Norway CCS Update:

Sleipner, Snøhvit and the Northern Lights project

GoMCarb meeting Feb 11, 2019 Beaumont

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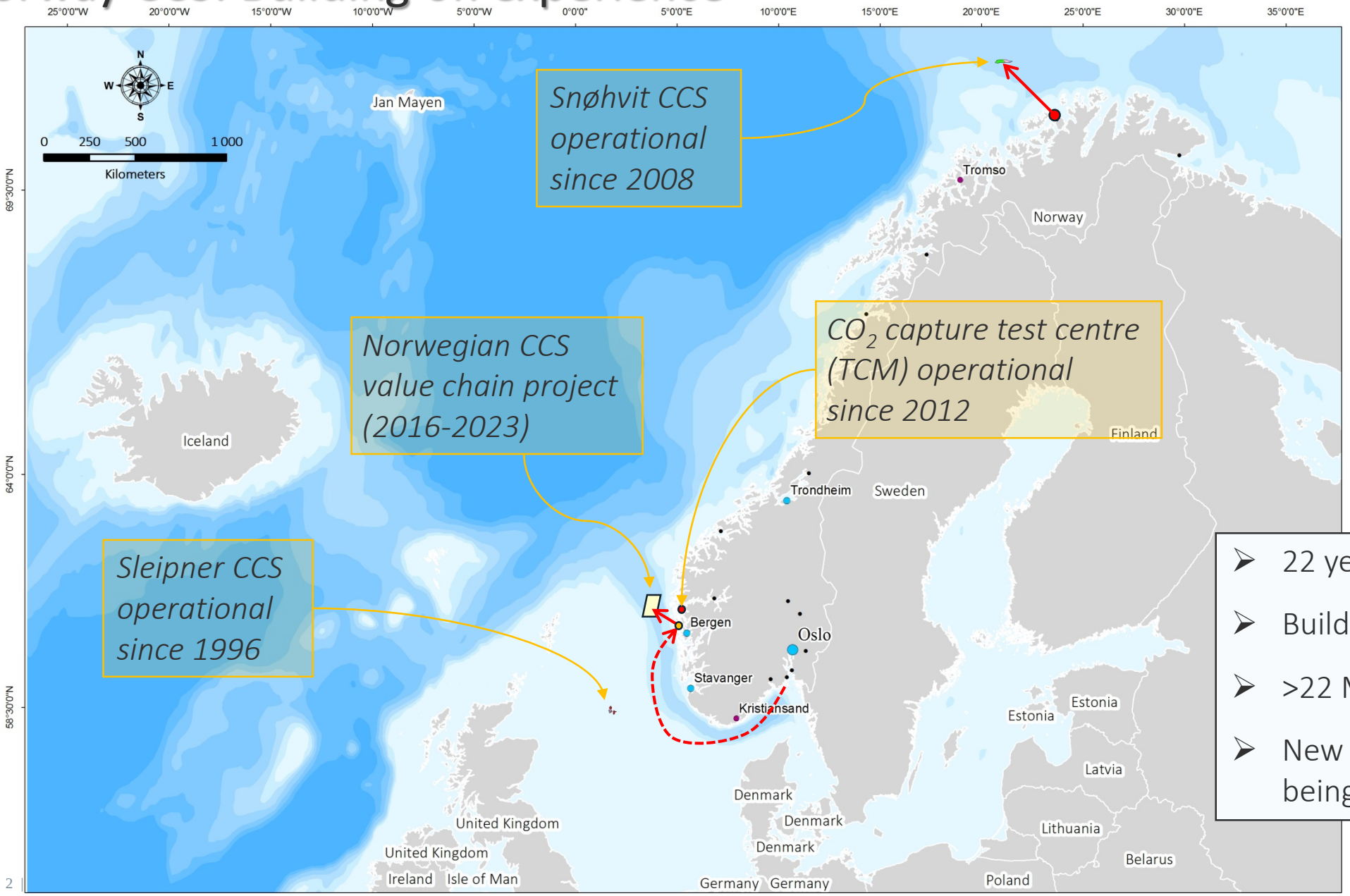
Norway CCS: Building on experience



