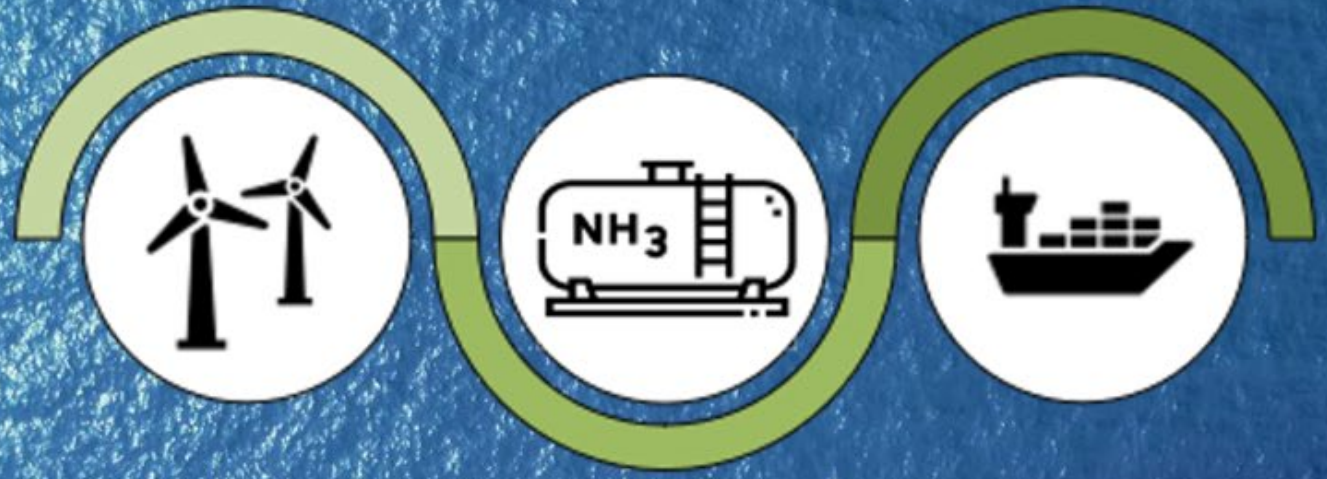


Danish Pilot Study on Ammonia

Mapping of barriers in the HØST PtX project

Presented by:

Dr. Frank Stuer-Lauridsen

10 April 2025

North Sea's Energy Potential

- Denmark can become a net exporter of offshore wind energy with a capacity of 25-35 GW in the Danish North Sea by 2050
- PtX plants can stabilise electricity prices and support the expansion of renewable energy in Denmark's expected 35 GW offshore wind build-out

31 PtX projects

- **18** Hydrogen
- **10** Methanol
- **3** Ammonia

HØST in Esbjerg

- Located in the Måde Industrial Area near the Port of Esbjerg
- A facility to cover 30 hectares and produce around 100,000 tonnes of green hydrogen annually
- The hydrogen can be converted into 600,000 tonnes of green ammonia
- Permitting envelope of up to 1GW installed electrolyser capacity
- Capital investment exceeding 2 billion EUR

