Hybrid Propulsion Solutions for ships

Hydrogen between Propeller and Propeller

Helmut Behrens
Siemens Energy

Siemens Energy is a

global leader in the energy business

~ 1/6

of global electricity generation is based on our technology.

92,000

employees work as a team to energize society.[1]

We are present in

> 90 countries.

We invest around

€1bn annually in research and development.

1 Number of employees as of September 30, 2022

Our company structure

supporting our customers along the entire energy value chain

SIEMENS energy

Business Areas

Gas Services	Grid Technologies	Transformation of Industry	Siemens Gamesa Renewable Energy

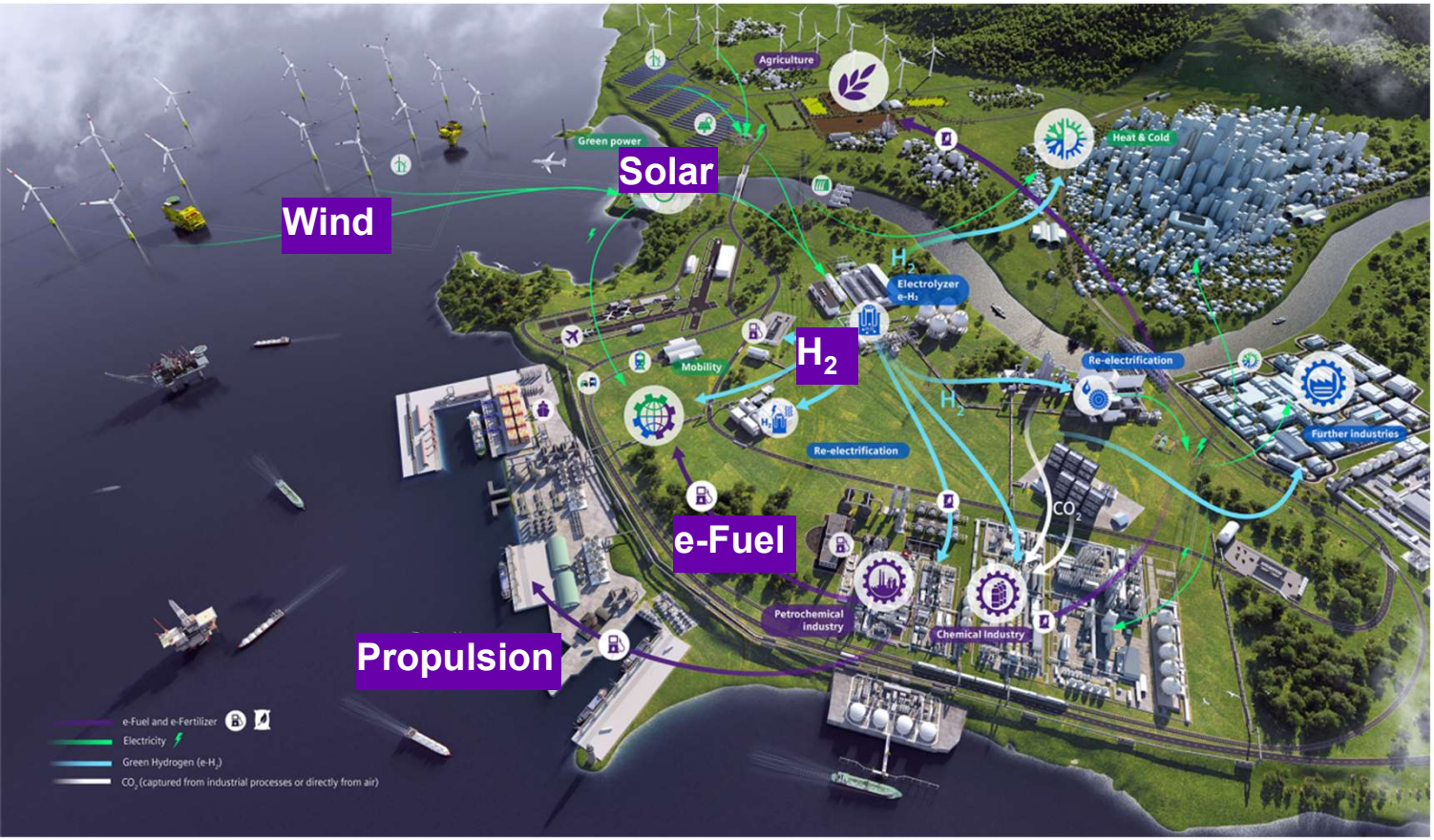
Therein: Independently Managed Businesses

- Sustainable Energy Systems
- Electrification, Automation, Digitalization
- Industrial Steam Turbines & Generators
- Compression

