



Green Inland Shipping Event
Brussels, 16 October 2019

Richard Klatten

Our Vision

A zero-emissions shipping world by 2040



2040: Zero-emissions shipping

When is the goal possible?

Technology

Renewables based, 0-emissions ship propulsion technology is commercially and financially viable. Hydrogen based fuels play a major role in the future of shipping.



Infrastructure

The ecosystem to support 0-emissions ship propulsion technologies is fully developed, accessible, and easy to use.



Awareness & demand

There is global acknowledgement of the need to reduce the environmental impact of shipping.



Macroeconomic & political environment

The zeitgeist is in sync with our goals and ambitions, and macro-economic and political trends are riding the same waves.



Favourable outcomes

Market Entry

Disruptive technologies rapidly reach commercial readiness. 'Proven technologies' have access to capital to scale. Attractive business cases spur shipping companies to go fossil fuel free.

Knowledge Development

Know-how is available to enable commercial use of hydrogen based fuels for propulsion of ocean-going vessels. New and more effective technologies are constantly being developed.

Industry leadership

Influential coalitions disrupt the status quo and efficient networks that enable 0-emissions shipping are established. Logistics value chains are redefined.

Research and Development

New techniques and markets for the long-term are continuously developed. Research to pre-test lab scale technologies and develop them for commercial applications is facilitated globally.

Global stakeholders

Global stakeholder awareness and interest in the fossil-free shipping is high. Wide recognition of the economic opportunities offered by sustainable shipping.

Consumers

Global (end-) consumer awareness and demand for sustainable logistics chains. Recognition of the positive impact that sustainable shipping would make possible.

Political climate

Countries across the world are in favour of transforming into sustainable economies. Shipping's 'fair share' of emissions is quantified and widely accepted.

Economic incentives

Subsidies for R&D, loans, tax benefits, emissions pricing accelerate the transition of the maritime industry to 0-emissions.

Legislation & regulation

Allows for transformation of the energy supply network & adoption of hydrogen technologies with required infrastructure.

Disruptive global happenings

Unexpected events and developments (like Fukushima), technology advancements like 3D-printing, blockchain and renewables reaching grid parity.

Activities

FPS B.V.



STICHTING DURZAM TRANSPORT

FPS' efforts can be accelerated or hindered by global developments in the above areas.

FPS' work would create momentum to change regulation and influence key decision makers.

Potential partners



Partnerships with key players in different sectors and areas

We created a Theory of Change to help us identify the measures that will enable us to reach our goal.

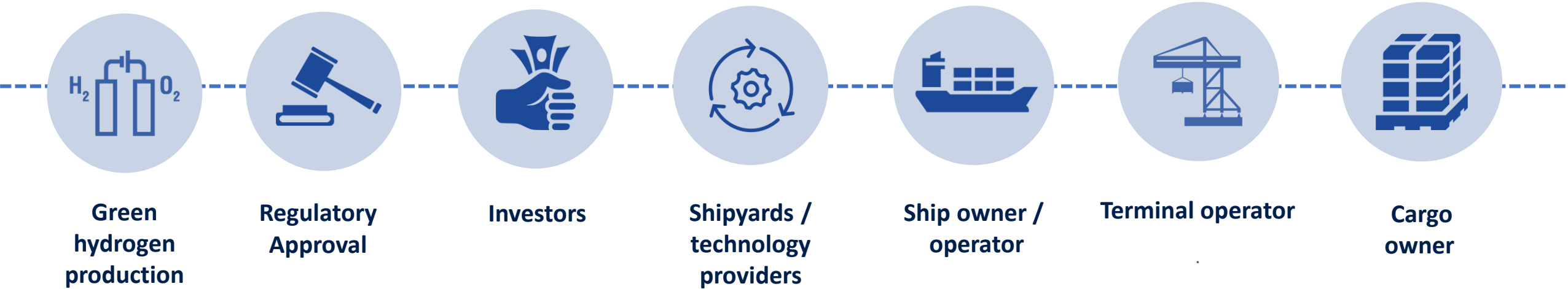
Our Mission

We will contribute to a future proof shipping world by creating new waterborne value chains to make the industry free of fossil-fuels and harmful emissions.



Future Proof Shipping BV is a network organisation that provides zero-emissions marine transportation solutions.

Value chain



We offer zero-emissions waterborne transportation solutions



Advisory

An integrated services offering comprising technical, financial and commercial services tailored to the specific needs of our customers.



Project Development

Development of zero-emissions shipping projects and their end-to-end management.



Tonnage Provider

Zero-emissions vessels for charter.

