Digital, Data Analytics, and Automation: Value Creation Through Digital E&P

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Web-based reservoir simulation

Applications for carbon storage

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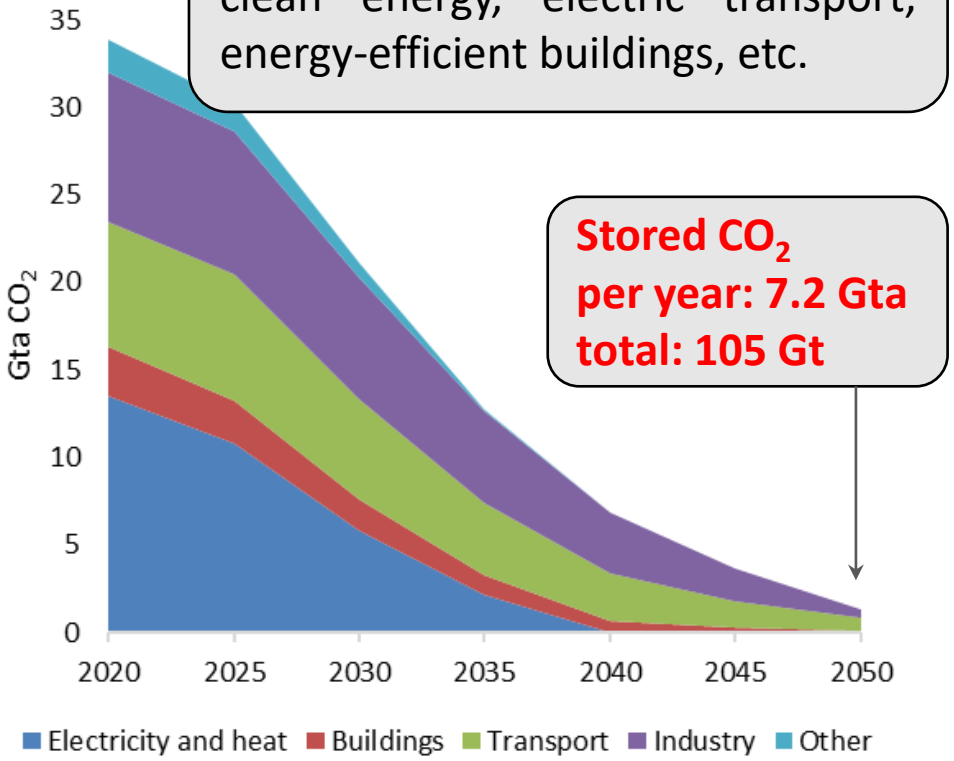
Geological Survey of Denmark and Greenland (GEUS)