Helmut Behrens
Head of Sales Marine
Hamburg, Germany

Antonio Carvalho
BD South West Europe
Lisboa, Portugal

Decarbonization of Energy Convertion @ SE



The decarbonization of the transportation sector requires CO_2 neutral fuels

Technology

- Renewable Production of Electricity
  ➔ Wind, PV, …

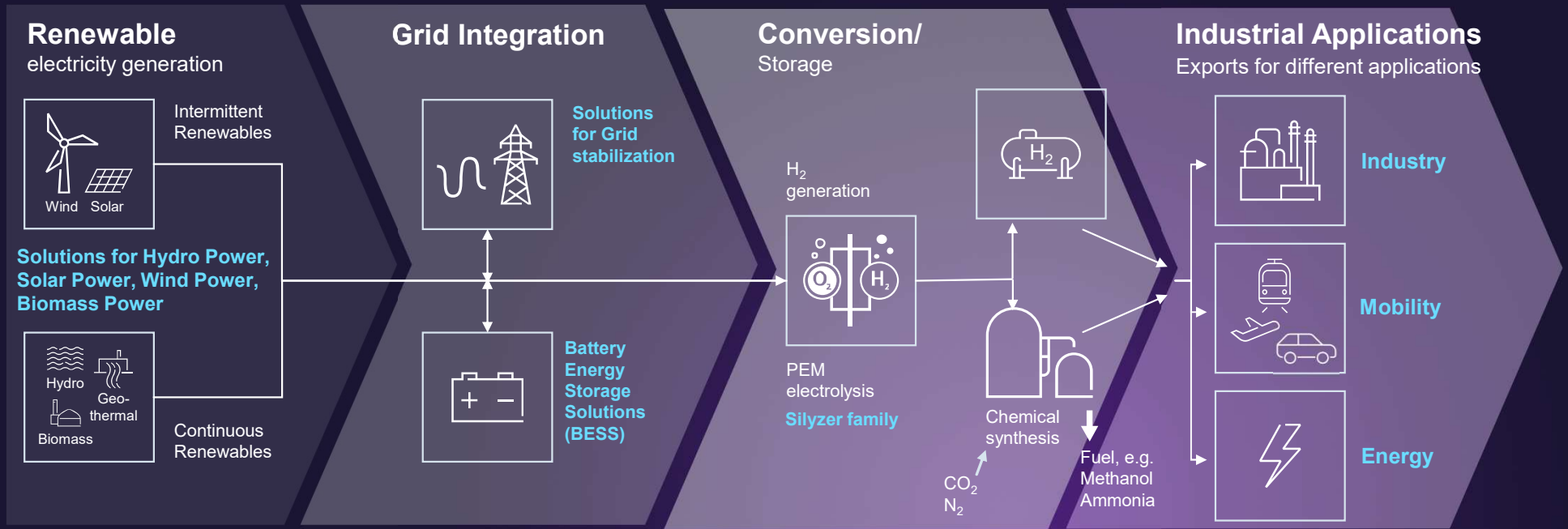
- Converting electricity in P2X-Fuels (Power to ..)
  ➔ H2, e-methane, e-diesel, e-methanol, ..

- Re-Electrification of P2X-Fuels
  ➔ turbines, combustion motors, fuel cells

Markets

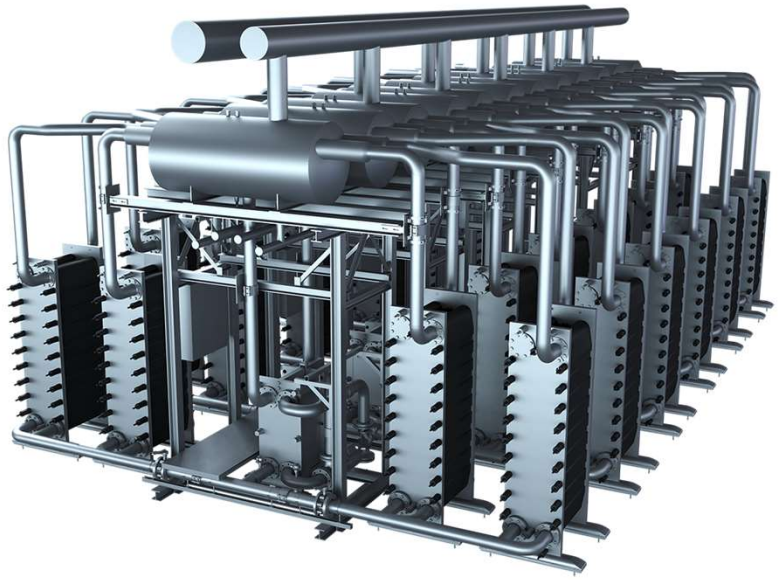
Stationary	➔ ren.-electricity and re-electrification
Mobility	➔ Automotive ➔ Railway ➔ **Maritime** ➔ Aviation
Private	➔ Heating

Hydrogen from renewables enables large scale sector coupling



Silyzer 300 – Full Module Array
The next paradigm in PEM electrolysis

Silyzer 300 – full module array (24 modules)

