

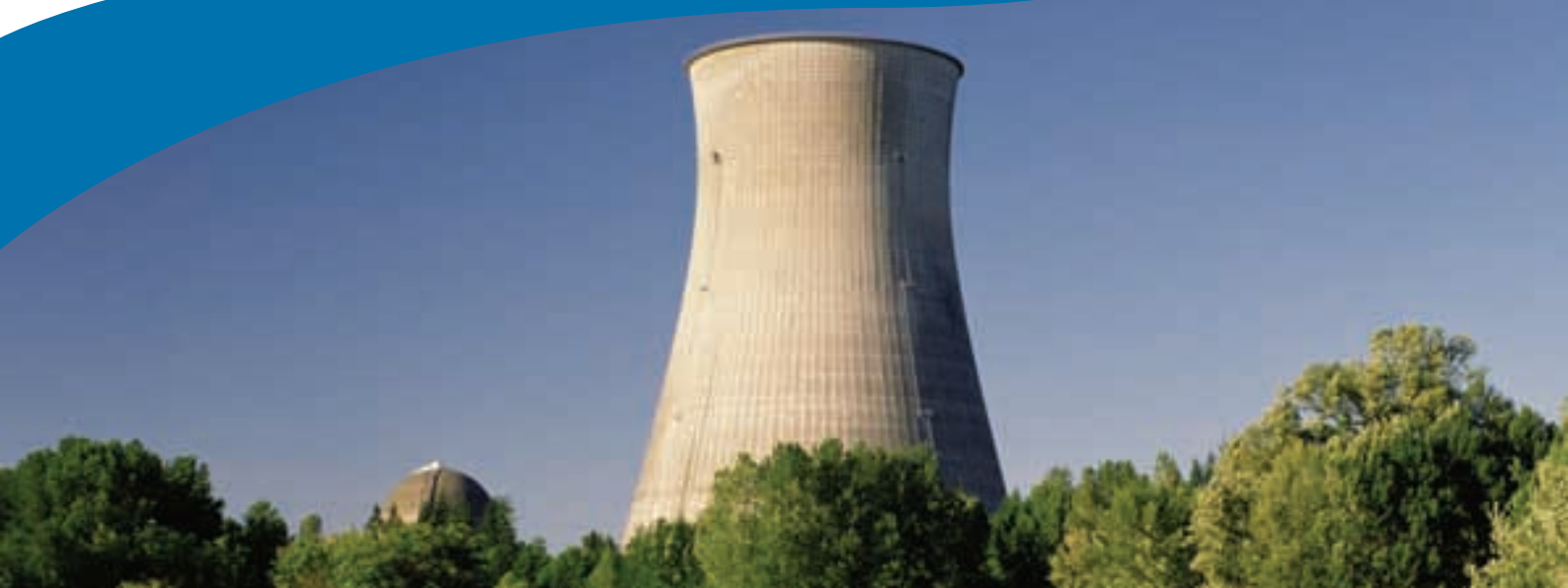
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Carbon Capture & Storage

An overview

2008



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Carbon Capture and Storage (CCS) - A Definition

- **CCS is a Carbon Abatement Technology where the carbon in fossil fuels is captured as CO₂ before or after combustion and stored in geological formations (such as old oil and gas fields and natural underground reservoirs under the sea bed).**
- **To affect CCS, power plants would have to install a second plant to collect CO₂ alongside their main emissions source.**
- **3 main technologies:**
 - ▶ 'Pre-combustion,' reacting fuel with oxygen to produce a gas consisting of carbon monoxide and hydrogen, reacted with steam and separated.
 - ▶ 'Post-combustion,' CO₂ separated from flue gas via scrubbing the latter with a chemical solvent (a well-established industrial process).
 - ▶ Clean coal gasification (IGCC) converts coal into a gas of hydrogen and carbon monoxide by partially burning it using oxygen and then burning it in a gas turbine to generate electricity. IGCC plants can be designed to capture CO₂.
- **CCS has the potential to reduce carbon dioxide emissions from fossil fuel power stations by as much as 90% as the CO₂ released when the coal is burnt is stored underground rather than released into the atmosphere. CCS could contribute up to 28% of global CO₂ mitigation by 2050.¹**
- **Possible problems with CCS include the leakage of stored CO₂, safety and security, cost and transport. The latter could prove to be problematic and would involve either the use of pipelines or transportation via ship.**
- **Across the world, at least 2,000 coal-burning power stations are expected to be built or revamped to add CCS capacity over the next 20 years.²**
- **There is a race to become the first country to create a fully-functioning CCS plant, with the ability to export skills and technology. Although Australia, Norway and the UK are front-runners, "the smart money seems to be on the US...which may have a plant in commercial operation by 2012."³**

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European Union Pilot Projects

