CO_2 Emissions Go to Work to Produce More Oil

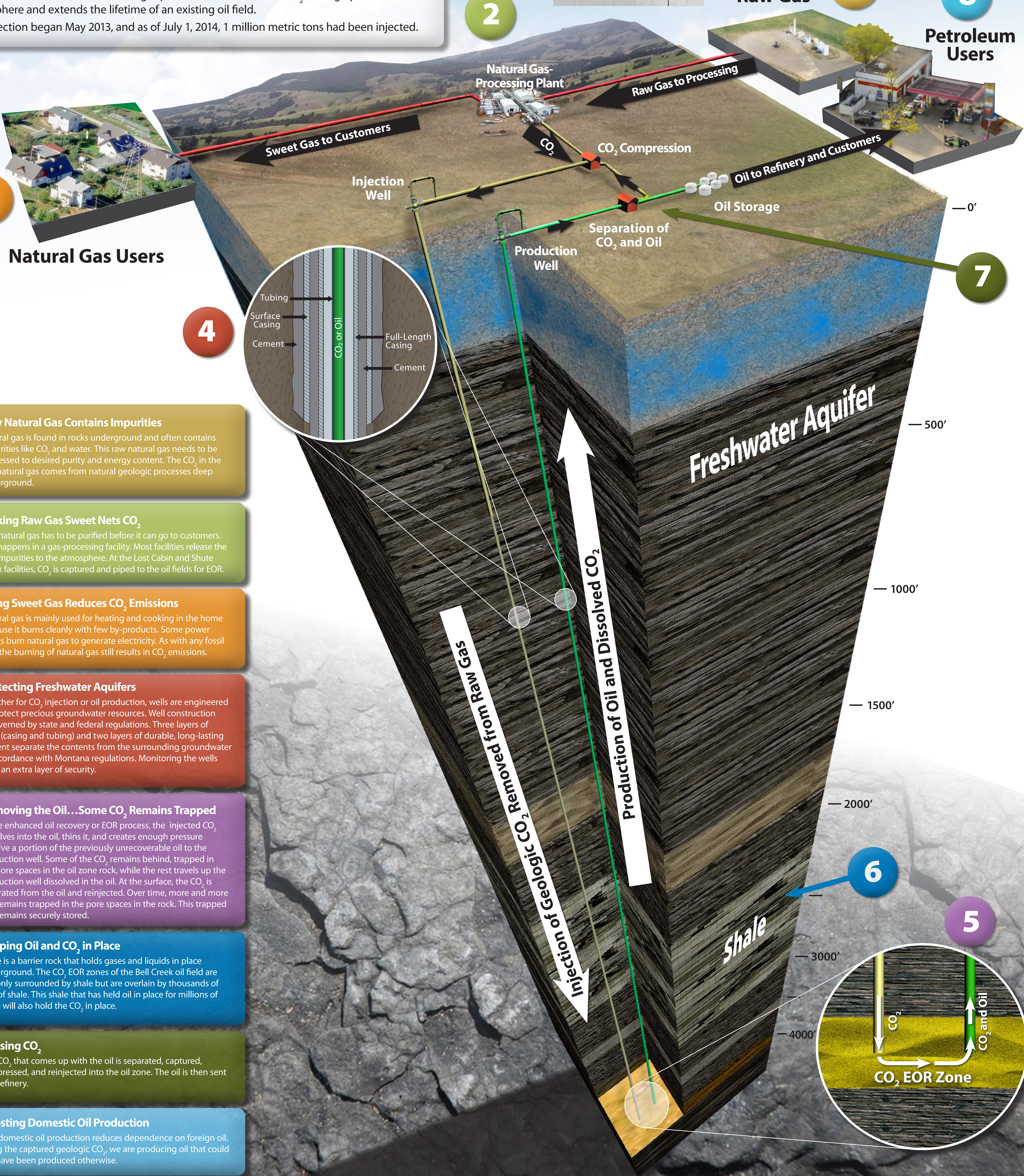
The Bell Creek Story

Denbury's Bell Creek oil field in Montana is the site of an innovative oil recovery/greenhouse gas storage project that benefits the economy and the environment:

