Environmental Health

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Meeting UK Energy and Climate Needs: The Role of Carbon Capture and Storage

Carbon Capture and Storage (CCS) is likely to be tested on an industrial scale in the UK, within the next ten years.

Many of the liability related risks can be predicted from experience with industrial chemistry and oil production. Commercial liability risks would depend on the economic model imposed by policy makers. Long term liability for stored CO_2 [to be stored for hundreds of years] would probably damage the economic case for private industry investment and operation of CCS. The current practice of dumping CO_2 into the atmosphere incurs no third party commercial liabilities and is usually free of liabilities for personal injury or environmental harm.

Climate change is an active consideration in UK politics; mechanisms for limiting carbon dioxide emissions are being discussed as part of the UK energy strategy.

A number of options are available besides conservation and expansion of renewable and nuclear sources.

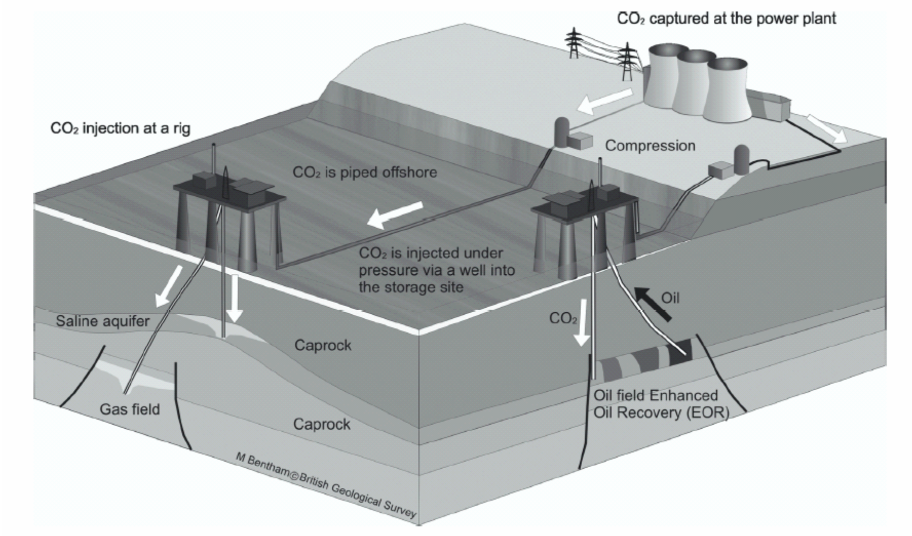
Continued reliance on fossil fuels would not seem, at first sight, to be compatible with the aim of maintaining atmospheric CO_2 levels below 400 ppm during this century. [computer modelling of levels as high as 500 ppm result in predictions of large changes in climate and weather]. However, short term, if CO_2 emissions from the combustion of fossil fuels could be controlled this would provide a breathing space for the emergence of new economic and technological solutions to the energy equation.

Carbon Capture and Storage (CCS) is the expression, now in common use, that describes the process of reducing carbon emissions from power generation and from industrial processes which rely on combustion. In essence carbon emissions are intercepted before release into the atmosphere, purified to the required degree and piped into long term storage. The report indicates that the basic technical components required for commercially viable CCS are available and have been tested in full scale operations, but for non-CCS purposes. What is lacking are 1) the proof of the technologies in commercial CCS applications and 2) the economic model.

Hazards
The CCS technologies that are currently at hand would involve a number of conventional hazards that have been successfully managed since industrial chemistry began. There would be the usual liabilities associated with industrial chemical operations and the extensive use of low pressure onshore and high pressure offshore pipelines.

What is untested is the development of CO_2 storage on a scale that would make CCS a genuine solution to short term emission control targets.

Figure 1: An overview of the CCS process



The current proposal centres on the use of North Sea oil production infrastructures to pipe and pump CO_2 underground. [CO_2 injection is currently used to enhance oil recovery from oil wells; high pressure CO_2 helps mobilise underground oil.] The capacity of spent, or nearly spent, oil fields in this region would be sufficient to accommodate 20 years worth of fossil fuel power generation. Much larger capacity is available in other, but untested, geological formations in the same region, such as saline aquifers.

The risk is that storage would be insecure. Gradual release of CO_2 over a period of decades or less would defeat the object, sudden release could, in addition, cause localised temporary toxicity and possibly loss of life and property through physical effects and asphyxiation. Testing the long term security of storage should a high priority if this technique is to be applied on the required scale.

To a great extent, the economic model that permits the development of CCS will also determine what, if any, additional commercial liabilities attach.

A company that runs its own carbon capture plant would need an economic incentive to do so; the plant would be expensive, the use of a network of pipelines would not be free and neither would storage itself. Failure of CCS process could result in significant financial losses, depending on the economic model, and some of these losses could be insurable. For example, if the incentive is provided through the current system of carbon trading then stored carbon has a direct commercial value, it has no value once released. [some economists estimate the cost of one tonne of carbon dioxide would need to be set at £40 if there is to be an effective market in CCS; in 2002 UK power generation produced 228 million tonnes of CO_2] .

The probability of failure of storage can be estimated [by geologists] if it is based on the use of the intensively researched oil fields in the North Sea region, but not (yet) if it is based on alternative geological structures such as saline aquifers. There is currently one large scale trial of storage in a saline aquifer in another part of the world.

Saline aquifers are more common than exploitable oil fields.

Once stored, the liability for release would either be owned by the storage operator or some other institution.

If long term storage is to be of benefit to the climate it would have to be on a timescale of hundreds of years. It seems unlikely that any commercial organisation, or their insurer, could guarantee to be solvent over such a timescale, nations also come and go on this timescale.

At this point it would seem that liabilities arising from the failure of storage, once the store is sealed off, could not rest with the store operator, or a commercial insurer.

<u>Comment</u>
Carbon Capture and Storage would provide a short term solution to UK energy and climate change strategy problems. It seems likely it would be attempted if a market mechanism can be created to make it viable and if pilot projects prove the value of storage in geological structures other than spent oil fields.

Liabilities for failures of the CCS process would be dependent on the market mechanisms that are created to make CCS practicable. Other liabilities would be of a more conventional nature in line with experience from industrial chemistry, oil exploration and use of high pressure pipelines.

In our view, the probability of failure of plant and pipelines could be estimated from current industrial experience. CO_2 is relatively harmless and would require very little by way of clean-up after release. Commentators agree that shipping CO_2 by sea would not be cost effective.

At atmospheric pressure 5 years worth of storage from the UK power industry would occupy around 5×10^{11} m^3 (500 cubic kilometres). Sudden release of this volume of gas underwater would have a significant transient effect on local sea levels and would add by about 1 millionth to the total atmospheric CO_2. UK CO_2 emissions account for about 2% of the total annual production worldwide.

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