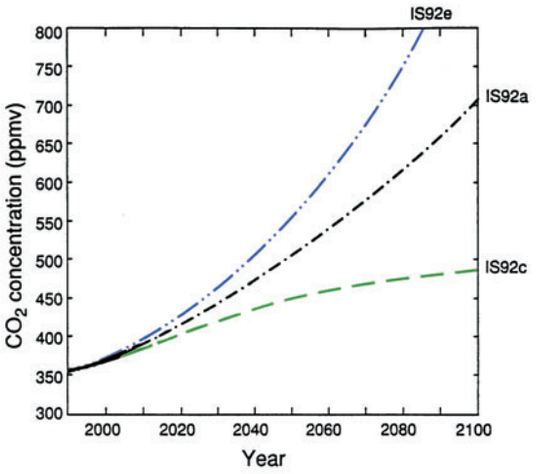
Ocean Storage of CO_2

One way to combat climate change is to prevent the release of CO_2 to the atmosphere by storing it in the deep ocean. This information sheet describes the concept and discusses some of the associated issues.

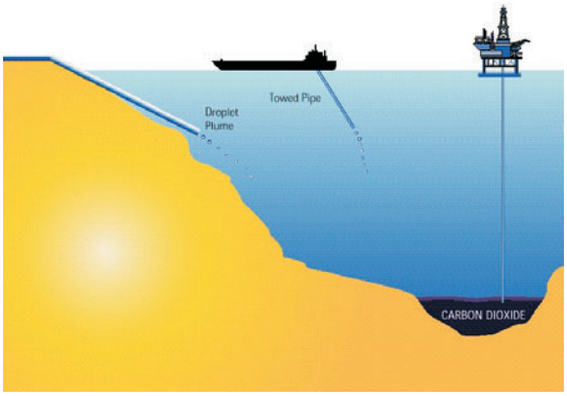
Ocean storage of CO_2

The combustion of fossil fuels emits an estimated 23 Gtonnes† of CO_2 annually into the earth's atmosphere. If captured and stored, this would significantly benefit the global environment. However, a very large store would be required.



Some scenarios[1] of CO_2 concentrations suggest major changes in climate

Several types of potential reservoir are being considered, including the deep ocean, which is where CO_2 from the atmosphere would eventually be stored if left to natural processes. It has been estimated that the capacity of the deep ocean for deliberate storage of CO_2 may be more than 4000 Gtonnes.



Ocean sequestration concepts

How would it work?

CO_2 from large sources, such as power plant, would be captured and piped or shipped to the storage site. The technology to achieve this is already available. The CO_2 would then be injected into the deep ocean. Various methods to achieve this have been proposed including:

- CO_2 dispersal in a very dilute form at depths of 1000-2000m.
- Discharge at 3000m to form a lake of liquid CO_2 on the seabed.
- Formation of a sinking plume to carry most of the CO_2 into deeper water.
- Release of solid CO_2 at depth.

Of these options, the first is thought to be the most promising in the short-term. The cost of capturing the CO_2, transporting it 500 km and storing it has been estimated at \$70/tonne CO_2.

† 1 Gtonne is 10^9 tonne

Further research

Before such a scheme could be employed, further research would be required to assess the potential benefits and drawbacks. For example, how much CO_2 could be stored and for how long? What would be the overall effect of such reductions in emissions? What adverse effects might occur? What changes would take place in the ocean, even without storage, if emissions continue as at present?

In order to understand the importance of these factors, it is necessary to:

- Make reliable predictions of the technical feasibility and storage times.
- Understand how to predict and minimise any environmental impact.
- Make reliable cost estimates.
- Assess the net benefit of storing CO_2 in the ocean and compare this with other options.

This is not possible at present; specifically designed research programmes are needed to provide this information. Better understanding is also needed of the various natural processes, which determine the carbon cycle in the ocean.

Laboratory high pressure test rig
(Courtesy of S Masutani, Hawaii Natural Energy Institute, University of Hawaii)

An LPG tanker - CO_2 could be transported in a similar way (Courtesy of Mitsubishi Heavy Industries Ltd.)

Questions regarding the legal basis for such action need to be addressed. For example, the discharge of CO_2 from ships has not been specifically considered for inclusion under the London Convention (which regulates discharges into the ocean), so at present it would not be permitted. In addition, the jurisdiction of governments wishing to use this option would have to be considered. Public understanding and opinion about the use of the oceans for this purpose will also be important.

The next steps

Ocean storage has the potential to significantly reduce the emission of CO_2 to the atmosphere. It is one of the few techniques that might be able to handle the huge quantities of CO_2 involved. However, it will have an impact on the ocean environment close to the point of injection, although the precise extent of this is not yet known. International research programmes are now being established to provide better understanding and to improve the technology. By the time the results are available, the likely effect of climate change will also be better understood. This will allow informed decisions to be made about the potential benefits and disadvantages of using this technique at the appropriate time.

1 Houghton J.T., Meira Filho L.G., Callander B. A., Harris N., Kattenberg A,. and Maskell K. "Climate Change 1995. The Science of Climate Change". Cambridge University Press 1996.

IEA Greenhouse Gas R&D Programme
The Orchard Business Center, Stoke Orchard,
Cheltenham, Glos. GL52 7RZ, United Kingdom

Tel: +44 1242 680753 Fax: +44 1242 680758
mail@ieaghg.org
www.ieagreen.org.uk