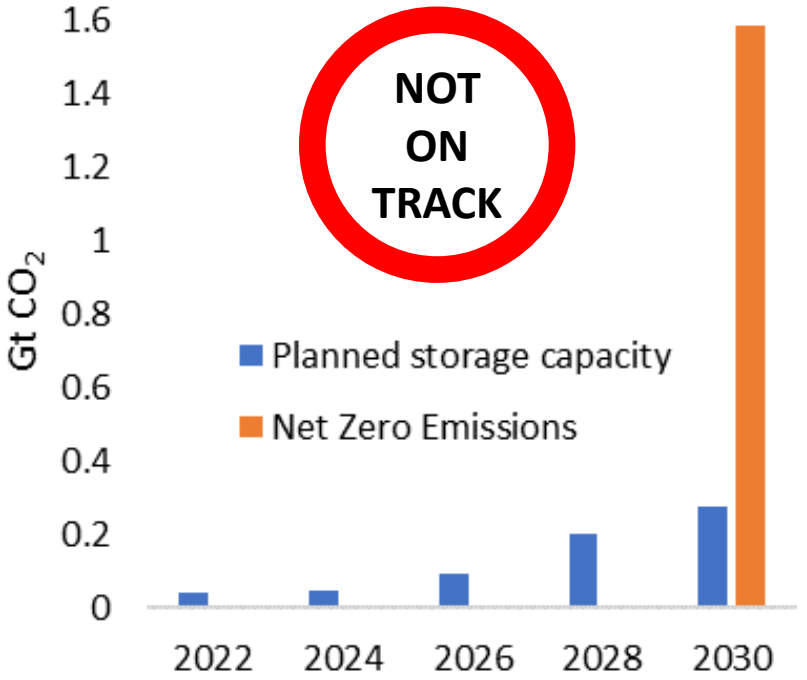
G E U S

The IEA pathway to Net Zero for the energy sector

Phasing out fossil fuels, investing in clean energy, electric transport, energy-efficient buildings, etc.

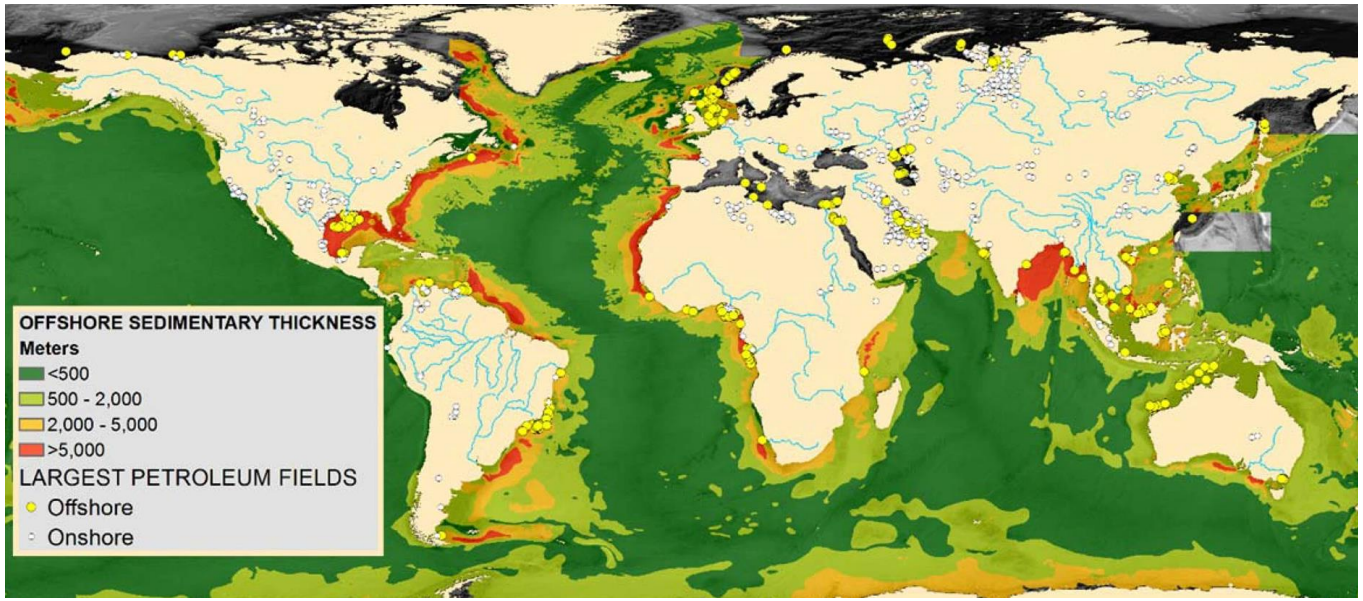
Stored CO_2 per year: 7.2 Gta
total: 105 Gt

