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By email to :
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July 24th 2025

Dear Secretary of State,

Planning Act 2008 and The Infrastructure Planning (Examination Procedure) Rules 2010

Application by H2 Teesside Limited ("the Applicant") for an Order granting Development Consent for the proposed H2Teesside development ("the Proposed Development")

I refer to your letter of July 21 2025 inviting all interested parties to comment on the information provided in response to your information requests.

1 Background

I am an interested party and contributed to the examination both at Issue Specific Hearing and with written submissions. Just for clarification, these submissions were made under "Climate Emergency Planning and Policy" (CEPP), and I have recently changed the name of my consultancy to "Climate Emergency Science Law" (CESL). This CESL submission should be taken as a continuation of my previous submissions under CEPP.

I have the letter from Broadfield on June 27 2025 on behalf of the South Tees Group (**STG**) promoting a data centre and arguing against consent for the H2 Teesside project. I have also seen press reports (for example in the Financial Times, July 23 2025) that ministers have selected the site in Teesside as the location for its second AI Growth Zone. Whilst both these factors might be "show stopper" events suggesting that the project is unlikely to go forward to ministerial DCO consent, I make this submission now for the scenario in which you do not consider the data centre

project to be a show stopper. In any case, it is vital, of course, that the EIA assessment made, even if the scheme is not consented, is lawful and up-to-date with the science.

The purpose of my letter is to update you, as Secretary of State, on various matter concerning Carbon Capture and Storage since the examination closed. These relate primarily to the Greenhouse Gas (GHG) emissions footprint of this project which was the main focus of my submissions to the examination. My letter continues after the Contents index below.

Contents

2 GENERAL MESSAGE TO THE SECRETARY OF STATE

For transparency, I inform you that I currently campaign for your Government to re-evaluate its current support for gas- and bioenergy-based CCS, in light of new evidence showing it could worsen emissions, lock in fossil fuels, and impose vast costs on households. I provide further information on this campaign in a later section (see "Transparency on campaigning position" section).

I believe that it is helpful to say at the outset that much has changed since this application was first submitted several years ago. You often argue compellingly and eloquently to move away from fossil fuels and towards clean energy. **Secretary of State – and this is addressing Mr Miliband personally - I support you in that, and have done for many years.**

You have also long been a champion of carbon capture and storage (CCS). That position was entirely reasonable when you advanced it during the last Labour Government, at the time of the early carbon budgets based on a 2 degree temperature target (and 80% reduction by 2050), and what was known then about upstream emissions from natural gas.

However, with new information, there is now a compelling case for an independent review into CCS, and for CCS when it increases emissions to be removed from the Climate plan, and a more radical shift to a truly clean energy strategy.

You made a strong case (for example[1]) to use CCS to decarbonise the UK's fleet of gas and coal power stations around 2008.

However, the evidence has moved on dramatically in the seventeen years since then. It has moved on since the May government launched the current CCUS programme, which you inherited, in 2018. It has moved on since BP made its application for H2 Teesside. And it has moved on since your predecessor Grant Shapps made the first attempt to publish a Climate Change Act ("CCA 2008") section 13 climate plan for the Sixth Carbon Budget under the Johnson government in 2021.

In 2008, North Sea gas was thought to have relatively modest upstream emissions. However, now we know that we are dealing with more natural gas imports, and the upstream emissions are greater for two key reasons.

Firstly, the gas supply itself has changed. Since the war in Ukraine, UK gas imports have increased, with a growing reliance on LNG, including from the US. This is set to continue as the North Sea basin and Norwegian supplies decline over the next decades.

Second, the science around gas supply chain emissions has advanced rapidly since the May government launched the current CCUS programme in 2018, satellite and remote imaging of fugitive methane emissions from fossil fuel infrastructure has rapidly advanced. There have also been a number of academic studies, detailed later in this letter.

Most recently, a major peer reviewed paper published in 2024 by Professor Robert Howarth from Cornell shows US-sourced LNG has far higher upstream methane emissions than previously understood — wiping out any emissions benefits from carbon capture at the point of processing for blue hydrogen. This evidence was not put in full before the planning examination. It is only since

[1] https://www.theguardian.com/environment/2009/apr/18/coal-carbon-capture-storage#:~:text=Ed%20Miliband%2C%20the,on%20the%20table

Feb 28 2025 when the examination closed, that I have integrated the Howarth data into my own modelling of H2 Teesside – and I present that later in this letter.

According to the Howarth study, which was very influential on the US Biden administration in its pre-publication form, around two thirds of the total emissions for UK natural gas carbon capture lie outside UK territory in the supply chain, when LNG from the US Permian basin is a fuel source. I present much more detail on this, and an infographic, later in this letter.

My two upfront messages at this point are that you cannot rely on the data in the Examination report because the Examining Authority (ExA) did not see the material I present in this letter, and I urge you to reconsider the issue of CCS in general, given the data and updates I provide in this letter. You need to look at this with fresh eyes. All the material in this letter extends the Environmental Statement and is relevant to your reasoned conclusions on the environmental impacts of the scheme.

3 POLITICAL AND LEGAL UPDATE

3.1 Whitehead review

You have initiated a "Greenhouse Gas Removals (GGRs) Independent Review" lead by Dr Alan Whitehead. I welcome this review and hope that it may lead to a much more robust policy approach to GGR and CCS, based on the full science. I submitted a comprehensive submission to Dr Whitehead.

Dr Whitehead's forward to this consultation states "*the review will consider all GGRs, with a focus on engineered approaches, and I welcome information and evidence about all GGR technologies in this Call for Evidence.*"

I submitted that the review should consider all technologies for capturing or removing greenhouse gas emissions because the distinction between GGR and CCS is somewhat arbitrary. For example, I would argue that BECCS is a CCS technology capturing emissions at the point of combustion of biomass, rather than removing emissions already in the atmosphere.

There are, in any case, very good reasons to use the opportunity of the Whitehead review to review all available technologies – CCS and GGR, including:

(A) They may share common supporting technology. For example, DACCS may require use CO2 transport and storage technology developed for CCS applications. This is certainly the case for BECCS at Drax which would use off shore storage planned for east coast CCUS clusters.

(B) Any removals should be looked at in the round as to how they might "assist the UK in meeting our net zero targets, out to 2050". It is not coherent to review some or just part of the portfolio of proposed removal technologies.

I made many arguments to Dr Whitehead, some of which are relevant to this planning decision. I attach my submission to Dr Whitehead as Appendix A of this letter. To avoid some repetition, I point to some sections of that in this letter.

I submit that the Secretary of State should not make a decision on H2 Teesside project until after the Whitehead review reports.

3.2 US DoE and US Greenpeace reports on US LNG exports

Since the DCO examination, Greenpeace US published (on July 9th) a very hard hitting report on the climate impacts of US LNG exports: 'Failing the "Climate Test"[2]'. You, Secretary of State, must note this report carefully, especially given the proportion of US LNG already in the UK gas supply, and the additional demand which will be generated for it by your department's CCS programme. Please also see section "Indirect emissions driven by UK CCS demand for LNG" of this letter.

The Greenpeace report:

- shows that major proposed LNG projects would fail to achieve the "climate neutrality" benchmark[3] put forward by a previous 2024 US DoE analysis (the "2024 LNG Study[4]"). This 2024 study tried to answer the question about whether the US should licence more LNG export facilities following the Biden LNG export pause during 2024. The Biden administration did urge caution[5] over further LNG exports (see Secretary Jennifer Granholm's statement[6]). The Greenpeace report updates the DoE report: evidencing that it underestimated the climate impacts of LNG. It then updates the climate impact assessment accordingly, and concludes all LNG export facilities analysed have a severe impact on the climate, and that no further LNG export facilities should be built.

- Gives this recommendation in the main report "*Energy purchasers, financial institutions, and* ***foreign governments should refrain from entering into long-term offtake agreements for U.S. LNG and financing of LNG infrastructure****. Instead, these parties should prioritize measures that accelerate the renewable energy transition and plan for a managed phase-out of fossil fuels. Group of Seven nations, in particular, should abide by their 2022 commitment to stop financing overseas fossil fuel infrastructure with taxpayer money.*" The Secretary of State must take note of this recommendation from the report. LNG infrastructure includes projects, such as H2 Teesside, which consume LNG, and create further demand for US LNG exports – which in turn creates further demand for US LNG exporting facilities. Giving planning consent to such facilities also set in the motion a later further demand for US LNG exports. **Given the devastating climate impacts, the Secretary of State must consider this alone as reason to not consent H2 Teesside.**

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[2] https://www.greenpeace.org/static/planet4-usa-stateless/2025/07/e22bd025-failing-the-climate-test_final.pdf

[3] https://www.greenpeace.org/usa/failing-the-climate-test/#:~:text=major%20proposed%20lng%20projects%20would%20fail%20to%20achieve%20the%20%E2%80%9Cclimate%20neutrality%E2%80%9D%20benchmark%20put%20forward%20by%20a%202024%20federal%20analysis%20(%E2%80%9C2024%20lng%20study%E2%80%9D)%20to%20inform%20the%20review%20of%20lng%20export%20applications%20under%20the%20natural%20gas%20act.

