

# Hystories; European database of aquifer and depleted field H<sub>2</sub> storage candidates

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CO<sub>2</sub>GeoNet-British Geological Survey

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## Acknowledgment



# Outline

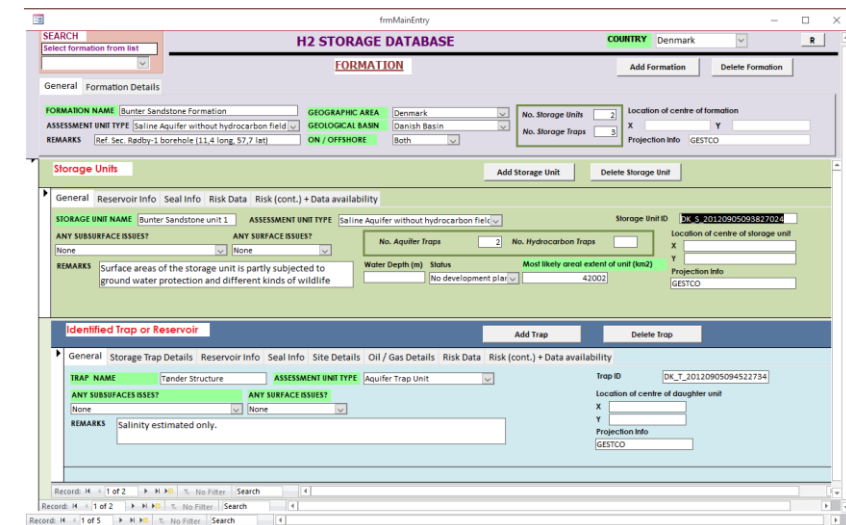
- Database structure
- Data availability
- Database and Geographical Information System
- Summary

# Workpackage 1

**Key aim** = produce a European database and Geographic Information System collating data relevant to geological storage of hydrogen in porous media in Europe

**Main activity** = collate publicly available data on where geological storage of hydrogen in depleted fields or saline aquifers might be possible

Database feeds into Hystories work on modelling capacity and provides data to support geochemical and microbiological work in Hystories



The screenshot displays the 'fmMainEntry' window for the 'H2 STORAGE DATABASE'. It is divided into several sections:

- SEARCH:** Includes a search bar and a 'COUNTRY' dropdown set to 'Denmark'.
- FORMATION:** Contains fields for 'FORMATION NAME' (Bunter Sandstone Formation), 'GEOGRAPHIC AREA' (Denmark), 'ASSESSMENT UNIT TYPE' (Saline Aquifer without hydrocarbon field), 'GEOLOGICAL BASIN' (Danish Basin), and 'ON / OFFSHORE' (Both). It also has fields for 'No. Storage Units', 'No. Storage Traps', and 'Location of centre of formation'.
- Storage Units:** Shows details for a 'Storage Unit' with 'STORAGE UNIT NAME' (Bunter Sandstone unit 1) and 'ASSESSMENT UNIT TYPE' (Saline Aquifer without hydrocarbon field). It includes fields for 'ANY SUBSURFACE ISSUES?', 'ANY SURFACE ISSUES?', 'No. Aquifer Traps', 'No. Hydrocarbon Traps', 'Water Depth (m)', 'Status', 'Most likely areal extent of unit (km2)', and 'Remarks'.
- Identified Trap or Reservoir:** Shows details for a 'Trap' with 'TRAP NAME' (Tender Structure) and 'ASSESSMENT UNIT TYPE' (Aquifer Trap Unit). It includes fields for 'ANY SUBSURFACE ISSUES?', 'ANY SURFACE ISSUES?', and 'Remarks'.

At the bottom, there are navigation controls for records, including 'Record: 1 of 2' and 'Record: 1 of 5'.

The aim of the database is to highlight regions and sites that may be suitable for development into geological storage sites for hydrogen, from a geological perspective.

