

North Sea Energy

offshore
system
integration

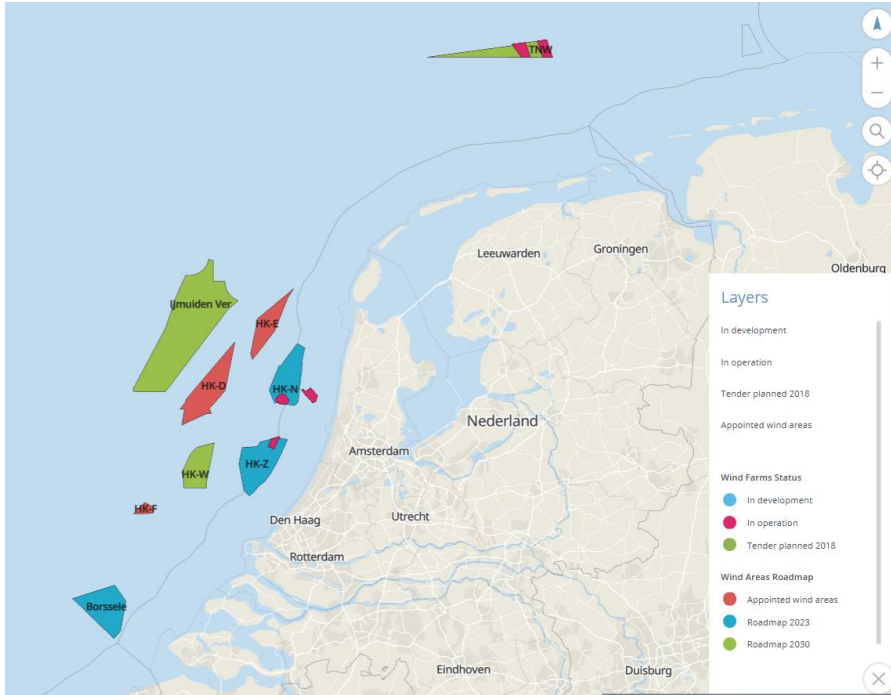


North Sea Energy Perspective

CATO conference 'CCUS developments in the North Sea region', Spijkenisse, 26.06.2019

Joris Koornneef, Madelaine Halter, Ellen van der Veer, Rene Peters & Remco Groenberg (ECN.TNO)