- Carbon dioxide (CO_2) (from natural underground processes) comes to the surface with raw natural gas.
- Natural gas-processing facilities capture this CO_2 instead of releasing it into the atmosphere (the current practice elsewhere).
- The CO_2 separated from the raw natural gas at the processing facility goes by pipeline to the Bell Creek oil field where it is injected into an oil reservoir to help produce more oil. This practice is called CO_2 enhanced oil recovery, or EOR.
- Eventually, the injected CO_2 is trapped in the underground injection zone.
- Monitoring helps ensure that the CO_2 remains securely stored.

This greener form of oil and natural gas production results in less CO_2 ending up in the atmosphere and extends the lifetime of an existing oil field.

CO_2 injection began May 2013, and as of July 1, 2014, 1 million metric tons had been injected.



1 Raw Natural Gas Contains Impurities

Natural gas is found in rocks underground and often contains impurities like CO_2 and water. This raw natural gas needs to be processed to desired purity and energy content. The CO_2 in the raw natural gas comes from natural geologic processes deep underground.

2 Making Raw Gas Sweet Nets CO_2

Raw natural gas has to be purified before it can go to customers. This happens in a gas-processing facility. Most facilities release the CO_2 impurities to the atmosphere. At the Lost Cabin and Shute Creek facilities, CO_2 is captured and piped to the oil fields for EOR.

3 Using Sweet Gas Reduces CO_2 Emissions

Natural gas is mainly used for heating and cooking in the home because it burns cleanly with few by-products. Some power plants burn natural gas to generate electricity. As with any fossil fuel, the burning of natural gas still results in CO_2 emissions.

4 Protecting Freshwater Aquifers

Whether for CO_2 injection or oil production, wells are engineered to protect precious groundwater resources. Well construction is governed by state and federal regulations. Three layers of steel (casing and tubing) and two layers of durable, long-lasting cement separate the contents from the surrounding groundwater in accordance with Montana regulations. Monitoring the wells adds an extra layer of security.

5 Removing the Oil…Some CO_2 Remains Trapped

In the enhanced oil recovery or EOR process, the injected CO_2 dissolves into the oil, thins it, and creates enough pressure to drive a portion of the previously unrecoverable oil to the production well. Some of the CO_2 remains behind, trapped in the pore spaces in the oil zone rock, while the rest travels up the production well dissolved in the oil. At the surface, the CO_2 is separated from the oil and reinjected. Over time, more and more CO_2 remains trapped in the pore spaces in the rock. This trapped CO_2 remains securely stored.

6 Keeping Oil and CO_2 in Place

Shale is a barrier rock that holds gases and liquids in place underground. The CO_2 EOR zones of the Bell Creek oil field are not only surrounded by shale but are overlain by thousands of feet of shale. This shale that has held oil in place for millions of years will also hold the CO_2 in place.

7 Reusing CO_2

Any CO_2 that comes up with the oil is separated, captured, compressed, and reinjected into the oil zone. The oil is then sent to a refinery.

8 Boosting Domestic Oil Production

This domestic oil production reduces dependence on foreign oil. Using the captured geologic CO_2, we are producing oil that could not have been produced otherwise.

This poster was produced by the Plains CO_2 Reduction (PCOR) Partnership, led by the University of North Dakota's Energy & Environmental Research Center, in cooperation with Denbury Onshore LLC. The PCOR Partnership represents a wide variety of public and private sector stakeholders located across nine states and four Canadian providences in the central interior of North America and 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 was provided by NETL and the members of the PCOR Partnership. To learn more about the options to manage carbon emissions from energy use and the Bell Creek project, visit the PCOR Partnership Web site at www.undeerc.org/PCOR.