Connah's Quay Low Carbon Power

Environmental Statement Volume IV
Appendix 20-A: Greenhouse Gas Baseline Data and Methodology Report

Planning Inspectorate Reference: EN010166
Document Reference: EN010166/APP/6.4
Planning Act 2008 (as amended)
Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 - Regulation 5(2)(a)
Revision 00

August 2025

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1. Greenhouse Gas Baseline Data and Methodology Report

1.1 Scope of the Assessment

1.1.1 **Table 1** outlines a breakdown of emissions, and their respective sources, accounted for within this greenhouse gas (GHG) assessment. GHG emissions have been considered across the whole lifecycle of the Proposed Development (**Table 1**).

Table 1: Scope of Potential GHG Emission Sources across the Proposed Development's Lifecycle

Lifecycle stage (PAS 2080 module)	Activity	Primary emission sources	Scoped In/out?
Construction (A0-5)	Any site enabling works.	GHG emissions from any activities required onsite prior to construction, including the demolition of existing assets within the Order limits.	In
	Land use change	Loss of a carbon sink.	In
	Raw material extraction and manufacturing of products/ materials.	Embodied GHG emissions of the raw materials used to construct the Proposed Development.	In
	Transport of products/ materials to site.	GHG emissions from fuel consumption for the transportation of materials.	In
	On-site construction activity.	Energy consumption from plant and vehicles, generators on site, and construction workers commuting. This would include 'direct' GHG emissions from fuel use (e.g., combustion of diesel from generator use) and 'indirect' GHG emissions associated with electricity use.	In

Lifecycle stage (PAS 2080 module)	Activity	Primary emission sources	Scoped In/out?
	Transport of construction workers.	GHG emissions from fuel consumption for transportation of construction workers.	In
	Transportation and disposal of construction waste.	GHG emissions from energy use and from fuel consumption for transportation of waste.	In
	Provision and treatment of water.	GHG emissions from the supply of potable water, and the disposal and treatment of wastewater.	In
Operation (B1-9)	Operation of the Proposed Development.	GHG emissions from electricity generation, when not captured by the carbon capture plant, and energy use in buildings. GHG emissions associated with potential unabated operation due to unavailability of the captured carbon transport and storage system. GHG emissions from the upstream supply chain of natural gas i.e., well-to-tank emissions.	In
	Use of vehicles (i.e. cars and motorcycles).	GHG emissions from vehicle use from worker journeys to and from the Site.	In
	Disposal and transportation of operational waste.	GHG emissions from recycling/ disposal of process waste and domestic waste. GHG emissions from fuel consumption for transportation of raw materials and waste.	In

Lifecycle stage (PAS 2080 module)	Activity	Primary emission sources	Scoped In/out?
	Building/infrastructure maintenance.	GHG emissions from maintenance of buildings and infrastructure /assets in the operational stage.	In
	Grid electricity use	GHG emissions from operation of the Proposed Development.	In
	Provision and treatment of wastewater.	GHG emissions from the supply of potable water, and the disposal and treatment of wastewater.	In
Decommissioning (C1-4)	On-site decommissioning activity.	Energy (electricity, fuel, etc.) consumption from plant and vehicles, generators on site, and workers commuting.	In
	Transport of decommissioning workers.	GHG emissions from fuel consumption for transportation of Workers.	In
	Transportation and disposal of waste.	GHG emissions from energy use and from fuel consumption for transportation of waste.	In
	Provision and treatment of water.	GHG emissions from the supply of potable water, and the disposal and treatment of wastewater.	In

1.1.2 The PAS 2080 Specification (Ref 1) allows the exclusion (or 'scoping out') of GHG emissions sources that contribute or remove less than 1% to the total inventory (**Table 1**). Where an emissions source is less than 1% it may be considered as not material. Inventories that exclude these minor sources are still considered complete for verification purposes. This exclusion of immaterial emission sources, that are <1% of a given emissions inventory, is based on a 'de minimis' (relatively minimal) contribution.

