

SUMMARY

Validity of the Examination

1. The examination is premature on the following grounds:
 - The UK has not completed and assessed four pilot demonstration CCS projects to the extent set out in EN-1, covering the entire carbon capture and storage chain.
 - Government's Net Zero Policy is currently being revised.
 - The specific sustainability requirements for BECCS referred to in the BEIS Biomass Policy Statement have not been published and therefore the application cannot be assessed against them.
 - The specific air pollution standards and regulations for emissions from BECCS systems called for in the BEIS Biomass Policy Statement have not been set, and therefore the application cannot be assessed against them.
 - There is no certainty that the Humber pipeline project on which this development depends will be consented or whether in its consented form it will be satisfactory for the Applicant.
2. In addition, the examination has wrongly excluded consideration of the environmental impacts of the full carbon capture chain comprising capture, transport and storage, contrary to the BEIS Biomass Policy Statement.

Conformity with Government policy

3. The proposal is contrary to policies EN-1 and EN-3 in that it reduces UK electrical generating capacity and energy security.
4. The proposal is likely to result in an increase in annual woodfuel consumption at the Drax power station. The proposal is intended to extend the life of biomass burning at the power station for decades. Both will mean further depletion of forests overseas, and this is contrary to the COP26 Leaders' Declaration on Deforestation. The Declaration acknowledged the negative impacts caused by deforestation to nature, the climate, human health and society. The proposed development will increase deforestation in countries producing woodfuel for Drax.

Air Quality and Emissions

5. Human health is already being harmed by air pollution in the vicinity of the facility. The proposal will add to pollution and increase harm. Emissions of pollutants currently released by Drax will increase, and new pollutants will be released by the PCC. There is very limited understanding of the behaviour of the new air pollutants and their effect on human health. Recently introduced Environmental Assessment Levels for the new releases (amine and nitrosamines) are unproven and are not conservative.

6. The description of the impacts of air pollution from the proposed development impacts provided in the Environmental Statement is incomplete and is inaccurate, and the significance of the impacts is under-stated.
7. The decision by UKHSA not to comment on the impacts to human health from the novel air pollutants is very concerning, particularly as there are no real world examples on which to assess the release of amine degradation products from BECCS with woody biomass.
8. The Applicant is intending to use a proprietary amine mixture in the PCC, and has declined to provide full details of the compounds and mixture. As a result, the human health risks from nitrosamines cannot be fully and adequately assessed.
9. There is inadequate provision for monitoring emissions from the PCC in operation. Neither the standards nor the technology currently exist to support continuous monitoring of nitrosamine emissions and the amine precursors to nitrosamines.

Biodiversity and Ecology

10. The Environmental Statement provides an incomplete and inadequate assessment of the impacts on wildlife and natural habitats of the deposition of air and water pollutants from the PCC system itself, and from the increased burning of woodfuel at the power station. The assessment of the impacts of those depositions is also inadequate.
11. It is acknowledged (Environment Agency) that deposition modelling is an inexact science, and consequently any predictions are likely to have a considerable margin of error. The uncertainties are likely to be greater with the unproven system forming this proposal (large scale BECCS and novel amines). The Applicant must ensure sources of uncertainty are listed and quantified to support a quantified estimate of the cumulative uncertainty of the modelling predictions. Currently, the Applicant's air quality predictions are not sufficiently precautionary for compliance with the Habitats Directive.

Climate Change impacts

12. The intended purpose of the development is to capture carbon dioxide from the combustion emissions produced by the Drax power station. The Applicant has stated that the development is conditional on it reaching a satisfactory financial agreement with the government on funding. Government is developing a 'business model' to provide financial support to operators of BECCS. Because the development will be partially (and probably significantly) supported by public funding, its performance in capturing carbon dioxide is a matter of great public interest and must therefore be thoroughly scrutinised by the examination.
13. The Applicant has put forward projections of performance for the PCC. Its document submitted following the Issue Specific Hearing 1 and Open Floor Hearing 1 estimates that 9.2m tonnes (gross) of carbon dioxide would be captured per year, with a net figure for 'negative emissions' of 6.6m tonnes. These figures are based a) on a wholly implausible assumption of carbon capture efficiency which conflates best practice requirement with likely real-world performance, and b) on a very unrealistic expectation

that the two biomass units to be equipped with BECCS will run continuously 8760 hours per year. The Applicant has provided no evidence to support either assumption. It is incumbent on the Examining Authority to ensure that a realistic estimate of overall performance is available for consideration before making its recommendation on consent.