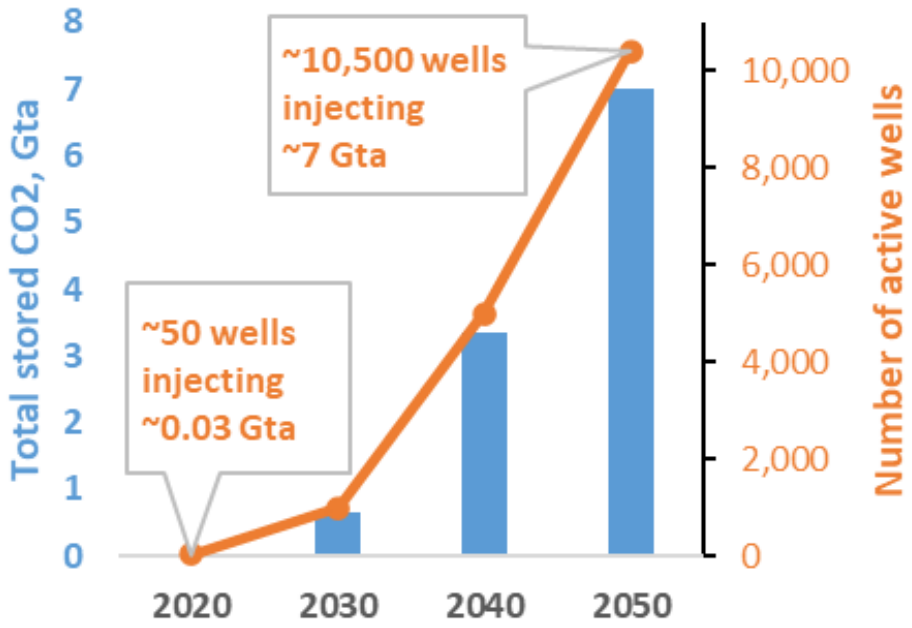




Data: International Energy Agency

Is it feasible to achieve the Net Zero CCUS target?





Suitable geological structures are widespread, but a detailed regional analysis is required to determine the storage capacity

For comparison: there are ~1,000,000 active oil & gas wells in the USA

Source: Ringrose et al., 2021, Ringrose & Meckel 2019

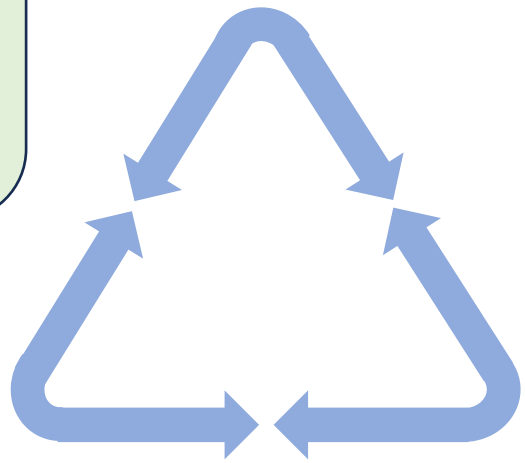
… Yes, it is!

Large-scale collaboration needed

Live up to net-zero pledges
- Legal framework to enable net-zero targets
- Competitiveness of national economy
- Communities' support

Authorities

Sustainable life
- No environmental risks
- Limited new infrastructure & traffic
- Benefits to the locals



