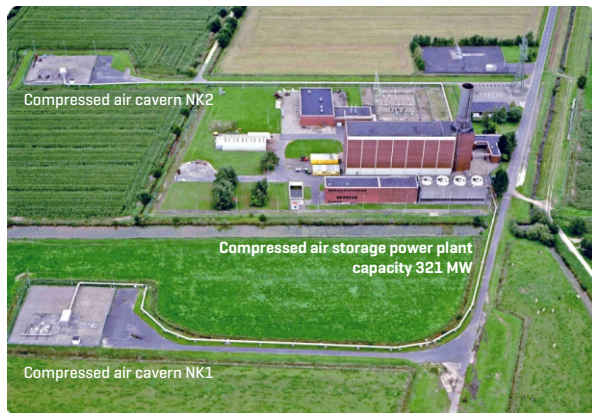


OUR SERVICES

We offer you a wide range of services for geological renewable energy storage using compressed air and hydrogen. Our interdisciplinary approach involves specialists in geology, drilling technology, completion, plant technology, thermodynamics and rock mechanics.

- Location search and evaluation depending on the renewable energy storage strategy
- Technical viability studies for cavern storage facilities within an overall plan for storing renewable energies
- GIS [geographical information system]-based storage capacity assessment
- Design studies for energy storage underground on a grid scale [compressed air storage, hydrogen storage, hydraulic storage]
- Development and implementation of demonstration projects
- Project management for extraction projects and combination projects
- Research and development in the field of geological energy storage



The world's first compressed air storage power plant in Huntorf near Oldenburg, Germany

DEEP.KBB GmbH Convincing Competence

DEEP.KBB specializes in engineering and geoscientific services relating to consulting, planning, construction and operation of underground energy storage facilities, as well as brine and salt extraction. Our competence is based on the extensive technical and scientific know-how that comes from many years of experience. Our goal is to find innovative solutions that are safe and economical.

Over the past decades, we have worked on numerous projects for storing renewable energies in caverns using compressed air and hydrogen. This gives us the experience and expertise essential to successful planning and realization of such facilities. Key aspects here are assessing storage capacity and setting up demonstration projects. Our current projects to determine the storage potential for compressed air and hydrogen in Germany include:



We are closely networked with various entities in the public domain, energy utilities and official authorities, take part in a range of working groups and are represented in specialist publications.



Office Bad Zwischenahn

Eyhauser Allee 2a
26160 Bad Zwischenahn
Germany

Phone: +49 4403 9322-0
Fax: +49 4403 9322-11

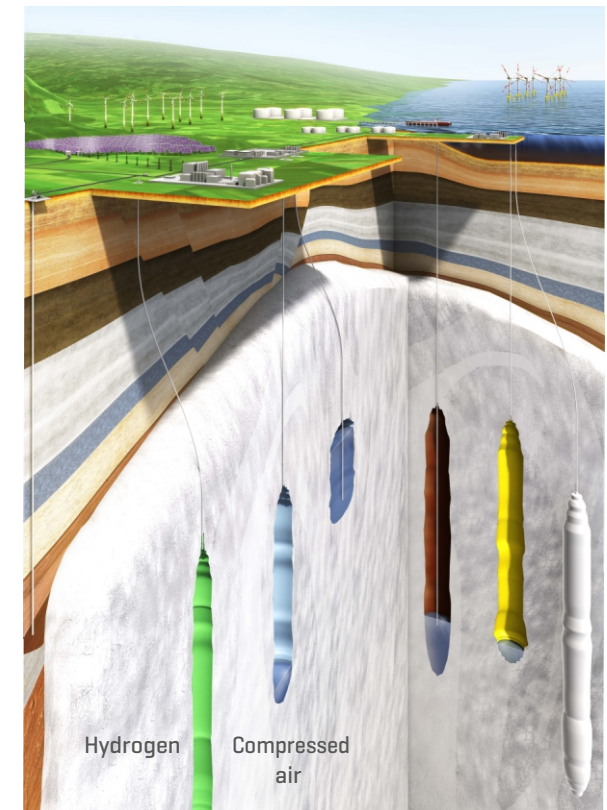
Office Hannover

Baumschulentallee 16
30625 Hannover
Germany

Phone: +49 511 542817-0
Fax: +49 511 542817-11



STORAGE OF RENEWABLE ENERGY



INNOVATIVE ENERGY STORAGE.

