RCSP Water Working Group

Regional Carbon Sequestration Partnership Water Working Group

Introduction

Members of the U.S. Department of Energy (DOE) Regional Carbon Sequestration Partnerships (RCSPs) have formed the Water Working Group (WWG), a team of experts from government, academia, and industry whose goal is to address stakeholder concerns regarding emerging carbon capture and storage (CCS) technology and its potential interactions with local and regional water resources. Members of the WWG represent different regions of North America, each with its own unique set of challenges surrounding water resources and CCS (Figure 1). The opportunities and challenges at the nexus of CCS and water are being evaluated by the RCSP WWG as various carbon dioxide (CO_2) capture and storage strategies are assessed.

Carbon Capture and Storage

A majority of CO_2 generated by humans comes from the use of fossil fuels as reliable sources of energy, helping us to maintain our current economy and quality of life. Carbon dioxide emissions can be reduced through energy conservation, increased fossil fuel efficiency, increased utilization of renewable sources of energy and nuclear power, and implementation of CCS.

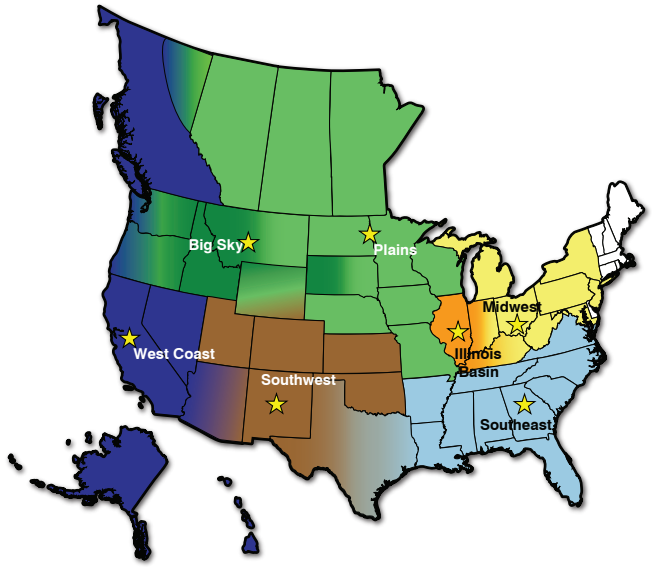

Figure 1. DOE has organized seven RCSPs to evaluate a variety of CO_2 storage strategies to determine which is best suited for specific regions of the country.

CCS holds the potential to substantially reduce greenhouse gas emissions to the atmosphere and is most efficient when applied to large utility or industrial sources where high volumes and/or concentrations of CO_2 are emitted. Through the use of specialized processes and equipment, CO_2 is captured, compressed, and transported to sites appropriate for safe long-term geologic storage (Figure 2).

Figure 2. CO_2 is pumped 4800 feet underground at the CO_2 injection site in the Weyburn–Midale Field in Saskatchewan, Canada.

Underground storage entails injecting compressed CO_2 into deep rock formations that are both physically and chemically stable; have an appropriate amount of porosity (spaces within the rock); and are covered by thick, relatively impermeable (flow-resistant) rock formations that confine the CO_2 at depths typically greater than 1 mile.

Water and CCS

Water is involved in every step of the CCS process (Figure 3). Current capture technologies require additional water supplies at the site of CO_2 generation, either as a direct result of the capture process, or indirectly through parasitic electrical demand and the associated cooling water requirements for thermoelectric power generation. Within the reservoir itself, the impact of storage activities on appropriately targeted rock formations has been shown to be minimal. CCS activities require great depth, and in most cases, the targeted formations will be separated

