.3.2. This section explains how the scope of the assessment has developed, and re-iterates the evidence base for insignificant effects (which have therefore been scoped out of the assessment), following further iterative assessment.

15.3.3. An EIA Scoping Report was submitted to the SoS in September 2017, as presented in Appendix 1.1. A Scoping Opinion was received by the Applicant from the Planning Inspectorate (on behalf of the SoS) on 23 October 2017, including formal responses from statutory consultees. The responses from the Planning Inspectorate/SoS in relation to climate change, and how those requirements should be addressed by the applicant, are set out below in Table 15-1. No comments specifically relating to climate change were received from consultation bodies as a result of the statutory consultation on the PEIR.

Table 15-1 - Scoping Opinion Summary Table (Climate)

Section of Scoping Report	Applicant's Proposed Matter	Planning Inspectorate's Comments	Summary of Response
6.1.1	Effects on climate change	The EIA Regulations require (where relevant) a description of the likely significant effects from the impact of the project on climate and vulnerability of the project to climate change. There is a potential contradiction in the Scoping Report which states at section 6.1.1 that the ES will not quantify the effect of the Proposed Development on climate change, but then states in the first table in section 7.2.3 that 'climate impact of CO_2' will be considered during operation of the proposed development. For the avoidance of doubt and having had regard to the nature of the proposed development the Inspectorate does not agree that the impact of the project on climate during operation can be scoped out.	This Chapter provides a description of the likely significant effects from the impact of the Proposed Scheme on climate (the GHG assessment) including construction and operation. The vulnerability of the Proposed Scheme to climate change (climate change resilience and adaptation) is discussed in Chapter 3 (Site and Project Description) and Appendix 15.1.
6.1.1	Carbon emissions against carbon budgets	Notwithstanding the comments made above, the EIA Regulations do not specifically require an assessment of carbon emissions against carbon budgets. On that basis the Inspectorate agrees that, this approach to the assessment can be scoped out of the ES.	This approach is scoped out.
6.1.1	Emissions	The Scoping Report states that there will be a change in emissions of carbon dioxide (CO_2) resulting from the conversion of coal fired units to gas power, but lower overall emissions intensity in terms of CO_2 emitted per unit of power generated. The terminology used within the	This ES chapter now clearly explains the use of the term 'emissions intensity' in terms of GHG emissions per unit of electricity generation output.

Section of Scoping Report	Applicant's Proposed Matter	Planning Inspectorate's Comments	Summary of Response
		Scoping Report is vague. For example, it is unclear what the 'change' would be and whether 'emissions intensity' refers to the release rate, release volume or another matter. This should be clearly explained within the ES.	

Insignificant Effects

15.3.4. The following effects have been considered insignificant and have therefore not been considered within the ES:

- The generation of GHGs during decommissioning has not been assessed. There is little certainty surrounding the timing of this activity and the processes and emissions generating activity which will occur, so far into the future e.g. what plant would be used and what would be the fate (transport mode and destination) of demolition materials. Despite this, it is assumed that these emissions will be of the same order or smaller than those for the construction stage and therefore it is not considered likely that they will be significant; particularly as a proportion of the whole lifecycle emissions for the Proposed Scheme.

Potentially Significant Effects

15.3.5. Following the scoping report, the scope of the GHG assessment has been widened to include the likely magnitude of GHG emissions (or avoided emissions) in comparison to the 'do nothing' baseline scenario (no change to the existing coal-powered turbine units 5&6) both during construction and operation. The effects of any changes to the other turbine units at Drax Power Station (beyond the Proposed Scheme) are not considered in this assessment.

Construction Phase

15.3.6. The scope of the GHG assessment includes the likely magnitude of GHG emissions during the construction ('before use') stage e.g. embodied emissions associated with materials, transportation of materials to site and waste/arisings from site, as well as emissions from construction machinery/vehicles – see Table 15-2. These emissions are considered entirely additional to the baseline scenario in which no scheme construction occurs.

Operation Phase

15.3.7. The scope of the GHG assessment also includes the likely magnitude of GHG emissions during the operational ('use') stage in comparison to the evolving baseline e.g. emissions from the existing coal-powered generation units (5&6) or their replacement as well as any fuel/electricity consumption for operational processes and delivery of raw materials – see Table 15-2.

