

# Carbon capture

The UK is involved in a truly ambitious project to demonstrate carbon capture from traditional coal-fired power plant, as Dr Tom Shelley reports

The UK is to finance the construction of a 300–400MW coal-fired power station with full carbon capture, and intends to work with China on developing and implementing the technology globally. Why? “Because coal is still the cheapest and most readily available source of energy,” said Hilary Benn, Secretary of State for Environment, Food and Rural Affairs, at a meeting organised by the Institute of Physics, the Royal Society of Chemistry and the Institute of Biology.

“If we are going to have any chance of meeting our targets, post-combustion CO<sub>2</sub> capture is the technology with the greatest potential,” he added. Given that some are calling not just for a 60% cut in carbon emissions by 2050, but a cool 80% – and that’s against a background of rising worldwide demand – it’s easy to see the thinking.

## Costs captured

Coincidentally, at a meeting on the previous day, organised by the Institution of Materials, Minerals and Mining (IOM3), Keith Burnard, chief technical consultant at AEA Energy and Environment, and technical director of NZEC (the UK-China Near Zero Emissions Coal project) explained that the Energy Transfer Fund will cover up to 100% of the costs.

The specification is for around 90% post-combustion capture on a coal-fired station – most likely oxy fuel-fired – and the full demonstrator should be ready by 2014. Phase one is to assess options by mid 2009; phase two is to complete design by 2011; and phase three is to construct and operate the demonstrator by 2014, with the UK project likely to be near the North Sea.


Why? Because of experience already gained from Statoil’s CCS (carbon capture and storage) demonstration project on the Sleipner field in Norway – where one million tons of CO<sub>2</sub> per year, from natural gas production, have been sequestered in the Utsira Sand saline water-filled gravel aquifer, above the gas field (1,000m beneath the North Sea). That has been running since October 1996 and best estimates are of 10 million tonnes of CO<sub>2</sub> now stored.

Dr Andy Chadwick of the British Geological Survey, addressing the IOM3 meeting, described the results of seismic and gravimetric surveys, showing that CO<sub>2</sub> is being safely stored, with no sign of leakage and good dispersal into the aquifer.

Both the British Geological Survey’s Sam Holloway and professor Peter Styles, director of the Environment, Physical Science and Applied Mathematics Research Institute at Keele University, agreed that there is more than enough capacity under the North Sea – in saline aquifers and old oil and gas fields – to bury Western Europe’s waste CO<sub>2</sub> for the foreseeable future.

However, for countries without such aquifers, professor Klaus Lackner, from Columbia University, and Dr Mercedes Maroto-Valer, director of the Centre for Innovation in CCS at the University of Nottingham, spoke of techniques for reacting CO<sub>2</sub> with rocks such as olivine and serpentine, which are magnesium silicates, as well as red mud from aluminium extraction. Meanwhile, professor Styles also mentioned pumping CO<sub>2</sub> into un-mineable coal seams, producing methane and/or carbon monoxide and hydrogen fuels, while trapping CO<sub>2</sub>.

All will involve significant plant engineering challenges. CO<sub>2</sub> will be supercritical at the depths of injection discussed – and it had better be 99% pure, because wet CO<sub>2</sub> will result in corrosive carbonic acid. The CO<sub>2</sub> at Sleipner is removed from natural gas and dried first, but extracting CO<sub>2</sub> flue gas from conventional firing is far from straightforward – hence, among other reasons, the likelihood of oxy fuel-firing. Whatever transpires, we’re likely to be talking about big oil industry plant equipment and large compressors, as well as serious pipe and drilling plant.

As Benn concluded: “If we can show CCS to be viable, we may make it mandatory on all fossil fuel-powered plant.” 

## Pointers

- As carbon capture and clean-burn technologies grow in importance in the power sector, there will be an increasing role for skilled plant engineers
- Coal-fired power plant is likely to be at the leading edge of carbon capture projects, and will use substantial plant, as per the oil and gas industry
- Dr Carol Turley, at the Royal Society, says that carbon capture can be achieved using green algae in a photo bio reactor, producing biodiesel, using fatty acid transesterification

Coal-fired power stations in the UK are set to be the stage for carbon capture