1.2 Impact Assessment Methodology

1.2.1 The purpose of the GHG assessment is to understand the impact of GHG emissions from the Proposed Development on the climate. To understand this impact the assessment quantifies the GHG emissions over the lifecycle of the Proposed Development and puts them into the context of the UK and Wales meeting its net zero targets. Climate Change is an issue devolved to the Senedd Cymru, and Wales has published its own carbon budgets based on advice from the Climate Change Committee. Wales, along with other devolved administrations, remains part of the UK, so emissions within Wales are also included in the UK's legally binding carbon budgets.

1.2.2 To align with best practice set out in the PAS2080 Specification, the assessment adopts a project lifecycle approach to quantifying emissions. The output of this quantification is used to identify emissions 'hot spots' (i.e. sources of emissions with greatest contribution to the overall emissions footprint). This enables priority areas for mitigation to be identified. This approach is also consistent with the principles set out in the Institute of Environmental Management and Assessment (IEMA)[1] Guidance (GHG Assessment) (Ref 2).

1.2.3 Where activity data have allowed, expected GHG emissions arising from the lifecycle activities associated with the Proposed Development have been calculated by multiplying activity data by a relevant emission factor:

Activity data × GHG emissions factor = GHG emissions

1.2.4 Activity data is a quantifiable measure of activity or resources, such as operating hours or volumes of fuels used. Emission factors are used to convert the activity data into GHG volumes.

1.2.5 Activity data has been sourced from within Uniper. Where specific data sets are not available, a mix of assumptions and industry benchmarks have been used to fill data gaps. Where this is not possible, then a qualitative approach to addressing GHG impacts has been followed, in line with the IEMA Guidance (Ref 2). Any assumptions, inclusions and exclusions that inform the GHG emissions calculation have been clearly described in the sections below.

1.2.6 2024 Emission Factors published by the UK Department of Energy Security and Net Zero (DESNZ) (Ref 3), and material embodied carbon data from the University of Bath's Inventory of Carbon and Energy (ICE) V4.0 (Ref 4), have been used as the primary sources of emissions factors when calculating GHG emissions.

1.2.7 In line with the World Business Council for Sustainable Development (WBCSD) and World Resources Institute's (WRI) GHG Protocol guidelines (Ref 5), the lifecycle GHG impact assessment considers the seven Kyoto Protocol GHGs (Ref 6):

- carbon dioxide (CO_2);

[1] The Institute of Environmental Management (IEMA) has changed its name to the Institute of Sustainability and Environmental Professionals (ISEP). Where general reference is made to the institute in this document, the following distinction has been made: ISEP (formerly IEMA). When referencing legacy IEMA documents, this distinction is not made.

- methane (CH_4);
- nitrous oxide (N_2O);
- sulphur hexafluoride (SF_6);
- hydrofluorocarbons (HFCs);
- perfluorocarbons (PFCs); and
- nitrogen Trifluoride (NF_3).

1.2.8 These GHGs are referred to in this chapter under an encompassing definition of 'GHG emissions', in conjunction with the unit of tCO_2e (tonnes CO_2 equivalent) or $MtCO_2e$ (megatonnes of CO_2 equivalent).

Determining Effects

1.2.9 **Table 1** summarises the key anticipated GHG emissions sources associated with the Proposed Development and whether they have been scoped into the final assessment.

1.2.10 In particular, it should be noted the subsequent export of CO_2 from the Proposed CO_2 AGI (following metering and testing) is proposed to utilise the existing natural gas pipeline within the Main Development Area, as detailed in **Chapter 4: The Proposed Development** (**EN010166/APP/6.2.4**). Therefore, this has been discounted from the assessment of construction effects.