[4] https://fossil.energy.gov/app/docketindex/docket/index/30

[5] https://www.npr.org/2024/12/18/g-s1-38746/granholm-liquefied-natural-gas#:~:text=WASHINGTON%20%E2%80%94%20The%20United%20States%20should,year%20by%202050%2C%20Granholm%20said

[6] https://www.energy.gov/sites/default/files/2024-12/Statement%20from%20U.S.%20Secretary%20of%20Energy%20Jennifer%20M.%20Granholm%20on%20Updated%20Final%20Analyses_12.17.2024.pdf

3.3 ICJ opinion - Obligations of States in Respect of Climate Change

Yesterday, the ICJ published a landmark Advisory Opinion on the "Obligations of States in Respect of Climate Change[7]".

At this stage, I draw the Secretary of State's attention to these sections from the Opinion:

> 427: … "*Failure of a State to take appropriate action to protect the climate system from GHG emissions — including through fossil fuel production, fossil fuel consumption, the granting of fossil fuel exploration licences or the provision of fossil fuel subsidies — may constitute an internationally wrongful act which is attributable to that State. The Court also emphasizes that the internationally wrongful act in question is not the emission of GHGs per se, but the breach of conventional and customary obligations identified under question (a) pertaining to the protection of the climate system from significant harm resulting from anthropogenic emissions of such gases.*"
>
> *353: The Court considers that, in the context of climate change and in view of the impact of anthropogenic GHG emissions on the marine environment, Article 206 of UNCLOS requires States parties, as far as practicable, to conduct EIAs when there are reasonable grounds for believing that planned activities under their jurisdiction or control which emit GHGs may cause substantial pollution or significant and harmful changes to the marine environment. This obligation also extends to activities with an impact on areas beyond national jurisdiction …"*

4 Update on scientific and technical background

In my written representation to the examination [REP2-046], I laid out "tests" for the ExA and Secretary of State to consider (see, Summary on Page 2 of REP2-046]. I also presented sensitivity tests on the GHGs from the project as part of the Environmental Statement for the project.

I now update these matters, given recent science and further development of my own modelling since the examination closed. (Further sensitivity tests will be presented in a later section).

4.1 The four key ways of underestimating emissions

For brevity, I refer the SoS to my submission to his on-going Whitehead review (Appendix A, section 3.4). Here I lay out the four key ways in which emissions are underestimated for Carbon Capture projects. These are:

I. Overestimation of carbon capture rate
II. Venting of CO2 may not be included or is underestimated
III. Upstream emission factors: underestimated and don't reflect changes to natural gas supply
IV. The rapidly evolving science on methane emissions and their impact of the global climate

[7] https://www.icj-cij.org/sites/default/files/case-related/187/187-20250723-adv-01-00-en.pdf

In this letter, I am concerned primarily with the 3rd and 4th underestimations. The SoS is referred to my submission to his Whitehead review on the 1st and 2nd points (Appendix A). I now present more detailed material on the 3rd point, and then the 4th point. There may be some repetition from submissions made at the examination: however, my narrative has been updated, and it is essential that the Secretary of State looks at the issue freshly and considers this material for his reasoned conclusion of the environmental impacts of the project.

III. Upstream emission factors: underestimated and don't reflect changes to natural gas supply

Upstream emissions relate to the supply chain emissions in the natural gas supply. They involve leakage of methane (natural gas) from extraction and pipelines. Where Liquified Natural Gas (LNG) is the supply, they also involve methane leakage from compressing the gas, and regasifying it, and also shipping emissions. These are upstream Scope 3 emissions, both CO2 and methane. To obtain an accurate measure of these emissions is a very complex area as it is dependent upon industry practices across many nations, and the changing nature of the UK natural gas supply.

The key message, of which the Secretary of State must take heed, is that upstream emissions in the natural gas supply chain have been systemically underestimated, and this is now coming to light both from real-world evidence such as satellite methane detection, and academic analysis. **Of the latter, recent academic studies which have calculated both upstream methane and CO2 emissions from supply chains from first principles (for example, Zhu et al (2024)[8], Howarth (2024)[9], and a Carbon Tracker[10] 2024 report.**

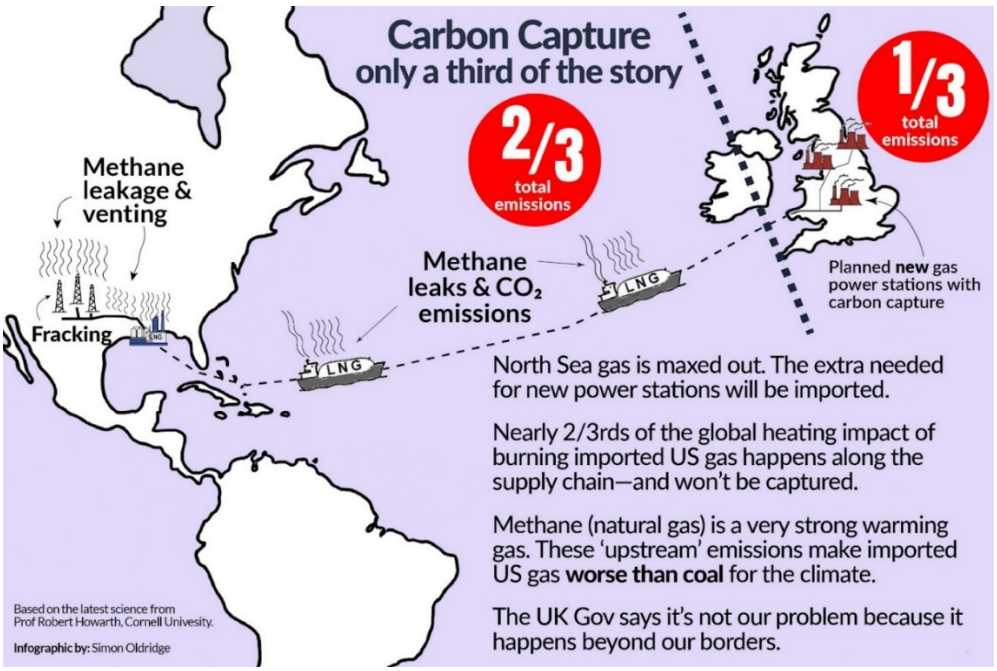

Figure 1: Infographic on supply chain emissions for UK gas+CCS projects

[8] https://pubs.acs.org/doi/10.1021/aCCSuschemeng.4c07255

[9] https://scijournals.onlinelibrary.wiley.com/doi/10.1002/ese3.1934

[10] https://carbontracker.org/reports/kind-of-blue/

III. i. Academic GHG footprints for LNG from first principles

The 2024 paper by Professor Robert Howarth[11] is a landmark study which shows that due to the powerful warming impact of methane leaks and shipping emissions along the supply chain for LNG exported from the US, only a third of greenhouse gas emissions occur at the point of use (eg at a UK gas-CCS or blue hydrogen plant). This is illustrated in the infographic above. So even if CCS were to achieve a high capture rate, around the 2/3rds of the carbon footprint arising elsewhere in the supply chain cannot be mitigated. Pre-publication drafts of this paper resulted in the Biden administration pausing new licences for LNG export from the US[12] in January 2024.

With respect to the Howarth paper, the Secretary of State must consider the following. The paper has been fully peer reviewed and was revised to reflect review comments. The paper calculates upstream emissions from first principles – calculating emissions at every stage. Table 1 of the paper summarises this and includes stages for: Upstream and midstream methane and CO2; Downstream methane; Liquefaction for methane and CO2; Tankers for Methane slip, Fuel consumption, Boil-off using Cargo volume and Voyage times data. Each of the major parameters is meticulously based on the latest references in the literature. Howarth's methane emission factor is "*derived from the very latest data set from a large body of independent observations from nearly one million aerial site measurements*[13] *and far better reflects the current state of the science*". The Howarth paper is thorough and must be treated as the very latest science on LNG emissions.

III. ii. Detailed issues for upstream emissions

Another recent report from Carbon Tracker "Kind of Blue"[14] sets out in detail the key issues which act together to compound the climate impact of gas-CCS or blue hydrogen production, including:

(A) The emission factors used for upstream emissions in the natural gas supply chain are underestimated. There are two compounding factors – underestimating the methane leakage in any particular source of natural gas and underestimating the effects of the changing balance of UK natural gas between UK and Norwegian gas (lower upstream emissions) and imported gas, especially LNG (higher upstream emissions).

(B) Although the Secretary of State's department (DESNZ) publishes emissions factors annually[15], underestimating has been historically perpetuated by using data self-reported by fossil fuel companies, and based on unpublished estimated leakage rates from up to 40 years ago.

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[11] Howarth, "The greenhouse gas footprint of liquefied natural gas (LNG) exported from the United States", Energy Science & Engineering, October 2024, https://scijournals.onlinelibrary.wiley.com/doi/10.1002/ese3.1934

[12] White House Fact Sheet, "Biden-Harris Administration Announces Temporary Pause on Pending Approvals of Liquefied Natural Gas Exports", https://www.whitehouse.gov/briefing-room/statements-releases/2024/01/26/fact-sheet-biden-harris-administration-announces-temporary-pause-on-pending-approvals-of-liquefied-natural-gas-exports/

[13] Sherwin ED, Rutherford JS, Zhang Z, et al. US oil and gas system emissions from nearly one million aerial site measurements. Nature. 2024;627:328-334. doi:10.1038/s41586-

024-07117-5

[14] Carbon Tracker, "Kind of Blue", 2024, https://carbontracker.org/reports/kind-of-blue/

[15] The latest being https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2024

A 2023 paper[16] in the Royal Society of Chemistry journal *Energy & Environmental Science* ("RSC paper") reported on the likely substantial underestimation of reported methane emissions from United Kingdom upstream oil and gas activities. The paper found that the total UK methane CH4 emissions from flaring, combustion, processing, venting, and Oil & Gas transfer to be 289 Gg CH4 (0.72% of production). This figure is five times larger than the estimate from United Kingdom (UK) government's National Atmospheric Emissions Inventory (NAEI) is used to provide UK greenhouse gas emission data to the United Nations Framework Convention on Climate Change. NAEI estimated the equivalent figure for 2019 to be 52 Gg CH4, corresponding to the loss of 0.14% of production. The paper stated, "*The difference between current estimates used by NAEI and our estimates, which use more recent research findings, strongly suggests that the current methods of compiling national GHG inventories in the UK, and likely elsewhere, are outdated (oldest [Emission Factor] derived in 1982) and systematically underestimate emissions.*" The reason given was "*Most of the emission estimates are derived using a bottom up approach that takes 30 to 40 year-old [Emission Factor]s from available unpublished literature (flaring and loss in pipelines), unavailable unpublished literature (venting and offshore oil unloading) or expert opinion (fugitive emissions).*"

This is one example of how in recent years, satellite and remote sensing has achieved much a more accurate picture of upstream methane emissions, and that this is revealing this systemic underestimation, including in Government emission factors[17],[18].