Our first project:
Zero-emissions inland container vessel

2020: Retrofit existing inland vessel with fuel cells



Concept drawing





- 110*11,45m container vessel
- 635 kW installed fuel cell capacity, propulsion and auxiliary power
- 300 kWh Lithium ion battery pack for peak shaving, emergency and bridging power
- 750V DC bus bar, e-motor for propulsion

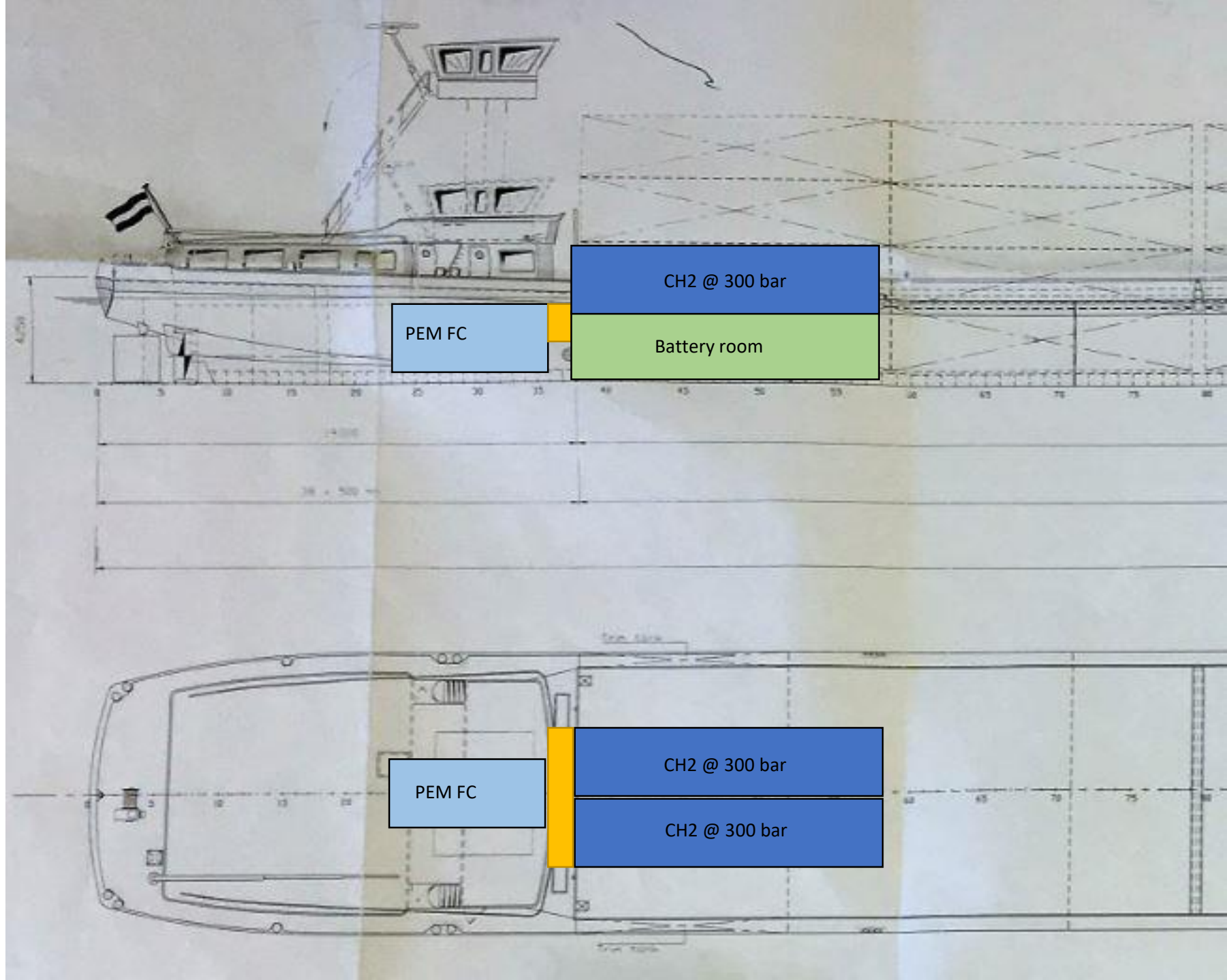
This vessel will operate between NL and BE



- Between ports of **Rotterdam** and **Meerhout**
- Distance: **404 km** (round trip)
- Average sailing time: **34 hours**
- Hydrogen container swap @ **Rotterdam**
- Hydrogen usage per roundtrip - **1160kg**
- Class: **Lloyd's Register**
- Require exemption from **CCNR**