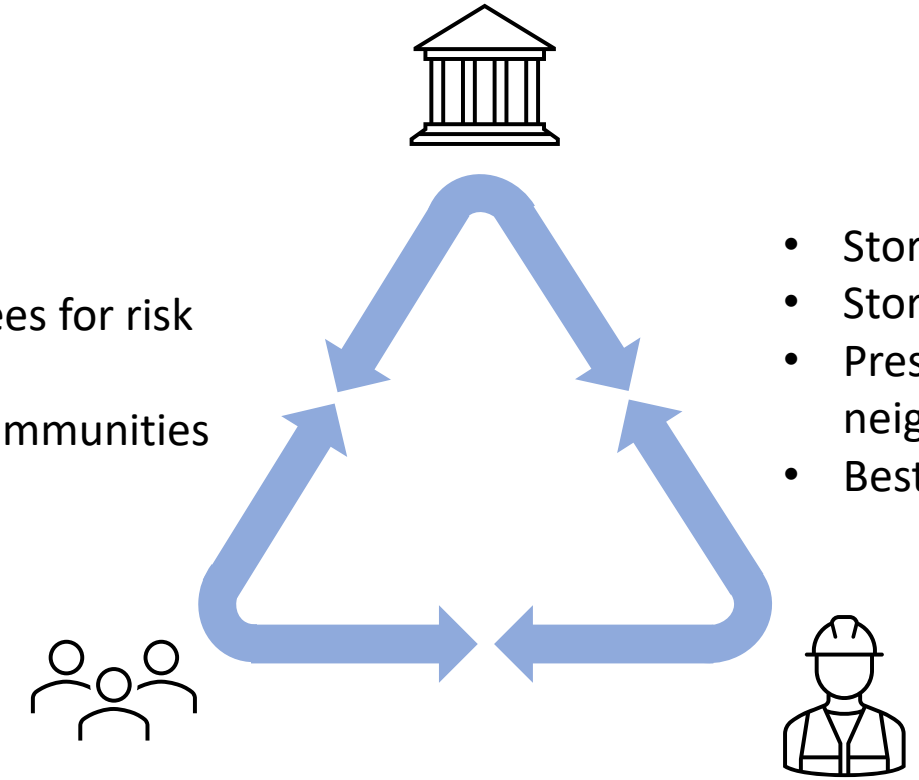
Communities

Industry

Growth in a new market
- Quick adaption to compliance requirements
- Attract state funding
- Advise on regulations
- Low-cost & scalable solutions

Transparency & openness in the use of the subsurface

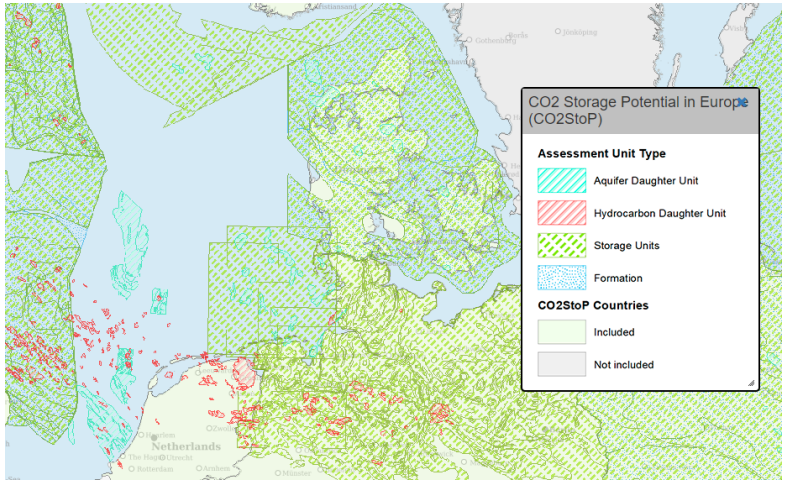
- State guarantees for risk management
- Benefits for communities

