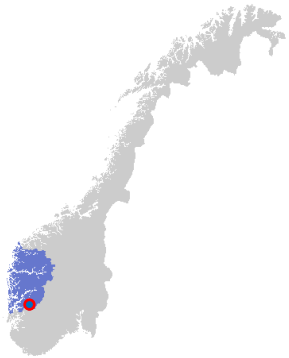
HARDANGER
HYDROGEN HUB

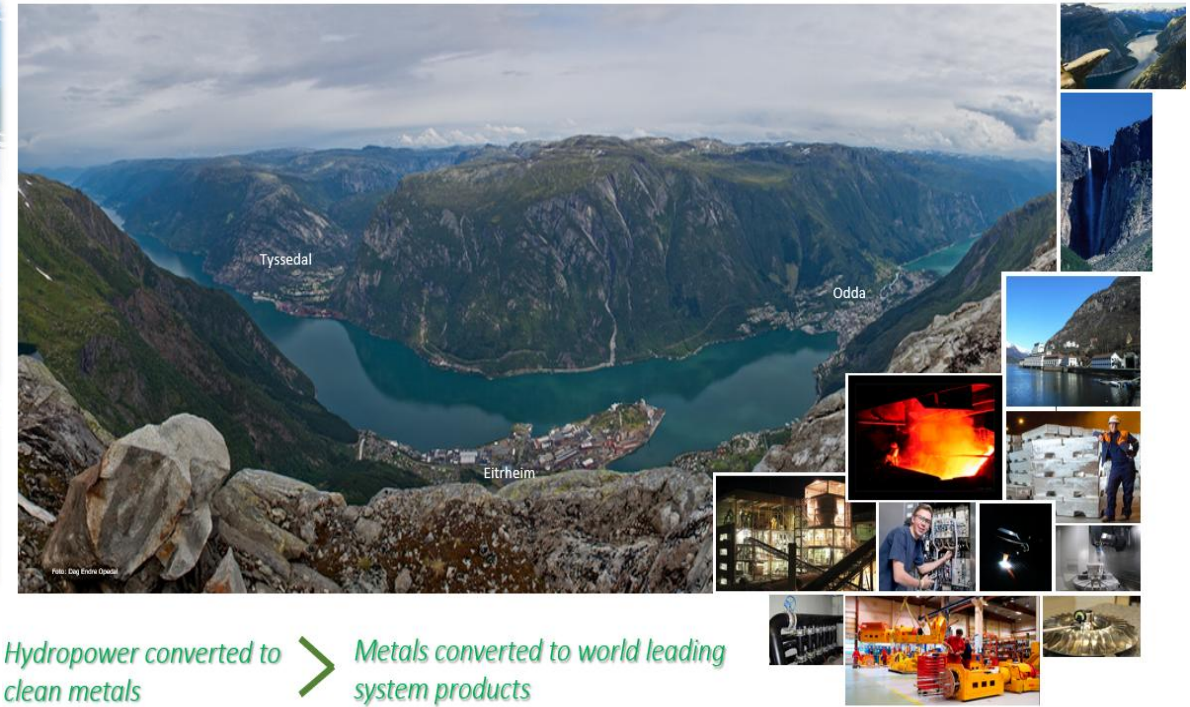
TechnipFMC

Hardanger

Energy-Prosess-System--industri

Farming
Tourism





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ODDA TECHNOLOGY

Hydropower converted to clean metals > *Metals converted to world leading system products*

Ingvald Torblå
owner & CEO

Hardanger Industri

ODDA TECHNOLOGY

From jet-engines to subsea oil & gas equipment-

-further to renewable

Timeline and Products

1977

Jet Engines

1987

Subsea oil & gas systems

1990

Supplier of the Year

2008

Global cooperation FMC Technologies

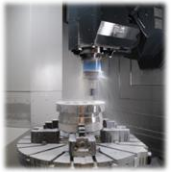
2012

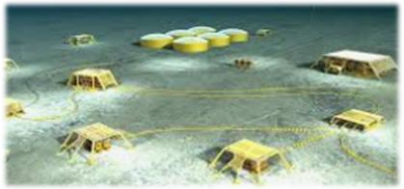
Odda Technology & Odda Digital System established

2016

Hardanger Hydrogen Hub Established

2024





From mining and defense to subsea oil & gas equipment-

-further to renewable

Norway

Industry development

System-Industry

Kongsberg Silver mines 1623 to 1957

Kongsberg Våpen from 1814 to 1945 -> 1980'
Mainly produces technology weapons, but slights over to civilian purposes

Statoil 1972
Norwegian government decides to establish Statoil to handle oil activity and explore and sell petroleum and systems

Important decisions that formed the System industry and complemented the process industry

Kongsberg Offshore 1974
Norwegian government decides to establish Kongsberg Offshore to create an undersea technology industry in Norway, based on Kongsberg weapon & turbine competence
Today TechnipFMC

Kongsberg Våpenfabrikk, Odda 1977
Establish Odda factory for the purpose of producing gas turbines and jet engines, trough the 80's converts to a subsea factory

Odda Technology 2016
Reestablished Odda factory for the purpose of producing high accuracy industry products, mainly subsea pressurized equipment.

