

EXECUTIVE SUMMARY

UNDERGROUND STORAGE OF NATURAL GAS AND HYDROGEN

Compared with natural gas and coal, hydrogen does not emit greenhouse gases when combusted. Unfortunately, hydrogen has a very low-volumetric energy density compared to hydrocarbons, requiring that it be liquified at very low-temperatures or compressed to very high-pressures to provide comparable energy. Liquefaction and compression consume large amounts of energy. Underground storage of large volumes of hydrogen in geologic formations is a feasible option that is being practiced to a limited extent today. Underground storage of natural gas and town gas are mature technologies that have been implemented since the early 1900s. This study summarizes a literature review of the state-of-the-industry on the underground storage of hydrogen, and its analog, the underground storage of natural gas.

Key findings from this report include the following:

- Underground storage of natural gas is a mature technology that is deployed globally to provide energy security and buffer price volatility. Approximately 670 storage facilities exist worldwide.
- In contrast, there are only a few underground hydrogen storage facilities in the world with limited storage capacity, serving limited geographic regions and specific industries.
- The low-volumetric energy density of hydrogen will require a much larger underground storage facility to hold the same amount of energy as a natural gas storage facility.
- Assuming demand dictates that the same amount of energy be stored in the future in the form of hydrogen, then the total number of large-scale, hydrogen underground storage facilities will need to increase substantially to match the same working gas capacity of those facilities containing natural gas today.
- Hydrogen markets are just starting to emerge in Canada, European Union, Japan, and the United States. To facilitate these markets, price transparency and carefully crafted policies are needed to facilitate and incentivize hydrogen production and trade.
- Key differences in hydrogen and natural gas storage are noted, and future research needs are identified in the report.

The [full report](#) provides an overview of the existing hydrogen storage industry, markets, costs, and challenges that organizations might face if hydrogen fuel is adopted at large scale in the transitioning to a low-carbon economy. The results are intended to inform and stimulate stakeholder thought on future research needs.



The Low-Carbon Resources Initiative

This executive summary was published under the Low-Carbon Resources Initiative (LCRI), a joint effort of the Electric Power Research Institute (EPRI) and GTI Energy addressing the need to accelerate development and deployment of low- and zero-carbon energy technologies. The LCRI is targeting advances in the production, distribution, and application of low-carbon energy carriers and the cross-cutting technologies that enable their integration at scale. These energy carriers, which include hydrogen, ammonia, synthetic fuels, and biofuels, are needed to enable affordable pathways to economy-wide decarbonization by mid-century. For more information, visit www.LowCarbonLCRI.com.

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