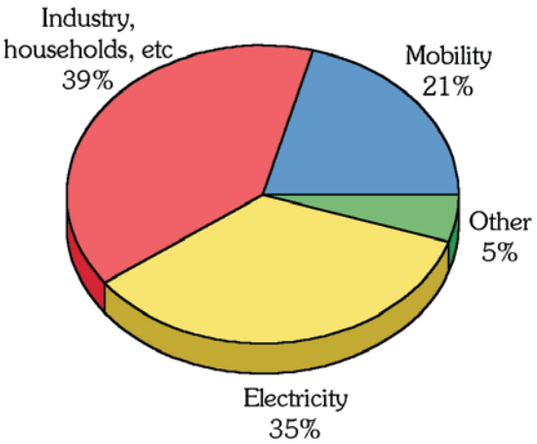
Capture and Storage of CO_2

The capture and storage of CO_2 could play a significant role in reducing the release of greenhouse gases to the atmosphere. This information sheet outlines the main techniques being considered.

Why should CO_2 be captured and stored?

Approximately one third of all CO_2 emissions due to human activity come from fossil fuels used for generating electricity, with each power plant capable of emitting several million tonnes of CO_2 annually. A variety of other industrial processes also emit large amounts of CO_2 from each plant, for example oil refineries, cement works, and iron and steel production. These emissions could be reduced substantially, without major changes to the basic process, by capturing and storing the CO_2. Other sources of emissions, such as transport and domestic buildings, cannot be tackled in the same way because of the large number of small sources of CO_2.



Sources of CO_2 emissions in 1995 (IEA World Energy Outlook, 1998).

Methods to capture and store CO_2

There are many ways in which CO_2 emissions can be reduced, such as increasing the efficiency of power plant or by switching from coal to natural gas. However, most scenarios suggest that these steps alone will not achieve the required reductions in CO_2 emissions. The capture and storage of CO_2 from fossil fuel combustion could play an important part in solving this problem. Widespread use of this technique could be achieved without the need for rapid change in the energy supply infrastructure.

In the long-term the world's energy system may have to be based on non-fossil energy sources. Decarbonising the use of fossil fuels, by capture and storage of CO_2, would help the transition to a future carbon-free energy system.

What is the status of CO_2 capture?

CO_2 is already being captured in the oil and gas and chemical industries. Indeed several plants capture CO_2 from power station flue gases for use in the food industry (see figure over page). However, only a fraction of the CO_2 in the flue gas stream is captured - to reduce emissions from a typical power plant by 75% the equipment would need to be 10 times larger.

If capture is used to minimise CO_2 emissions from power plant it would add at least 1.5 US cents/kWh to the cost of electricity generation. In addition, the generating efficiency would be reduced by 10 to 15 percentage points (e.g. from 55% to 45%)

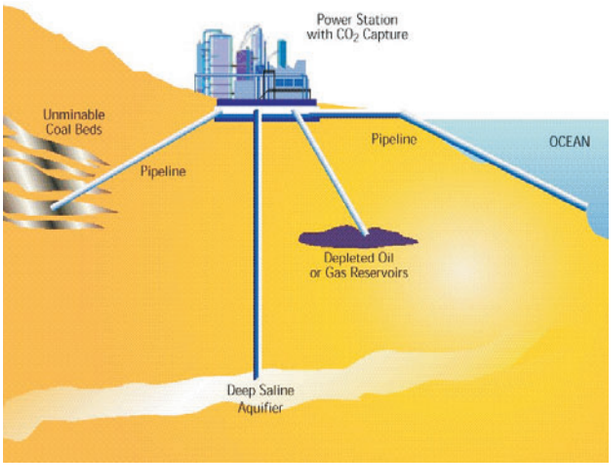
based on current technology. It is expected that wide-spread application of this technology would result in developments leading to a considerable improvement in its performance. The cost of avoiding CO_2 emissions is 40-60 US$/tonne of CO_2 (depending on the type of plant and where the CO_2 is stored), which is comparable to other means of achieving large reductions in emissions.

CO_2 capture at AES Warrior Run power station in Cumberland, MD, USA.

What is the status of CO_2 storage?

Having captured the CO_2 it would need to be stored securely for hundreds or even thousands of years, in order to avoid it reaching the atmosphere. Major reservoirs, suitable for storage, have been identified under the earth's surface and in the oceans. Work to develop many of these options is in progress.

Underground storage of CO_2 has taken place for many years as a consequence of injecting CO_2 into oil fields to enhance recovery. Now, for the first time, CO_2 is being deliberately stored in a salt water reservoir under the North Sea for climate change reasons. The potential capacity for underground storage is large but not well documented. Other geological storage schemes are under development and plans to monitor them are well advanced.



Options for storage of CO_2

The deep ocean could be used to store large quantities of CO_2. Indeed, most CO_2 resulting from human activity is eventually absorbed by the oceans. This is considered a longer-term option and will require a much greater understanding of the various processes involved before it can be used.

The next steps

The main priority for the development of CO_2 capture technology is to reduce its cost.

For CO_2 storage the priority is to establish its credibility and acceptability as a safe, reliable, long-term store. Proof that any losses will be insignificant is a major issue for storage. The fact that CO_2 has been naturally stored for geological time-scales enhances the credibility of many of the storage options.

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