Providing green ammonia to shipping in Esbjerg

Pilot project stakeholders

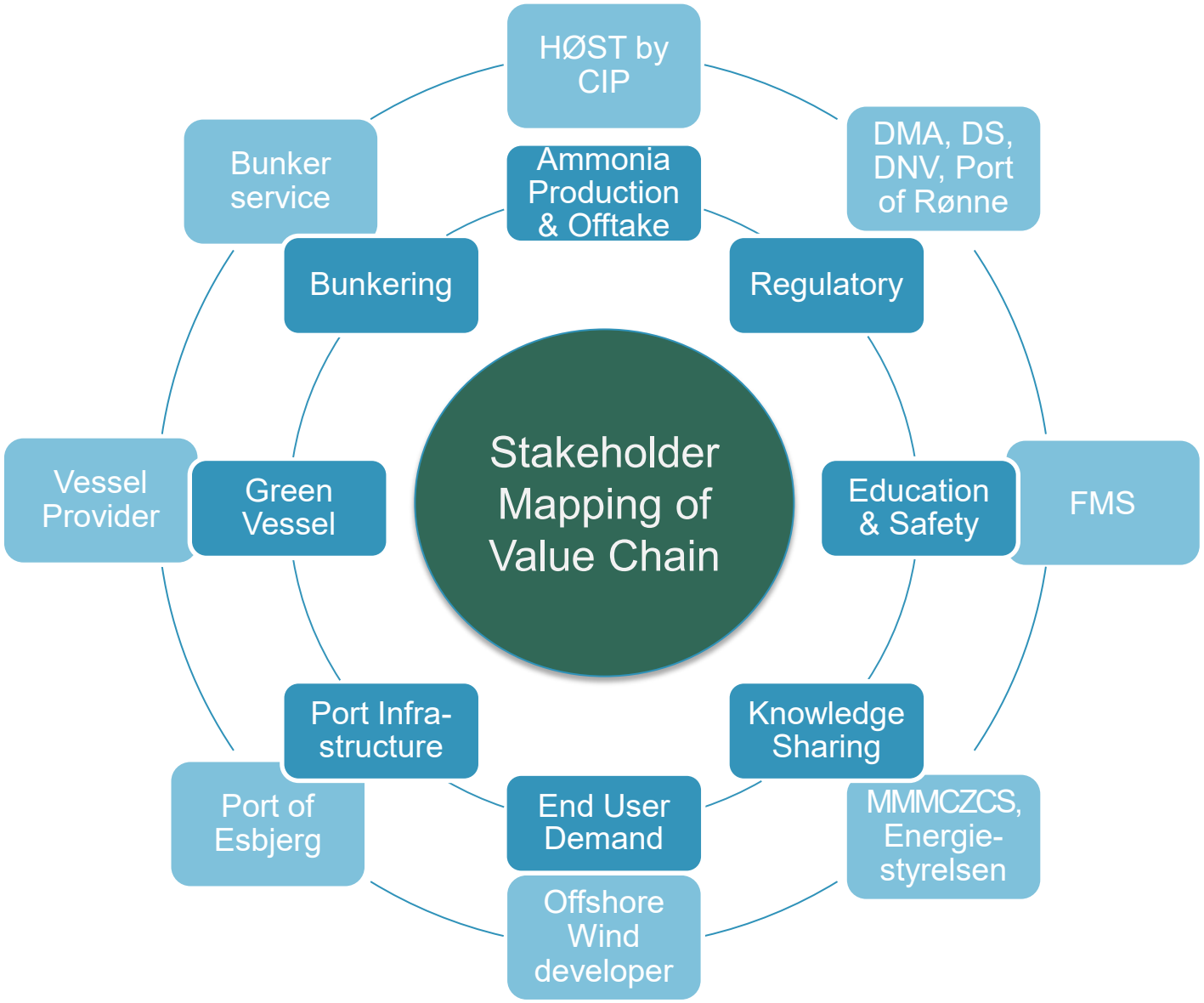
HØST by CIP

Danish port **Port of Esbjerg**

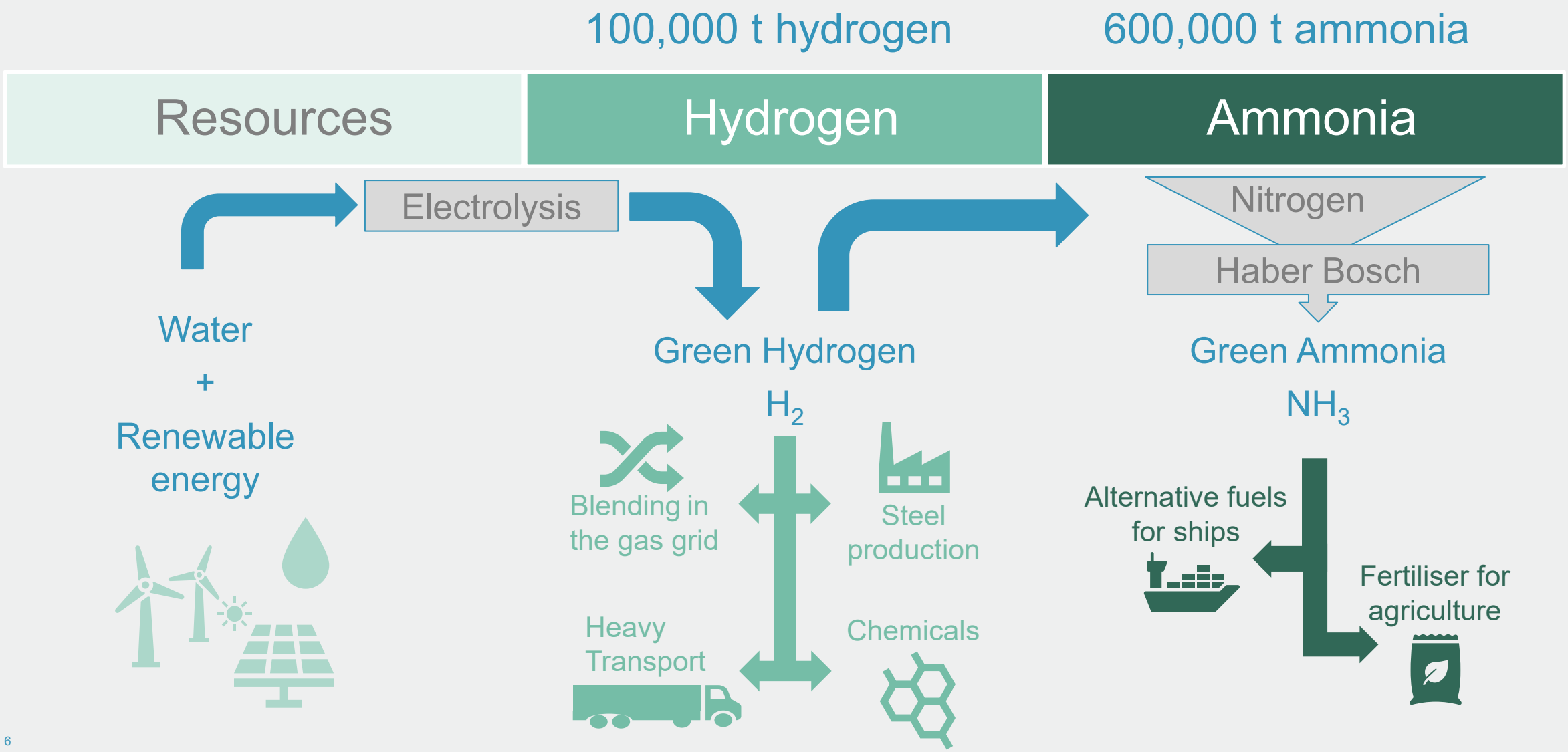
