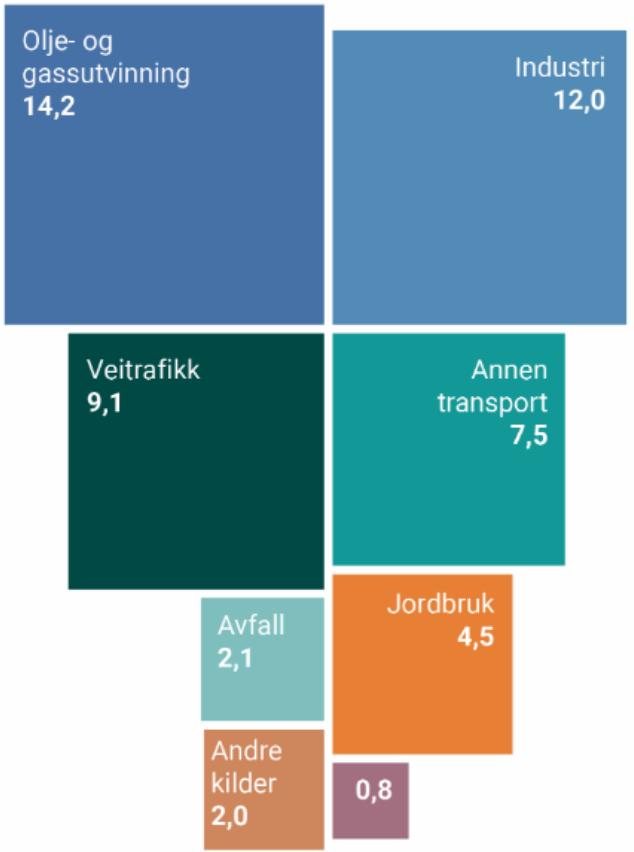
An holistic approach to electrification of the North Sea

Presentation for Bergen Energy Lab, 21th January 2020

Foto: Equinor ASA

Norges totale klimagassutslipp i 2018

Millioner tonn CO_2-ekvivalenter



Oppvarming av bygg

Miljødirektoratet og Statistisk sentralbyrå 2019/Miljostatus.no

Electrification 101?

- **The most important drivers for electrification for oil & gas companies**
  - Better energy efficiency and reduced greenhouse gas emissions
  - Lower operation and maintenance costs, more uptime and more gas for sale
  - Greater safety and a better work environment

- **Global impact**
  - Gas-fired power plants on land are far more efficient then offshore plants
  - A large-scale gas-fired power plant will permit future large-scale CO2 capture and storage
  - An increased percentage of gas in the energy mix may supplant more polluting sources such as coal

Foto: Equinor ASA

- **BKK og CapeOmega**
  - CapeOmega is the largest private owner of infrastructure assets on NCS
  - BKK is the largest renewable company in Western Norway

- **Area solution for Northern North Sea**
  - A holistic solution, including several oil and gas fields (licenses)
  - Considerable CO2 reductions at an attractive cost
  - Connection to Samnanger – avoiding grid challenges at Kollsnes and Bergen region

