Underground Shafts for Hydrogen Storage

Tech ID: 30093 / UC Case 2015-671-0

SUMMARY

Researchers at UCLA have developed an underground drilled shaft concept for storage of hydrogen or other gases.

BACKGROUND

One challenge in creating a hydrogen economy is developing hydrogen gas storage solutions. Increased interest has helped the global hydrogen storage market grow to $2.6 billion in 2016, and it is expected to reach over $5 billion by 2021 (BCC research). Underground hydrogen gas storage decreases costs while increasing storage capacity. Salt caverns are commonly used for underground gas storage, with over 2,000 of them in use throughout North America. However, salt cavern storage sites are constrained by the availability of suitable salt deposits. Thus, other mechanisms for underground sites should be considered for increasing the availability of hydrogen storage sites.

INNOVATION

UCLA researchers have developed an alternative gas storage system consisting of large-diameter drilled underground shafts, which remove the site choice constraint imposed by salt caverns. While large drilled shafts for mine access are an established technology, this innovation is the first instance where they are applied to gas storage. Shafts with thin steel linings to prevent gas leakage can contain hydrogen and other gas mixtures at very high pressures due to the structural support of the surrounding geology, at much lower cost than pressure vessels on the surface. Costs as low as $400/m3 are estimated, and pressures up to several hundred bar are possible.

APPLICATIONS

- Hydrogen gas storage including:
  - Hydrogen gas storage for buffering electricity generation
  - Hydrogen gas storage for fuel cell vehicle filling stations
- Syngas storage (hydrogen CO mixtures)
- Hydrogen-nitrogen mix storage for ammonia-based thermochemical energy storage
- Compressed air energy storage (CAES)

ADVANTAGES

- No site choice constraints as observed in other underground hydrogen storage approaches
- Low-cost high pressure storage of hydrogen and other gases

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	11,009,261	05/18/2021	2015-671

RELATED MATERIALS

- Lovegrove, K.M., Lavine, A.S., Aryafar, H. and Chen, C., 2017. Leveraging the ammonia industry for solar energy storage. Chemical Engineering Progress, 113(7), pp.36-41.

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OTHER INFORMATION

KEYWORDS

solar energy, hydrogen storage, pressure vessel, solar thermal energy, thermochemical energy storage (TCES), renewable energy, shaft drilling

CATEGORIZED AS

- **Energy**
  - Solar

RELATED CASES

2015-671-0

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