Bunkering company **Monjasa**

Danish Shipowner and short sea RoRo operator **DFDS**

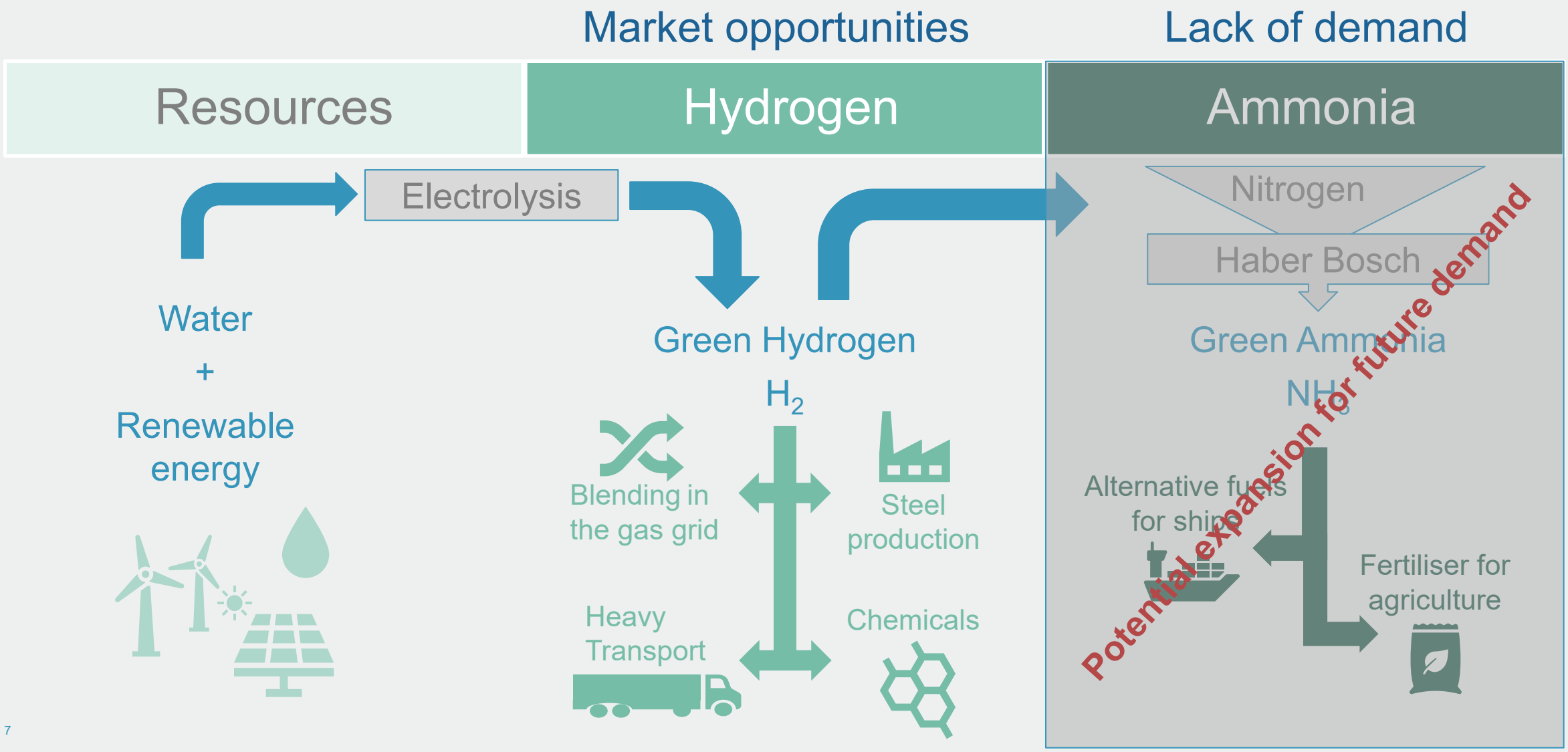
Short sea container feederline operator **Unifeeder**