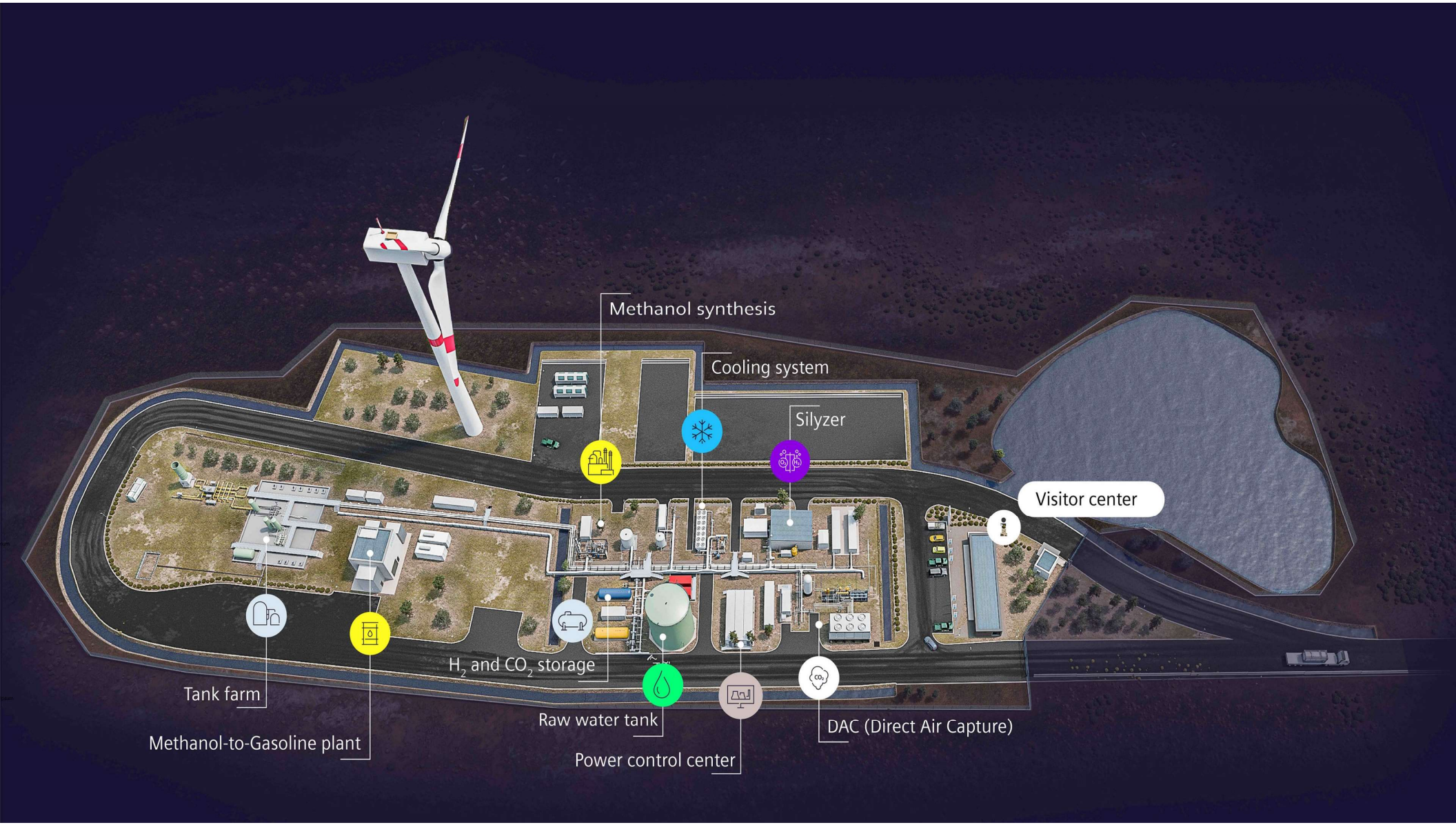


17.5 MW
plant power demand

>75.5 %
plant efficiency

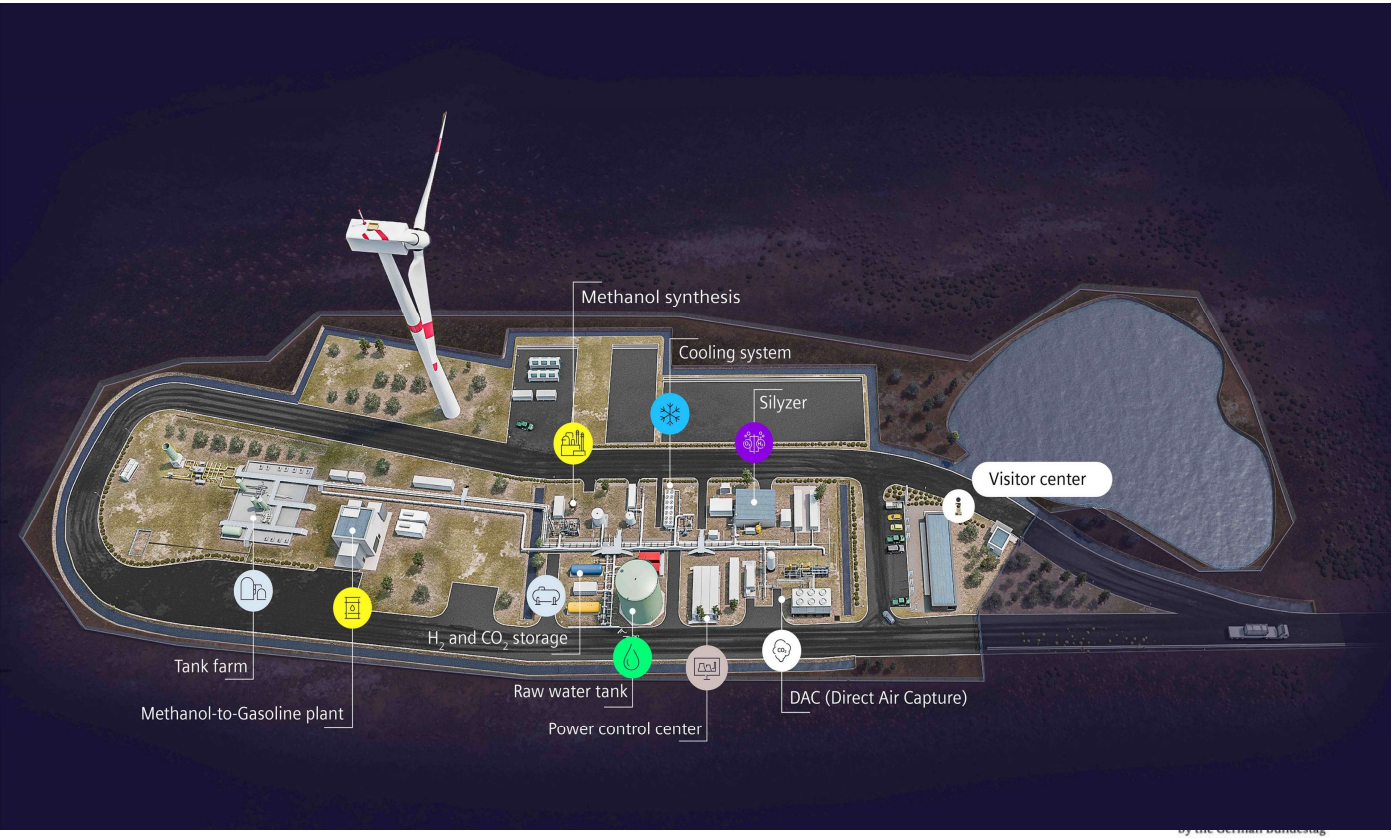
24 modules
to build a full module array

335 kg
hydrogen per hour


Methanol synthesis
Cooling system
Silyzer
Visitor center
H_2 and CO_2 storage
Tank farm
Raw water tank
DAC (Direct Air Capture)
Methanol-to-Gasoline plant
Power control center

