



RH2IWER | Renewable Hydrogen² for
Inland Waterway Emission Reduction



Co-funded by
the European Union

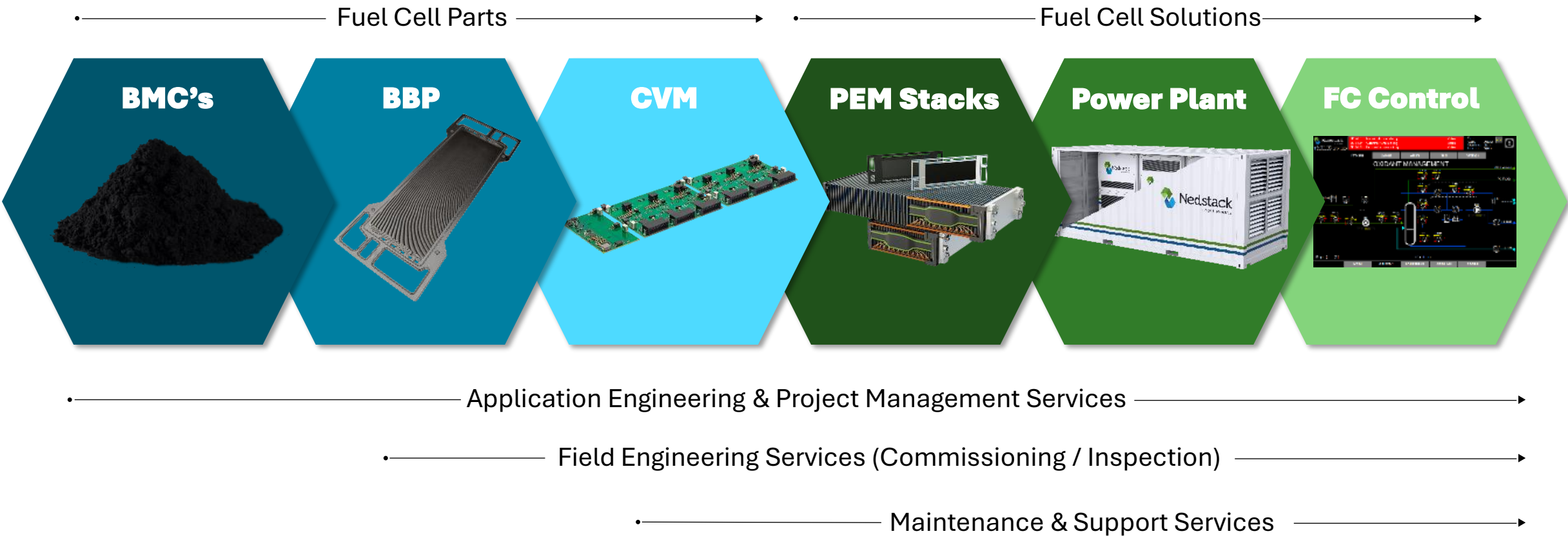
Solutions for zero-emission waterborne mobility: H₂FC solutions and liquid hydrogen transportation

April 14, 2026 – AMON | RH₂IWER Webinar

The project is supported by the Clean Hydrogen Joint Undertaking and its members Hydrogen Europe and Hydrogen Europe Research. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or Clean Hydrogen Joint Undertaking. Neither the European Union nor the granting authority can be held responsible for them.