System placement

-  40' CH2 300 bar
-  PEM FC system
-  Connection area
-  Battery room



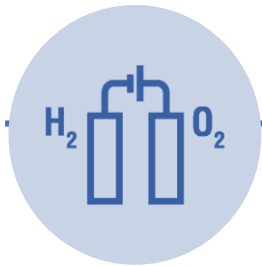
We will accelerate solutions to current challenges to (green) hydrogen use in shipping



Fuel cell and hydrogen technology has been proven in other industries and at a smaller scale in shipping. Applying it in a commercially operating vessel requires solving systemic issues:

- **Infrastructure:** refuelling, distribution and storage(on-board and on-shore) infrastructure
- **Technology:** balancing energy needs, cost and operational aspects; long-term supply of **green hydrogen**
- **Cost efficiency:** optimizing operations and planning
- **Regulation:** no adequate regulations in place yet

We're tackling the entire value chain



Green hydrogen production

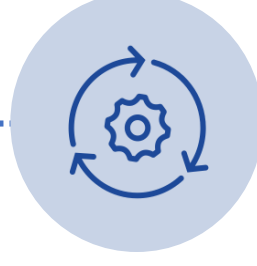


Regulatory Approval



Investors

Vessel privately funded.
Combination of different funding sources for the technology.

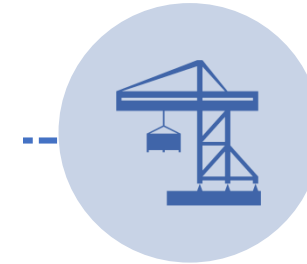


Shipyards / technology providers

RFP process ongoing.
Will make a final decision during the profiling phase.



Ship owner / operator



Terminal operator

Long-term charter agreement in discussion; working in collaboration with the cargo-owner.



Cargo owner

Long-term charter agreement in discussion with a large cargo owner in the lifestyle goods segment.



Timeline

Preparation

Ongoing

Vessel purchase completed before 30 September 2019.

Official project 'launch' on World Hydrogen Day – 8 October 2019.

Profiling

**Start
November 2019**

Retrofit

**Expected
October - December 2020**

Hydrogen Ops

**Expected start
January 2021**

What's next?

We are navigating towards..

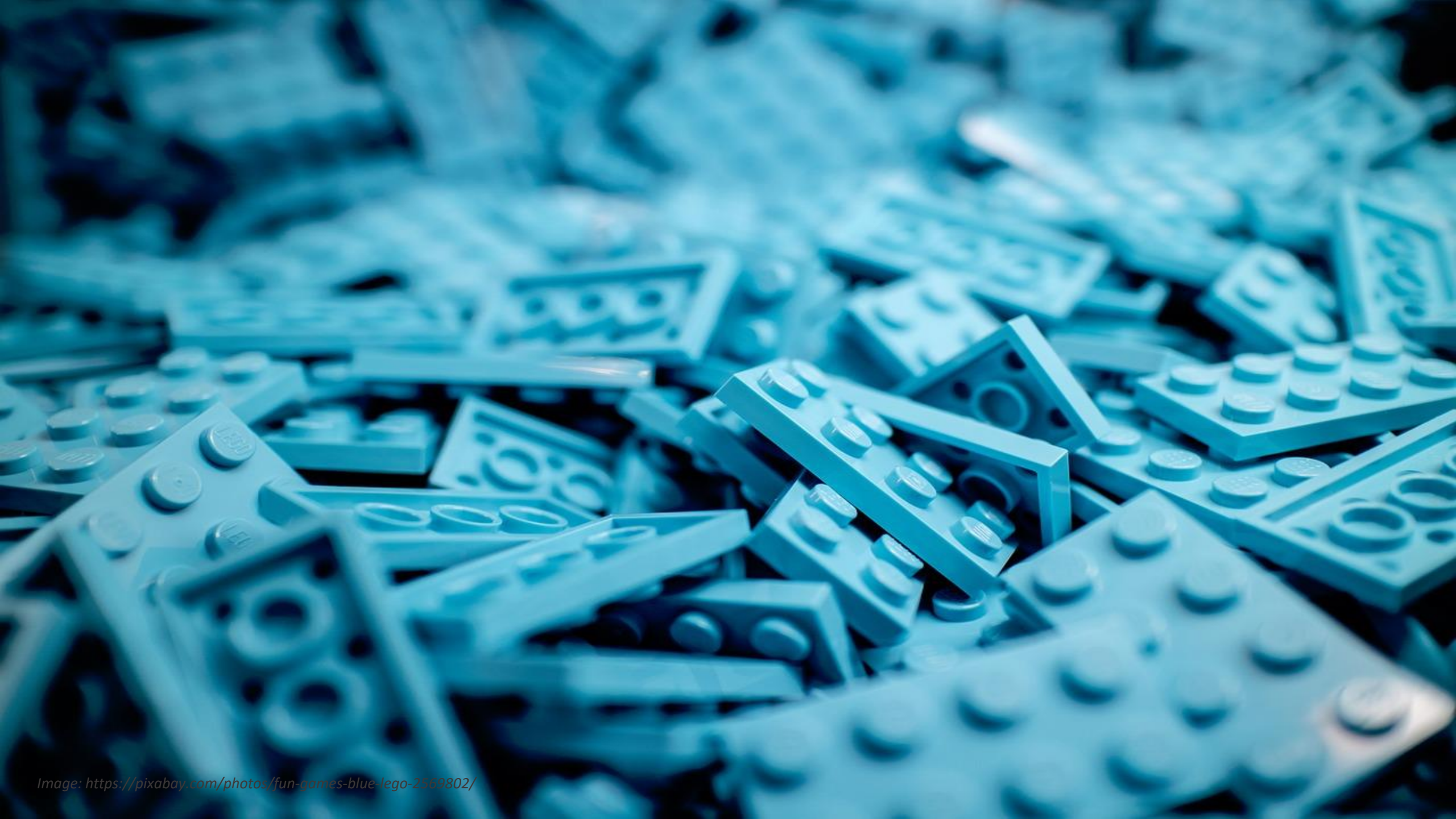
- 6 zero-emissions inland vessels**
- 2 zero-emissions short-sea vessels**
- 2 zero-emissions ocean-going vessels**