Table 15-2 - Potential Whole Lifecycle Scope of GHG Assessment for the Proposed

Lifecycle stage		Potential sources of Emissions
Construction ('Before use' stage) or Stage 0, 1 and 2	Product stage	• 'Cradle to gate' or 'embodied' emissions: extraction, sourcing and manufacture of all raw materials/components for the Proposed Scheme (new turbine units, housing, gas pipeline, battery storage etc)
	Construction process stage	• Site enabling works, transport and disposal of arisings. • Transport of all raw materials/components to site. • Construction process (vehicles, plant). • Land use, land use change and forestry: loss of agricultural land and loss/planting of trees.
Operation ('Use' stage) or Stage 2 and 3	Operation	• Net change in emissions for power generation, compared to the current and future baseline scenario. • Other minor fuel/power consumption for operation of the plant.
	Maintenance, refurbishment	• Fuel, power • Embodied emissions in materials for maintenance and refurbishment.
Decommissioning	End of life decommissioning process	• Emissions from decommissioning process (fuel, power for plant and vehicles) • Fuel for transport of materials/arisings • Emissions from end-disposal

15.4 Assessment Methodology and Significance Criteria

Scenarios Assessed

15.4.1. The following scenarios have been considered for this GHG assessment with respect to the Proposed Scheme which repowers and therefore decommissions existing Units 5 and 6 only. The remaining coal and biomass units operating at the Existing Drax Power Station Complex are not considered by this assessment as they are not subject to change as part of the Proposed Scheme.

15.4.2. Baseline scenario - The government intends to end unabated coal generation after October 2025 so that coal generation could only continue if a reduced concentration-based limit on GHG emissions can be met of 450g CO_2/kWh (Ref. 15.2) – roughly equivalent to the emissions intensity of gas-powered generation. Existing coal-powered generation from units

5 and 6 at the Existing Drax Power Station Complex (each with 660 MW combined capacity; 1,320 MW in total) far exceeds this limit and therefore the baseline scenario assumes this will only continue until October 2025. After that date it is assumed that one of the following would occur:

- Coal powered generation at Units 5 and 6 would be adapted to meet this new emission limit of 450 gCO_2/kWh, and this would continue until 2050 (the lifetime of the Proposed Scheme). The feasibility of adapting to meet this emissions limit is not considered as part of this assessment. This is the assumption the future baseline scenario set out in Chapter 3 of the ES (Site and Project Description) is based on.
- Alternatively, coal generation at Drax would end after 2025 with units 5 and 6 decommissioned and no replacement generation capacity provided at the site. Since this would result in a loss of 1,320 MW of generation capacity, there would be a requirement to replace this elsewhere on the national grid. While this sub-scenario is not considered in detail, it is assumed that such replacement generation capacity would be similar in scale and nature and of a similar emissions intensity (450gCO_2/kWh). This sub-scenario would also lead to GHG emissions and other environmental impacts associated with the construction of new generation plant.

15.4.3. Proposed Scheme - The Proposed Scheme is to repower one or both existing coal-powered generating units (Units 5 and 6) at the Existing Drax Power Station Complex with new gas turbines that can operate in both combined cycle and open cycle modes. A full description is set out in Chapter 3 of the ES (Site and Project Description).

15.4.4. Construction to repower either unit 5 or unit 6 and construct new Unit X is assumed to commence in 2019/20, with Unit X entering into operation in 2022/23 providing 1,800 MW new combined capacity. Construction to repower the second unit and construct new Unit Y is assumed to commence in 2024, with Unit Y entering into operation in 2027 providing 1,800 MW new combined capacity. Together the units would have a new combined capacity of up to 3,600 MW in combined cycle mode, replacing the existing coal-powered units with a combined capacity to generate up to 1,320 MW.

15.4.5. It is assumed that the operational life of Units X and Y would be 25 years followed by decommissioning (of Unit X in 2047 and Unit Y in 2051).

15.4.6. The Proposed Scheme also involves the construction of up to two battery storage facilities with a combined gross storage capacity of up to 200 megawatts. This will mean that some surplus generation output can be stored and fed into the grid when the Proposed Scheme gas-generation units are not in operation. This will allow for a small reduction in loading for the Proposes Scheme, while maintaining output, and thereby a small reduction in GHG emissions. There is insufficient information to assess the impact of this storage capacity but it is not considered to be a material factor.