- 22 years of operations
- Building confidence in CCS
- >22 Mt CO_2 stored
- New full-scale CCS project being developed

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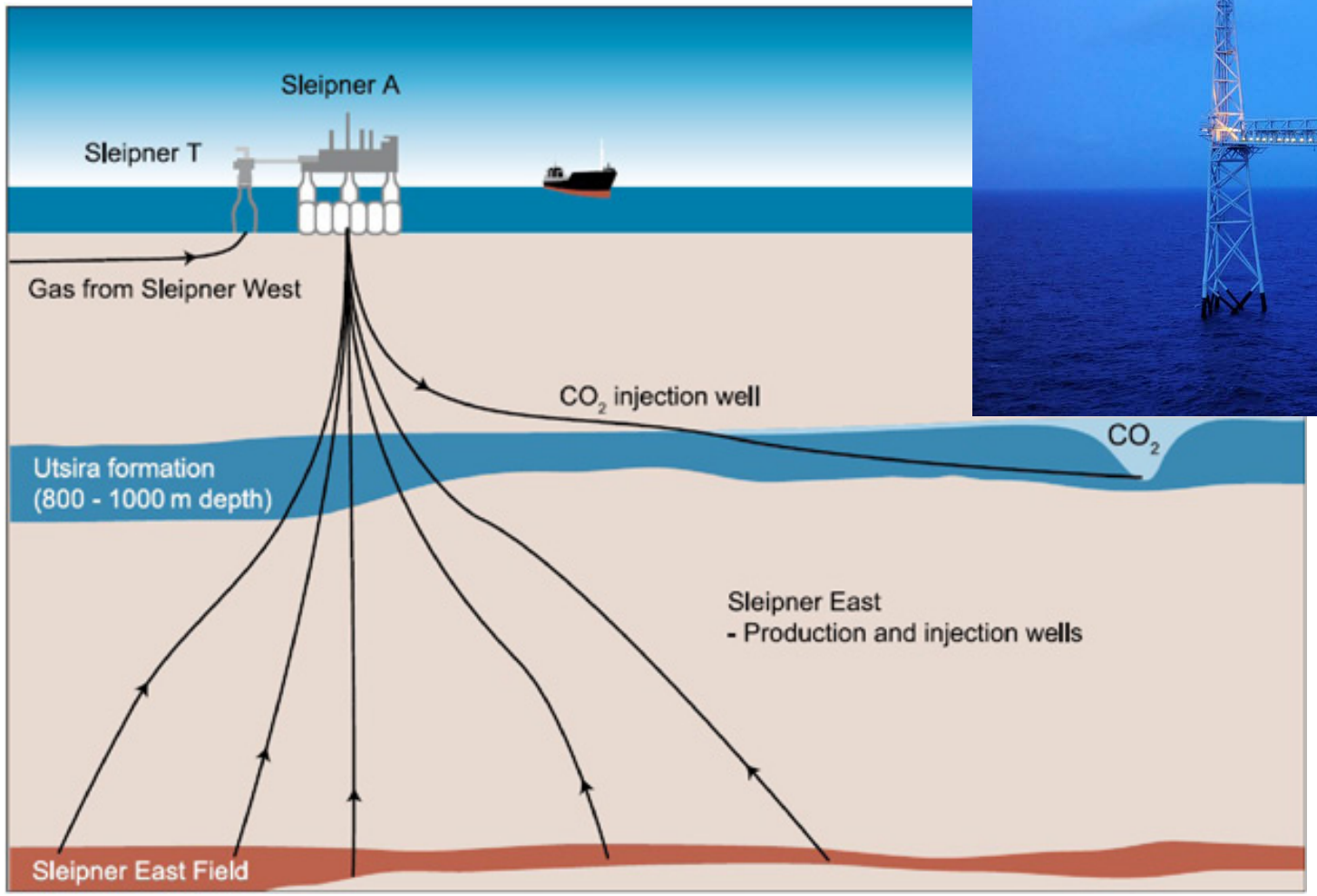
Sleipner Project Summary