(C) The Secretary of State should note that the UK Government has claimed "*the UK is one of only four countries in the world that uses an independent system of Earth Observation measurements to supplement its greenhouse gas inventory and the first to do so*[19]". Whilst this statement may be true in parts, it does not extend to the emissions factors published by his department.

Examination of the annual "major changes" documents which are published with the DESNZ conversion factors shows that the emission factor for upstream emissions in the natural gas supply (Well-to-tank, "WTT-fuels") was last reviewed in 2021[20]. The associated methodology paper for 2021[21]shows that some changes were made to reflect volumes of LNG being imported. However, these changes were effectively only tweaks[22] to the 2015 report from Exergia[23] which is based on an outdated methodology, and does not reflect the recent academic papers quoted in the section, nor the latest satellite and remote sensing data. Effectively, 2015 methodology and data are still being used by the UK Government.

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[16] Stuart N. Riddick, Denise L. Mauzerall. Likely substantial underestimation of reported methane emissions from United Kingdom upstream oil and gas activities. Energy & Environmental Science, 2023; 16 (1): 295 DOI: 10.1039/d2ee03072a, https://pubs.rsc.org/en/content/articlehtml/2023/ee/d2ee03072a

[17] The latest being https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2024

[18] Carbon Tracker, "Kind of Blue", page 14 *"Numerous independent reports have pointed out that there is still a large gap between the emissions self-reported by major fossil fuel companies and emissions estimated via satellites or remote sensing <footnote 26>. In particular, the IEA reports that most of the self-reporting is today based on reference values instead of measured emissions and that the difference between the two approaches could be massive."*

[19] https://questions-statements.parliament.uk/written-questions/detail/2024-12-09/18534/

[20] See https://assets.publishing.service.gov.uk/media/61ee7e2ae90e0703731d3b5d/2021-ghg-conversion-factors-major-changes.pdf

[21] Sections 2.19 to 2.23, and Table 4 of https://assets.publishing.service.gov.uk/media/61ee7e198fa8f5058d5a7771/2021-ghg-conversion-factors-methodology.pdf

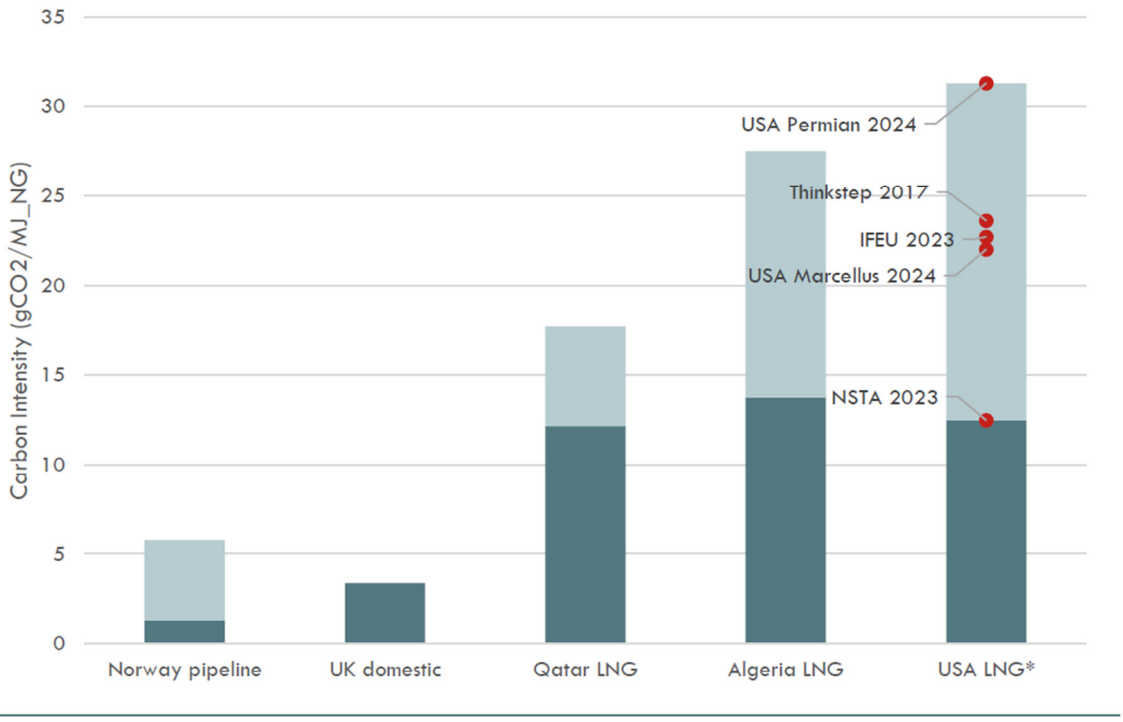
[22] Sections 2.19 of https://assets.publishing.service.gov.uk/media/61ee7e198fa8f5058d5a7771/2021-ghg-conversion-factors-methodology.pdf

[23] https://energy.ec.europa.eu/system/files/2015-08/Study%2520on%2520Actual%2520GHG%2520Data%2520Oil%2520Gas%2520Final%2520Report_0.pdf

Use of these outdated emission factors by the applicant is at the basis of the applicant's failure to genuinely apply the Rochdale envelope to the EIA. Essentially, the "full knowledge" approach has not been applied. The full knowledge in terms of emissions factors based on recent academic work, such as the Howarth paper, is out there and available, but the applicant has chosen to ignore it.

(D) The source of the natural gas is important given the very different scale of emissions possible[24]. LNG imports have a much greater upstream emission footprint than UK domestic or Norwegian pipeline sources, see below.

FIG 7: NATURAL GAS UPSTREAM EMISSIONS VARY WIDELY DEPENDING ON THE ORIGIN COUNTRY AND TRANSPORT ROUTE



Source: Carbon Tracker (2024); based on multiple sources available in Appendix Table 5.

Figure 2: Carbon intensity for different Natural Gas supplies[25]
(the lighter shading shows the range of carbon intensities)

(E) UK sources of natural gas are declining, and imports are growing[26].

(F) LNG imports are predicted to grow, and DESNZ's December 2023 report "The role of gas storage and other forms of flexibility in security of supply"[27], notes:

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[24] Carbon Tracker, "Kind of Blue", page 13, "Upstream emissions vary widely depending on the origin of natural gas, due to different extraction processes (conventional, fracking), transportation (pipeline, LNG shipping) and the leakages in the full supply chain."

[25] Carbon Tracker, "Kind of Blue", page 13,

[26] Carbon Tracker, Kind of Blue, page 14, "*Natural gas production in the UK has been in steep decline since the 2000s and, in the last ten years, it stabilised around half of the national supply with the rest being imported via pipeline (mostly from Norway) or LNG. Domestic production is expected to drop further in the coming decades while pipeline imports from Norway are also expected to decrease, though more slowly.*"

[27] DESNZ, December 2023, "Role of gas storage and other forms of flexibility in security of supply", pages 19-20, https://www.gov.uk/government/publications/role-of-gas-storage-and-other-forms-of-flexibility-in-security-of-supply

> *"… the UK's import dependence for both LNG and interconnector gas supply is projected to rise from a predicted 13% in 2023 to around 32% by 2030. This is forecast to peak at around 58% in 2045, falling to 50% by 2050. It is likely that LNG will make up a significant proportion of these future gas imports."*

Although interconnector and LNG supplies are conglomerated in the above quote, based on DESNZ Statistics from March 2024, Carbon Tracker estimated that in 2023 LNG accounted already for 24% of the UK's total gas supply[28]

Critically, the DESNZ December 2023 report also identified that further research and analysis was required[29] on the methane emission intensity from the gas supply:

> *"As we import more gas, we are also mindful that the level of greenhouse gas emissions from overseas extraction, liquefaction and shipping of LNG varies considerably and is, in many cases, higher than UKCS[30] production. NSTA research shows that the production and transportation emissions of CO2 associated with LNG imports are on average over quadruple the global emission intensity of UKCS gas production. Further research and analysis is needed to develop our understanding of the methane emissions intensity of different sources of gas supply."*

According to Paradigm Futures, the recent US-UK trade deal cements "US Dominance" in LNG exports to the UK[31]. Whilst the Oil and Gas journal recently reported that "*LNG imports increased by 42% in Jan-Mar 2025 compared with the same period in 2024*"[32]. Whilst ReportLinker predict that LNG usage in the UK will increase at over 3% a year from 2023[33].