15.4.7. The baseline and Proposed Scheme scenarios are summarised in Table 15-3.

Table 15-3 - Baseline and Proposed Scheme Scenario at Drax

<table>
<tr><th rowspan="2">Year</th><th rowspan="2">Baseline</th><th colspan="2">Proposed Scheme</th></tr>
<tr><th>Generation Unit X</th><th>Generation Unit Y</th></tr>
<tr><td>2020</td><td rowspan="4">Continued operation of existing coal-powered generator units 5&6

(2 x 660MW output: 1,320MW total)

Coal generation emissions limit enters into force (2025)</td><td rowspan="2">Stages 0&1: construction of Unit X
[Once Unit X is connected to the existing steam turbine, then only one coal unit will continue with 660MW output]</td><td rowspan="2">Coal generation of one existing unit continues; 660MW output]</td></tr>
<tr><td>2021</td></tr>
<tr><td>2022</td><td rowspan="4">Operation of Unit X begins (1,800MW per year output, gas-powered)</td></tr>
<tr><td>2023</td></tr>
<tr><td>2024</td><td rowspan="2">Stage 2: construction of Unit Y
[Once Unit Y is connected to the existing steam turbine, then no more coal units at Drax]</td></tr>
<tr><td>2025</td></tr>
<tr><td>2026</td><td rowspan="13">Adaptation of coal generation units 5&6 to meet emissions limit <u>or</u> decommissioning and replacement capacity elsewhere on grid

(2 x 660MW output - 1,320MW total)

Timescales for decommissioning uncertain</td><td rowspan="6"></td><td rowspan="6"></td></tr>
<tr><td>2027</td></tr>
<tr><td>2028</td><td rowspan="5">Operation of Unit Y (1,800MW per year output, gas)</td></tr>
<tr><td>↓</td></tr>
<tr><td>2047</td><td rowspan="6">Decommissioning of
Unit X

Assume replacement generation capacity provided elsewhere on the grid at same GHG intensity as the baseline</td></tr>
<tr><td>2048</td></tr>
<tr><td>2049</td></tr>
<tr><td>2050</td></tr>
<tr><td>2051</td><td>Decommissioning of
Unit Y</td></tr>
</table>

Embedded Mitigation – Carbon Capture Ready

15.4.8. The Proposed Scheme has been designed to be carbon capture ready including safeguarding the Carbon capture readiness reserve space and monitoring and reporting on the feasibility of CCS (as secured by requirements in Schedule 2 to the draft DCO

(Document Ref. 3.1)). This provides the potential for Drax to be connected to any future Carbon Capture and Storage (CCS) scheme. In this way, if CCS technology is shown to be feasible in future, the operational emissions of the Proposed Scheme could be captured and stored and therefore their contribution to climate change avoided.

15.4.9. No other assumptions have been made about embedded mitigation.

Extent of the Study Area

15.4.10. The GHG assessment is not restricted by geographical area but considers any increase or decrease in emissions as a result of the Proposed Scheme. This includes construction and decommissioning emissions in the Proposed Scheme's footprint but also related to the transport of materials to and from the Site, their manufacturing and disposal (wherever that may be). It also includes operational emissions resulting from the Proposed Scheme (fuel combustion within the Proposed Scheme's footprint).

Assessment Methodology

15.4.11. GHG emissions are assessed by considering data on the scale of emissions-generating activity (e.g. tonnes of concrete for construction, cubic meters of natural gas consumption) as well as the corresponding emissions factor ($kgCO_2e$ per unit of emissions activity). Emissions factors are taken from reliable industry-standard sources, principally the 'Greenhouse gas conversion factors for company reporting' (Ref. X.6); government-issued emissions factors for fossil fuels, transport, materials manufacturing and disposal.

15.4.12. The GHG emissions resulting from construction of the Proposed Scheme are assessed qualitatively based on limited information regarding the scale of construction activity (materials consumption and transport; disposal of arisings; construction process; land use change and forestry).

15.4.13. The GHG emissions resulting from operation of the Proposed Scheme are assessed quantitatively reflecting their overwhelming contribution to the overall total lifecycle emissions.

