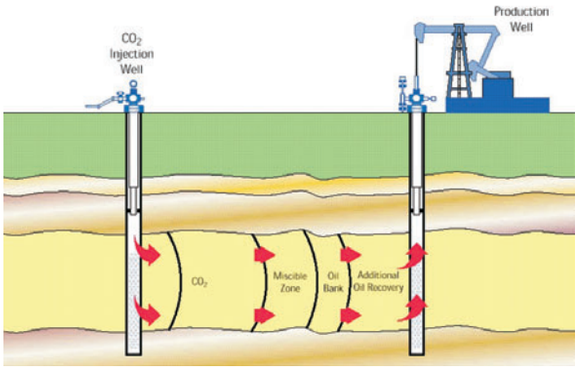
# Depleted Oil & Gas Fields for $CO_2$ Storage

One way to combat climate change is to prevent the release of $CO_2$ to the atmosphere by storing it in geological reservoirs. This information sheet provides an overview of the storage potential in depleted oil and gas fields.

## Why store $CO_2$ in depleted oil and gas fields?

Of the various options for storing $CO_2$ underground, the use of depleted oil and gas fields has a number of attractions. In particular, these fields are known to have held gases and liquids for millions of years, their geology is known and there is substantial capacity available. Indeed, thousands of oil and gas fields are approaching the end of their economic lives. Such depleted fields provide the opportunity for storing $CO_2$.




*Schematic diagram of $CO_2$-EOR*

## How is $CO_2$ stored in oil fields?

Only a proportion of the oil in a field can be recovered using standard extraction techniques. Injecting $CO_2$ can enhance oil recovery (EOR), a technique already well established in the oil industry. After injection, a fraction of the $CO_2$ remains in the field, so this technique can also be used for storing $CO_2$. Especially for fields approaching the end of their useful working life, the extra income generated could offset the cost of $CO_2$ injection.

When $CO_2$ is injected into an oilfield it may mix with the crude oil, causing it to swell and thereby reduce its viscosity. This also helps to maintain or increase the pressure in the reservoir. The combination of these processes allows more of the crude oil to flow to the production wells.

In other situations the $CO_2$ is not soluble in the oil. Here, injection of $CO_2$ raises the pressure in the reservoir, helping to sweep the oil towards the production well.

Up to half of the injected $CO_2$ is stored in the immobile oil remaining in the reservoir at the end of production. The rest is collected from the production well and re-circulated. Globally, 130 Gtonne† of $CO_2$ could be stored as a result of $CO_2$-EOR operations. The cost of capturing the $CO_2$, transporting it 300 km and storing it has been estimated to be between $30-50/tonne $CO_2$ avoided.

$CO_2$-EOR is commercially proven. It is used extensively in the USA, where 74 projects are now operating, injecting some 33 million tonnes of $CO_2$ annually. Although most of this $CO_2$ comes from natural sources, about 3 million tonnes per year is from natural gas processing plant, from ammonia production and other man-made sources. So some storage of $CO_2$ is already taking place. A limited amount of $CO_2$ is used for EOR projects in other countries.

† 1 Gtonne is $10^9$ tonne

## How is $CO_2$ stored in gas fields?

In a depleted gas field the $CO_2$ would occupy some of the void space that had previously been occupied by the natural gas. Some depleted gas fields are reused as buffer stores for natural gas production. The techniques of gas re-injection can be adapted to store $CO_2$ in these fields.

Globally, 900 Gtonne of $CO_2$ could be stored in depleted natural gas fields, substantially more than in depleted oil fields. The cost of capturing the $CO_2$, transporting it 300 km and storing it in depleted gas fields has been estimated to be between $40-60/tonne $CO_2$ avoided.

Initial investigations in the USA indicate that it may be possible to inject $CO_2$ into gas fields that are approaching the end of their productive lives and enhance gas production, without contamination of the residual gas. Further research into $CO_2$ enhanced gas production is required. If, however, it is established that the process is technically feasible, then the overall cost of $CO_2$ capture and storage could be similar to that in oil fields.

## The next steps

It is important to demonstrate that storing $CO_2$ in a geological structure is both safe and environmentally acceptable. Scientific information on the $CO_2$ injected into the reservoir will come from monitoring the operation – techniques for doing this are already available.

The latest $CO_2$-EOR project to come on stream is the Weyburn field in Canada. In this project, 1.8 million tonnes of $CO_2$ per year (captured from a coal gasification plant in the USA) will be injected into an operating oil field. It is expected that $CO_2$ injection will increase production from the Weyburn field over the next 20-25 years and, in that time, store 19 million tonnes of $CO_2$.

*Weyburn $CO_2$-EOR project*
*(Courtesy of Saskatchewan Energy and Mines)*

An international research project to monitor the Weyburn field has been established. The project will provide an objective evaluation of the geological sequestration of $CO_2$ during EOR operations. It will also improve the understanding of the physical and chemical processes by which the injected $CO_2$ is sequestered. The first results from this project will be available in 2002.

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