Activities in Norway on Hydrogen

US-Norway Bilateral meeting 31st October-1st November

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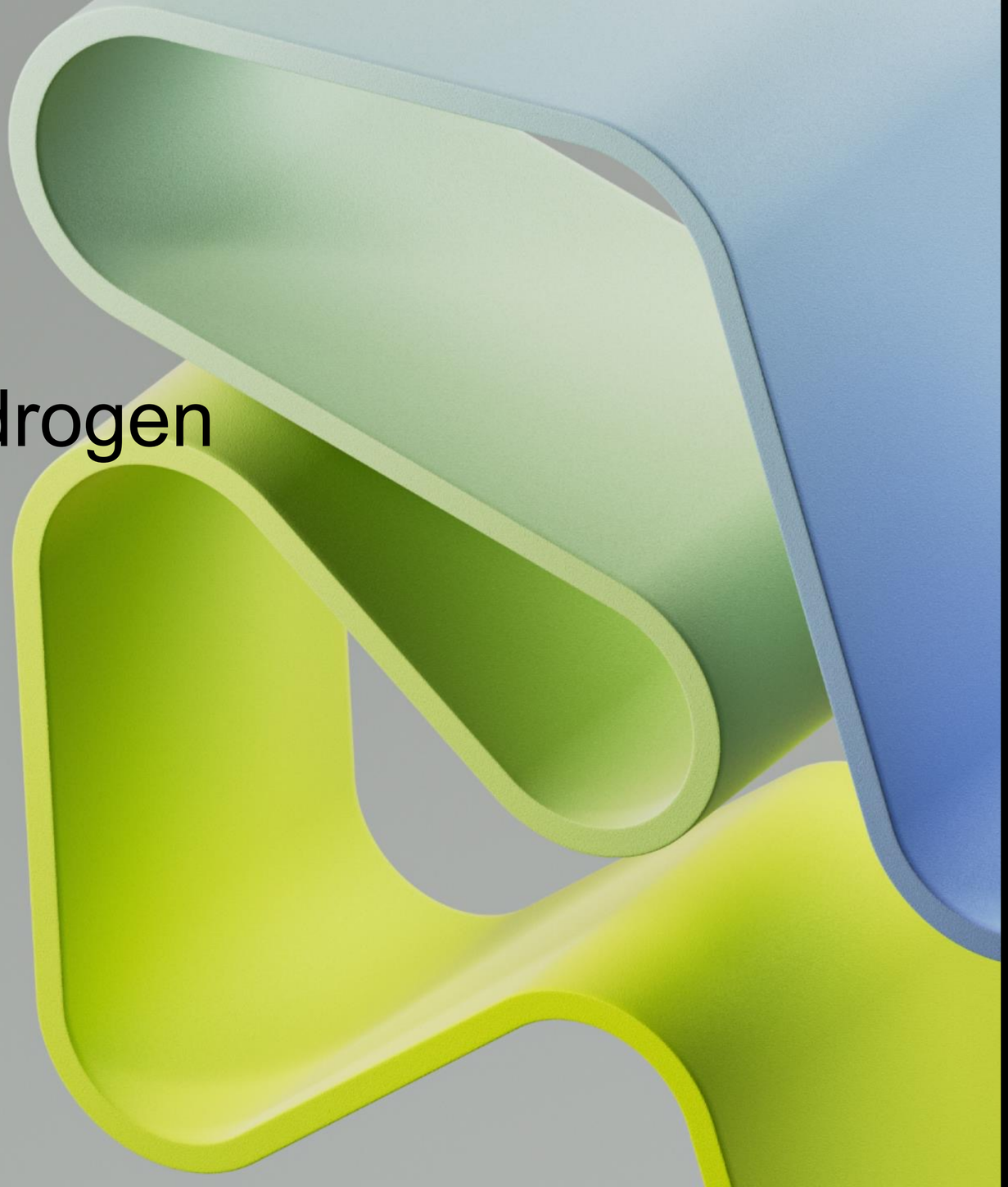
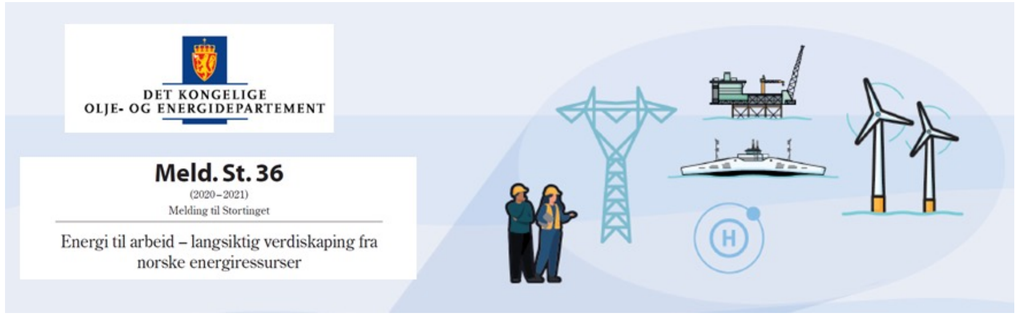