Technology & Engineering Services Portfolio

PEM Fuel Cell Excellence from Powder-to-Power

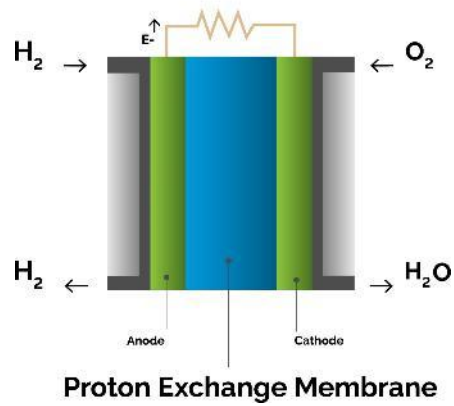


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LT-PEM Fuel Cell Stack Overview

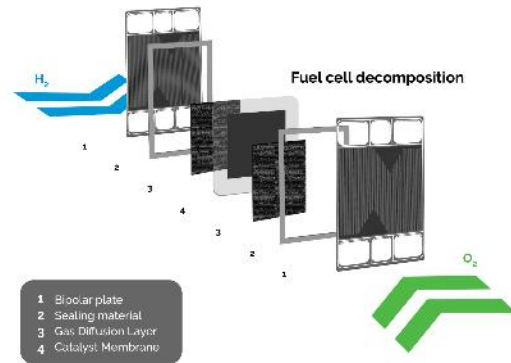
Fuel cell stacks convert hydrogen into electricity, heat and water, without emissions

PEM FC Principle



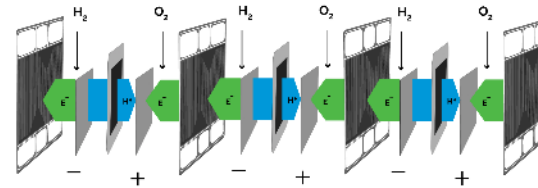
- > Emission free power generation
- > Gaseous Hydrogen (H_2)
- > Oxygen (O_2) from air
- > Produce electricity, heat and water

Fuel Cell Decomposition



- > Inhouse cell plate production
- > Flow fields distribute gases
- > Membrane Electrode Assembly
- > Cell plates are conductive

FC Stack Concept



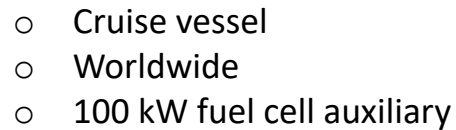
- > Multiple cells are stacked
- > Cells are connected in series
- > A single cell produce > 200A
- > Individual cell voltage < 1VDC

FC Stack Design



- > The stack of fuel cells is enclosed
- > Cell voltage monitoring is included
- > Quick connections for ease of service
- > Spring-loaded