Hardanger Hydrogen Hub 2024
Odda & Kongsberg has companies & facilities to compete in world class renewable competition

– a part of a big process

Green Region Vestland

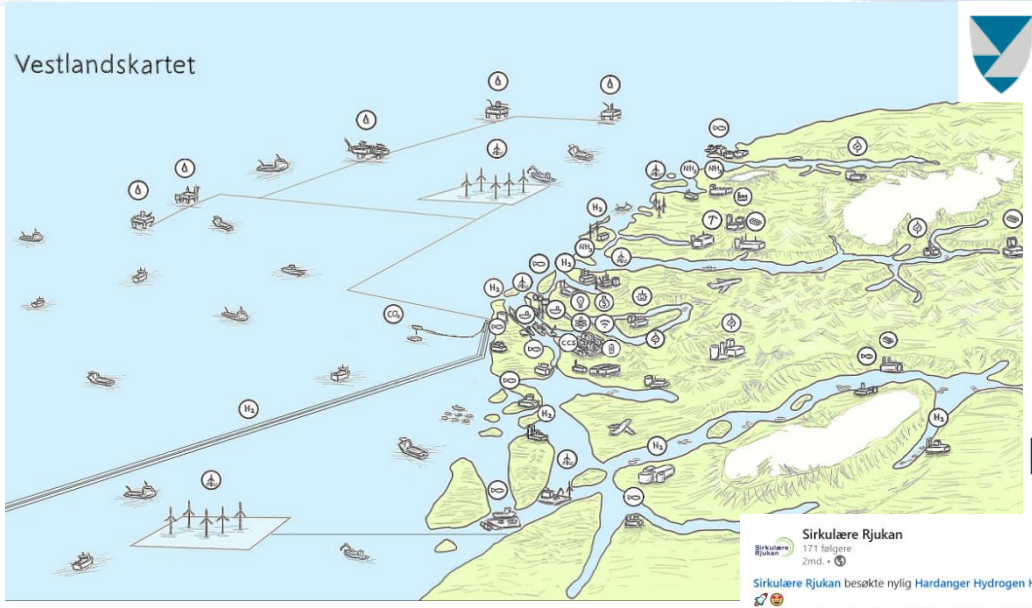
The green industry hubs are segmented in four categories broad categories based on main industry, but most have projects across industries and value-chains

Maritime
- Hjeltefjord Basin
- Fensfjord Basin
- Maritim Technology Cluster
- Fjord Base
- Lutelandet

Bio
- Bio-Gloppen
- Bio-Voss
- Bio-Bergen
- Bio-Sunnhordland

Process industry
- Hardanger Hub
- Årdal Technology Park
- Circular Høyanger
- Green Industry Park Kvinnherad

Marine
- Ocean City Bergen
- Ocean Region Fjordane
- Ocean Region Sunnhordland



Vestland fylkeskommune

Grøn region Vestland

Innovasjon Norge

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– support of all sustainable projects

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Industry analysis Vestland

Kunnskapsgrunnlag for systemindustrien i Vestland, videreføring av Grønn Region prosess

Building a better working world

System industries delivers complete systems for energy handling, mainly oil & gas

Subsea installasjoner

Foto: OneSubsea

Hydrogensystemer

Foto: HYDS

HVDC plattform

Foto: ABB

Pumpesystem

Foto: FRAMO

Systemer for energilagring

Foto: TechnipFMC

Industrielle generatorer og motorer

Foto: Bergen Engines

The systems industry has a large footprint in oil and gas, but will be able to deliver technology that enables new business opportunities

A significant part of the systems industry is currently linked to oil and gas

- The systems industry is defined as enterprises engaged in the design, production, procurement and service of industrial machinery and equipment.
- Vestland is home to Norway's leading companies in the field of energy systems.
- These are primarily maritime and offshore supplier
- The technology, knowledge and solutions from the systems industry are also relevant to other markets.

