energy technologies institute

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Angus MacNeil MP
Chair - Energy and Climate Change Committee
House of Commons
London
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Dear Angus,

ETI analysis of the UK energy system design implications of delay to deployment of carbon capture and storage (CCS) in the UK

The purpose of this letter is to provide the Energy and Climate Change Committee with a short written summary of ETI's analysis of the key UK energy system design implications which arise from the cancellation of the CCS Commercialisation Programme.

Over the past 8 years the Energy Technologies Institute (ETI) has developed strong credentials in national energy system analysis, informed by the latest industrial and engineering expertise. This enables ETI to explore lowest-cost decarbonisation pathways, under a range of assumptions, constraints and uncertainties. Our analysis has been widely cited by academics, government and by the Committee on Climate Change in its advice to government.

This letter sets out:

- ETI's quantitative analysis of the impact of delaying CCS deployment on the costs and risks of UK strategy to meet carbon targets, drawing on our national energy system modelling
- Evidence on the actions needed to develop UK CCS capability in a timely manner
- ETI's view on the need for a new strategy to support timely CCS deployment in the UK.

I hope you find this letter to be helpful context for the Committee's examination of the future of CCS in the UK, following the cancellation of the CCS Commercialisation Programme. If you require further information please let us know.

Yours sincerely,

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The impact of delaying CCS market development and deployment

