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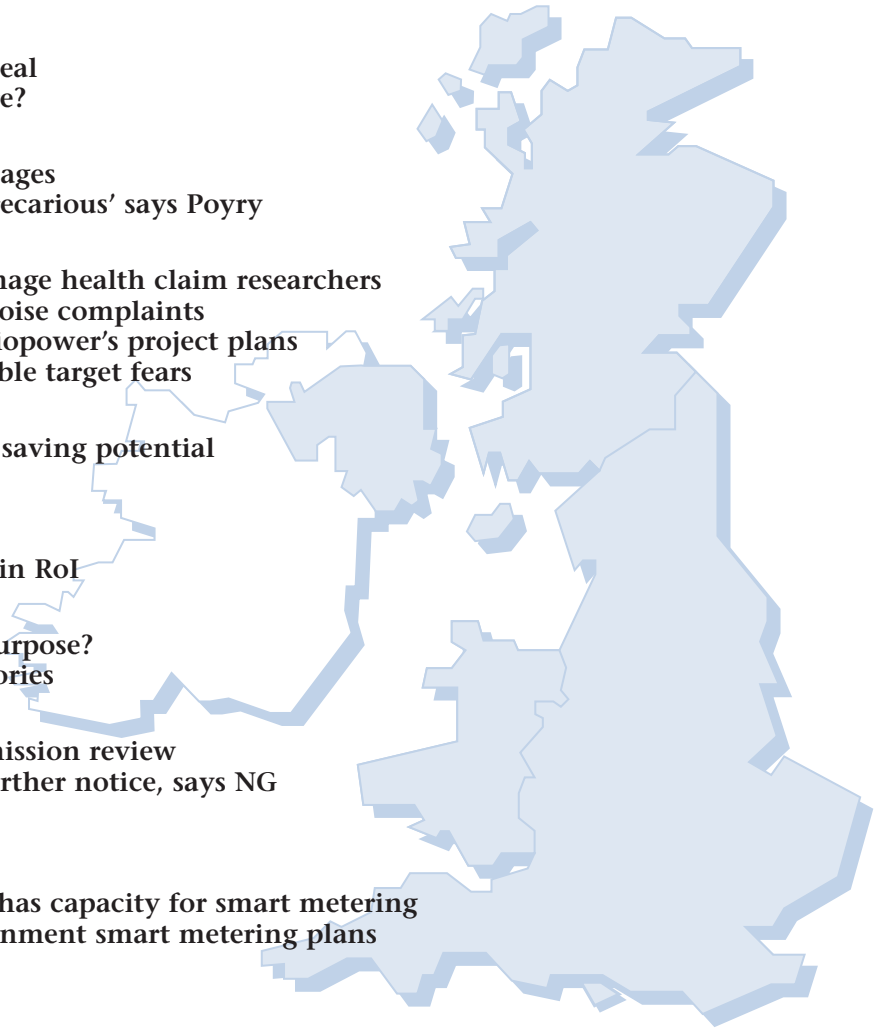
Power UK



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Decision time for carbon capture?

Both the European Union and the UK have made a number of ambitious climate change commitments. Big changes will be required if the UK and Europe are to meet their commitments. Within the power sector it is difficult to see how renewables alone will deliver the significant emissions reductions required. In the following article, **Alice Waltham** and **Dr Michael Wagner*** argue that serious thought should be given to backing the carbon capture and storage (CCS) option.

The EU has made a number of challenging emissions reduction commitments. Most recently in March 2007, it committed to cut greenhouse gas emissions by 20% by 2020 against a 1990 baseline, with an aim to increase this to 30% if other industrialised nations follow suit.

The UK has also made a number of its own climate change commitments. The Draft Climate Change Bill includes a commitment for a cut in carbon dioxide of 26-32% by 2020 and 60% by 2050. This would make the targets set in the 2003 Energy White Paper binding. The government has already set a non-binding target to reduce carbon dioxide emissions by 20% by 2010 against a 1990 baseline although it now acknowledges that this may be too challenging.