DEVELOPMENT 1: OFFSHORE WIND



Source: North Sea Energy Atlas

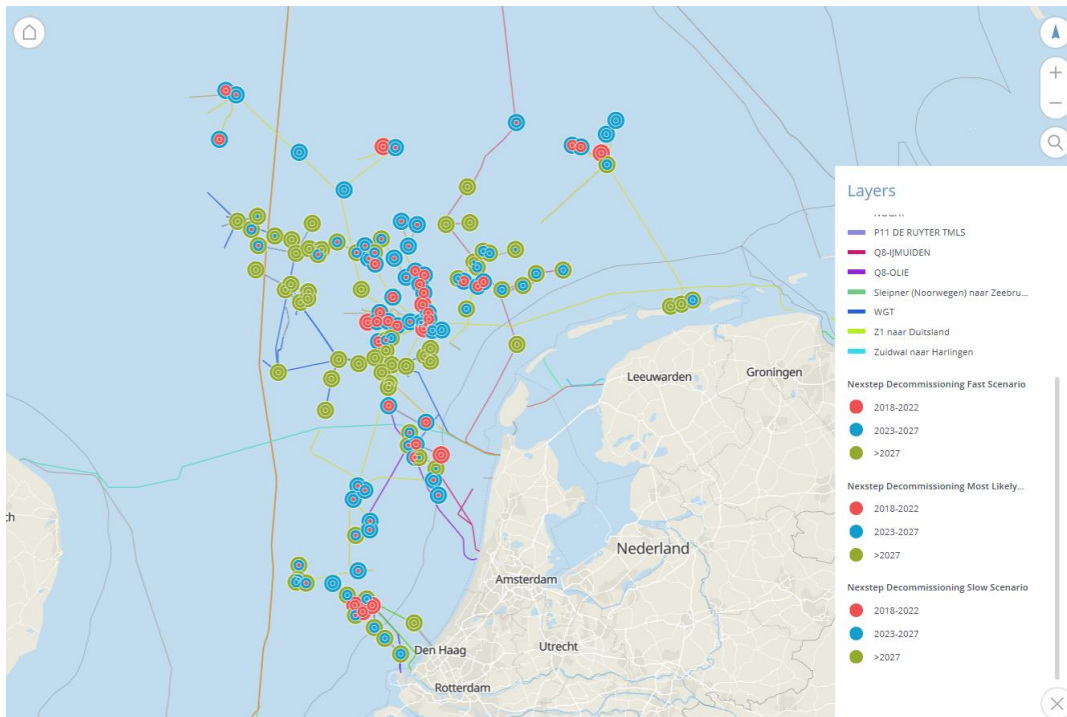


Source: Kamerbrief Wind 2019

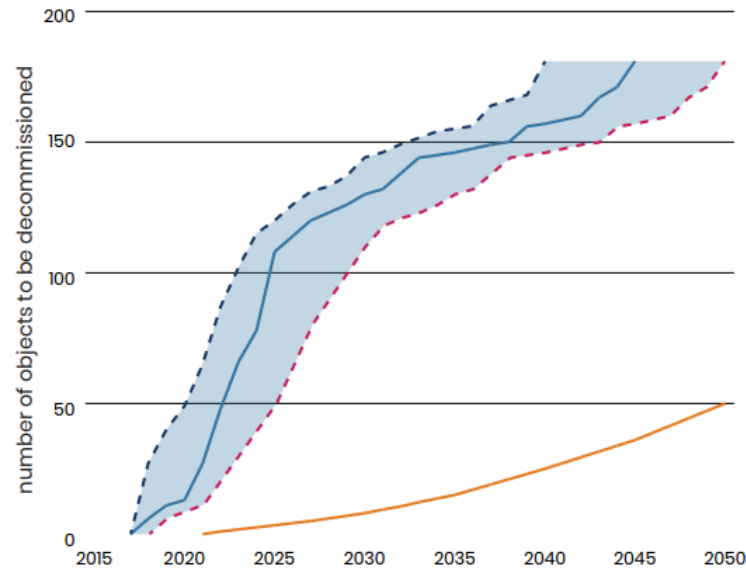
- › Offshore wind build-up known quite well up to 2030 (11,5 GW).
- › Towards 2050 up to 60 GW of wind

- › Until 2030 transport and landing of wind from offshore full electric
- › Challenges afterwards: spatial, onshore implementation

DEVELOPMENT 2: DECOMMISSIONING OF GAS INFRA



Source: North Sea Energy Atlas, NexStep



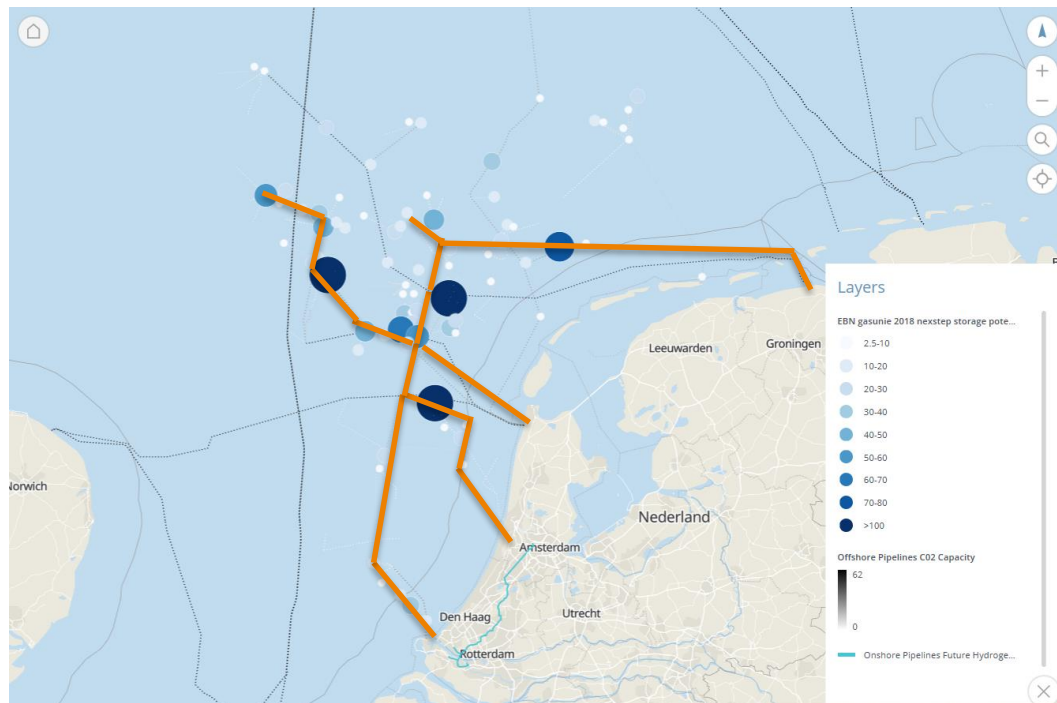
Re-use & decommissioning report 2018, NexStep