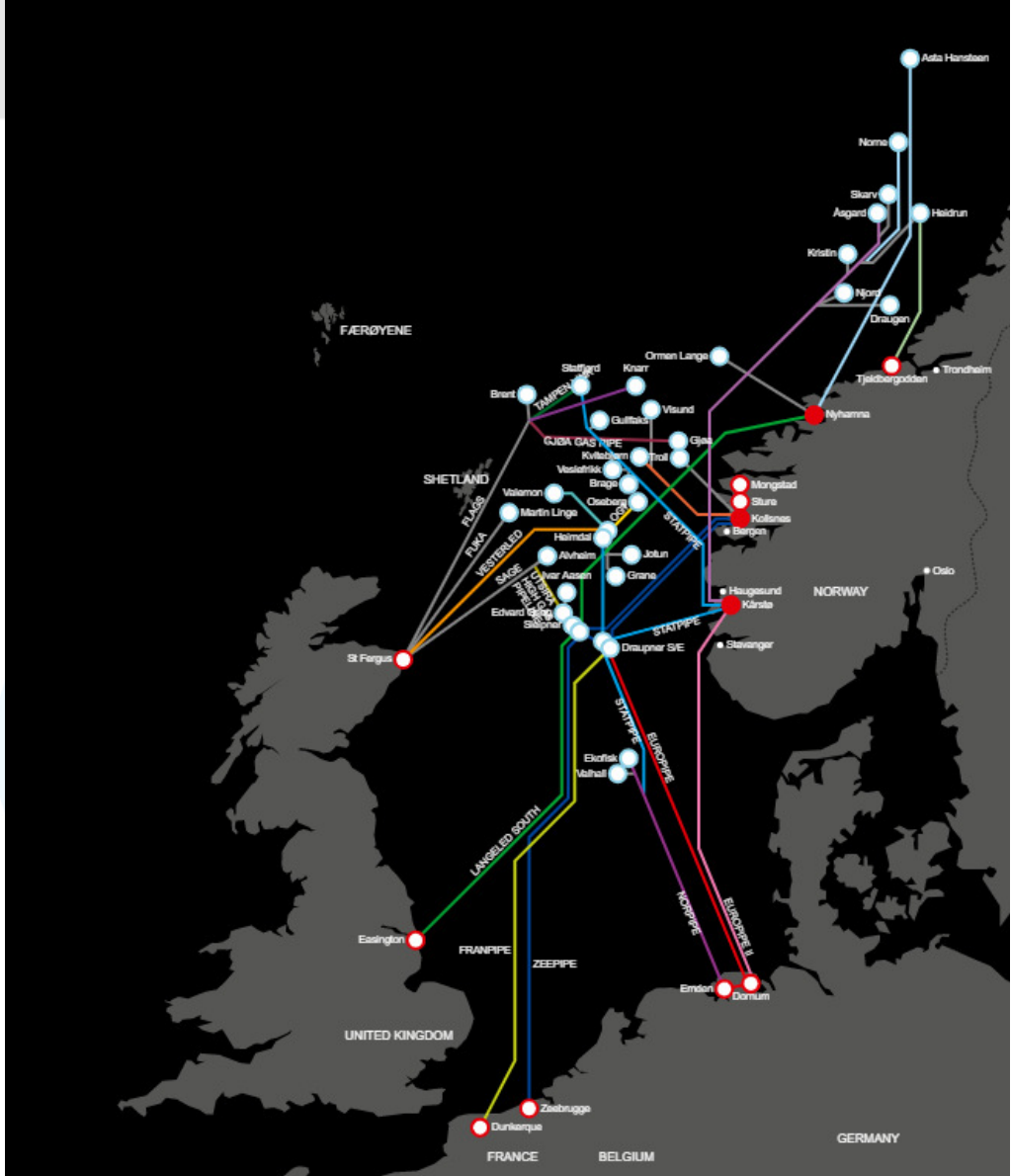
- **Verified technical solution and commercial model**
  - Comprehensive dialogue with operators and suppliers.
  - Siemens have verified the technical solution, costs and timeline
  - Commercial model based on Gassled

Inspiration: GASSLED

From stand-alone gas pipes to the worlds largest offshore gas transport system

Gas transport now considered a natural monopoly - providing equal access and efficient operations.

Conceptual very similar to the electricity grid onshore. The model is based on a reasonable return for the infrastructure owner, limiting excessive profits.