CCS in coal plants could deliver savings of around 17% against the UK's total 1990 level.

The Stern Review indicated that carbon capture and storage (CCS) could contribute 28% of global carbon dioxide mitigation by 2050. Based on current levels of coal generation, CCS in coal plants could deliver savings of around 17% against the UK's total 1990 level – bringing the UK much closer to its 2020 target.

A factor in favor of CCS is that environmentalists (who have generally been opposed to nuclear) have taken a broadly neutral view on CCS,[1] which could make it politically easier to implement.

Given the significant potential carbon savings, the EU is looking seriously at the role CCS could play in helping it meet their carbon reduction targets. It has recently announced plans for up to twelve CCS demonstration plants in Europe by 2015. The UK intends to contribute to this total. The 2007 Budget launched a competition for a commercial scale CCS plant.

The European Commission is also examining a number of other options to bring forward the development of CCS. One of the most dramatic proposals it is considering is mandatory CCS for new build coal generation from 2020 and for all coal from 2050.[2]

What CCS can deliver

Coal is one of the most carbon intensive energy sources so it is the obvious candidate for CCS. In Great Britain coal currently provides 42% of electricity generation, but carbon emissions from coal make up 73% of power sector emissions under the EU ETS[3]. Using provisional Department of Environment, Farming and Rural Affairs (Defra) data for the UK in 2006, it can be estimated that 23% of the UK's total carbon dioxide emissions were from coal fired power stations.[4]

The net effectiveness of CCS at capturing carbon (taking into account the additional energy required) is 80-90%.[5] In the UK in 2006 coal power plants were responsible for 128 million tonnes of carbon dioxide emissions.[6] Therefore if CCS was applied across all coal plants in the UK it could theoretically reduce current carbon dioxide emissions by 103 million tonnes – that is a significant proportion of the UK's total carbon dioxide emissions, which in 2006 were about 561 million tonnes.[7]

Legal and regulatory hurdles

The greatest potential for storing carbon within the EU is burying it in oil and gas wells or aquifers beneath the sea. However, there are strict international rules governing how waste can be stored in the sea, which include the London Convention and OSPAR (the Convention for the Protection of the Marine Environment of the North Atlantic).

The EU has devoted a lot of time and effort adapting the legal and regulatory framework to make it legal to store carbon dioxide. From February 2007, the London Convention now permits seabed geological storage providing it is "overwhelmingly" carbon dioxide (no other waste). The OSPAR Commission has also adopted measures to permit CCS at this year's convention in June 2007. This removed the last major regulatory hurdle to sub-seabed storage of carbon dioxide.

Another question that will need to be resolved before large scale CCS can begin is who has the long term liability?

Storing carbon for potentially thousands of years means that any insurance is likely to be prohibitively expensive especially given the novel nature of the technology. The most likely solution would be for the liability to pass to the state at some defined point after the projects stops being operational.

The UK government has already indicated that it is likely to take this route. The Department for Business, Enterprise and Regulatory Reform (DBERR formerly the DTI) said in June 2007 that its current intention is that an operator would be licensed to store carbon dioxide offshore. Once the site has been decommissioned and the licence has ended DBERR expects there to be a contractual provision for any residual liability to pass to the Crown – although the operator may need to make some payment for this transfer.