Significance Criteria

15.4.14. The significance level attributed to each effect has been assessed subjectively based on the magnitude of change due to the Proposed Scheme and the sensitivity of the affected receptor. In the case of GHG emissions, their contribution to global warming and climate change (and the consequent impacts on human and natural receptors) is the same wherever and whenever those emission occur i.e. the sensitivity of receptors does not vary and the significance of effects is determined solely by the magnitude of GHG emissions.

15.4.15. There are no established thresholds for defining the significance of climate impacts in EIA resulting from GHG emissions of different magnitude and therefore the significance of effects on climate is considered subjectively.

15.5 Baseline Conditions

Construction Emissions

15.5.1. The baseline scenario assumes the Proposed Scheme does not occur and therefore there are no construction emissions at the outset. However, in 2025 following the government's intended end to unabated coal generation, it is assumed that the generation capacity of units 5 & 6 will either be replaced elsewhere (not at Drax) or they will be adapted to meet

the new emission intensity limit of 450gCO_2/kWh. Either of these sub-scenarios will involve the construction of new or modified generation plant with additional GHG emissions for the construction process and embodied within the construction materials.

15.5.2. No quantitative assessment of these construction emissions has been completed given the inherent uncertainty involved.

Operational Emissions from 2020 to 2025

15.5.3. For the first years of the baseline scenario, prior to the Government's intention to end unabated coal generation, the existing generation units 5 and 6 will continue as at present. The key operational-stage emissions generating activity is the consumption of coal for electricity generation and is calculated as follows:

Table 15-4 – Baseline Activity (2020-2025)

Item	Value
Total generation capacity; coal-powered unit 5 & 6	2 x 660 MW = 1,320 MW
Assumed loading factor (proportion of time operational)	100%
Total electricity generation output per year	11,563,200 MWh
Generation efficiency	45%
Total energy input per year (coal consumption)	25,696,000 MWh

15.5.4. The GHG emissions factor for the consumption of coal is comprised of that for the emissions which occur at the point of use (combustion for energy generation) and the 'Well to Tank' factor covering emissions associated with the extraction, refining and transportation of coal to the point of use. The factors are set out below, taken from BEIS (2017).

Table 15-5 – Coal Emission Factors

Item	Value
GHG emissions per kWh (Net CV) of coal (electricity generation) at the point of consumption	0.3249 kgCO_2e/kWh
'Well to Tank' GHG emissions per kWh (Net CV) of coal (electricity generation)	0.0529 kgCO_2e/kWh
Total GHG emissions factor per kWh (Net CV) of coal consumed	0.3778 kgCO_2e/kWh

15.5.5. The annual GHG emissions in tonnes (tCO_2e) and the emissions intensity (gCO_2e per kWh generated) in the baseline scenario up until 2025 are calculated as follows;

Table 15-6 – Baseline GHG Emissions (2020-2025)

Item	Value
Emissions generating activity; coal consumption per year for generation	25,696,000 MWh

Item	Value
unit 5 and 6:	
GHG emissions factor per kWh (Net CV) of coal consumed	0.3778 kgCO_2e/kWh
GHG emission per year	9,708,000 tCO_2e
GHG emissions intensity per unit electricity generation	840 gCO_2e/kWh

Operational Emissions from 2026 to 2050

15.5.6. Following the Government's intended end to unabated coal generation, it is assumed that generation units 5 & 6 will either be decommissioned or adapted to meet the new emission intensity limit of 450 gCO_2/kWh; just 54% of the current emissions intensity. In the case that they are decommissioned, it is assumed that equivalent generation capacity will be provided elsewhere on the grid, at the same emissions intensity.

15.5.7. The annual GHG emissions from units 5 and 6 from 2026 to 2050 is therefore calculated as follows;

Table 15-7 - Baseline GHG Emissions (2026-2050)

Item	Value
GHG emissions intensity per unit electricity generation	450 gCO_2e/kWh
Total electricity generation output per year	11,563,200 MWh
GHG emission per year	5,203,000 tCO_2e

15.5.8. The total operational GHG emissions for the baseline scenario from 2020 to 2050 are presented below;

Table 15-8 - Baseline GHG Emissions (2020-2050)

Years	Annual GHG emissions	Total
2020 – 2025	9,708,000 tCO_2e per year	58,248,000 tCO_2e
2026 – 2050	5,203,000 tCO_2e per year	130,075,000 tCO_2e
Total (2020-2050)		**188,323,000 tCO_2e**