Fuel cell systems are already deployed in both sea-going and inland shipping



- Container vessel
- ARA area
- 900 kW fuel cell propulsion

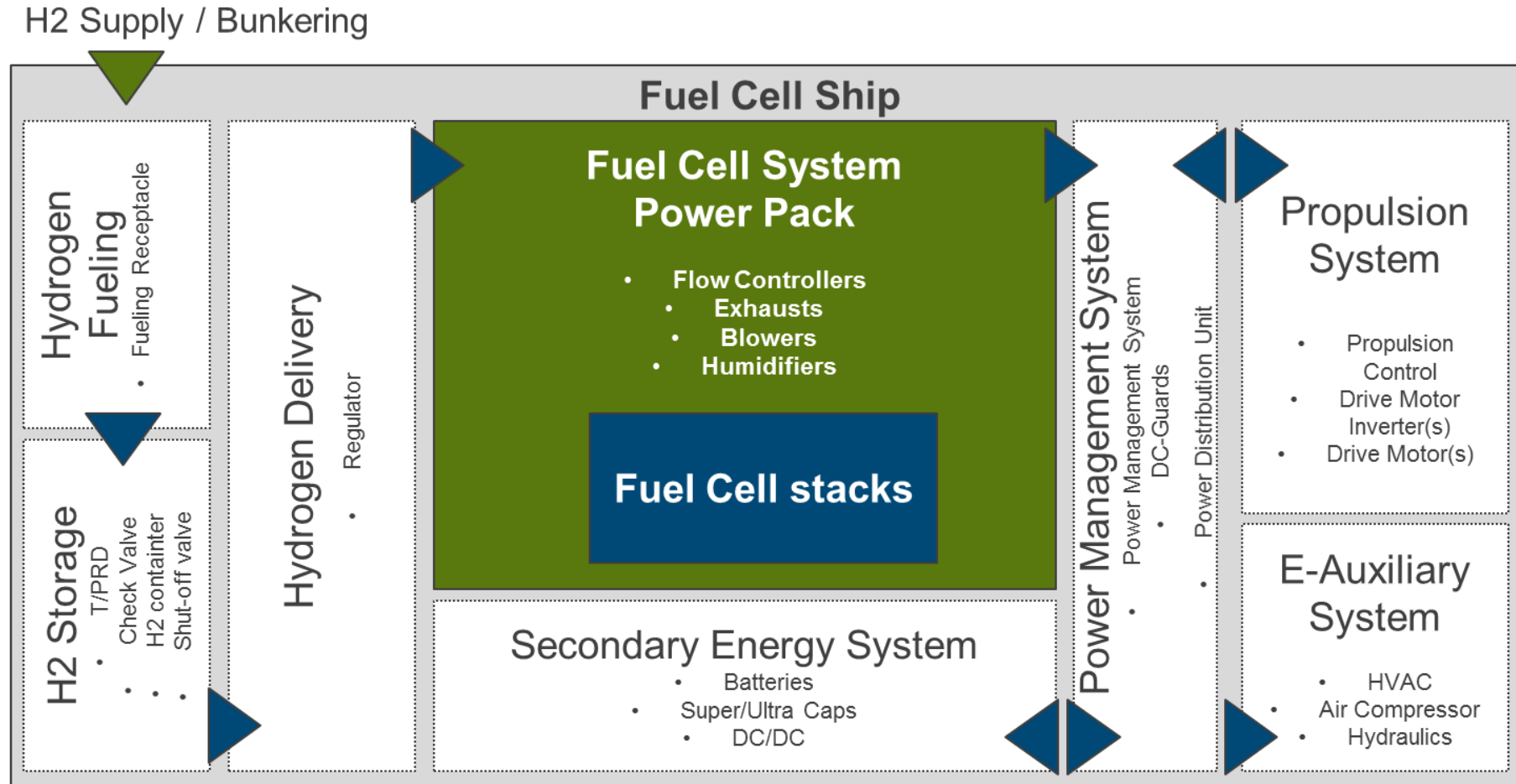
- Dry bulk
- Delfzijl – Rotterdam
- 300 kW fuel cell propulsion