At present CCS is not eligible under the European Union Emissions Trading Scheme (EU ETS), so it does get any value for carbon not being released into the atmosphere. However, there are now plans to include CCS in the EU ETS from 2013 and there has been discussion about whether it could also be incorporated in the period 2008-2012.[8]

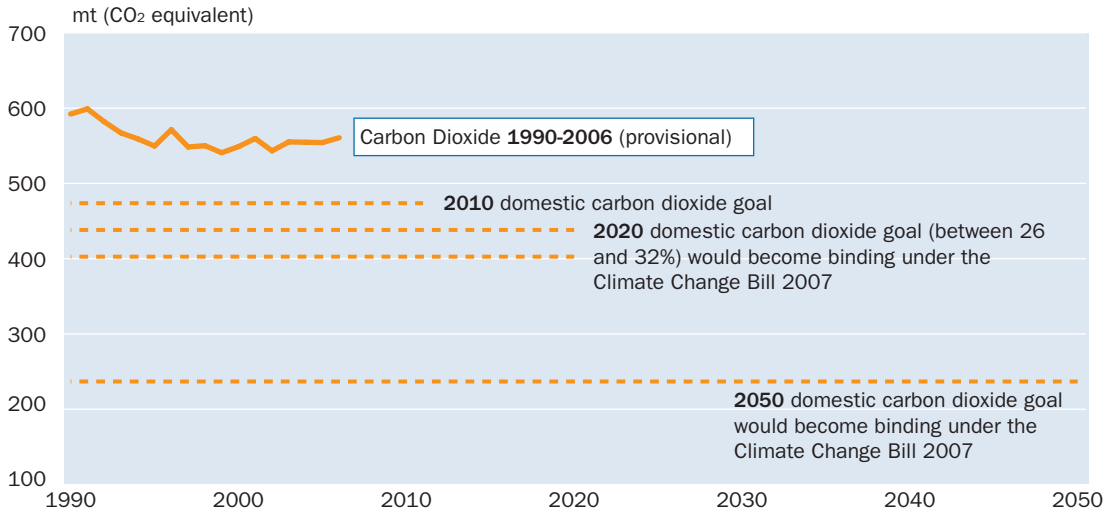
Counting the cost

CCS is an expensive technology and at a very early stage in its development. The most significant costs involved in CCS are:

- Additional capital costs of building new plants with CCS or adapting existing ones;
- Energy intensive process of extracting carbon dioxide from other flue gases;
- Capital cost of building the pipeline infrastructure necessary to transport the carbon dioxide.

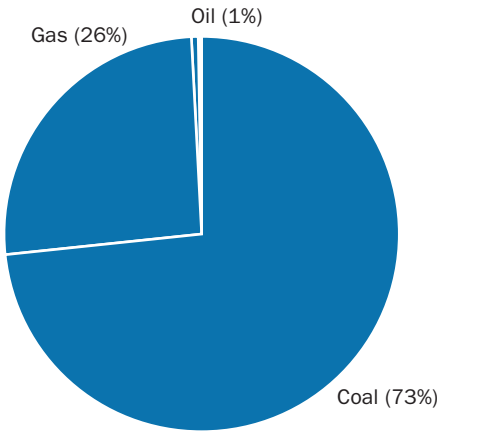
There is little commercial experience of CCS so cost estimates vary widely. Taking a broad view across a

Emissions of carbon dioxide



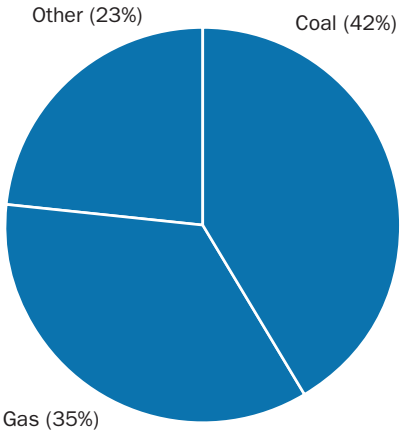
Source: AEA Energy & Environment

2006 GB Power Sector Verified Emissions



Source: IPA Analysis/EC Community Independent Transaction Log

2006 GB Electricity Generation



Source: IPA Analysis/Elexon Data

Forecasting the carbon price

IPA Energy + Water Consulting provides forecasts of EUA carbon prices over a 25 year forecast horizon. The carbon price forecasts are based upon proprietary modelling of supply and demand for EUAs, utilising assumptions on traded sector targets, limits on the use of imported credits and the level of supply of JI and CDM project credits. The effort required by the traded sector to meet emission reduction targets is calculated as a reduction on business as usual, with emissions abatement curves derived from Primes data (the energy systems model used by the European Commission for calculating its forecasts).

