

# *Norways opportunities to deliver low carbon hydrogen to Europe*

## *H2 Value Chain 2022*

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CHE scope

# Safety Moment: Detonation in an ammonia plant, 1985

## Where:

- POX unit in the Norsk Hydro N1 ammonia plant at Herøya

## Cause:

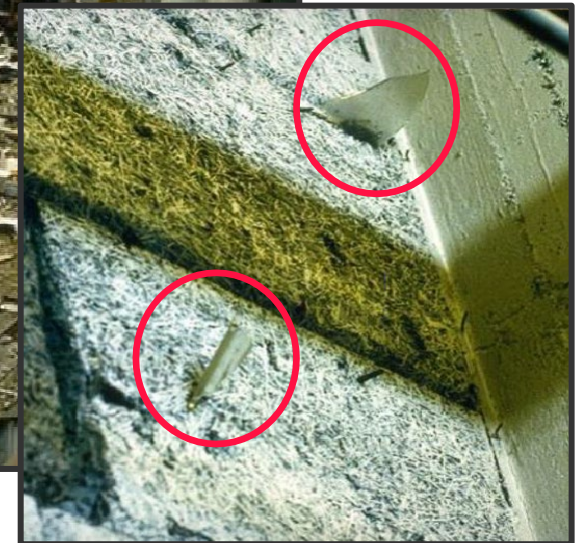
- A gasket in a water pump failed, causing a leak and loss of pressure followed by backflow from a pressurised H<sub>2</sub> drum
- 10-20 kg of hydrogen leaked from the system inside a building
- Most likely that a hot bearing ignited the gas cloud
- 3.5-7 kg of hydrogen involved in the explosion/detonation
- From the damage observed, detonation seems most likely

## Consequences:

- Two fatalities, extensive damage
- Huge horizontal jet fire from the pressurised H<sub>2</sub> drum
- The explosion caused large number of fragments representing a severe hazard
- Glass windows were broken up to 700 m from the centre of the explosion.
- The plant was never re-built

## Learnings:

- Importance of barrier thinking and proper design standards (e.g. ventilation, backflow, H<sub>2</sub> in buildings...)



# Shaping the European future of CCS and clean hydrogen

Competitive edge founded on experience, infrastructure and customers.



Capital Markets Day June 2021

**15-30** MTPA

CO<sub>2</sub> transport and storage capacity by 2035

Equinor share

**>25%**

CO<sub>2</sub> transport and storage market share in Europe by 2035

**3-5** MAJOR INDUSTRIAL CLUSTERS

Clean hydrogen projects by 2035

**>10%**

Clean hydrogen market share in Europe by 2035



# Norway energy hub

- Contribute to combat climate change
- Ensure value creation and green transition
- Build on strenghts, competence and experience