Large scale Biomass Electricity is Not Sustainable Development

14. Burning millions of tonnes of imported wood to generate electricity is wasteful, inefficient, harms biodiversity and human health, and accelerates climate change. Production of woodfuel in the USA for the Drax power station adversely affects people there with noise and air pollution. The proposed development significantly increases the amount of wood to be burnt at Drax and extends the previously expected life of the Drax power station by many years. As a result the existing harms will be worsened and perpetuated for decades, and the proposal is not therefore sustainable development.
15. The signatories to the Leaders Declaration on Deforestation at COP26 committed to slow deforestation, recognising the negative impacts caused to nature, the climate, human health and society. The proposed development will increase deforestation in countries producing woodfuel for Drax, and is contrary to the Declaration.

REPRESENTATION

Validity of this examination

16. The Examining Authority has stated that

"The designated National Policy Statements (NPS) for Energy Infrastructure, specifically the Overarching National Policy Statement for Energy (EN-1) and the National Policy Statement for Renewable Energy Infrastructure (EN-3) apply to this Examination and to decision-making relating to this application.

The ExA will consider the Proposed Development in accordance with the NPSs and any other applicable policy or considerations the ExA deems to be important and relevant. "

17. It is my submission that the Designated National Policy Statement for Renewable Energy Infrastructure (EN-3) does not address the use of post-combustion carbon capture at biomass power stations. It cannot therefore be used as a basis for examining this Proposed Development.
18. Secondly, the Designated Policy EN-1 states:

"Carbon Capture and Storage

3.6.4 As explained in paragraph 2.2.23 above, to meet emissions targets, dependency on unabated fossil fuel generating stations must be reduced.

To help achieve this reduction but maintain security of supply, it is necessary to reduce carbon emissions particularly from coal-fired generating stations. Carbon Capture and

Storage (CCS) has the potential to reduce carbon emissions by up to 90%, although the process of capturing, transporting and storing carbon dioxide also means that more fuel is used in producing a given amount of electricity than would be the case without CCS. The complete chain of CCS has yet to be demonstrated at commercial scale on a power station. Whilst there is a high level of confidence that the technology involved in CCS will be effective, less is known about the impact of CCS on the economics of power station operation. There is therefore uncertainty about the future deployment of CCS in the economy, which in the Government's view cannot be resolved without first demonstrating CCS at commercial scale.

3.6.5 The Government is leading international efforts to develop CCS. This includes supporting the cost of four commercial scale demonstration projects at UK power stations. The intention is that each of the projects will demonstrate the full chain of CCS involving the capture, transport and storage of carbon dioxide in the UK. These demonstration projects are therefore a priority for UK energy policy. The demonstration programme will also require the construction of essential infrastructure (such as pipelines and storage sites) that are sized and located both for the purpose of the demonstration programme and to take account of future demand beyond the demonstration phase. The IPC should take account of the importance the Government places on demonstrating CCS, and the potential deployment of this technology beyond the demonstration stage, in considering applications for consent of CCS projects and associated infrastructure “

AND

4.7.4 The Government has taken a number of steps to facilitate and encourage the demonstration of CCS technology. The demonstration programme described in 3.6.5 focused initially on coal-fired power stations. This is because the emissions from coal generation are substantially higher than from other fuels, including gas; the projected increase in coal use globally creates a greater urgency to tackling emissions from coal; tackling emissions from coal first makes most economic sense because of the greater emissions intensity; and new coal generating stations would contribute to the diversity and security of UK energy supplies as we make the transition to a low carbon mix. However, CCS will also be required for other combustion generating stations in future and the Government has therefore extended the demonstration programme to include gas-fired generating stations.”

In my view the "uncertainty about the future deployment of CCS in the economy" has not been resolved because CCS has not been demonstrated at commercial scale. EN-1 refers to four CCS demonstration projects stating: "that each of the projects will demonstrate the full chain of CCS involving the capture, transport and storage of carbon dioxide in the UK."

19. In fact, only very small demonstrations of CCS on power generation have been completed and these could not realistically be described as at commercial scale; also the demonstration projects have not involved the transport and storage of carbon dioxide using the technology proposed for the Drax BECCS development, so they have not demonstrated the "full chain of CCS".

