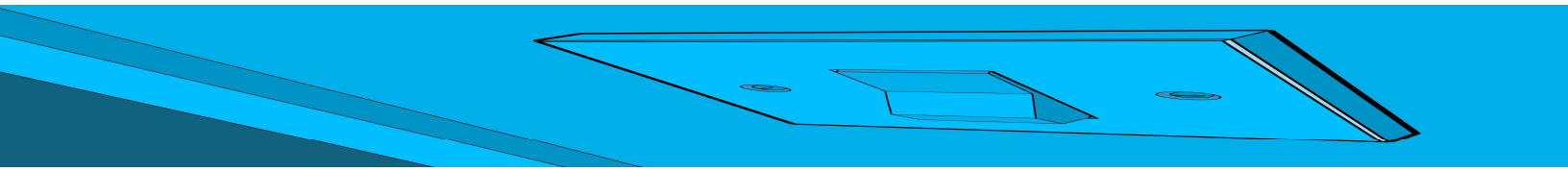

UKERC

UK ENERGY RESEARCH CENTRE

UKERC response to the DECC consultation 'A framework for the development of clean coal'.

September 2009

Dr Jeff Hardy
UK Energy Research Centre
58 Prince's Gate
Exhibition Road
London
SW7 2PG

Tel: +44 (0) 207 594 1572
Email: jeff.hardy@ukerc.ac.uk
www.ukerc.ac.uk

THE UK ENERGY RESEARCH CENTRE

The UK Energy Research Centre (UKERC) was established in 2004 following a recommendation from the 2002 review of energy initiated by Sir David King, the UK Government's Chief Scientific Advisor at the time.

The UK Energy Research Centre's mission is to be the UK's pre-eminent centre of research, and source of authoritative information and leadership, on sustainable energy systems.

UKERC undertakes world-class research addressing the whole-systems aspects of energy supply and use while developing and maintaining the means to enable cohesive research in energy.

To achieve this we are establishing a comprehensive database of energy research, development and demonstration competences in the UK. We will also act as the portal for the UK energy research community to and from both UK stakeholders and the international energy research community.

We are funded by three research councils: the Engineering and Physical Sciences Research Council (EPSRC), the Natural Environment Research Council (NERC) and the Economic and Social Research Council (ESRC).

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UKERC Response

This response is a concise summary of the UKERC view on the framework for the delivery of clean coal in the UK. It does not refer to specific questions within the consultation.

UKERC has previously responded to the BERR Consultation "Towards Carbon Capture and Storage" (September 2008) and House of Commons Environmental Audit Committee inquiry on Carbon Capture and Storage (June 2008). The key points from these are summarised below:

- Carbon capture and storage (CCS) can be a critical CO_2 reduction technology for the UK. CCS is now commencing the early *pre-commercial demonstration* stages worldwide, with the objective of widespread *commercial deployment* by 2020 - 2025.
- It is very unlikely that a CCS plant will operate in the UK until additional costs are covered by appropriate financial support.
- Capture ready design is an important set of practical actions during the design and building of new power plant or other combustion plant, which can be utilised to ensure that CCS retrofit is possible and, hence, avoid “locked-in” high carbon emissions from fossil fuel use in future.
- A wide and encompassing specification of capture ready is needed, to ensure feasible conversion to CCS, without unnecessary additional costs, when it is required by regulation and/or economically justified.
- At the nascent stage of CCS development and deployment, there is a role for Government to provide public education so as to enable citizens directly affected by CCS to understand and make decision about the technology.
- Lessons learned in UK and EU CCS demonstration projects should be shared globally.
- BERR (now DECC) has already given Section 36 planning consent to Natural Gas Combined Cycle (NGCC) power plants including a condition that they are capture ready, but without any detailed guidelines in place for this. Guidelines have now been drafted and were issued for consultation earlier this year.
- There is potential for strategic planning of the CO_2 transport and storage system.

