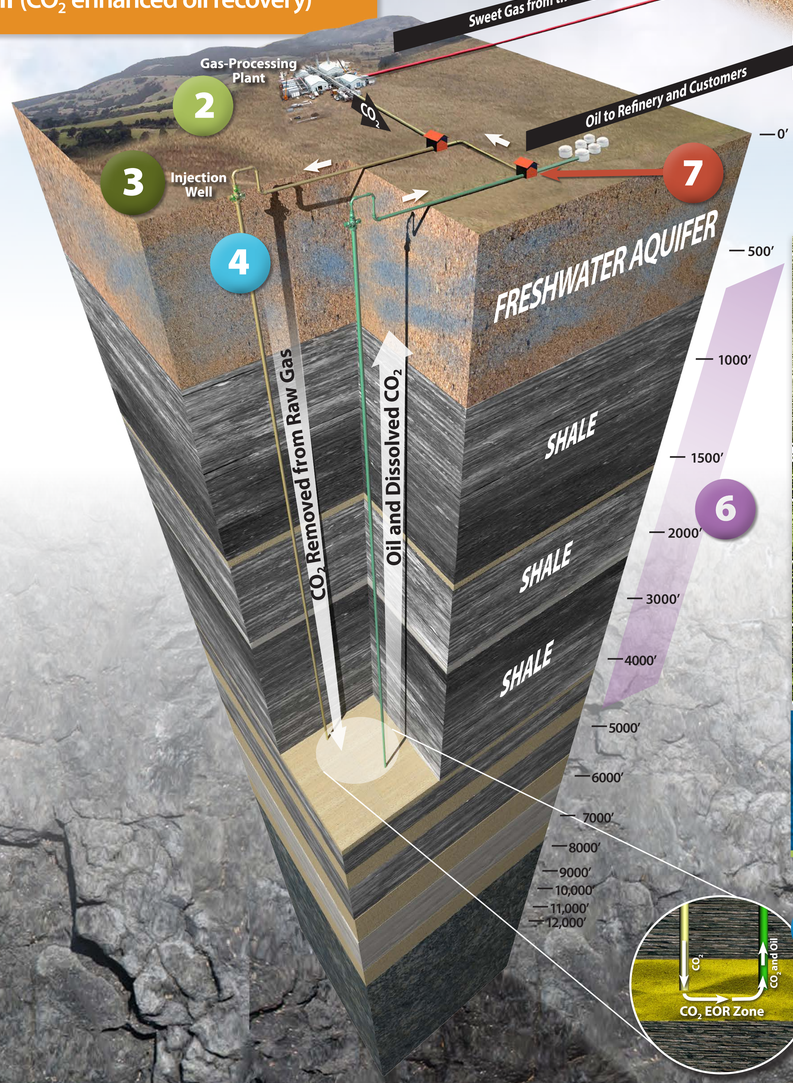
Reducing Greenhouse Gas Emissions

Energy with a Smaller Carbon Footprint

Safely Storing Carbon and Producing More Oil (CO_2 enhanced oil recovery)



Carbon storage projects are as varied as the geology of Earth. At right are two examples.

1 A Smaller Customer Carbon Footprint
The northern Great Plains region is the source of nearly 3% of the world's carbon dioxide emissions from human activities (called anthropogenic CO_2). Nearly 40% of this CO_2 comes from large industrial sources.

2 Large Industrial CO_2 Sources
Power generation, gas-processing, manufacturing, and ethanol facilities exhaust CO_2 into the atmosphere. Capturing CO_2 before it enters the atmosphere greatly reduces the carbon footprint of the facility. This is called carbon capture.

3 Transportation and Injection
CO_2 captured at the facility is compressed and moved via pipeline. The CO_2 might go to an enhanced oil recovery (EOR) project or it might go to the site of a CO_2 storage project. At either site, the CO_2 will be injected to a rock layer deep underground.

4 Drinking Water Protection
Wells are engineered to protect precious groundwater resources. Typically, three layers of steel (casing and tubing) and two layers of durable, long-lasting cement protect the groundwater from the fluids in the well. Strict regulations regarding construction, monitoring, and periodic testing add to well safety.

5 CO_2 Storage Zone
The rock that makes up the storage has tiny connected spaces (pores) that allow the injected CO_2 to flow through and fill the rock. In the case of EOR, each time CO_2 is injected to spur oil production, some of the CO_2 is permanently trapped in the rock, replacing the oil. Storage layers are usually sandstone or limestone.

6 CO_2 Storage Container
Some underground rock layers make excellent barriers to upward fluid flow. These cap rocks make effective traps for oil, water, natural gas, and injected CO_2. Cap rocks are usually shales and salts.

7 CO_2 Reuse
Any CO_2 that comes up the production well with the oil is separated, compressed, and reinjected. Virtually all of the purchased CO_2 will be stored by the end of an EOR project. The oil produced is refined into diesel, gasoline, or other products.

