



How Clean is Clean Coal?

Price
20p

Clean Coal?

The Government's energy review, the escalation of oil and gas prices due to rapid economic growth in China and India, damage to oil platforms and pipelines, shortage of refining capacity, fuel prices of £1/litre and conflict in the Middle East, have all focussed attention on the UK's dependence on imported fossil fuels and its vulnerability to interruptions in its free flow. It has already led the Government to concede that cost and safety concerns are insufficient to preclude new nuclear power stations, and promoted again thoughts about 'clean coal' technologies - coal being by far and away the most abundant fossil fuel in this country. How close are we, then, to using coal without accelerating global warming?

Some history

It is thought the Chinese, BC, and the Romans in Britain burnt coal but the oldest, intensively worked, coal mines are probably those in NE England where seams lie close to the surface and lumps of coal were, and are, washed up on the beaches. Records show movements of coal as early as the 13th century, notably through Newcastle which was blessed with a natural port on the Tyne close to shallow seams. Coal was shipped down the east coast to London as early as 1305, and Henry III took one load at least to warm Windsor Castle. By 1334 Newcastle was the 4th wealthiest town in England after London, Bristol and York. In 1378 15,000 tons were exported, some into mainland Europe. The demand for coal increased dramatically during the industrial revolution with its growth of manufactories, the movement of peoples into towns, and the subsequent spread of railways across the land. The massive uncontrolled use of coal enabled great gains in material wealth but led to death in mining accidents and through polluted air, and acid rain which attacked buildings as well as lakes. As early as 1854 Dickens was writing in *Hard Times* of Coketown, "a town of red brick, or of brick that would have been red if the smoke and ashes had allowed it". 'Smogs' were common even 50 years ago and London regularly suffered for 90 days in a year. In December 1952 men had to walk in front of ambulances, cinemas were closed because audiences couldn't see the screens and 4000 deaths were attributed to a smog which lasted 15 days.

Cleaning coal

Coals vary in quality with the deep mined anthracite from South Wales having the highest hydrocarbon content. Most have more than 90% with the residue including nitrogen and sulphur and traces of many minerals including some which make coal mildly radioactive. Nitrogen is a problem (combustion produces NO_x gases) but sulphur a greater one. Sulphur dioxide affects the respiratory tracts and dissolves to form 'acid' rain.

The first 'clean' coal technologies aimed to remove the 1-3% of sulphur in the coal, the best known being 'flue gas desulphurisation', begun some 25 years ago, which uses limestone to secure the sulphur in gypsum (used in plasterboard). FGD uses energy and adds cost.

Two other technologies have been described as 'clean'. The first which converts coal to methane, hydrogen and CO₂ by passing oxygen through the *underground* seam sounds attractive if control can be assured. Risks to life and limb and from dust are removed and thin, as well as thick, seams worked. First proposed in 1868 it was tried successfully in Derbyshire in the '50s, re-considered in the '70s and is now on the agenda again.

The second clean technology is the 'fluidised bed'. Basically air is forced upwards through a bed of coal increasing the efficiency of combustion and the electricity generated without increasing CO₂ emissions.

Progress with sequestration

It is only in the last 15 years that reducing or 'capturing' CO₂ itself has been considered. One obvious 'prison' is in depleted gas fields: another in underground aquifers. Four countries, Norway, Japan, USA and UK have made progress. Norway has been 'sequestering' 1 M tonnes/year of CO₂ (the emissions from roughly 100,000 UK citizens) in the Sleipner underground aquifer since 1996. Japan has plans to store 200 times as much. The UK project is being led by BP who are planning to pipe CO₂ from the 350 MW Peterhead power station, Aberdeenshire, 240 km offshore to their Miller oil field in the North Sea. BP's hope is that CO₂ injection could increase the field's yield by 40 million barrels by extending its life 15-20 years, and pay for the estimated £300M investment. A similar, 500 MW, project is being pursued with the Carson field off California.

Conclusions

Doubts about the technology remain. The challenges: undersea and high pressure, are forbidding. Injection needs to be at depths over 800 metres where the CO₂ will be liquefied. In underwater aquifers it should slowly dissolve in the brine and then form a solid carbonate with the rocks.

Costs are also uncertain. Peterhead-Miller is a favourable situation: others will be less so. It is possible sequestration will take 20% of electricity output and only add about 2p/unit¹ to the price making clean coal competitive with nuclear and wind. There is sufficient capacity. Aquifers have some 400 years storage at present rates of global emissions although 25,000 Sleipners would be needed to receive them all. Clean coal might provide an alternative or addition to nuclear - but the research needs to be done first.

1. This and subsequent numbers come from a very good article "Between a Rock ..." by Martin Blunt of Imperial College in a CIWEM publication "The Global Environment 2006"

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