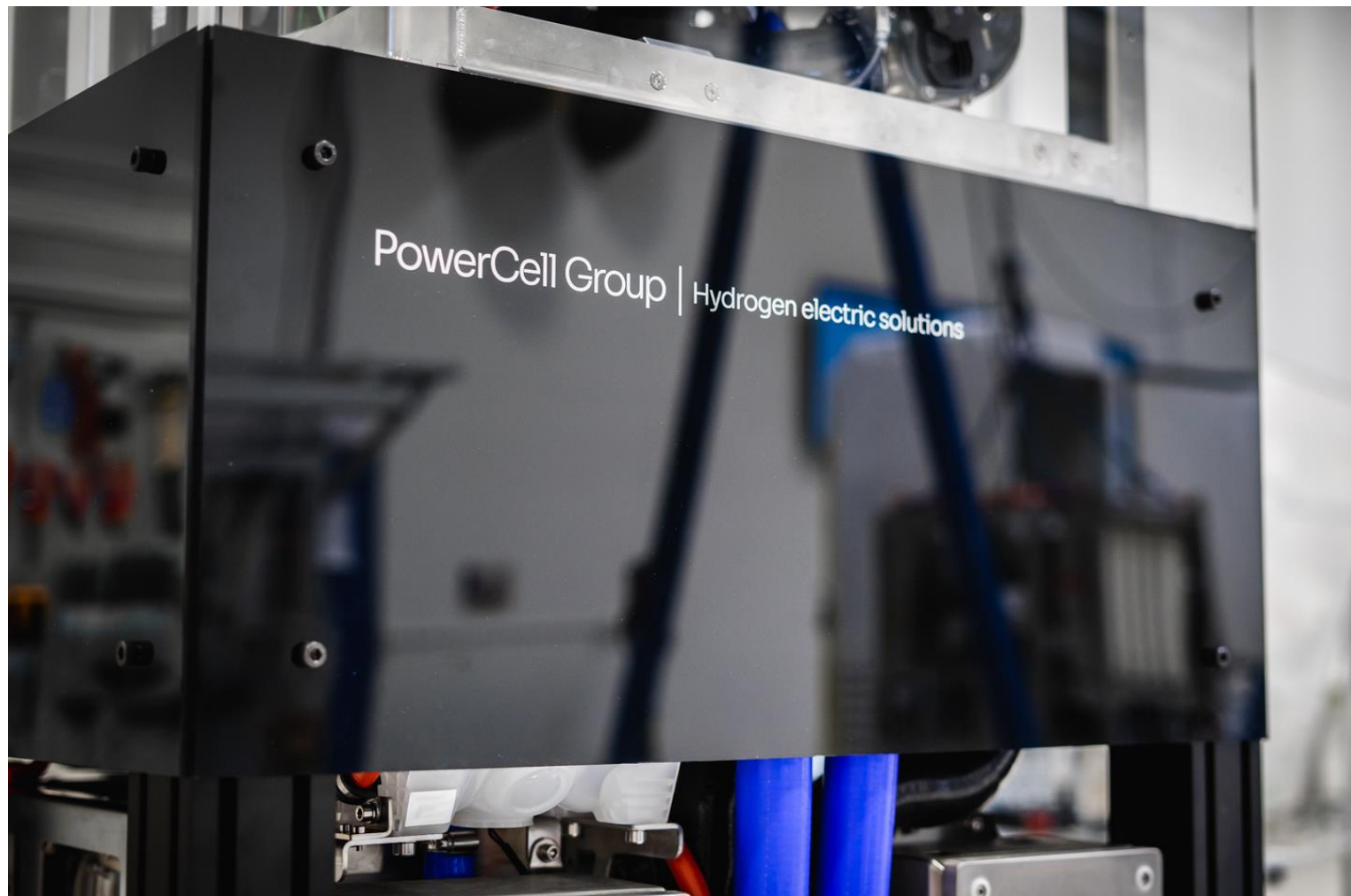


DSM 2023:

Future Fuels Safety Discussion



PS-200 System



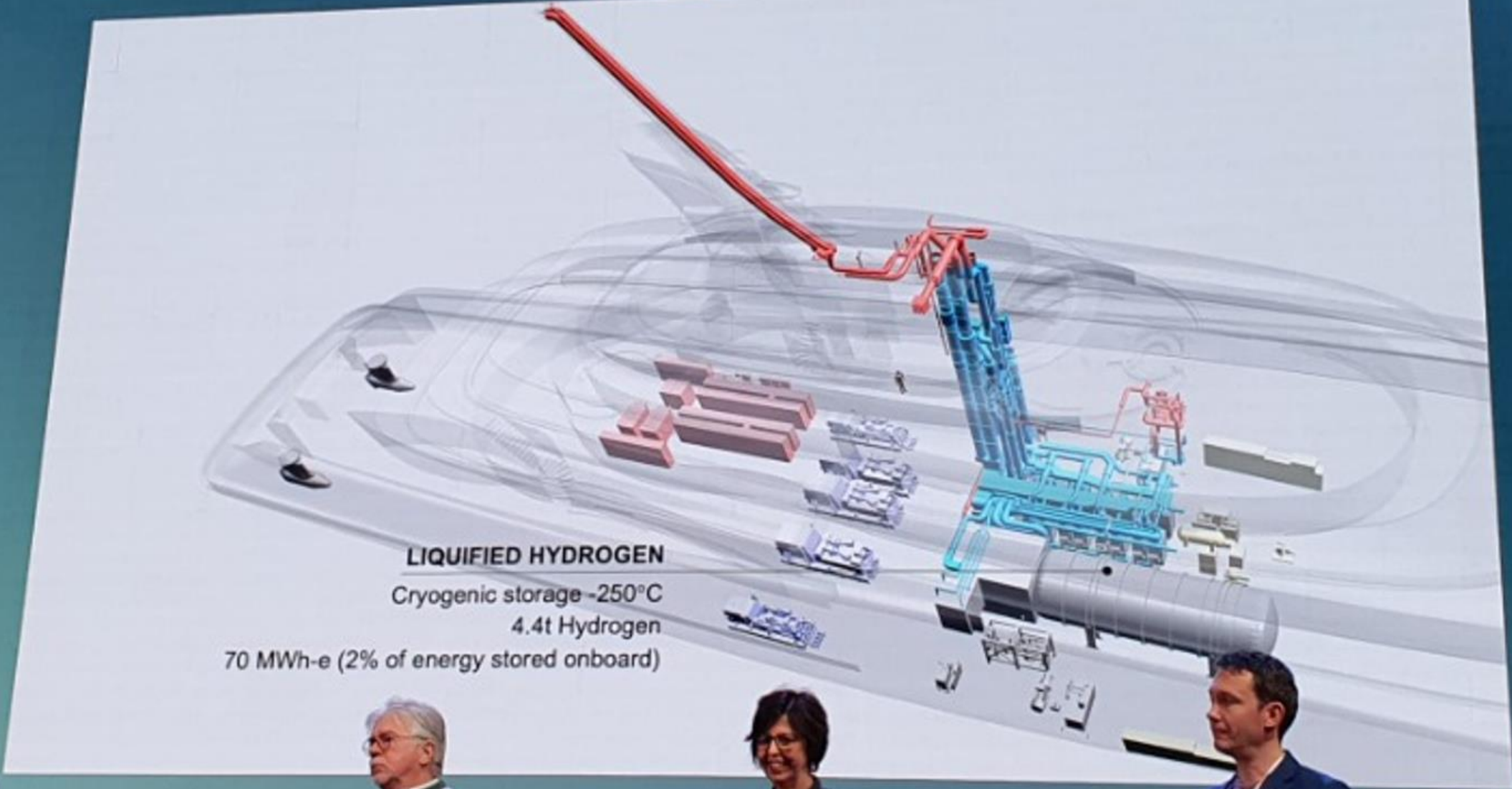
Commercialized

Easy Service

Classifiable

DAT
ACHT
L

IONFEST



Marine System 200 safety assessment:

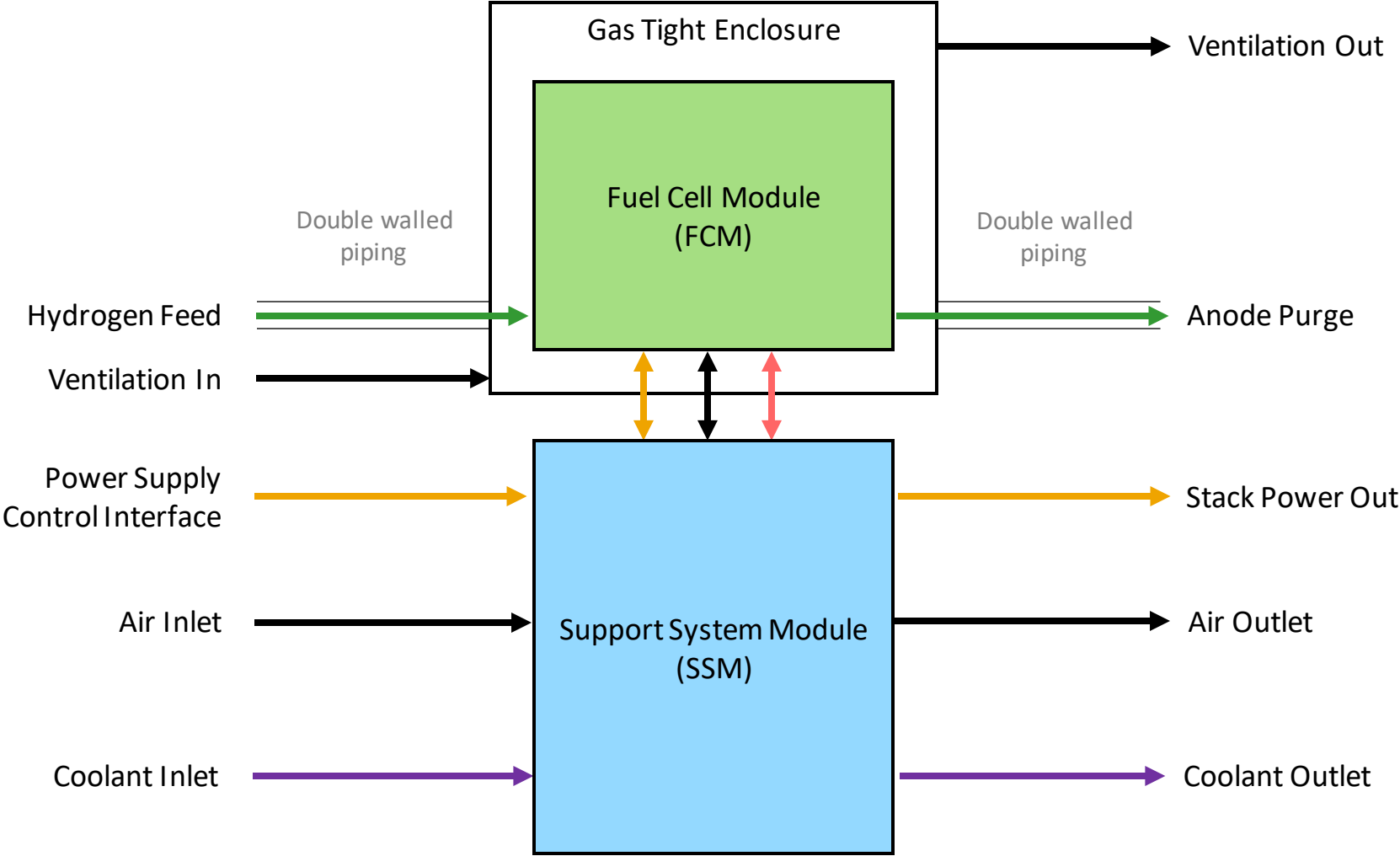
=>MSC Circ. 1455, Alternative safety approval process.