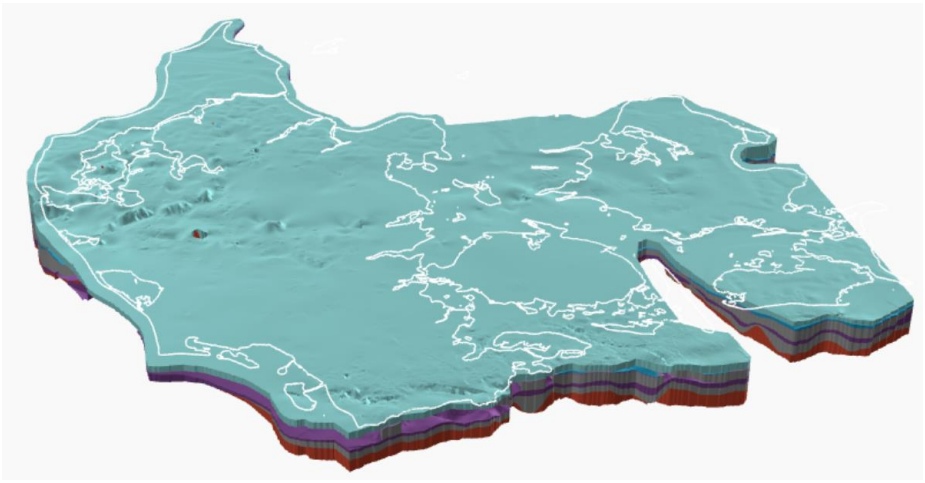


- Storage capacity estimates
- Storage licensing terms & conditions
- Pressure interaction between neighbouring license areas
- Best practices for carbon storage

- Site planning & operation
- Risk monitoring & communication

European Geological Data Infrastructure (EGDI)





- 460+ map layers for minerals, hydrocarbons, geothermal, groundwater, CCUS, ...
- Development of standardized metadata to enhance the compatibility of diverse geological datasets

- Open access to geological datasets
- 3D regional geological models for several countries

https://maps.europe-geology.eu

Static CO_2 storage capacity estimates

CO_2 storage capacity calculator

Area (km^2) 60

Thickness (m) 200

Porosity 0.2

CO_2 density (kg/m^3) 620

Storage efficiency factor 0.4

Submit About

About

The calculator estimates the static CO_2 storage capacity in saline aquifers, following the methodology detailed in Haeri et al. (2024). This method uses the following equation:

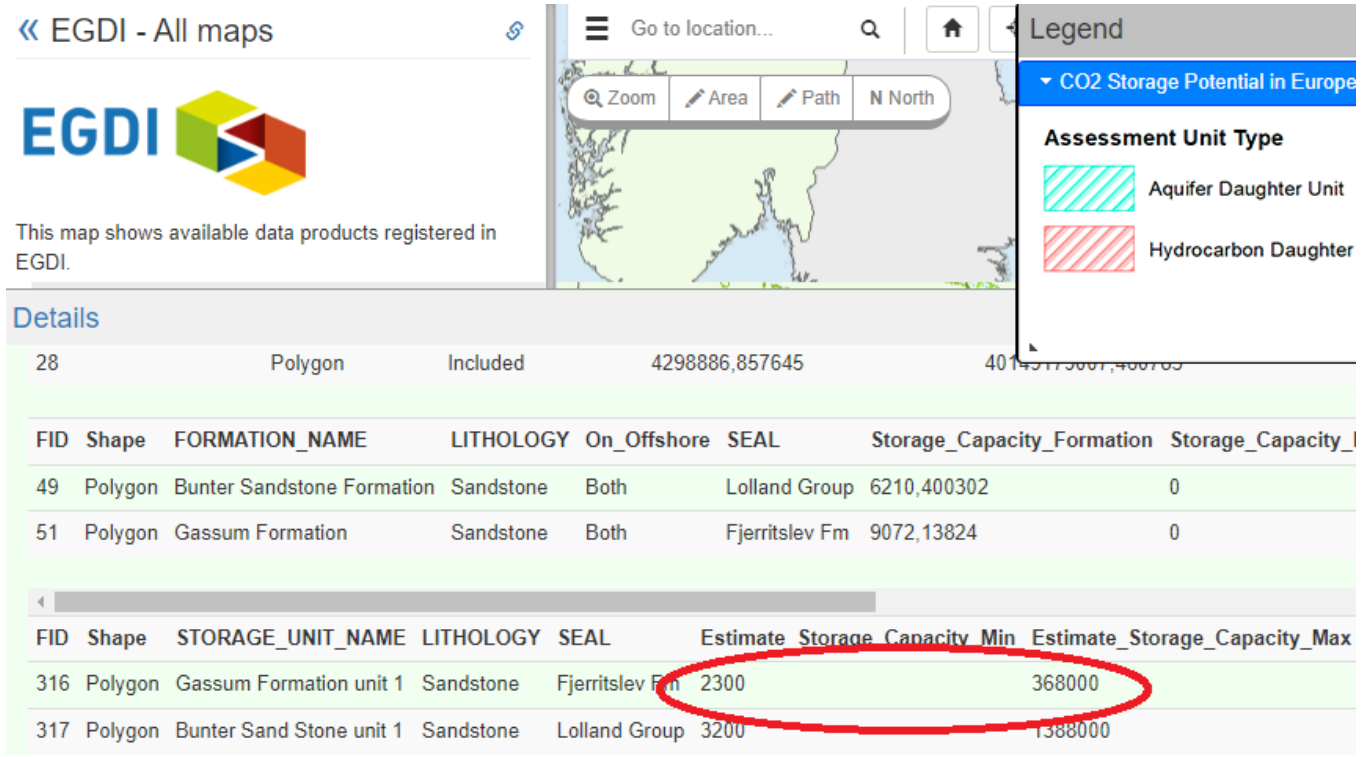
$$M = Ah\phi\rho_{CO_2}E,$$

where M is the storage capacity, A is the area of aquifer within trap, h is the average reservoir thickness, ϕ is the average reservoir porosity, ρ_{CO_2} is the CO_2 density at reservoir conditions, and E is the storage efficiency factor.

Reference

Haeri, F.; Goodman, A.; Myshakin, E. M. *CO_2 Storage prospeCtive Resource Estimation Excel aNalysis (CO_2-SCREEN) User's Manual: Python_V5.0;* DOE.NETL-2024.4801; NETL Technical Report Series; U.S. Department of Energy, National Energy Technology Laboratory: Pittsburgh, PA, 2024; p 40. DOI: 10.2172/2331225.