Sensitive Receptors

1.2.11 The identified receptor for GHG emissions is the global climate. This is because the effects of GHG emissions are not geographically constrained, meaning all developments have the potential to result in a cumulative effect on GHG emissions. The sensitivity of the global climate to GHG emissions is 'high'; the rationale for such is as follows:

- GHG emission impacts could compromise the CCC's sectoral construction and net-zero pathways and, therefore, the ability to meet its future carbon reduction trajectory;
- GHG emission impacts could compromise the UK's ability to reduce its GHG emissions and, therefore, the ability to meet its future legally-binding carbon budgets;
- the extreme importance of limiting global warming to below 2 °C above industrial levels, while pursuing efforts to limit such warming to 1.5 °C as set out in the Paris Agreement and a recent report by the Intergovernmental Panel on Climate Change (IPCC) highlighting the importance of limiting global warming below 1.5 °C; and
- disruption to global climate is already having diverse and wide-ranging impacts on the environment, society, economy, and natural resources. Known effects of climate change include increased frequency and duration of extreme weather events, temperature changes, rainfall and flooding, and sea level rise and ocean acidification. These effects are largely accepted to be negative, profound, global, likely, long-term to permanent, and are transboundary and cumulative from many global actions.

1.2.12 For the GHG emissions impact assessment, the UK's and Wales carbon budgets have been used as a proxy for the global climate (**Table 1**).

Classification of Effects

1.2.13 The IEMA Guidance (GHG Assessment) (Ref 2) states that there are no currently agreed methods to evaluate levels of GHG significance, and that professional judgement is required to contextualise a project's emission impacts.

1.2.14 In GHG accounting, it is considered good practice to contextualise emissions against pre-determined carbon budgets (Ref 2). Given this, emissions derived from the Proposed Development has been contextualised against both the UK (**Table 2**) and Welsh (**Table 3**) Carbon Budgets. These budgets are as proposed by the Climate Change Committee (CCC), agreed by government, and ratified by parliament and Senedd Cymru, respectively. This contextualisation has been applied in terms of both the sensitivity of the receptor and the magnitude of potential impacts, as appropriate.

1.2.15 In a UK context, it is essential to note that supplementary carbon budgets have not been formally adopted by the UK Government and/or ratified by Parliament beyond 2037[2] (see **Table 2**). Therefore, it is recommended that the CCC balanced net-zero pathway is utilised (post-2037) to illustrate the Proposed Development's progress towards the net-zero trajectory by 2050 (**Table 2**). However, as stated, supplementary Carbon Budgets (e.g., beyond 2037) have not been formally adopted by the Government or ratified by parliament. Therefore, they can only be used as an indicative measure to contextualise the Proposed Development's progress towards the national net-zero trajectory.

1.2.16 The CCC's balanced net-zero pathway is divided into 5-year periods post-2037; this is to match the previous legally binding UK national Carbon Budgets. The proposed Carbon Budget periods, derived from the net-zero pathway, encompass the 7^{th2}, 8th, and 9th indicative budget periods up to 2050. Such budgets are in line with the UK's 1.5°C trajectory; these are detailed in **Table 2**.

1.2.17 Beyond 2050, it is expected that the UK, and more specifically Wales, will remain at net-zero.

1.2.18 Whilst the majority of upstream natural gas supply chain emissions are likely to fall outside of the UK's carbon budget jurisdiction, these emissions have been included within the comparisons. Therefore, contextualising the Proposed Development's in this manner is considered a conservative assessment approach.

UK Carbon Budgets

1.2.19 The UK Carbon Budgets are in place to restrict the volume of greenhouse gas emissions the UK can legally emit in a five-year period (**Table 2**). The UK is currently in the 4th carbon budget period, which runs from 2023 to 2027, as

[2] The Committee on Climate Change (CCC) has now advised figures for the UK's 7th Carbon Budget (2038-2042). However, at the time of writing, these figures are yet to be adopted by government or ratified by parliament.

detailed in **Table 2**. The 3rd to the 5th carbon budgets reflects the earlier UK target (80% reduction target by 2050). The 6th carbon budget, legislated in June 2021, is the first budget to reflect the amended net-zero target. As the Proposed Development would be active past 2050, the assessment also compares the emissions against CCC balanced net-zero pathway (by 2050) (**Table 2**).

