WP SCCS 2019-05

Future Investment in Energy Infrastructure

SCCS response to BEIS Committee consultation

March 2019

Scottish Carbon Capture & Storage

Scottish Carbon Capture & Storage
Edinburgh Centre for Carbon Innovation
High School Yards, Infirmary Street, Edinburgh, EH1 1LZ
Telephone +44 (0)131 651 4647 www.sccs.org.uk

Future Investment in Energy Infrastructure SCCS consultation response

1 Summary

Carbon capture and storage (CCS) has a role to play in power generation, particularly in providing grid balancing services in the absence of nuclear power.

Hydrogen can replace fossil fuels in heat and transport, reducing emissions from dispersed sources. For heat, this is likely to use the existing gas distribution network.

CCS will require the use of new and re-purposed on- and offshore infrastructure.

2 Introduction

Carbon capture and storage is crucial for meeting UK climate change targets at lowest cost[1], and is essential for meeting the ambitions of the Paris Agreement[2].

CCS can be used to decarbonise gas-fired power generation, allowing despatchable electricity which can smooth out the peaks and troughs of renewable power availability.

CCS also enables the generation of hydrogen, which produces no carbon dioxide emissions when it is combusted, meaning there is huge potential to use it to decarbonise hard-to-treat areas such as domestic and industrial heat, and transport (most likely in fuel cells). Hydrogen can be produced using electrolysis, and if this process is done using electricity from renewable sources, then the production can be considered zero-carbon. However, this means of production is not currently cost-effective for the amounts of hydrogen that would be needed to kick-start gas grid decarbonisation. It is likely to be necessary, therefore, to produce hydrogen in bulk from methane using steam reforming, and combine this with capture and geological storage of the carbon dioxide (CO_2 by-product.

In addition to its role in the energy system, CCS is the only way to decarbonise industries with high emissions: either those with unavoidable process CO_2 emissions; or those with a high heat demand that requires either fossil fuels or, in future, hydrogen.

The Carbon Capture, Use and Storage (CCUS) Cost Challenge Task Force concluded that "CCUS and renewables complement rather than compete with each other and CCUS has value by potentially enabling greater integration of renewables in to the system."[3]

CCS requires infrastructure to transport and store CO_2 once it has been captured and compressed. This infrastructure is likely to include both on- and offshore pipelines, although transport by rail or ship is also possible; storage infrastructure will use offshore geological formations, either depleted oil and gas fields or saline aquifers.

[1] http://www.ccsassociation.org/news-and-events/reports-and-publications/parliamentary-advisory-group-on-ccs-report/
[2] https://www.ipcc.ch/sr15/chapter/summary-for-policy-makers/
[3] https://www.gov.uk/government/publications/delivering-clean-growth-ccus-cost-challenge-taskforce-report

Pipelines to transport CO_2 from capture site to storage site are expected to be essential infrastructure from the 2020s. It is currently unclear who the regulator would be for any onshore and offshore CO_2 pipelines.

3 Inquiry questions

How do recent investment decisions on nuclear and trends in low carbon investment affect the UK investment outlook for energy infrastructure? Is there a case for changing the Government's current approach to delivering a low cost, low carbon energy system? How could the 'nuclear gap' be filled?

The reason that nuclear has failed to be built is not because the technology does not work, it is because the cost of construction is high, and the price obtainable for the electricity is too low and too uncertain for investors - when compared against the price at which renewable onshore and offshore wind and tidal stream can sell into the power market. The market chooses short duration profit over long duration quality and certainty for the whole system. The strike price for Hinkley electricity was £92.50/MWhr index linked[4], which in 2018 would have been £107.30/MWhr[5].

Similarly, the reason that gas power with CCS has failed to be built is not because the technology does not work, it is because the cost of construction is high, and the price obtainable for the electricity is too low and too uncertain for investors - when compared against the price at which renewable onshore and offshore wind and tidal stream can sell into the power market. The market chooses short duration profit over long duration quality and certainty for the whole system. The price for gas power electricity with CCS has not been fully market tested as has Hinkley, by contractual commitment, but is calculated to be around £85 /MWh[6] (at 2016 prices: £90.99 in 2018 prices) under the right circumstances.

Commercial bidders have stated a strike price for gas power with CCS as low as £56/MWh, when grid services of frequency stability, capacity market and black start are included.[7]

In the absence of gas power with CCS, the Government's options to fill the 9.2GW[8] hole left by non-renewal of nuclear power are limited. Options would include a very aggressive reduction of demand for electricity, with demand management to eliminate peak demand spikes; massive increases in renewable generation, with unprecedented build-out rates and whole system-scale energy storage, for which there is no current plan; or acceptance of unabated gas power plant and resultant failure to meet carbon budgets for the 2030s and beyond.

The energy system is not just about electricity. About half the energy used in the UK is for heat, and decarbonisation of that is just beginning. It is clear that there is a fundamental choice. One route is to build large quantities of additional clean electricity - to generate and supply electricity to replace the heat supplied by methane, and to generate and supply electricity to replace the energy for vehicles currently supplied by diesel and petrol. This will require a further unprecedented construction of renewable power with the related issue of energy storage to manage supply and demand variability.