DEVELOPMENT 3: CARBON CAPTURE & STORAGE

Climate agreement

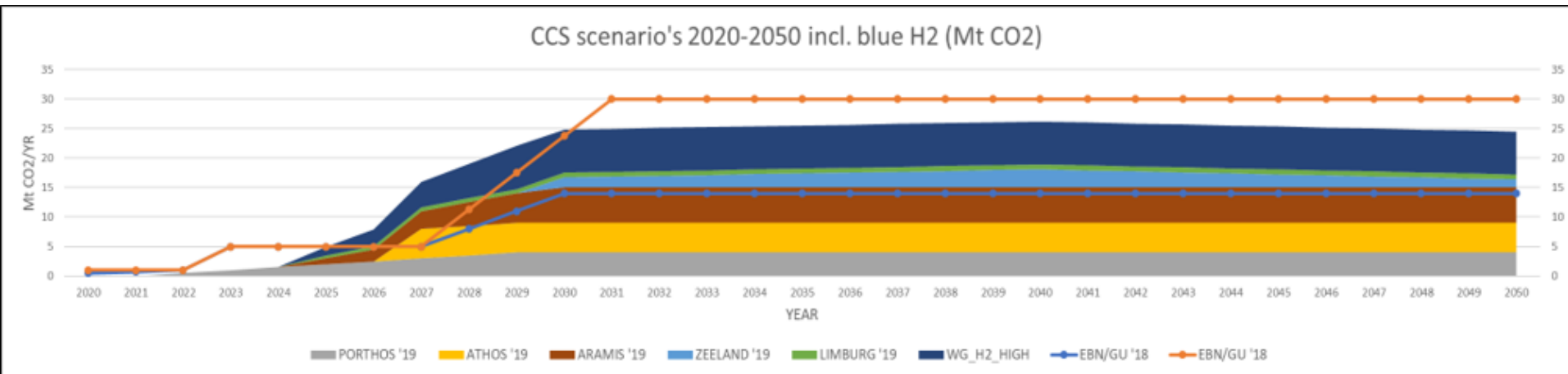
- › 7 MtCO₂/yr in 2030
- › 45 MtCO₂/yr in 2050? (PBL)

- › Capture and collection
- › Network development
- › Storage development
- › Flow assurance
- › Need of offshore power & heat