Lessons learned (so far)





Image: [https://commons.wikimedia.org/wiki/File:Falcon_Heavy_Side_Boosters_landing_on_LZ1_and_LZ2_-_2018_\(25254688767\).jpg#file](https://commons.wikimedia.org/wiki/File:Falcon_Heavy_Side_Boosters_landing_on_LZ1_and_LZ2_-_2018_(25254688767).jpg#file)





Images: https://de.wikipedia.org/wiki/Dotiel:ENERGY_OBSERVER_J%C3%89R%C3%89MY_BIDON.png
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Let's define shipping's new normal together!

futureproofshipping.com

Richard Klatten

CEO

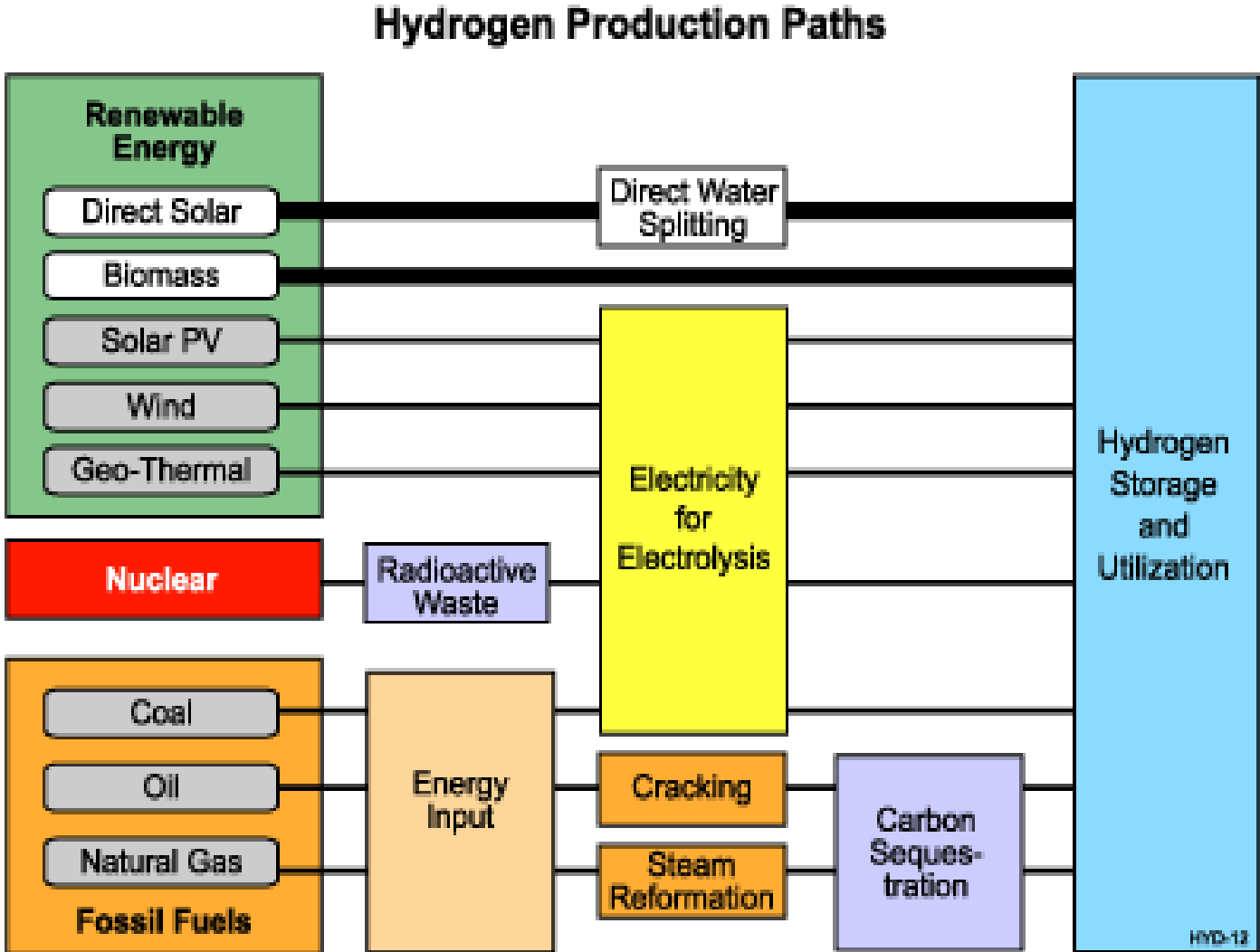
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Future Proof Shipping