Forskningsrådet

Norwegian Hydrogen Strategies

- Hydrogen Strategy launched 2020
- Hydrogen Roadmap launched 2021

Support technology development through piloting and demonstration of production and use of clean hydrogen in maritime transport, heavy vehicles and industry



Ambitions towards 2030:

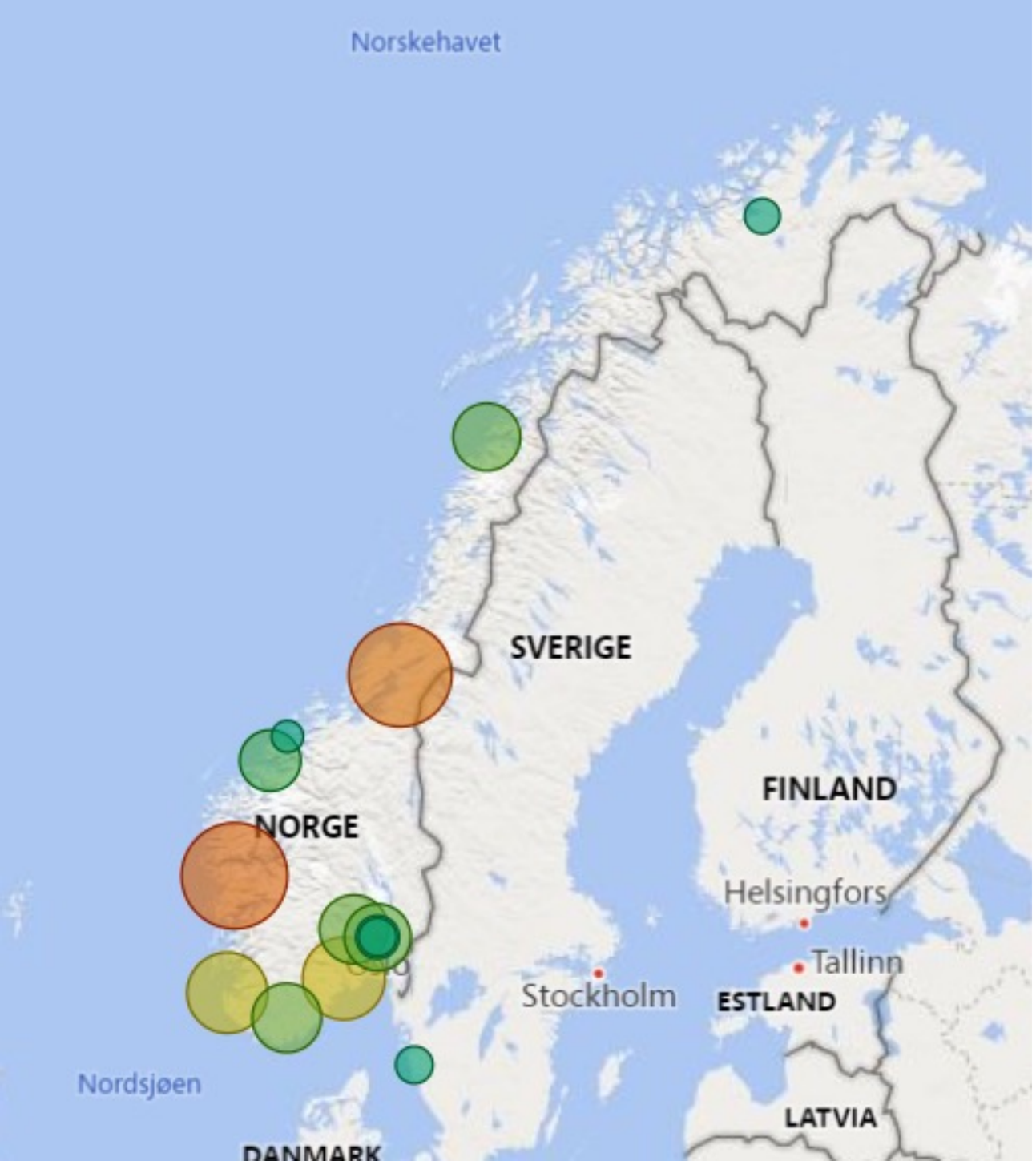
- Hydrogen as an energy carrier has been established as a real alternative in the maritime sector, and matures further as a good alternative in industry