Customers: Land and energy company

Level 1: System integrators, complete systems

Level 2: Design & Manufacturing, Components and Assemblies

Level 3: Manufacturing, assembly components

Systemindustry in Vestland is the biggest branch in the county

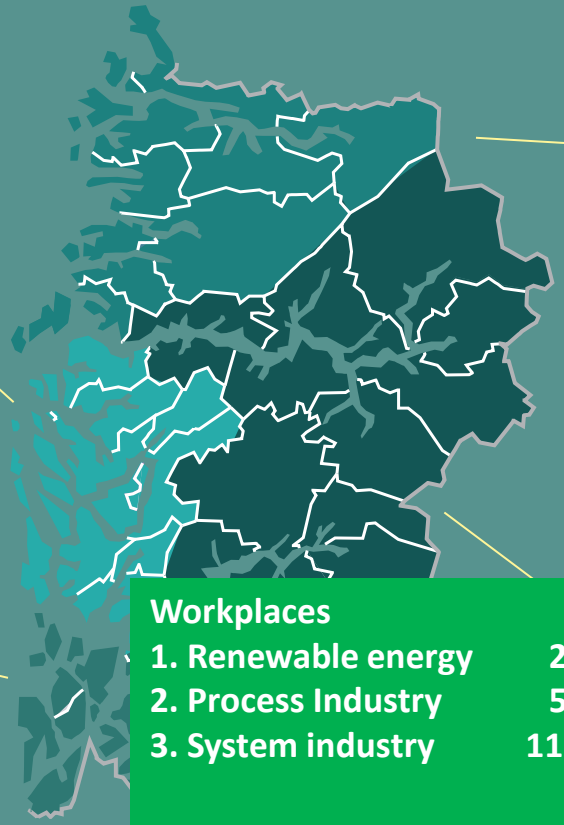
Norway is worlds biggest subsea technology provider

Systemindustri i bergensregionen
27,9 mrd. omsetning
8 130 ansatte

Prosessindustri: 1 574 ansatte
Fornybar energi: 1 313 ansatte

Systemindustri i Fjordane
2,6 mrd. omsetning
769 ansatte

Prosessindustri: 593 ansatte
Fornybar energi: 346 ansatte



Systemindustri i Sunnhordland
5,8 mrd. omsetning
2 219 ansatte

Prosessindustri: 620 ansatte
Fornybar energi: 389 ansatte

Systemindustri i Indre Vestland
0,5 mrd. omsetning
293 ansatte

Prosessindustri: 2 356 ansatte
Fornybar energi: 562 ansatte

Workplaces

1. Renewable energy	**2 610**
2. Process Industry	**5 143**
3. System industry	**11 235**

Kilde: EY Ortus

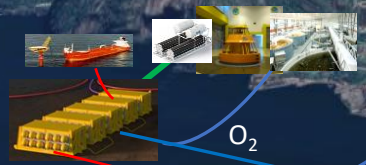
116+ years with industry based on renewable and fossil rawmaterials

Go more circular and sustainable with new Hydrogen technology

power production

Statkraft

TYSSEDAL



INEOS

H_2 pilot for industry

O_2

TechnipFMC

H_2

Final subsea hydrogen storage

Universitetet i Sørøst-Norge

pilot for subsea H_2 storage

ODDA

pilot for H_2 road

H2 Vegen

HARDANGER HYDROGEN HUB

EITRHEIM

pilot for protein production

FLUORSID

pilot for industry

UMOE Advanced Composites

BOLIDEN

pilot for sea transport

ODDA TECHNOLOGY

pilot production & test-center

Wilhelmsen

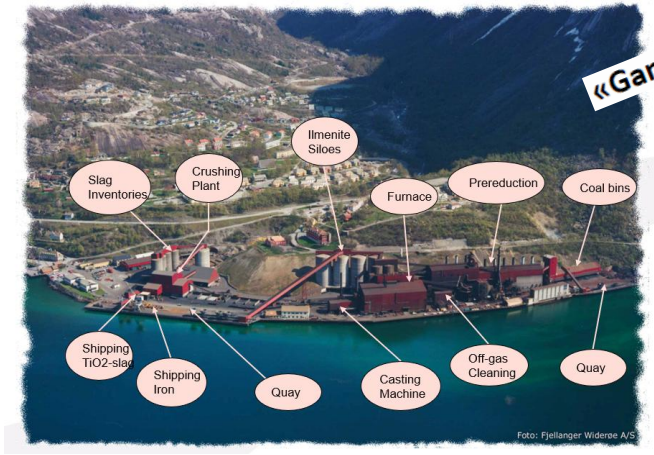
Topeka

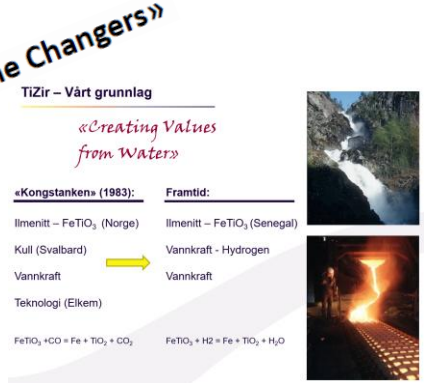
– H_2 start 10 year ago

Process industry project

New technology for Iron and titanslagg production

Reductionprocess: exchange coal with H_2





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Potensials

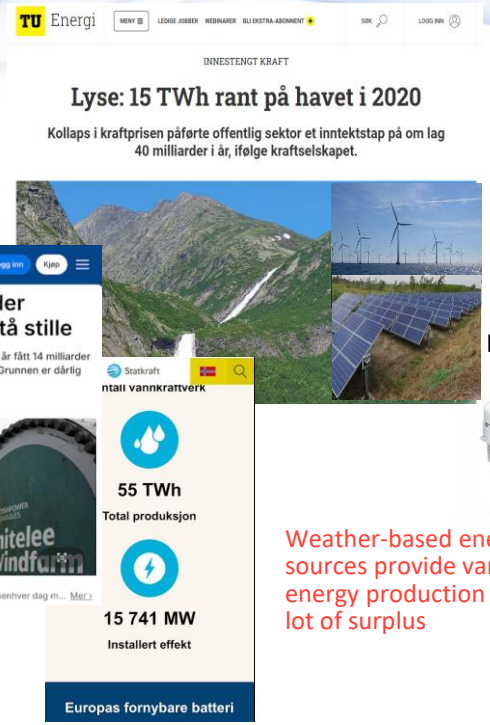
- **First player developing and testing H2 reduction of ilmenite/iron-ore**
- **Removal of CO_2 combined with growht in production**