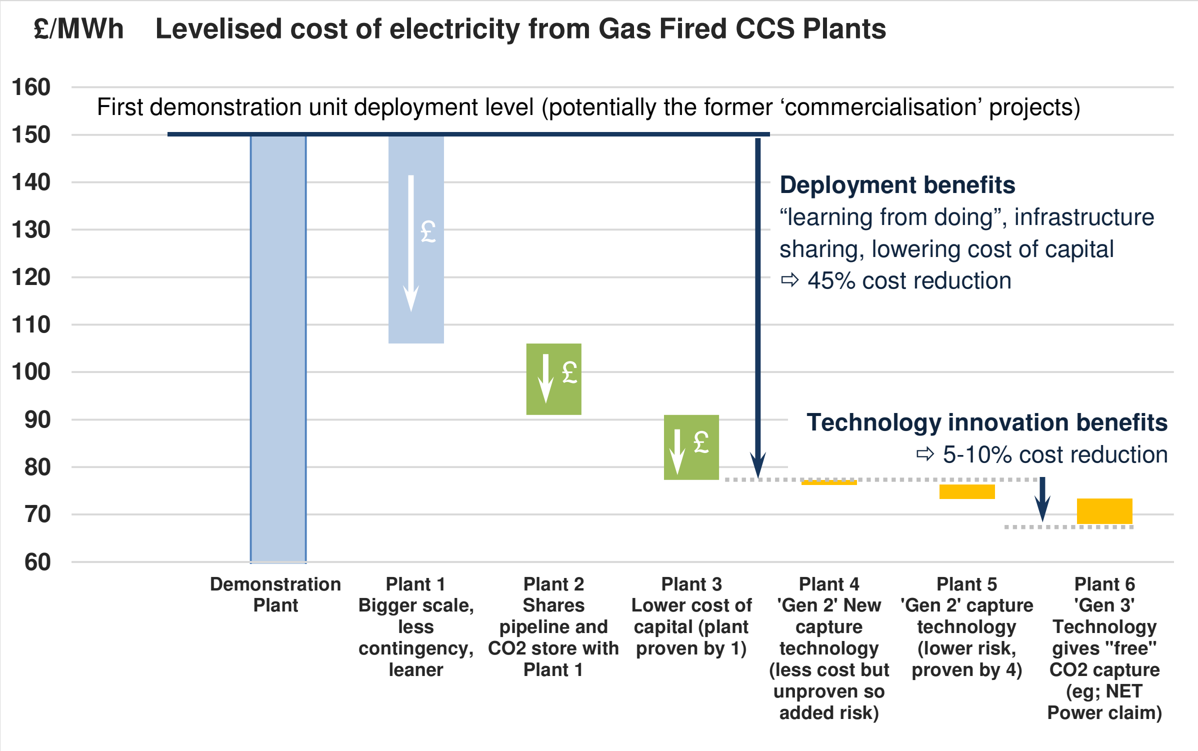
1. ETI's analysis has consistently shown that CCS is a key component of strategies to minimise the costs imposed on consumers and businesses by a transition to low carbon energy. This conclusion remains robust under a wide range of scenarios.
2. The recent government decision to cancel the CCS Commercialisation Programme clearly affects the prospects and potential timing of deployment of CCS in the UK.
3. In this context ETI has carried out further analysis to assess the impact of slowing progress in the deployment of CCS on the costs and risks of broader UK decarbonisation strategy. Specifically, ETI analysis can highlight how the cost impact of reducing emissions is affected by system design changes. We have examined the impact of :
    - a 10 year delay in developing UK capability to deploy CCS (equates to deployment from 2030 rather than 2020)
    - adopting a decarbonisation strategy which permanently excludes the deployment of CCS
4. We have compared these scenarios against our previous baseline case in which CCS is deployed from the early 2020s. The key cost messages emerging from this analysis are:
    - Delaying the development of CCS in the UK by ten years has a high chance of significantly increasing the cost of carbon abatement to the UK economy.
    - Delay adds an estimated £1-2 bn per year throughout the 2020s to the otherwise best achievable cost for reducing carbon emissions (an increase of 15-25% above the baseline).
    - Delay is also likely to increase longer term costs, adding an estimated £4–5 bn per year to the otherwise best achievable cost of reducing carbon emissions in 2040 (even after deploying CCS in the 2030s).
    - By 2050, as the delayed CCS infrastructure matures, the gap begins to narrow, but legacy effects still result in an additional cost estimated to be around £2–3 bn per year.
5. Meeting 2030 carbon budgets with a ten year CCS delay appears to :
    - Increase substantially the need to roll out more renewables (most likely onshore and offshore wind and solar PV farms) coupled with;
    - Implementing early decarbonisation of space heating (modelling suggests biomass boilers and district heat in preference to electric heating). This bring increased power system operability risks – principally the need for approaches to manage renewables intermittency and system resilience (frequency response).
    - Increase the desired roll-out rate for new nuclear and also suggest that this may be preferred as 'cyclable' Small Modular Reactors (SMRs) rather than large units.
6. In line with previous ETI analysis, achieving 2050 carbon targets without deploying any CCS is very likely to result in substantially higher costs (>2% of GDP by 2050 across the energy system).
7. Avoiding substantially higher costs in meeting carbon targets in the longer term (post-2030) depends on the UK developing a capability to rapidly rollout CCS infrastructure and capture projects in power, gasification and industry in the 2030s and 2040s.
8. ETI modelling evidence suggests that both costs and risks to the UK's decarbonisation pathway could be reduced by bringing forward, rather than delaying, the deployment of CCS.

Actions needed to develop UK CCS capability in a timely manner

9. ETI set out the actions needed to develop CCS in the UK in March 2015 in its publication *'Building the UK carbon capture and storage sector by 2030 – Scenarios and actions'* (see last page of this note for a summary). This work assumed that the CCS Commercialisation Programme would go ahead. ETI is now refreshing its assessment of the actions needed to develop the capability to deploy CCS in the UK in a timely manner in light of both the recent decision not to proceed with the CCS commercialisation competition and also the implications of other 'energy policy reset' announcements.

10. The key points relevant to CCS which emerge from our current analysis and major project work are that :

- The key to reducing the cost of CCS is delivering a small number of large plants sequentially (at least 3), ie; industrial scale deployment - not innovation from technology focused R&D activity (or reliance on CCS technology innovation taking place in other countries to drive cost reduction).
- Our analysis strongly suggests that risk reduction through sequential deployments of existing technology in the UK can drive output energy costs down by as much as 45% through a combination of learning by doing, infrastructure sharing and reductions in financing costs (see chart below).
- Early investment in the appraisal of potential North Sea CO2 stores continues to be a priority. This is due to the long lead times for developing storage sites, and the importance of giving investors clarity around access to proven stores to support final investment decisions.