Status electrification NCS

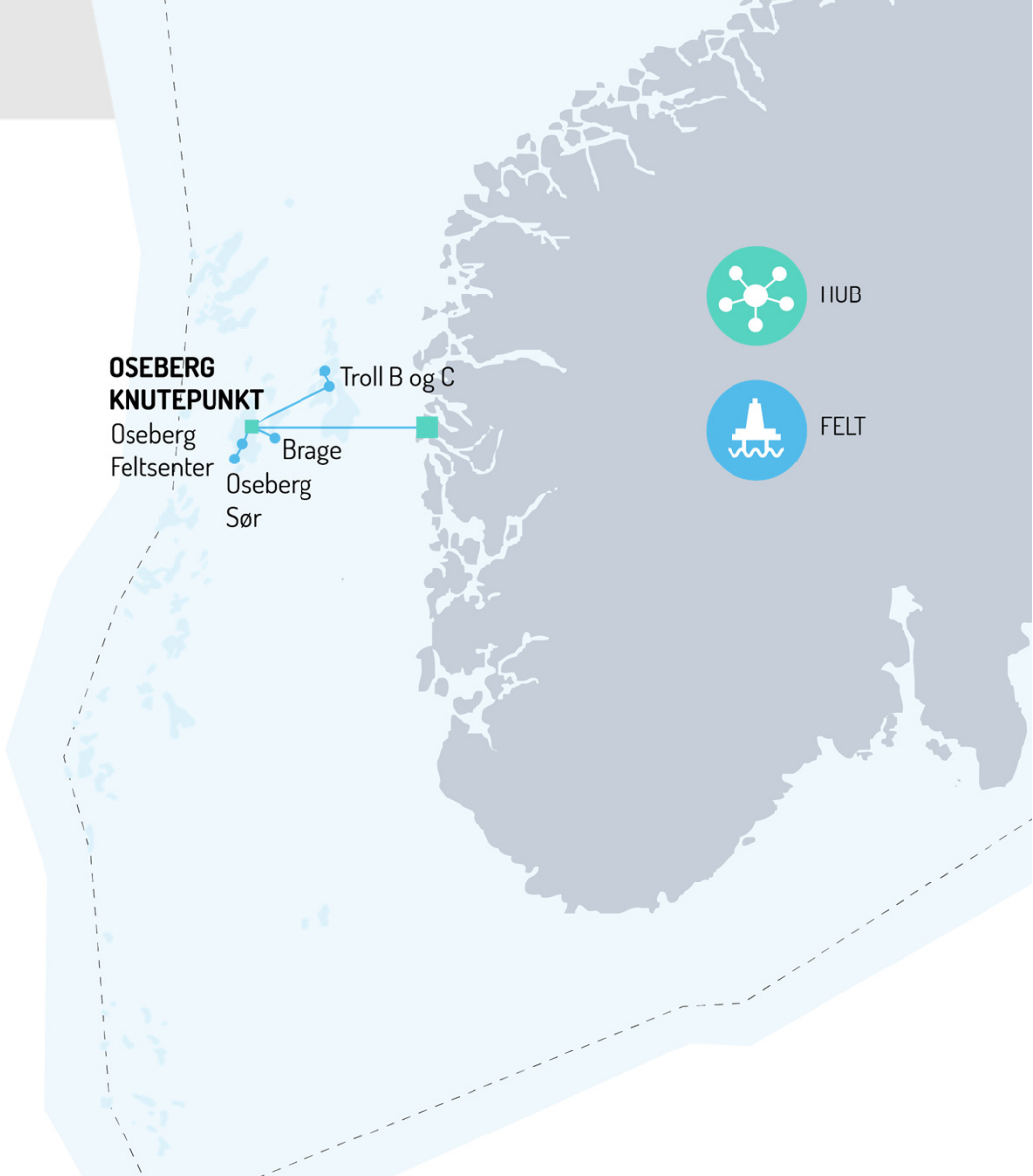
Single cables to installations

SERENE

An holistic approach to electrification of NCS

Phase 1 – **11 BNOK**

- HVDC solution with enough capacity to expand North and South
- Phase 1 has higher costs than single AC-cables, but will be lower the more fields will participate