=>MSC Circ. 1647 Interrim guidelines for Fuel Cells on ships.

=>Zoning requirements according to IEC 60079 -10

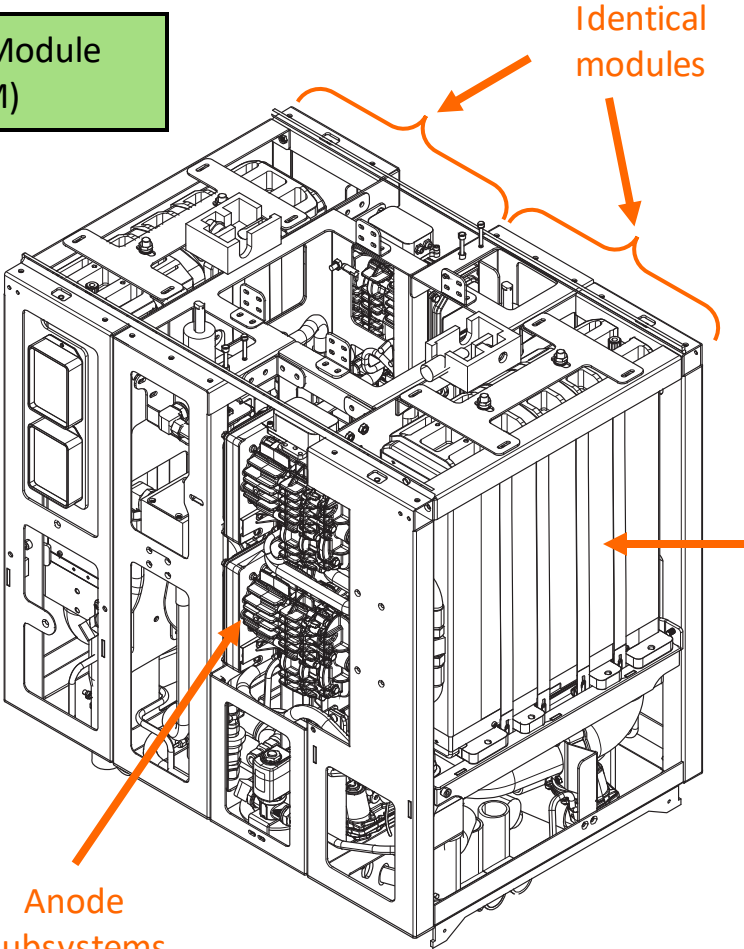


Physical Layout

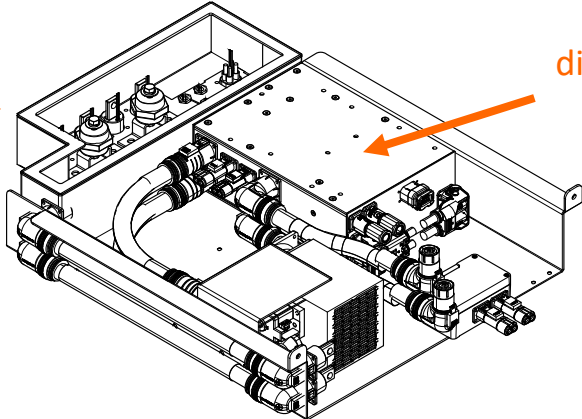


PS-200 System

Fuel Cell Module (FCM)