HØST in planning



HØST now


Market opportunities
Lack of demand
Resources
Hydrogen
Ammonia
Electrolysis
Water
+
Renewable energy
Green Hydrogen
H_2
Blending in the gas grid
Steel production
Heavy Transport
Chemicals
Nitrogen
Haber Bosch
Green Ammonia
NH_3
Alternative fuels for ship
Fertiliser for agriculture
Potential expansion for future demand

Main Barriers

Demand and cost

Energy cost/ competitive pricing

Political decisions

Long-term offtake agreements

Technology and safety

Ammonia supply chain safety requirements

Technical maturity

Public perception

Fuel availability

No existing supply chain

Infrastructure

Misalignment

Actions to overcome barriers

Collaborative Cost and Risk Management Tools

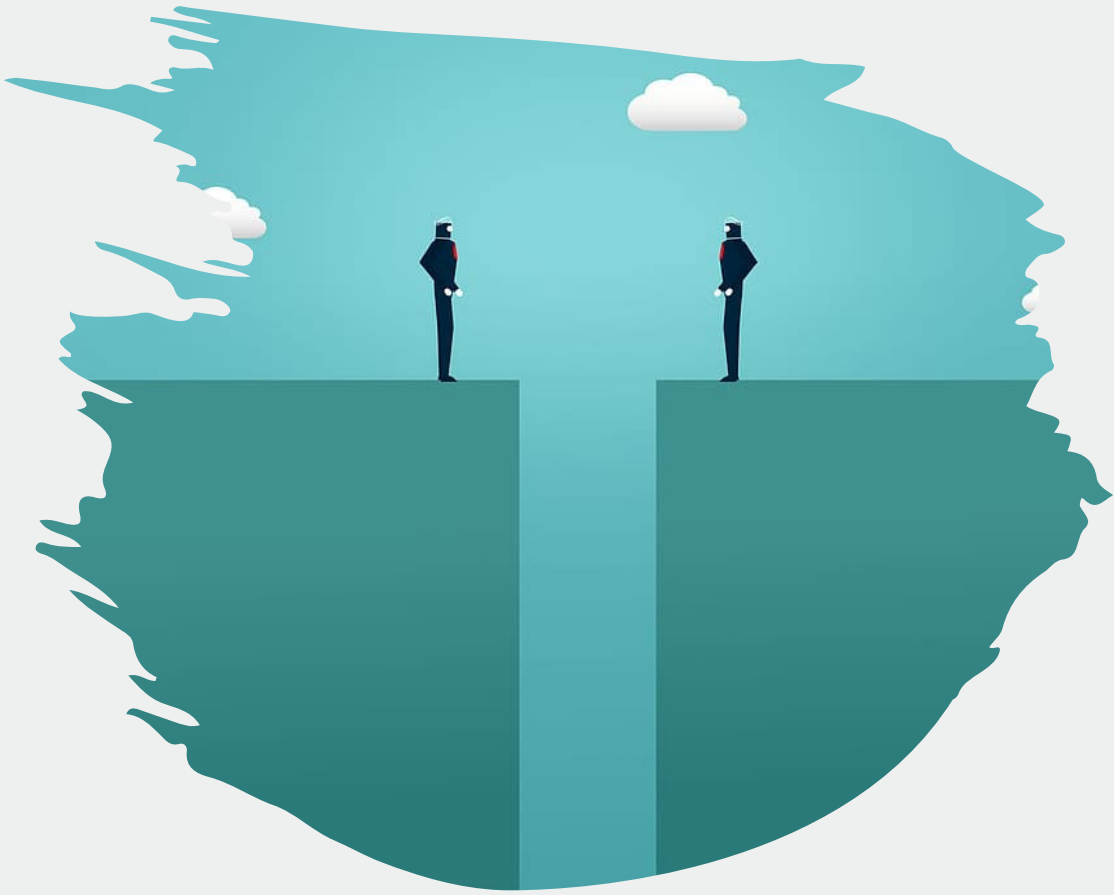
- Procurement policies
- Green financing
- Cover price gap on OPEX for duration