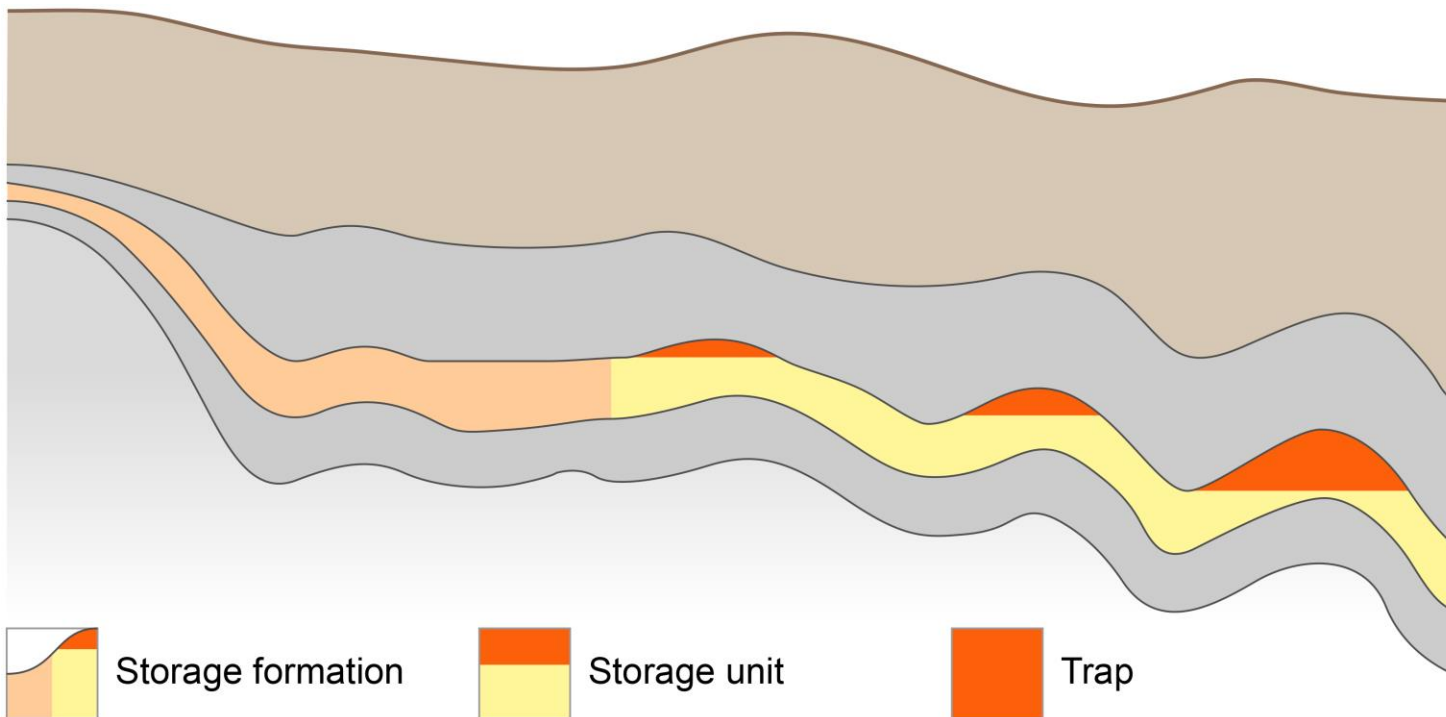
This significant effort from Hystories partners has produced a comprehensive database with a broad coverage of almost the whole Europe

Hystories database advances the level of knowledge for hydrogen storage in Europe by

- Making available the latest relevant geological data
- Including hydrogen-specific criteria supporting assessment of geochemical and microbiological impacts

This improved database will enable more accurate assessments of the potential future for green hydrogen storage in Europe

Three tier storage database to accommodate heterogeneous data availability:



Some caveats on the database:

- The database only contains publicly available data
- Data entry format is constrained for some data fields to make the database searchable
- Variable presentation of data and data collection bias – e.g. focus on zones with hydrocarbons
- Geological interpretation is interpretation!

Storage unit name/identifier

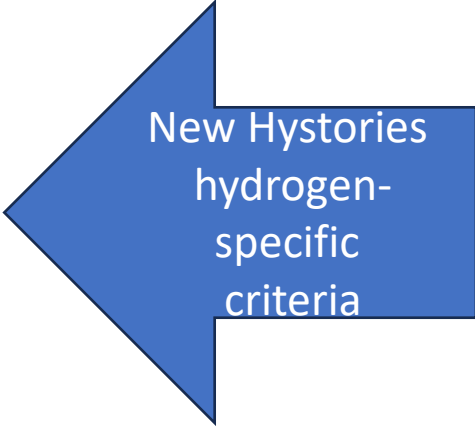
Basic geological data – depth (average), area, thickness, permeability, porosity, age, lithology

More geological data – pressure, temperature, depth to top, net:gross, environment of deposition, geological models, seismic/well data availability

Geochemistry – mineralogy, iron, sulphates/sulphides, CO<sub>2</sub>, oil/gas/condensate and pore water salinity