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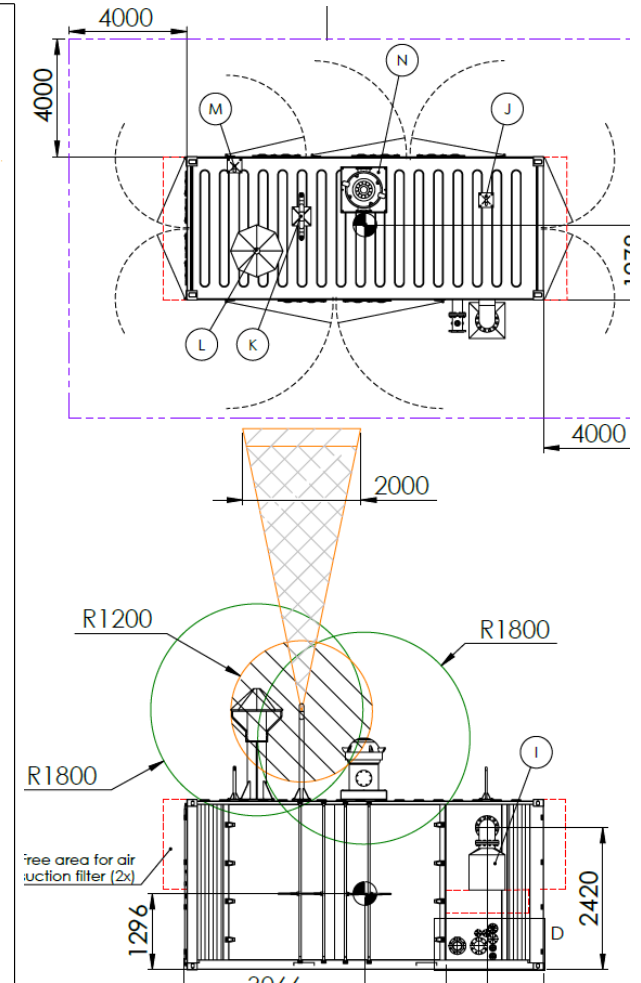
