A Brief Justification of Hystories

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Acknowledgment

The Project is co-founded by European Union

Outline

1. A few questions as an introduction
2. Underground storage of hydrogen: A technical overview
3. Value of hydrogen storage
4. Specificities of hydrogen storage in porous rocks
5. Conclusion

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A few questions as an introduction

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Are techniques for underground storage adapted to H_2 storage?

Is salt cavern the only available technique for H_2 storage?

How many techniques are considered for H_2 storage?

Are there values for underground storage of H_2?

Do we really need to have underground storage of H_2?

Can we say there are specific challenges for storing H_2 in porous rock?

What is the share of porous rock storage for natural gas in Europe?

Will it be easy to rely on salt caverns only for H_2 storage?

Does **hystories** address these various questions?

2

Underground storage of hydrogen: A technical overview

Various techniques for storing hydrogen underground

hystories
Hydrogen Storage in European Subsurface

Salt Cavern

Gaseous H2

Porous Media

Gaseous H2

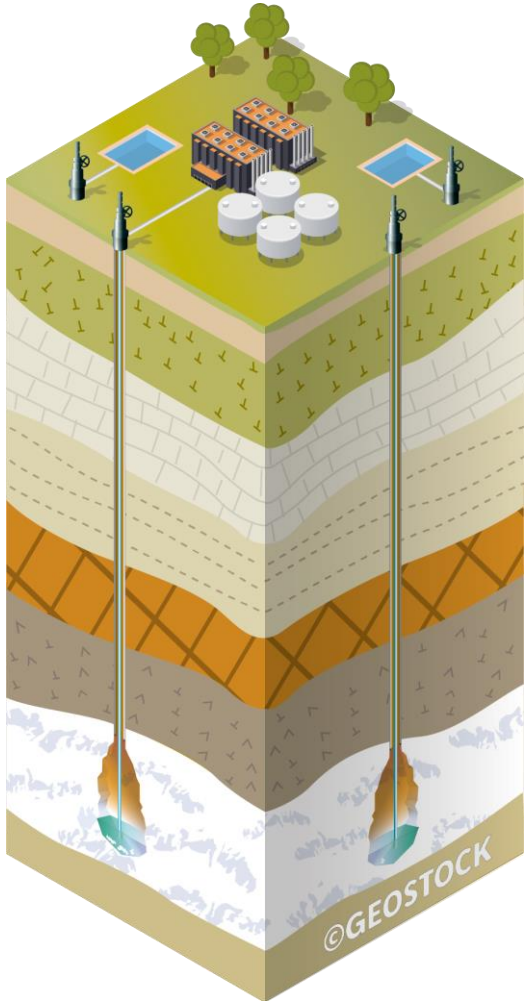
Lined Rock Cavern

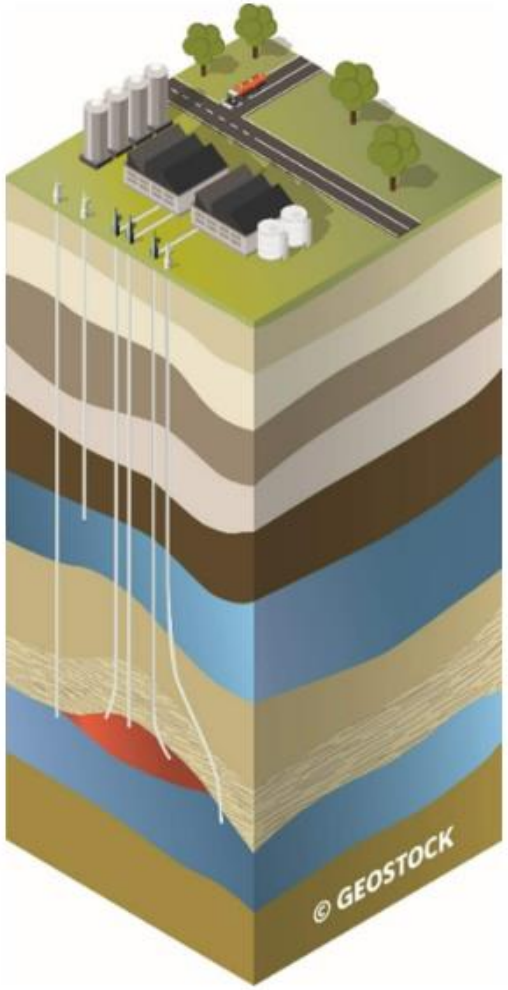
Gaseous H2

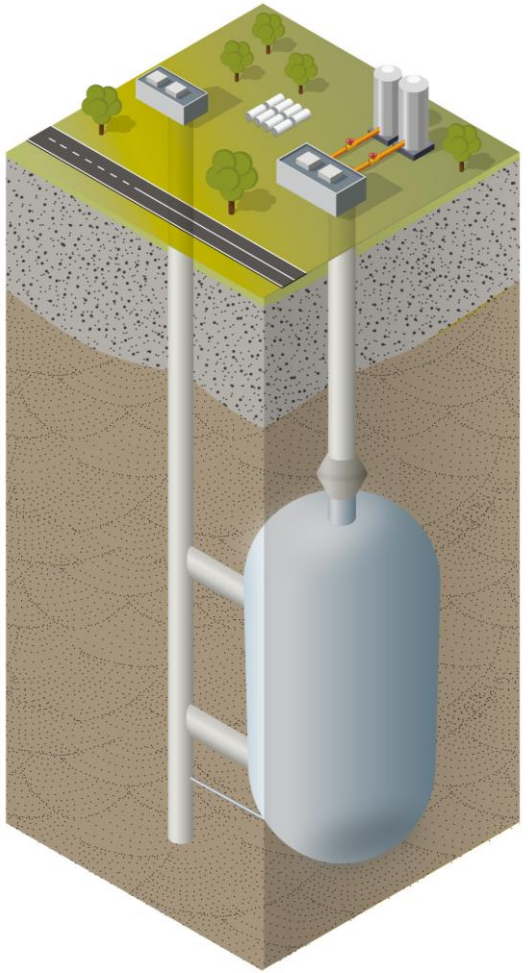
Lined Rock Cavern

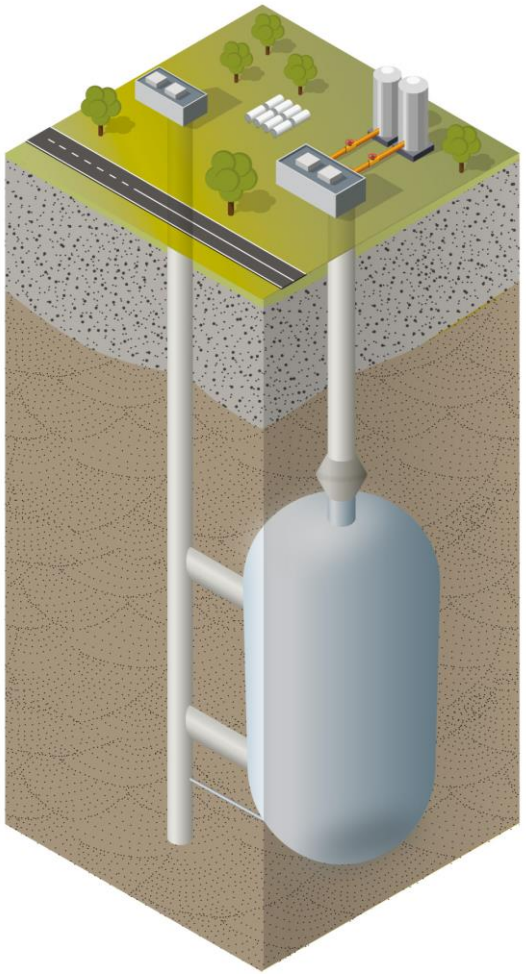
Liquid Carrier

Various techniques for storing hydrogen underground