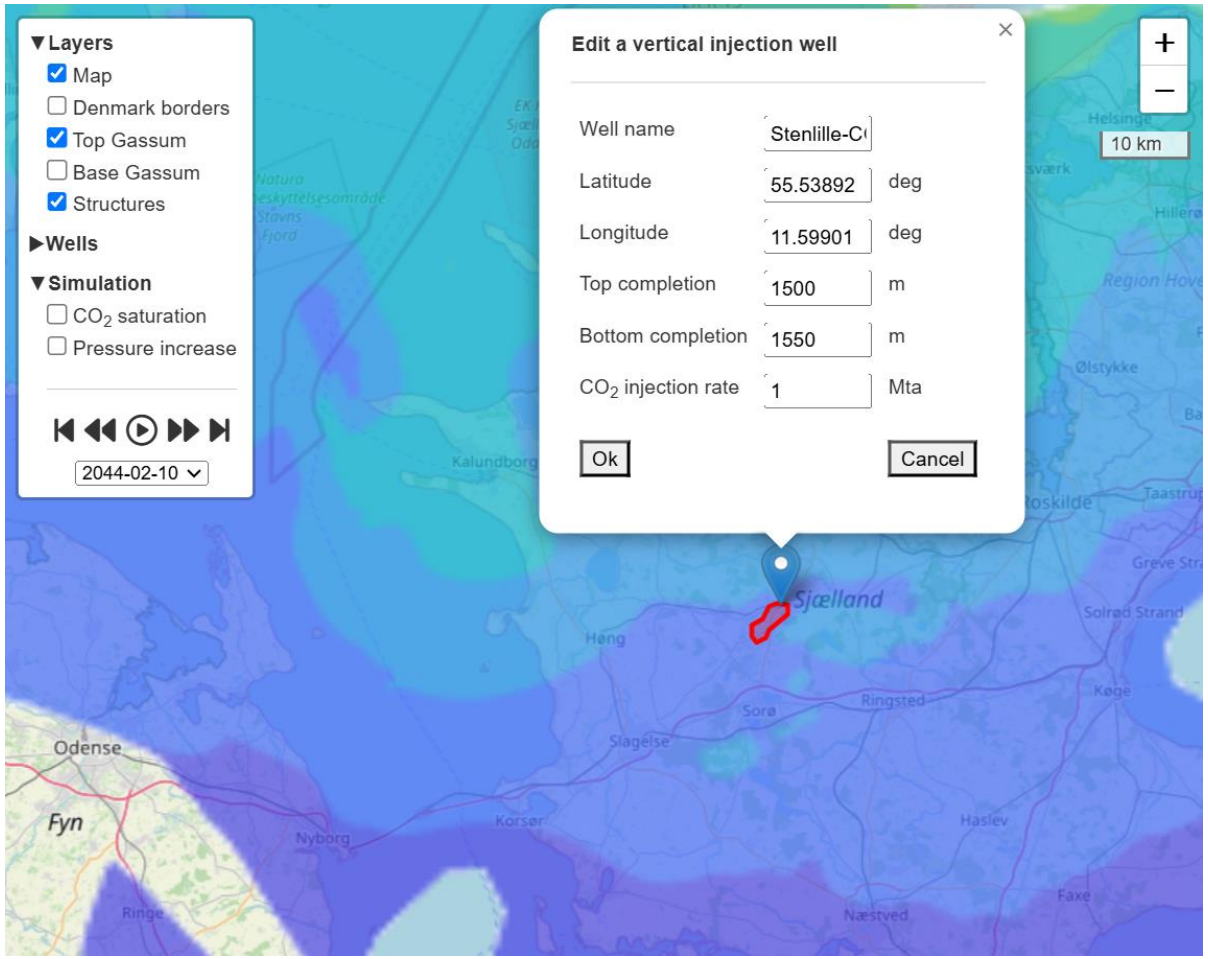
Storage capacity is 595.2 Mt

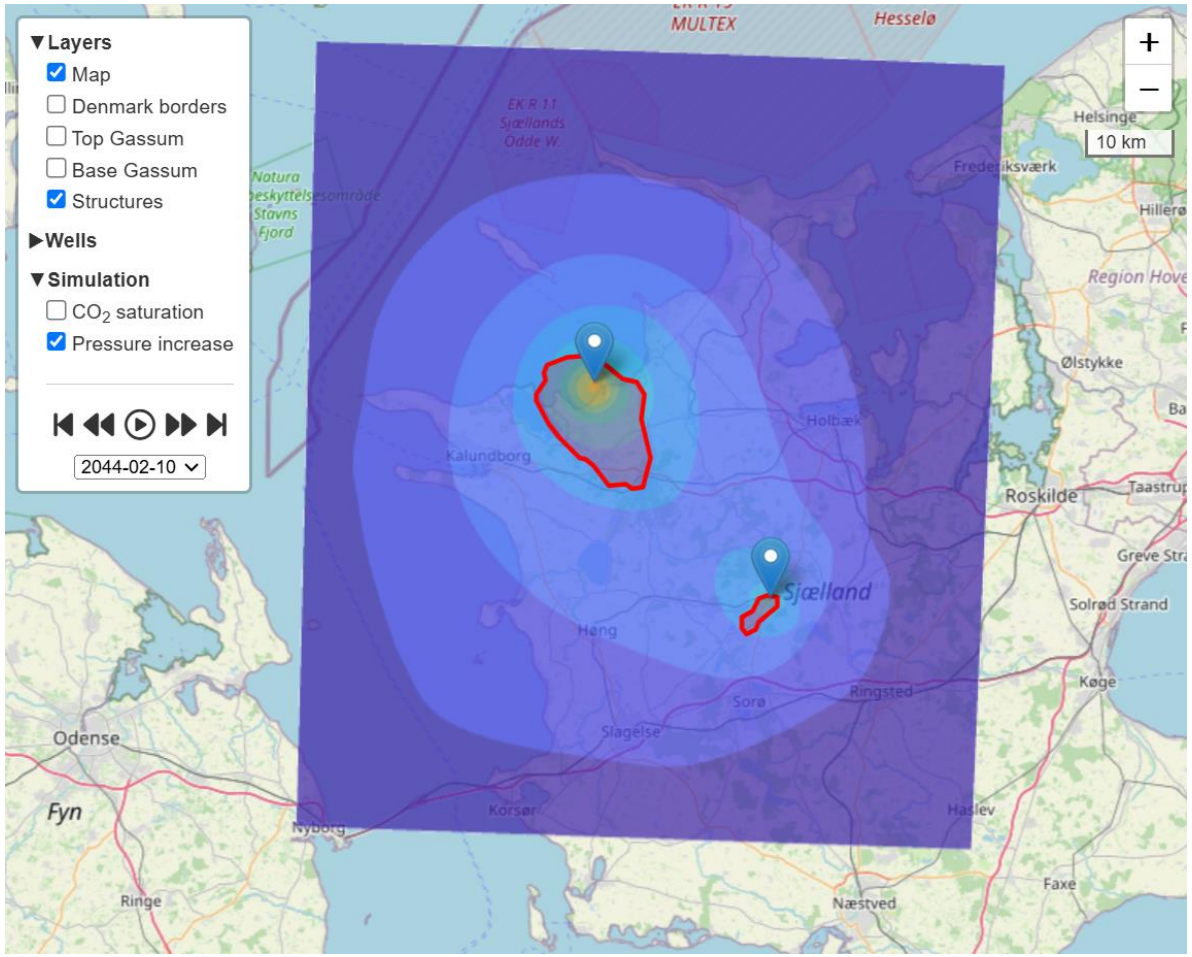


FID	Shape	FORMATION_NAME	LITHOLOGY	On_Offshore	SEAL	Storage_Capacity_Formation	Storage_Capacity_
49	Polygon	Bunter Sandstone Formation	Sandstone	Both	Lolland Group	6210,400302	0
51	Polygon	Gassum Formation	Sandstone	Both	Fjerritslev Fm	9072,13824	0

FID	Shape	STORAGE_UNIT_NAME	LITHOLOGY	SEAL	Estimate_Storage_Capacity_Min	Estimate_Storage_Capacity_Max