The Energy21 strategy

- Hydrogen is one of 6 prioritized focus areas

Recent development in 2023:

- The parliament has asked the government for a plan to introduce a system for Contracts for Difference for hydrogen



HEILO

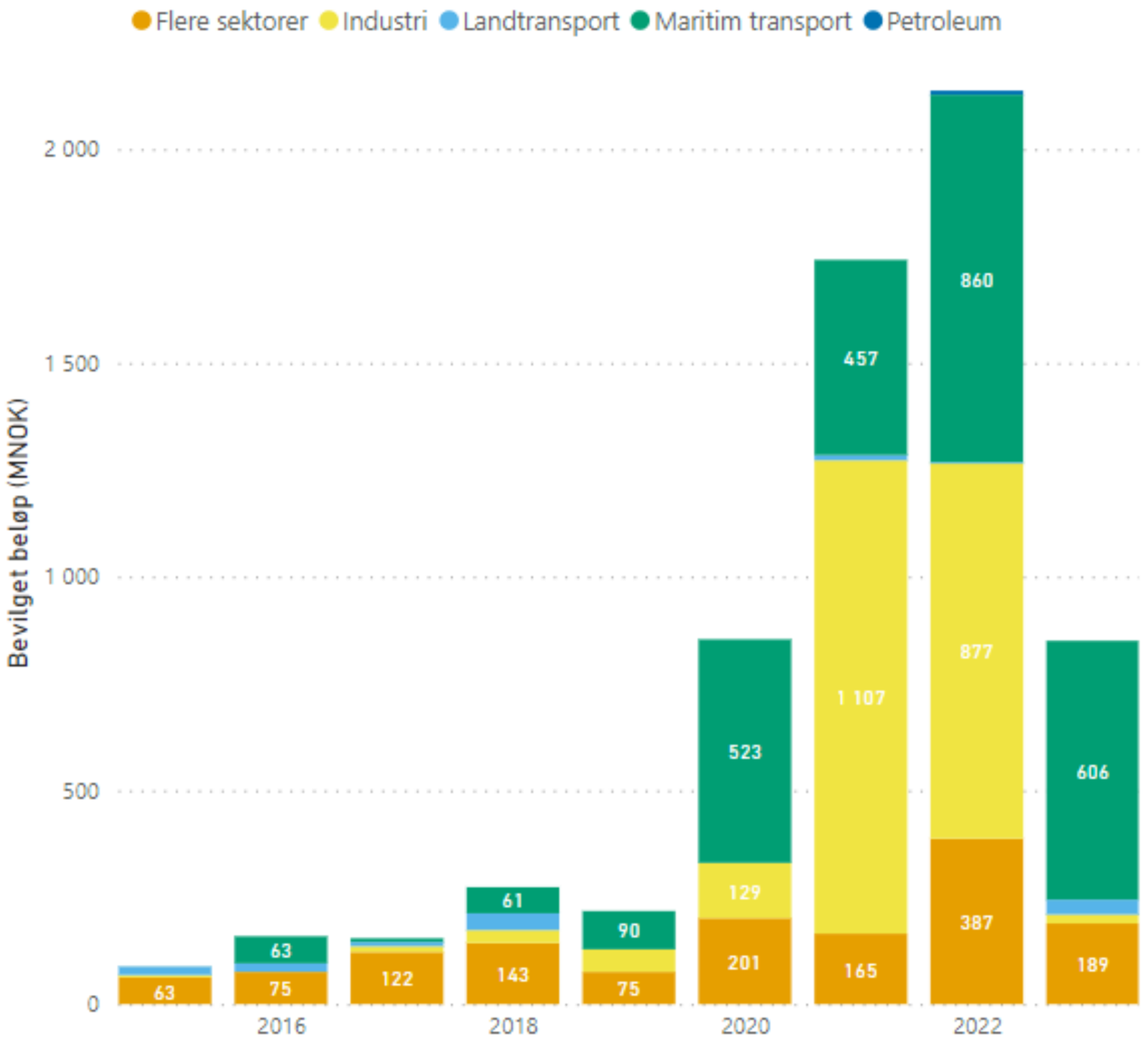
- Funding mechanisms for hydrogen, from basic research to innovation projects and investments in environmentally friendly technologies
- Cooperation between
  - The Research Council of Norway (R&D)
  - Innovation Norway (R&D)
  - Enova (R&D and investments)
  - Gassnova (R&D CO_2 capture and handling)
- Website: www.enova.no/heilo