20. In a relevant document produced by The Applicant – a 'variation request' for the Environmental Permit covering the existing operation at Drax, they state:

“The generation of electricity from sustainable biomass with post-combustion carbon capture has not been undertaken commercially in the UK before”

21. My contention is that it is premature to consider this proposal because the conditions set out in EN-1 regarding commercial-scale demonstrations have not been met.

Climate change impacts

22. Commenting on the Applicant's Environmental Statement – Volume 1 – Chapter 15 Greenhouse Gases

23. At 15.2.30, the Applicant writes

“The Biomass Policy statement makes reference to the need that any BECCS development “must be genuinely and credibly ‘net negative’”. The policy further notes on page 37 that BECCS in the power sector could be a major GGR with retrofitting BECCS to large scale biomass plants. “Power BECCS is expected to deliver a steady increase of engineered removals between the late 2020s and 2035.” “

24. While I agree that for BECCS to be of value, it must be genuinely and credibly net negative, the choice of woody biomass as a fuel for BECCS makes this impossible.

25. At 15.4.3 the Applicant writes

*“The transport and final storage of captured carbon beyond the Carbon Dioxide Delivery Terminal Compound is outside the scope of this assessment as it will be covered by a separate consent, as described in in **Chapter 2 (Site and Project Description) (paragraph 2.2.47)** of this ES.*

*As noted in **Chapter 2 (Site and Project Description) (paragraph 2.2.47)** of this ES, the scope of this DCO excludes processes associated with the captured CO2 which occurs after the Carbon Capture process (such as transport and permanent storage). These aspects will be consented separately.”*

[extract ends]

26. It is irrational to exclude from this examination the impacts of transport and storage of captured carbon outside the Carbon Dioxide Delivery Terminal Compound (“the Compound”). A significant length of pipeline with associated infrastructure such as pipeline inspection gauges (PIG traps) is planned to run from the Compound to the proposed Gas-fired power station at Keadby. This section of pipeline will only transport carbon dioxide from the Drax power station. The construction and operational GHG emissions from this section must therefore be accounted for in the assessment of EN010120. Ecological / biodiversity impacts of this section of pipeline also ought to be assessed in this examination.
27. The values presented in Table 15.12 of the ES Chapter do not include an assessment of the pipeline construction GHG emissions or the emissions from the pipeline when in operation. Consequently, Table 15.12 does not give an accurate picture of the Proposed Scheme Lifecycle impacts.
28. In the same Table 15.12, one significant source of emissions is omitted from the assessment of the Proposed Scheme Lifecycle impacts.
29. The Applicant acknowledges that operation of the proposed PCC system will introduce an energy penalty. They have estimated that with PCC operational, the net electrical output of biomass units 1 & 2 will each be reduced by approximately 200MW.

30. The consequence is that the generating capacity available to the UK National Grid would be reduced by a total of 400MW. That shortfall has to be made up, and the resultant greenhouse gas emissions if any, be accounted for in the inventory of impacts of the Proposed Development at Drax.
31. To supply 400MW for a period of 8000 hours from a typical UK gas-fired power station able to deliver dispatchable peaking power and so replicate the lost generation from Drax would produce approximately 1.3 million tonnes of GHG emissions per year, calculated as follows:
- $$400\text{MW} \times 8000 \text{ hours} \times 400\text{kgCO}_2\text{e/MWh} = 1,280,000 \text{ tonnes}$$
32. Not including this source of emissions in the assessment of the Proposed Scheme, introduces a sizeable error.
33. In Table 15.12, a figure of -9,206,989 tCO₂/yr is given for “CO₂ captured through the Carbon Capture Process (B1)”.
34. This forecast level of performance is a very best case estimate using unrealistic assumptions and does not provide a sound basis for the examination. My reasoning is as follows.
35. Firstly, the estimate is based on the two PCC-equipped biomass units running at full capacity for 8760 hours per year, i.e. continuously. This is implausible. The systems will always be subject to planned and unplanned down time, and there will be periods of operation when full power is not achieved or economic. The existing biomass units at Drax are never operational 8760 hours per year, partly because of maintenance and partly because they run to meet demand from the National Grid as dispatchable power.
36. In this connection I draw the ExA’s attention to a document the Applicant has submitted to the Environment Agency requesting a variation to their existing Environmental Permit. This is relevant because it provides more detail of the expected use of the proposed development when in operation.
37. An extract of the Variation Request is provided below discussing the likely hours of operation of the two biomass units to be equipped with PCC. In the request, Drax argue that it would suit their business model if National Grid allowed them to operate “generally” in a ‘baseload’ mode rather than as dispatchable generation after the PCC is operational. The Applicant says it expects that “*that the units would generally flex generation less frequently than other assets on the Grid.*”
38. The Applicant in these comments accepts that flexible rather than baseload operation is entirely possible. Meaning that in reality the annual operating hours at full power for the PCC-equipped biomass units are extremely unlikely to reach 8760.
39. Then, because the units will not be delivering full power over 8760 hours per year, less fuel will be burnt and the carbon dioxide available for capture will be reduced.
40. The relevant extract from the Applicant’s Environmental Permit Variation request follows.