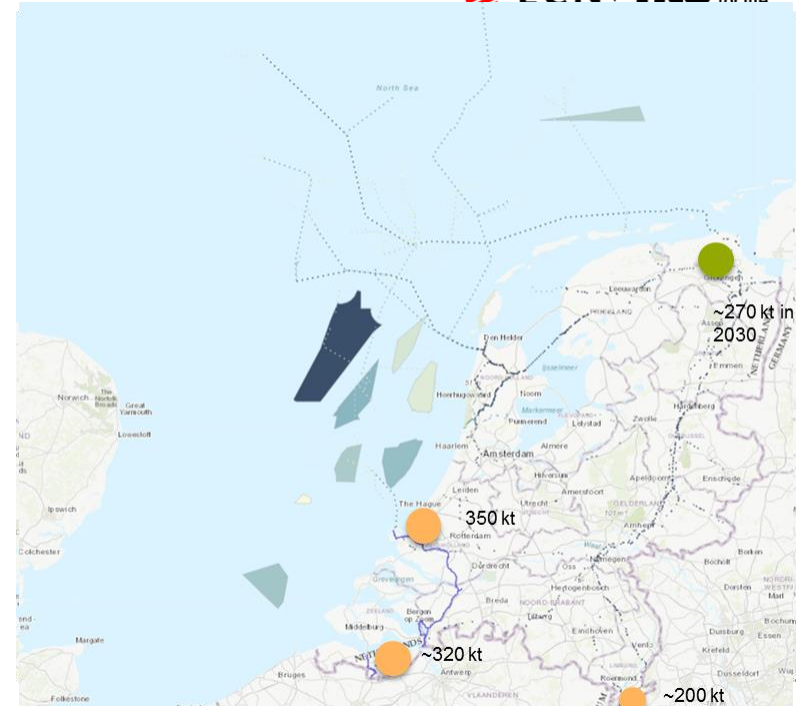
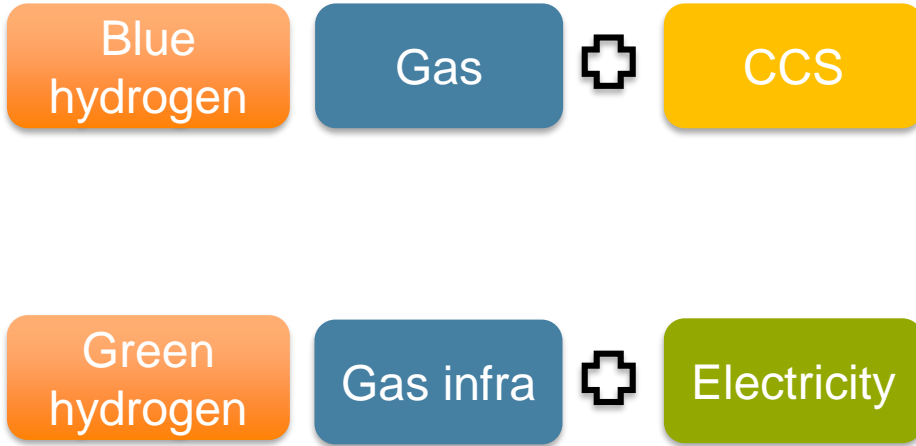
Source: North Sea Energy Atlas
Hypothetical roll-out scenario CO₂ infrastructure

Estimates based on public data on CCS Scenario projects



- NON-H2 CCS : 18Mt in 2050 (PORTHOS, ATHOS and ARAMIS together)
- NON-H2 CCS + BLUE H2 CLIMATE ACCORD: 25Mt in 2030
- No data after 2030, blue H2 demand kept constant

DEVELOPMENT 3: HYDROGEN



Current use:	≈ 1 Mt/y
IJmuiden Ver all H2	≈ 1 Mt/y
Max potential	≈ 14 Mt/y

Source: North Sea Energy Atlas

Research program aimed at research & development of opportunities for system integration by integrating offshore wind and gas



Strategic Spatial Planning

Scenario development for spatial synergies now and in the future



Society & Governance

Human Capital, Public Engagement and Regulations



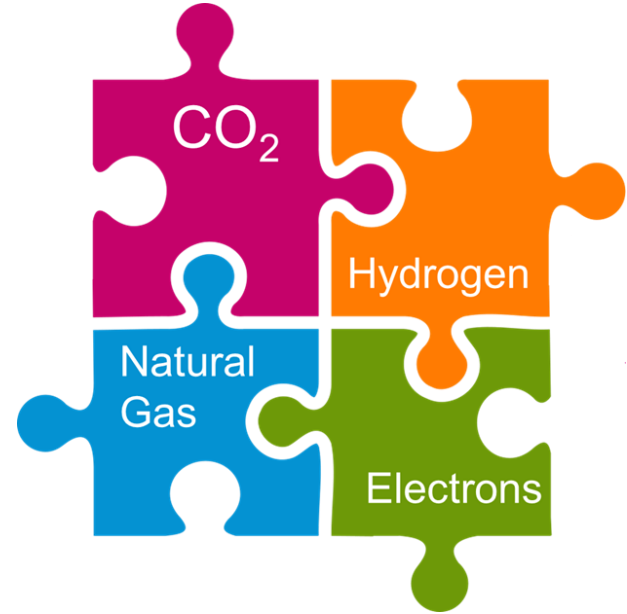
Physical Networks

Techno-economic evaluation of various system integration options



HSE

Health and Safety, Emissions and Environment



In collaboration with:

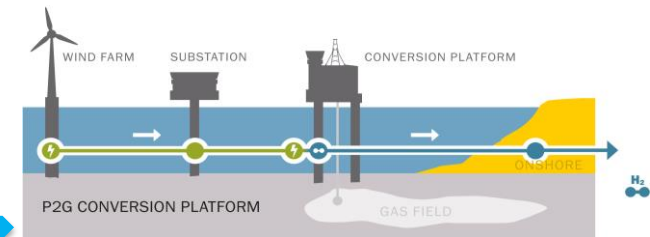
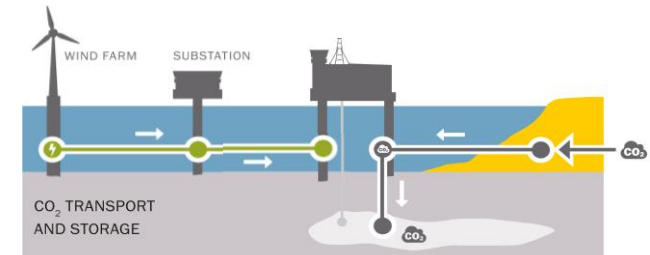
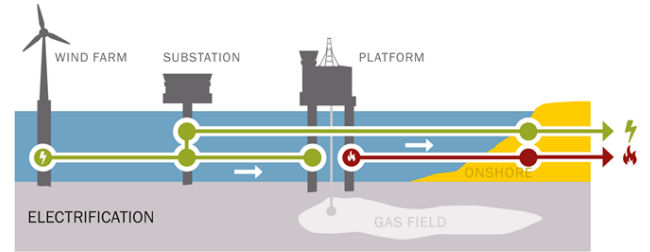
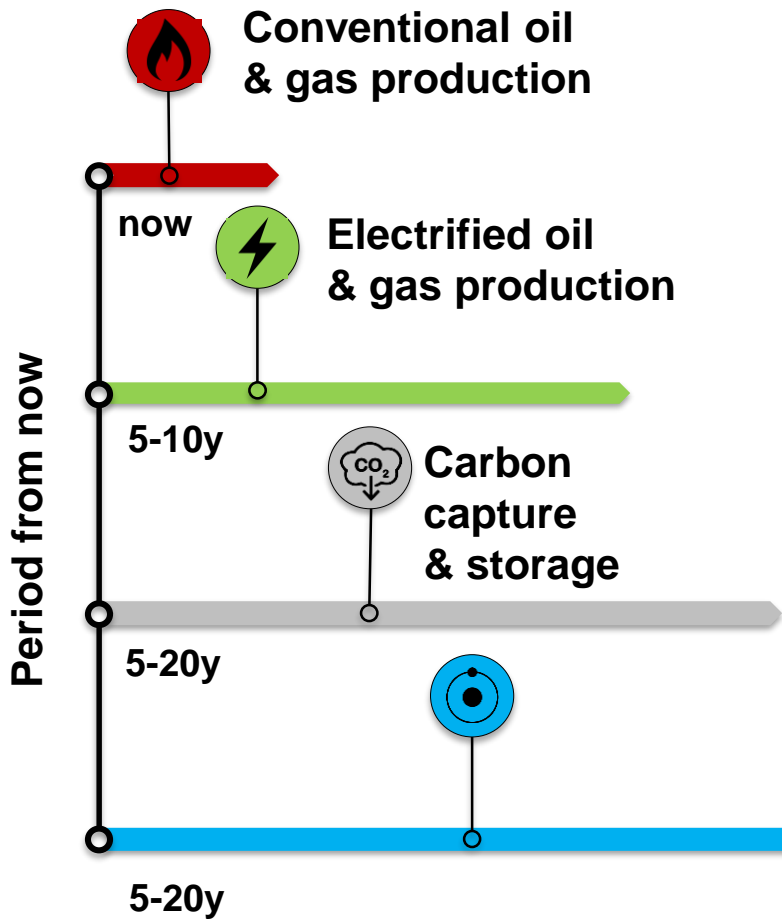