The Research Council of Norway

GASSNOVA

Innovasjon Norge

ENOVA



R&D&D, H2 projects

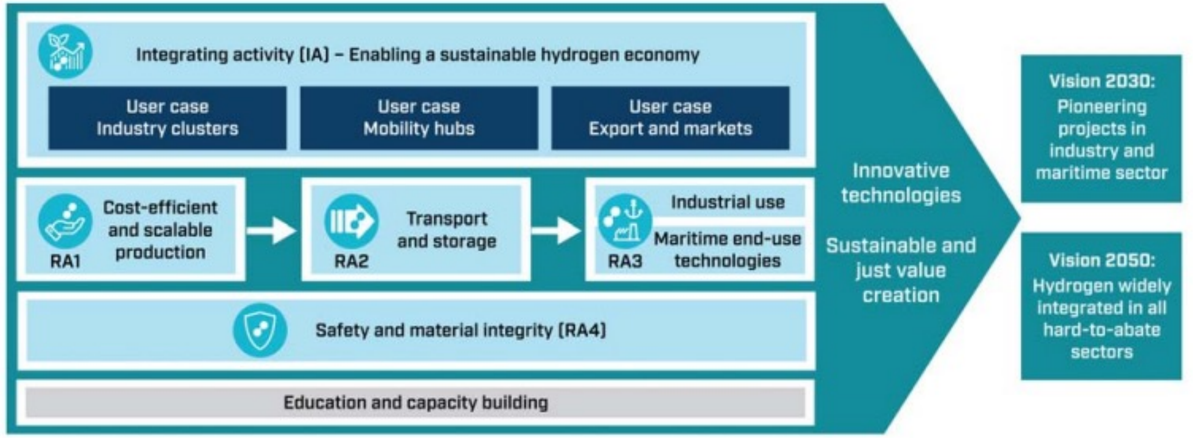
Safe, sustainable and cost-effective development **along the whole value chain** and in areas where hydrogen has an opportunity to become a competitive solution in the future

- Production of hydrogen
- Storage, transport and distribution of hydrogen
- Use of pure hydrogen in industrial processes
- Long range transport; especially maritime industry
- Other aspects related to hydrogen as an energy carrier such as safety, sustainability, business models and regulations