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[28] Carbon Tracker, "Kind of Blue", page 16

[29] DESNZ, December 2023, "Role of gas storage and other forms of flexibility in security of supply", pages 19-20, https://www.gov.uk/government/publications/role-of-gas-storage-and-other-forms-of-flexibility-in-security-of-supply

[30] UK Continental Shelf

[31] https://paradigmfutures.net/a/general/us-uk-strategic/ "**LNG: Cementing U.S. Dominance**

As the UK transitions its energy system, LNG has become increasingly central. Between 2019 and 2023, LNG imports grew from roughly 500 to 688 billion cubic feet, with a peak of 921 BCF in 2022. U.S. exporters accounted for 407 BCF of UK imports in 2023 alone. The trade agreement enhances U.S. positioning by recognizing it as a long-term strategic partner—critical in a post-Russia energy landscape where secure, diversified sources are paramount."

[32] https://www.ogj.com/general-interest/economics-markets/article/55300043/uk-natural-gas-imports-surge-as-production-drops

[33] https://www.reportlinker.com/dataset/e734eb04246d46b32f7226d18e2315e79c907bfb#:~:text=The%20imported%20volume%20of%20Liquefied,Gas%20Import%20in%20the%20UK "- 2024: +3.85%; - 2025: +3.86%; - 2026: +3.69%; - 2027: +3.54%; - 2028: +3.39%"

III. iii. UK CCS as driver for UK LNG imports

The overall scale of CCUS planned, including gas+CCS projects at Net Zero Teesside and at Peterhead, in the UK will also become a driver for increased LNG imports. Carbon Tracker found that 4 GW of blue hydrogen and 9 GW of gas-CCS plants are planned by 2035[34], and report that:

> *"We estimate that if all the gas-based CCUS projects proposed by the UK's Net Zero strategy are built, by 2035 new gas demand could two times greater than the projected domestic production requiring an inevitable reliance on LNG imports."*

Carbon Tracker have also developed a model of a long-term gas outlook built on UK Government and other projections which broadly shows that, even assuming the unlikely development of new gas licenses in the 2030s, the 2030s the share of imported LNG could average around 50%[35].

Currently, the oil and gas sector has proposed a long pipeline of new CCS projects in the UK. According to Carbon Capture and Storage Association's UK CCS Project Pipeline[36], there are 64 projects under consideration in the country. This includes six new fossil gas projects[37] and twelve new blue hydrogen projects[38].

The evidence is that imported LNG will play an increasingly significant role in meeting UK natural gas demand.

III. iv. Indirect emissions driven by UK CCS demand for LNG

Since cheaper pipeline gas will always be utilised first before turning to expensive LNG, any extra demand created by investing in new gas power stations or blue hydrogen production will, at a national level, be met entirely by imported LNG. Another way of putting this is that additional demand from new CCS facilities like the H2 Teesside project will generate new indirect upstream emissions in the UK LNG Supply chain – these are attributable to the new CCS facility. With UK pipe gas supply already maxed out, this additional demand can only be met by LNG imports. **Life cycle assessments for new CCS-enabled plants, such as the Track-1 and Track-2 start-up projects, including H2 Teesside, should therefore treat the methane gas input as 100% provided by LNG imports.**

The Secretary of State should also note that the Permian basin is strongly linked to increased US LNG exports as it is close to the Gulf Coast export facilities. Natural gas production growth on the US Gulf Coast and in the Southwest reflects increased extraction activity in the Haynesville Formation and Permian Basin[39]. Permian Basin gas will form an increasing and high proportion of

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[34] Carbon Tracker, "Kind of Blue", Pages 26-27

[35] Lorenzo Sani, Carbon Tracker, personal communication, Sept 2024

[36] https://www.ccsassociation.org/capture-projects/

[37] C.Gen Killingholme, Keadby Carbon Capture, Net Zero Teesside Power, Peterhead Carbon Capture, Stallingborough Carbon Capture CCGT, Whitetail Clean Energy

[38] Acorn Hydrogen, H2NorthEast Phase 1, Vertex HPP1, H2H Saltend, INEOS Grangemouth Fuel Switching Net Zero, H2NorthEast Phase 2, Humber H2ub, Vertex HPP2, H2H Production 2, VPI Immingham Hydrogen, H2 Teesside

[39] https://www.lngindustry.com/liquid-natural-gas/01052023/eia-us-natural-gas-production-and-lng-exports-will-likely-grow-through-2050/#:~:text=In%20the%20reference%20case%2C%20the,production%20growth%20in%20the%20Southwest

LNG exports due to the building of a number of pipelines to the Gulf Coast[40] including the recent Matterhorn pipeline[41] which started supplying gas in October 2024. This supports the use of the Howarth paper emission factor(s) as a reasonable worst case for the H2 Teesside GHG EIA.

III. v. UK DESNZ emissions factors out-of-date

The DESNZ emission factors, used by the applicant, are based on a 2015 report from Exergia[42]. The ten-year old report does not reflect the latest scientific findings on upstream emissions, particularly the more accurate measurement by satellites and remote sensing available now. The evidence base of this Exergia report is quite clearly outdated.

The Secretary of State should note that it is imperative for DESNZ to update its methodology and assessment of emission factors. The planning decision by his department cannot, and must not, rely on these out-of-date conversion factors. It is imperative that the Secretary of State and DESNZ require that the Environmental Impact Assessment (EIA) is reworked using emission factors for upstream emissions which are consistent with the latest science and the latest satellite data, outlined above.

In summary, the upstream GHG footprint for the UK natural gas supply is underestimated by existing emissions factors, and the growth of high carbon intensity imports, such as LNG, are overlooked in emission factors. In short, the emission factor(s) used by DESNZ is an out-of-date underestimate as shown by recent measurements by satellites or remote sensing, academic analysis, and does not reflect future scenarios of gas supply. **The DESNZ data does not provide the basis for scientifically congruent greenhouse gas assessment.**

IV. The rapidly evolving science on methane emissions and their impact of the global climate

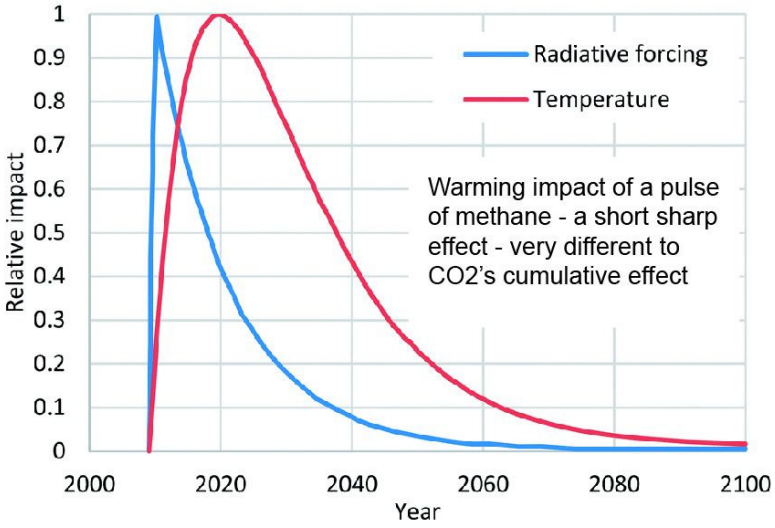
As described, the most significant carbon footprint for the Track-1 and Track-2 gas-CCS and blue-hydrogen plants, such as H2 Teesside, comes from methane and other upstream emissions in the supply of the gas. A further crucial issue is that methane has a half-life in the atmosphere of around 10 years which means that its effects on global heating is concentrated in the first 20 years from its release. This is shown in the figure[43] below which shows the atmospheric effect, known as "radiative forcing" (blue line), of a methane pulse in 2010 being largely complete by 2030 (although actual physical temperature change trails in time).

[40] https://www.eia.gov/todayinenergy/detail.php?id=63044#:~:text=Natural%20gas%20pipeline%20takeaway%20capacity%20in%20the,EnLink%20Midstream%2C%20one%20of%20the%20project's%20stakeholders

[41] https://matterhornexpress.com/#:~:text=The%20Matterhorn%20Express%20Pipeline%20is,Katy%20area%20near%20Houston%2C%20Texas

[42] https://energy.ec.europa.eu/system/files/2015-08/Study%2520on%2520Actual%2520GHG%2520Data%2520Oil%2520Gas%2520Final%2520Report_0.pdf

[43] From: Balcombe etc al, 2018, "Methane emissions: choosing the right climate metric and time horizon", https://pubs.rsc.org/en/content/articlelanding/2018/em/c8em00414e



From Study: "Methane emissions: choosing the right climate metric and time horizon"

Figure 3: The short sharp effect of methane emissions

It is urgent to reduce methane emissions. This was recognised by global policy initiatives like the Global Methane Pledge[44] signed by over 150 countries[45] at the United Nations Climate Change conference in November 2021 (COP26), including the UK as COP26 host country. The UN said in 2021 that sharp cuts to methane (45% this decade) would avoid nearly 0.3° of warming by 2045[46]. Yet in September 2024, Carbon Brief reported that levels of methane in the atmosphere have soared by record-breaking amounts since 2020[47].

Urgent action on methane emissions is even more important following recent science finding that we are closer to crossing dangerous tipping points than previously thought. Of key concern is the abrupt collapse of the Atlantic Meridional Overturning Circulation (AMOC) ocean current which stops UK temperatures plunging to those seen in northern Canada—which several new studies now find could well start irreversibly within the next few decades on current emissions trajectories[48]. The Scottish Government should note that this was highlighted at the July 2025 conference at Exeter University on Global Tipping Points and endorsed by over 200 experts in an urgent message to world leaders[49].