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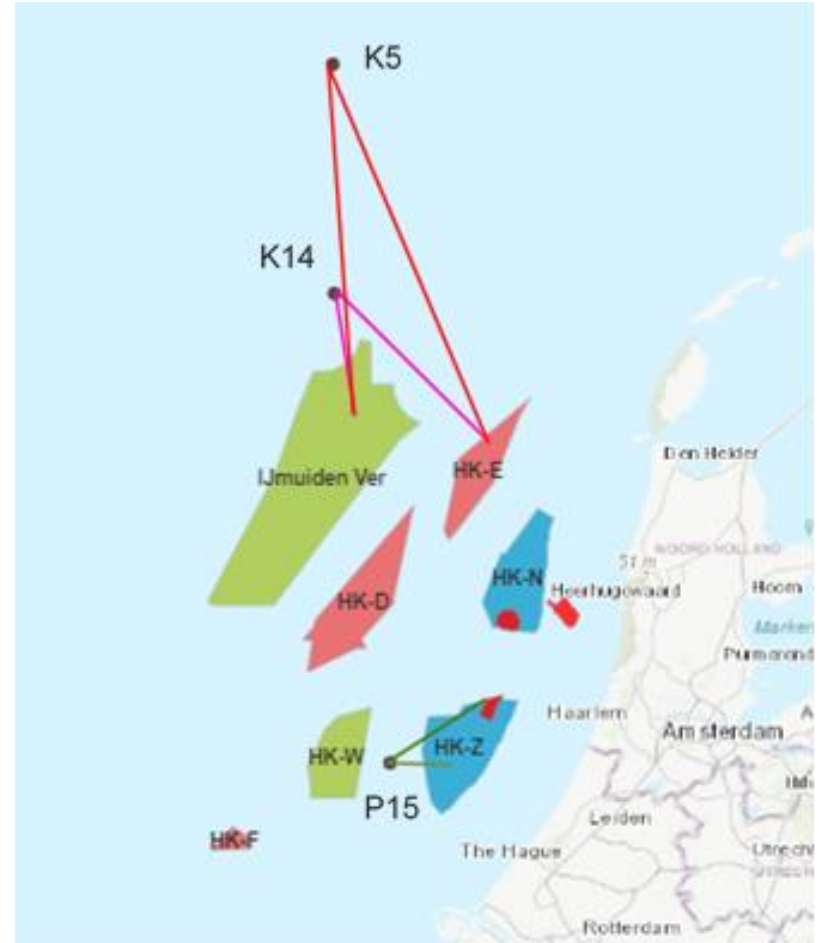




Platform Electrification

- Investments (e.g. cable, refurbishment)
- Power price
- Time horizon
- 75 tot 100 euro/ton CO₂
- Very much case specific

