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Environmental Audit Committee: Personal submission to Sustainability and HM Treasury inquiry

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1. The Role of Carbon Capture and Storage

The UK has, since the G8 meeting in 2005, and especially since creating a carbon capture and storage “CCS Competition” in 2007, been a strong promoter domestically and internationally of CCS as one direct technique to reduce the rate of anthropogenic carbon dioxide (CO_2) emission to atmosphere, where it acts to increase global temperatures and ocean acidity.

On 25 November 2015, the UK Government issued a statement to the London Stock Exchange a few hours after the Chancellor’s Autumn Statement, which withdrew the capital funding support for the CCS Competition in the UK. This abrupt and unexpected change of support led to immediate cessation of work on the two CCS projects underway in the Competition: Capture Power at Drax in Yorkshire, which has subsequently cancelled the project; and Peterhead to Goldeneye in Aberdeenshire, where the project is currently suspended. Confidence among investors in CCS has plummeted domestically and internationally. Government (DECC Ministers) have spoken about the UK being “still interested” in CCS, although there is no definitive information.

2. Cost of cancellation

Does the cancellation have a direct money impact? Recently ministers suggested that £222 million of public money has been spent to date on CCS. However, the full cost should also consider lost investment. The cancellation means that Capture Power have returned €300m to Brussels, which was awarded to the specific project under the New Entrant Reserve policy (NER300). Government has also stated that £100m of the £1 billion had been spent, implying that the two ongoing studies between them had received Government support of £100m. The two commercial bidders have also stated that they have lost their own money in this Competition which, if costs were shared 50:50, could be an additional £100m. The UK has operated a previous CCS Competition, with Longannet and Kingsnorth being unsuccessful and an estimated additional £50-100m spent by commercial participants and Government. In addition to these detailed projects, there have been about 14 additional large commercial CCS projects put forward to UK Government – each of these with some self-funded work by the companies and businesses involved – perhaps an additional £30m committed. And, of course, an entire sub-department of DECC, 15 people for 15 years, maybe £20m on salaries and buildings. Research budgets are not included here. Thus, a total spend exceeding £500m. This is comparable to the capital grant for one CCS Competition project.

Additional, less well-defined costs are that decommissioning of offshore oil and gas fields will now be enacted, instead of re-using some of these for CO_2 storage. Many decommissioning costs are shared with Treasury, depending on individual contracts, so it is highly probable that publicly funded payments of £100-200m for each hydrocarbon field decommissioning will be made sooner and faster than if those fields had been converted and re-used as lower cost stores for CO_2. Government has been, and remains, very poorly cross-connected over addressing offshore engineering and hydrocarbon problems by creating a new and more sustainable offshore industry in CO_2 storage, which by 2030 is estimated to have potential to earn £5bn per year from revenue for securely storing CO_2 from EU states, which have poor access to their own domestic CO_2 storage.

3. Method of announcement

The method of cancelling the CCS Competition was highly unusual. In the Conservative manifesto the CCS Competition and £1bn support was specifically mentioned and, as recently as the week before cancellation, Secretary of State DECC, Amber Rudd, presented an "energy re-set" speech, where CCS was again mentioned positively. Anecdotal evidence makes it clear that DECC officials working on the CCS Competition had no forewarning of this cancellation. It is also clear that no formal justification has been presented, i.e. there has been no publication of a consultation, or a cost-benefit analysis, or a formal impact statement, as is customary in many government decisions.

4. Costs of CCS

After the CCS capital grant cancellation, this action was justified by Government using diverse reasons.

PMQ's: "You have to do what works," i.e. implying CCS does not work. This is not true as CO_2 separation operations have occurred globally since the 1920's, CO_2 injection since the 1970's and subsea storage of CO_2 for climate mitigation purposes since 1996.

PM at Liaison Committee: The cost of CCS was quoted as "CCS costs £170 per megawatt hour (Mwr) of electricity". The full statement being "At the moment, it seems to me that with carbon capture and storage, while I completely believe in the idea, the technology is not working. CCS is £1bn of capital expenditure, £1bn that we could spend on flood defences, schools or the health service. Even after you've spent that £1bn, that doesn't give you CCS that is competitive in the market. The government hoped the costs would come down. But they did not."