**3,9**  
Million boe/d  
Oil & Gas

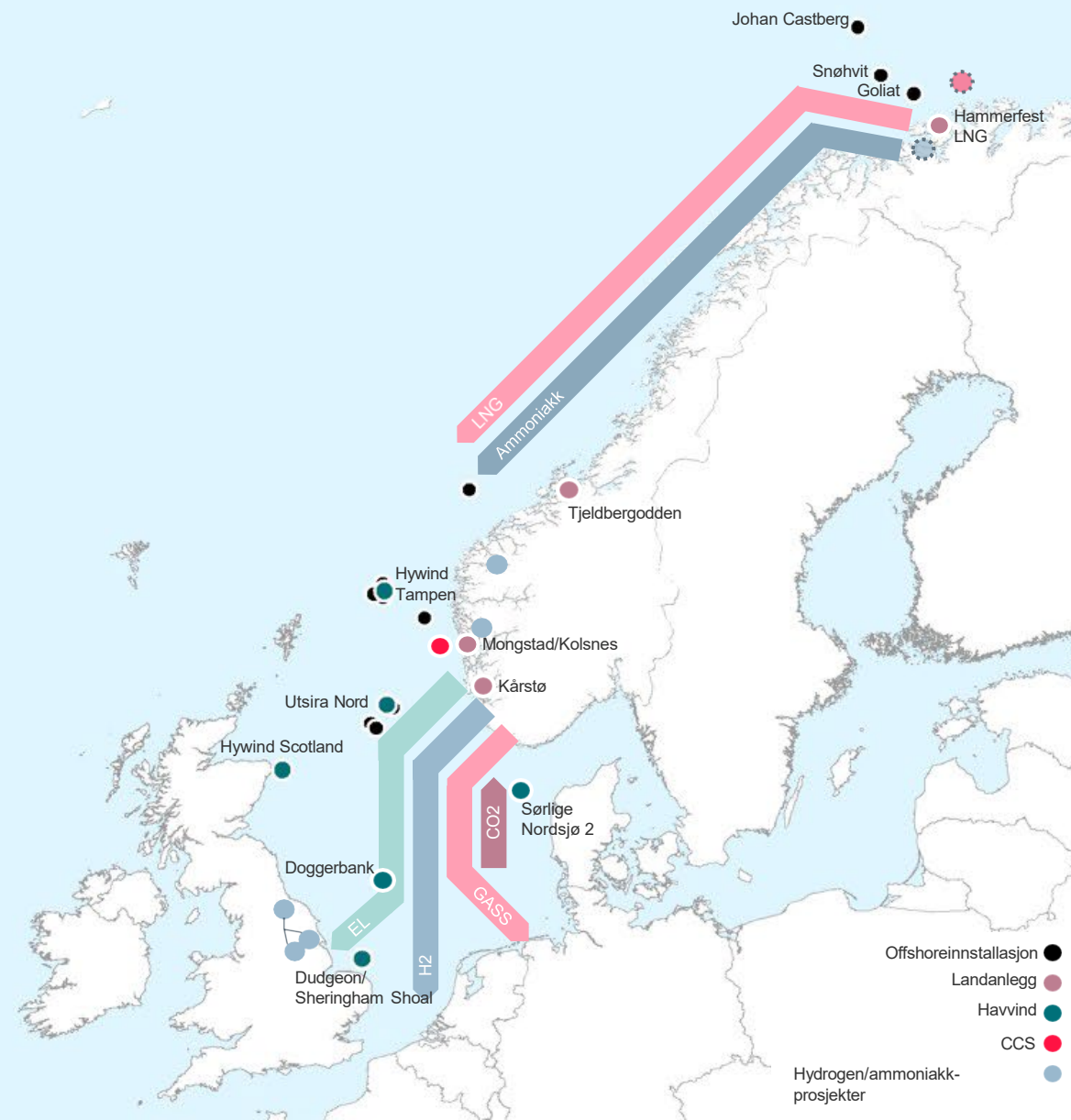
**50-100**  
kboe/d  
Export LNG

**6,5**  
GW  
Bottom fixed

**3,5**  
GW  
Floating

**40**  
Million tons/år  
CCS storage capacity

**2**  
GW  
Hydrogen



# Enhanced Norwegian German Energy Cooperation

Signing Troll Gas Sales agreement in 1986









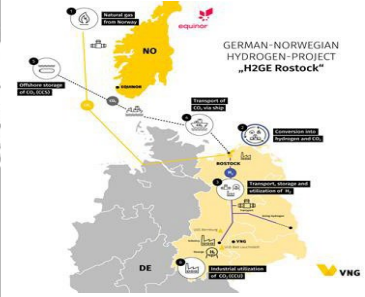

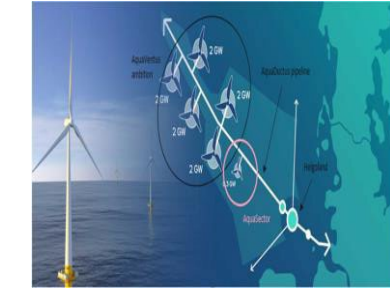

Signing Energy partnership 2050 in 2022?



## What we need is three-fold:

1. **Long-term security of demand** to underpin multibillion Euro investments: willing and able buyers of low carbon hydrogen and CO2 services.
2. **A regulatory framework** within and between countries **that gives predictability for investors** in industrial scale hydrogen and CO2 systems.
3. **Industrial investment partners with a long-term perspective** and **aligned incentives along value chains**.