– H_2 continue 4 year ago

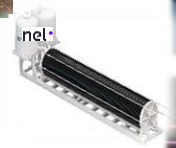
System- industry project

New technology for storing renewable energy carriers under development;

Subsea hydrogen storage appropriate to our topography

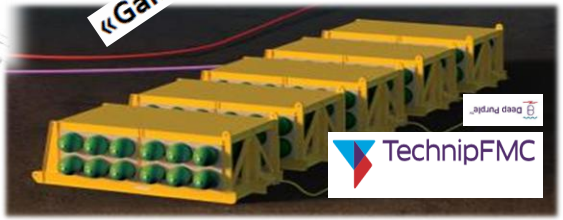


Electrolysis



Weather-based energy sources provide varying energy production with a lot of surplus

The Tyssedalsproject needed lot of hydrogen



Piloting new technology for Subsea storage for H_2

-Using surplus energy for industrial purposes

-Intermediate long duration storage to buffer and ensure smooth operation

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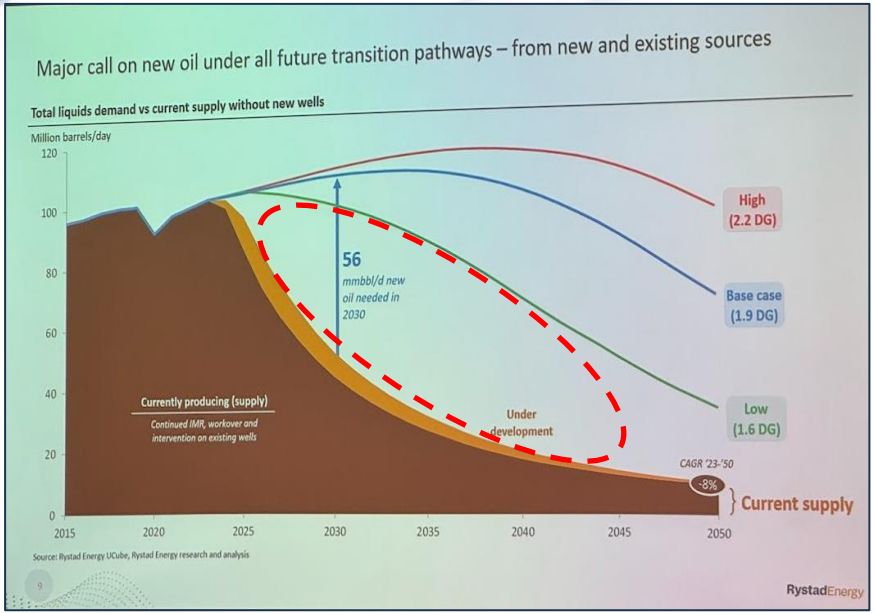
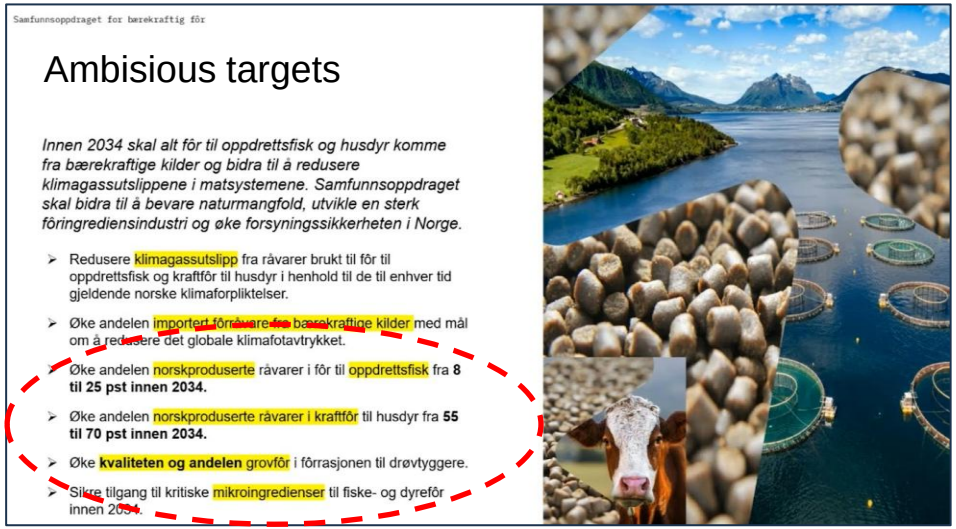
– overall motivation

Worlds energy demand



➢ Energy-crisis?