- **The UK Government is working with the EU on the latter's plan for 10 to 12 pilot CCS projects within Europe by 2015. The Commission announced plans to remove regulatory barriers to support this development.** ⁴
- **In January 2008, the Commission proposed a Directive to develop an enabling legal framework and economic incentives for CCS within the EU. This was designed to manage the environmental risks, remove unwarranted barriers in existing legislation and improve communication to the public and stakeholders on the risks of CCS and how they are addressed.**
- **CCS is expected to enter into EU discussions on the next round of the EU Emissions Trading Scheme, as well as the future of the post-2012 Kyoto Protocol.**
- **Major energy companies (including Centrica, Powerfuel and ConocoPhillips) want a move to full auctioning of allowances to emit CO₂ from 2012 in the third phase of the EU ETS, as well as tighter National Allocation Plans for distributing carbon permits and bigger penalties for high-polluting plants.**
- **This would move carbon prices up and help CCS projects become more attractive. Centrica described a reformed ETS as "critical in ensuring the UK gets the greener yet diverse power generation mix it needs."**⁵
- **More information on CCS in Europe can be found here: http://ec.europa.eu/environment/climat/ccs/index_en.htm**

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UK Demonstration Project

Aims:

The Government believes fossil fuels will continue to play a leading role in the global energy mix in the foreseeable future. Therefore, they say, it is important to develop CCS to meet the UK's climate change and security of supply objectives.

- **The 2007 Budget announced plans for a competition to develop the UK's first full-scale demonstration CCS plant in the UK, which would be operational "early in the next decade," most likely around 2014.**
- **DBERR announced in October 2007 that it would launch the competition in mid-November for companies to build the £1bn plant.**
- **The winner is expected to be announced in Summer 2009.**

- **The aims of the demonstration project are to:**
 - ▶ Reinforce the UK's international leadership on climate change.
 - ▶ Demonstrate that CCS can deliver large reductions in carbon emissions.
 - ▶ Reduce the risks and demonstrate the success of a full chain of CCS technologies on a commercial scale.
 - ▶ Enable the UK to demonstrate an effective regulatory framework.
 - ▶ Build a skills base and demonstrate the effectiveness of the supply chain.
 - ▶ Contribute to the deployment of CCS internationally by demonstrating it is relevant and transferable to key global markets and emerging economies.⁶

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Criteria

- **The competition is for the “design, construction and operation of an integrated power plant which successfully demonstrates a full chain of carbon dioxide capture, transport and storage technology. The project would have to demonstrate the capture, transport and storage of carbon dioxide at a commercial scale and on a long term basis.”⁷**
- **Business Secretary John Hutton refined the specification of the competition in October 2007, explaining that the project “should demonstrate post-combustion CCS on a coal-fired power station, with CO₂ stored offshore. The Government will consider a phased approach to the project as long as the full CCS chain is demonstrated by 2014, and the project captures around 90% of the CO₂ emitted by the equivalent of 300MW generating capacity as soon as possible thereafter.”⁸**
- **It was originally thought that the project would include pre-combustion CCS. Post-Combustion could also include the Oxyfuel process, whereby the fuel would be burnt in pure oxygen.**

- **The foundations of the competition, therefore, are⁹:**
 - ▶ Single Project, Phased Approach – Government is prepared to fund up to 100% of CCS costs, not including the power plant, subject to affordability and State Aid clearance.
 - ▶ Offshore storage – The Government will need to change the regulatory regime to do this, but is doing so through the Energy Bill currently going through Parliament. Onshore storage will be examined in the future..
 - ▶ Post-Combustion Coal – The reasons for choosing post-combustion coal are that it will differentiate the UK project from equivalents in the and Norway (concentrating on pre-combustion), it is the only technology that can be easily retrofitted to existing stations (particularly relevant for the likes of China) and it is a fuel in abundance in the UK.

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Progress

- **In a report for Government, consultants Bronwen Northmore suggest the following areas as possibilities for the demonstration.^{10,11}**
 - ▶ North East – Centrica/Progressive (joint)
 - ▶ East coast of Yorkshire – EON, Conoco Phillips
 - ▶ Hatfield, South Yorkshire – SSE/Powerful (joint)
 - ▶ Tilbury, Essex – RWE npower¹²

- **BP did have plans for Peterhead in the North East of Scotland, but abandoned these in May 2007 after the Government delayed a decision on subsidies.¹³**

- **DBERR has developed a series of workstreams to govern the competition process:**
 - ▶ Objectives and evaluation criteria
 - ▶ Competition design
 - ▶ Financial support Mechanism
 - ▶ Regulatory
 - ▶ Stakeholder Management

- **Plus, they have announced consultants on the competition:**
 - ▶ PB Power (Technical)
 - ▶ PWC (Economic/Financial)
 - ▶ Freshfields (Legal)

- **It is not yet clear how much money will be awarded to the winner, but there is speculation that it could be around the £300m mark (about a third of the total cost of CCS of around £1bn).¹⁴**

- **According to the national press, “the winner could dominate the sector for decades to come.”¹⁵**