---

[4] https://www.theguardian.com/news/2017/dec/21/hinkley-point-c-dreadful-deal-behind-worlds-most-expensive-power-plant
[5] Calculated using Bank of England inflation calculator, available at https://www.bankofengland.co.uk/monetary-policy/inflation/inflation-calculator
[6] http://www.ccsassociation.org/news-and-events/reports-and-publications/parliamentary-advisory-group-on-ccs-report/
[7] http://www.ccsassociation.org/files/1015/2866/4538/CCEP_Feasibilility_Final_Report_-MAY_2018_SUMMARY_VERSION.pdf
[8] https://utilityweek.co.uk/will-fill-nuclear-gap/

The other option is to avoid full electrification of heating by using hydrogen where possible. This can make use of existing investment in the gas grid, and provide the opportunity for inter-seasonal energy storage.

This nuclear electricity supply crisis can become an opportunity to provide low carbon electricity and low carbon heat. Both of those - by gas power with CCS, and methane reforming to provide hydrogen for heat, require that CO_2 transport and storage infrastructure becomes available at grid scale. To close the 'nuclear gap' would require an acceleration of the timescales planned by BEIS for CCS and low-carbon heat, which currently aim for a CCS facility operating at pilot scale in the late 2020's. Instead, a number of CO_2 capture facilities, transport infrastructure and at least one full-scale storage facility, with expansion capability, would be required. Constructing a CO_2 transport and storage infrastructure network can enable gas power and hydrogen manufacture by conversion of methane, at multiple sites around the UK; this is also infrastructure that the UK will inevitably need for future industrial clean growth.

What types of investor can we expect to finance future UK energy infrastructure? What are their criteria for investment, including on risks and returns? Does it matter if investors for specific technologies are largely from overseas?

The industry-led CCUS Cost Challenge Task Force found that the private sector could deliver CCUS:

> "The Taskforce's view is that with viable business models in place and clear Government and industry commitments to the policy framework, CCUS projects can be financed through private investment. However, developing CCUS projects is capital intensive and the cost of financing will be directly related to risk allocation. Experience from other sectors shows that a reduction in the cost of capital, supported by an appropriate risk allocation framework, could be a significant component of future cost reduction in CCUS as a whole."[9]

The Task Force suggested the use of a regulated asset base (RAB) model, regulated by Ofgem, to deliver CO_2 transport and storage infrastructure:

> "The RAB model is attractive to those with longer term investment horizons. RAB models have low volatility in returns, a stable regulatory regime and the potential for future growth and deployment of further capital, all of which attract different investors from higher risk, higher reward projects. RAB models therefore command a lower cost of capital which helps drive down the overall costs of delivery. The RAB model could also help to attract bids which include strong operational expertise."[10]

What role should the Government play in providing financial support and sharing risks for new energy infrastructure? Are existing financing mechanisms, notably the Contracts for Difference, fit for purpose? Are there any practical issues, or potential unintended consequences, that could affect the feasibility of implementing alternative support models (such as a Regulated Asset Base)?

The CCUS Cost Challenge Task Force identified five irreducible risks for development of a CCUS industry in the UK. They define 'irreducible risk' as

> "those low probability but high impact risks which the private sector, at least initially, cannot price or take and where, as a result, it may be better value for money for the Government to hold."

[9] https://www.gov.uk/government/publications/delivering-clean-growth-ccus-cost-challenge-taskforce-report
[10] https://www.gov.uk/government/publications/delivering-clean-growth-ccus-cost-challenge-taskforce-report

The irreducible risks identified by the Taskforce are:

- Political risk: long-term policy stability is needed to incentivise the private sector to make long-term investment decisions.
- Cross-chain risk: the elements of the CCS chain (capture, transport and storage of CO_2) are interdependent, so failure of one part could cause problems for the whole chain.
- Stranded asset risk: If there is no CO_2 captured then the store has no customers; if there is no store then investors in capture would be similarly left with a stranded asset.
- CO_2 leakage risk: any CO_2 leakage must be paid for at the prevailing EU ETS price – there is no certainty over what this would be in future, so the risk is unquantifiable.
- Un-insurability of CO_2 storage liability: the probability of CO_2 leakage is low, but any such leakage would be costed at the prevailing EU ETS price at the time of the leak. This uncertainty over cost makes the risk unquantifiable and, therefore, uninsurable

The Taskforce notes that, as the industry matures, these risks may become more acceptable and insurable. The Task Force proposes the use of the regulated asset base (RAB) model for CO_2 transport and storage infrastructure, in order to lower the cost of equity and the cost of debt.

We urge the Government to work with industry to develop and consult with the finance community on an agreed risk allocation for CCUS projects, as recommended by the Task Force.

Although Contracts for Difference are suitable for electricity generation, they are not the appropriate business model to support either hydrogen production or industrial decarbonisation using CCS. We understand that BEIS is exploring these business models further, in conjunction with industry.