Utilising publicly available datasets for identifying offshore salt strata and developing salt caverns for hydrogen storage

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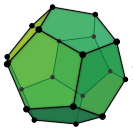

GeoNetZero

Geoscience Solutions to address the Net Zero Challenge

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Acknowledgements

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"Assessing the potential of developing offshore salt caverns for hydrogen storage, UK Continental Shelf"

@ the GSL Special Publication "Enabling secure subsurface storage in future energy systems"

Dr. Georgios Yfantis: *Senior geotechnical engineer with Atkins*

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Why Hydrogen?

Hydrogen can enable the renewable energy system → **DECARBONISE END USES**

Enable large-scale renewables integration & power generation.

Etc...

Distribute energy across sectors & regions.

Act as a buffer to increase system resilience.

Help decarbonise transportation.

Help decarbonise industrial energy use.

Help decarbonise building heat & power.

Serve as a renewable feedstock.

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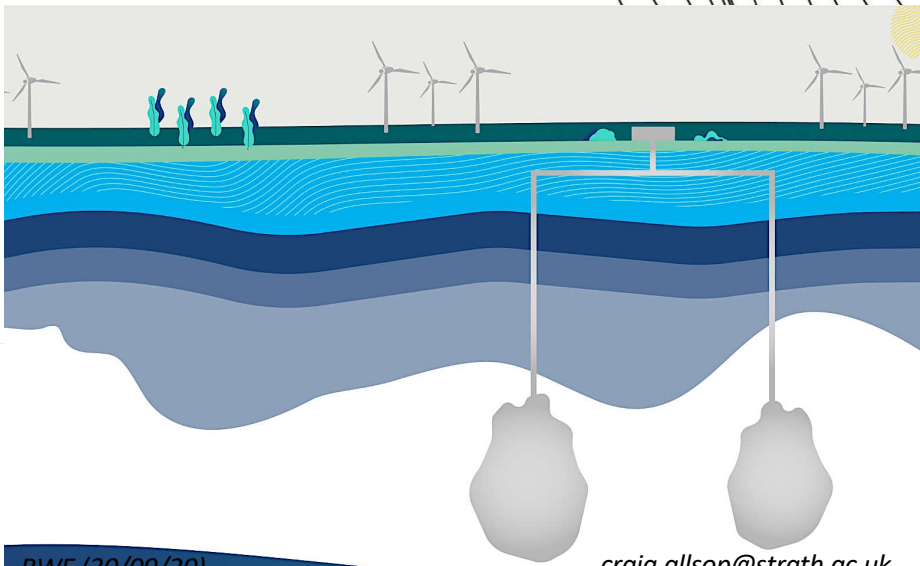
What are Salt Caverns?

They are engineered underground void spaces that are characterized by:

1) High gas tightness / sealing potential
2) Inert chemical behaviour
3) Capability of large injection / withdrawal flow rates
4) **Large storage volume capacity**

Importantly hydrogen storage in salt caverns have been in operation for decades:

- Teeside, UK
- Moss Bluff dome, USA
- Clements dome, USA



RWE (30/09/20)