Hydrogen is a flexible energy carrier

- Hydrogen can be produced from multiple sources.
- The environmental footprint of the hydrogen depends on the production pathway.
- Hydrogen can be stored in different forms (compressed, liquid, solid, etc.) to support different applications and end-uses.

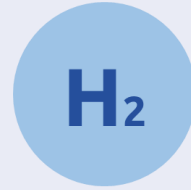


Hydrogen comes in different 'colours'



Green hydrogen

Produced via electrolysis of water, using renewable energy (solar, wind, hydro, geothermal, etc.)



Blue hydrogen

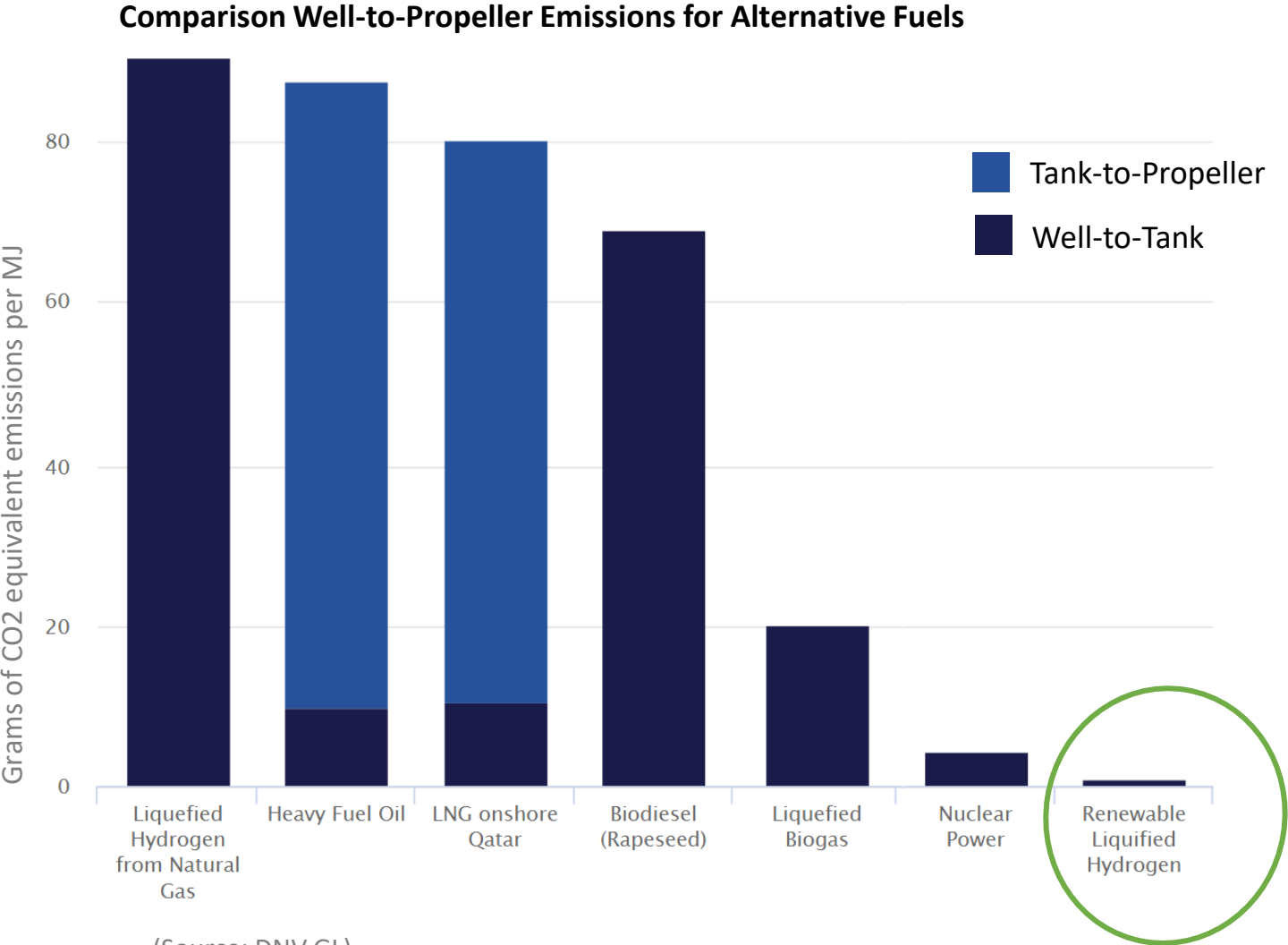
Produced via Steam Methane Reformation (from fossil fuels) with carbon capture.



