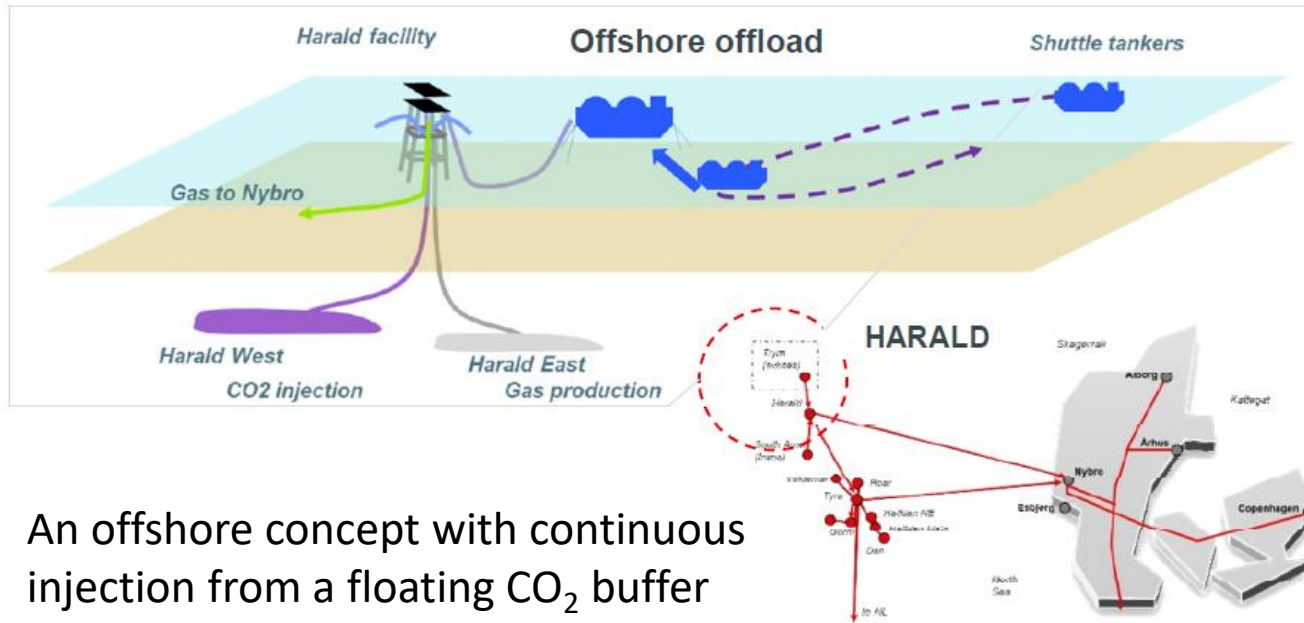




Bifrost, - offshore CO₂ transport and storage project

Urs Mohn, Noreco

Bifrost project kick-off in December 2021 - with partial sponsoring by DK EUDP funding



An offshore concept with continuous injection from a floating CO₂ buffer store and conditioning facility.

- Qualification of the Harald main sandstone store.
- Assess and mature Harald East Chalk reservoir to prepare for storage expansion
- Define a robust, safe and competitive development for transportation and storage

#	Work Package	Lead	Support
1	Project Management	DUC*	DTU/ Ørsted
2	Communication	DUC	
3	Harald West storage potential	DUC	DTU
4	Harald East chalk subsurface studies	DTU	DUC
5	Well design and drilling	DUC	
6	Surface facilities engineering & operation	DUC	
7	Cryogenic CO ₂ shipping	DUC	
8	Offshore pipeline	Ørsted	DUC
9	HSSE and stakeholder management	DUC	
10	Monitoring Plan	DTU	DUC
11	Socioeconomic assessment	DTU	DUC

* 'DUC' activities carried out by TotalEnergies on behalf of the partnership (TotalEnergies, Noreco, Nordsøfonden)