El. interface



Control Unit

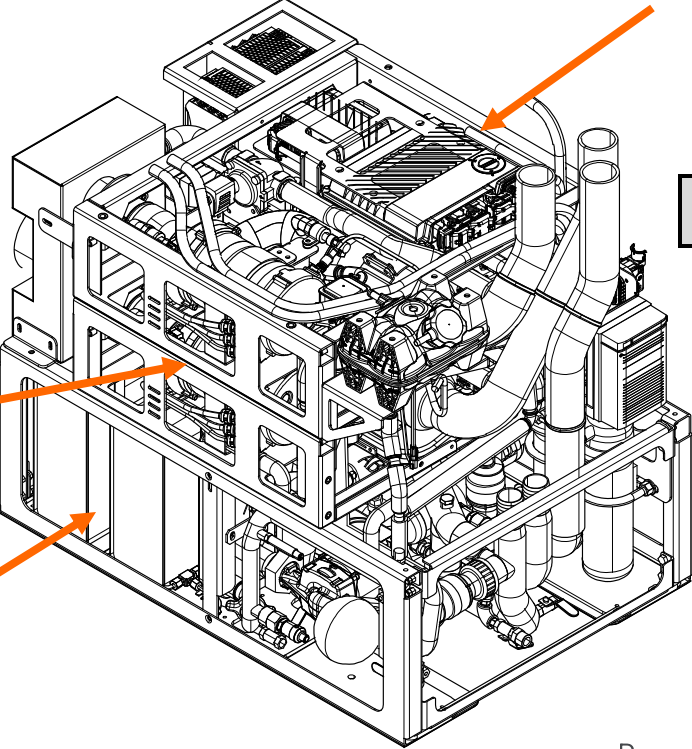
Cathode Module

Cooling Module

Fuel Cell Stack

Air Compressors

Heat Exchangers



Risk Assessment

- We have performed internal risk assessments through use of assessment tools like FMEA
- Performed HAZIDs and HAZOPs as a part of a commercial projects
 - Attendees from Class, Yard, Gas experts, Gas suppliers experts, Electrical integrator experts, Naval Architects.

The main safety hazards associated with the system are:

- Small Explosion
- Large Explosion
- Fire

And there are some minor safety hazards involving:

- Electrical Shock
- Burns



Safety Layers

There are a number of independent layers of protection from an hazardous event occurring

1. The control system
 - Keeps the system within normal ranges and triggers errors on abnormal conditions
2. Hardware safety loop
 - Loop will open on detection of hydrogen leak or high temperature detection, or an external trigger
 - De-powers all actuators if loop is broken
3. Limited number of ignition sources and flammable material
 - There are no preminent ignition sources (requires rare malfunction)
 - There is a limited amount of flammable material present in the system
4. Ventilation system
 - External ventilation will full redundancy and monitoring by ship safety system
5. Gas tight cabinet
 - Acts as a physical barrier to separate personnel from the hazard



Fuel Cell Projects coming to market 2024-2026:





2024:Superyacht

3 MW FUEL CELL



PowerCell Sweden selected for world's largest marine hydrogen project

3 March 2023 by [Alan Sherrard](#)

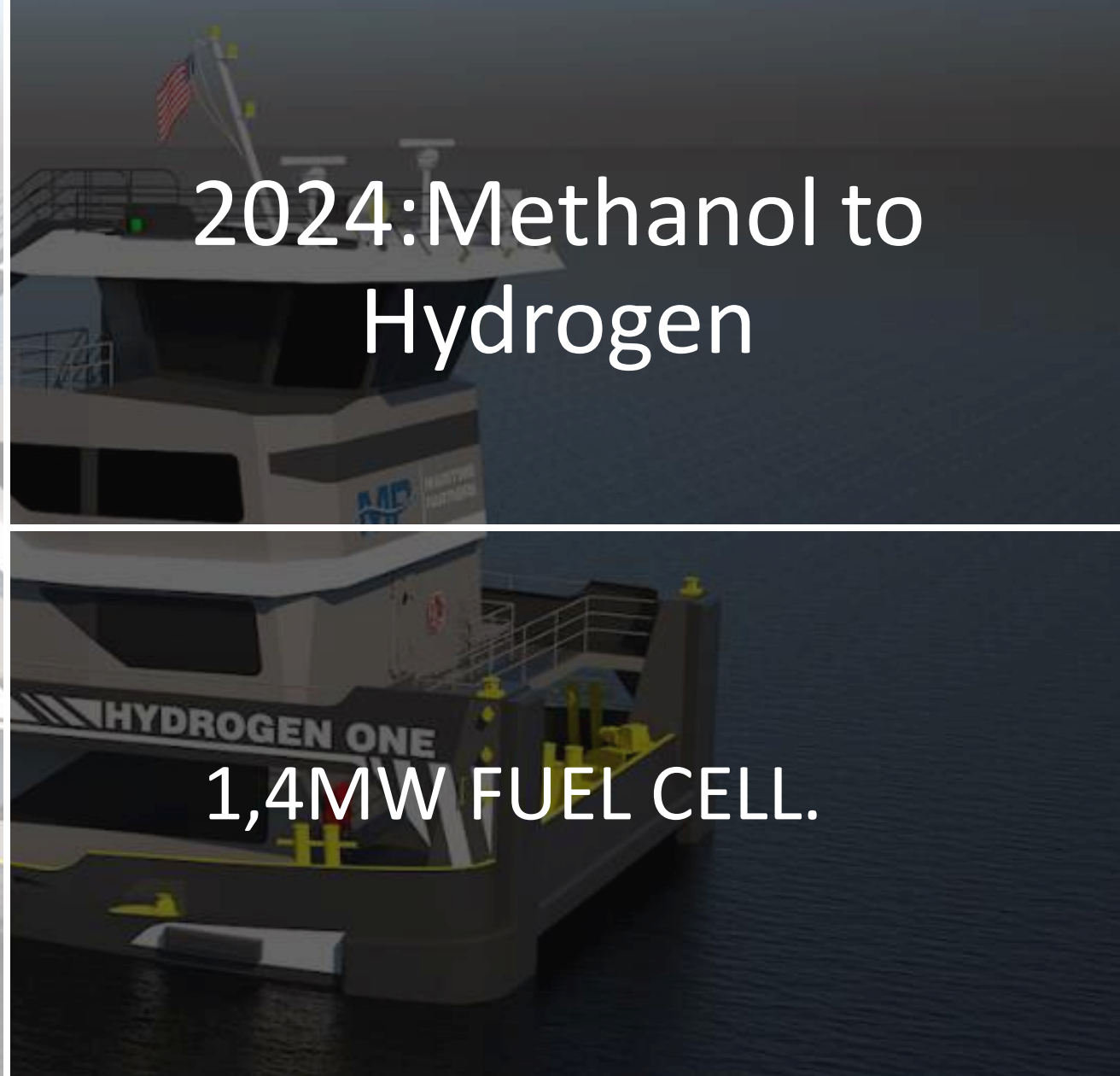
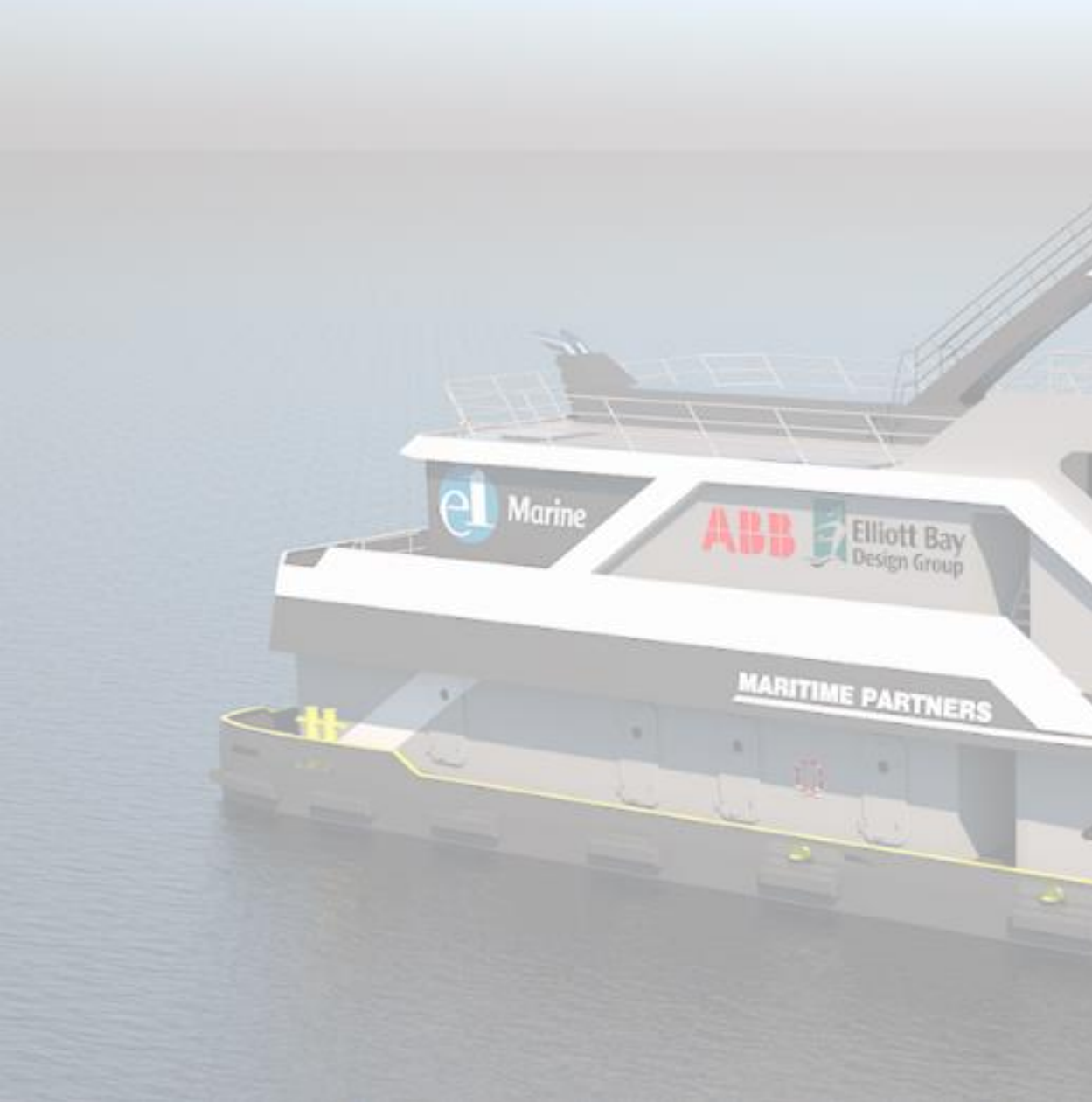


An artist's rendering of one of the two green hydrogen-powered Torghatten Nord ferries that will operate in Vestfjorden, Norway in 2025 (image courtesy The Norwegian Ship Design Company).

2025: Two Ro-PAX ferries
Powered by hydrogen fuel cells

13 MW (2x6,5 MW) of FUEL
CELL





2024: Methanol to Hydrogen

1,4MW FUEL CELL.





Ammonia to Hydrogen

FUEL CELL USING HYDROGEN

FROM GREEN AMMONIA





Commercialized Marine Fuel Cell module to be adopted in multiple MW size fuel cell Vessels. Full technical documentation for installation and operation available.



LR Type approval with LR ready by 2024-Q2.
Full design appraisal and individual approval received 2023. Approved to IMO interim rules in Solas Circulars





Optimized service focused on OPEX savings.

=>No dry docking required.

=>Service Contract on fixed rate possible for financial predictability.



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