Two Centres on Environment friendly Research (FME) on Hydrogen

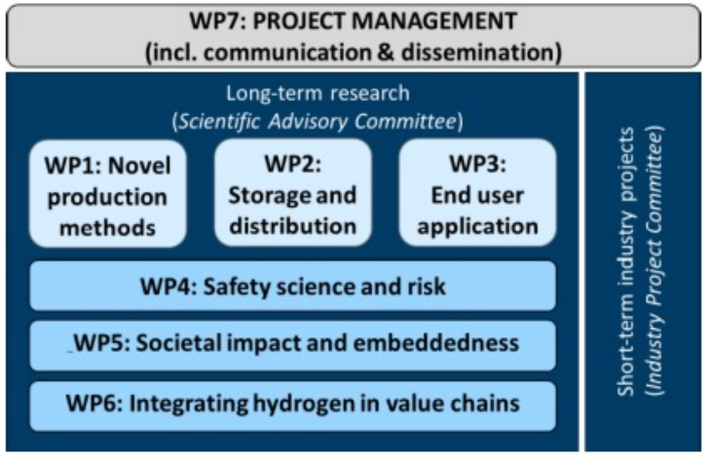
HYDROGENi: Norwegian centre for hydrogen and ammonia research and innovation, NOK 2.3 mill USD/Year 5-8 year 2022-2030

- Host SINTEF Energy
- Forskningspartnere; SINTEF, SINTEF Ocean, NTNU, IFE, UiO, USN, UiT
- 50 user partners



HyValue – Norwegian Centre for hydrogen research, NOK 1.4 mill USD/Year 5-8 year 2022-2030

- Host NORCE
- Research partners; UiB, UiS, NHH, Western Norway University of Applied Science, SNF, FNI, TØI
- 45 user partners



R&D&D, H_2 Projects, Maritime focus

Support for **Maritime Projects** (H2 and NH3 ships) **Parallel build-up of Supply and Demand**

Enova awards funding for three ammonia ships 2023

- **Skarv Shipping Solutions AS** awarded 130 MNOK for building of three cargo ships for zero emission sailing along Norwegian coastline.

New program launched by Enova to fund development of hydrogen and ammonia fueled vessels.

- **Objective is to**; Reduce network barriers, Reduce cost barriers and contribute to cost reduction, Further development of technology

Ocean Infinity (**H2**) – 148,6 MNOK

Færder Tankers (**NH3**) – 93 MNOK

Færder Tankers (**NH3**) – 112,6 MNOK

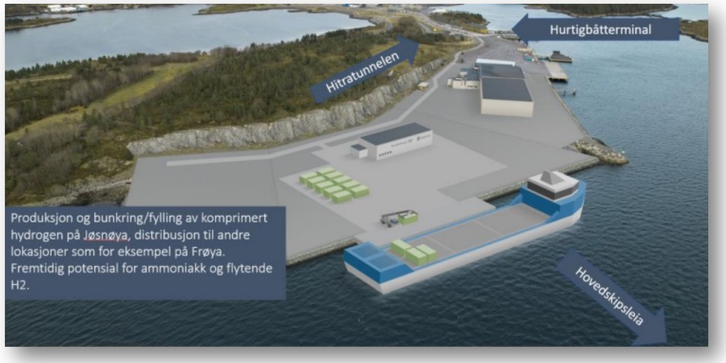
Thor Dahl Bulk (**H2**) – 97 MNOK

Egil Ulvan (**H2**) – 104 MNOK

Loran (H2) – 92,5 MNOK

R&D&D H2 Projects, infrastructure

Support for the establishment of five **Hydrogen Hubs** along the coast of Norway