Bifrost partners

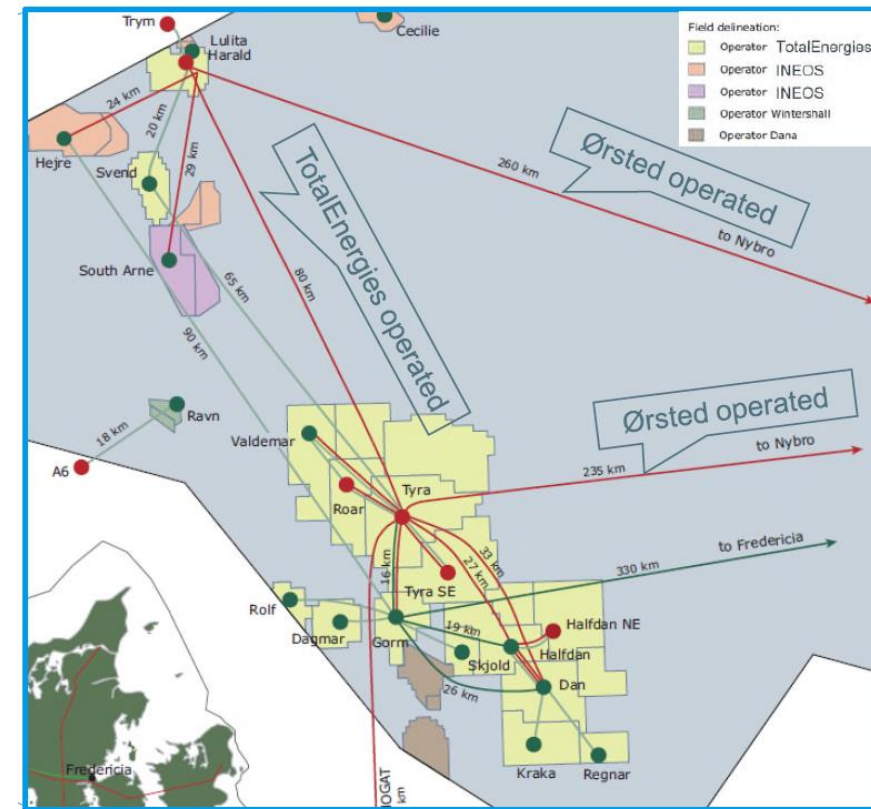
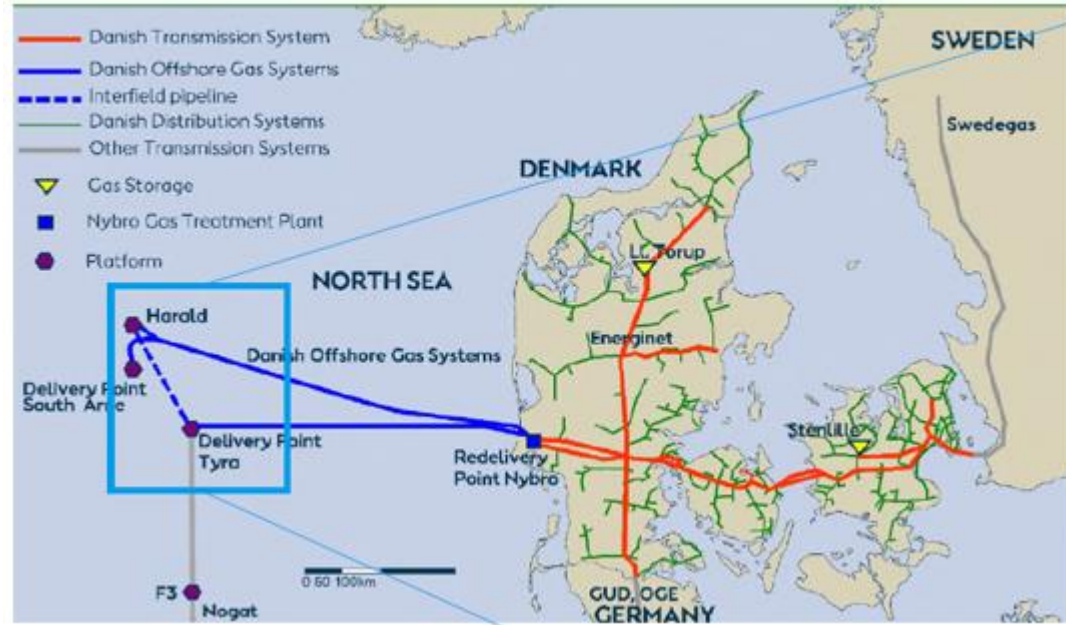
FACTS ON THE BIFROST PARTNERS CONTRIBUTION:

- **DUC** consists of TotalEnergies (43.2%), Noreco (36.8%) and Nordsøfonden (20%). The DUC produces 85% of the oil and 97% of the gas from the Danish North Sea. As DUC operator, TotalEnergies will lead the CCS partnership and perform technical studies of the reuse of the Harald field infrastructure for CO₂ storage as well as CO₂ transportation by ship.
- **Ørsted** owns the pipeline infrastructure connecting the DUC offshore fields and installations to shore. Ørsted will conduct technical studies for repurposing of the existing pipeline infrastructure to CO₂ transportation.
- **DTU** – The Technical University of Denmark will be academic partner delivering technical studies. This implies laboratory testing and simulation and socioeconomic studies exploring sector integration, including studies of the positive impacts to innovation, export opportunities and job creation from a new CCS industry.



Danish gas system

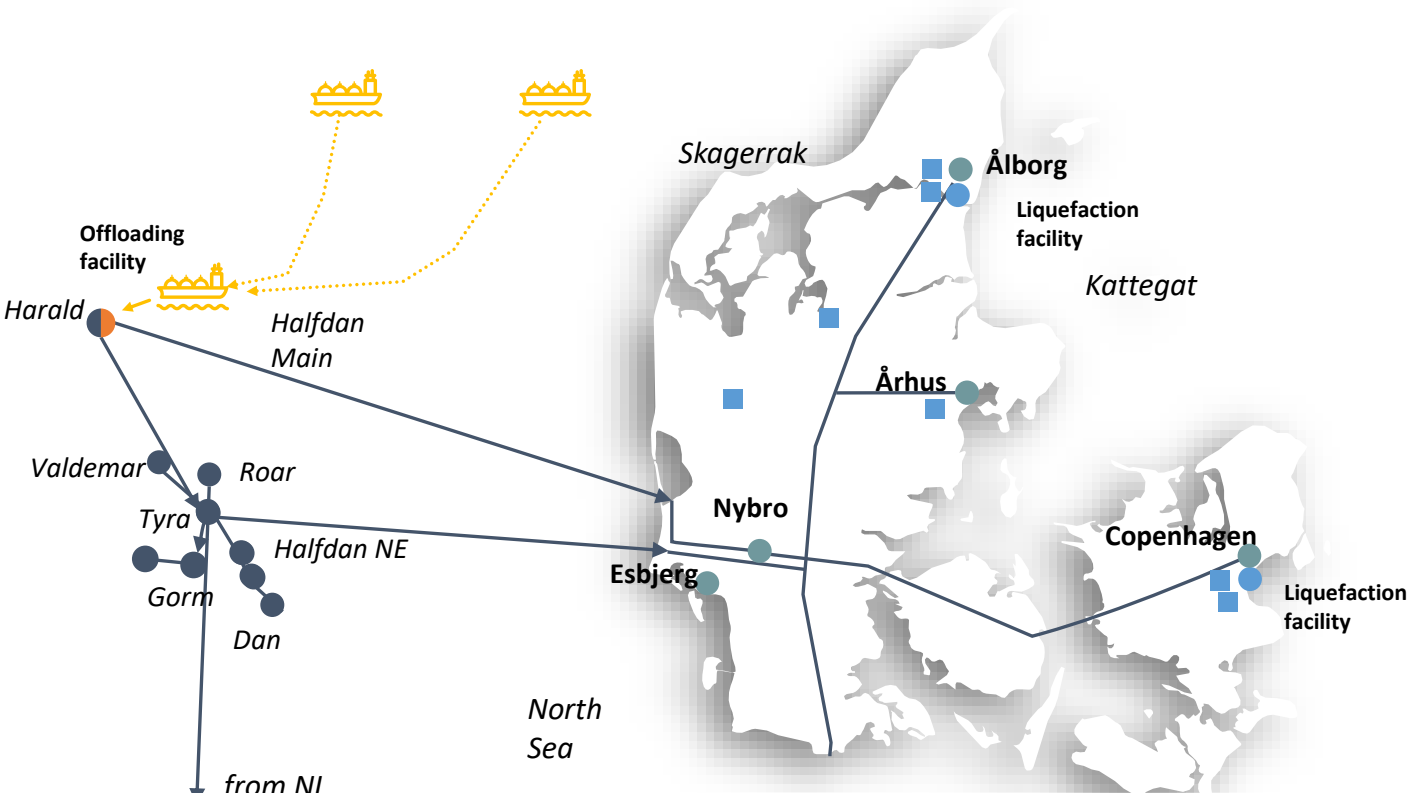
Danish gas system including connections



- Existing HC offshore transmission system in the Danish North Sea
- Opportunity to study the re-purposing of existing infrastructure for CO2 transport



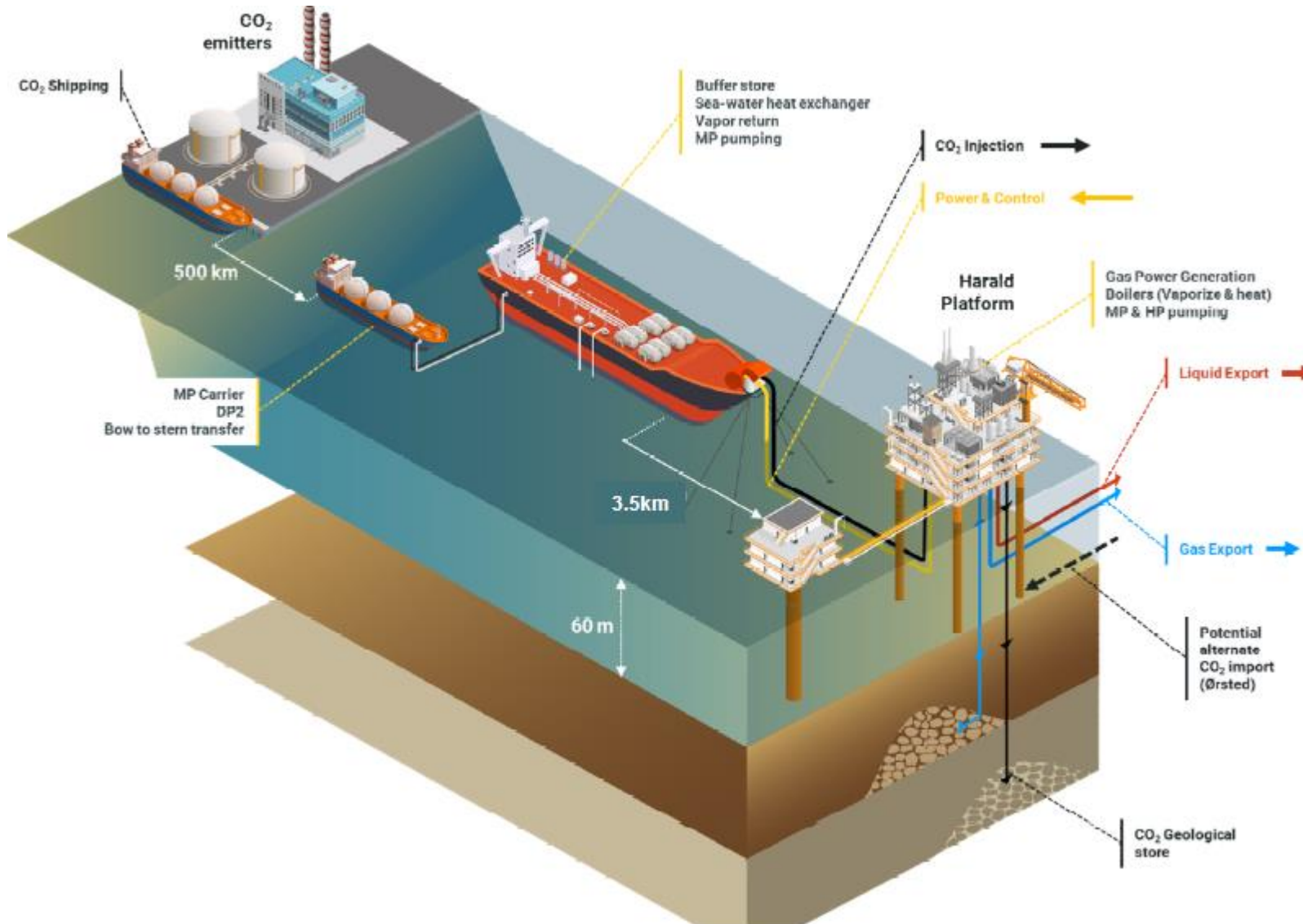
CO₂ injection into the depleted Harald gas field