Despite, these very significant concerns about methane emissions, the emissions factors (such as the DESNZ ones) used to model and assess upstream emissions from CCS plants use an outdated model of the radiative effects and climate impacts. This is due to a historical quirk from

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[44] https://www.globalmethanepledge.org/

[45] Now signed by over 150 countries, Carbon Brief, https://www.carbonbrief.org/qa-why-methane-levels-are-rising-with-no-hint-of-a-decline/

[46] UNEP, May 2021, "Global Assessment: Urgent steps must be taken to reduce methane emissions this decade, https://www.unep.org/news-and-stories/press-release/global-assessment-urgent-steps-must-be-taken-reduce-methane

[47] Carbon Brief, 10 September 2024, "Q&A: Why methane levels are rising with no 'hint of a decline'", https://www.carbonbrief.org/qa-why-methane-levels-are-rising-with-no-hint-of-a-decline/

[48] Rahmstorf, Oceanography, April 2024, "Is the Atlantic Overturning Circulation Approaching a Tipping Point?", https://tos.org/oceanography/article/is-the-atlantic-overturning-circulation-approaching-a-tipping-point

[49] https://news.exeter.ac.uk/faculty-of-environment-science-and-economy/tipping-points-experts-issue-urgent-message-to-world-leaders/#:~:text=These%20include%20a,change%20and%20deforestation. *"'Tipping points' experts issue urgent message to world leaders"*

international standards developed in the 1990s which model methane's climate impact over 100 years rather than over the much more realistic 20 years. By effectively spreading the radiative forcing effect over 100 years, this approach significantly underestimates methane's impact over the 20 years in which most of its global heating impact is originated, and is the timescale in which we need decisive action to avoid runaway global heating.

Technically, this is described as the emission factor being based on a 100-year Global Warming Potential (GWP) called GWP100 rather than a 20-year GWP called GWP20.

Recently Professor Robert Howarth of Cornell University who has advised the US Government and given evidence to the Senate Climate Change Task Force published a landmark paper[50] in which he explains the issue with the different GWPs as in the footnote. Note, also that Professor Howarth states that the use of US exported LNG always has a larger greenhouse gas footprint than coal. Professor Howarth also identifies in the footnote quote that methane has been responsible for around 2/5ths of the global heating temperature rise to date.

4.2 Where does the natural gas supply chain fit in the UK carbon budget regime

Natural gas may be sourced either from UK fields, or by pipeline from Norway, or as Liquified Natural Gas (LNG) shipped from far afield places such as Qatar or the US. But whatever private contracts the operators of new CCUS projects enter into, at a UK national level, all the extra demand will have to be satisfied by LNG imports. The fact that UK is already importing expensive LNG, the share of which is set to grow, provides evidence that cheaper pipeline gas output is already maxed out.

The very high carbon footprint from natural gas supply occurs both within UK territories as covered under UK carbon budgets (under the Climate Change Act 2008) and ex-territorially when the gas comes from other countries.

With LNG, the ex-territorial LNG supply chain emissions then form part of UK consumption emissions and ex-territorial greenhouse gas emission inventories: for example, GHGs international shipping inventories and for other countries. The UK-territorial emissions for natural gas supply fall under the Fuel Supply sector in the carbon budgets under the Climate Change Act 2008.

As the majority of upstream emissions generated by UK demand for natural gas occur outside UK territory, making policy on the basis of UK territorial emissions **only** does not make sense. However, this is what the Government and Climate Change Committee (CCC) do, by just

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[50] "The greenhouse gas footprint of liquefied natural gas (LNG) exported from the United States", Energy Science & Engineering, October 2024, https://scijournals.onlinelibrary.wiley.com/doi/10.1002/ese3.1934 :

"While the 100-year time frame of GWP100 is widely used in lifecycle assessments and greenhouse gas inventories, it understates the extent of global warming that is caused by methane, particularly on the time frame of the next several decades. The use of GWP100 dates to the Kyoto Protocol in the 1990s, and was an arbitrary choice made at a time when few were paying much attention to the role of methane as an agent of global warming. As the Intergovernmental Panel on Climate Change stated in their AR5 synthesis report, "there is no scientific argument for selecting 100 years compared with other choices" (IPCC 2013). The latest IPCC AR6 synthesis reports that methane has contributed 0.5° C of the total global warming to date since the late 1800s, compared to 0.75° C for carbon dioxide (IPCC 2021). The rate of global warming over the next few decades is critical, with the rate of warming important in the context of potential tipping points in the climate system (Ritchie et al. 2023). Reducing methane emissions rapidly is increasingly viewed as critical to reaching climate targets (Collins et al. 2018; Nzotungicimpaye et al. 2023). In this context, many researchers call for using the 20-year time frame of GWP20 instead of or in addition to GWP100 (Ocko et al. 2017; Fesenfeld et al. 2018; Pavlenko et al. 2020; Balcombe et al. 2021, 2022). GWP20 is the preferred approach in my analysis presented in this paper, as was the case for our earlier lifecycle assessment of blue hydrogen (Howarth & Jacobson 2021). Using GWP20, LNG always has a larger greenhouse gas footprint than coal."

considering UK territorial emissions. So policies to tackle climate change and reduce emissions are being created without consideration of most of the emissions being generated.

This point is relevant to the applicant's assessment made of the H2 Teesside emissions which based upon comparisons with UK and Scottish carbon budgets.

4.3 CCC and DESNZ policy making on gas imports does not follow Treasury Green Book guidance

The CCC and DESNZ has not followed Treasury Green Book guidance on treatment of CO2 emissions[51]. Supplementary guidance to Treasury's Green Book provides guidelines to government analysts for quantifying GHG emissions. The main document[52] explains that policies and projects can affect GHG emissions "*directly through changes in energy use, or indirectly through planning, land use change, construction or the introduction of new policies that use energy*." The guidance states that proposals can have "*a significant impact on emissions produced abroad"*. Critically, the Green Book guidance calls for **counterfactual modelling of emissions**, stating at 3.34 *"A policy or project that increases or decreases GHG emissions domestically or internationally relative to a 'business as usual' scenario is required to quantify the change in emissions"* and that emissions should be assigned a monetary value by using carbon cost values provided in an associated spreadsheet.

This should apply both to biomass imports and LNG imports. This guidance is for assigning a monetary value to carbon emissions using Treasury carbon cost values, and it is clear that ex-UK emissions generated by from UK activities (eg: consuming fossil fuels and producing blue hydrogen at H2 Teesside) should be accounted for in monetary terms. It follows that such emissions should be accounted for in policy making, and planning decsion such as the H2 Teesside project.

However, CESL have seen no evidence that CCC and DESNZ are following these guidelines – either for monetary and value for money appraisal, or for greenhouse gas and climatic impacts – in policymaking. In fact, a recent FoI (see Appendix B) shows that calculations for the CCC Sixth Carbon budget report on upstream emissions from natural gas were made in line with "territorial emissions accounting". My understanding is that the same assumptions has been made in the Seventh Carbon Budget report.

This Nelson's blind eye approach means that the economic impacts of the upstream emissions associated with gas consumption at H2Teesside have not been considered. **The Secretary of State should consider the real costs of the huge GHG emissions from the H2 Teesside project, and calculate them according to Green Book guidance.** When accounted properly against full operational GHGs (as presented later), the carbon costs will hugely outweigh any benefits.

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[51] **Please read pages 12-15** from - Comments to the UK Subsidies Advice Unit on the proposed subsidy to Drax Power from the Partnership for Policy Integrity and The Lifescape Project, , https://forestlitigation.org/wp-content/uploads/2025/06/PFPI-Lifescape-comments-on-Drax-subsidy-June-12-2025.pdf

[52] https://assets.publishing.service.gov.uk/media/65aadd020ff90c000f955f17/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal.pdf ; full list of relevant docs at https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal

4.4 UK policy making only sees a small part of the full GHG footprint

There is a very severe concern above that UK policy making has predominantly been concerned with only those emissions which come under the UK territorially based Climate Change Act 2008.

And as confirmed above, a recent FoI (see Appendix B) shows that calculations for the CCC Sixth Carbon budget report were made in line with "territorial emissions accounting". My understanding is that the same assumptions has been made in the Seventh Carbon Budget report.

In other words, and the Secretary of State should note this, the UK has developed its own climate policy incorporating CCUS without concern for the international climate impacts from the natural gas demand inherent in the policy. This blind approach to policy making infects decisions, such as the planning decisions for H2 Teesside now before him.

5 Evidence from CESL on full lifecycle GHG emissions

Since the DCO planning examination, new science has become available. I previously provided sensitivity tests for the GHGs at H2 Teesside. I have now updated my analysis for H2 Teesside based on the emissions factors from Professor Robert Howarth's paper – this provides a revised reasonable worst case scenario for the GHGs for H2 Teesside.

For simplicity and accessibility, I have summarised my analysis into a single Table given below, and I have sourced/referenced my assumptions as fully as possible. Should the Secretary of State wish to have my full spreadhseet model, I am more than happy to provide it on request.

I start with data provided by the developer from its Environmental Impact. The first row of my table reproduces full lifecycle construction and operation EIA data from the applicant.