- CCS part of gas field development
- Amine capture from natural gas
- 0.9 Million tonnes stored per year
- Injection started in Sept. 1996
- 22 years assurance monitoring
- Sleipner platform processing CO_2 from Gudrun field from 2017

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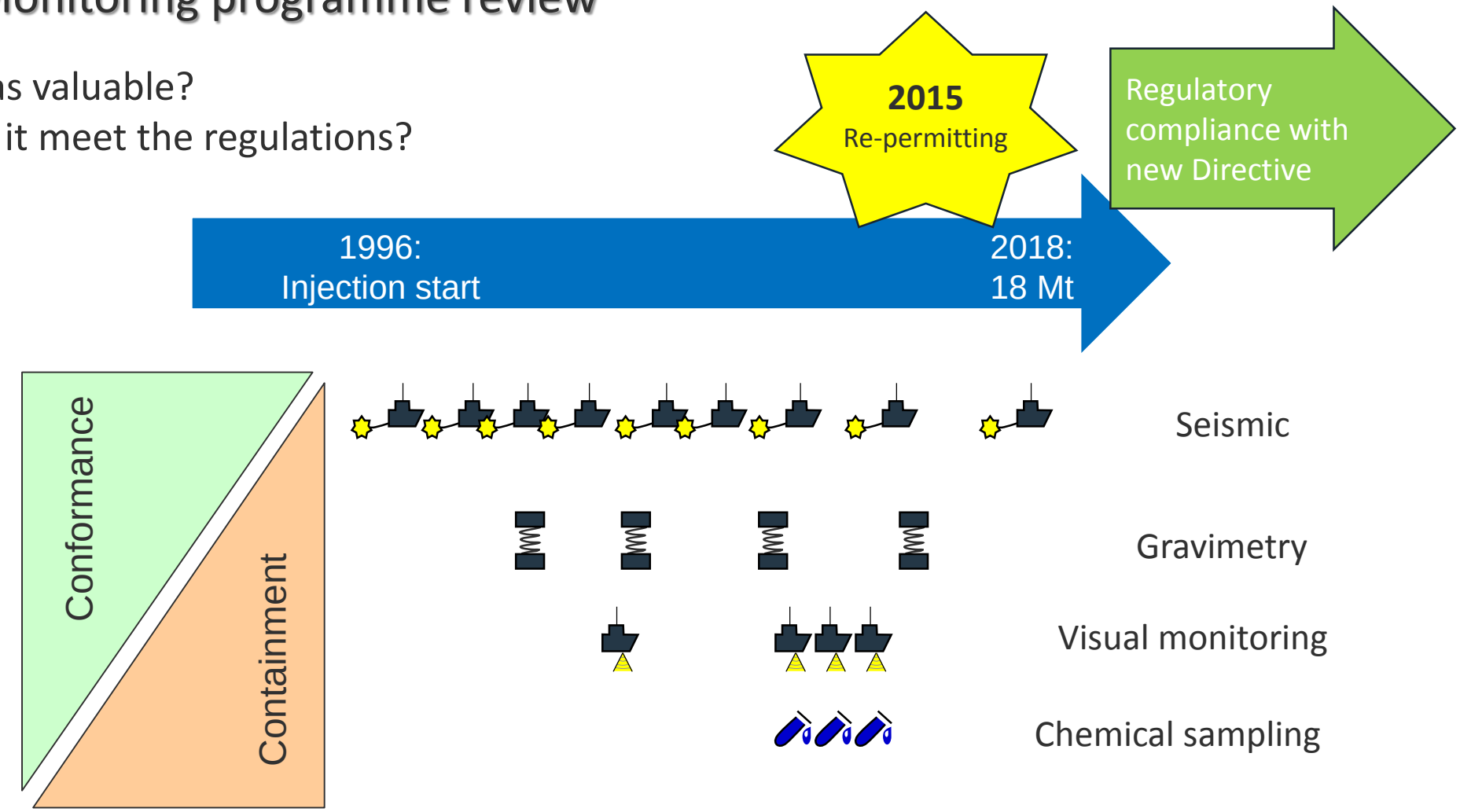
Sleipner Monitoring programme review

- What was valuable?
- How did it meet the regulations?