Response to "A framework for the development of clean coal"

General points regarding CCS

- CCS is technically achievable but cost and performance may be variable especially in the early deployment phase. Many estimates exist of the support needed to avoid losses on demonstration plant, typically stated to be a total of €70-100 per ton CO_2. There are likely to be parallels between the implementation of CCS and the history of the deployment of flue gas desulphurisation (FGD) and other technologies[1].
- A market-based approach to CCS would be preferable in the long-term because it matters little where or when CO_2 is emitted. This would also allow CCS to be benchmarked against other low-carbon generation sources and other mitigation options, provided they also operate in the same carbon market.
- However, if the aim is to develop and deploy CCS rapidly, a market-based instrument is insufficient. The EU ETS price is currently too low and too volatile. From an investor's perspective there is huge policy risk attached to the carbon price during the 2020s. There is substantial evidence that clear regulatory signals and the minimisation of policy risk is critical in encouraging the take-up of novel energy technologies.[2]
- Investors make their decisions based on an assessment of risks as well as rewards. Public policy especially needs to minimise and manage policy risk, whereas technical and market risks are best borne by equipment suppliers and operators respectively.
- Regulatory interventions, such as an Emissions Performance Standard (EPS), have a proven track record in forcing the development of emission control technologies whose scientific principles are understood but where engineering practice has yet to be demonstrated (for example FGD and catalytic convertors for cars).
- Such interventions have succeeded where there is no alternative to the technology being forced (for example FGD in Japan, Germany and the US in

[1] E Rubin et al (2006). Estimating the future trends in the cost of CO2 Capture technologies. IEA Greenhouse Gas R&D Programme, Technical Study 2006/6, Cheltenham, February.
[2] UKERC Technology and Policy Assessment report - "Investing in Electricity Generation: the role of costs, incentives and risks", http://www.ukerc.ac.uk/support/tiki-index.php?page=InvestingInPower

the 1970s). Where there is an alternative, investors will seek to avoid the add-on costs associated with emission control technologies. For example in the UK in the 1990s there was a switch to natural gas and in the US to low-sulphur western coal and gas to avoid fitting FGD to power plants.

- Care is needed in defining the purpose of an intervention. The interventions required simply to exclude the option of unabated emissions from coal could be different from those needed to positively encourage the use of coal in a way that reconciles security and climate concerns.
- Regarding EPS specifically, unless care is taken in setting EPS values and timescales, there could be unintended consequences such as a flight from coal, a renewed dash for gas, or the current burn of biomass (which relies on imports and so is not inherently transferable to other nations). It is possible that separate EPS pathways need to be established for coal and for gas (and for other fuels).

Specific points regarding a framework for the deployment of CCS

- The add-on costs of CCS will by themselves discourage coal use. To maintain coal use (and encourage any CCS development at all) will require: a) financial support in addition to the carbon price; b) the extension of the regulatory regime to CCGTs, effectively the back-stop technology; or c) a mixture of the two.
- There would be advantage in establishing a regulatory/financial framework at the earliest possible date to reduce policy uncertainty, leaving technical and economic risks to suppliers and operators who are best equipped to manage and address them. The framework needs careful design and wide consultation in order to: a) avoid incentivising perverse or undesirable outcomes; and b) avoid excessive financial burdens on consumers or taxpayers.
- The framework does not depend on CCS having been “technically or economically proved”. A start could be made now with analytical work and consultation with a view to establishing a regime providing greater certainty to investors as early as possible.
- Such a framework could cover a range of contingencies as regards progress in demonstrating CCS. The contingency measures explored in chapter 4 of the consultation document could be more than just for contingency and in fact

represent a sensible place to start in developing an overall regulatory framework.