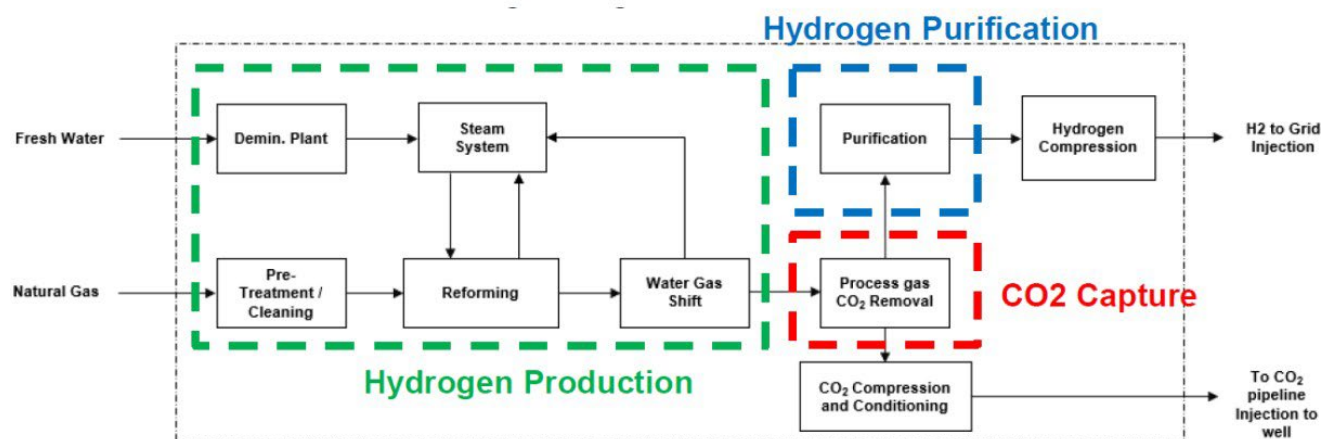
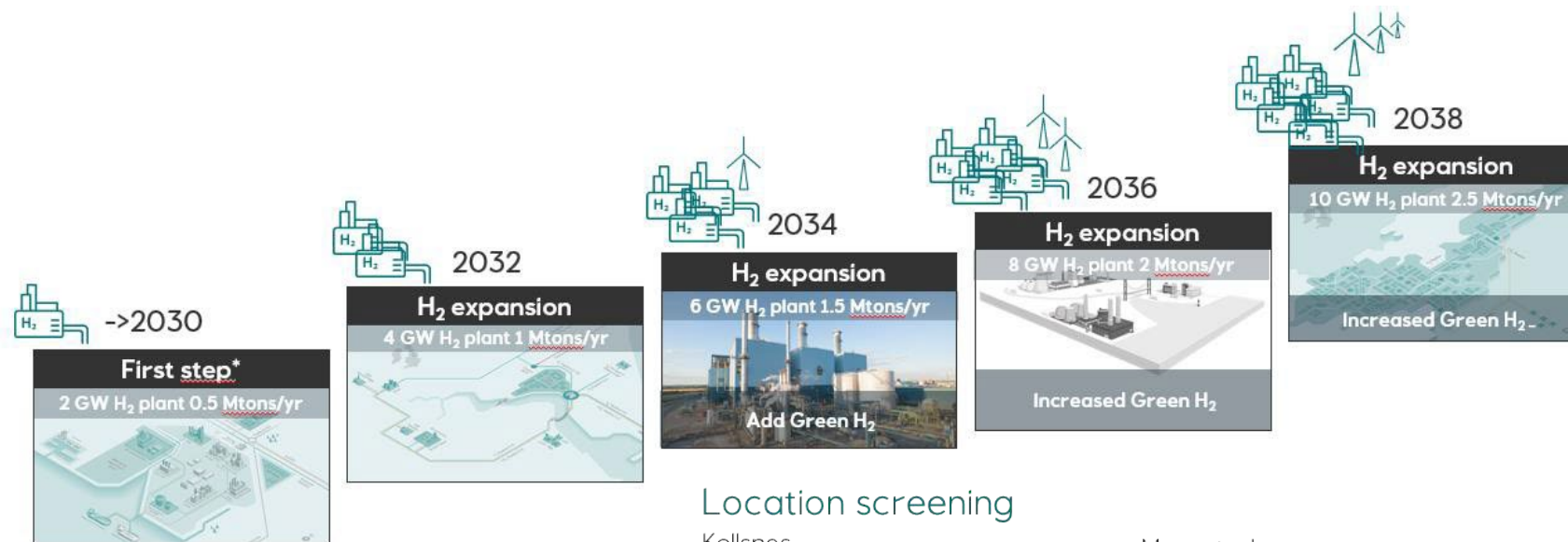
# A broad pipeline of H<sub>2</sub> projects targeting to supply Europe