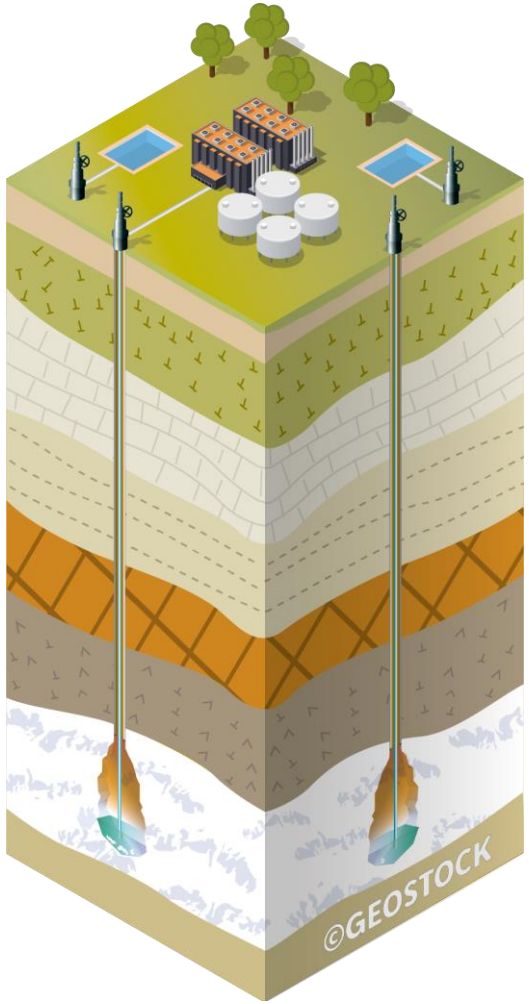


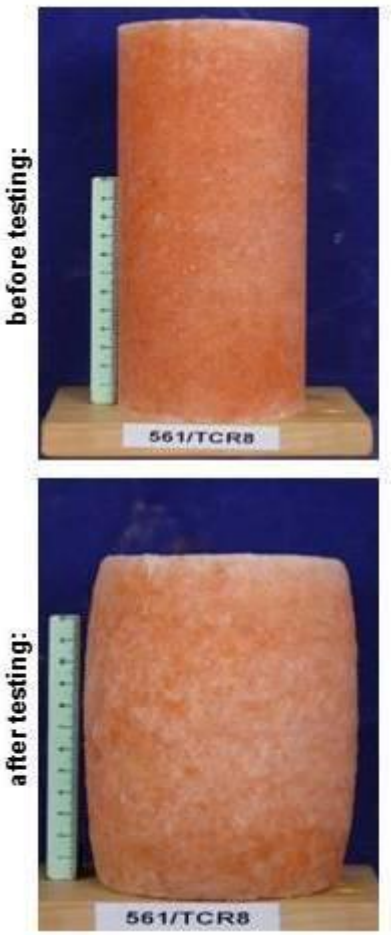


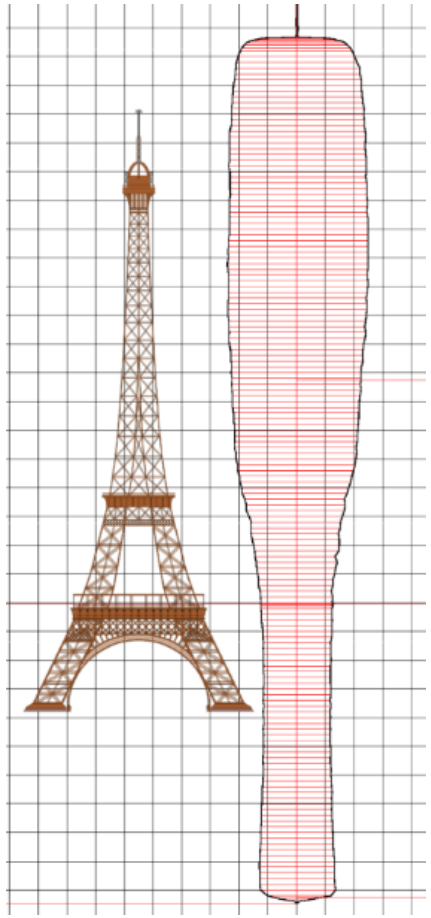




Salt cavern

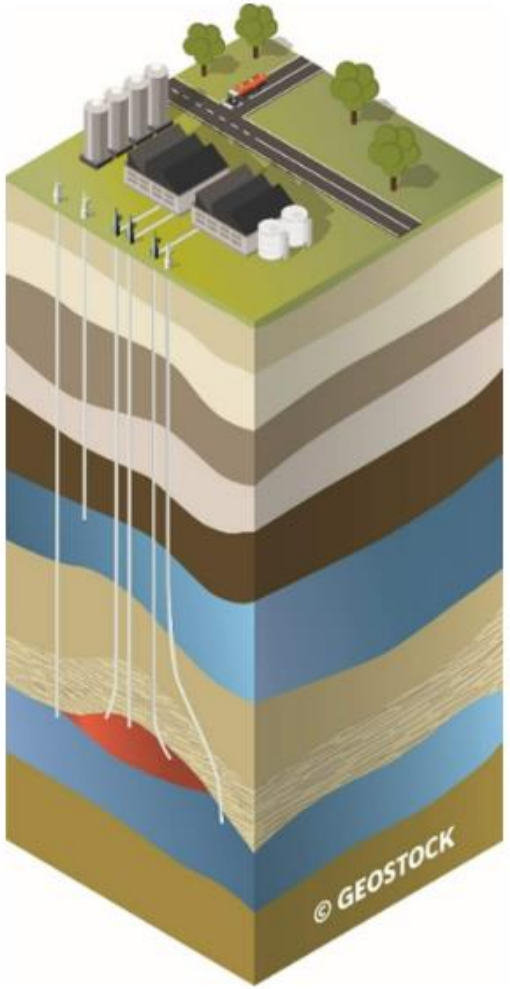


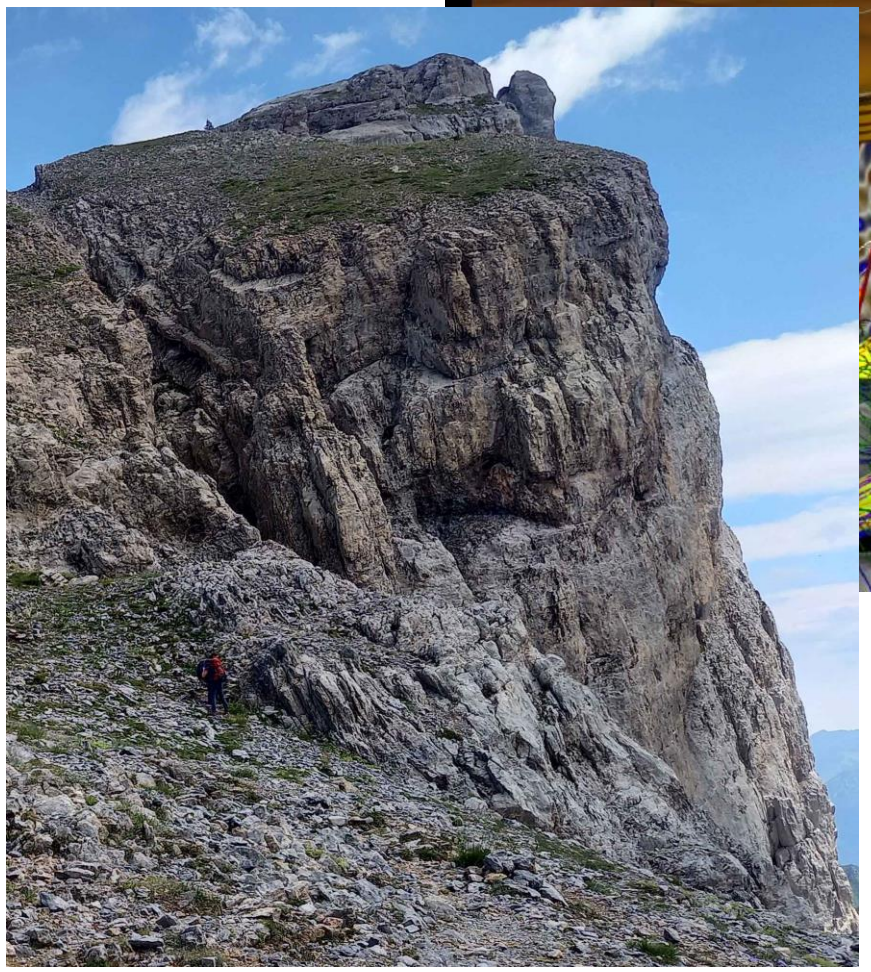


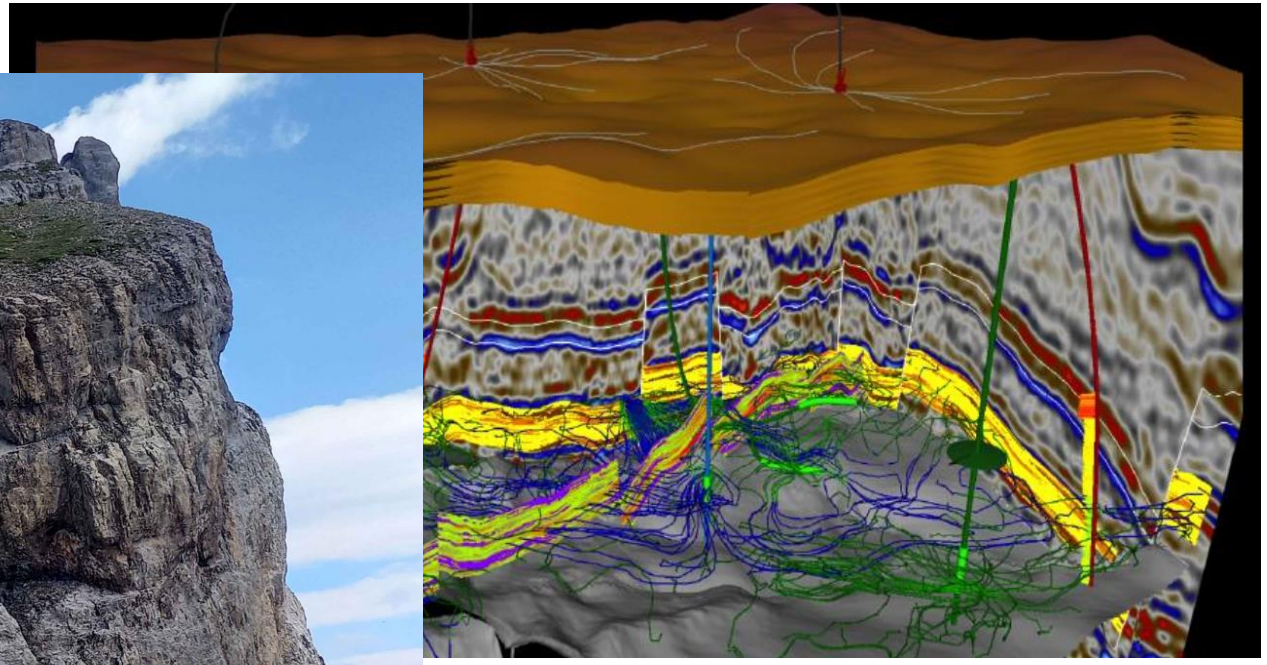


https://www.philippe-crochet.com/galerie/desert/details/209/iran-fevrier-2016-domes-de-sel/237024/vo-16-0465-legende