HARU ONI PILOT PROJECT

First integrated plant for climate-neutral e-fuel production from wind and water



Project

Customer:	HIF (Highly Innovative Fuels)
Off-taker:	Porsche AG
Country:	Chile, Patagonia
Installation:	2021
Product:	Power-to-methanol solution based on SE Electrolyzer

Use cases

- E-Fuel for Porsche cars
- Potential for adding Kerosene or Diesel production in future phases
- Methanol for ship motors

Transformation of Industry in action

Producing green fuel from wind and water

Punta Arenas

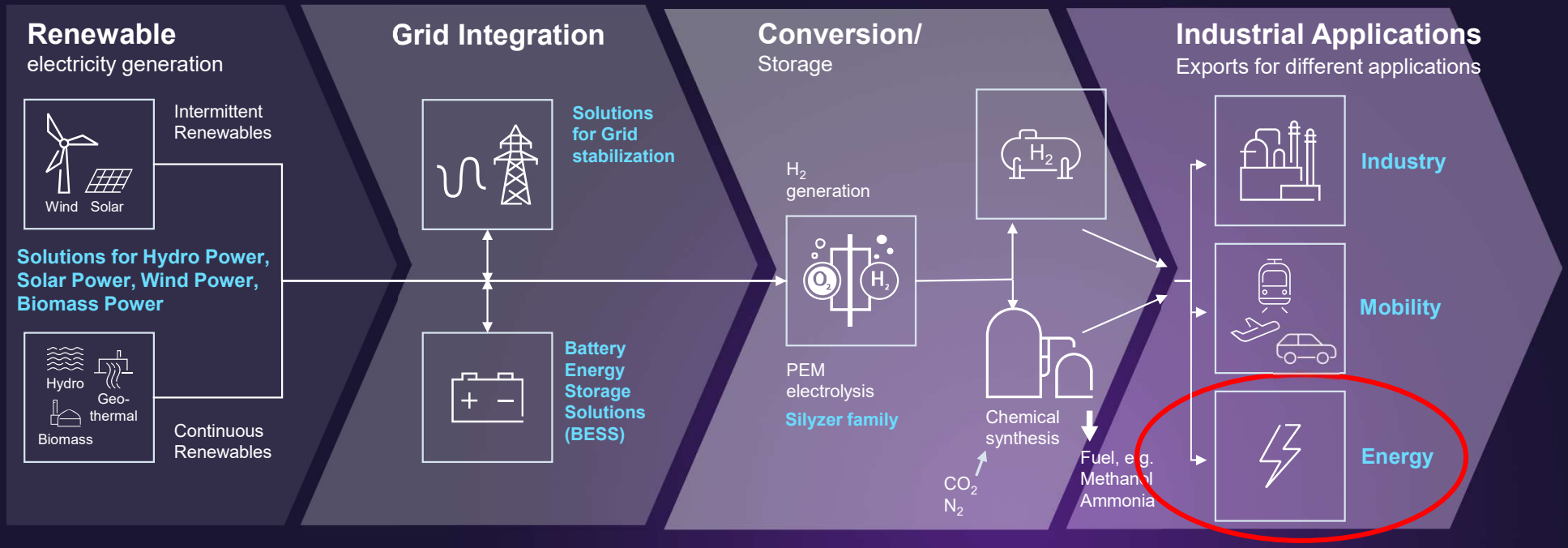
Chile

- The first commercial facility to produce climate-neutral fuels is currently under construction in the Magallanes province.
- Electrolyzers from Siemens Energy will produce CO_2-neutral fuel using low-cost green wind power.
- Production will be increased to more than 550 million liters of e-fuels annually by the middle of the decade.
- Synthetic fuels emit 90% less CO_2 than fossil fuels and can make a key contribution to the decarbonization of transportation.
- In addition to Siemens Energy, Porsche and HIF (project lead), Enel, ExxonMobil, Gasco and ENAP are participating in the Haru Oni project.

