

Longyearbyen CO2 Lab project of Arctic Norway

*'CO2 sequestration in unconventional reservoir'
'CCS show case in Arctic Frontier'*

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*and the large
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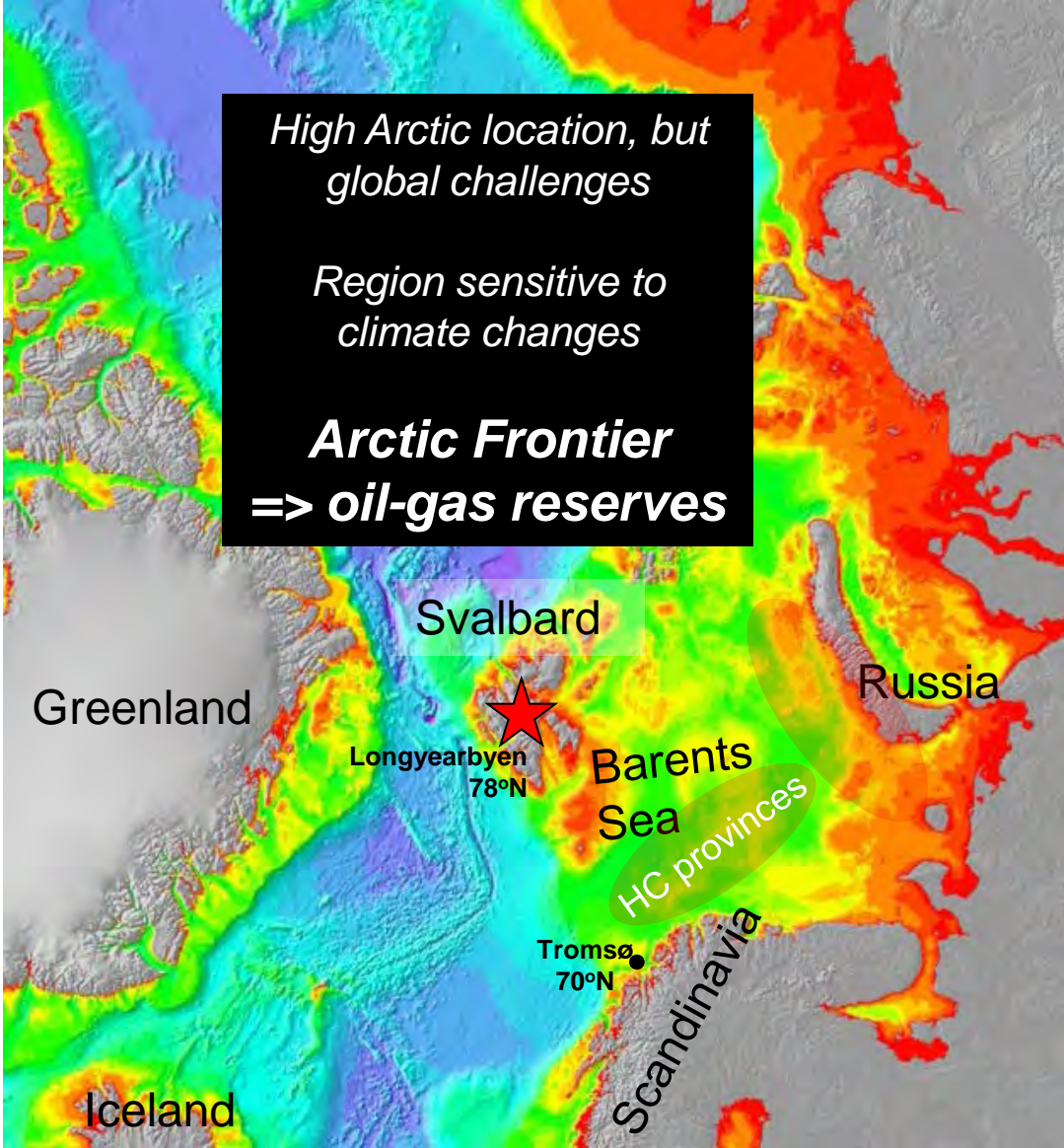
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ON TOP OF THE WORLD (78° North) - LYB CO2 Lab

.... exploring CCS in the High Arctic Frontier

Svalbard - an uplifted part of the Barents Shelf



SCIENTIFIC APPROACH ...