Norways food demand



➢ Food crisis?

– avoid dangerous dependency by deloping energy and food systems

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– what to do

While extracting fossile, ***we need to improve utilization of renewable energy sources***

Present utilizaton of installed **EL**-capacity
Norway ~ 45 % (hydro)
Brazil ~ 35 % (mix)

Significant potential for new TWh's based on catching & storing **surplus energy**

Present opinion:
Green hydrogen & ammonia;
expensive "waste"

"Need to get" opinion:
Hydrogen & ammonia;
a key to increase renewable efficiency

U.S. Department of Energy (DOE)

Under the leadership of the Brazilian Presidency at Foz do Iguacu, this year's #G20 Energy Ministers dug deep to find consensus on an outcome statement for the first time since 2021. Our negotiated consensus outcome sets up Leaders this November to land an energy storage target of 1500 GW by 2035 in support of last year's ambitious #triplingrenewables goal, transforming variable renewable energy into reliable, dispatchable baseload clean power.

G20 - Storage target 1500GW by 2035

-which type of storage?

Batteries or hydrogen comparison

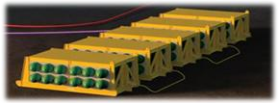
Size

How big is the Tesla battery in South Australia?

150 MW = 0.15GW = 10 000 storages to reach target

The original installation in 2017 was the largest lithium-ion battery in the world at 129 MWh and 100 MW. It was expanded in 2020 to 194 MWh at 150 MW.

- ✓ Tyssedal H2 storage can be up to **80 times bigger**
  5 modules = 10GWh =125 storages to reach target



Environmental

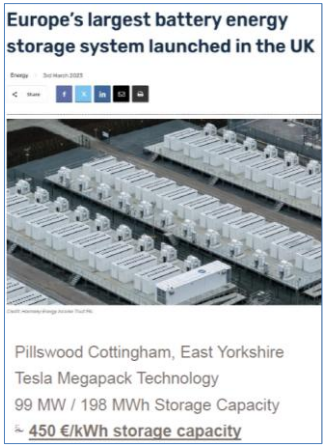
- ➢ Batteries made by non-sustainable and non-local materials
- ✓ H2 storage made by sustainable and local materials

Safety

- ➢ Big batteries is not 100% safe, easily catches fire
- ✓ Surface H2 storage also dangerous, a subsea solution would improve

In September 2022, a Tesla Megapack energy storage battery system operated by Pacific Gas and Electric Company in Monterey, US, caught fire; in July 2021, a Tesla Megapack energy storage battery fire occurred in Australia. Previously, in 2019, a Tesla energy storage facility in Arizona also experienced a sudden fire...

Price



Pillswood Cottingham, East Yorkshire
Tesla Megapack Technology
99 MW / 198 MWh Storage Capacity
450 €/kWh storage capacity

A sub-water system of 5 modules contains up to 2 GWh
At a cost in a range of 1/10 ? €/kWh Storage Capacity compared to batteries

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➢ **Norwegian industry as a main actor in storage systems**

Systemenergy analyzis

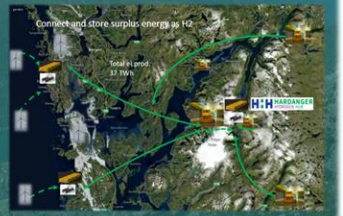
Making more renewable energy available

1. Energy optimization - production side

(Store and balance surplus energy as H2 and use it as a source for sustainable industry and transport)

By connecting the energy sources (power plants) utilization and balancing can be increased in favor of achieving growth and sustainability goals

- Vestland County / Norway potentials with H2 storage; 10% more from renewable energy sources
  Vestland County ~4TWh
- 50% more out of process industry plants
- O&G subsea systems converted to renewables
  H2 energy products can mean between 500-1000 billion in value for Norwegian manufacturing



Vestland county can be the first county to take care of surplus energy and use for industry!

SINTEF

FORREGION Vestland

10% more
Out of energy systems

3. Energi-utnyttelse - forbrukssiden

(Utnytte grønne drivmidler til transport)

Hydrogen som drivstoff

- Industrielle skipsruter
- Industriell langtransport
- Anleggsmaskiner

Industrien langs Europavei 134 kan bli første aktør med utslippsfri transport

E 134

H2 Vegen

HARDANGER HYDROGEN HUB

A non-profit developmentcompany by Odda og Kongsberg

AGENDA VESTLANDET

Ullensvang kommune

Grøn region Vestland

Vestland fylkeskommune

4. Nasjonale test og visnings senter

(Fremme ny Norsk systemteknologi, utvikling, produksjon og anvendelse)

Temaer for test og visning:

- Produksjon
- Lagring
- Distribusjon
- Anvendelse

Systemindustrien i Norge kan bli første aktør som kombinerer industri og turisme

KRAFT MUSEET

Subsea Hydrogen Storage Qualification Project

Innovasjon Norge

enova

H_2 Pilot

Common = H_2

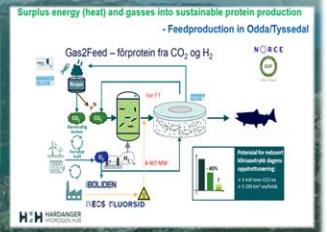
Protein production -industrial symbiosis

Providing feed for food production

2. Energy optimization - consumption side

(Utilizing waste energies for protein production)

- Replace the import of feed for farming, with in-house production based on waste resources
- Developing a new 'protein' technology industry
- Export of new process technology



Vestland county can be the first county to become self-sufficient in feed for farming!