Furre et al. 2017

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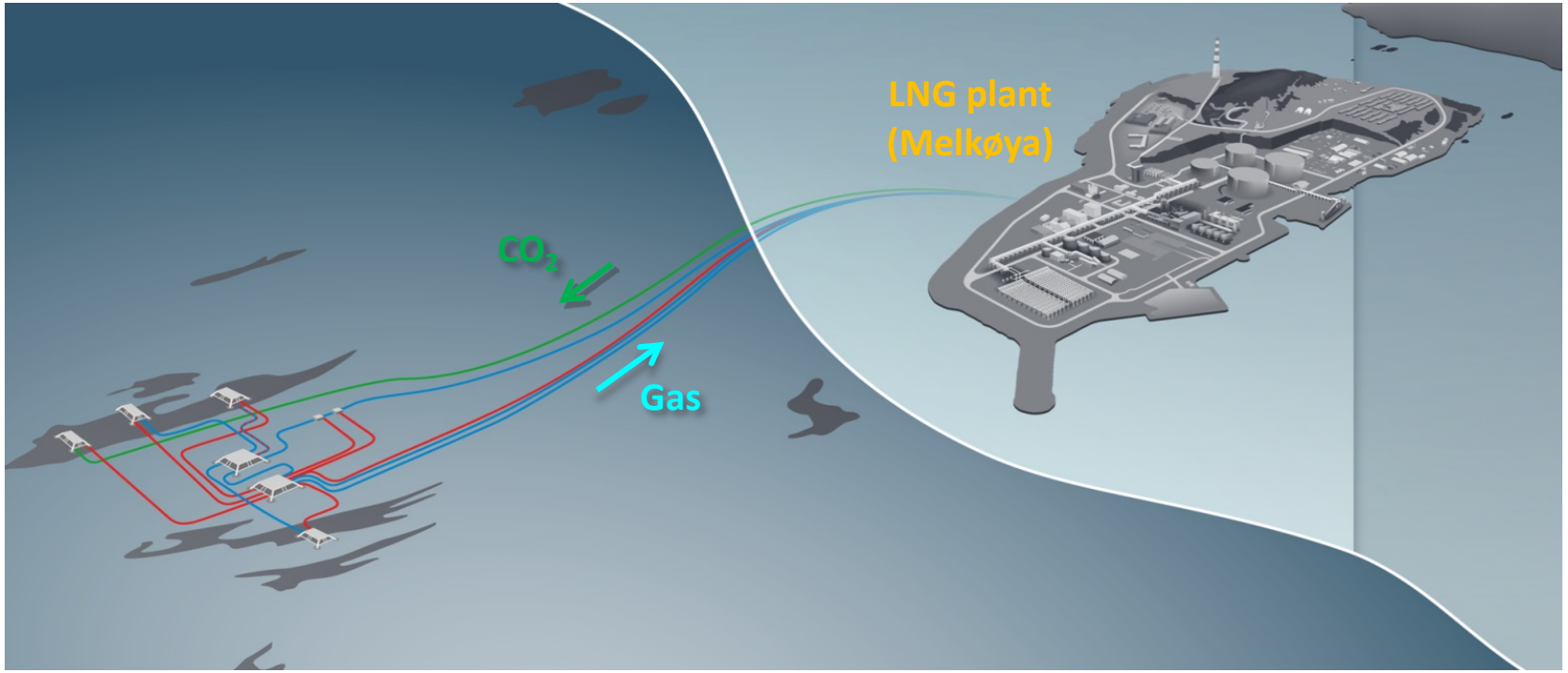
Snøhvit Project Summary

➢ First onshore capture - offshore storage project (combined with LNG)

