Assessment of Water Management and Costs on CO2 Geologic Storage Operations in Saline-Bearing Formations

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9.29.2020 - 10.1.2020 – AAPG Annual Convention and Exhibition 2020, Online/Virtual

Abstract

Even though pilot, small-scale carbon capture and storage (CCS) projects have been successfully demonstrated in the United States in recent years, commercial-scale CCS deployment is necessary to provide energy security and mitigate carbon dioxide (CO2) emissions. However, it will introduce new challenges since larger volumes of CO2 will need to be stored. While many of the challenges associated with large-scale deployment of CCS are continually being researched—such as cost of capture, safety of storage, and regulatory hurdles— water management and its associated costs is an additional challenge that needs to be assessed. The extraction of brines from storage reservoirs has been suggested as a mechanism to maintain safe working pressures during the injection of CO2. Additionally, it simultaneously increases the storage capacity of the formation to allow greater control over the subsurface plume migration. Understanding the costs associated with the management of produced water allows for a thorough evaluation of additional factors that could dictate the rate of CCS deployment. The National Energy Technology (NETL) developed Fossil Energy (FE)/ NETL CO2 Saline Storage Cost Model was used to evaluate the implementation and economics associated with the treatment, disposal, and/or reuse of water produced from saline reservoirs during CO2 injection operations across different water management scenarios— water production and disposal with coincident CO2 injection, water production and water treatment with parallel CO2 injection, and pre-injection water production and water treatment with the intent of increasing injection capacity. All three water management scenarios

incorporated both disposal through onsite injection wells and third-party offsite disposal, totaling six management strategies. This study does not quantify the pressure effects of water management or associated plume migration, instead the analysis focuses on the effect water management practices has on the overall CO2 break-even price for a potential storage project in the Appalachian, Williston, Gulf Coast Onshore, San Joaquin and Illinois basins. On average, the addition of water management practices to a CCS project doubles the break-even cost. Overall, the cheapest break-even costs are associated with the deep saline aquifers of the Gulf Coast Onshore basin where the formations are equal or greater than 1,000 feet thick and contain the highest permeabilities compared to all other formations.