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Shortlist

- **DBERR announced in July 2008, that 4 companies out of a longlist of 9 had made it onto their shortlist:**
 - ▶ BP Alternative Energy International Ltd
 - ▶ EON UK Plc
 - ▶ Peel Power Ltd
 - ▶ Scottish Power Generation Ltd

- **However, BP pulled out of the race in November 2008 after struggling to find suitable partners for a bid.²⁸**
- **In addition, there is speculation that RWE nPower will initiate a legal challenge to the selection process after being excluded on a technicality.²⁹**
- **Discussions in the next phase of the competition between the Government and the four bidders will focus on technical, commercial, contractual and financial issues.**
- **The Government says that “the project continues to be on course to be operational by 2014 – making the UK one of the first countries in the world to demonstrate CCS on a commercial-scale.”¹⁶**
- **The competition winner is expected to be announced in May/June 2009.**
- **Competition webpage: <http://www.berr.gov.uk/energy/sources/sustainable/carbon-abatement-tech/ccs-demo/page40961.html>**

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CCS Consultation

- **The Government launched a consultation in July 2008 on the legislative framework for CCS, including Carbon Capture Readiness.**
- **The proposals are designed to create a more consistent understanding of CCS across the EU and mean that carbon capture readiness of new power stations will have to be addressed by developers in the design process and taken into account by the Government in deciding whether or not to consent to such stations.**

Industry Reaction

- **Carbon Capture Association¹⁷**
 - ▶ Said the Government had failed to deliver on the market potential of CCS and had “damaged the confidence of the sectors involved in the CCS industry” by specifying a specific technology (post-combustion).
 - ▶ Outlined that industry was developing a number of technologies for commercial-sized CCS and that the Government had originally encouraged this: “By choosing to support only one modestly sized project, the opportunity to make the UK a world leader in this important area will be missed.”
 - ▶ It will, they said, result in several projects being abandoned after considerable cost, especially in terms of pre-combustion CCS, which were well advanced and could have been installed faster than the Government intends for post-combustion.
- **Stakeholders**
 - ▶ Climate Change Capital, an independent investment bank specialising in climate issues, said the Government’s decision to back post-combustion CCS was wrong. “The Government is basically telling power companies that they can keep building conventional high-emitting coal plants and that the taxpayer will bail them out.”¹⁸

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- ▶ The Renewable Energy Foundation called the demonstration project a waste of taxpayer's money that could prevent investment by making the technology look as if it needs Government assistance. "We don't need to see whether we can capture carbon dioxide from power stations. We know we can. We don't need a competition. We just need to get on with it."¹⁹

■ Major energy companies

- ▶ Several major energy companies are preparing to seek a judicial review of the Government's change of specification, accusing them of poor consultation, wasting taxpayers' money and leaving the detailed and expensive plans of many companies suddenly ineligible.²⁰
- ▶ The companies named include; Centrica (owner of British Gas), Shell, Scottish and Southern Energy, Conoco-Philips, Marathon Oil, Powerfuel Group, Climate Change Capital and Greenpeace.²¹
- ▶ The Government's decision throws into doubt plans for a £1bn "clean" coal power station in the Tees Valley, as the interested investors, Centrica and Progressive Energy, were planning a pre-combustion CCS facility.²² Centrica said that there was now "a question mark over the economics of the project."²³
- ▶ Scottish and Southern (East Yorkshire), Powerfuel (East Yorkshire) and Eon (see below) have all been working on pre-combustion projects, which are now in doubt.

■ E.ON²⁴

- ▶ E.ON expressed its support for the Government's amendments, confirming its intention to take part in the competition.
- ▶ It is one of the few of the UK's leading generating companies to have developed both pre- and post-combustion projects, notably at Kingsnorth in Kent (plans for Carbon Capture ready supercritical coal-fired units).
- ▶ EON "believes that the choice of post combustion demonstration technology is entirely rational given that the Government has set the objective of demonstrating technology that can be retrofitted in China and other countries to their new and future coal-fired plant....We therefore support the Government's decision and are currently evaluating options for entering a post combustion project or projects into the competition."

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- ▶ The Government is currently considering a planning application from E.ON to build two 800MW supercritical coal-fired units at its existing Kingsnorth power station.

■ **Scottish & Southern Energy (SSE)**

- ▶ SSE have plans for carbon capture facilities at Peterhead, Scotland, and are actively exploring options in Yorkshire and Lancashire.²⁵

■ **Shell & Powerfuel**

- ▶ Powerfuel and Shell signed a license agreement in April 2007, allowing the former to use Shell's gasification technology in its proposed IGCC coal fired power station at Hatfield, South Yorkshire. This would enable carbon capture and storage to take place at the lowest cost using current technology.²⁶

■ **ConocoPhillips**

- ▶ In its 2006 Sustainable Development Report, they said that "ConocoPhillips is actively pursuing advances in the technology components of CO2 capture and storage and making detailed studies of specific opportunities to demonstrate the process on a large scale."²⁷

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