- 150km seabed CO_2 transport pipeline
- Saline aquifers c. 2.4km deep adjacent to gas field
- CO_2 stored initially in the Tubåen Fm. (2008-2011) and then in the Stø Fm. (2011-)
- Now injecting in second injector with first injector used as back-up
- > 5Mt injected so far



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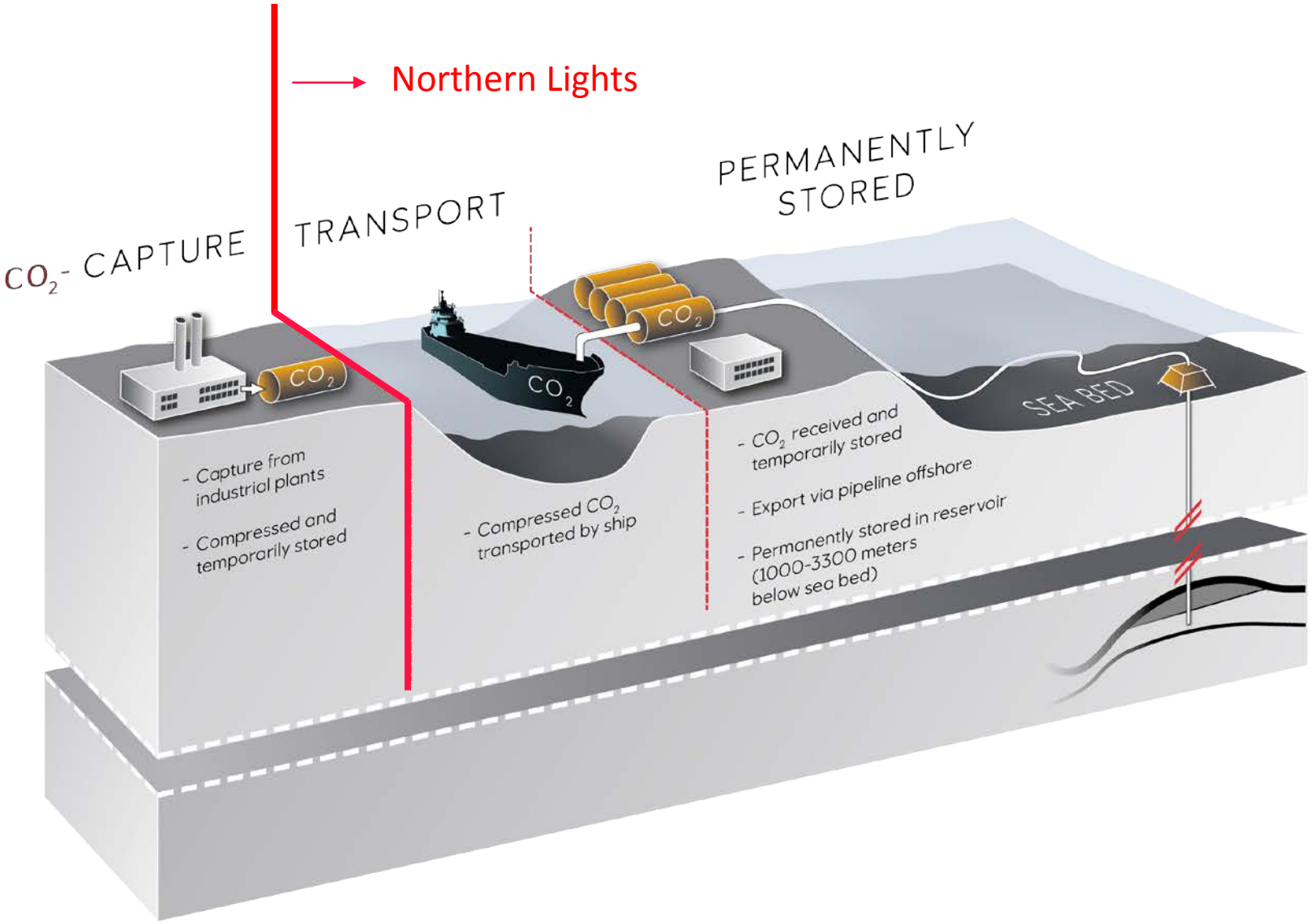
Northern Lights: Part of the full CCS value chain