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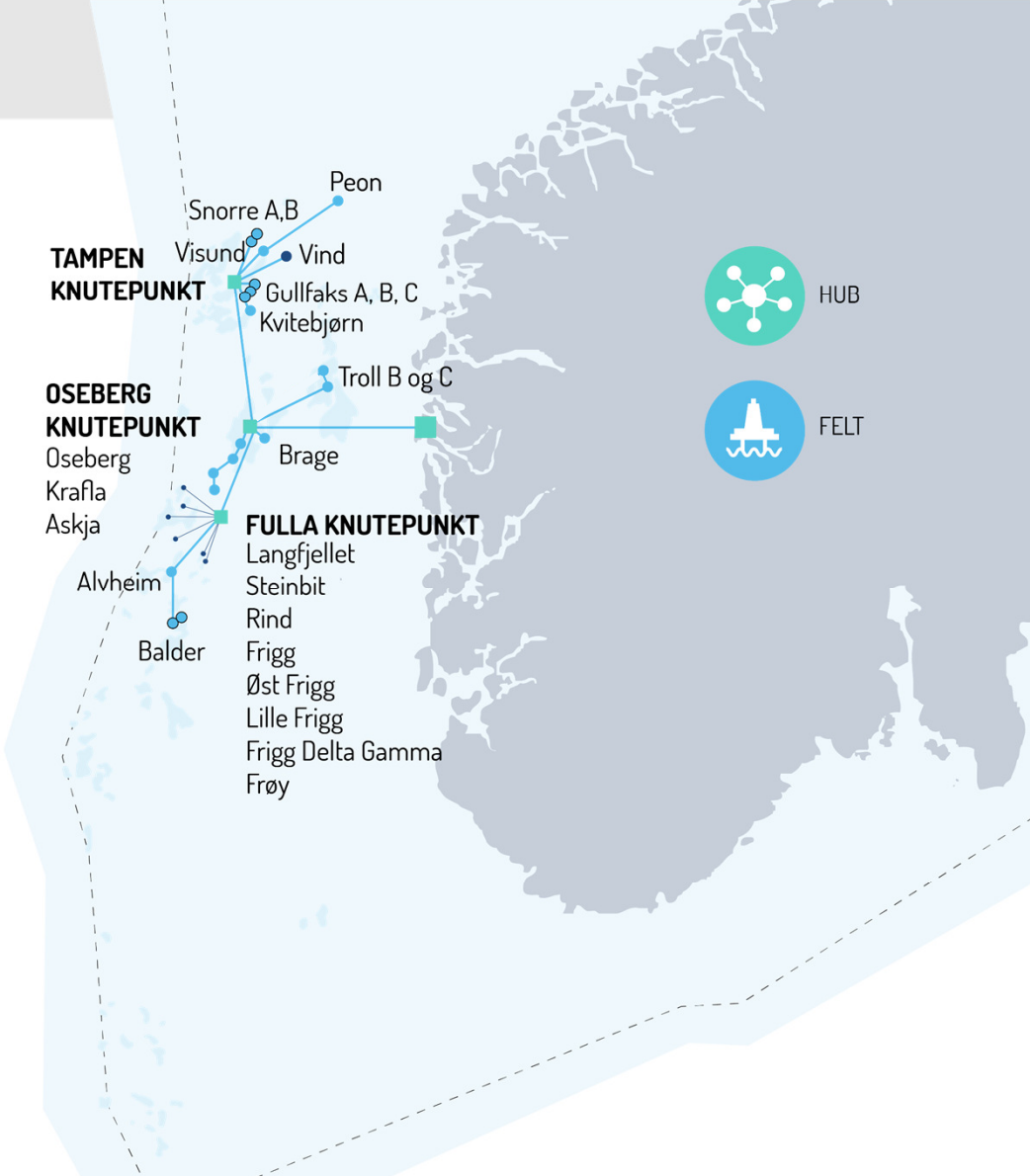
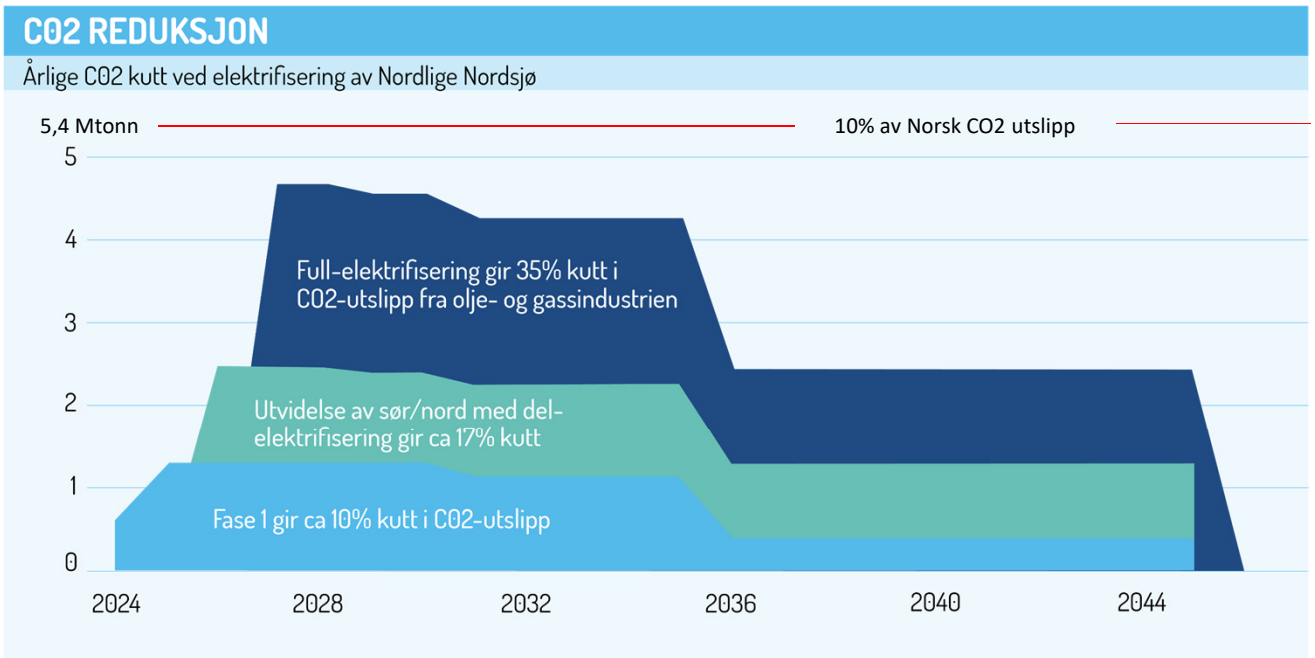
EXPANSION NORTH AND SOUTH