“9.2.1.10 Dispatchable Operation

The generation of electricity from sustainable biomass with post-combustion carbon capture has not been undertaken commercially in the UK before.

The primary benefit to adding the PCC to the existing generation units is to generate the negative carbon dioxide emissions across the full biomass supply chain, which is required in order for the UK to meet its future net zero targets and the sixth carbon budget. Accordingly whilst the effect of the addition of the

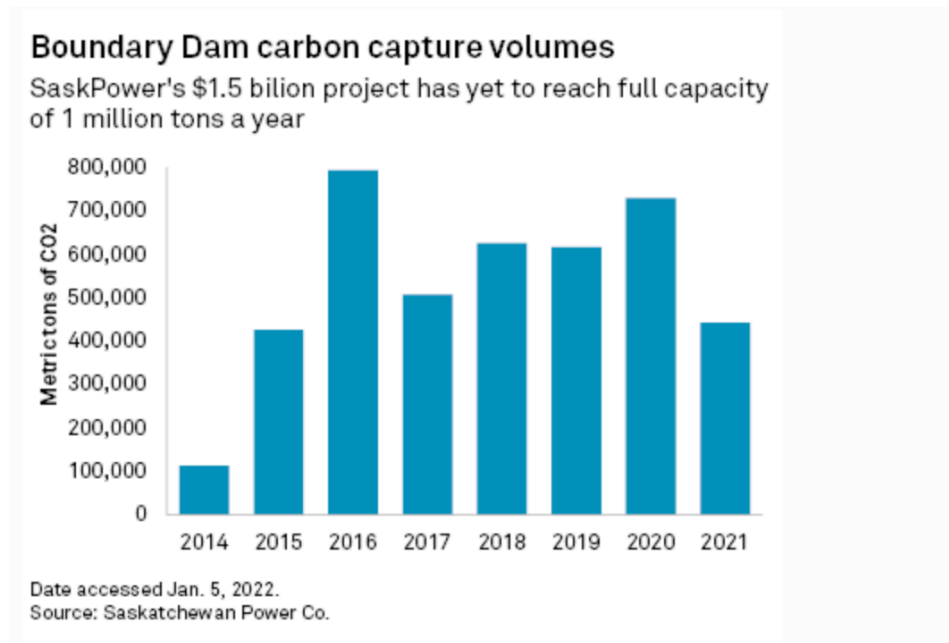
PCC is that the units will produce two valuable products (electricity and negative emissions), the project is being designed with the expectation that it will generally aim to operate baseload to maximise negative emissions.

Whilst a subsidy scheme for BECCS is not yet in place to support the development of power BECCS projects in the UK, Drax expects that any future scheme will be designed such that the units will generally be placed in the merit order such that they operate on a baseload basis.

Whilst the units will be able to flex power generation output and associated carbon dioxide capture within defined limits such that Drax can turn down the units in the balancing market where economic to do so or else to support system security, any decision to do so would need to price in and take account of the foregone revenue opportunity from the captured carbon dioxide. Accordingly, it is expected that the units would generally flex generation less frequently than other assets on the Grid.”