Forecasts of Phase II EUA prices are based upon detailed analysis of the NAPs and analysis of the likely supply of imported credits (and limitations on their use), as well as utilising evidence from the current traded market. Analysis of the Phase II NAPs shows that the traded sector is bearing a larger proportion of the cuts than the rest of the economy based on 1990 levels. However, traded sector reductions on business as usual projections are less stretching, and this coupled with generous limits on the use of imported credits has helped mitigate upward carbon price pressures.

Forecasts looking beyond Phase II require assumptions on political developments, particularly the level of future targets. The IPA Base Case assumes 2020 emission reduction targets of 20% on 1990 levels (with the traded sector assumed to be bearing a larger proportion of required reductions), reflecting the EU's recent independent commitments, with a 2030 target of 30% assumed.

The future value of EUAs will be highly dependent upon future political decisions about emissions reduction trajectories and the industries and gases covered by the Emissions Trading Scheme, all of which are currently under debate. IPA produces three carbon price scenarios, capturing a credible range of uncertainty surrounding the future trajectory of EUA prices. IPA forecasts for 2030 currently place EUA values in a range between €20/tCO_2 to €40/tCO_2, depending on the scenario considered.

range of studies it seems that any significant take-up of CCS will need a stable carbon price of about €40 (or £27) per ton of carbon dioxide abated.[9] It is likely that initial costs will be higher because of the costs involved in adapting the technology to commercial scale.

Phase two EU carbon allowance (EUAs) are currently trading at around €20 per ton. IPA's own modelling suggests that, given current indications on the level of emissions reductions targets and the scope for achieving reductions through the Kyoto flexible mechanisms, EUA prices are unlikely to rise sufficiently to stimulate significant CCS development until approaching 2030. These forecasted carbon prices indicate that it is doubtful whether the EU Emissions Trading Scheme (ETS) alone can support CCS development over the medium term. Even if carbon prices reach the higher end of the forecast range, the regulatory uncertainty that surrounds future values may discourage investors relying on future carbon prices to support project economics.

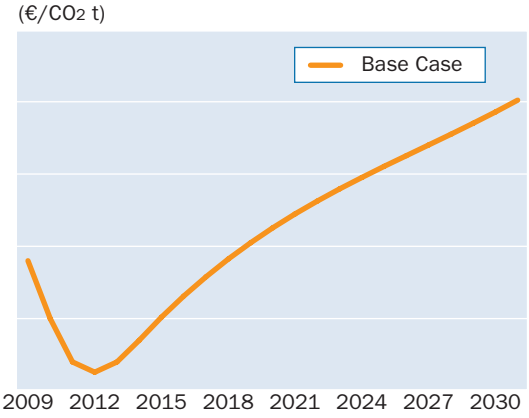
Supporting CCS

There are a number of mechanisms that the UK government and the EU could choose to use to provide additional support to CCS. As well as the EU ETS, many member states also have environmental taxes. In the UK Climate Change Levy (CCL) is a tax on final energy use, at £4.41 per MWh of electricity. Renewables and good quality CHP are exempt from the CCL but at present CCS generation would not be exempt from the levy. An exemption for CCS might help to encourage development although it is unlikely to be sufficient on its own.

Another option would be a support mechanism that reduces the cost to companies of installing CCS. This could take the form of public financing, state-funded infrastructure or some form of subsidy (eg feed in tariffs). Some of these options may be difficult under state-aid rules and could be considered as contrary to the "least cost" principle of the ETS.