- Fields with limited resources for electrification can participate
- Can be a basis for future business development in the area



Electrification of Northern North Sea
Yearly CO_2 reductions



10 % of CO2 emissions in Norway

Full-electrification will imply a reduction of 35 %* of all oil and gas emissions on NCS.

Expansion North and South will imply reduction of 17%

Phase 1 will imply a reduction of 10%*

** Of all CO2 emissions on NCS*

Abatement Cost

Calculation

- Will be dependent on power prices, increased gas revenue, NOX fee saved and differences in operational efficiencies with/without power
- The project is normally low risk and this implies a low discount rate
- Costs will both be greenfield and brownfield

If the future cost for emitting CO2 is higher than the abatement cost the project is economical profitable

On NCS there is both a CO2 fee and EU ETS prices per ton. Using 0% discount rate the Serene greenfield abatement cost are (NOK/ton):

- 600 Phase 1,
- 500 Expansion North and South,
- 400 Full electrification

Shore Connection Point

- **Customer-Specific installation from Samnanger til Offshore Hub**
  - Samnanger offers available spare capacity with required redundancy
  - Will relieve severe grid situation in Bergen area by shifting offshore consumption from Kollsnes to Samnanger
  - No increase in grid fees for industries and households
  - Fast implementation - meets required lead time for key installations

- **Status license process**
  - Licensing process according to the Energy Act and Offshore Energy Act
  - Notification forwarded to Norwegian Water Resources and Energy Directorate (NVE)
  - Awaiting public hearing of Notification

Foto: ABB