- CO₂ injection
- Production
- Simultaneous injection / production
- New "Offshore" Facility
- New "Onshore" Facility
- Main city
- Emitter
- CO2 Line
- Gas Line
- Ceased operation
- Shipping route
- New "Offshore" Line
- New "Onshore" Line



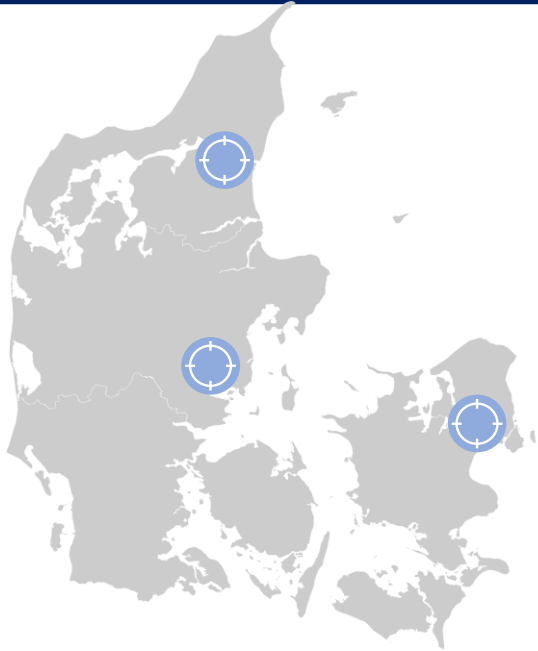
Maturing the logistics and the injection requirements



- High spec CO2
- Fluid temperature above 0 deg C
- Floating facility for:
 - Temporary storage
 - CO2 conditioning
- Well performance and well design (reuse)
- LCO2 carrier w DP and Bow-Stern offloading
- Cryolines for offloading



Shipping study



Bifrost tests a notional storing scenario of 3Mtpa of national emitters CO₂. Cryogenic CO₂ is transported by ships and offloaded onto a novel floating facility for temporary store, conditioning and injection

- **Objective:** define shipping needs, FSIU storage size and offloading availability
- **Scenario:** 3 MTPA, 3 loading ports, offshore offloading to an FSIU
- **Assumptions:** 12,000 or 20,000 m³ LCO₂ carriers
- **Input:** Harald field weather data – 37 years on hourly basis