1.2.20 Construction of the Proposed Development is likely to intersect the UK carbon budget periods running from 2028-2032 and 2033-2037 (UK 5th and 6th carbon budgets respectively) (**Table 2**). This is due an anticipated simultaneous construction of both CCGT Trains 1 and 2 from Q4 in 2031 taken as a reasonable worst-case scenario, as stated in Section 5 of **Chapter 5: Construction Management and Programme** (**EN010166/APP/6.2.5**). Under this worst-case scenario, site enabling works, construction activities, and the eventual commissioning of the Trains is expected to last for approximately five years. This is visualised within the indicative simultaneous construction and commissioning programme (see Table 5-2 of **Chapter 5: Construction Management and Programme** (**EN010166/APP/6.2.5**)).

1.2.21 As described in paragraph 2.2.36 of **Chapter 2: Assessment Methodology** (**EN010166/APP/6.2.2**), each Train of the Proposed Development could have an operational life of circa 30 years. Given the assumed approximate 5-year construction of both Trains from Q4 2031 (see above), the Proposed Development is anticipated to operate from 2035 to 2065, as a reasonable worst-case scenario. This operational period would intersect the UK 5th and 6th Carbon Budgets and the net zero target of 2050 (**Table 2**).

1.2.22 At the end of the operational period outlined above, decommissioning activities are currently anticipated to commence after 2065 for the assumed adoption of the Proposed Development's simultaneous construction (paragraph 1.2.20), as per Section 4 of **Chapter 4: The Proposed Development** (**EN010166/APP/6.2.4**).

Table 2: UK Carbon Budgets and Indicative Carbon Budgets Based Upon the CCC's Balanced Net-Zero Pathway (Ref 7)

Carbon budget period	UK Carbon Budget ($MtCO_2e$)	Indicative Carbon Budgets based upon the CCC's balanced net-zero pathway ($MtCO_2e$)	Indicative CCC's Electricity Supply Carbon Budgets based upon the CCC's balanced net–zero pathway for Electricity Supply ($MtCO_2e$)	Indicative CCC's Construction Carbon Budgets based upon the CCC's balanced net–zero pathway for Construction ($MtCO_2e$)
4th (2023-2027)	1,950		189	254
5th (2028-2032)	1,725		9	183
6th (2033-2037)	965		36	95
7th (2038-2042)[2]		*526**	*23*	*34*
8th (2043-2047)		*195*	*12*	*17*
9th (2048-2050)		*17*	*3*	*9*

**As noted within footnote 2, the CCC has now advised a figure (535 $MtCO_2e$) for the UK's 7th Carbon Budget (2038-2042). However, given that this figure has not been adopted by government and/or ratified by parliament, the CCC's previous indicative carbon budget figure (526 $MtCO_2e$) for the 2038-2042 period has been considered for this GHG assessment.*

Welsh Carbon Budgets

1.2.23 Like above, the Welsh Carbon Budgets are in place to restrict the mass of GHG emissions that Wales can legally emit in a five-year period (**Table 3**). Wales is currently situated in Carbon Budget 2 (2021 to 2025).

1.2.24 Construction of the Proposed Development is likely to intersect the UK carbon budget periods running from 2026-2035 (Welsh Carbon Budgets 2026-2030 and 2031-2035) (**Table 3**).

1.2.25 The operation of the Proposed Development (approximately 30 years) is expected between 2030-2060 and 2035-2065, intersecting Welsh Carbon Budgets 3, 4, 5, 6 and 7, and beyond) (**Table 3**).

Table 3: Welsh Carbon Budgets

Carbon Budget Period	Welsh Carbon Budget ($MtCO_2e$)
2021-2025	163

Carbon Budget Period	Welsh Carbon Budget ($MtCO_2e$)
2026-2030	127
2031-2035	83
2036-2040	48
2041-2045	27
2046-2050	14

Significance of Effects

1.2.26 The IEMA Guidance (GHG Assessment) (Ref 2) describes five distinct levels of significance; these are not solely based on whether the Proposed Development emits GHG emissions alone, but on how the Proposed Development makes a relative contribution towards achieving a science-based 1.5°C aligned transition towards net-zero. The different significance levels are plotted against the UK and Welsh net-zero compatible trajectory, as presented in **Table 2** and **Table 3**, to evaluate the likely significance of effects of the Proposed Development.