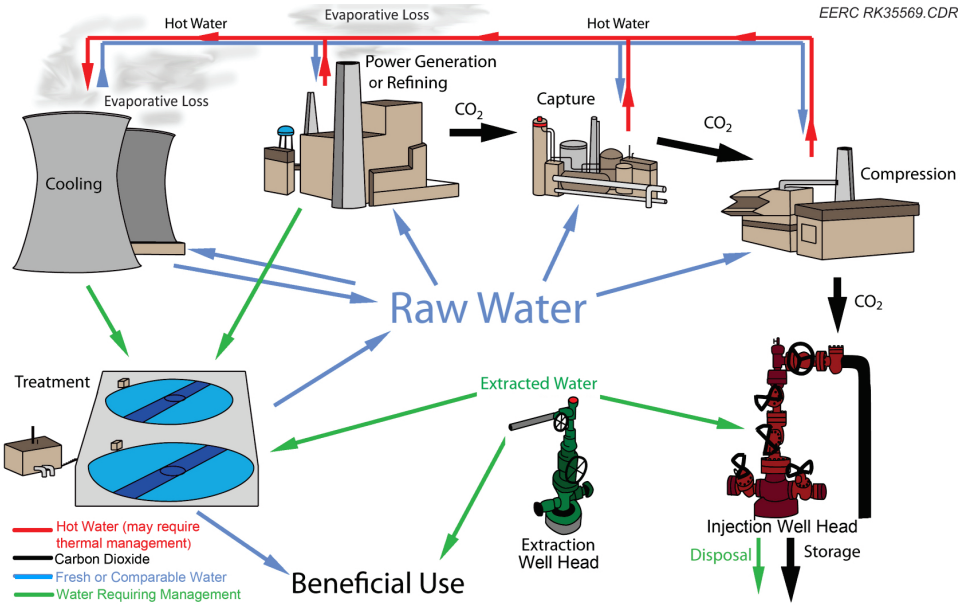

Figure 3. The nexus of CO_2 and water results in water usage at CO_2-generating sources and potential production and beneficial use near storage sites. Blue arrows represent freshwater either directly usable or able to be returned to freshwater sources. Red arrows represent hot water requiring cooling facilities. Green arrows represent water requiring some management strategy. Black arrows represent the flow of CO_2 through the system. Depending on the nature of the capture technology, additional water treatment stages may be necessary.

from potable water resources by hundreds to thousands of feet of rock, including multiple low-permeability barriers. Producing water (removing formation water from the carbon storage formation) is not necessary for carbon storage, though it may be beneficial in individual circumstances as described below. The RCSPs are actively working on testing the various phases of CCS to identify safe, efficient, stable, and cost-effective methodologies to minimize impacts to the surrounding environment, both aboveground and belowground. State and federal regulations currently exist or are being developed to further ensure that CCS activities will be conducted in a responsible manner.

Regional Water- and CCS-Related Challenges

Additional Water Resources for CCS

All currently available carbon capture technologies require additional water for exhaust gas processing, equipment cooling, and replacement power generation (large-scale capture and compression are expected to consume 30% or more of a facility's power output and associated water usage). More efficient use of available resources (water recycling), improving various capture process efficiencies, and increased use of alternative cooling technologies (such as dry cooling) are under development to meet this challenge.

Produced Water Utilization

Many technologies exist to treat water that may be produced from carbon storage activities. The greatest challenge is matching subsurface water sources with treatment options that economically provide the water quality suitable for potential users. All stakeholders (CO_2 generators, site managers, government regulators, and water users) will need to work together to demonstrate and significantly expand beneficial uses of CCS produced water.

Water Production for Plume Management

Producing water as part of CCS projects has the potential to become an important reservoir injection management tool, particularly at sites where a need for the water has been identified. By producing water near an injection well, the overall reservoir pressure can be reduced in the immediate area of production. The reduction of reservoir pressure effectively increases the overall potential storage volume and will likely draw the CO_2 plume in the direction of the pressure differential. In summary, the plume control capability coupled with the on-site production of an important resource is a potential benefit to all stakeholders.

WWG Focus

The RCSP WWG is focused on addressing the challenges and opportunities at the nexus of CCS and water and is working to find technically and economically feasible answers to these questions.

The WWG consists of members from all of the RCSPs. This particular working group is organized by the Plains CO_2 Reduction (PCOR) Partnership, which is a group of public and private sector stakeholders working together to better understand the technical and economic feasibility of sequestering CO_2 emissions from stationary sources in the central interior of North America. The PCOR Partnership is led by the Energy & Environmental Research Center at the University of North Dakota and is one of seven regional partnerships under DOE's National Energy Technology Laboratory RCSP Initiative. To learn more, contact:

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Visit the PCOR Partnership Web site a www.undeerc.org/PCOR. New members are welcome.

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