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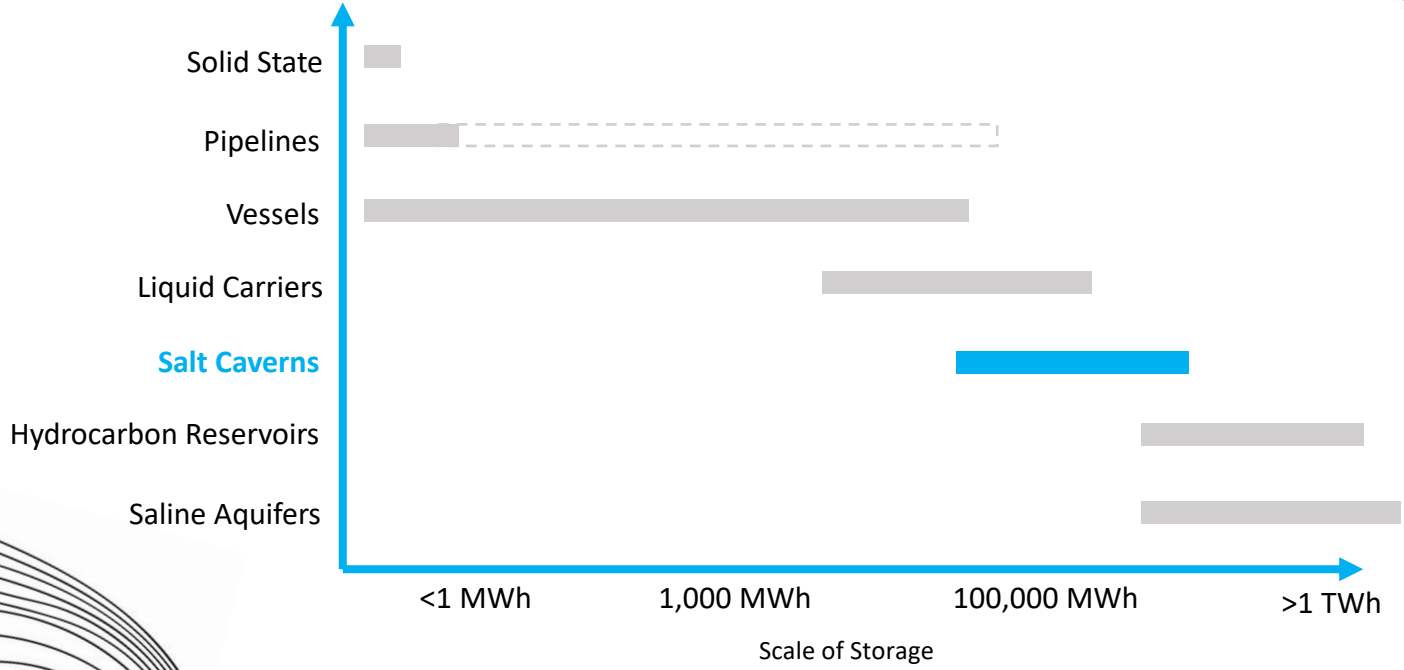
Why Salt Caverns?

Salt caverns provide a medium to high storage potential:



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Offshore Salt Potential

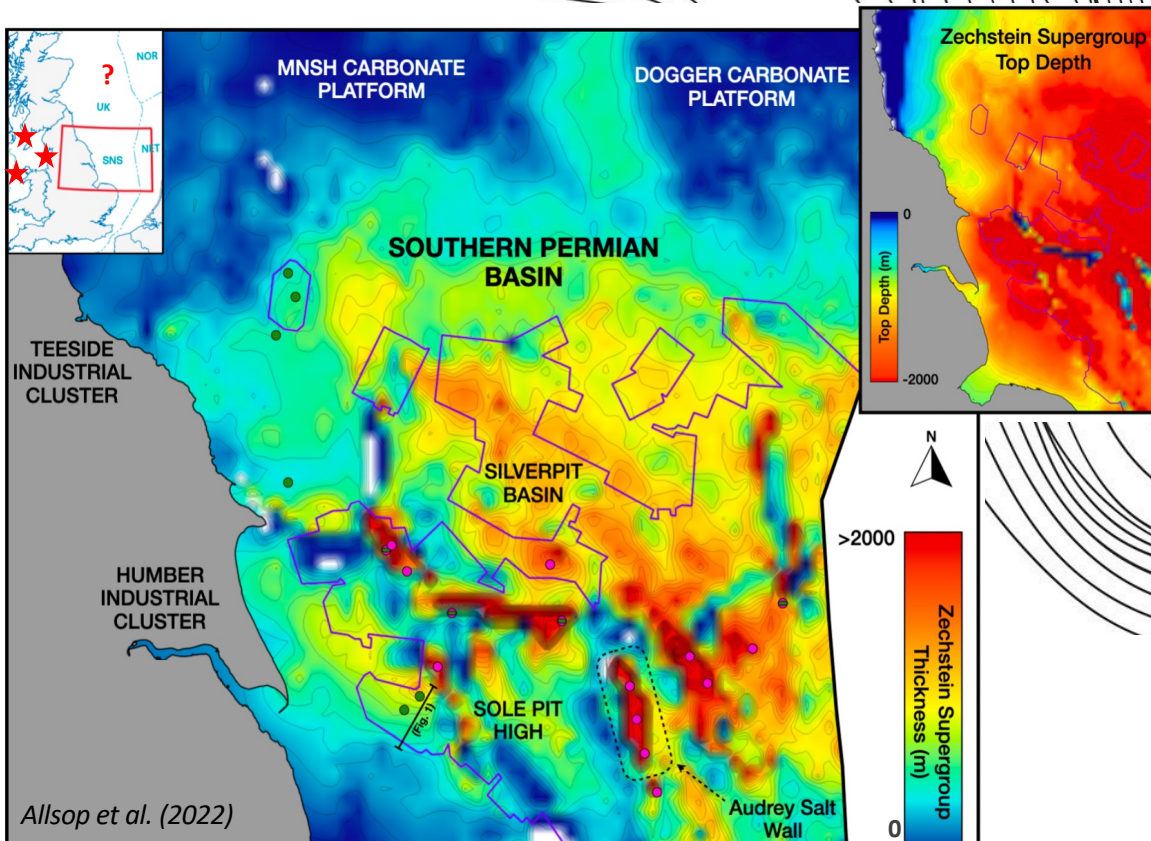
Why the Interest?