The Prime Minister then compared various technologies to reinforce the point: "CCS would still cost £170 per Mwr. That compares with nuclear energy costing £90, or onshore wind costing £70 ... we are confident of the mix we have committed to in gas nuclear and renewables."

However, it is worth considering the rationality of those cost comparisons. First, the figures for nuclear and for onshore wind are costs of "established" technologies, where construction of many examples of the equipment have enabled learning and efficient operations to drive down costs. By contrast, the CCS cost is for a project which is experimental in the UK and which has been co-designed by Government.

Second, it is extremely well known in large engineering equipment operations that the first projects are over-designed, with multiple layers of over-specification included to guarantee safe and secure operations. A routine cost elevation would be 20-40%. Thus the second, third and fourth examples would be correspondingly much less cost.

Third, the Government co-design interventions have persistently added extra design specification and extra security to a project, which is already inevitably expensive. These interventions could add an extra 10-20% onto costs. An analogy could be that the Government wishes to order a car and is not prepared to accept a standard Ford Mondeo but instead wishes to have a UK Rolls Royce; and in addition then wishes that Rolls Royce to be individually specified as gold plated. That costs more.

Fourth, even though these first two CCS projects are large engineering feats, these are financially sub-optimal in size and duration. The projects are asked to run for just 10 or 15 years when such power plant equipment is normally lasting and paid off over a 20-30 year period, and offshore equipment lasting and paid off over a 40-60 year period. It is inevitable that capital re-payments over a short time are greater – just like a domestic house mortgage. That means an electricity cost some 10-20% greater than a long duration equipment write-off. A large part of a total project cost for CCS is the fuel, and is especially sensitive to uncontrollable gas pricing internationally. Paradoxically, as pointed out by Jeremy Carey of 42 Technology, the profit of a project for a baseload plant running continually is less than a power generation project running at times of increased demand. That is because the baseload plant burns lots of expensive fuel whilst selling at a low electricity price competing with renewables which have zero fuel cost, and so makes less profit. By contrast a CCS plant running less time but filling in for insufficient renewable power will use less fuel and will be able to sell electricity for 2x or 10x the price achieved in a glut market. Inevitably, by Government stipulating baseload operation, short duration life, and comparing to power with no fuel costs, then CCS will appear expensive. A fair comparison is to cost all types of power on the same longevity and to use each generation type at its most effective point in a dynamic market.

Fifth, in any large project it is necessary to pay to borrow money. The interest rate paid “cost of money” can be very low (1% to 4%) to a Government borrower with guaranteed repayment, and on an established project with minimal construction and operation risk. By contrast, the political, business and engineering uncertainties combined on the UK’s first CCS project have clearly been judged as severe – this will already have attracted a penalty interest rate on borrowing that can add 20% to the cost of a project. Although Civil Service planning and operation of the requested actions on CCS has been exemplary, this lack of financial confidence will now persist into future projects with lack of trust in the UK Government. That means future costs of borrowing will be extreme. A package of Government actions will be needed, similar to the benevolent contracts bestowed onto Hinkley Point C nuclear, to entice investors into UK CCS projects.

Sixth, what is actually being paid for in these two first CCS projects? It has always been clear that such a project can be considered in three parts: the power plant and capture step; the transport step (e.g. pipeline to offshore site); the borehole injection, geological storage, monitoring and long-term liability step. Serial CCS projects, including Capture Power and Peterhead, have chosen their internal arrangements such that power and (possibly) capture is one operator, and maybe capture but certainly transport and storage a second one or two operators. This is not one core business but several joined together.

The cost quoted by the PM of £170 per Mwr includes power plant, capture, transport and storage and liability. Crucially, the transport, storage and liability should be regarded as “infrastructure”. Taking the example of Peterhead to Goldeneye project, that infrastructure is sufficient in size and longevity to service not just this first project, but three, four or five follow-on CCS projects of similar size and longer duration.

In other types of network infrastructure – for example, national and domestic methane gas grids, electricity networks connecting to offshore wind, disposal of radioactive waste from nuclear generation, national broadband supply, railways – the cost of the network infrastructure is not laid onto the first project. A diversity of methods have been enacted to share costs of renting network space or carrying capacity between all users of the network. In all cases there is some organisation responsible for building, operating, and maintaining the network.

It is highly probable that CCS needs to have a network approach, to unbundle the costs of power and capture from the network costs of transport and storage. It is consequently not at all surprising that adding in the costs of creating infrastructure overcapacity makes the first CCS projects appear expensive.