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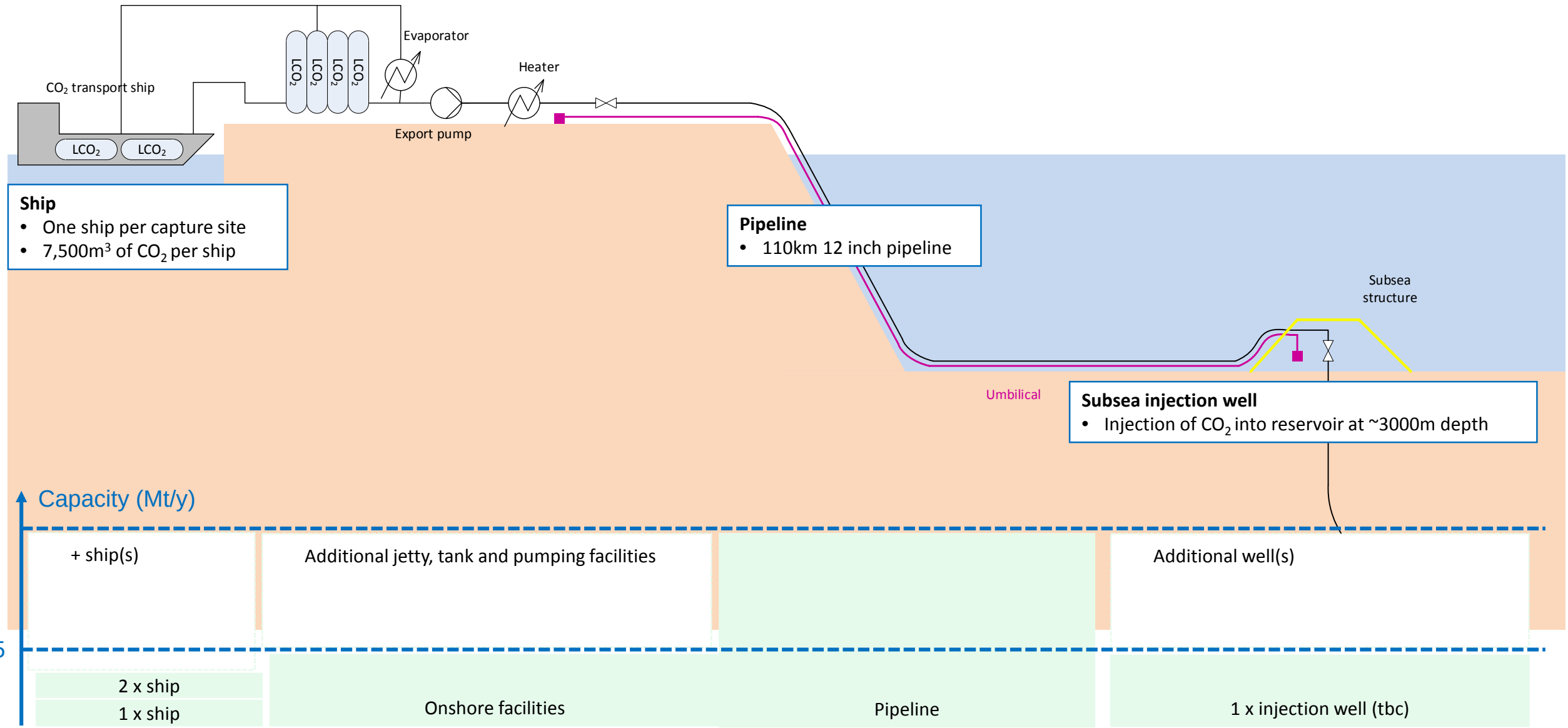
Northern Lights: design concept overview



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Design for onshore terminal in Kollsnes, Øygarden