I then make sensitivity tests on two key factors:

(1st) **Realistic upstream emissions.** In the case of natural gas (for new fossil fuel based infrastructure), the extra demand for gas for the new infrastructure will, at a national level, be met entirely by imported LNG, with cheaper UK gas or Norwegian pipeline gas always being utilised first in the existing market demand. Therefore, the upstream emissions in this sensitivity test are based upon imported LNG supplies meeting the demand created by the new CCS infrastructure at H2 Teesside.

(2nd) **Realistic CO2 capture rates.** This sensitivity test models a 70% capture rate.

The figures show that upstream emissions are by far the major effect. The applicants are modelling the upstream emissions at around one tenth of their potential impact. The data is now given.

5.1 Full lifecycle emissions for blue hydrogen at H2 Teesside

I calculate below a summary of the full lifecycle emissions for the proposed blue hydrogen plant at H2 Teesside in three scenarios:

- Based on full lifecycle construction and operation EIA data, submitted by developers BP to the planning examination over 25 years. Using applicant's Phase 2 operation data for upstream emissions gives 20,009,374 tCO2e[53] over 25 years.
- A sensitivity test "Howarth" based upon upstream supply chain emissions data from the recent paper by Prof Robert Howarth for LNG supplied natural gas from Texas, transported on a 9070 km journey from Sabine Pass, TX to the UK.
- A further sensitivity test on "Howarth" which uses a 70% CO2 capture rate, a more realistic capture rate[54].

25-year full lifecycle tCO2e	ATR Process Not Captured	Construction & Decommissioning	LCHS Other Scope 1,2&3	Other Scope 1,2&3	CO2 venting	CO2 Captured	Upstream	TOTAL Emitted	CO2 Stored	% Capturable	% Captured & Stored
Blue H2Teesside @95%CCS – BP's submitted EIA	3,399,000	180,699	1,004,175	6,650	4,197,775	64,581,000	11,221,075	20,009,374	60,383,225	80.4%	71.4%
submitted EIA + Howarth + 90%CCS	6,798,000	180,699	1,004,175	6,650	3,976,830	61,182,000	115,945,273	127,911,627	57,205,170	36.0%	30.3%
Howarth- 70% CCS	20,394,000	180,699	1,004,175	6,650	3,093,090	47,586,000	115,945,273	140,623,887	44,492,910	36.1%	23.6%

[53] This is based on 25 years operation of Phase 2 of the plant. It is slightly different value to BP's figure of **19,133,421 tCO2e** which is based on hybrid calculations of Phase 1 and Phase 2 operation over 25 years. [**See my submission REP3-017, section 4.8** – 'The Applicant bases its EIA assessment on the 25-year Phase 2 operation period. However, for the comparison with the Relevant CBDP Sectoral Carbon Budget Projections in Table 19-11, the Applicant's calculation has introduced "hybrid" numbers which are a mixture of Phase 1 (Table 19-8) and Phase 2 (Table 19-9) data. This has actually confused the Applicant itself too when it reveals further down the "error" associated with the T&S unavailability data where it used only Phase 2 data.'

[54] CCS has a poor track record of capturing CO2 from combustion and hydrogen processing (known as Scope 1 emissions). No known commercial system has exceeded 80% and much lower capture rates are prevalent. See the research from the Institute of Energy Economics and Financial Analysis (IEEFA) who have recently researched the CCS market and reviewed existing commercial projects, see (IEEFA), Morrison, K, "The Good, the Bad, and the Ugly reality about CCS (Carbon Capture and Storage)", slide 12, https://ieefa.org/sites/default/files/2024-03/CCSpresentation4-MPCMarch24_CK.pdf

Notes:

1. The "Howarth" sensitivity test uses a Global Warming Potential of 20 years ("GWP20") for methane. This is scientifically correct for capturing the real climate impacts of methane which has a half-life in the atmosphere of around 10 years. Professor Howarth explains the issue with the different GWPs as in the footnote[55].

2. The "Howarth" sensitivity test attributes all gas supply to LNG from Texas as modelled by Professor Howarth. This is because any extra demand created by investing in new gas power stations or blue hydrogen production will, at a national level, be met entirely by imported LNG, with cheaper UK gas or Norwegian pipeline gas always having been utilised first to meet exisiting demand. It is acknowledged that the sensitivity case is a reasonable worst case because some LNG may be sourced from other countries such as Qatar, but US LNG is expected to be increasingly prevalent as an import to the UK[56].

A number of points arise from the Full Lifecycle emissions calculations provided in the Table above:

(A) The upstream emissions in the Howarth sensitivity test are over ten times greater than those in the BP supplied data based upon the UK Govt emissions factor. This is important showing that the UK emissions factors are out-of-date and severely underestimate upstream emissions as discussed in main text.

(B) The impact of this is only 36.0% of the full life-cycle emissions are capturable. Leading to the maximum possible storage of emissions as 30.3% (at 95% capture) or 23.6% (at 70% capture, adjusted for T&S unavailability (CO2 venting)).

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[55] "The greenhouse gas footprint of liquefied natural gas (LNG) exported from the United States", Energy Science & Engineering, October 2024, https://scijournals.onlinelibrary.wiley.com/doi/10.1002/ese3.1934 :

"While the 100-year time frame of GWP100 is widely used in lifecycle assessments and greenhouse gas inventories, it understates the extent of global warming that is caused by methane, particularly on the time frame of the next several decades. The use of GWP100 dates to the Kyoto Protocol in the 1990s, and was an arbitrary choice made at a time when few were paying much attention to the role of methane as an agent of global warming. As the Intergovernmental Panel on Climate Change stated in their AR5 synthesis report, "there is no scientific argument for selecting 100 years compared with other choices" (IPCC 2013). The latest IPCC AR6 synthesis reports that methane has contributed 0.5° C of the total global warming to date since the late 1800s, compared to 0.75° C for carbon dioxide (IPCC 2021). The rate of global warming over the next few decades is critical, with the rate of warming important in the context of potential tipping points in the climate system (Ritchie et al. 2023). Reducing methane emissions rapidly is increasingly viewed as critical to reaching climate targets (Collins et al. 2018; Nzotungicimpaye et al. 2023). In this context, many researchers call for using the 20-year time frame of GWP20 instead of or in addition to GWP100 (Ocko et al. 2017; Fesenfeld et al. 2018; Pavlenko et al. 2020; Balcombe et al. 2021, 2022). GWP20 is the preferred approach in my analysis presented in this paper, as was the case for our earlier lifecycle assessment of blue hydrogen (Howarth & Jacobson 2021). Using GWP20, LNG always has a larger greenhouse gas footprint than coal."

[56] The evidence is that imported LNG will play a significant role in meeting UK natural gas demand. Since cheaper pipeline gas will always be utilised first before turning to expensive LNG, any extra demand created by investing in new gas power stations or blue hydrogen production will, at a national level, be met entirely by imported LNG. Life cycle assessments for new CCS-enabled plants, such as the Track-1 and Track-2 start-up projects should therefore treat the methane gas input as 100% provided by LNG imports.

(C) In the latter 70% capture sensitivity test, less than one quarter of emissions are captured, and three quarters escape to the atmosphere accelerating global heating.

(D) The key bottom-line point is that BP H2 Teesside plant does not achieve "*an overall reduction in greenhouse gas emissions*".

5.2 Summary analysis

A number of points are now summarised from the data above.

(A) Using data from the 2024 Howarth paper, the upstream are over 10 times greater than those in the than those in the BP supplied data based upon the Secretary of State's departmental emissions factor. **This is important showing that the UK emissions factors are out-of-date and severely underestimate upstream emissions** as discussed in the section above "Upstream emission factors: underestimated and don't reflect changes to natural gas supply".

(B) The impact of this is only 36.0% of the full life-cycle emissions are capturable. Leading to the maximum possible storage of emissions as 30.3% (at 95% capture) or 23.6% (at 70% capture, adjusted for T&S unavailability (CO2 venting)).

(C) The overall footprint of the H2 Teesside blue hydrogen plant is up to 140MtCO2 over 25 years.

(D) The project is being put forward as the second emitter project in the Net Zero Teesside cluster. **For the Net Zero Teesside cluster to ever become carbon neutral over its lifetime, savings from other third party emitters need to first offset both the huge footprint of the Net Zero Teesside power plant, even when it is running in dispatchable mode, and the H2 Teesside blue hydrogen plant running at full production.**

(E) Currently, there is only one further emitter project being considered in Net Zero Teesside with relatively small emissions savings.

(F) **I am aware of no evidence which demonstrates how the Net Zero Teesside cluster can become carbon neutral over its lifetime when the full impacts of upstream emissions of its first two projects – Net Zero Teesside Power plant and H2 Teesside blue hydrogen plant - are calculated with the latest science.**

(G) This is the point being made in the previous section "UK policy making only sees a small part of the full GHG footprint".

6 Full knowledge EIA: Rochdale envelope and Reasonable Worst-case scenarios

I refer the Secretary of State to section 7.1 of my written submission REP2-046. This matter is so important that I summarise some of the issues again for the Secretary of State. I do not consider that the applicant has dealt with this at all.

At ES 19.3.2, the Applicant claims to have adopted the principles of the "Rochdale envelope". For EIA of GHGs, such an approach is required by the IEMA Guidance (with which the Applicant says its assessment is in accordance with at ES 19.1.1) when it states the assessment[57] "*methodology should result in a relevant, complete, consistent, transparent and accurate assessment of the reasonable worst-case. In most cases, the assessment should use activity data and emissions factors*".

However the applicant has not actually applied the Rochdale Envelope principles to its EIA assessment. Activity data has been provided. However, the translation of this activity data to a reasonable worst-case estimate of the GHGs associated with each activity has not been done in a way which is consistent with recent science.