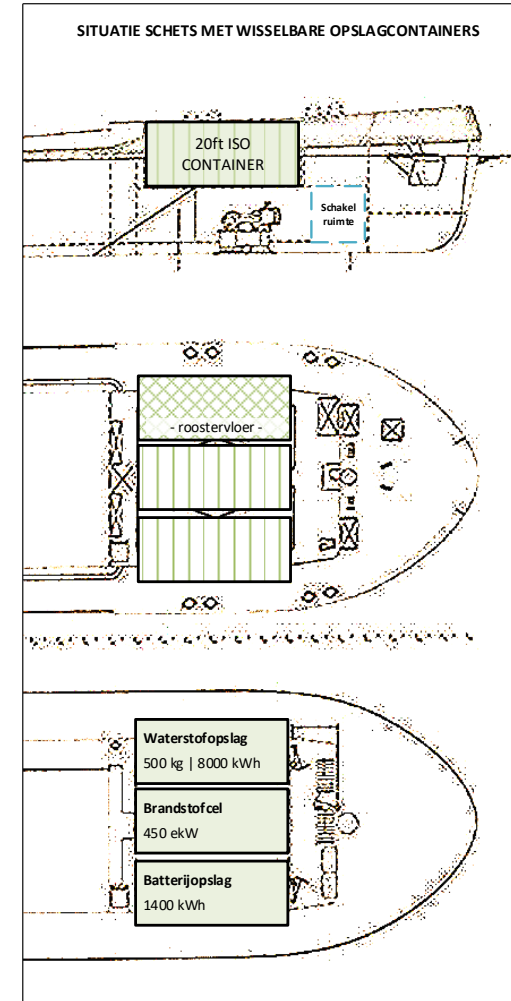
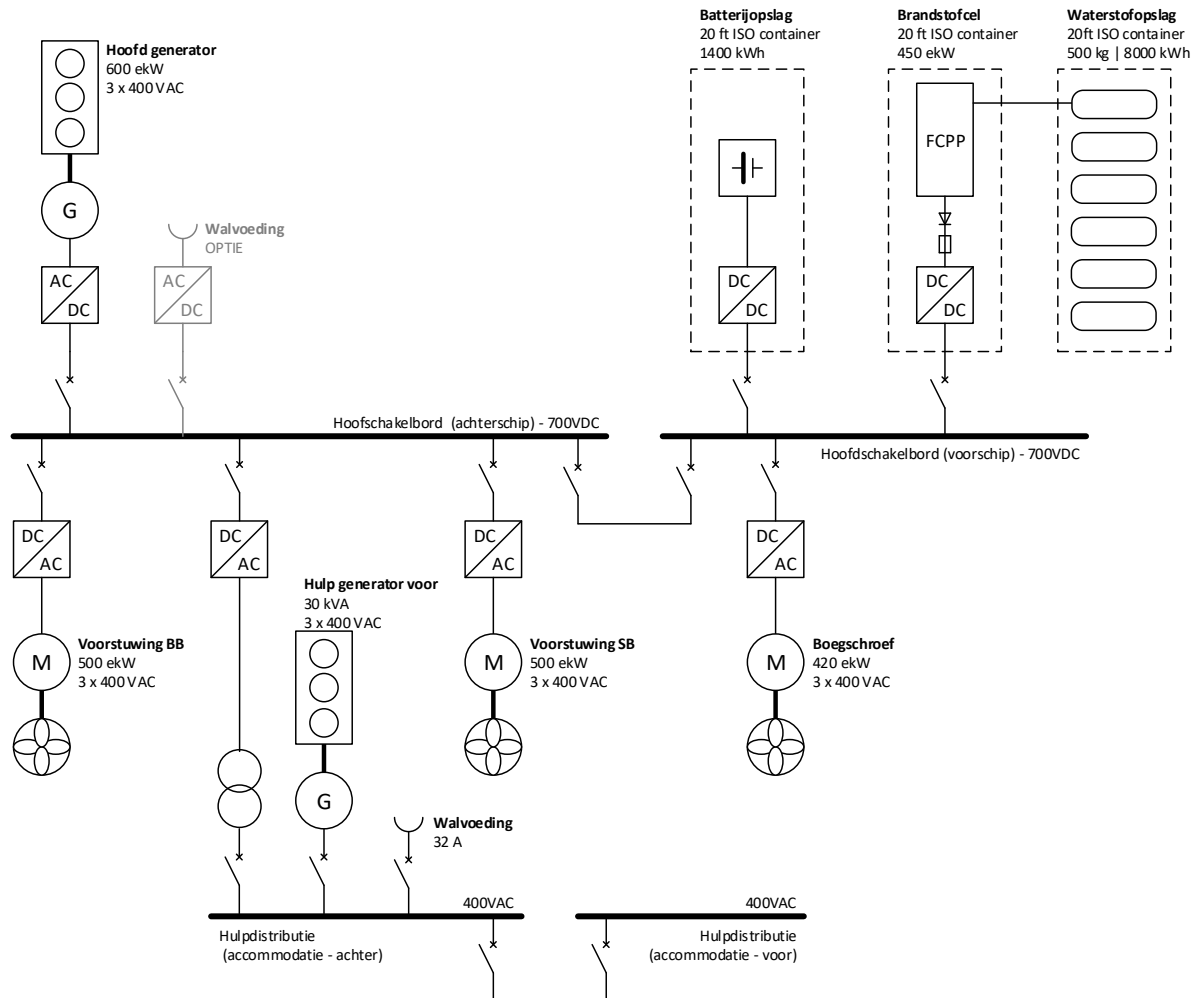
Maritime Hydrogen Fuel Cell Propulsion drive train