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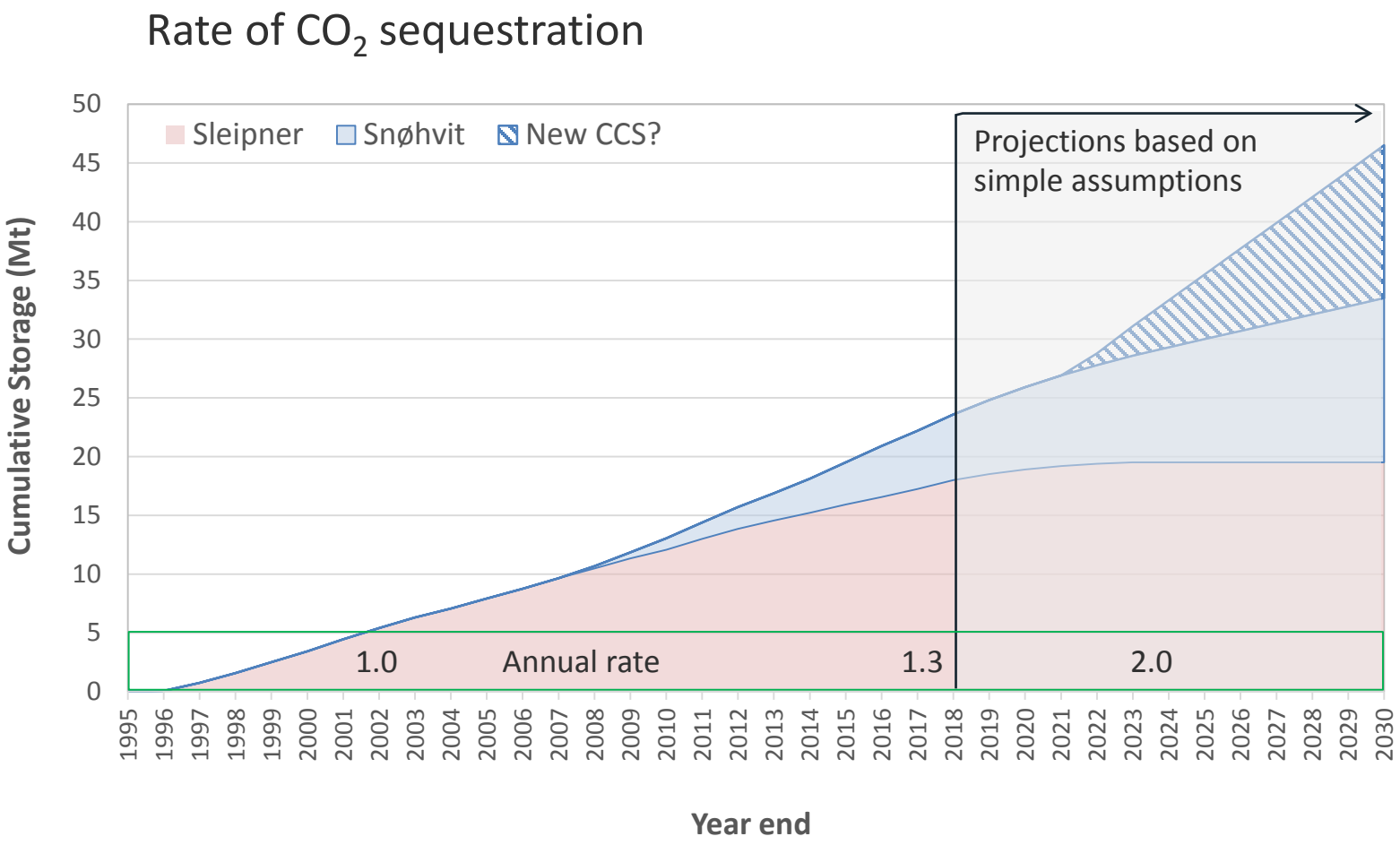
Norway CO_2 storage in numbers



How much is 1Mt of CO2?