Possible stepping stone for CCS and Hydrogen

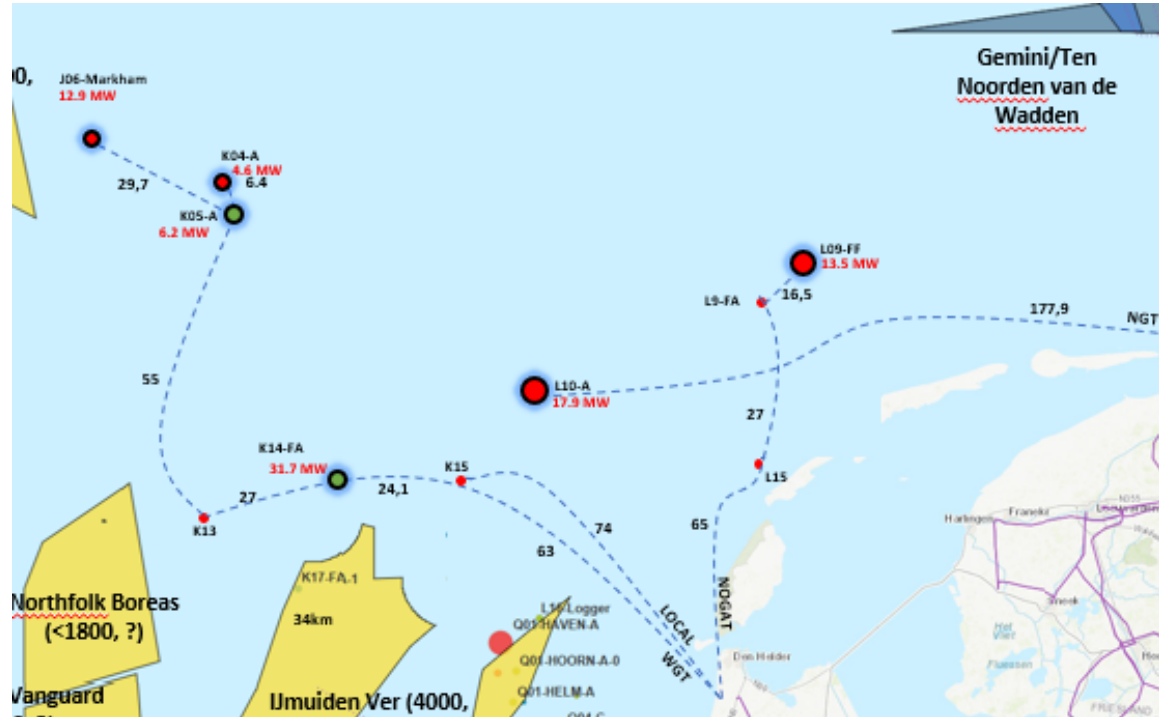


Work in progress electrification with CCS

- Strategic power grid K&L blocks
- Value for stakeholders

Challenges:

- Timing of cessation of production Oil and Gas
- Power and heat demand offshore for CCS
- Transparency in CO2 supply scenarios



Opportunities when breaking out of the silos

Gas

CCS

Electricity

Cost: efficient use of existing and new energy infrastructure

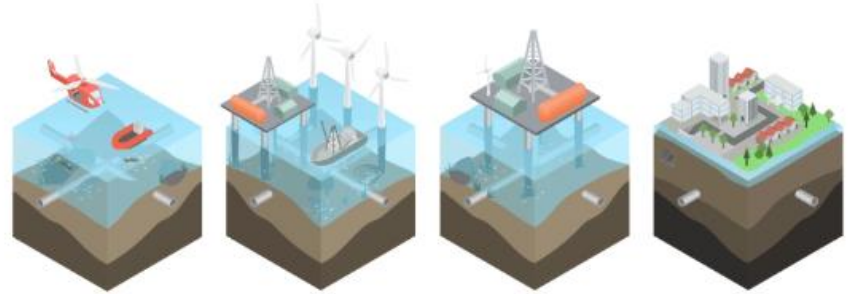
Energy: saving and more low carbon energy in the energy system with increased security of supply

Space: Reduced spatial claim

Time: Reduced lead time energy transition

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<https://www.north-sea-energy.eu/>