DEEP.KBB GmbH | www.deep-kbb.de | info@deep-kbb.de

ENERGY STORAGE

Facts and figures

Typical dimensions of a salt cavern

Depth	approx. 600 - 1,400 m
Height	approx. 100 - 500 m
Diameter	approx. 30 - 80 m
Volume	approx. 200,000 - 1,000,000 m ³

Energy densities

Material use/reconversion into electricity

Crude oil *	9,500 kWh/m ³
Methane **	1,100 kWh/m ³
Hydrogen **	280 kWh/m ³
Hydrogen ($\eta=0,6$)**	170 kWh/m ³
Compressed air [adiabatic]***	2.4 kWh/m ³
Pump storage system****	0.7 kWh/m ³

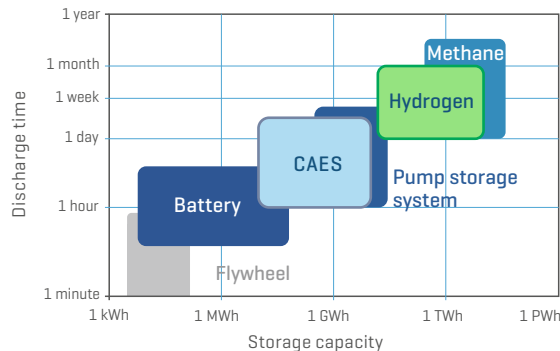
* Relating to the heating value

** Relating to the heating value and a pressure difference of 120 bar

*** Relating to a pressure difference of 20 bar

**** Relating to an effective drop height of 300 m

Use of various storage technologies

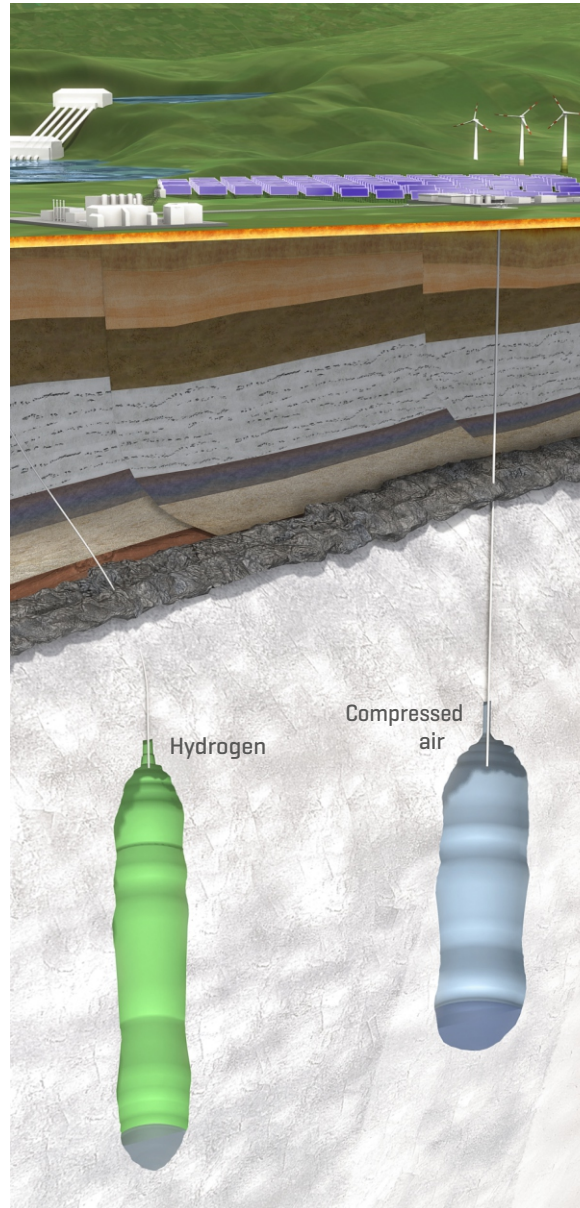


Stored energy in Germany

Crude oil	> 200,000 GWh
Natural gas	> 200,000 GWh
Compressed air [diabatic]	0.64 GWh
Pump storage system	40 GWh

COMPRESSED AIR AND HYDROGEN STORAGE IN SALT CAVERNS –

A major component in the integration of renewable energies into the energy system



The high power supply reliability historically achieved mostly with fossil fuels such as coal, oil and natural gas is inconceivable without extensive storage systems to balance out short-term or seasonal fluctuations in availability and demand. For this purpose, Germany today holds reserves of oil and natural gas sufficient for several weeks. These reserves are almost exclusively stored in geological formations such as depleted gas and oil fields, aquifers and artificial salt caverns.

The current transition to the renewable energy types wind and solar result in completely new requirements for balancing generation and demand in order to secure adequate power supply: from short-term forecast deviations to calm periods lasting several days to seasonal fluctuations. Particularly suitable for short-term demand are compressed air energy storage systems [CAES] with high degrees of electricity-to-electricity effectiveness. Large energy volumes can be stored by converting electric power to hydrogen which is then fed as a high-quality raw material into various uses within the framework of sector coupling.