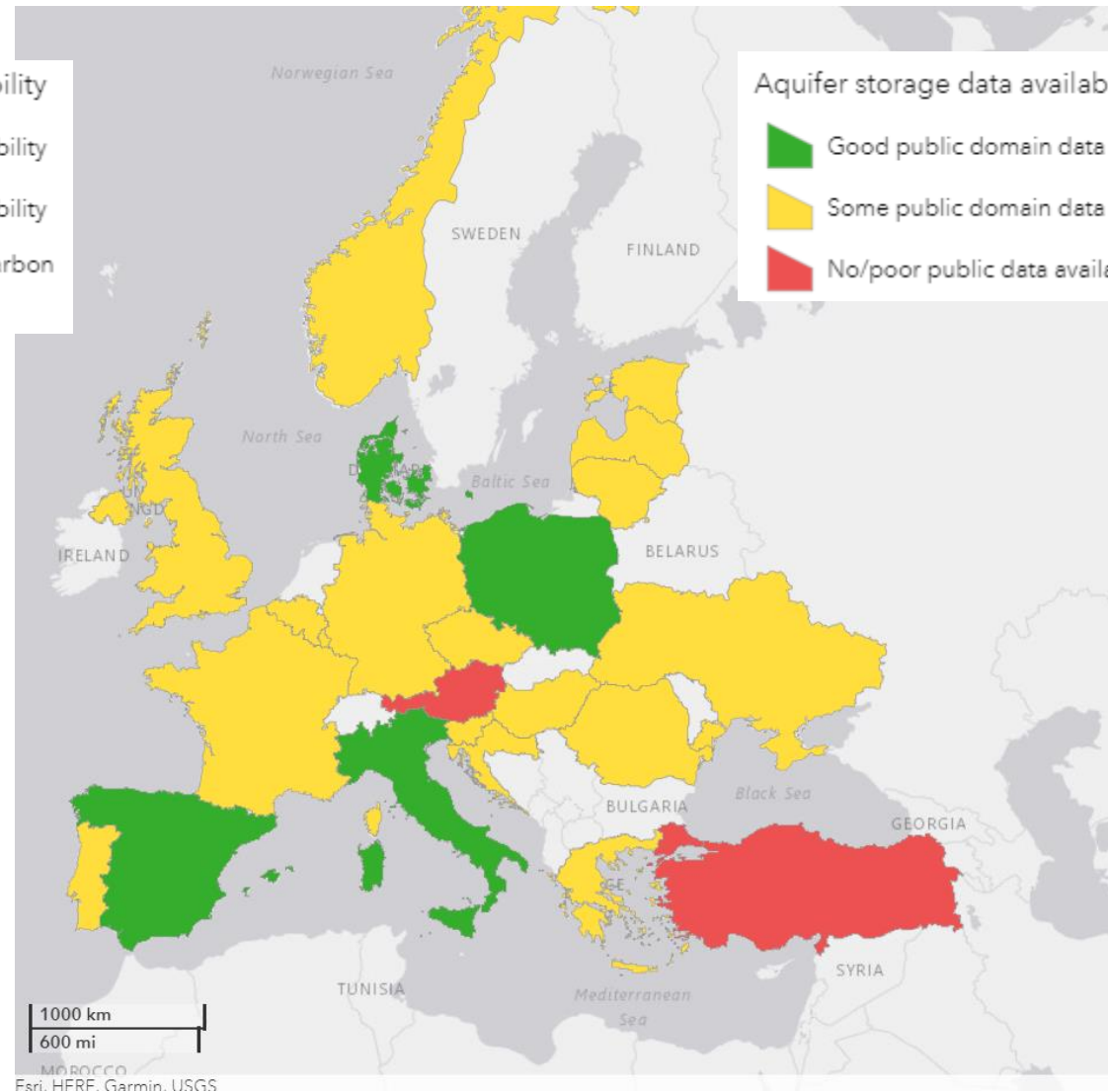
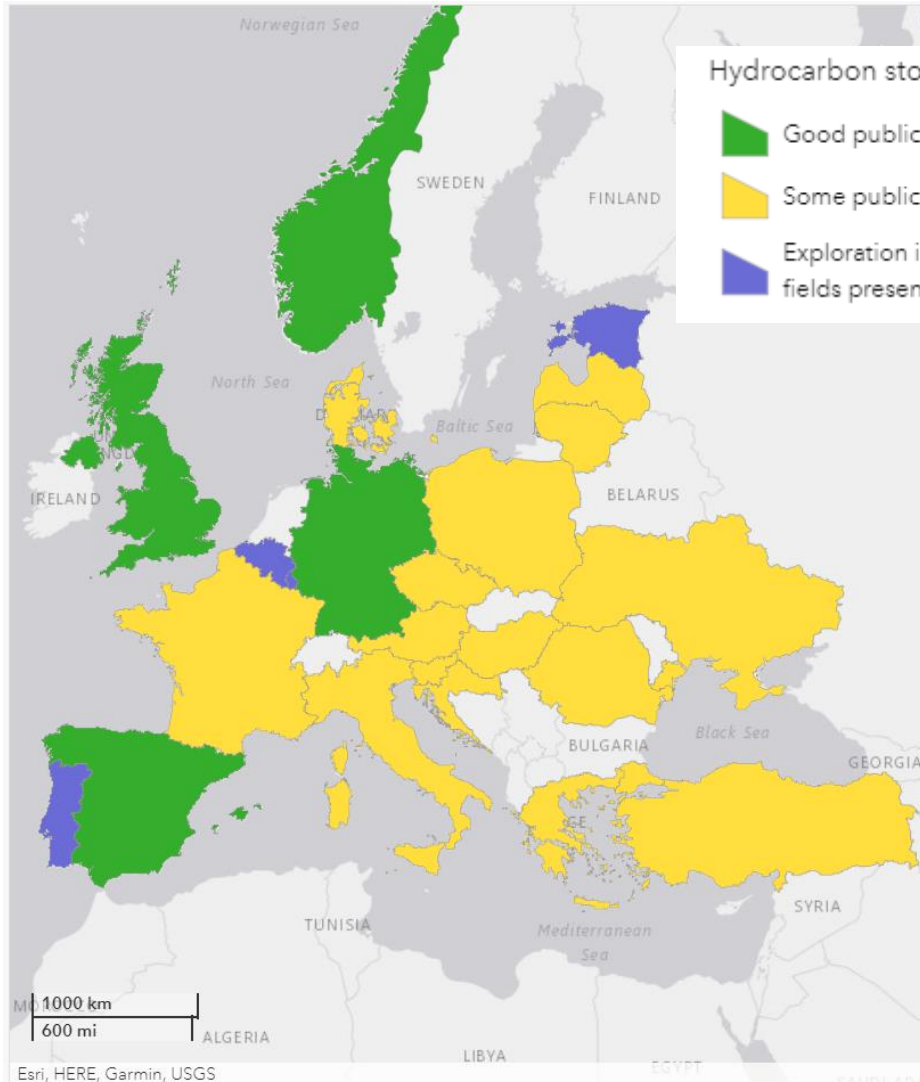
Leakage risks – caprock, faults, depth to top

