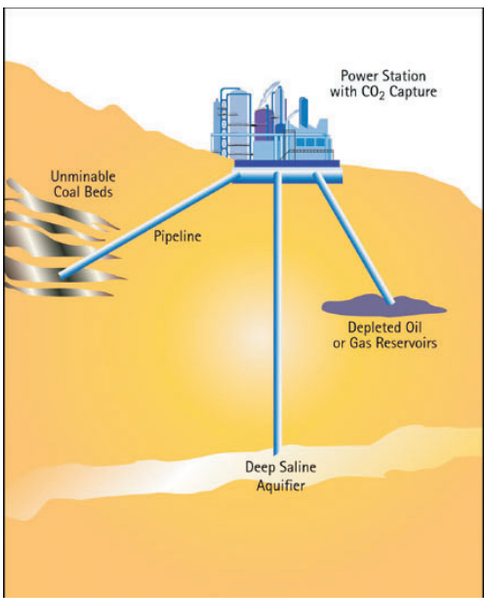
Geological Storage of CO_2

One way to combat climate change is to prevent the release of CO_2 to the atmosphere by storing it in natural underground reservoirs. This information sheet describes the concept and outlines some of the issues involved.

Geological storage of CO_2

CO_2 produced by large sources, such as power plants and other industrial processes, could be captured and stored underground using:

- Depleted oil and gas fields
- Coal seams
- Deep saline reservoirs.



Options for Storage of CO_2

Other options include CO_2-enhanced oil recovery and CO_2-enhanced coal bed methane production. These options are particularly attractive because injection costs are offset by increased fossil fuel production.

How much CO_2 can be stored?

The IEA Greenhouse Gas R&D Programme has estimated the global potential for CO_2 storage in geological reservoirs (see table). These numbers have been compared with the projected total emissions between 2000 and 2050, using the "business as usual" scenario derived by the Intergovernmental Panel on Climate Change in 1992. This comparison shows that geological storage could have a substantial impact on CO_2 emissions.

The estimates for deep saline reservoirs were made in the early 1990s. More recent figures suggest that the storage capacity in geological reservoirs in Northwest Europe alone could be as high as 800 Gtonne CO_2, most of which is in deep saline reservoirs. Further research is needed to assess the global potential storage capacity for deep saline reservoirs.

Geological Storage Option	Global Capacity	
	Gtonne† CO_2	As a proportion of total emissions 2000 to 2050
Depleted oil and gas fields	920	45%
Unminable coal seams	>15	>1%
Deep saline reservoirs	400-10,000	20-500%

† 1 Gtonne is 10^9 tonne

Is geological storage of CO_2 safe?

Many of the reservoirs that are being considered have already stored gases and liquids for thousands of years. Oil and gas fields are known to be effective stores for hydrocarbons and natural gas. Similarly, methane has been trapped in coal seams since the coal was formed and deep saline reservoirs in sedimentary basins have held water for many thousands of years. There are also many cases throughout the world where naturally occurring CO_2 from volcanic activity has been stored in sedimentary rocks for millions of years. These examples give confidence that CO_2 can be stored safely for thousands of years.

Once it is stored, slow releases of CO_2 from geological reservoirs, especially those under the ocean, are unlikely to give rise to safety concerns, unless the CO_2 is inadvertently trapped. The risk of a large-scale sudden release of CO_2 can be avoided by careful selection of the storage reservoirs. For example, storage in regions that are liable to tectonic or seismic activity should be avoided. Any selection procedure needs to consider:

- The integrity of the overlying cap rock
- Regional geology and possible faulting
- Groundwater flow.

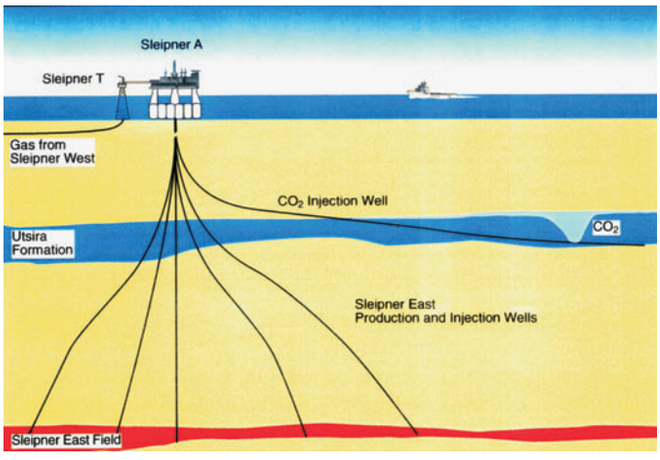
What is the status of geological storage of CO_2?

In the USA there are currently 74 projects in which CO_2 is injected into oil fields for enhanced oil recovery. These projects inject 33 million tonnes of CO_2 annually. A more limited amount of CO_2 is used for enhanced oil recovery projects in other countries.

In a project in the North Sea, CO_2 is being injected into an offshore deep saline reservoir. The project, at the Sleipner West gas field off the Norwegian coast, has been operating since 1996. To date over 2 million tonnes of CO_2 have been injected underground.

Since 1994, acid gases (containing both CO_2 and H_2S) from natural gas processing plants have been injected into onshore saline reservoirs and depleted oil fields in Alberta, Canada. These are just some examples which demonstrate that storage of CO_2 is already taking place.

In the future, as geological storage becomes commercial practice, a clear understanding of legal matters will be required. For example, questions of ownership of the reservoirs and their licensing as storage sites will need to be addressed.



CO_2 injection into the Utsira deep saline reservoir (Courtesy of Statoil)

Can storage be verified?

If geological storage is to be used as a basis for emissions trading or to meet national commitments it will be necessary to verify the amounts that can be stored. Underground volumes of gas can be measured by seismic monitoring, which is an established procedure in the oil industry. So verification of CO_2 storage in geological reservoirs will make use of technology that is currently available.

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