10% more
Out of industry

NORCE

G2F

Gas 2 Feed

District heating option in small towns

TechnipFMC

About TechnipFMC

At a glance

We are a **fully integrated technology and services provider** in **Subsea and Surface**.

Key facts

21,000
Employees

39
Countries

1
Stock exchange listing

$7.8bn
Total company revenue (2023)

One vision, one purpose

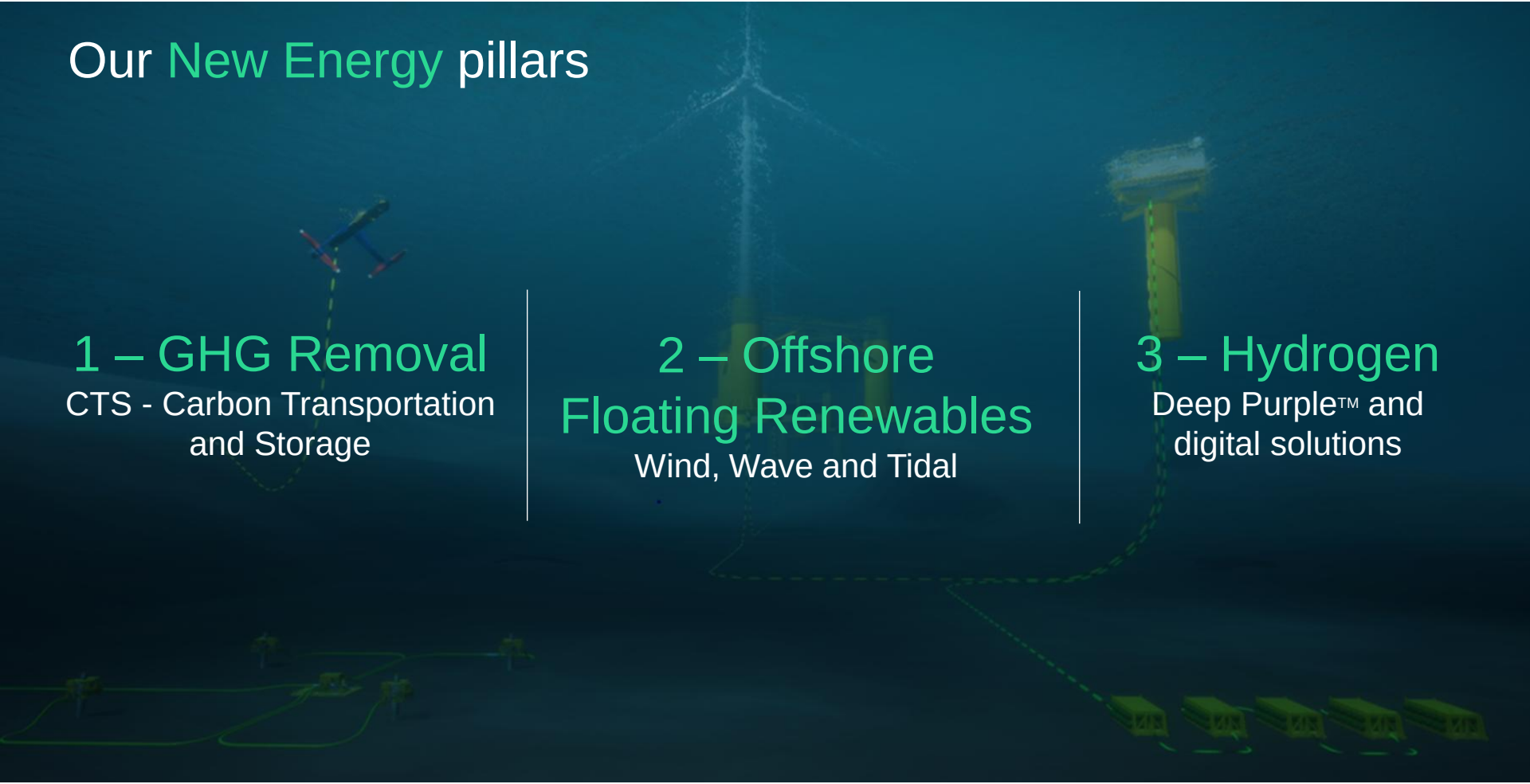
Vision

To enhance the performance of the world’s energy industry.

Purpose

Bringing together the scope, know-how and determination to transform our clients’ project economics.