Operational – owner, production years, wells and vintage, status/planned development



New Hystories  
hydrogen-  
specific  
criteria

# Data availability to identify potential storage sites (1)



- Sufficient data were available to identify geological traps in 20 of the 22 countries assessed by Hystories.
- There was significantly more data available for hydrocarbon fields
  - Four countries declaring good public data availability and all other countries indicating at least some public domain data
- And fewer data for saline aquifers
  - Four countries declaring good public data availability, two countries declaring no or poor data availability, and the remaining countries declaring some public data availability
- Detailed data, such as well logs and seismic data, to further assess potential for hydrogen storage are available in several countries but are not always free to access or publish.



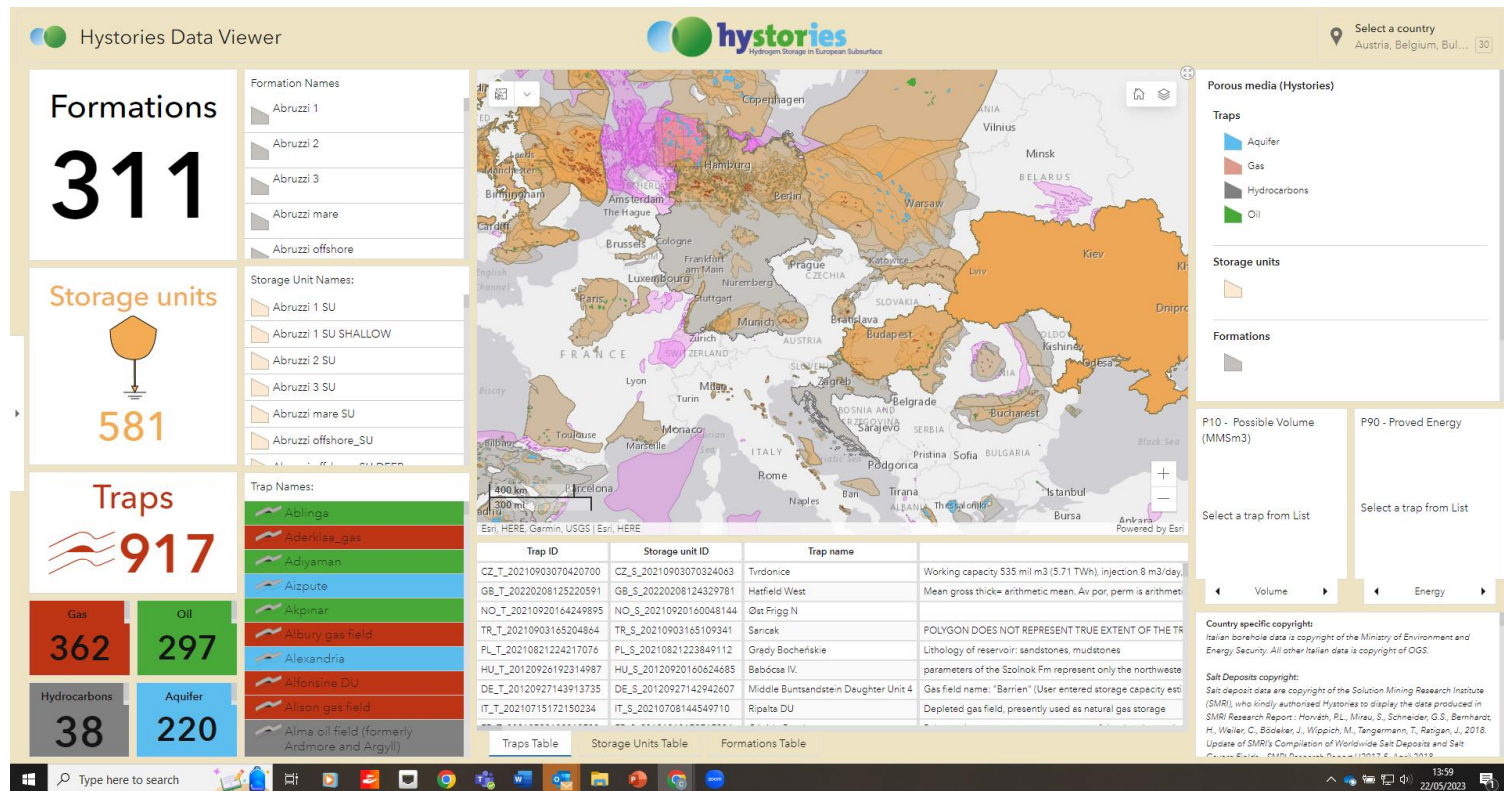
# Geographical information system

Hystories 'traps' = 917  
(See map)

units = 581

formations = 311

Note: These are the traps that could be identified using publicly available data, therefore, an absence of identified traps does not necessarily indicate an absence of storage potential



The screenshot displays the Hystories Data Viewer interface. It features a central map of Europe with various colored overlays representing storage potential. The interface includes several panels:

- Formations:** 311 formations listed, including Abruzzi 1, 2, 3, mare, and offshore.
- Storage units:** 581 storage units listed, including Abruzzi 1 SU, 1 SU SHALLOW, 2 SU, 3 SU, mare SU, and offshore\_SU.
- Traps:** 917 traps listed, including Ablinga, Adarklee\_gas, Adiyaman, Aizpute, Akpinar, Albury gas field, Alexandria, Antonine DU, Alixon gas field, and Alme oil field (formerly Ardmore and Argyl).
- Summary Statistics:** Gas (362), Oil (297), Hydrocarbons (38), and Aquifer (220).
- Map:** A map of Europe showing storage potential overlays in various colors (blue for Aquifer, red for Gas, green for Hydrocarbons, and orange for Oil).
- Table:** A table with columns for Trap ID, Storage unit ID, and Trap name. The table lists several traps and their corresponding storage units.
- Country Selection:** A dropdown menu to select a country (Austria, Belgium, Bulgaria).
- Legend:** A legend for Porous media (Hystories) showing Traps (Aquifer, Gas, Hydrocarbons, Oil) and Storage units.
- Volume and Energy:** Panels for P10 - Possible Volume (MMSm3) and P90 - Proved Energy.
- Copyrights:** Country specific copyright information for Italian borehole data and Salt Deposits copyright information.