The key to hydrogen fuel cell application in shipping is system integration



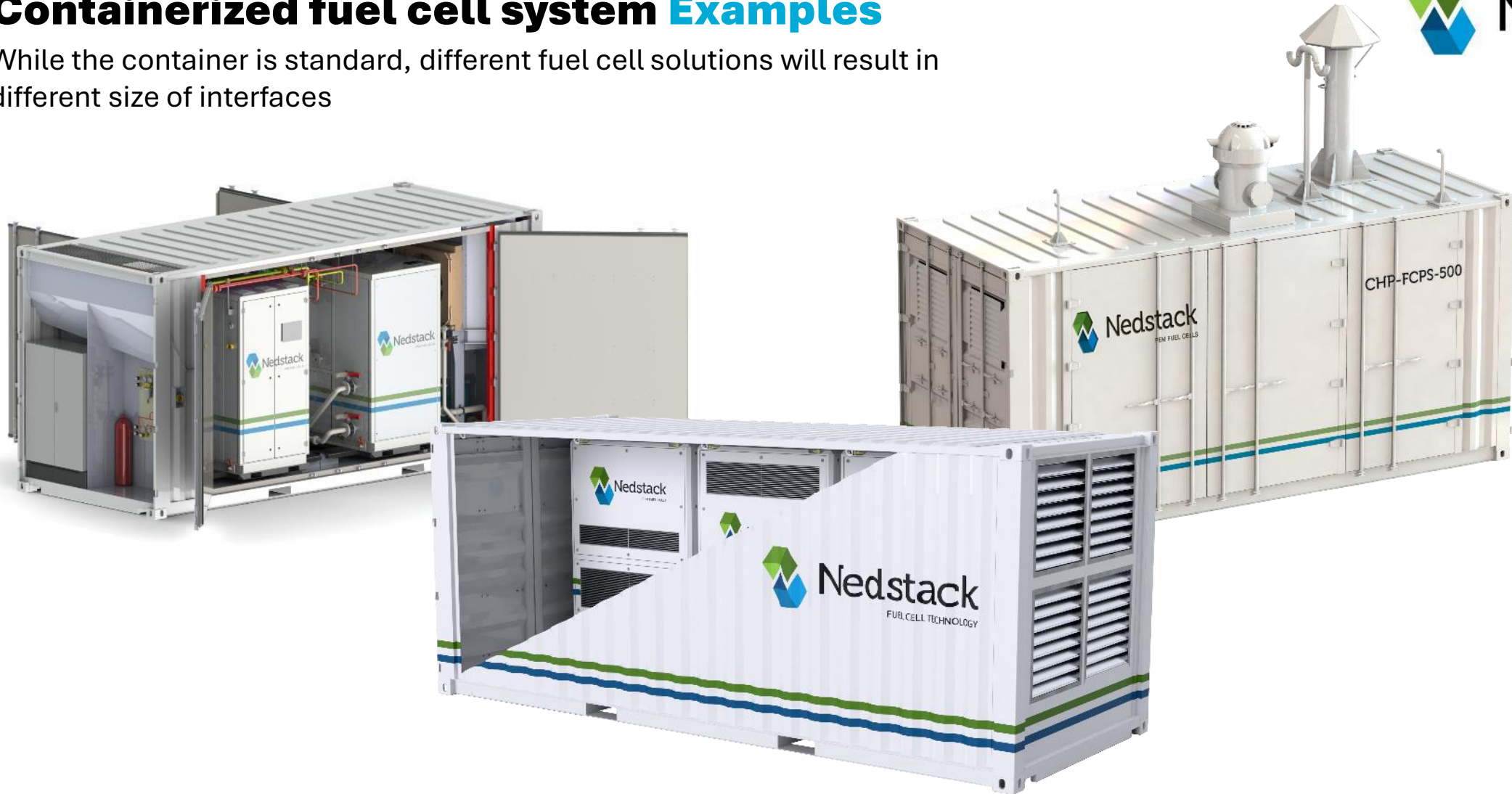
Fuel Cell Power System Standardization

Containerised systems with standard interfaces will reduce costs and complexity



Containerized fuel cell system Examples

While the container is standard, different fuel cell solutions will result in different size of interfaces



Hydrogen Tanktainer Standardization Similarities

The standardization of hydrogen storage containers has made significant progress; we take learnings from this process for fuel cells.

SIMILAR CONSIDERATIONS

- Container handling
- Applicable
- Interfaces
- Standard connections
- Vessel integration
- Logistics
- Quality assurance



Containerized hydrogen storage system in practice

Hydrogen 'tanktainer' swapping is happening on a daily basis, so the concept is proven.

FutureProof Shipping

Air Liquide



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Air Liquide Maritime Liquid Hydrogen supply with 40 ft T75 ISO containers

Guido GILARDI



4 business unit & 1 Joint Venture

Global Helium

SOURCING, STORAGE AND
DISTRIBUTION OF HELIUM TO
AFFILIATES AND GLOBAL ACCOUNTS
Markets: MRI & NMR,* electronics,
speciality gases, leak detection,
fiber optics, space, airships, big
science, diving, party balloons.