*Levelised costs are in UK£ 2013, capital costs are +/- 40%(EPC *1.4), discount rates are adjusted for risk (range 9-16%). Gas £24/ MWht and CO2 emission £31/te. All plants other than first demonstration plant are 860MW net output.*

Towards a new strategy for CCS in the UK

11. In view of the strong evidence that points to the likelihood of increased costs and risks arising from delaying CCS in UK, there is a critical need to develop a new, alternative strategy to support CCS deployment during the 2020s and avoid a situation where the availability of CCS is effectively denied to the UK permanently. The previous strategy of public sector capital support has now failed twice, hence a different approach is key.

12. A new, realistic and pragmatic strategy should be developed, recognising:

    - The constraints around public expenditure on capital support for CCS and the emerging emphasis on the role of new gas capacity.
    - The need for an attractive policy 'offer' to attract private sector investment to develop and build early projects, with clear rewards for first movers and those who deliver low carbon energy cost-effectively.
    - The need to strategically shape early project selection and scoping to minimise costs and risks, maximise the chances of success and create the platform for further deployments with steadily reducing costs.

13. There are a range of strategy options (which we are currently examining) but all will depend on clear policy support and signals to attract the private sector risk capital required during the early stages of CCS development. New thinking is needed to develop an attractive policy offer, structured to reflect the particular challenges of CCS. From a policy perspective this can be structured in a 'no regrets' format, by linking rewards and contract award to the delivery of policy objectives, most obviously, delivery of cost-effective low carbon energy.

14. A strategic approach could also minimise cost and risk during the early stage of CCS development, by paying close attention to the location and design of the first project(s). Selecting and scoping the right early projects can maximise early cost reductions, so helping to build confidence in the emerging sector and in the firmness of policy support.

15. Recognising that a delay is now inevitable, greater emphasis needs to be placed on ensuring that any new unabated gas plants are both sited and financed in line with any new CCS strategy, even if they are not fitted with CCS from day 1. This would create the early, visible linkage between rewards for delivery of cost-effective low carbon energy and subsequent long term retrofit implementation of CCS.

Appendix – Extracts From ETI insights report :

Carbon Capture and Storage

Building the UK carbon capture and storage sector by 2030 – Scenarios and actions

(published mid 2015 with expectation that DECC commercialisation project(s) would proceed)

Key Headlines >

- Successfully deploying CCS would save billions of pounds – capturing industrial emissions at low cost, providing low carbon energy for industry, transport & heat and delivering negative emissions combined with Bioenergy
- To deliver these savings requires around 10GW of capacity by 2030 - needs capital investment around £21-31bn[1] – based on efficient sharing of infrastructure and co-ordinated cluster/hub development
- Early investments in transport and storage infrastructure can unlock future unit cost reductions and strategic build out options. Strike prices below £100 per MWh are achievable in the 2020s
- 10GW scale deployment is achievable and affordable, capturing and storing around 50 million tonnes of CO_2 per annum from power and industry by 2030
- Developing capture technology options and diversifying geographical location can deliver reduced risk
- Success or otherwise in deploying CCS determines key aspects of the UK's energy infrastructure architecture
- Delay increases reliance on nuclear and offshore wind – increasing system risk and costs before and after 2030

Key conclusions emerging from the scenarios >

- Developing a 10 GW scale CCS sector by 2030 is feasible and affordable through a number of different pathways, based on co-ordinated cluster/hub development
- Early 'phase 2' projects can make use of the stores and transport infrastructure developed under the commercialisation programme, delivering strike prices at or below £100 per MWh by 2025, with potential further cost reductions by 2030
- A 10 GW scale CCS sector would be affordable in terms of the demand on levy control framework funds (an annual support cost of around £1.1 to £1.3 billion by 2025) and efficient in terms of cost per tonne of CO_2 reduction
- This scale of CCS deployment could capture and store around 50 million tonnes of CO_2 emissions per annum from power and industry by 2030, enabling CCS to develop in the 2030s to the optimal scale suggested by longer term analysis of the UK energy system
- This outcome can be delivered by creating a supportive policy environment with early action on critical issues to bring forward timely investment