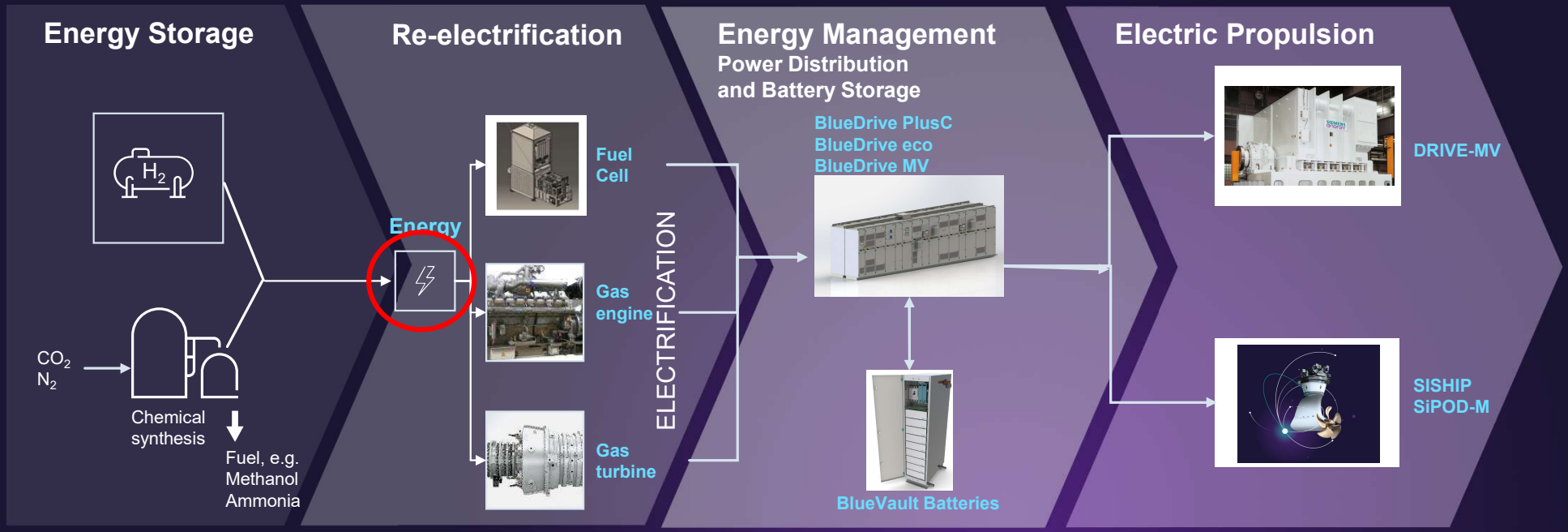
Learn more

November 2022

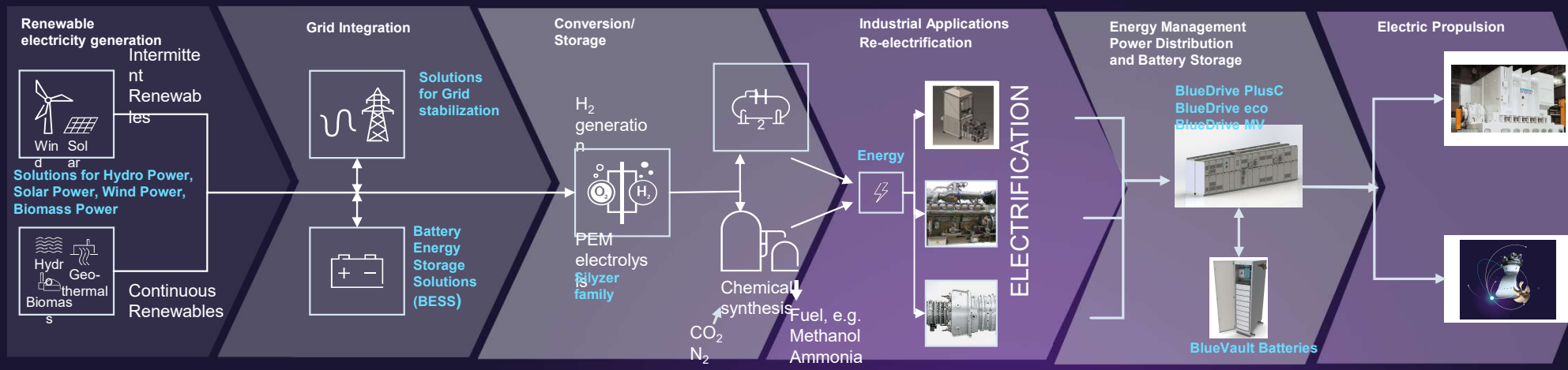
Hydrogen from renewables enables large scale sector coupling



Hydrogen from renewables enables energy supply for maritime applications



From Propeller to Propeller
➔ Complete Energy Chain provided by Siemens Energy



Complete energy chain from

- **Production of electrical energy (Wind/Solar)**
- **Transmission**

- **Conversion of electrical energy into storable, chemical energy (H2) – or different (methanol etc.)**
- **Re-electrification**

- **Local energy distribution (DC & AC technologies**
- **Battery storage**
- **Conversion of electrical energy into mechanical propulsion technology**

DC Energy and Propulsion Concepts Examples @ low voltage scale

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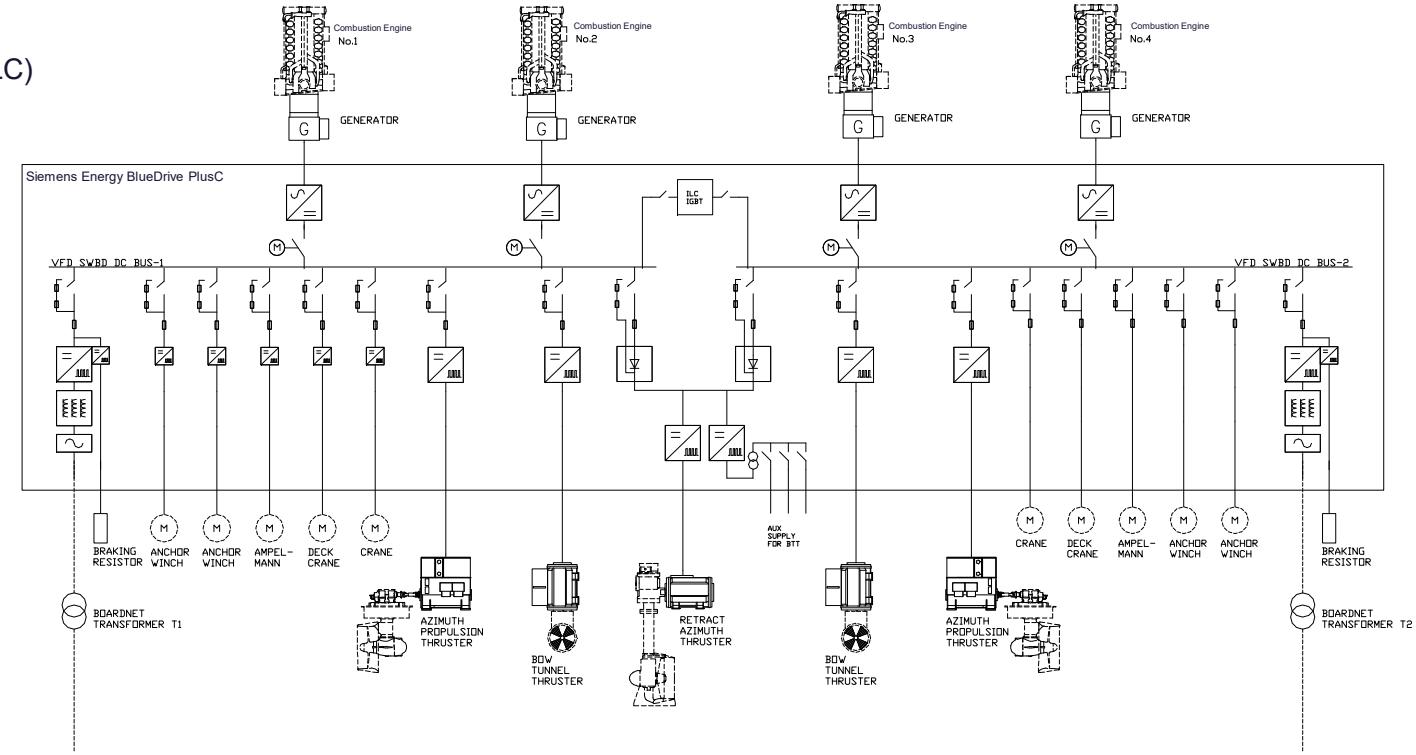
- ❑DC Power Distribution
- ❑DP Operation with joined by coupling device (ILC)
- ❑Generators with variable rotation
- ❑Integrated ACDC Converter
- ❑Integrated DCAC Converter
- ❑Integrated Grid Supply
- ❑Integrated VFD- or DC-auxillary supply
- ❑Dual feed for drives