There is large salt volumes suitable for cavern development!

Storage potential in both bedded and diapiric salt structures!

Offshore Projects:

- The Gateway Gas Storage Facility, East Irish Sea
- Larne Lough, Northern Ireland
- Tractabel et al., announcement *(17/12/2021)*
- dCarbonX & ESB *(15/02/2022)*

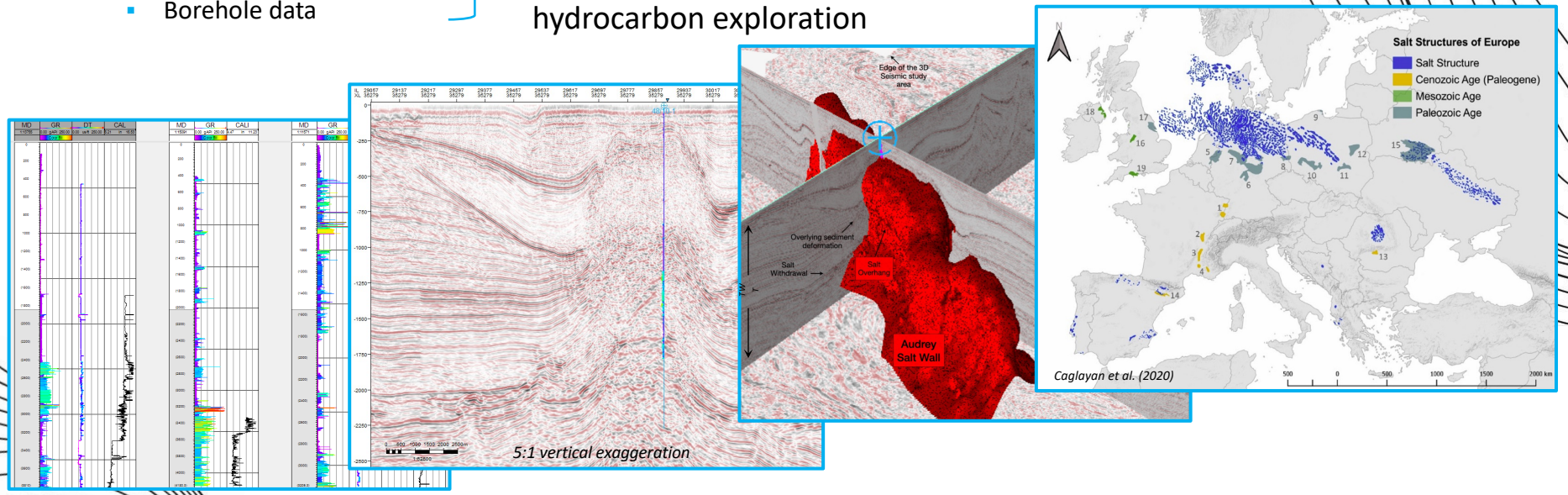


Assessing Public Data

Datasets available:

- Existing geological maps
- Seismic lines / images
- Borehole data

Likely collected for the purpose of hydrocarbon exploration



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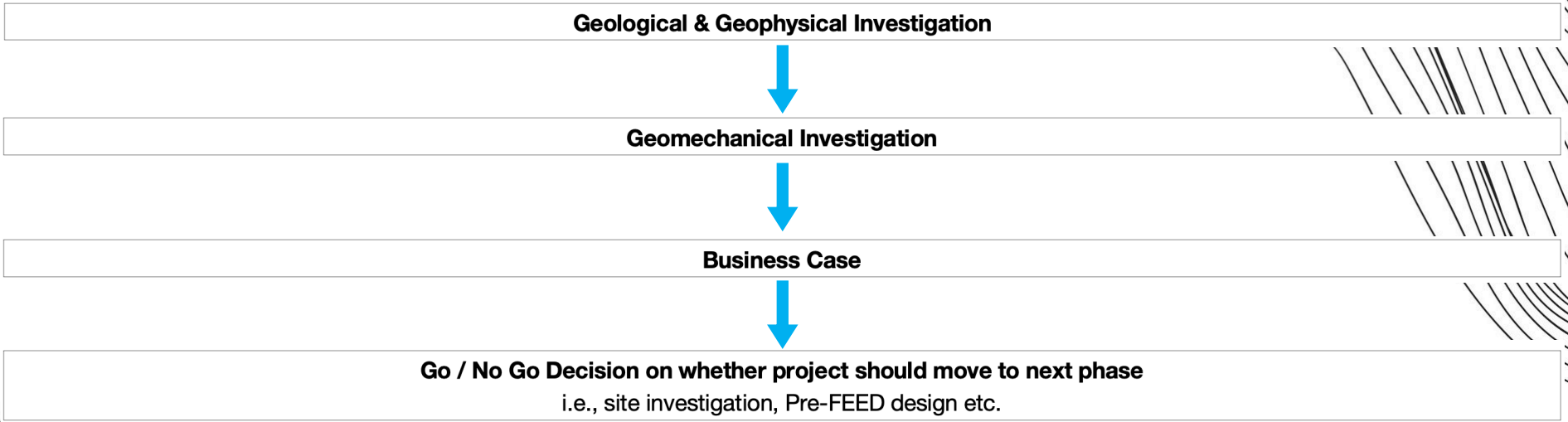
Site Selection Methodology



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Site Selection Methodology

Geological & Geophysical Investigation

Identification & Characterisation of Salt Formations

Geological literature review for identifying suitable offshore salt formations in the area of interest.

Process involves reviewing and assessing:

- Available geological maps,
- 2D & 3D interpreted seismic data, and
- Borehole logs and down hole geophysical data

Geo-referencing & Digitalisation

Import geological data into GIS for creating a dynamic, geo-referenced database.

Screening & Fine-tuning of Geological Data

Additional search for available data, further refinement of data and assumptions utilising existing knowledge to the areas with highest prospectivity.

Assess salt insolubles content and map any potential cavern development geological shortcomings accounting for data limitations.

Geomechanical Investigation

Business Case

Go / No Go Decision on whether project should move to next phase

i.e., site investigation, Pre-FEED design etc.

Allsop et al. (2022)

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Site Selection Methodology

Geological & Geophysical Investigation

Geomechanical Investigation

Suitability Assessment of Salt Deposits

Gap analysis regarding information and risk identification/mitigation.

Selection of potential underground salt cavern storage site location based on the derived geological model.

Cavern Placement

Determination of cavern placement and numbers based upon the derived geological model and on geomechanical rule of thumbs accounting for the limitations of utilized data.