NORTH SEA ENERGY ATLAS

Introduction Wind Oil & Gas Energy Transition options



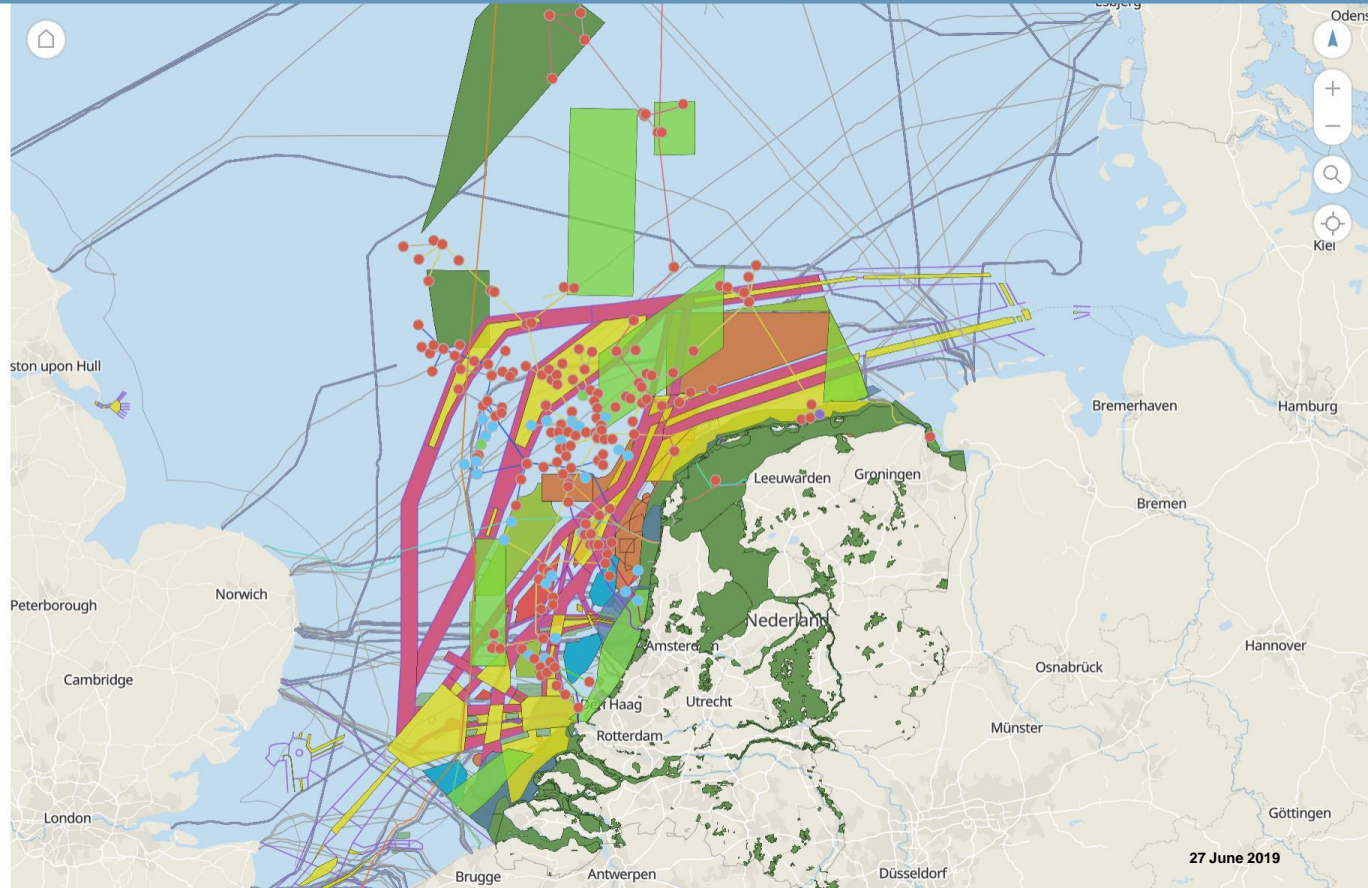
North Sea Energy Atlas

The North Sea is spatially dominated by either offshore economic activities or reserved areas. A large variety of offshore activities have their claim on the North Sea domain, like fishery, offshore wind energy and offshore hydrocarbon production. Large shipping routes cross through the area and there is always a delicate balance with reserved areas for environmental protection or safety (defence area).

A balance between vested and future interests can be further optimized and opportunities can be initiated to speed up the energy transition. Smart coupling of energy sectors and infrastructure can create mutual benefits for the offshore energy system players and can also reduce greenhouse gas emissions, reduce spatial claims and lower societal costs of the energy transition.

To support this, the interactive online North Sea Energy Atlas is developed that brings you new perspectives regarding our current and future offshore energy system. This includes current energy flows from hydrocarbon production and wind energy, and how these are transported to the onshore energy system. Also potential future grids for hydrogen and CO2 are explored.

atlas.north-sea-energy.eu



› **THANKS FOR YOUR ATTENTION**