- Exploring a tight saline formation for CO₂ sequestration
- Targeting knowledge gaps of unconventional reservoirs
- Identifying challenges to CCS in the cold, High Arctic



Fulfil the requirements of saline formation and top-seal
=> Tight sandstone reservoir, Cap rocks, Permafrost cap

Site verification roadmap since 2007

Drilling in
October

- 1) **Succeed with technical operations in the High Arctic**, obeying a strict environmental regime
- 2) **Baseline database on tight reservoir and cap-rocks**
 - Seismic imaging, Drill cores with analysis, Outcrop analysis (rocks and fractures)
- 3) **De-risking site – fracture flow systems and cap rock integrity**
 - Well-tests (LOT and injectivity) and Micro-seismicity
- 4) **Evaluate Injectivity and Storability**
 - Dh4 in 2009-10, Dh5R and Dh7A in 2012
 - **CO2 capacity estimate: Probabilistic assessment volumetric** (modified industry workflow)
- 5) **Conclusions of pilot project**

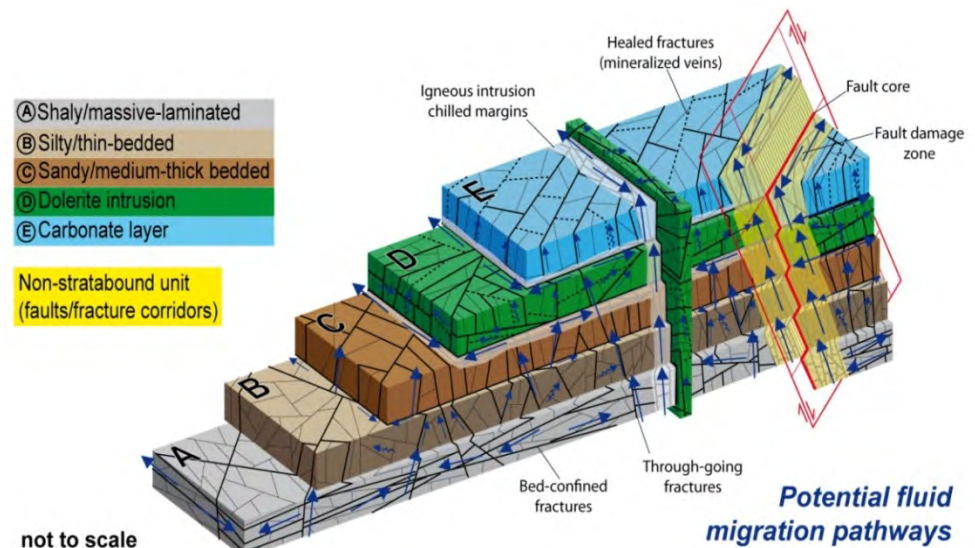
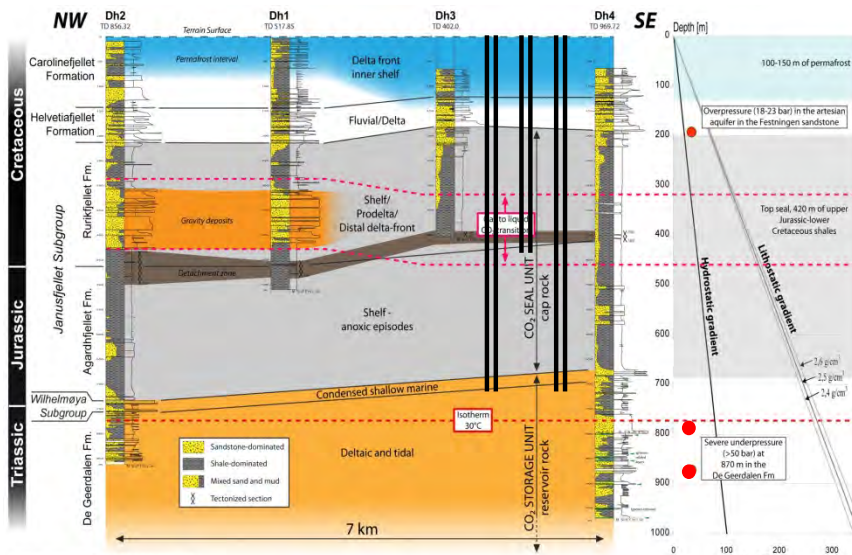
Drilling and test site Adventdalen