One of the less controversial options that the EU may consider in order to cut costs for early stage projects is to provide the infrastructure required to transport the carbon dioxide. This could reduce the cost to developers by €4-10 per tonne in the UK[10]. In some circumstances this infrastructure could be shared between plants using the same storage site; however the geographical spread of generators and storage sites may mean it is cheaper to build a direct pipeline for a specific plant.

IPA Forecast Carbon Prices



Source: IPA

Decision time...

If the EU went ahead with the suggestion to mandate CCS for coal, without some form of support mechanism, then it is likely to simply discourage the replacement of coal plants.

If the EU went ahead with the suggestion to mandate CCS for coal, without some form of support mechanism, then it is likely to simply discourage the replacement of coal plants.

Although coal is the largest emitter of carbon in the power sector its total removal from the fuel mix would not necessarily be a good outcome. Coal currently plays an important role in power generation across the UK and Europe by helping to ensure the security and diversity of energy supplies.

CCS has another factor in its favor – it can be rolled out relatively quickly. It can either be part of a new-build power station or retro-fitted to existing plant provided there is enough space (the plant required to separate the carbon takes up about the same amount of land as the generator itself).

But for this to happen the economics need to be right and this is far from the case at present. CCS is unlikely to happen on a significant scale without targeted initial support from the government.

And there are indications that the power industry is growing impatient to know whether the government will provide extra support. Delays in decision-making have already led to BP announcing it will pull out of a potential CCS project at Peterhead.

The UK competition for commercial scale CCS is the biggest sign of action so far. However, if CCS is to deliver significant carbon savings then it is likely that the EU and UK will have to do more. The important question is whether the benefits of coal with CCS justify the additional cost of targeted support?

** Alice Waltham is a consultant and Dr Michael Wagner is an associate director at IPA Energy + Water Consulting*

(1) Current positions judged from websites: Greenpeace opposes CCS, Friends of the Earth has moved from opposing to neutral, Campaign to Protect Rural England and the Green Alliance are neutral, World Wildlife Fund is broadly in favour

(2) Sustainable Power Generation from Fossil Fuels: Aiming for Near-Zero Emissions from Coal After 2020 – European Commission, January 2007

(3) EU ETS Verified Emissions data and Elexon Balancing Mechanism data

(4) Based on AEA Energy & Environment data from the DEFRA website

(5) Special Report on Carbon Dioxide Capture and Storage – Intergovernmental Panel on Climate Change (IPCC), 2005

(6) Data from EU ETS Verified Emissions

(7) Based on provisional DEFRA data for the UK in 2006

(8) Sustainable Power Generation from Fossil Fuels: Aiming for Near-Zero Emissions from Coal After 2020 – European Commission, January 2007

(9) Studies include MIT (1997), IEA (2001), FES (2003), IPCC (2005) and Pöyry (2007). Precise figures depend on the circumstances considered.

(10) Distributed Collection Study by Gastec & AMEC for IEA

Earnings up 39% at RWE npower

continued from page four

RWE npower increased its profits by nearly 40% year on year in the six months to June 2007.

The company says that its EBITDA rose 39.9% year on year from £224 million (€331 million) to £313 million (€463 million). Operating profits rose 44.2% from £185 million (€274 million) to £267 million (€395 million) on the back of higher wholesale power prices, the ending of low price power offtake contracts and improved plant availability, the company says.

The company generated more from its gas-fired plant (8.3 TWh compared with 5.9TWh) as gas purchasing costs fell while coal generation fell from 11.2 TWh to 7.4 TWh.

RWE npower's electricity sales were down however because of lower demand caused by the very mild weather. Sales totalled 27.6 TWh (11.2TWh related to domestics and small business customers and 16.4TWh to larger customers) and were 4% below the high level achieved in the first half of 2006.

* RWE-Npower has picked Alstom as contractor for its planned 2,000-MW combined cycle gas turbine power plant at Pembroke in southwest Wales. The company hopes to secure Section 36 consent from the government to start construction next year in 2008. RWE-Npower has recently submitted an environmental impact assessment for the Pembroke plant.