Our New Energy pillars



1 – GHG Removal

CTS - Carbon Transportation and Storage

2 – Offshore Floating Renewables

Wind, Wave and Tidal

3 – Hydrogen

Deep Purple™ and digital solutions

Project goal

The goal of this project is to **qualify a safe and reliable hydrogen subsea storage system at industrial scale (**to ISO Technology Readiness Level 8 - ready for commercial projects), and to make it ready for a commercial market. The project also aims to prepare a competitive and qualified Norwegian supply chain ready for rapid scale up for a growing global export market.

This will be achieved through building, installing and operating a storage system demonstrator.

TechnipFMC

Subsea Hydrogen Storage Qualification Project in Sørfjorden, Hardanger

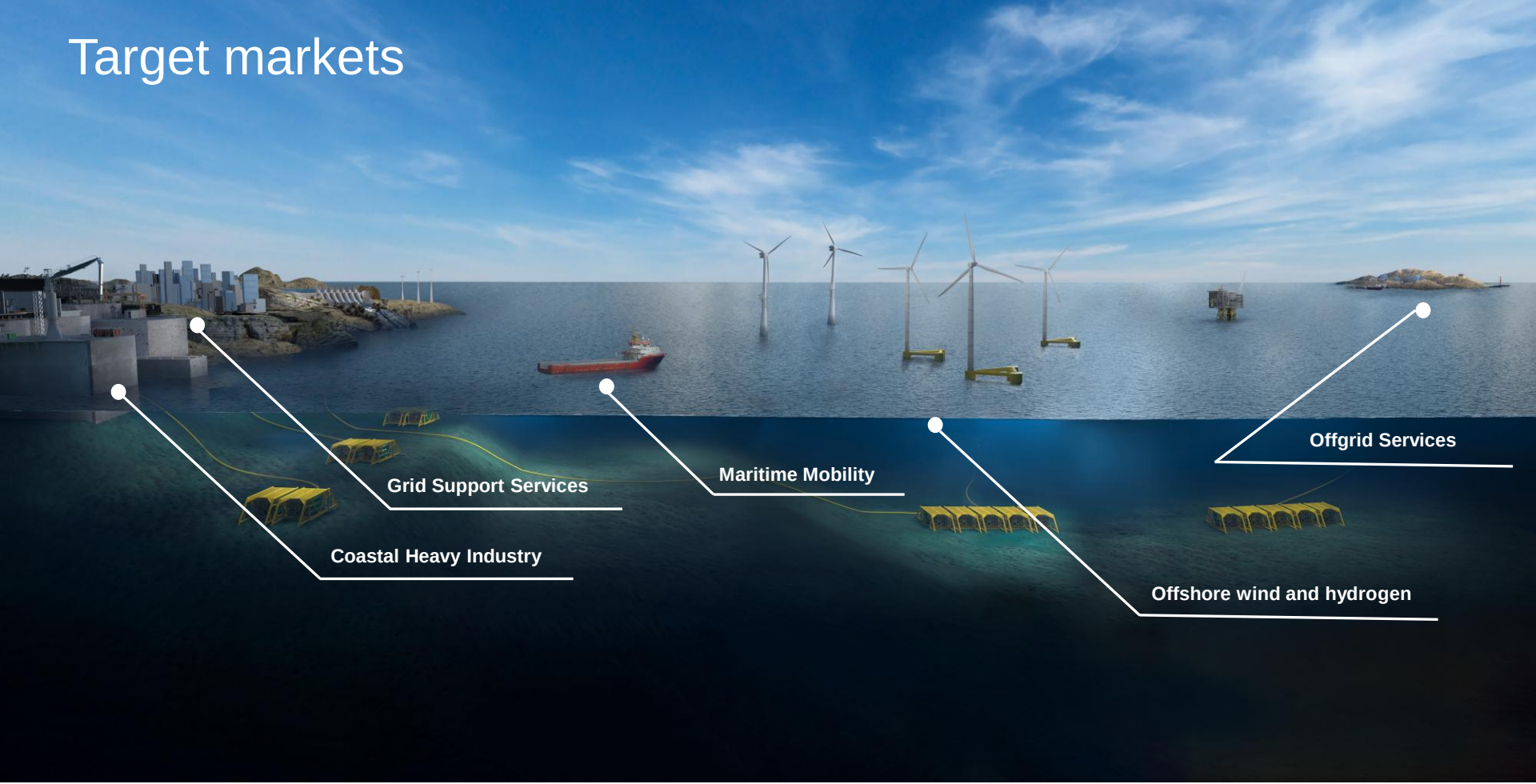
Subsea Hydrogen Storage Qualification Project

