

Carbon capture and storage

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The technology

Carbon capture and storage (CCS) is a relatively new technology designed to tackle climate change by preventing the release of carbon dioxide (CO₂) from the burning of fossil fuels. Instead, the CO₂ is collected and stored deep underground. In theory, it may be possible to apply CCS to any industrial process that emits large amounts of CO₂, but for now it is being considered mainly for use in coal fired power plants.

CCS technology consists of three distinct phases:

- **the capture phase**, in which CO₂ is collected either pre-combustion by gasification (processing the coal at high temperature with steam or oxygen), by an oxy-fuel process (burning the coal with almost pure oxygen), or post-combustion (collecting the CO₂ from the flue gas). It is unclear at present which method is the most effective in any given situation.
- **the transport phase**, the most straightforward phase in technical terms but which could entail significant infrastructure investment on the scale of the oil and gas industry.

- **the storage phase**, which is currently being employed on depleted oil fields, into which CO₂ is injected in order to extend the field's life. Eventually, an underground store of salt water (saline aquifer) capable of absorbing the carbon may be an option providing a much larger potential capacity.

Until now, each of these phases has been shown to work successfully, but only on a small scale and not as a full chain, which is crucial if the technology is to work commercially.

The coal challenge

Globally, coal accounts for over a quarter of total primary energy supplies, and the International Energy Agency estimates that by 2030, without changes in global policy, it will still account for about 28%.¹ Coal production has risen sharply since 2000, mainly due to the growth of the Chinese economy, which is heavily reliant on electricity generated from coal-fired power stations.²

In the UK, coal accounted for about 36% of electricity supplied in 2008.³ There are currently 18 coal fired power plants in the UK, including Drax,

the biggest power plant in the UK at 4GW. Under the European Large Combustion Plant Directive, several of these plants are due to close down. Combined with the closure of our ageing fleet of nuclear plants, this means that a significant amount of new capacity will need to be built over the next decade.

Much of this may come from renewable sources such as wind or a new generation of nuclear plants. But, in order to keep the lights on, it is likely that new fossil fuel power plants will be required.

Given the UK's statutory targets for carbon reduction as outlined in the Climate Change Act (see *Climate Change Act*, overleaf), the continuing use of coal is clearly problematic – coal releases more CO₂ per unit of energy than other fossil fuels. CCS presents a possible solution. It would offer the advantages of coal – large-scale flexible generating capacity and increased diversity of supply – but avoid any increase in carbon emissions.

The question of whether or not new coal fired plants should be allowed has become a contentious issue – as highlighted by protests centred around the Kingsnorth site

1 www.iea.org/textbase/nppdf/free/2009/key_stats_2009.pdf (p. 46)

2 Ibid (p. 14)

3 www.decc.gov.uk/media/viewfile.ashx?filepath=statistics/source/electricity/dukes5_6.xls&filetype=4

in Essex where energy generator and distributor E.ON was planning to replace its existing coal and oil fired plant with a new coal fired plant. E.ON has since shelved these plans but it is likely that any future projects involving coal will prove controversial because of the perceived conflict with the drive to reduce carbon emissions.

However, even if CCS does prove commercially viable, the rate at which it can be integrated into the global energy system is also a factor. By the time retrofitting of CCS technology to existing power stations is possible, it may be too late.

Government action

In 2007, the UK government launched a competition to build a full-scale CCS demonstration plant.⁴ The winning entry will be required to show the full capture and storage chain by 2014 and generate the equivalent of 300MW of power. The terms of the competition were set so that only CCS options that can be retrofitted to existing power plants were eligible to enter.

The Government made further commitments to developing CCS in the 2009 Budget that were developed in a consultation document in June 2009.⁵ This laid out a new regulatory and financial framework to: provide financial support for up to four commercial-scale demonstration plants, require any new coal plant to demonstrate CCS on part of its capacity, require full retrofit on

new coal plants within five years of CCS being proven, and prepare contingencies should CCS not be proven as early as expected.

Summary

The UK is currently heavily reliant on coal for energy. Many coal-fired plants and nuclear plants are due for closure. To meet the shortfall in energy supply, the UK may have to look at new coal power and CCS is a technology that could allow that new capacity to come on-stream without increasing carbon emissions. It should be a priority to develop this technology.

The Royal Academy of Engineering:

- believes that CCS is uniquely placed to make a significant contribution to reducing CO₂ emissions, both nationally and globally, and that its rapid development must be a priority
- recognises the scale of the challenge and calls on Government to put in place policies that will incentivise the development of CCS technology as a matter of urgency
- calls for the Government to work with the engineering community to scope the further demonstration work is needed for CCS plants. The existing framework for further demonstration projects is to be supported but the expedient delivery of these projects is required to assess the actual potential of CCS within a very tight timescale.

Climate Change Act

The Climate Change Act stipulates that the UK should reduce greenhouse gas emissions by at least 80% below 1990 levels by 2050.

In addition, following advice from the newly formed Committee on Climate Change, the 2009 Budget announced that the Government will set the UK's first three carbon budgets at levels leading to a 34% reduction in greenhouse gases by 2020 relative to 1990 levels.

Contact

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4 www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/ccs/demo_comp/demo_comp.aspx
5 www.decc.gov.uk/en/content/cms/consultations/clean_coal/clean_coal.aspx