15.6 Assessment of Likely Significant Impacts and Effects

Construction Emissions (Stage 0, Stage 1 - Construction of Unit X, and Stage 2 – Construction of Unit Y)

15.6.1. The Proposed Scheme will involve the construction of new and replacement infrastructure at the Site, comprising:

- Site Reconfiguration Works.
- Up to two new electricity generating stations (to replace existing units 5 and 6) fuelled by natural gas and with a gross electrical output capacity of 1,800 MW each (3,600MW total).
- Up to two battery storage facilities with a combined gross storage capacity of up to 200 megawatts.
- Up to two new gas insulated switchgear banking buildings.
- A GRF.
- AGI.
- Gas Pipeline.
- Electrical connections.
- Temporary construction laydown areas.
- Safeguarding of the Carbon capture readiness reserve space.
- Retained and new landscaping and biodiversity measures.
- Decommissioning and demolition of existing sludge lagoons and construction and reinstatement of replacement sludge lagoons.
- Removal of existing 132 kilovolt overhead line and associated towers and foundations.
- Passing place in the Rusholme Lane Area.

15.6.2. The above works will result in substantial GHG emissions particularly during the ‘product stage’ (emissions from manufacture and supply of construction materials such as concrete and steel) as well as ‘construction process stage’ (emissions from transport of these materials and the construction process). It is not anticipated that significant emissions will result from land-use, land-use change and forestry since additional land take is minimal, and agricultural land use will be reinstated following construction of the Gas Pipeline.

15.6.3. However, the Proposed Scheme will continue to utilise existing infrastructure such as the cooling towers and steam turbines.

15.6.4. A qualitative appraisal of the above emissions generating activity for the construction stage, comprising expert judgement regarding their relative scale, suggests that they will be of minor significance in comparison to the operational stage emissions (see below). In addition, these construction stage emissions are expected to be of a similar magnitude to those which would result under the baseline scenario from construction to abate emissions from coal-powered Units 5 and 6 post 2025. The construction emissions for the Proposed Scheme are likely to be lower than those which would occur under the baseline scenario should Units 5 and 6 close post 2025 meaning that a new generating station would be required elsewhere to replace the loss of electricity output.

15.6.5. Quantitative assessment is not completed for the construction stage.

Operational Emissions

15.6.6. The operational-stage emissions generating activity (consumption of natural gas for electricity generation) for the operation of Units X and Y is calculated:

Table 15-9 – Operational Activity

Item	Value
Total generation capacity; natural gas-powered (Units X and Y)	2 x 1,800 MW = 3,600 MW
Assumed loading factor (proportion of time operational)	100%
Total electricity generation output per year	2 x 15,768,000 MWh = 31,536,000 MWh
Generation efficiency	62%
Total energy input per year (natural gas consumption)	2 x 25,432,000 MWh = 50,865,000 MWh

15.6.7. The GHG emissions factor for the consumption of natural gas is comprised of that for the emissions which occur at the point of use (combustion for energy generation) and the 'Well to Tank' factor covering emission associated with the extraction, refining and transportation of gas to the point of use. The factors are set out below, taken from BEIS (2017).

Table 15-10 – Gas Emission Factors

Item	Value
GHG emissions per kWh (Net CV) of natural gas (electricity generation) at the point of consumption	0.2046 kgCO2e/kWh
'Well to Tank' GHG emissions per kWh (Net CV) of natural gas (electricity generation)	0.0309 $kgCO_2e/kWh$
Total GHG emissions factor per kWh (Net CV) of natural gas consumed	0.2356 $kgCO_2e/kWh$

15.6.8. The annual GHG emissions in tonnes (tCO_2e) and the emissions intensity (gCO_2e per kWh generated) for the Proposed Scheme are calculated as follows;

Table 15-11 – Operational GHG Emissions

Item	Value
Emissions generating activity; natural gas consumption per year	25,432,000 MWh per unit
GHG emissions factor per kWh (Net CV) of coal consumed	0.2356 $kgCO_2e/kWh$
GHG emission per year	5,991,000 tCO_2e per unit
GHG emissions intensity per unit electricity generation	380 gCO_2e/kWh

15.6.9. Assuming that the Proposed Scheme involves the construction of Unit X (to operate from 2023) and Unit Y (to operate from 2027), the total operational GHG emissions for the period 2020 to 2050 are presented below;