- Annual emissions from 330,000 cars (assuming 200g/km)
- 5 million passenger air kilometres
- 100 million tonnes/km of maritime shipping
- One tenth of Norwegian road traffic emissions in 2014

Annual rate of gas injection in all Equinor-operated oilfields (NCS)

- ~35 Gsm^3/year (methane)
- Which is equivalent to 64.8Mt CO_2

Ringrose, 2018

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Norwegian CO_2 Storage: Future potential

- Reduces risk and threshold for others
- Enables additional CO_2 storage

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- Allows stepwise development of CCS from more regional hubs

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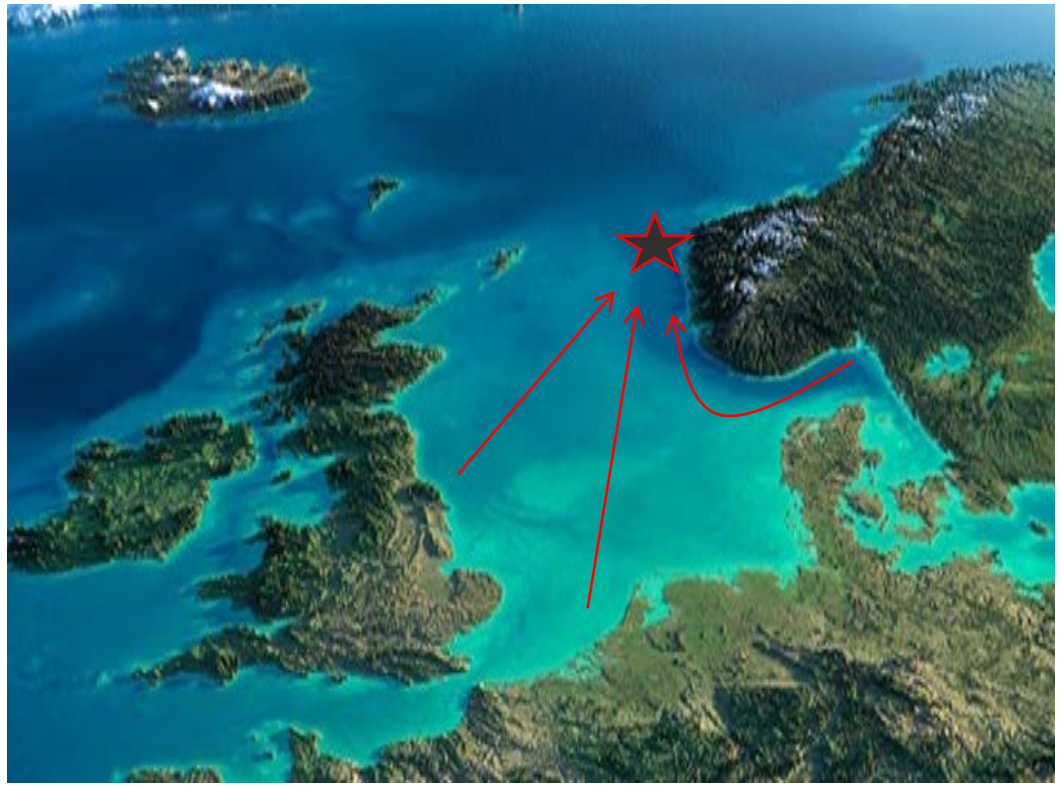
- Basis for emerging CO_2 value chains:
  - Natural gas to hydrogen
  - CO2 EOR



- Norway CCS hub:
  Possible catalyst for roll-out of CCS in Europe?

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Supporting Refs:

- Furre, A. K., Eiken, O., Alnes, H., Vevatne, J. N., & Kiær, A. F. (2017). 20 Years of Monitoring CO2-injection at Sleipner. *Energy Procedia*, *114*, 3916-3926.
- Ringrose, P. S. (2018). The CCS hub in Norway: some insights from 22 years of saline aquifer storage. *Energy Procedia*, *146*, 166-172.

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Presented by Philip Ringrose, Equinor R&T - Future Value Chains

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