- 7 cored slim holes wells (Description and interpretation of 4,5 km cored section-one well TD 970m i.e. 960MSL)
- 3 units tested and analysed with high pressured water injection (Including two units with cross well flows)
- 3 LOT tests for sealing properties
- 2D Seismic and micro seismic acquisition and monitoring
- Petrophysics, petrology, diagenesis
- Subsurface/outcrop link studies (tectonics, sedimentology, mapping of fractures)
- Reservoir modeling focused on dual porosity/permeability ; matrix and fractures

Targeting knowledge gaps (tight reservoir)

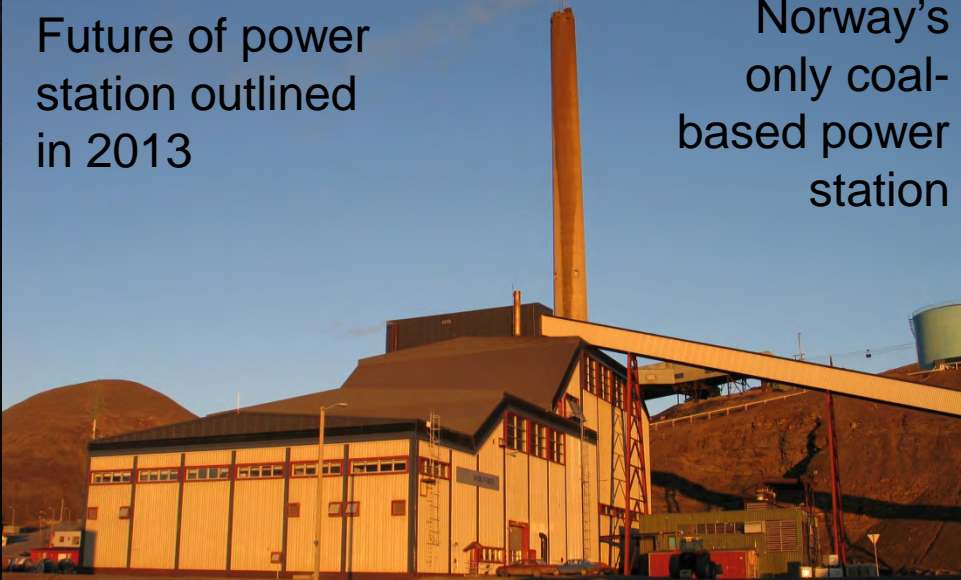
- ✓ **Reservoir response to injection**
 - => relevance for CO2 EOR and HC production alike
 - => «new type» micro earthquakes (slow-slip) during injection
- ✓ **Flow path and plume shape predictions**
 - => benchmarking reservoir modelling
 - => assessing reliability of simulations
- ✓ **Breaking new ground: CO2 flow in unconventional reservoir**
- ✓ **Addressing plume-front degassing (low-pressure reservoir)**



Svalbard relies on black, dirty coal

Future of power station outlined in 2013

Norway's only coal-based power station



Let's follow the CO₂ from the source to the solution

... is that a threat or an opportunity?



Designing a CCS show case ...