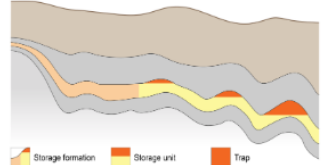
# Online database viewer (1)

## About Hystories

The Hydrogen Storage in European Subsurface (Hystories) project addresses the main technical feasibility questions for subsurface storage of green hydrogen as an enabler to help meet climate targets. The main deliverable from workpackage 1 was a unified database collating available geological data on reservoir and seal characteristics for depleted hydrocarbon fields and saline aquifers to support strategic decision making. The database is accessed via this GIS to highlight regions and sites that may be suitable for development into storage sites for hydrogen, from a geological perspective. This GIS only displays data available in the public domain and therefore the absence of identified storage potential does not necessarily indicate an absence of opportunity.

## The Hystories database

The primary data included in the desktop and web GIS are the three-level hierarchy of storage used by the Hystories database:



- Storage formations (rock bodies which may have suitable reservoir properties)
- Storage units (parts of the storage formations which have promising reservoir properties)
- Storage traps (parts of storage units that should locally contain hydrogen; hydrocarbon fields or mapped geological closures) Data is added in the following order to the database; first a storage formation is added, then the storage units that fall within that formation. Storage traps, which fall within each storage unit are added to the database last.

Hystories Dashboard
My Recordings - Zoom

bgs.maps.arcgis.com/apps/dashboards/630ec7b3cbd54e39b4111e397315ae99
Select a country: Austria, Belgium, Bul... 30

### Hystories Data Viewer

#### Formations

# 311

#### Storage units

# 581

#### Traps

# 917

Gas  
362

Oil  
297

Hydrocarbons  
38

Aquifer  
220

#### Formation Names

- ▾ Abruzzi 1
- ▾ Abruzzi 2
- ▾ Abruzzi 3
- ▾ Abruzzi mare
- ▾ Abruzzi offshore

#### Storage Unit Names:

- ▾ Abruzzi 1 SU
- ▾ Abruzzi 1 SU SHALLOW
- ▾ Abruzzi 2 SU
- ▾ Abruzzi 3 SU
- ▾ Abruzzi mare SU
- ▾ Abruzzi offshore\_SU

#### Trap Names:

- ▾ Ablinga
- ▾ Aderklaa\_gas
- ▾ Adiyaman
- ▾ Aizpute
- ▾ Akpınar
- ▾ Albury gas field
- ▾ Alexandria
- ▾ Alfonsine DU
- ▾ Alison gas field
- ▾ Alma oil field (formerly Ardmore and Argyll)

Trap ID	Storage unit ID	Trap name	
CZ_T_20210903070420700	CZ_S_20210903070324063	Tvrdonice	Working capacity 535 ml m3 (5.71 TWh), injection 8 m3/day.
GB_T_202202081125220591	GB_S_20220208124329781	Hatfield West	Mean gross thick= arithmetic mean. Av por, perm is arithmetic
NO_T_20210920164249895	NO_S_20210920160048144	Øst Frigg N	
TR_T_20210903165204864	TR_S_20210903165109341	Sarıcak	POLYGON DOES NOT REPRESENT TRUE EXTENT OF THE TR
PL_T_20210821224217076	PL_S_20210821223849112	Grądy Bocheńskie	Lithology of reservoir: sandstones, mudstones
HU_T_20120926192314987	HU_S_20120920160624685	Babócsa IV.	parameters of the Szolnok Fm represent only the northwest
DE_T_20120927143913735	DE_S_20120927142942607	Middle Buntsandstein Daughter Unit 4	Gas field name: "Barrien" (User entered storage capacity esti
IT_T_20210715172150234	IT_S_20210708144549710	Ripaia DU	Depleted gas field, presently used as natural gas storage

#### Porous media (Hystories)

Traps

- Aquifer
- Gas
- Hydrocarbons
- Oil

#### Storage units

-

#### Formations

-

#### P10 - Possible Volume (MMSm3)

Select a trap from List

#### P90 - Proved Energy

Select a trap from List

Volume

Energy

**Country specific copyright:**  
 Italian borehole data is copyright of the Ministry of Environment and Energy Security. All other Italian data is copyright of OGS.

**Salt Deposits copyright:**  
 Salt deposit data are copyright of the Solution Mining Research Institute (SMRI), who kindly authorised Hystories to display the data produced in SMRI Research Report: Horváth, R.L., Mirau, S., Schneider, G.S., Bernhardt, H., Weiler, C., Bödeker, J., Wippich, M., Tangermann, T., Ratigan, J., 2018. Update of SMRI's Compilation of Worldwide Salt Deposits and Salt Cavern Fields. SMRI Research Report 11/2017, 5. April 2018.