1.2.27 The effect of a project can shift from significant to not-significant by incorporating mitigation measures that substantially improve on business-as-usual and meet or exceed the science-based emissions trajectory of ongoing, but declining emissions towards net zero.

1.2.28 This method to determine the significance of GHG emissions are summarised in **Table 4**.

Table 4: Definition of Levels of Significance (Ref 2)

Significance	Effects	Description	Example in the IEMA Guidance (Climate Change)
Significant	Major adverse	A project that follows a 'business-as-usual' or 'do minimum' approach and is not compatible with the UK's net zero trajectory or accepted aligned practice or area-based transition targets. It is down to the practitioner to differentiate between the 'level' of significant adverse effects e.g. 'moderate' or	The project's GHG impacts are not mitigated or are only compliant with do-minimum standards set through regulation, and do not provide further reductions required by existing local and national policy for projects of this type. A project with major adverse effects is locking in emissions and does not make a meaningful contribution to the UK's trajectory towards net zero.
	Moderate adverse		The project's GHG impacts are partially mitigated and may partially meet the applicable existing and emerging policy

Significance	Effects	Description	Example in the IEMA Guidance (Climate Change)
		'major' adverse effects.	requirements but would not fully contribute to decarbonisation in line with local and national policy goals for projects of this type. A project with moderate adverse effects falls short of fully contributing to the UK's trajectory towards net zero.
Not significant	Minor adverse	A project that is compatible with the budgeted, science based 1.5 °C trajectory (in terms of rate of emissions reduction) and which complies with up-to-date policy and 'good practice' reduction measures to achieve that. It may have residual emissions but is doing enough to align with and contribute to the relevant transition scenario, keeping the UK on track towards net zero by 2050 with at least a 78% reduction by 2035, thereby potentially avoiding significant effects.	The project's GHG impacts would be fully consistent with applicable existing and emerging policy requirements and good practice design standards for projects of this type. A project with minor adverse effects is fully in line with measures necessary to achieve the UK's trajectory towards net zero.

Significance	Effects	Description	Example in the IEMA Guidance (Climate Change)
	Negligible	A project that achieves emissions mitigation that goes substantially beyond the reduction trajectory, or substantially beyond existing and emerging policy compatible with that trajectory and has minimal residual emissions. This project is playing a part in achieving the rate of transition required by nationally set policy commitments.	The project's GHG impacts would be reduced through measures that go well beyond existing and emerging policy and design standards for projects of this type, such that radical decarbonisation or net zero is achieved well before 2050. A project with negligible effects provides GHG performance that is well 'ahead of the curve' for the trajectory towards net zero and has minimal residual emissions.
Significant	Beneficial	A project that causes GHG emissions to be avoided or removed from the atmosphere. Only projects that actively reverse (rather than only reduce) the risk of severe climate change can be judged as having a beneficial effect.	The project's net GHG impacts are below zero and it causes a reduction in atmospheric GHG concentration, whether directly or indirectly, compared to the without-project baseline. A project with beneficial effects substantially exceeds net zero requirements with a positive climate impact.

Rochdale Envelope

1.2.29 A focused use of the Rochdale Envelope approach has been adopted to present a worst-case assessment of potential environmental effects of the different parameters of the Proposed Development that cannot yet be fixed. The parameters included within the Rochdale Envelope are described within **Chapter 20: Climate Change** (**EN010166/APP/6.2.20**).

Assessment Assumptions and Limitations

1.2.30 At the time of preparing this ES chapter (March 2025), the Lifecycle GHG Assessment has been based on available information for the Proposed Development's construction and operational phases, commensurate with the application status. Available activity and materials data has been sourced from the Applicant.

1.2.31 The Lifecycle GHG Assessment assumes a simultaneous construction scenario whereby the construction of both CCGT trains begins in Q4 2031, as stated in section 5 of **Chapter 5: Construction Management and Programme** (**EN010166/APP/6.2.5**). This has been considered as a worst-case scenario for GHG emissions because it represents the latest date, following potential DCO consent, by which the Proposed Development would be constructed and commissioned; therefore, demonstrating the longest period the existing unabated Connah's Quay Power Station remains operational in its unabated capacity.

