



## Measurement, Monitoring and Verification of CO<sub>2</sub> Geological Storage

### Project Leader:

**International research  
consortium**

### Project Title:

**International Energy  
Agency (IEA) GHG  
Weyburn-Midale CO<sub>2</sub>  
Monitoring and Storage  
Project**

### CO<sub>2</sub> Source:

**Dakota Gasification  
Company's Synfuels Plant,  
Beulah, North Dakota, USA**

### CO<sub>2</sub> Storage Type:

**Enhanced Oil Recovery  
(EOR)**

### Location:

**Weyburn, Saskatchewan**

### Project Description

Launched in 2000, this international research project studies CO<sub>2</sub> injection and geological storage in depleted oilfields in southeastern Saskatchewan. It is operated in conjunction with two commercial CO<sub>2</sub> floods, where huge volumes of the gas (2.8 million Mt per year) are injected to enhance oil production. The CO<sub>2</sub>, a by-product from the Dakota Gasification Company's Synfuels Plant, is delivered via a 323 km pipeline to EnCana's Weyburn field and Apache's Midale field.

The IEA research project's Final Phase (2007–2011) is building on the successes of the First Phase (2000–2004) to deliver the framework necessary to encourage implementation of CO<sub>2</sub> geological storage worldwide. Specifically, the project will develop and demonstrate technology solutions required for the design, implementation, monitoring and verification of CO<sub>2</sub> geological storage projects, as well as influence and accelerate good public policy development for regulations, public communications and the business environment.

### Storage Operations

#### Weyburn Field – EnCana

The Weyburn CO<sub>2</sub> enhanced oil recovery (CO<sub>2</sub>-EOR) project began operation in 2000, when new facilities were installed for the CO<sub>2</sub> flood. By injecting CO<sub>2</sub>, EnCana currently produces about 28,000 barrels of oil per day — a 180 percent increase. CO<sub>2</sub>-EOR technology also increased injection capacity to approximately 6,500 tonnes per day (125 MMscf/d) of CO<sub>2</sub>, resulting in the storage of 2.4 Mt of CO<sub>2</sub> per year.

Since the start-up of the CO<sub>2</sub> flood, more than 13 Mt of CO<sub>2</sub> have been safely stored at Weyburn. Over the life of the field, it is projected that a total of about 30 Mt of CO<sub>2</sub> will be stored as part of the EOR project. Once the project is complete, the infrastructure may be used exclusively for CO<sub>2</sub> storage, providing about a 25 Mt capacity in addition to the 30 Mt that will be stored through EOR.



## Midale – Apache Canada

Using the same CO<sub>2</sub> supply source as EnCana, Apache began injecting CO<sub>2</sub> in the neighbouring Midale field in 2005. Incremental oil production is on the order of 6,500 barrels per day as the result of injecting 1,300 tonnes of CO<sub>2</sub> per day (25 MMscf/d), or close to 0.5 Mt per year. Well over 1.8 Mt of CO<sub>2</sub> have been stored at Midale to date, and more than 10 Mt are expected to be stored over the 30-year life of this EOR project.

## Expected Outcomes

The main deliverable of the IEA research project is a comprehensive Best Practices manual, which will provide practical protocols for the design and implementation of CO<sub>2</sub> geological storage, especially in the context of enhanced oil recovery (EOR). At the same time, the project will influence the development of clear, workable regulations for CO<sub>2</sub> geological storage, building on existing oilfield regulatory frameworks. The project will identify effective public consultation and outreach processes, including the establishment of a carbon capture and storage (CCS) Web site. The project will also help create a business environment of fiscal incentives to seed the development of large CCS infrastructures and mechanisms for monetizing credits for CO<sub>2</sub> storage.

## Company Profile

The consortium comprises six governments and government agencies, including Natural Resources Canada, the provincial governments of Alberta and Saskatchewan, the U.S. Department of Energy, the Japanese Research Institute of Innovative Technology for the Earth and the IEA GHG R&D Programme. The project is also supported by 10 Canadian and international energy companies, including Apache Canada, Aramco Services Company, Chevron, Dakota Gasification Company, EnCana Corporation, OMV, Nexen Inc., SaskPower, Schlumberger and Shell Canada Ltd. The technical work is led by the Petroleum Technology Research Centre in Regina, Saskatchewan.

## Project Web Sites

**IEA Research:** [www.ptrc.ca/weyburn\\_overview.php](http://www.ptrc.ca/weyburn_overview.php)

**Encana Weyburn:** [www.encana.com/operations/canada/weyburn](http://www.encana.com/operations/canada/weyburn)

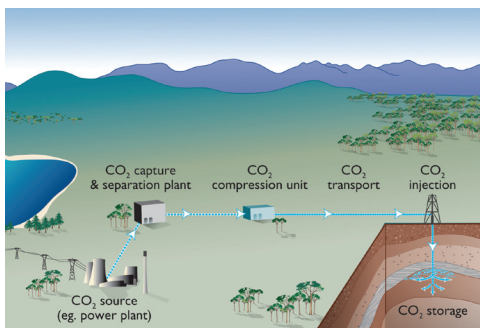
**Apache Midale:** [www.apachecorp.com/Operations/Canada/Stewardship/EOR.aspx](http://www.apachecorp.com/Operations/Canada/Stewardship/EOR.aspx)

*Aussi disponible en français sous le titre :  
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géologique de CO<sub>2</sub>*

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