injecting carbon dioxide (CO2) into an underground oil zone can help boost production in a process called CO2 enhanced oil recovery, or CO2 EOR. If the injected CO2 used for EOR comes from human activity, then the EOR process can help reduce our carbon footprint by putting the CO2 into permanent storage deep underground.

An oil recovery project using CO2 injection …

Denbury Onshore LLC (Denbury), a leader in CO2 EOR operations, is implementing a commercial CO2 EOR project that will add 20 plus years and 40–50 million barrels of oil to the life of the Bell Creek oil field in southeastern Montana. A 232-mile-long pipeline delivers over 1 million tons of CO2 a year from the Lost Cabin natural gas-processing facility in central Wyoming to the Bell Creek oil field. CO2 injection for EOR and incidental CO2 storage began in the spring of 2013.

… combined with the innovative use of subsurface CO2 modeling and monitoring systems …

Denbury has teamed with the Plains CO2 Reduction Partnership, led by the Energy & Environmental Research Center, to characterize and model CO2 behavior in the subsurface as a basis for designing a comprehensive monitoring plan for the CO2 storage and EOR operation. Detailed site characterization, modeling, subsurface risk analysis, and monitoring of the CO2 EOR and storage operations allow site operators to account for the CO2 utilized in oil production and to verify that the CO2 remains in place once EOR operations are complete.

… to benefit the environment and the economy.

The integrated approach at the Bell Creek oil field helps meet the commonsense safety expectations of local landowners and communities. Further, by storing human-generated CO2 at the Bell Creek oil field, Denbury benefits the environment by decreasing the carbon footprint of its regional oilfield operation. The results of the Bell Creek project will help future projects effectively implement a proven CO2 monitoring, verification, and accounting (MVA) system as part of a comprehensive approach to subsurface CO2 management and EOR operations.

The Bell Creek Integrated CO2 EOR and Storage Project combines the proven techniques of CO2 EOR with the characterization and monitoring needed for effective carbon storage. The result is a new standard for safe and practical geologic CO2 EOR to CO2 storage operations.

Bell Creek Project Benefits

• Approximately 40–50 million barrels of incremental oil
• Millions of tons of CO2 safely in storage
Natural Gas, Gas Processing, and Carbon Capture

When natural gas comes from the production well, it can contain impurities like CO₂ and hydrogen sulfide (H₂S), along with petroleum liquids like butane and propane. These constituents must be removed before the natural gas can be tied into a distribution pipeline or used by a customer. This cleanup is done at large facilities called natural gas-processing plants. There are more than 1300 natural gas-processing plants in the United States and Canada and over 1900 worldwide (PennWell, 2013, Worldwide gas-processing database). Because natural gas-processing plants are among the few sources of relatively pure streams of CO₂, they are good candidates for geologic CO₂ storage—the permanent storage of CO₂ deep underground. The Bell Creek project is using the CO₂ produced at the Lost Cabin natural gas-processing facility in central Wyoming in a commercial CO₂ project.

How CO₂ EOR and Storage Works

Injecting CO₂ into a producing zone is called CO₂ EOR. When CO₂ comes into contact with oil, a significant portion of the CO₂ dissolves into the oil, reducing oil viscosity and increasing the oil's mobility. This, combined with the partial restoration of original reservoir pressure, can result in increased oil production rates as well as an extension of the operational lifetime of the oil reservoir.

In an oil field, CO₂ floods are designed to be active for decades. Over the years, there are many cycles of CO₂ injection. With each cycle, another portion of injected CO₂ becomes permanently trapped, or stored, in the oil reservoir. This is called incidental CO₂ storage. As a result of ongoing CO₂ EOR projects since the 1970s, a large amount of CO₂—hundreds of millions of tons—is now permanently stored in oil fields.

The Bell Creek project employs an innovative approach that integrates EOR, incidental CO₂ storage, and MVA in a commercial oil production operation in the northern Great Plains.