The potential for merging a regional low-temperature geothermal resources assessment with the recent USGS geologic carbon dioxide storage assessment

by Marc L. Buursink, U.S. Geological Survey, National Center MS-956, 12201 Sunrise Valley Dr., Reston, VA 20192

Progress towards a low-carbon energy future may include research on both geologic carbon dioxide (CO2) storage and low-temperature geothermal resources. The US Geological Survey (USGS) completed a basin-scale geologic CO2 storage assessment in 2013 for the onshore areas and State waters of the United States (US). The USGS last released low-temperature geothermal resources assessments in 1983 for the Western, Central and Eastern US with a national reinterpretation of the results discussed in 1994. Follow up work on geologic CO2 storage and low-temperature geothermal resources assessments should be complementary because each characterized and discussed subsurface properties are relevant to both assessments, including regional temperature and pressure gradients, along with reservoir porosity and hydraulic permeability.

The CO2 storage assessment relied on subsurface property data from multiple sources including proprietary oil and gas drilling databases, and State geological surveys. When these properties are amenable for supercritical CO2 injection, storage units were outlined in a geographic information system (GIS) for the assessment. Ultimately, storage assessment units (SAUs) were identified in 36 sedimentary basins in various physiographic provinces across the United States. The SAUs ranged from 3,330 to 22,000 ft. deep, and from 20 thousand to 83 million acres in size. The 2013 assessment focused on potential CO2 storage resource in both oil and gas reservoirs, and in deep saline aquifers. The low-temperature geothermal resources assessment work focused on an inventory of conductive and convective heat supply. Conduction or heat flow dominated systems include sedimentary basins where geothermal gradients exceed 30 degrees Celsius (°C) per kilometer. Convective hydrothermal resources include flowing groundwater around 90°C. USGS research on updating geothermal assessments is ongoing, in particular for deep sedimentary basin resources in the Western US. Also included in the geothermal assessment update are areas with a concentration of smaller low-temperature systems and areas of geopressured geothermal resources in the conterminous US.

The geologic CO2 storage and low-temperature geothermal resources assessments share common characteristics, so highlighting sedimentary basins with elevated subsurface temperatures and favorable hydraulic permeability that were part of the geologic CO_2 storage assessment will provide valuable subsurface data and interpretations for ongoing low-temperature geothermal resources assessment work. A GIS study overlapping the CO_2 SAUs and the geothermally prospective or warm gradient areas highlights physiographic provinces or geologic formations worthy of further investigation. Additional geothermally prospective areas may be derived from Southern Methodist University and USGS mapping work on heat flow, and on ground water and sediment temperatures at depth. While other subsurface properties were documented during the assessments, overlapping elevated pressure areas and favorable reservoir porosity could be considered in a follow on study. Essentially, areas with elevated subsurface temperatures and favorable hydraulic permeability in deep saline aquifers may also be amenable for both CO_2 storage and the extraction of geothermal energy resources. Regional examples of this concept include both the downdip areas of the Northern Gulf Coast Region and the Atlantic Coastal Plain, while basin-scale examples include the Repetto and Puente Formations in the Los Angeles Basin and the Muddy Sandstone in the Denver Basin.

When located in the same physiographic areas, co-production of geothermal energy could offset the power requirements for compression and injection of CO_2 into the deep subsurface, therefore possibly reducing carbon output. Production of geothermal energy through extraction of warm water could also alleviate subsurface pressure management issues associated with CO_2 injection. The CO_2 storage and geothermal resources assessments did not discuss economic trade-offs and transportation logistics, such as pipelines, and while these are important considerations, they are also beyond the scope of this abstract. Ultimately, based on preliminary examples in different geologic settings and information on shared subsurface properties, working on components of low-temperature geothermal resources and geologic CO_2 storage assessments together appears to benefit a low-carbon energy future.