He



Cryogenic Supply

CROSS-BORDER SUPPLY OF
CRYOGENIC GASES TO AFFILIATES
AND THIRD-PARTIES

Markets: industries and healthcare

O₂ N₂O N₂ Ar CO₂ H₂ BioLNG



*Magnetic resonance Imaging
and nuclear magnetic Resonance

Offshore Energies

GAS SUPPLY, EQUIPMENT RENTAL AND
SERVICES TO THE OFFSHORE MARKET

Markets: diving and construction vessels,
well services, offshore oil & gas
platforms and wind farms

He Heliox Nitrox N₂ Ar CO₂



LARGE-SCALE LIQUID CO₂
SHIPPING AND BARGING
SOLUTIONS TAILORED TO THE
NEEDS OF FUTURE CARBON
CAPTURE AND STORAGE (CCS)
PROJECTS IN EUROPE

CO₂



Global Rare Gases

FROM SOURCING OF CRUDE FEEDSTOCK
TO DELIVERY OF PURE GASES TO
AFFILIATES AND GLOBAL ACCOUNTS

Markets: electronics, space, lighting,
deep tech, insulated glazing

Xe Kr ³He



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Design specification for LH2 container



UN portable tank container
UNT75 type



Standard 40 ft size: 40 ft × 8 ft × 8.6 ft
(12,192 × 2,438 × 2,591 mm)



Multimodal transportation mode
by road and sea



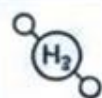
Maximum Allowable Working
Pressure (MAWP) is 12 barg



Volume capacity
41,000 Liters



Container weight when loaded
~23,200 kg



Hydrogen load at 90% fill level
2,600 kg corresponding to 30,500 m³



Rear side



The long holding time discloses possibilities



Holding time: 60 days
With nitrogen top-up: 100 days

On site tests without fix storage
Temporary buffer storage



Long distance logistics across
the oceans

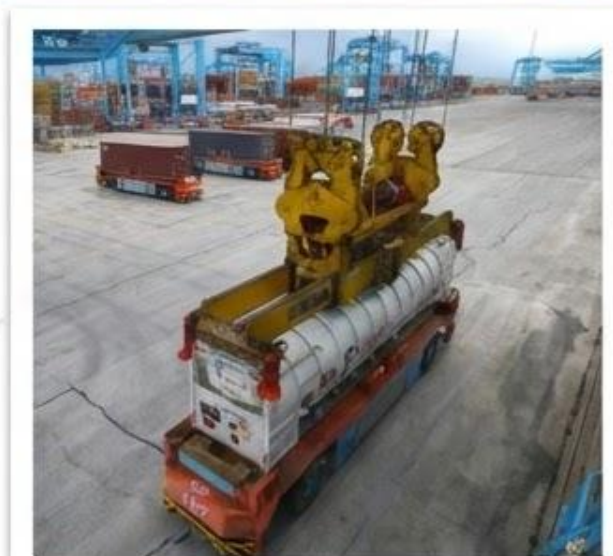
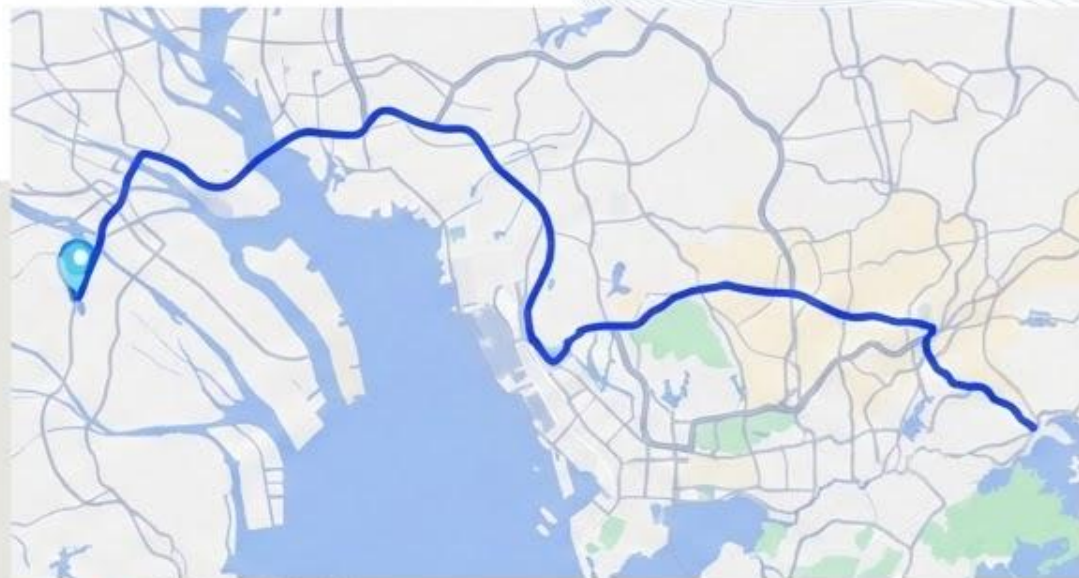