Table 15-12 – Total Operational GHG Emissions (2020-2050)

Generation Unit	Years	Annual GHG emissions	Total
Unit X	2023 – 2046	5,991,000 tCO_2e per year	143,784,000 tCO_2e
Unit Y	2027 – 2050	5,991,000 tCO_2e per year	143,784,000 tCO_2e
Total			**287,568,000 tCO_2e**

Net GHG emissions effect of the Proposed Scheme

15.6.10. The following table summarises the operational stage GHG emissions at the Existing Drax Power Station Complex under the baseline scenario and with the Proposed Scheme. The figures do not take account of any indirect increase or decrease in emissions which may occur in relation to energy consumption by end-users. The figures are expressed in terms of:

- Total GHG emissions per year.
- Total GHG emission for the period 2020 to 2050.
- GHG emissions intensity (emissions per unit electricity generation).

Table 15-13- Net GHG Emissions

Item	Years	Baseline Scenario (2 x 660 MW)	Proposed Scheme (2 x 1,800 MW)	Net effect of Proposed Scheme
Total GHG emission per year (tCO_2e/year)	2020-2022	Unit 5: 4,854,000 Unit 6: 4,854,000 **=** 9,708,000	Unit 5: 4,854,000 Unit 6: 4,854,000 **=** 9,708,000	No net change (Unit X not yet fully commissioned)
	2023-2025		Unit X: 5,991,000 Unit 6: 4,854,000 = 10,845,000	+1,137,000 (+12%)
	2026	Unit 5: 2,601,500 Unit 6: 2,601,500 **=** 5,203,000	Unit X: 5,991,000 Unit 6: 4,854,000 = 10,845,000	+5,642,000 (+108%)
	2027-		Unit X:	+6,779,000 (+130%)

Item	Years	Baseline Scenario (2 x 660 MW)	Proposed Scheme (2 x 1,800 MW)	Net effect of Proposed Scheme
	2046		5,991,000 Unit Y: 5,991,000 = 11,982,000	
	2047-2050		Unit X: 5,203,000 Unit Y: 5,991,000 = 11,194,000	+5,991,000 (+115%)
Total GHG emissions (tCO_2e)	2020-2050	188,323,000	287,568,000	+168,597,000 (+90%)
Maximum electricity generation capacity	2020-2050	2 x 660 MW = 1,320 MW	2 x 1,800 MW = 3,600 MW	+2,280 MW (+173%)
GHG emissions intensity (gCO_2e/kWh)	2020-2050	***2020 to 2025:*** 840 ***2026 to 2050:*** 450	***2023 to 2050:*** 380	***2023 to 2025:*** -460 (-55%) ***2026 to 2050:*** -70 (-16%)

15.6.11. Once the current generating units have been replaced with gas-powered units, the Proposed Scheme will generate electricity with a GHG intensity of 380 gCO_2e/kWh; 55% less than the emissions intensity for current coal-fired generation which is expected to continue until 2025. Even after 2025 when it is assumed that emissions abatement would be required for the existing coal-powered generation units to meet the Government's proposed limit of 450 gCO_2e/kWh, the Proposed Scheme would generate electricity of 16% lower GHG intensity. In terms of the GHG emissions intensity per unit of electricity output, the Proposed Scheme is judged to provide a significant positive effect on climate compared with the baseline/do nothing scenario.

15.6.12. The latest GHG emissions factor published by the Government (BEIS, 2017) for average UK grid electricity generation is 407.61 gCO2e/kWh (comprising of emissions at the point of generation and 'Well to Tank' emission – see table below).

Table 15-14 - GHG emission factors for UK grid electricity

Item	Value (BEIS, 2017)

Item	Value (BEIS, 2017)
GHG emissions for electricity generation (average UK grid electricity)	351.56 gCO_2e/kWh
'Well to Tank' GHG emissions for electricity generation (average UK grid electricity)	56.05 gCO_2e/kWh
Total GHG emissions for electricity generation (average UK grid electricity)	407.61 gCO_2e/kWh

15.6.13. The emission intensity of electricity generation by the Proposed Scheme (380 gCO_2e/kWh) therefore compares favourably to the average for UK grid electricity at present. It should be noted that the Government projects a major reduction in the GHG intensity for average UK grid electricity over the coming years meaning that by 2050 the Proposed Scheme will be significantly less 'clean' (higher GHG intensity) than the UK average which will by then be dominated by renewable generation.