1.2.32 As is typical practice, a series of assumptions have also been made where specific data sets are not available to conduct a robust assessment of the likely impacts of the Proposed Development on climate change. Assumptions used to assess the likely impact of GHG emissions across the construction, operational, and decommissioning phases have been detailed in section 20.3 of **Chapter 20: Climate Change** (**EN010166/APP/6.2.20**).

1.3 Baseline Conditions and Study Area

Study Area

1.3.1 The study area for the baseline of each assessment type is informed by the needs of the future assessment itself.

1.3.2 As the GHG assessment considers the impact of the Proposed Development on the climate, the GHG assessment includes emissions associated with the Proposed Development within the context of both the UK's and, more specifically, the Welsh Carbon Budgets (see Section 1.2). This includes all direct GHG emissions from within the Order limits arising during all stages of the construction, operation, and decommissioning of the Proposed Development. It also includes indirect GHG emissions occurring off-site that are significantly related to the Proposed Development, such as embodied carbon as a result of production of the construction materials, transportation, waste processing and waste disposal.

Existing Baseline

1.3.3 The Order limits are described in **Chapter 4: The Proposed Development** (**EN010166/APP/6.2.4**). The Main Development Area is situated within the existing Connah's Quay Power Station and land under the control of the Applicant. The existing Connah's Quay Power Station currently provides 1,380 MWe of dispatchable power to the National Grid. As noted within Section 2 of **Chapter 2: Assessment Methodology** (**EN010166/APP/6.2.2**), it has Capacity Market Agreements in place until 2028, with any future plans for the existing power station being confirmed by the Applicant in due course.

1.3.4 For the adopted worst-case for GHG emissions, the existing Connah's Quay Power Station is assumed to operate continually until 2035 when, operationally, these units would be replaced by Train 1 and 2 of the Proposed Development (Section 2 **Chapter 2: Assessment Methodology**(**EN010166/APP/6.2.2**)).

1.3.5 For this GHG assessment, the baseline is the 'business as usual' scenario whereby the Proposed Development is not developed. However, given the uncertainty surrounding the existing power station's future operation, it is reasonable for the 'business as usual' scenario to assume that the Proposed Development's lifetime generation would ultimately be provided by another existing, unabated CCGT power station within the grid, as a means of balancing the National Grid's generation capacity. This is because existing, unabated CCGTs provide similar dispatchable marginal generating capacity to that that would be provided by the Proposed Development. Contextualising lifetime operational emissions from the Proposed Development against those from an existing unabated CCGT, therefore, allows a direct like for like comparison to be carried out.

1.3.6 Whilst it is recognised that EN-1 (paragraph 4.9.25, Ref 7) requires all new commercial scale combustion power stations to be constructed Carbon Capture Ready, this assessment solely compares the operational GHG impact of Proposed Development with an existing, unabated CCGT technology and not with new installations. It is existing gas-fired power stations, such as the existing Connah's Quay Power Station, that low-carbon installations such as the Proposed Development must displace in support of the UK's net zero ambitions.

Future Baseline

1.3.7 The future baseline scenarios are set out in Section 2 of **Chapter 2: Assessment Methodology** (**EN010166/APP/6.2.2**).

1.3.8 The future baseline for the assessment of the impact of the Proposed Development on climate is a projected 'business as usual' scenario where the Proposed Development is not constructed, and the Proposed Development's projected lifetime generation is provided by an existing, unabated CCGT power station (paragraph 1.3.5).

1.3.9 For the adopted worst-case project scenario, the existing Connah's Quay Power Station is assumed to remain operational until 2035 as described in **Chapter 2: Assessment Methodology** (**EN010166/APP/6.2.2**), followed by an eventual decommissioning and closure of the existing plant by 2035. At this point, the future baseline emissions are considered to be zero and all other emissions are considered as additional. Use of this precautionary principal approach provides a conservative assessment, as not all activities (and therefore GHG emissions) would be additional activities given the nature of existing land-use on the Main Development Area.

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