Geomechanical Assessment

- Cavern shape & volume,
- Geometrical configuration of LCCS from top of salt and cavern roof,
- Height and maximum diameter of cavern,
- Cavern distance from adjacent caverns & perturbing geological features, and
- Cavern operating pressures & flow rate limits.

Business Case

Go / No Go Decision on whether project should move to next phase

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Site Selection Methodology

Geological & Geophysical Investigation

Geomechanical Investigation

Business Case

Storage Capacity Estimation

Storage potential derived from thermodynamic calculations. Calculation of required cushion gas quantities.

Conversion of storage capacity into available stored energy (MWh).

Utilisation of Existing & Future Infrastructure

Identification of existing infrastructure that could be repurposed both too and from the storage facility, i.e., pipelines.

Identification of onshore industrial clusters which are/will be involved in the H2 economy.

Financial / Risk Estimations

Derive at a high level:
- CAPEX
- OPEX
- Other relevant KPIs

Conduct GAP analysis and derive risk matrix.

Go / No Go Decision on whether project should move to next phase

i.e., site investigation, Pre-FEED design etc.

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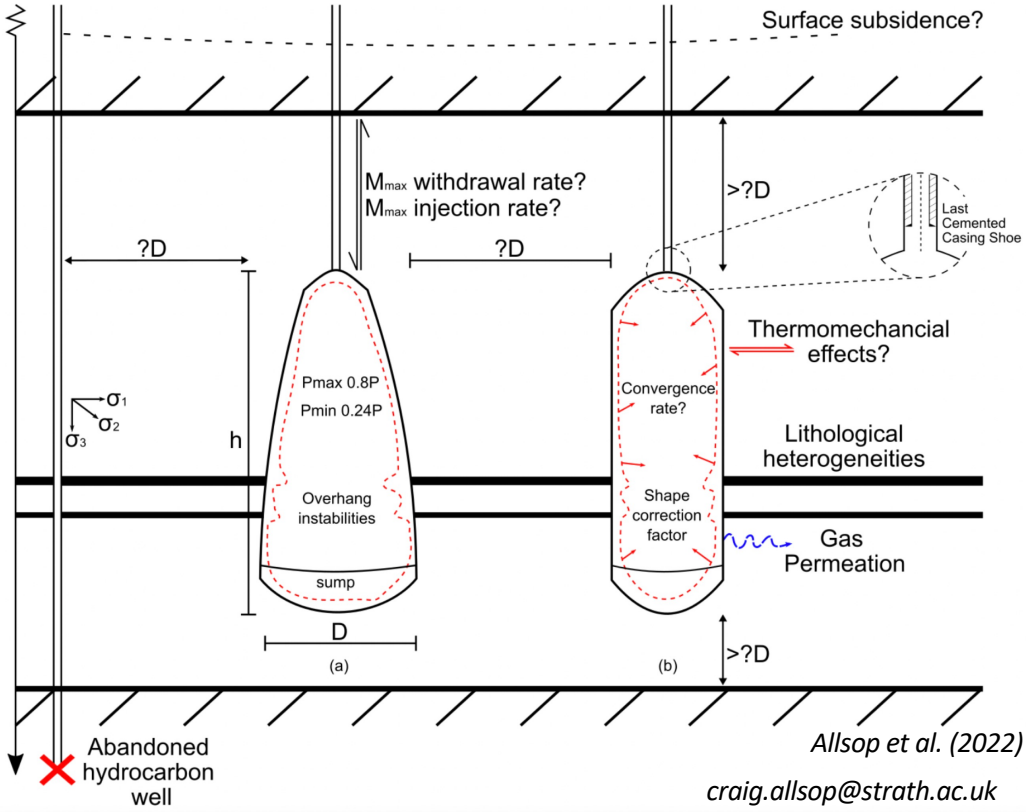
Geomechancial Evaluation

General demands for geotechnical safety:

Geology
- Geological make-up?
- Proximity to other subsurface structures?