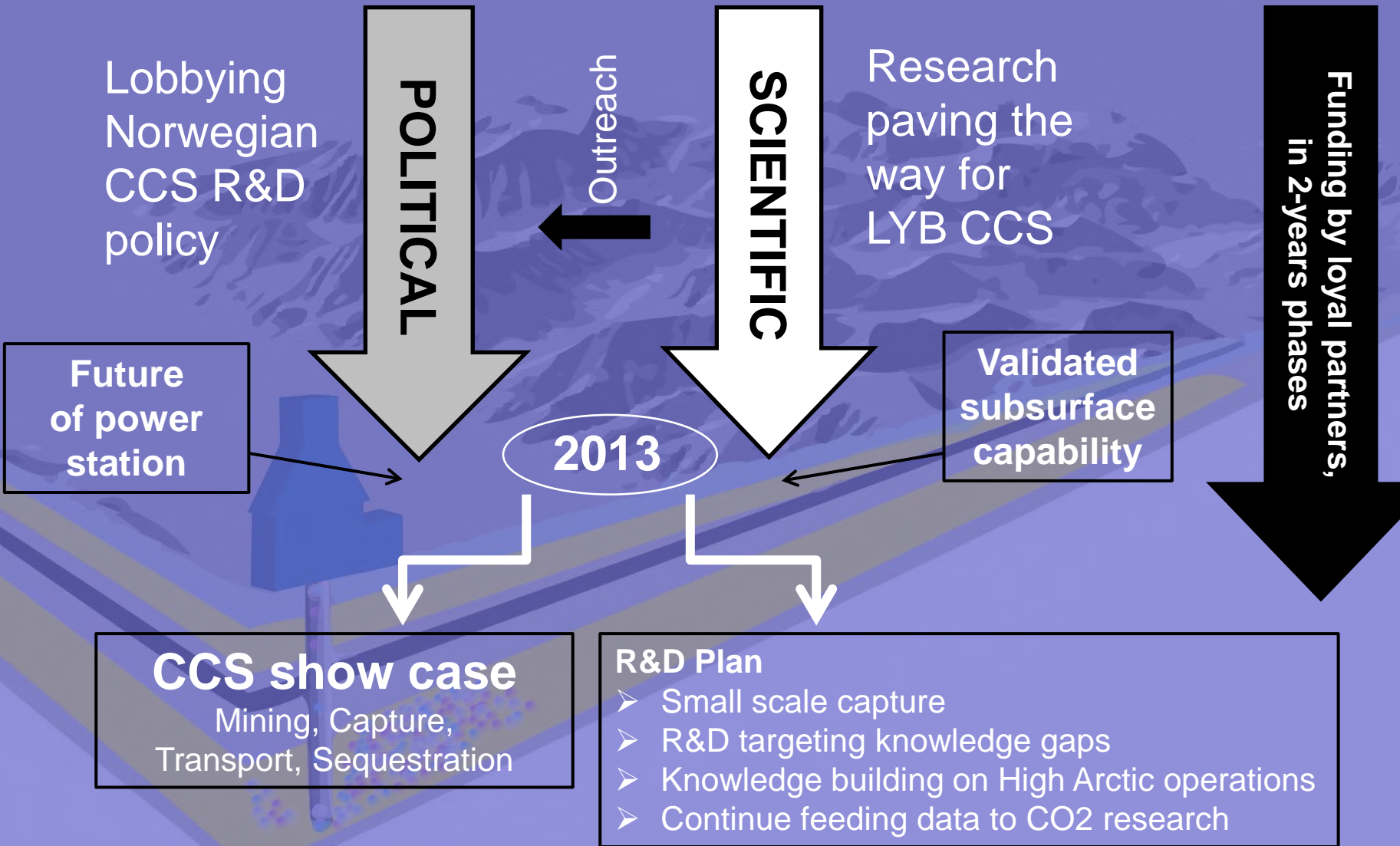


- Local power plant is “pilot size”
- Svalbard is a closed energy system running on locally extracted coal
- Reservoir quality in sedimentary rocks
- Distance between power plant and storage site is 7 km
- Locally available competence in areas vital to the project

Local attention and acceptance, no NIMBUS

Timeline ... LYB CO2 past 2013

2006: Vision of a CO2 neutral society



Thank you for
your attention!