 <b>H2M Eemshaven</b>	 <b>H2BE</b>	 <b>H2GE</b>	 <b>Clean H2 to Europe</b>	 <b>AquaSector</b>	 <b>NorthH2</b>
					
<p>Low-carbon H<sub>2</sub> from natural gas for hard-to abate industry and power.</p>	<p>Low-carbon H<sub>2</sub> from natural gas for hard-to abate industry and power.</p>	<p>Low-carbon H<sub>2</sub> from natural gas for hard-to abate industry and power</p>	<p>Large scale low-carbon H<sub>2</sub> production from NCS gas</p>	<p>H<sub>2</sub> production from offshore wind.</p>	<p>H<sub>2</sub> production from offshore wind.</p>
<p>Transport to off-takers by pipeline.</p>	<p>Transport to off-takers by pipeline.</p>	<p>Transport to off-takers by pipeline.</p>	<p>Transported via pipeline to continental Europe and off-takers</p>	<p>Transported via pipeline to continental Europe and off-takers.</p>	<p>Transported to off-takers by pipeline.</p>



# CHE low carbon hydrogen production plant (West coast Norway)

- Ambition 2.5 million tons (100 TWh) of low-carbon hydrogen p.a.
- FID Phase 1 2026/start up 2030
- Up to 20 million tons CO2 stored p.a.
- Feasibility ongoing



## Location screening



# Two PCI projects being developed to enable large scale CCS and H<sub>2</sub>

## CO<sub>2</sub> Import Pipelines



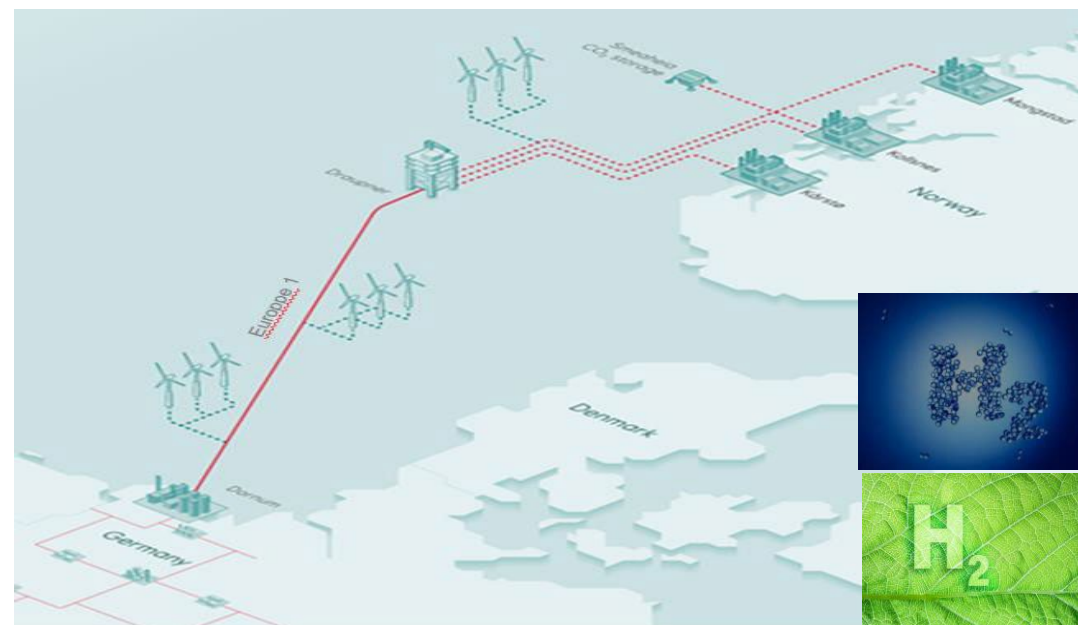
CO<sub>2</sub> imports from industrial emitters and hydrogen plants in Germany, Belgium, and also France, Netherlands and Baltics.

New pipelines, may later consider repurposed gas pipelines

PCI application in development, connecting with CO<sub>2</sub> large emitters / hubs hubs / backbones

Built for future expansion

## H<sub>2</sub> Export Pipeline



Low-carbon H<sub>2</sub> from natural gas produced in Norway serving industrial off-takers in GER/ NWE.

New or partly new and partly repurposed natural gas pipeline. Feasibility study with Gassco.

PCI process initiated seeking to connect with the EU Hydrogen Backbone.

Built for future expansion and tie-in of H<sub>2</sub> from offshore wind along route.