GENERATOR ONLY OPERATION



DC Energy and Propulsion Concepts Examples @ low voltage scale

BATTERY ONLY – ALL ELECTRIC OPERATION

- DC Power Distribution
- DP Operation with joined by coupling device (ILC)
- Generators with variable rotation
- Integrated ACDC Converter
- Integrated DCAC Converter
- Integrated Grid Supply
- Integrated VFD- or DC-auxillary supply
- Dual feed for drives
- Optional Integration of **Storage Solutions such as Batteries** or Fuel Cells

≈ 60 kWh

DC Energy and Propulsion Concepts Examples @ low voltage scale

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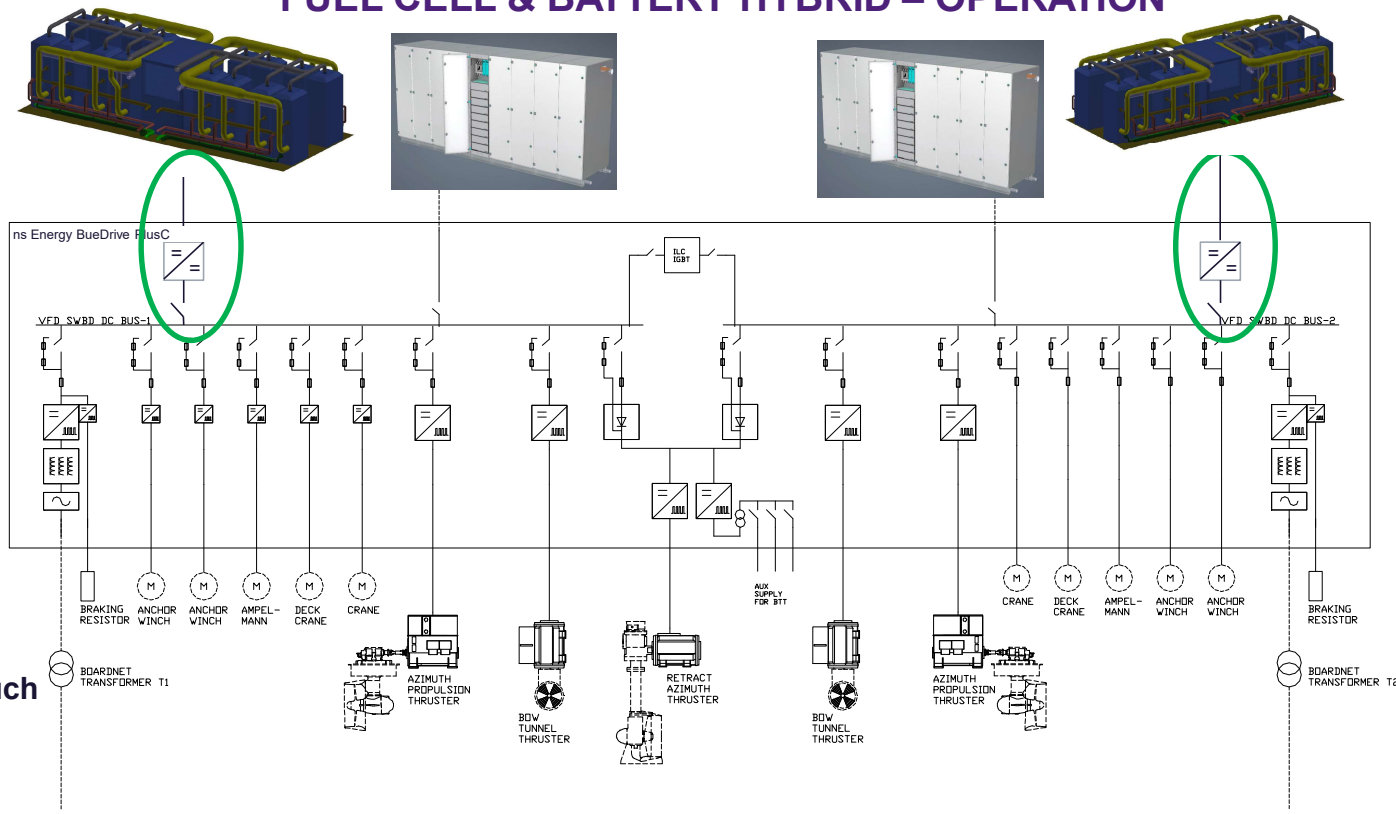
- **Integration of Fuel Cells**