[extract ends]

41. Secondly, The Applicant has calculated the forecast annual carbon capture tonnage using a capture efficiency rate of 95%. This is the design target for the system, not a figure based on real world operational experience at scale.
42. The longest-running and largest power station equipped with post-carbon capture in the world is Boundary Dam 3 in Canada. Its operator, Saskpower, set an expectation that it would capture 90% of the carbon dioxide produced by coal burning. Analysis of the reported figures for captured carbon suggest the actual capture rate is below 65%, see the following figure:



43. SaskPower monthly reports going back to early 2020 showed frequent, mostly brief outages due to issues like "wet coal," "plugging," "issues in the powerhouse," "trip," "water cooling issues" and other technical hiccups. Unexpected outages of the power

plant itself also affected production at the carbon capture facility.

44. It is implausible that Drax's operation will not suffer from operational issues of the same nature.

45. Returning to the Applicant's Variation Request for their Environmental Permit, we find this comment:

"9.2.1.5 Carbon Capture Efficiency

The KM-CDR process when used in combination with the latest reiteration of the solvent in KS21TM is designed to be the most efficient available in terms of carbon capture. The design is guaranteed to deliver 95% capture within the normal operating envelope when operating stably. Although Drax expect the units to operate in a base load capacity the balance of operation between the host unit and PCC system will cause operational fluctuations that have the potential to impact capture efficiency for periods while systems stabilise or are recovered. It is due to these short duration events that Drax propose that the BAT position of 95% capture efficiency is measured as an annual average of all operational hours above the stable operating threshold. This will be measured through the use of continuous emission monitors prior to and post the absorber coupled with either a volumetric flow measurement or calculation, the basis of which will be agreed with the EA once the finalised design and instrument details are determined."

[extract ends]

46. The key point to draw from this is the comment that *"the design is guaranteed to deliver 95% capture within the normal operating envelope when operating stably"*, which acknowledges that the overall capture rate will in reality be lower than 95%.

47. Given the experience at Boundary Dam3 and the Applicant's statement in their EP Variation Request, it is not credible that the Applicant's proposed scheme will produce a long-term carbon capture rate anywhere near 95%. That figure of 95% must be treated as the absolute best case. The examination cannot make an informed recommendation on the application based on the Applicant's 'best-case' and frankly unrealistic performance projections for capture efficiency. We respectfully ask the ExA to require the Applicant to revise their estimate of capture efficiency and to re-calculate the projection for tonnes of carbon dioxide captured.

Air quality impacts

48. The data presented by the Applicant regarding the levels of amines and nitrosamines emitted by the Proposed scheme is subject to uncertainties.

49. In the Environmental Permit Variation Request referenced above, the Applicant gives figures for the cumulative impacts on air quality of the Proposed Scheme together with a nearby proposed scheme at Keadby, consisting of a gas-fired power station with carbon capture using amines. (Keadby 3 Low Carbon Gas Power Station Project, Planning ref EN010114).

50. The Variation Request states:

"7.14.10.1.1 Amines & Nitrosamines

As detailed in Section 7.14.5, a quantitative modelling assessment of cumulative impacts for amine and nitrosamine concentrations was not considered appropriate. However, to provide a qualitative and conservative judgement on potential cumulative impacts, the maximum-modelled PC concentrations from both the PCC activity and Keadby 3 (Keadby Generation Ltd, May 2021) project were summed, as follows:

•Amine (as MEA) cumulative maximum 1-hour mean PC ($\mu\text{g}/\text{m}^3$) = 0.24 (PCC) + 25.2 (Keadby 3) = 25.44 $\mu\text{g}/\text{m}^3$ •

Amine (as MEA) cumulative maximum 24-hour mean PC ($\mu\text{g}/\text{m}^3$) = 0.06 (PCC) + 0.22 (Keadby 3) = 0.28 $\mu\text{g}/\text{m}^3$

•Nitrosamine (as NDMA) cumulative maximum annual mean PC (ng/m^3) = 0.017 (PCC) + 0.064 (Keadby 3) = 0.081 ng/m^3 “

[extract ends]

51. The purpose of drawing the ExA's attention to these figures is to highlight that the levels of emissions forecast for the Proposed Scheme are significantly **lower** than those for Keadby. Noting that Keadby is proposed to be rated at approximately 300MW, whereas as the Drax biomass units with PCC will be just under 1000MW, i.e. three times larger.
52. For Amines, the Keadby figure is between four and ten times that given for Drax, and for Nitrosamines, the ratio is just under four.
53. I do not have the expertise to argue that the figures for the Proposed Scheme (Drax) are wrong, but request that ExA invite the Applicant to comment on this point, given the considerable difference from the Keadby figures.

REPRESENTATION ENDS