15.6.14. Notwithstanding this point, the Government's Overarching National Policy Statement for Energy; EN-1 (Ref. 15.1), is clear on the need for some future generation capacity to continue to come from non-renewable sources in order to cope with the intermittency of most renewable generation technologies (e.g. wind, solar).

15.6.15. Although the Proposed Scheme generates much 'cleaner' electricity than the baseline scenario, it also increases generation capacity from 1,320 MW to 3,600 MW; a 173% increase. For this reason, the total direct GHG emissions related to electricity generation at the Existing Drax Power Station Complex between 2020 and 2050 are 90% higher for the Proposed Scheme than the baseline scenario. Focussing on the direct GHG emissions from generation of electricity at the Existing Drax Power Station Complex, the Proposed Scheme therefore results in a significant negative effect on climate.

15.6.16. To provide some context in relation to the magnitude of GHG emissions; the Government's 5th carbon budget (the final one agreed) for the period 2028-2032 is 1,725,000,000 tCO_2e (Ref. X.7). For most of the operational life of the Proposed Scheme (i.e. from 2027 to 2046), there is an increase of 6,779,000 tCO_2e/year in comparison to the baseline scenario (additional emissions in relation to generation at Drax). Over the same 5 year carbon budget period, this would be 33,895,000 tCO_2e which is equivalent to 2% of the carbon budget for the UK.

15.6.17. It should however be noted that this assessment is not able to take into account the potential for an indirect reduction in GHG emissions (at the wider National level) which may be enabled by the additional electricity generation capacity provided by the Proposed Scheme. The Government's Overarching National Policy Statement for Energy; EN-1 (Ref. 15.1), is clear on the need for a major increase in (double or triple) electricity generation capacity in order to enable the switching of industry, transport and building heating to electrical energy. In these cases, electrical energy will typically result in less GHG emissions than traditional fossil-fuel sources of energy and therefore this switching represents an

indirect benefit of the Proposed Scheme i.e. a reduction in GHG emissions compared to the baseline scenario.

15.7 Limitations and Assumptions

15.7.1. The assessment has been completed on the basis of a 100% load factor (i.e. constant operation) for the baseline scenario and the Proposed Scheme.

15.7.2. The assessment is based on standard emissions factors for the combustion of coal or natural gas for electricity generation (per unit energy contained), rather than specific emissions factors for the generation units in the baseline scenario or Proposed Scheme.

15.7.3. The assessment has not taken account of the battery storage included in the Proposed Scheme, which may serve to slightly reduce the total emissions in comparison to the baseline scenario.

15.8 Summary

Construction Emissions

15.8.1. The Proposed Scheme will result in substantial GHG emissions during construction, particularly during the 'product stage' (emissions from manufacture and supply of construction materials such as concrete and steel). However, the Proposed Scheme will continue to utilise existing infrastructure such as the cooling towers and steam turbines.

15.8.2. A qualitative appraisal of the above emissions generating activity for the construction stage, comprising expert judgement regarding their relative scale, suggests that they will be of minor significance in comparison to the operational stage emissions (see below). In addition, these construction stage emissions are expected to be of a similar magnitude to those which would result under the baseline scenario from construction to abate emissions from coal-powered Units 5 and 6 post 2025. The construction emissions for the Proposed Scheme are likely to be lower than those which would occur under the baseline scenario should Units 5 and 6 close post 2025 meaning that a new generating station would be required elsewhere to replace the loss of electricity output.

15.8.3. Quantitative assessment is not completed for the construction stage.

Operational Emissions

15.8.4. The following table summarises the operational stage GHG emissions at the Existing Drax Power Station Complex under the baseline scenario and with the Proposed Scheme. The figures do not take account of any indirect increase or decrease in emissions which may occur in relation to energy consumption by end-users. The figures are expressed in terms of:

- Total GHG emissions per year.
- Total GHG emission for the period 2020 to 2050.
- GHG emissions intensity (emissions per unit electricity generation).