Design
- Cavern geometry?
- Cavern roof to LCCS distance?
- Cavern roof to top salt distance?
- Sump to bottom of salt distance?

Operation
- Cavern operations?
- Convergence rates?
- Subsurface subsidence?



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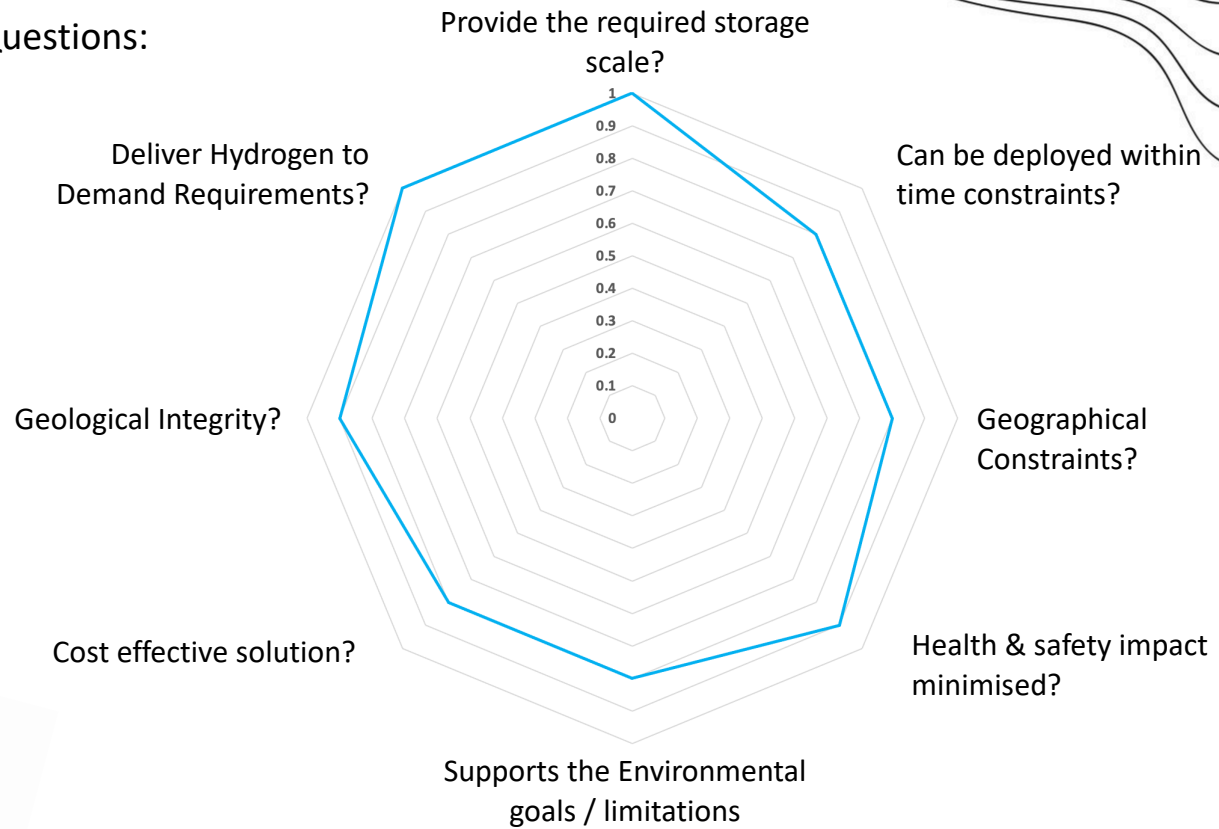
Why Salt Caverns?

Key Questions:



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Key Takeaways

- There are large salt volumes on the UKCS suitable for salt cavern development.
- Recent project announcements indicate the presence of interest and practicality of this subsurface storage technology.
- Geology will continue to be fundamental component in the energy sector, facilitating the transition to low carbon energy technologies.
- H_2 storage caverns can be developed!

Net-Zero is not an option, but a necessity for a greener future!

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Thank you for listening!

Any Questions?

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