5. How much does CCS actually cost?

There is clear evidence available from existing operations worldwide that the cost of CCS is substantially less than the misleading figures quoted by the PM, and that it is closely cost-competitive with existing low-carbon power generation. Two examples include:

- The cost of CO_2 separation offshore at Sleipner condensate field, Norway, drilling a dedicated borehole for injection to deep geological storage beneath the North Sea and operation since 1996 is less than the environmental tax on CO_2 emissions offshore levied by Norway. That is less than $50 per tonne CO_2. As 1 Mwr of gas-fuelled electricity emits approximately 1 tonne CO_2 the price of CCS is here less than $50 per Mwr.
- At Boundary Dam power plant, Saskatchewan, the full CCS chain has been operating since mid-2014. Initial teething troubles were expected and have been overcome, so that now the CCS project is operating above its designed capacity. This project uses CO_2 capture technology designed and operated by Cansolv, which is the chosen CO_2 capture technology company for Peterhead. Calculations by Grantham Institute in 2015 using public domain data assume the borrowing rate achieved by the project developer SaskPower internally and the cost of fuel from its owned resources achieved internally. The cost of electricity delivered including CO_2 capture, transport, and geological storage, is calculated as £100 per Mwr. Peterhead, being newer and more efficient, could expect to improve on this.

It appears that established CCS operations work at less than £100 per Mwr. The apparent high costs quoted by UK Government are due to first-project costs, the extra quality specifications of UK Government, the financing and operation arrangements peculiar to the first projects and to oversized infrastructure costs.

Forward issues and actions

The UK was an instrumental player in securing the successful and ambitious outcome of the UNFCCC Paris Climate Conference (COP21). Here, the UK ministers and the UK delegation repeatedly highlighted the UK's Climate Change Act as a model for robustly driving decarbonisation of the economy. However, the abrupt, badly managed and seemingly poorly informed abandonment of CCS by HM Treasury undermines the UK's pathway for delivery of this Act. There appears to be a failure of communication and cross-connection across Government on priorities and actions with respect to climate mitigation and sustainability.

Further, the high ambition secured in the Paris Agreement includes recognition of the need for emissions to reach net-zero from 2050 – in effect, increasing the goals of the UK Climate Change Act. CCS is the only technology capable of reaching into many of the diverse sectors of the UK (and global) economy, where emissions reductions will be required to deliver this ambition. There appears to be a misinterpretation that CCS is a technology that could be purchased as and when required, when it is in fact a core low-carbon enabling infrastructure. The timely provision of this enabling infrastructure – CO_2 transport and storage – requires strategic and coordinated UK development. In particular, the evaluation of specific geological sites for CO_2 storage cannot be "bought in". In the Central North Sea there is closing opportunity to secure first-phase CO_2 storage access to existing subsurface hydrocarbon assets with operational pipeline, platform and borehole facilities. Securing later re-entry is uncertain and certainly higher cost, especially as action now will defer and defray decommissioning costs.

With respect to onshore infrastructure, HM Treasury is overseeing the creation of the new National Infrastructure Commission (NIC), tasked to "set out a clear picture of the future infrastructure we need producing an in-depth assessment of the UK's major infrastructure needs on a 30-year time horizon". This time horizon in effect entirely covers the period of the UK Climate Change Act, its long-term 2050 goal and corresponding interim carbon budgets. The development of robust, forward looking low-carbon infrastructures in energy sourcing, creation and supply, and transportation networks, is perhaps the most critical practical state action to support the realisation of the low-carbon economy. It is therefore surprising that the suggested governance, structure and operation of the NIC recently proposed by HM Treasury makes only passing mention – "the commission would need to be mindful" – of the decarbonisation agenda enshrined in the UK Climate Change Act. Rather, it should be core competence and priority for the NIC to examine and communicate the strategic infrastructures necessary to support, facilitate and secure the UK's decarbonisation pathway.

This should include the identification and planning of CO_2 transportation infrastructures linking existing and new ("capture-ready") emissions sources, such as new gas power plant to beachhead facilities connected to storage. This could include, where appropriate, retention for re-assigning and re-use of existing methane networks. This planning for infrastructure must further evaluate and propose a coherent model for network delivery, unbundling the infrastructure investment from individual industry or plant costings.