# Online database viewer (2)

Hystories Data Viewer

Select a country  
Italy

### Formations

49

Formation Names

- Abruzzi 1
- Abruzzi 2
- Abruzzi 3
- Abruzzi mare
- Abruzzi offshore

**Cellino DU**

Trap Name	Cellino DU
Trap ID	IT_T_20220812161405519
Remarks	Depleted gas or hydrocarbon field, presently used as natural gas storage
Country	Italy
Storage Unit ID	IT_S_20210702171937861
Onshore or Offshore	Onshore
Operator	

### Porous media (Hystories)

Traps

- Aquifer
- Gas
- Hydrocarbons
- Oil

Storage units

Formations

### Storage units

66

Storage Unit Names:

- Abruzzi 1 SU
- Abruzzi 1 SU SHALLOW
- Abruzzi 2 SU
- Abruzzi 3 SU
- Abruzzi mare SU
- Abruzzi offshore\_SU

### Traps

26

Trap Names:

- Alfonsine DU
- Bagnolo Mella DU
- Bordolano DU
- Brughiero DU
- Cellino DU
- Collalto DU
- Cornegliano DU
- Cortemaggiore DU
- COTIGNOLA DU
- FERRANDINA
- GROTTOLE

Trap ID	Storage unit ID	Trap name	Remarks	Country
IT_T_20210715172150234	IT_S_20210708144549710	Ripalte DU	Depleted gas field, presently used as natural gas storage	Italy
IT_T_20210713122404294	IT_S_20210625180012792	Alfonsine DU	Depleted gas or hydrocarbon field, presently used as natural gas storage	Italy
IT_T_20121031102518070	IT_S_20121003174921322	GROTTOLE	Depleted gas or hydrocarbon field, presently used as natural gas storage	Italy
IT_T_20121031122327520	IT_S_20121003174921322	FERRANDINA	gas	Italy
IT_T_20210715165412354	IT_S_20210705121033883	Cortemaggiore DU	Depleted gas or hydrocarbon field, presently used as natural gas storage	Italy
IT_T_20121031111306552	IT_S_20121031111303505	PIADENA EST DU	gas	Italy
IT_T_20210714161156323	IT_S_20210702174439029	Cornegliano DU	Depleted gas or hydrocarbon field, presently used as natural gas storage	Italy
IT_T_20210830175004792	IT_S_20210830173702105	COTIGNOLA DU	Depleted gas or hydrocarbon field, presently used as natural gas storage	Italy

Traps Table    Storage Units Table    Formations Table

### P10 - Possible Volume (MMSm3)

Select a trap from List

Volume

### P90 - Proved Energy

Select a trap from List

Energy

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Formation Names

Selection required on one or more elements

Storage Unit Names:

Selection required on one or more elements

Trap Names:

Selection required on one or more elements

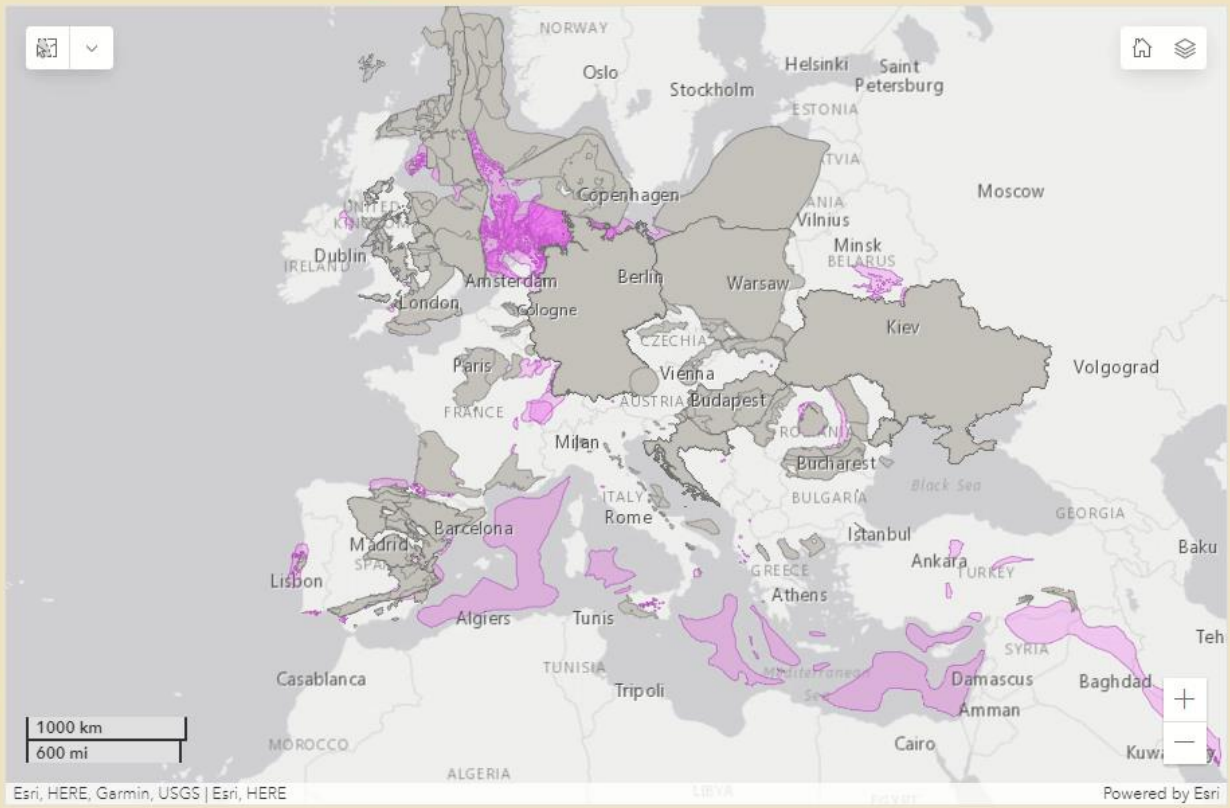
<p><b>Gas</b></p> <p>Selection required on one or more</p>	<p><b>Oil</b></p> <p>Selection required on one or more</p>
<p><b>Hydrocarbons</b></p> <p>Selection required on one or more</p>	<p><b>Aquifer</b></p> <p>Selection required on one or more</p>