Developing a Shared Framework

- Unified approach to safety standards
- Promotion of infrastructure
- Standardized GHG emissions tracking

Alignment of stakeholders

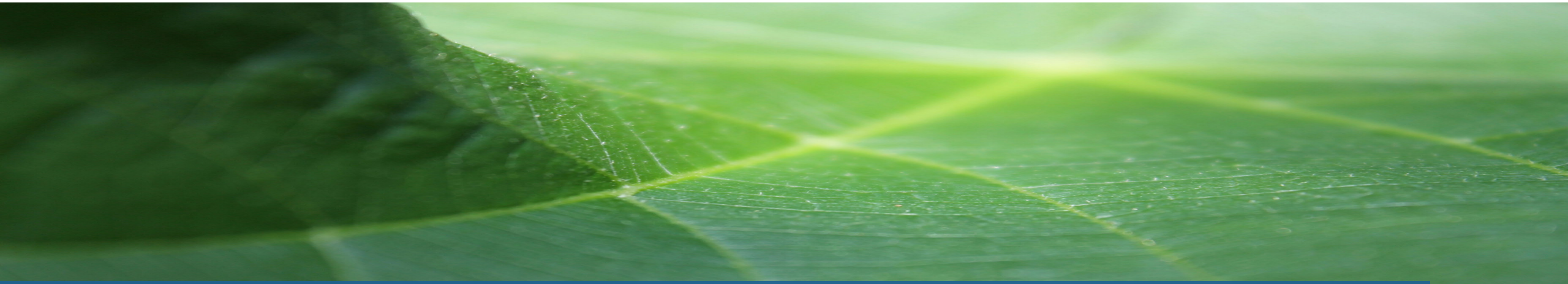
- Structure incentives
- Funding
- Recognition to reward alignment with common goals



Route and fuel green corridor work going forward

- **Green transport DK-U**K: Arla, Danish Crown, DFDS and DSV develop climate-neutral food transports from Denmark to the UK (net zero) by 2030
- **Hydrogen fuelled vessel Esbjerg-Immingham:** H2 Energy and DFDS completed a technical and operational feasibility study of hydrogen propulsion system for DFDS cargo (Ro-Ro) vessel *Magnolia Seaways* on the Esbjerg-Immingham-Esbjerg route
- **DFDS ammonia driven route:** The Sweden-Belgium green corridor is initiated by DFDS and the ports of Gothenburg, Antwerp-Bruges, and North Sea Port.
- **Ammonia fuelled-fuelled vessels:** CIP, through its Energy Transition Fund, has signed MOUs to develop ammonia-fuelled carriers.
- **Ammonia engine:** MAN Energy Solutions began full-scale engine testing in November 2024

- Ensure predictabilty in market related to green electricity
- Establish frameworks regarding regulatory and planning issues
- Work toward a competive and level playing field
- Funding mechanisms should also address OPEX price gap
- Green corridors with open tenders are a suitable mechanism to align all interests



Thank you

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LITEHAUZ

Nordic Roadmap
Future Fuels for Shipping

HØST PTX ESBJERG — Pilot study owner

DFDS — Pilot study participant

UNIFEEDER — Pilot study participant

CIP Copenhagen Infrastructure Partners — HØST PtX project owner

PORT ESBJERG — Pilot study participant

MONJASA — Pilot study participant

YARA — Extended pilot participant

PORT OF GOTHENBURG — Extended pilot participant

DANISH MARITIME AUTHORITY — Extended pilot participant

MAN Energy Solutions — Extended pilot participant

BIRR — Extended pilot participant