Trønderenergi Hydrogen AS (113 MNOK) – **Hitra**

Glomfjord Hydrogen AS (150 MNOK) – **Glomfjord**

NTE Energy AS (125 MNOK) – **Rørvik**

Greenstat ASA (148 MNOK) – **Kristiansand**

HyFuel AS (132 MNOK) – **Florø**

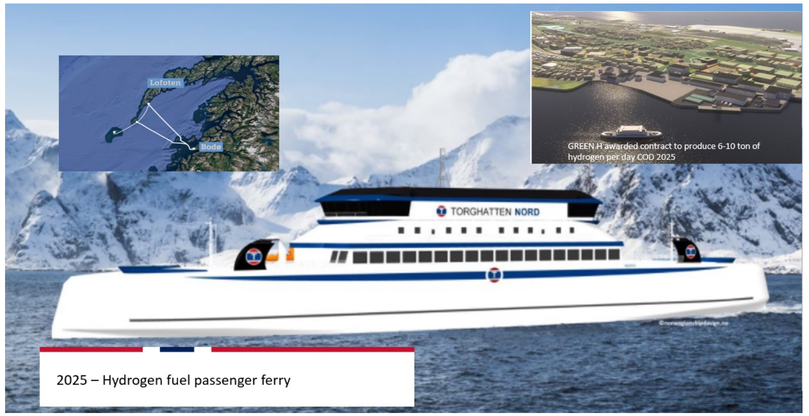
Commercial project, Maritime focus

M/F Hydra from Norled

- Public procurement
- The first ship sailing on liquid hydrogen was put into operation 31. March 2023.
- The capacity of the ferry is 300 passengers and 80 cars.
- The ferry that operate between Nesvik and Hjelmeland on western part of Norway
- The ferry is the result of a public procurement process lead by the Norwegian Public Road Administration.

GreenH and Torghatten

- GreenH and Torghatten Nord signed deal related to hydrogen supply for the ferries across Vestfjorden.
- Production facility planned located outside Bodø and have a capacity of 6-10 t green H2/d.
- Starting 2025



R&D&D, H_2 Projects, Industry and technology focus

Support for four large national Industry **Projects**:

- **Yara** Norge AS (283 MNOK)
  - PEM Water Electrolysis → **Green Ammonia**
- **Tizir** Titanium & Iron AS (261 MNOK)
  - Hydrogen as a **reducing agent** (to replace coal)
- **Celsa** armeringsstål AS (121,4 MNOK)
  - Hydrogen for **high temperature heat** in Mo Industry Park
- **Horisont** Energi AS (482 MNOK)
  - *The Barents Blue project (*w/Equinor and Vår Energi). **Blue Ammonia**

Norwegian **Hydrogen Technologies**

BLUE HYDROGEN DERIVATES

GREEN HYDROGEN DERIVATES

Z·E·G HYDROGEN MEM-TECH

CoorsTek

AKER CARBON CAPTURE

nel

Hydrogen pro

hystar

Yara, Herøya (near Porsgrunn)

Norwegian projects received significant support from **EU Innovation fund**

- **Norway Fortescue Future Industries** – aim to use 280 MW of installed hydropower capacity to produce approx. 40kt H2/y for conversion to approx. 226 kt liquid ammonia.
- **Nordic Electrofuel AS** will produce carbon-neutral e-fuel based on synthetic hydrocarbons using renewable energy, water and CO/CO2.

International: Norway collaborates in several international arenas

- Clean Hydrogen Partnership
- CETP
- IPCEI
- Hydrogen Europe
- Nordic Hydrogen Partnership
- IEA
- CEM H2I
- IPHE
- Mission Innovation

Bilateral

- Norway – Germany
- Feasibility Study: H2-pipeline for large scale H2 transport

Norwegian Pavilion/Stand North America 2024->

Alternatives:
- Norwegian stand/pavilion
- Business forum/reception
- Site visit

CERAWeek
Houston, Texas
March 2024

Canadian Hydrogen Convention
Edmonton, Alberta
April 2024

Hydrogen & CCUS Technology Expo
Houston, Texas
June 2024

Carbon Capture Canada
Edmonton Canada
September 2024

Hydrogen America Summit
Washington DC
October 2024

Gastech 2024
Houston, USA
September 2024

Idékraft verden trenger

Forskningsrådet