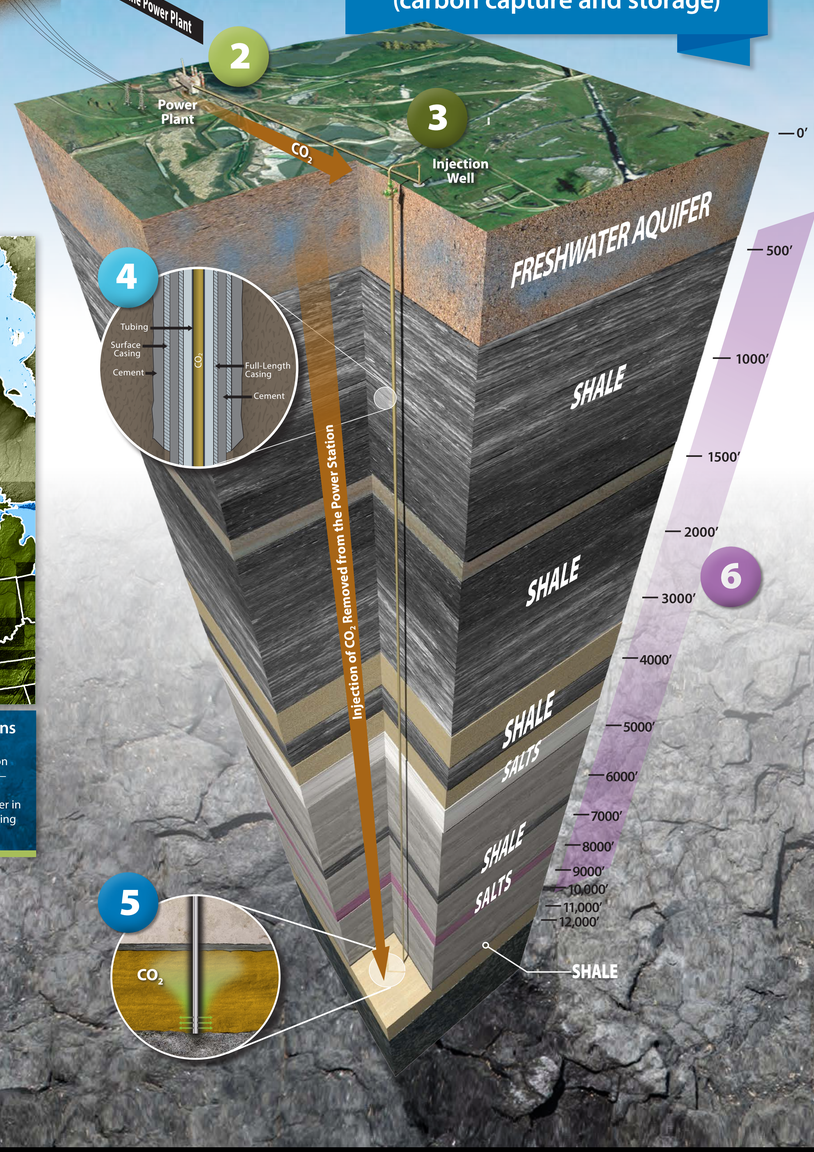
8 Greater Domestic Oil Production
CO_2 EOR increases domestic oil production and reduces our dependence on foreign oil. By using anthropogenic CO_2, we are recovering oil that could not have been produced otherwise while reducing carbon emissions.

Geologic Storage of Carbon in the Northern Great Plains

Whether for EOR or carbon capture and storage, injecting CO_2 from human activities into deep geologic formations is a practical way to reduce the carbon footprint of human energy demands. Our region—the northern Great Plains—has the perfect geology, many CO_2 sources, oil-bearing reservoirs, and the technical know-how to make it happen. That's why this region is a world leader in the development and implementation of EOR and carbon storage projects using CO_2 from major industrial sources.

Producing more oil is not the only benefit of EOR. An EOR operation using anthropogenic CO_2 permanently stores CO_2 and helps pay for development of a source (for example, the capture facility at a power plant) as well as the pipelines, compressors, etc., needed to carry out future carbon capture and storage projects.

Safely Storing Carbon (carbon capture and storage)



To learn more about carbon capture and storage, CO_2 EOR and associated CO_2 storage, or the projects in our region, visit www.undeerc.org/PCOR.

This poster was produced by the Plains CO_2 Reduction (PCOR) Partnership, led by the University of North Dakota's Energy & Environmental Research Center. The PCOR Partnership represents a wide variety of public and private sector stakeholders located across nine states and four Canadian provinces in the heartland of North America. It is one of seven regional partnerships that make up the Regional Carbon Sequestration Partnership Program, managed within the U.S. Department of Energy's Office of Fossil Energy by the National Energy Technology Laboratory (NETL). Funding is provided by NETL and the members of the PCOR Partnership.

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