Porous rock

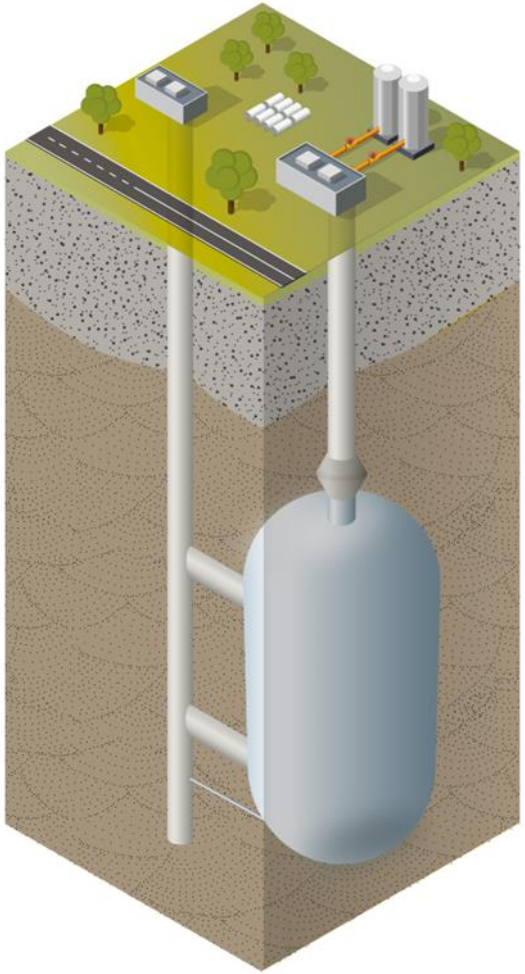






Source : https://www.software.slb.com/products/petrel/petrel-core-systems/reservoir-engineering

Lined mined cavern



3

Value of Hydrogen Storage

Value of hydrogen storage

- **Arbitrage value** - Storage enables sourcing H_2 when it is the cheapest on the market
- **System value** - Storage enables avoiding over-investments in H_2 infrastructures
- **Insurance value** - Storage ensures sufficient H_2 rates are available for all users
- **Kick-start value** - Storage helps optimizing investment in renewable energy systems
- **Environmental value** - Storage helps avoiding fossil-based H_2 production and renewable energy curtailment

Artelys Report on GIE web site: https://www.gie.eu/publications/studies/

Value of hydrogen storage – Exemple on electrolysers

Without hydrogen underground storage, it would be difficult to scale up and down the operation of electrolysers to provide flexibility to the electricity system; Consequences:

- **Economic impact** (higher CAPEX and OPEX in alternative flexibility solutions)
- **Environmental impact** (higher emissions)
- **Social impact** (higher prices for costumers)

Artelys Report on GIE web site: https://www.gie.eu/publications/studies/

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Specificities of hydrogen storage in porous rocks

Specificities of hydrogen storage in porous rock

From a geoscience viewpoint:

- Porosity and permeability requirements
- Quality of geological seal
- Geochemical and microbiological activity

Specificities of hydrogen storage in porous rock

From a market viewpoint:

- 80% of natural gas is stored in porous media in Europe
- Hydrogen energy is only 30% of natural gas energy (at equivalent pressure, for the same volume)
- Salt is not present everywhere
- Salt cavern creation is not always possible even when salt is available

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Conclusion

Conclusion

Yes, almost

Yes!

Definitely not

Yes, indeed

Of course

4

80%

Yes

No

Hystories project consortium

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ludwig bölkow systemtechnik

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The Project is co-founded by European Union

Clean Hydrogen Partnership

Thank you !

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