316	Polygon	Gassum Formation unit 1	Sandstone	Fjerritslev Fm	2300	368000
317	Polygon	Bunter Sand Stone unit 1	Sandstone	Lolland Group	3200	1388000

Pressure interaction between neighbour license areas





Open-source technology stack

Web server

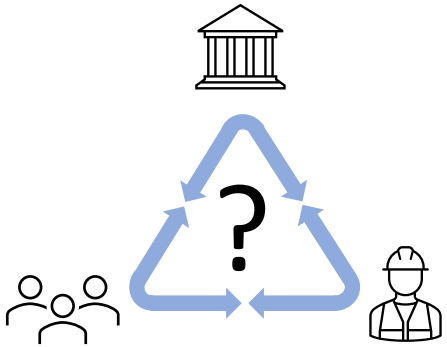
Frontend + backend

Maps

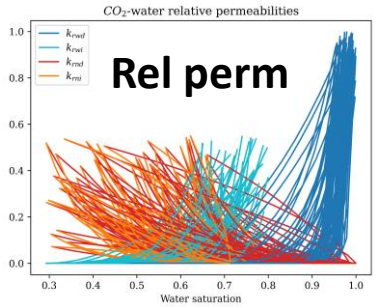
Reservoir simulation

Open questions

- Information sharing between the stakeholders



- How to communicate uncertainty



- Priorities for further project development