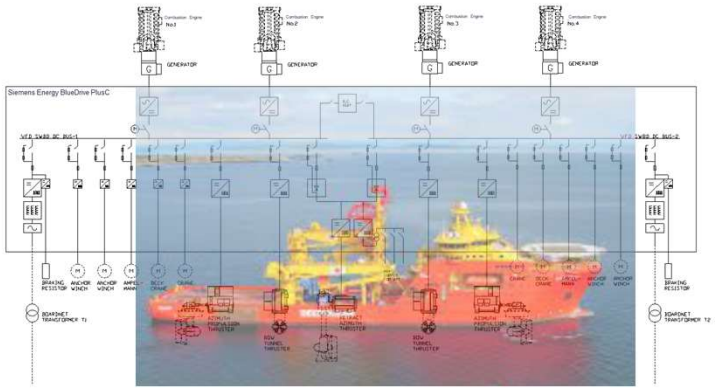
FUEL CELL & BATTERY HYBRID – OPERATION



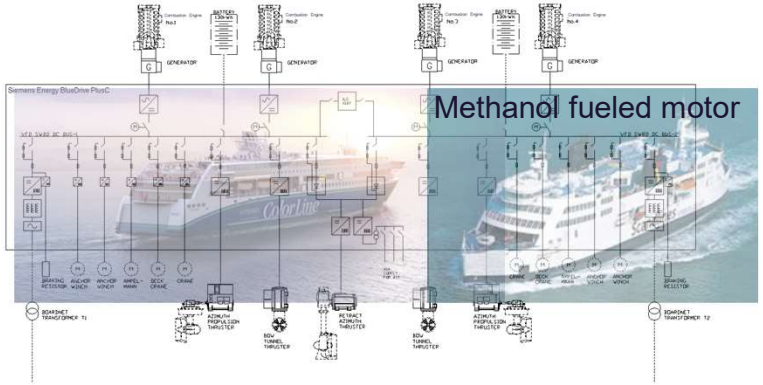
DC Energy and Propulsion Concepts Examples @ low voltage scale