Grey hydrogen

Produced via Steam Methane Reformation or other methods, from fossil fuels.

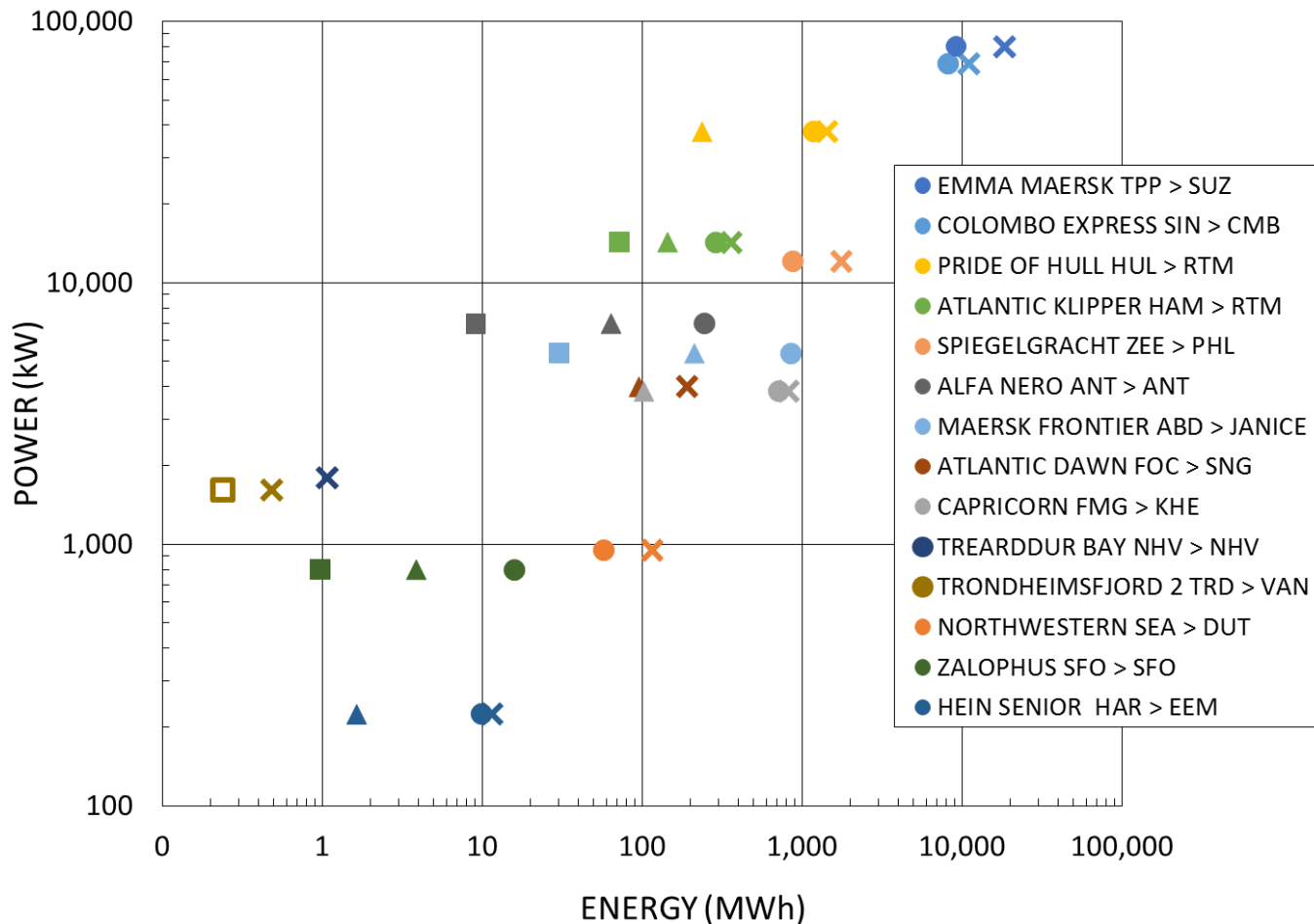
'Green' hydrogen offers a path to zero-emissions shipping