Selection required on one or more elements

Selection required on one or more elements

Selection required on one or more elements

Selection required on one or more elements



**Porous media (Hystories)**

**Traps**

- Aquifer
- Gas
- Hydrocarbons
- Oil

**Storage units**

- 

**Formations**

- 

P10 - Possible Volume (MMSm3)

Select a trap from List

Volume

P90 - Proved Energy

Select a trap from List

Energy

Selection required on one or more elements

Traps Table    Storage Units Table    Formations Table

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- Geodata is key in making strategic decisions on the role for the subsurface in meeting energy and climate demands. Having access to data and the knowledge on how to process, manage and manipulate this data will have a wide-ranging impact on the capacity for strategic decision making.
- Where geological data are available in the public domain, it is possible to identify opportunities where the subsurface could play a role in meeting climate targets
- The wealth of data collated during the Hystories project indicates that there is significant potential for geological storage of hydrogen in depleted hydrocarbon fields and saline aquifers across Europe.

- Where the required data are available for assessment, geological traps which could be used to store hydrogen have been identified.
- All countries, with the exception of Estonia, were able to identify formations and storage units for potential hydrogen storage
- However, storage opportunities are not evenly distributed and will require varying amounts of effort to realise.

- The geological traps identified through the Hystories project will require further assessment to confirm their suitability for storage of hydrogen
  - Acquire detailed data (either purchase/collect)
  - Site specific investigation and business case
- Additional data collation could be undertaken in a new project to improve pan-European understanding of storage opportunities
  - Additional resource to purchase and interpret seismic and well data
  - New data collection, especially to better understand opportunities offered by saline aquifers

# Summary - Hystories workpackage 1 on European porous media storage database

Hystories Work Package 1 generated a **comprehensive, cross-border, database of potential opportunities** for geological storage of hydrogen. The database represents a significant new knowledge deliverable

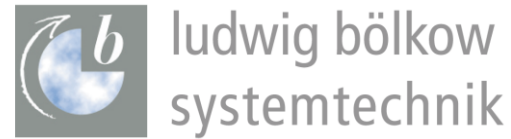
Public **availability of data varies** between countries and for different trap types. An absence of identified traps does not necessarily indicate an absence of storage potential

The wealth of data collated indicates there is **significant potential for geological storage of hydrogen** in depleted hydrocarbon fields and saline aquifers across Europe. Storage opportunities are not evenly distributed

Traps identified through Hystories require **further investigation** to confirm site-specific suitability of specific sites for H<sub>2</sub> storage. Development time will vary



# Hystories project consortium



Mineral and Energy  
Economy Research  
Institute  
Polish Academy of Sciences

## Acknowledgment

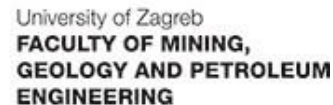
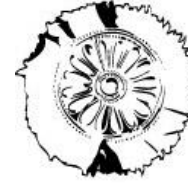
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The Project is co-funded by European Union



# Thanks to all WP1 participants



**Thank you !**