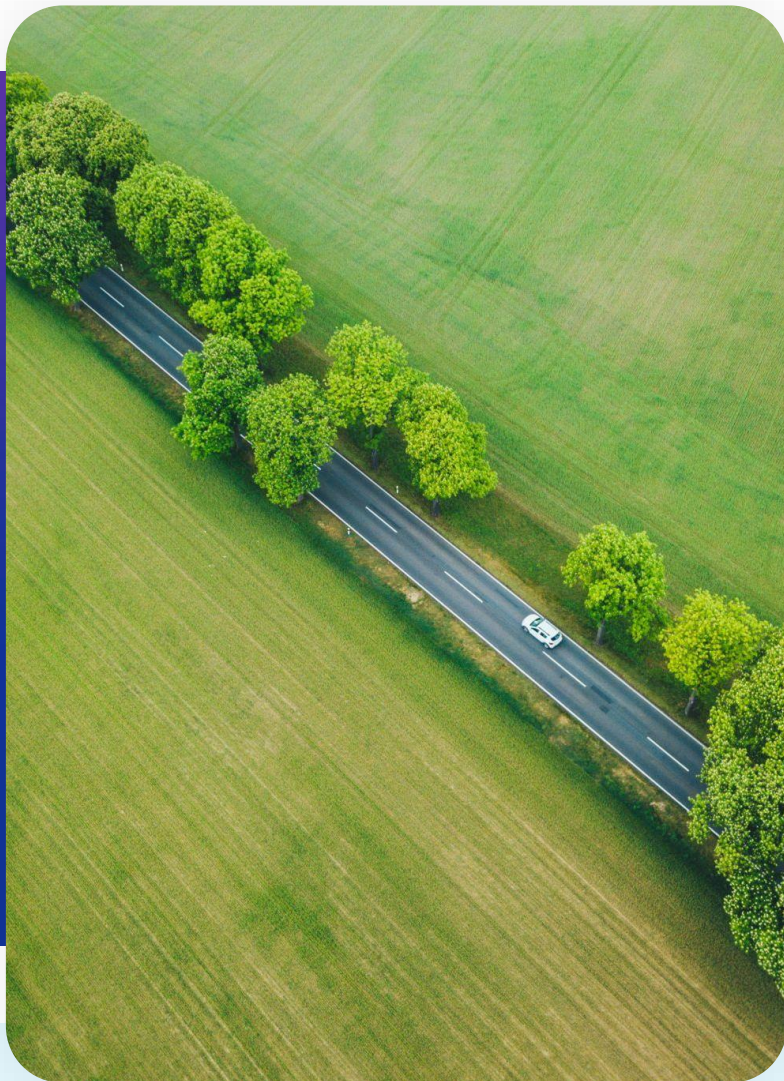
Long lasting supply on board



Intercontinental shipment to China (Sep 2024)

Sea shipment from Rotterdam to Yantian, China





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15

We would like to thank you for your attention

Loppu – Einde – Ende – Fine – Fin - Slutning



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