SIEMENS energy

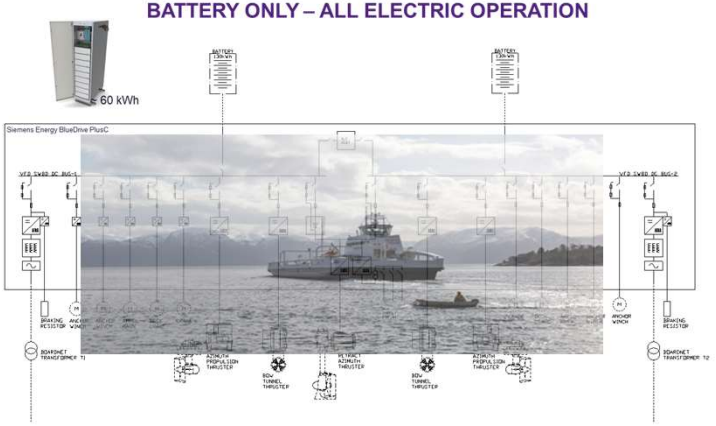
GENERATOR ONLY OPERATION



HYBRID SOLUTION



BATTERY ONLY – ALL ELECTRIC OPERATION



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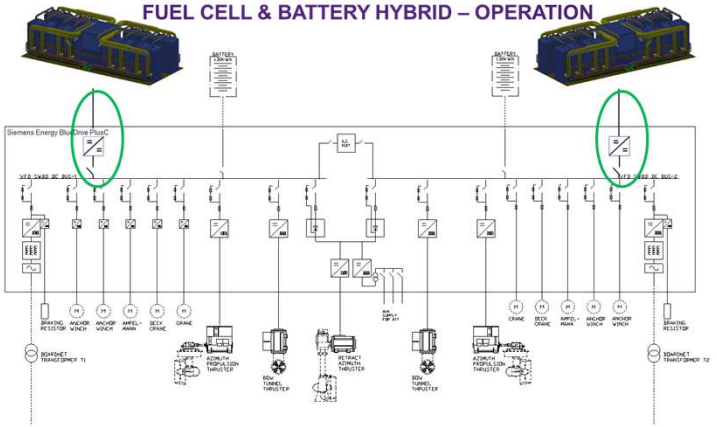
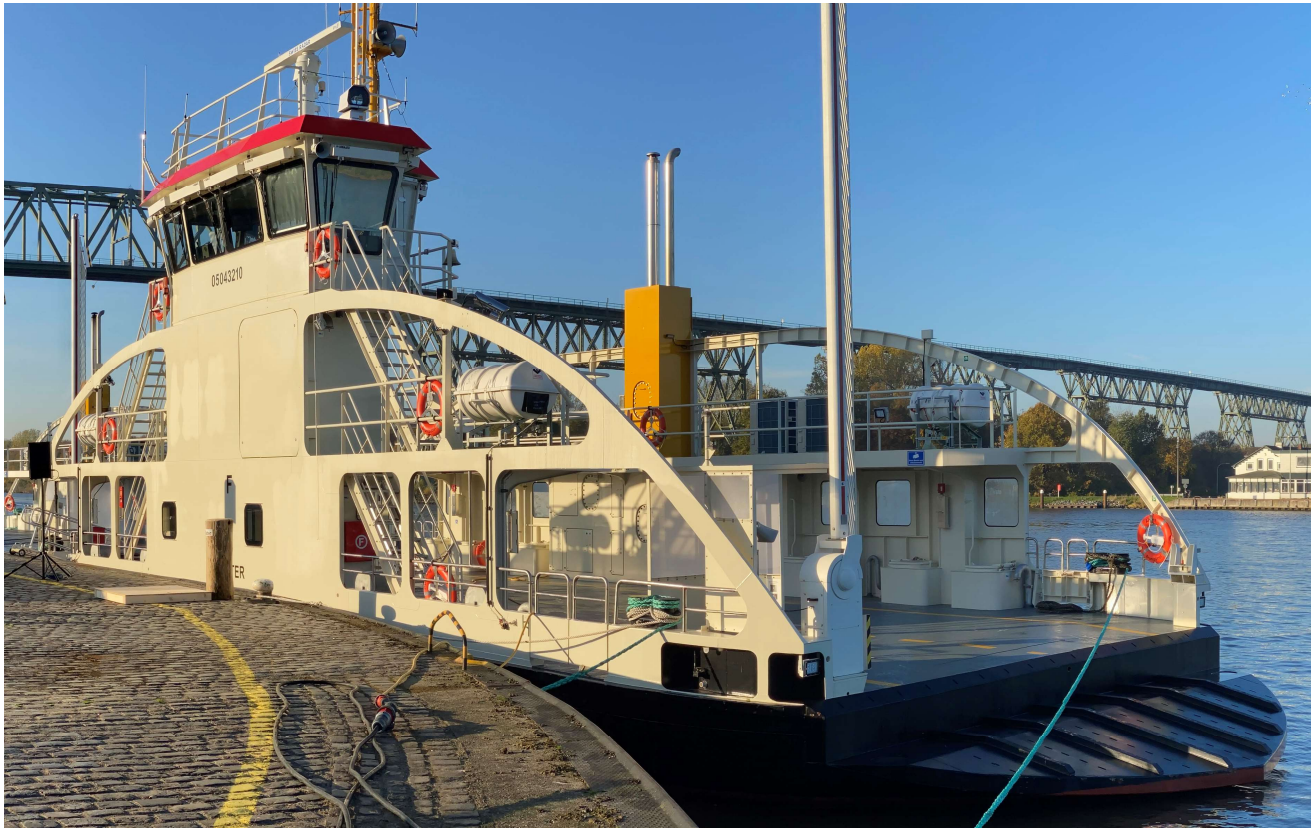


References NOK Ferries



- **NOK Canal Ferry**

- **Goal:**
- Efficient hybrid propulsion in canal operating conditions

- **Delivery in 2021**

- **Configuration:**
- 2 x 100 kW Electric Propulsion
- 1 x 294 kW Generator
- 2 x 237 kWh Battery system

References KiwiRail Ferries

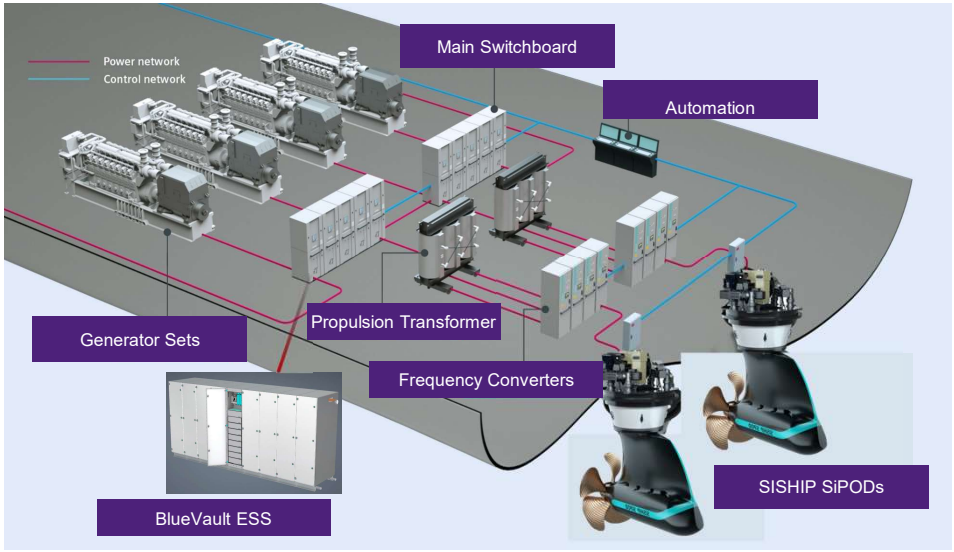
- **KiwiRail Ferries**

- **Goal:**
- Efficient hybrid propulsion,
- sailing emission free during
- Maneouvring on battery power

- **Delivery in 2024**

- **Configuration:**
- 2 x 12MW SISHIP SiPOD Prop
- 7,5 MWh Battery system
- 4 Generators

Solutions for High Propulsion Power Demands
SISHIP Drive LV & MV



Key feature	• Market leader in MV Drives • Widest power range on the market • Well proven Siemens industrial design • Worldwide availability of spare parts • Continuous product improvements
Scope of supply	• Sinamics LV or MV converters • high torque motors for propulsion • transformers/switchboards • Power management & propulsion control • Energy Storage System ESS (Batteries)
Environmental value	• Reduced fuel consumption • Less emissions
Customer benefit	• Single source for all drives on board • Reduced operational cost • Improved flexibility • Minimized downtimes • Highest redundancy

Superyacht Segment
Cooperation with Sanlorenzo

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Decarbonization through Technology

Honestly, we cannot wait for the perfect solution: We have technologies to shape the energy transition now.