In this representation, I apply the latest science, and find that the applicant's GHG description is severe underestimate with upstream emissions being underestimated tenfold against a reasonable worst case scenario based on the latest science. Therefore, the Rochdale Envelope principle has not been genuinely applied by the applicant, and the data presented in the EIA is not a reasonable worst-case.

In the recent Finch[58] the Supreme Court judgment, Lord Justice Leggett explained that the overarching purpose of EIA is that if consent is given for a development it is given *with full knowledge of the environmental cost.* This is not the case with the H2 Teesside project for GHGs. The Rochdale Envelope has not been genuinely applied, nor has a "full knowledge" EIA been produced.

I examine this out in more detail, what a "full knowledge" approach means, in the next section.

Lack of "full knowledge" is particularly striking in the EIA with respect to the *likely significant effects* of the three aspects of GHG emissions from the development which I summarise below. My two sensitivity tests for the GHG assessment are provided with the purpose of making a "full knowledge" description of effects for EIA. The three aspects lacking a "full knowledge" description are:

i. The future upstream emissions of the natural gas supply[59]. The applicant has used an emission factor which is outdated as it does not reflect the true upstream emissions as now measured by satellites and remote sensing, analysed in recent academic literature, nor the likely future sources of the natural gas supply.

[57] Institute of Environmental Management and Assessment (IEMA) for Assessing Greenhouse Gas (GHG) Emissions and Evaluating their Significance (IEMA, 2022), under Step 3 "assessment Methodology", page 19

[58] *R (on the application of Finch on behalf of the Weald Action Group) v Surrey County Council and others*

[59] As related to the GHG Scope 3 emissions associated with the activity "Natural Gas Demand" in ES Table 19-7

ii. The carbon capture rate[60], which the applicant has fixed as a minimum of 95% in, despite no commercial CCS plant delivering this capture rate.

iii. Using a 100-year GWP for upstream methane emissions[61], which does not reflect the real climate impact in the 20-year near term period that released methane acts, as detailed later.

6.1 What does "full knowledge" mean

In the recent Supreme Court judgment *R (on the application of Finch on behalf of the Weald Action Group) v Surrey County Council and others*, ("**Finch**"), Lord Justice Leggatt laid out the principles of Environmental Impact Assessment which in the UK are based on the EIA Directive[62].

At Finch para 3, Lord Leggatt describes the overarching purpose of EIA as follows:

> *"3. Before a developer is allowed to proceed with a project which is likely to have significant effects on the environment, legislation in the United Kingdom and many other countries requires an environmental impact assessment ("EIA") to be carried out. The object of an EIA is to ensure that the environmental impact of a project is exposed to public debate and considered in the decision-making process. The legislation does not prevent the competent authority from giving development consent for projects which will cause significant harm to the environment. But it aims to ensure that, if such consent is given, it is given with full knowledge of the environmental cost."*

In a more recent judgment on September 13th 2024, R (on the application of Friends of the Earth and another) v Secretary of State for Levelling Up, Housing and Communities and others on the Whitehaven coal mine ("**Whitehaven**") Holgate, J refers to Finch and says at paras 60 and 61:

> *'60. The object of an EIA is to ensure that the environmental impact of a project likely to have significant effects on the environment is exposed to public debate and then considered in the decision-making process on whether development consent should be granted. It aims to ensure that if such consent is given, it is given with "full knowledge of the environmental cost" [3].*
>
> *61. I would add that the meaning of the expression "full knowledge" is well-established. For example, in R v Rochdale Metropolitan Borough Council ex parte Milne [2012] Env. LR 22 Sullivan J (as he then was) explained at [94] that "full knowledge" does not connote some abstract threshold of knowledge which must be attained. The legislation seeks to ensure that as much knowledge as can reasonably be obtained, given the nature of the project, about its likely significant effects on the environment is available to the decision-maker.'*

Under a section "Predicting likely effects", Leggatt, LJ says (Finch, 72):

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[60] As related to GHG Scope 1 "Uncaptured CO2 emissions" in ES Table 19-7

[61] As related to the GHG Scope 3 "Natural Gas Demand" in ES Table 19-7

[62] Finch, 9: '*The 2017 Regulations are one of a number of UK statutory instruments designed to implement Directive 2011/92/EU of Page 4 the European Parliament and of the Council, as amended by Directive 2014/52/EU.*'

'72. Typically, when questions of causation arise in law the inquiry involves looking backwards to determine whether one past event caused another past event. In determining the required scope of an EIA, however, the inquiry is forward-looking. The question is: on the assumption that the project goes ahead, what possible future effects on the environment will constitute "effects of the project" which (if significant) must therefore be assessed? The EIA Directive answers that question by imposing the test of whether the effect is "likely". Thus, article 5(1)(b) requires the information provided by the developer to include "a description of the likely significant effects of the project on the environment" (emphasis added) and Annex IV further specifies what this obligation involves.'

7 PERSONAL POSITION STATEMENT

I have followed the science and policy debate around Carbon Capture and Storage for many years, with concerns which have now matured into those as expressed in this submission. I was an interested party at the planning examination for the Track-1 Net Zero Teesside gas fired (gas-CCS) power station, and following my submissions, the project promoters changed their Environmental Statement to include an estimate of upstream emissions from the fuel supply chain. I believe this the first example where an environmental assessment of upstream emissions in a UK CCS project, though it was a very limited underestimate for the same reasons as the H2 Teesside assessment is, as explained later in this document, has been made.

My work is motivated by genuine concern for planning and policy decisions on UK infrastructure to be made based upon the latest and correct scientific understanding. I continue here with that concern that planning and policy decisions should be made on the latest scientific understanding, and in particular this planning decision for H2 Teesside.

7.1 Transparency on campaigning position

I am the lead campaigner on the Scrap Carbon Capture (ScrapCC) campaign[63] which was started in May 2025 and after the end of the H2 Teesside examination. This campaign is supported by a number of NGOs including MP Watch[64] (who work alongside MPs and communities to champion evidence-based climate and nature policies), Zero Hour[65] (the campaign for a new UK law, the Climate and Nature Bill, that addresses the root causes of the climate-nature crisis) and the Campaign against Climate Change[66] (a UK-based campaign that aims to raise public awareness for the urgent action we need to prevent the catastrophic destabilisation of global climate) who are key partner campaign organisations. The campaign is supported wider by the NGO community.

Our campaign is evidence based and strongly supports a science-based approach to policy development. We are not ideological - the core principle of our work is to argue for rapid decarbonisation of our global society in the most effective way.

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[63] https://scrapcc.org/FILM

[64] https://www.mpwatch.org/

[65] https://www.zerohour.uk/

[66] https://www.campaigncc.org/

And I should make it very clear that the ScrapCC campaign is **not** opposed to CCS for industrial emissions where genuine decarbonisation may be possible. However, we do note that the case for industrial CCS may not be that strong, and in some areas superior long-term options are rapidly developing, for example in steel production[67]. It is generally better to electrify processes, rather than trying to patch over 20th Century technology with very costly CCS technology.

That said, there may be a case for CCS in some industries where there isn't yet a scalable alternative: for example, cement production. We consider that the case for any such industrial decarbonisation should be made outside the current CCUS cluster model approach which promotes clusters, such as the Net Zero Teesside cluster, around fossil fuel based anchor projects, such as the Net Zero Teesside gas+CCS project. This model locks in very high emissions at the outset before even any industrial emissions may be saved. Given very high upstream emissions from the gas based anchor projects when they are properly accounted, clusters may never even reach carbon neutrality.

8 CONCLUSIONS

In my written representation [REP2-046], I posed four key tests for the ExA and the Secretary of State. These remain fundamental to my submission, and I restate them here:

i. whether the full knowledge of the environmental cost of the project has been described in the ES (Finch [3]); and

ii. does the ES contain as much knowledge as can reasonably be obtained, given the nature of the project, about its likely significant effects on the environment (Whitehaven [61]);

iii. have the possible future effects on the environment been adequately described (Finch [72]); and

iv. has the EIA inquiry been "forward looking", and has it tested whether effects are likely (in the future), and then fully included and described them in the ES (Finch [72]).

In addition to the 15 key points that I made in my written representation [REP2-046, summary section], I make these further recommendations to the Secretary of State:

(A) That he takes heed that upstream emissions in the natural gas supply chain have been systemically underestimated, and this is now coming to light both from real-world evidence such as satellite methane detection, and academic analysis from first principles.

(B) That he must consider that the peer reviewed Howarth paper, referred to and used in my GHG assessment, is thorough and that it must be treated as the very latest science on LNG emissions for UK imports of US LNG. He should explicitly apply its findings, and emission factors, in considering its reasoned conclusion and decision on the H2 Teesside.

[67] https://ieefa.org/resources/carbon-capture-steel

(C) That he should note that UK emissions factors for upstream emissions have **remained unchanged since 2015**, and not been reviewed (except for minor tweaking as described).

(D) That his department should urgently carry out a systematic review of the emissions factors used for upstream emissions in the gas supply chain against the latest science, and take into account projections of LNG imports. Although I recommend refusal for H2 Teesside, it should not be consented until this has happened, and the applicant resubmits a revised data and assessment, based on reviewed DESNZ emissions factors.

(E) That it is imperative for his department to update its methodology and assessment of emission factors. His planning decision cannot, and must not, rely on these out-of-date conversion factors. It is imperative that he requires that the Environmental Impact Assessment (EIA) is reworked using emission factors for upstream emissions which are consistent with the latest science and the latest satellite data, as outlined.

