Hydrogen at Scale—Why Geology Matters

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ABSTRACT

Energy deployment and long-duration energy storage are major challenges for a low carbon economy. Hydrogen (H_2) offers the potential for a transportable, storable energy carrier to realize a low carbon economy in the U.S. Hydrogen can be generated renewably using electrolysis, or from fossil fuels including natural gas and coal, which when combined with carbon capture and storage (CCS) can reduce greenhouse gas emissions. Natural gas is the main source of hydrogen from steam methane reforming in the U.S. Approximately 95% of the current U.S. production is generated from natural gas for petrochemical processing and industrial. Technology developments in electrolysis using power from wind, solar, and nuclear sources offer the potential for cost-competitive hydrogen generation in the future. Regardless of the source of hydrogen, the use of hydrogen as an energy carrier at urban, regional or national scales will require development of a robust supply network integrating storage, transportation, and distribution infrastructure with potential markets. Large-scale geological hydrogen storage is essential given the large volumes of hydrogen that will be required for even a partial hydrogen economy. In the U.S., an extensive natural gas pipeline and storage network provides an excellent starting point for considering hydrogen transportation and distribution options, including low percentage (10%) admixtures of hydrogen with natural gas. Hydrogen has been stored for decades in salt (dissolution) caverns in the Texas Gulf Coast to supply petrochemical processing. However, salt caverns are limited to geologic basins with thick salt deposits. Reservoirs in saline aquifers and depleted hydrocarbon fields offer much greater geographic coverage in the United States. Saline aquifer aquifers and depleted hydrocarbon fields are used extensively for natural gas storage, but have not been tested and developed for hydrogen storage. We see the need to prove these reservoirs for hydrogen storage to allow for integrated hydrogen systems and infrastructure to be developed for a range of potential markets.

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