Table 15-15 – Summary of GHG Emissions

Item	Years	Baseline Scenario (2 x 660 MW)	Proposed Scheme (2 x 1,800 MW)	Net effect of Proposed Scheme
Total GHG emissions (tCO_2e)	2020-2050	188,323,000	287,568,000	+168,597,000 (+90%)
Maximum electricity generation capacity	2020-2050	2 x 660 MW = 1,320 MW	2 x 1,800 MW = 3,600 MW	+2,280 MW (+173%)
GHG emissions intensity (gCO_2e/kWh)	2020-2050	***2020 to 2025:*** 840 ***2026 to 2050:*** 450	***2023 to 2050:*** 380	***2023 to 2025:*** -460 (-55%) ***2026 to 2050:*** -70 (-16%)

15.8.5. In terms of the GHG emissions intensity per unit of electricity output, the Proposed Scheme results in a significant positive effect on climate.

15.8.6. Although the Proposed Scheme generates much 'cleaner' electricity than the baseline scenario, it also increases generation capacity by 173%. Focussing on the direct GHG emissions from generation of electricity at the Existing Drax Power Station Complex, the Proposed Scheme therefore results in a significant negative effect on climate.

15.8.7. It should however be noted that this assessment is not able to take into account the potential for indirect reductions in GHG emissions (at the wider National level) which may be enabled by the additional electricity generation capacity provided by the Proposed Scheme. The Government's Overarching National Policy Statement for Energy; EN-1 (Ref. 15.1), is clear on the need for a major increase in (double or triple) electricity generation capacity in order to enable the switching of industry, transport and building heating to electrical energy. In these cases, electrical energy will typically result in less GHG emissions than traditional fossil-fuel sources of energy and therefore this switching represents an indirect benefit of the Proposed Scheme i.e. a reduction in GHG emissions compared to the baseline scenario. The NPS is also clear on the need for some future capacity to continue to come from non-renewable sources in order to cope with the intermittency of most renewable generation technologies (e.g. wind, solar).

Table 15-16 - Summary of Effects Table for climate (Greenhouse Gas Emissions)

Description of Effects	Receptor	Significance and Nature of Effects Prior to Mitigation / Enhancement	Summary of Mitigation / Enhancement	Significance and Nature of Effects Following Mitigation / Enhancement (Residual)
Stage 0, 1 and 2 – Reconfiguration Works, Construction of Unit X and Y				
Greenhouse gas (GHG) emissions due to construction contribute to climate change	All global human and natural systems	Minor / - / P / D / LT	None defined	Minor / - / P / D / LT
Stage 2 and 3 – Operation of Unit X and Y				
GHG emissions due to operation (electricity generation) contribute to climate change	All global human and natural systems	Absolute (total) GHG emissions: Major / - / P / D / LT GHG emissions intensity of generation: Moderate / + / P / D / LT	The Proposed Scheme includes the potential for Drax to be connected to any future Carbon Capture and Storage (CCS) scheme. If CCS technology is shown to be feasible in future, the operational emissions of the Proposed Scheme could be captured and stored and therefore their contribution to climate change avoided.	Absolute (total) GHG emissions: Major / - / P / D / LT GHG emissions intensity of generation: Moderate / + / P / D / LT

NB: Aspects of the proposed scheme considered as part of the pre-mitigation scenario are summarised above in Section 1.6, and within Chapter X: Summary of Environmental Statement.

Key to table: + / - = Positive or Negative P / T = Permanent or Temporary, D / I = Direct or Indirect, ST / MT / LT = Short Term, Medium Term or Long Term N/A = Not Applicable

REFERENCES

- Ref.15.1 Department of Energy & Climate Change (2009) Draft Overarching National Policy Statement for Energy (EN-1);
- Ref.15.2 Department for Business, Energy & Industrial Strategy (2018) Implementing the end of unabated coal by 2025; government response to unabated coal closure consultation.
- Ref.15.3 Climate Change Act (2008)
- Ref.15.4 Institute of Environmental Management and Assessment (IEMA; 2017) Environmental Impact Assessment Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance.
- Ref.15.5 Royal Institute of Chartered Surveyors (2017) Whole life carbon assessment for the built environment, 1st edition.
- Ref.15.6 Department for Business, Energy & Industrial Strategy (2017) Greenhouse gas conversion factors for company reporting.
- Ref.15.7 The Carbon Budget Order 2016, Statutory Instrument 2016 No. 785.