- The framework could signal financial support that starts high for the first tranche of plant commissioned (measured in GW capacity) and falls for successive tranches. This has the twin advantage of setting a ceiling on financial support and encouraging investors to be "first in the queue". This approach was used in the US to re-start nuclear construction. It is important that the 'build rate' for new or retrofitted plant with CCS is predicted through to 2030 and beyond. This will ensure that sufficient plant is built at an early stage, to ensure that learning is capable of being transmitted to second and third tranche plant, and that a sufficient quantity of plant with CCS is available on the UK grid by the intended 2030 date. Consideration should be given to setting a 'CCS target' in terms of TWh or GW capacity, as has been done for renewable introductions, so that progress or failure can be assessed.
- The regulatory framework could be based on: a) emission limits calibrated in terms of MW capacity or electricity output; b) maximum annual operating hours for unabated plant; or c) operators electing to take on one of the two previous options. This would allow operators to run: a) plant with CCS at a high load factor; or b) unabated plant at a low load factor. If the electricity system in the 2020s has a large amount of intermittent renewable capacity, unabated fossil plant operating at a low load factor could have a legitimate role to play even in a low carbon future.
- Emission limits or operating hours could be set at different levels for different plant/fuel types (gas as well as coal), by analogy with the LCPD or BREF notes for combustion plant. Different limits could also be set for plants of different vintages (e.g. new v retrofit). A useful guide in setting differential limits would be a "unit cost of CO_2 abatement" benchmark applying to all technologies/fuels. Different timetables could be set for different technology/fuel types. Care would be required in applying such a framework to ensure that accurate and verifiable claims are made regarding costs.
- In the long term, the aspiration should be that caps in the "traded" sector of the economy covered by the EU ETS become progressively tighter and, through a high carbon price, render a "command-and-control" regime irrelevant.

Additional comments

- Skills supply chain – In addition to a financial and regulatory framework the skills supply chain should also be considered at the earliest point. Incentivised business clusters are cited (Chapter 6) as a mechanism for agglomerating business and skills around CCS projects, but specific training activities to ensure a pipeline of people with the requisite skills to deliver CCS on a large scale are not discussed. Over the next few decades, for the UK to meet is carbon and renewable energy targets a number of new supply chains will need to be established. CCS will be competing for skilled people alongside renewable, nuclear and other energy supply chains. A shortage of skilled people is a substantial risk factor in the timely deployment of CCS. UKERC has recognised the need for inspiring the next generation of energy researchers and technical experts through activities such as our annual Energy Summer School[3], Carbon Crucible[4], UKERC Interdisciplinary PhD studentships and through research workshops and training and outreach events[5] organised by the UKERC Meeting Place[6].
- Public acceptance – UKERC is concerned that the public acceptance of CCS is a factor that has been given insufficient attention in consultations to date. In 2009, the experience in Europe is that storage for CCS has been rejected by local publics in Netherlands, Denmark and Germany. We recommend that the Government engage in this issue at the earliest convenience. There is a small but growing body of academic work in this area. In the UK Shackley *et al* have noted that[7] "The potential public perception of carbon dioxide capture and storage (CCS) in the United Kingdom has been recognized as a vital aspect which may hinder (or possibly even facilitate) the future development of the CCS option (e.g. the Energy White Paper (DTI, 2003)). Very little research has been conducted to date on public perceptions and perceived acceptability of CCS, with a few completed or on-going studies in north European countries, the USA and Japan". Dr Shackley is currently completing

[3] http://www.ukerc.ac.uk/support/tiki-index.php?page=MP+Summer+School+events&structure=TheMeetingPlace
[4] http://www.ukerc.ac.uk/support/tiki-index.php?page=MP+Carbon+Crucible+events&structure=TheMeetingPlace
[5] http://www.ukerc.ac.uk/support/tiki-index.php?page=Studentships&structure=Education+Overview
[6] http://www.ukerc.ac.uk/support/tiki-index.php?page=TheMeetingPlace&structure=TheMeetingPlace
[7] S. Shackley et al (2005). The public perceptions of carbon dioxide capture and storage in the UK, Greenhouse Gas Control Technologies, 7, p1699-1704

a review of public perception for the IEA CCS roadmap, to be published in autumn 2009. Related UK work continues at the Tyndall Centre at University of Manchester (Drs Gough and Mander), and University of Cambridge (Dr Reiner). Particular attention ought to be given to the scope the UK has for offshore storage and transport of CO_2. Even if technically more expensive experience elsewhere in Europe suggests that onshore projects are not the way to go for the first examples of CCS projects.