(Source: DNV GL)

- 'Green' refers to hydrogen produced via electrolysis of water using renewable (wind, solar, etc.) energy.
- The greenhouse gas footprint of renewably produced hydrogen is almost zero.

Fuel cells appear to be the most scalable solution for clean ship propulsion



(Source: SANDIA NATIONAL LABS)

- When hydrogen is put through fuel cells, electricity is produced, and water vapour is the only exhaust.
- Fuel cells are silent.
- A recent [study](#) by **Sandia National Labs** (US) found that **fuel cells in combination with liquid hydrogen** is a technical solution that is potentially viable for the largest vessels operational today.

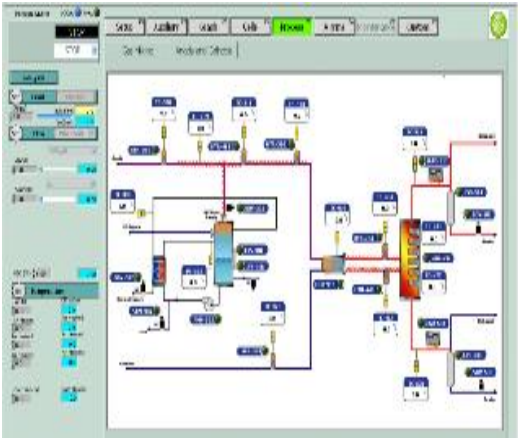
The fuel cell system comprises several components