TechnipFMC

ODDA TECHNOLOGY · Topeka · Statkraft · Kongsberg Innovation · NYMO · UMOE · USN

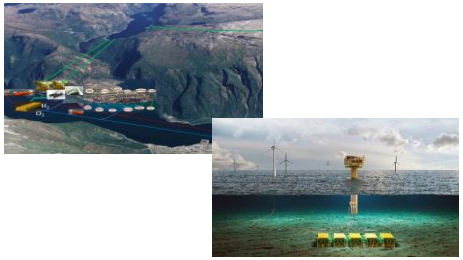
SAFE	FLEXIBLE	SCALABLE
Safe storage in stable environment out of harms way from people and assets	Minimize use of valuable onshore acreage for footprint and safety areas	Modularized and easily scalable to meet increasing demand for storage

Target markets



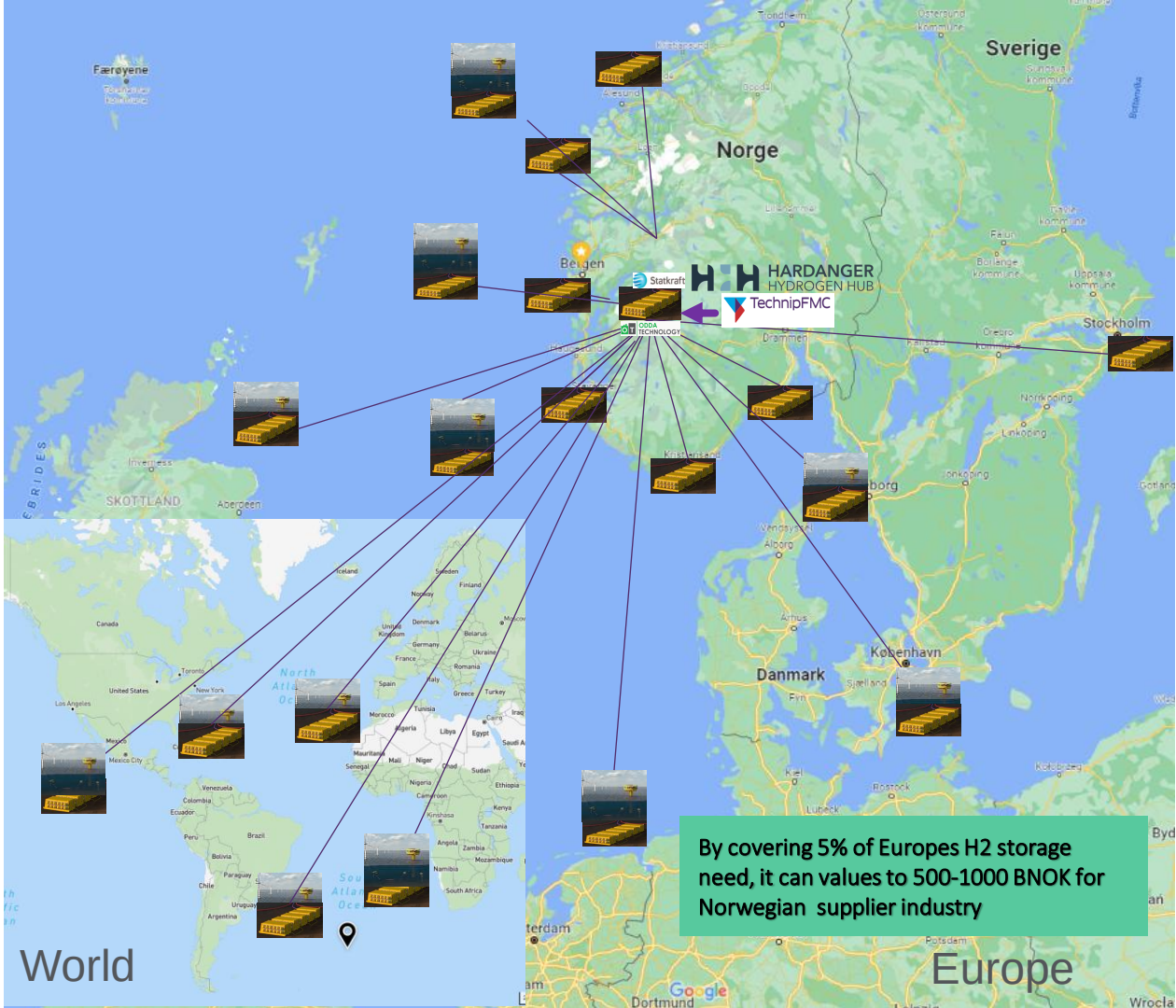
Global potential

Deep Purple™
Empowering ocean energy systems
with green hydrogen



TechnipFMC
Statkraft
UMOE Advanced Composites
ODDA TECHNOLOGY
NYMO
University of South-Eastern Norway
Innovasjon Norge
Kongsberg Technology Cluster
Wilhelmsen

HARDANGER HYDROGEN HUB



-foreign attention

Rio Oil & Gas 2022

Rio SPE Subsea Oil & Gas conference 2024

Hardanger H2 symposium 2022

Foz do Iguaçu 2023

HARDANGER HYDROGEN HUB

Thank you for your attention.

Lars Kristian Åtland Skårberg

TechnipFMC Kongsberg

Project manager

Ingvald Torblå

Odda Technology/Hardanger Hydrogen HUB

CEO