(F) That methane emissions are properly represented, in policy making and planning decisions, for their climate impact over a twenty year period ie calculations of the climate impact of methane emissions should be based on GWP20. Although I recommend refusal for H2 Teesside, it should not be consented until GWP20 is incorporated as the best scientific representation of the climate impacts of methane, and the applicant resubmits a revised data and assessment, based on emissions factors based in GWP20.

(G) That he should note that the applicant has provided no evidence which demonstrates how the Net Zero Teesside cluster can ever become carbon neutral over its lifetime when the full impacts of upstream emissions are calculated with the latest science (for Net Zero Teesside Power and H2 Teesside).

(H) That he should consider and note that the UK has developed its own climate policy incorporating CCUS without concern for the international climate impacts from the natural gas demand inherent in the policy. And this blind approach infects this planning decision for H2 Teesside now before him.

(I) He is obliged to consider the international climate impacts from the demand and consumption of natural gas (a fossil fuel) in the UK following the ICJ landmark Advisory Opinion on the "Obligations of States in Respect of Climate Change[68]. He must consider, in making his planning decision, if he is taking appropriate action to protect the climate system from GHG emissions under paragraph 427 of the Advisory Opinion.

(J) He is obliged to conduct EIAs when there are reasonable grounds for believing that planned activities under his jurisdiction or control which emit GHGs may cause substantial pollution or significant and harmful changes to the marine environment following ICJ landmark Advisory Opinion on the "Obligations of States in Respect of Climate Change[69]. Whilst his planning decision requires an EIA anyway – and it exists, and this letter is part of it - the Advisory Opinion is clear that Article 206 of UNCLOS[70] requires that this obligation also extends to activities with an impact on areas beyond national jurisdiction. I have laid out how a majority of the GHGs which would be

[68] https://www.icj-cij.org/sites/default/files/case-related/187/187-20250723-adv-01-00-en.pdf

[69] https://www.icj-cij.org/sites/default/files/case-related/187/187-20250723-adv-01-00-en.pdf

[70] United Nations Convention on the Law of the Sea

caused by H2 Teesside lie outside UK territory (see sections "Where does the natural gas supply chain fit in the UK carbon budget regime" and "UK policy making only sees a small part of the full GHG footprint"). The Secretary of State must apply a "full knowledge" approach to the EIA which is required by UNCLOS Article 206.

(K) That he must note the Greenpeace US report's recommendation that "*foreign governments should refrain from entering into long-term offtake agreements for U.S. LNG and financing of LNG infrastructure"*. As described, LNG infrastructure includes projects, such as H2 Teesside, which consume LNG, and create further demand for US LNG exports.

(L) That he should reach a stand-alone reasoned conclusion as to the significance of the project GHGs based upon the IEMA criteria.

(M) That based on the IEMA guidance and criteria, the full knowledge EIA of the GHG emissions from the H2 Teesside, provided in this letter, the project GHGs can only be considered **"significant adverse" and "major adverse"[71].** At least 70% of the project emissions (upstream emissions) cannot be mitigated. These emissions are locked in - no one else is capturing them. The project clearly does not make a meaningful contribution to the UK's trajectory towards net zero. He cannot ignore the international climate impacts from the natural gas demand inherent in the H2 Teesside project.

(N) That he should consider the real costs of the huge GHG emissions from the H2 Teesside plant, and calculate them according to Green Book guidance. He should require that the applicant makes this calculation in any revised submission.

(O) That he should be fully aware that any investment by his department in the H2 Teesside plant is paying to make climate change worse.

(P) That urgent action on methane emissions is even more important following recent science finding that we are closer to crossing dangerous tipping points than previously thought. He should note that this was highlighted at the July 2025 conference at Exeter University on Global Tipping Points and endorsed by over 200 experts in an urgent message to world leaders[72].

(Q) That he should look to much greater investment in renewables and energy storage technologies to decarbonise the grid and deliver energy security. I acknowledge that his department is doing good work in this area – we just need more of it.

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[71] The applicant has claimed a significance assessment at ES 19.5.83 of **Minor Adverse** and **Minor Adverse** and **Not Significant** for the operational emissions. There is no explanation of how this significance assessment has been derived, and no reference the IEMA Significance Criteria at ES Table 19-4.

[72] https://news.exeter.ac.uk/faculty-of-environment-science-and-economy/tipping-points-experts-issue-urgent-message-to-world-leaders/#:~:text=These%20include%20a,change%20and%20deforestation. *"'Tipping points' experts issue urgent message to world leaders"*

The full life-cycle emissions of the H2 Teesside project are massive. The Secretary of State is recommended to refuse consent – the only decision consistent with taking appropriate action to protect the climate system from GHG emissions.

Yours faithfully

Dr Andrew Boswell for Climate Emergency Science Law (CESL)

Appendix A: CESL submission to Whitehead review – attached separately

Also available at https://scrapcc.org/WHITEHEAD

Appendix B: Climate Change Committee : FOI : Upstream Emissions

Follows on next page

Climate Change Committee
10 South Colonnade,
Canary Wharf, London
E14 4PU
w theccc.org.uk

Environmental Information Regulations (EIR) request

Received: 4 November 2024
Date: 27 November 2024
Ref: Sent by email from enquiries@theccc.org.uk
Published: www.theccc.org.uk/about/transparency

Your request:

Freedom of Information request

Dear CCC,

Enquiry on Upstream Emissions of Natural Gas

Please reply to the following queries.

What figures does the CCC use in its models of fuel supply emissions for the per unit (eg in CO2e/KWh) "upstream" emissions of natural gas supplying :-

1) gas power stations

2) hydrogen plants (ie gas reformers) ?

Have these figures been updated since the publication of the Sixth Carbon Budget Report and is there any intention to update them further before carrying out any further analysis?

Some explanation of how your figures are arrived at would also be helpful.

Background Information and comments related to the above questions

The Sixth Carbon Budget Report (Fuel Supply Report, page 24) states that the emissions saving for blue hydrogen compared to grey hydrogen plants:-

".....depends on both achieving a 95% CO2 capture rate at the gas reformation stage, but also on upstream emissions from fossil gas production being at the bottom end of our estimated range of

15-70 gCO2e/kWh. ..."

Climate Change Committee

It is not entirely clear whether the figure used then was 15gCO2e/kWh or some slightly higher figure within that 15-70 range.

That range applied specifically to UK gas supplies. Recent independent studies report that these have been under-reported by the industry.

UK gas supplies will run down over time. Will UK gas emissions figures nevertheless continue to be used as a proxy for all the gas supplied?

Alternatively, if estimates will factor in an increasing proportion of imports in the UK gas supply and especially if your methodology is to use figures entirely based on LNG, which seems certain to fulfil additional UK gas demand, will only those emissions occurring within the UK be accounted for? If so, how will they be defined? For example, for LNG, will extraction and compression (into a tanker) emissions be excluded, due to the country of origin including them in their own carbon accounting ? Also, will shipping emissions be excluded until the end of 2032 and thereafter included from the start of the Sixth Carbon Budget period in 2033 (ie once international Aviation and Shipping emissions attributable to the UK start being included in Carbon Budgets)? If that last assumption is correct, will half of the import shipping emissions be included, with half allocated to the exporting country or will some other method be used to measure the "UK share"?

Please explain what UK wide energy system modelling is done to generate emissions levels, and if you use the Dynamic Despatch Model. In the case that the DDM is not used by CCC, please explain how your modelling differs from the DDM.

Your Sixth CB Methodology Report, (page 161) stated that in your modelling, gas-CCS is used as a proxy for BECCS, and unabated CCGT for hydrogen plants. Is this still the case? If not, how has it changed?

Direct replies to these questions and any further explanatory comments you believe would be helpful would be very welcome.

Best Regards,

[name redacted]

Our response:

Thank you for your request. We have handled your request under the Environmental Information Regulations 2004.

1. We do not use a single figure for upstream emissions of natural gas in our analysis. Under the Climate Change Act (2008), we are required to follow international carbon reporting practice for determining emissions, as per the UK's national emissions inventory. The guidelines for this are set through the international process by the UNFCCC/IPCC and are based on territorial emissions. We model emissions associated with domestic fuel production on a bottom-up basis in our 'fuel supply sector. Combustion emissions associated with use of natural gas are allocated to the sector where the use of fuel occurs. Emissions associated

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with production of imported fuels are captured in the emission inventory of the exporting country.

2. Our analysis in the Sixth Carbon Budget advice report will be updated with the publication of our Seventh Carbon Budget advice report, on 26 February 2025.

3. The calculation in the Sixth Carbon Budget advice report for emissions savings from blue hydrogen is illustrative and provided as context. Gas emissions are based on the carbon content of the fuel, in line with territorial emissions accounting.

4. Our latest modelling of the energy system, using AFRY's BID3 model, was published in 2023 and can be found in our Delivering a reliable decarbonised power system report.

Information disclosed in response to this EIR request is releasable to the public. In keeping with the spirit and effect of the EIR and the government's Transparency Agenda, this letter and the information disclosed to you may be placed on the CCC website, together with any related information that will provide a key to its wider context. No information identifying you will be placed on the CCC website.

If you are dissatisfied with the handling of your request, you have the right to ask for an internal review. If you are not content with the outcome of the review, you may apply directly to the Information Commissioner for a decision. In keeping with our transparency policy, the information released to you will be published on www.theccc.org.uk. Please note that this publication will not include your personal data.

Kind regards,

Climate Change Committee

Climate Change Committee