Fuel cell module



Ultracapacitor / battery



User interface

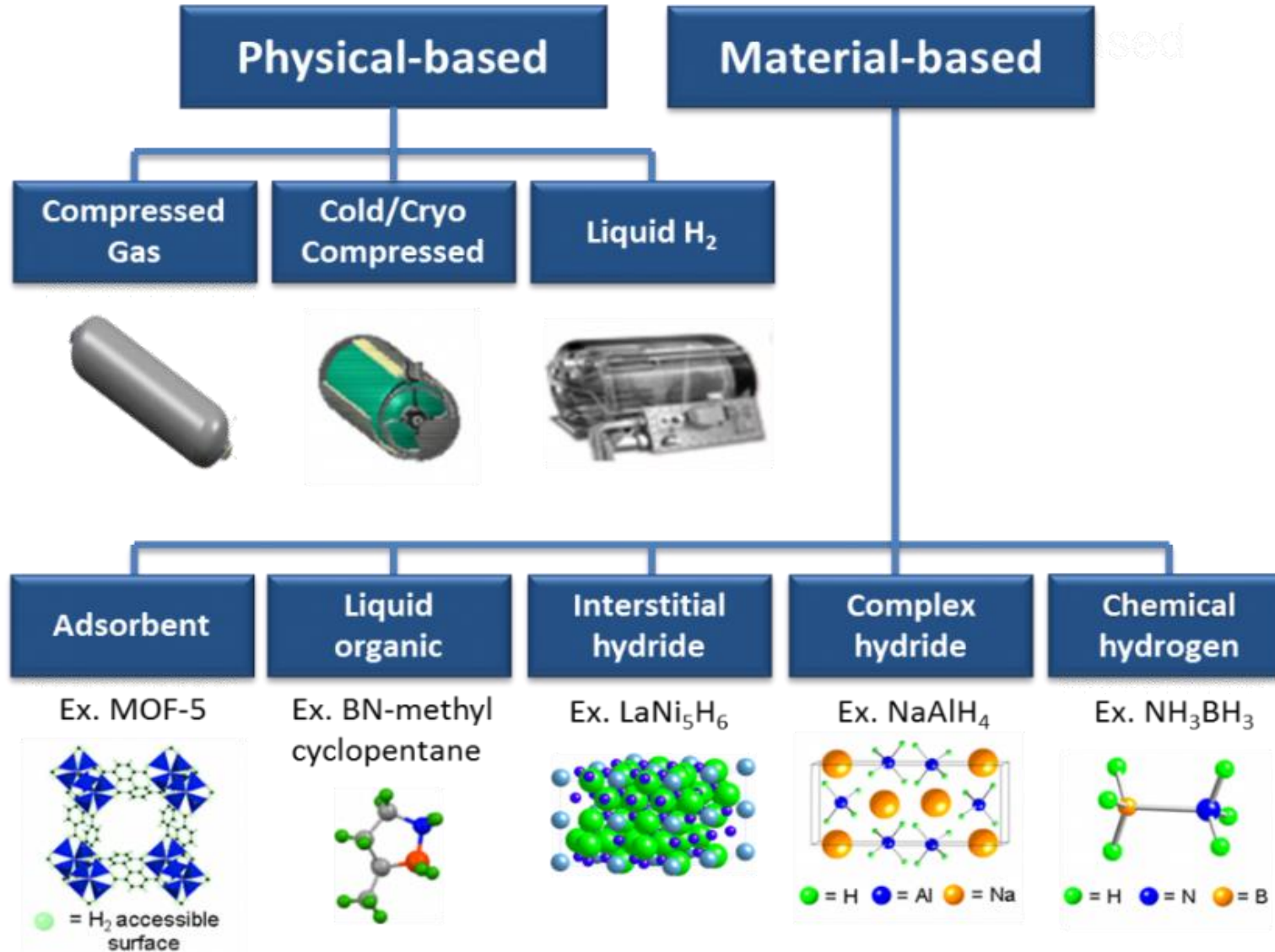


Inverter



Pilot system module

Hydrogen can be stored in several ways



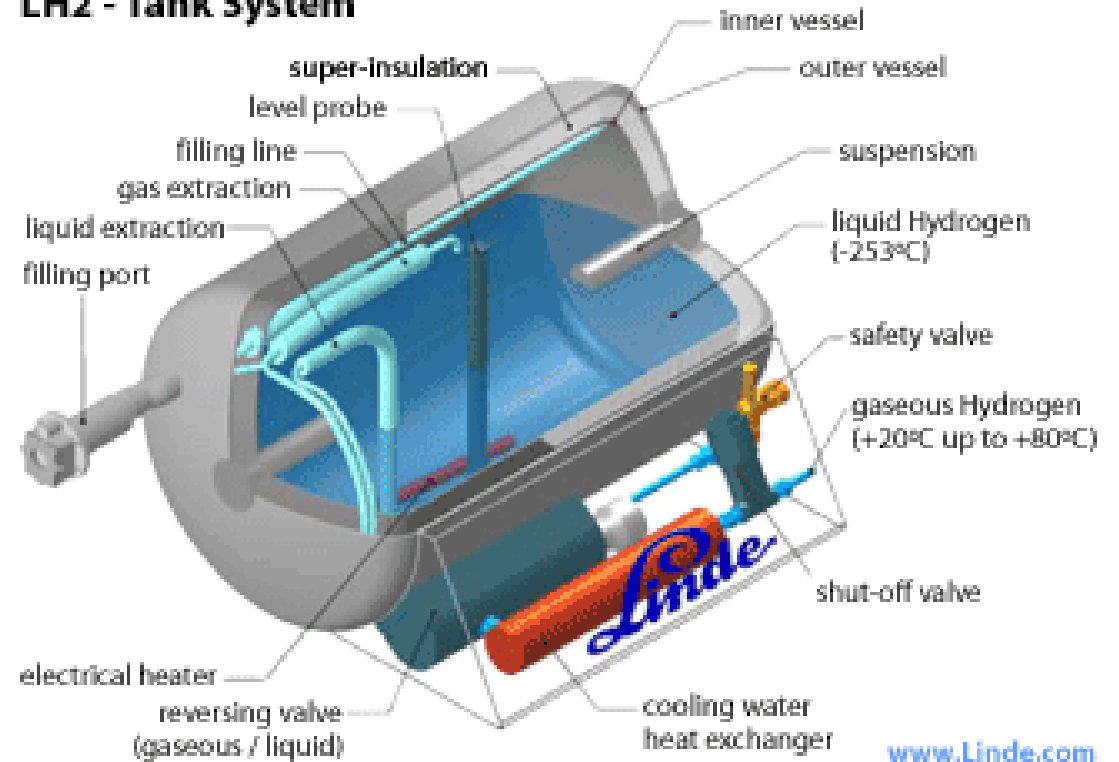
Hydrogen storage and distribution technology is developing rapidly



Kawasaki Compressed Hydrogen Trailer

(Source: <http://global.kawasaki.com/en/hydrogen/>)

LH2 - Tank System



Linde Liquid Hydrogen Tank