



# HYDROGEN POWER SOLUTIONS

ENABLING ZERO EMISSION VESSELS



# About Genevos

## *Marine hydrogen power solutions*

### MISSION

Pioneering plug & play marine hydrogen power solutions to enable clean and resilient mobility on our oceans.

### HERITAGE

Genevos was founded in 2018 as a spin-off company from 'OceansLab – Cleantech Accelerator', a record-breaking zero-emission offshore sailing project that innovates and demonstrates low-carbon technologies in the maritime sector.

### ACTIVITY

Genevos engineers, certifies and produces plug-and-play Hydrogen Power Modules (HPM) offering scalable power solutions from 15 kW to multi-MW scale.

Genevos goes further to support the energy transition for clients through the provision of engineering services and energy optimisation through an advanced power management system.





# Hydrogen Power Module 'HPM'

*The plug & play power solution for marine*

*Decarbonising vessels through auxiliary, primary or hybrid integration*

This scalable solution can be applied across the maritime sector from small to large vessels including yachts, ferries, service vessels, inland transport and shipping.

## FEATURES

- **Zero emissions** no vibration and low noise
- **Practical** compact and low weight
- **Stackable** to high power
- **Modular** enabling high redundancy
- **Marinised** protection against humidity & salinity
- **Durable** resistant graphite plate technology
- **Certified** for use on commercial vessels
- **Plug & play** fully integrated balance of plant
- **Efficiency** through adaptive power management



electric  
& hybrid marine  
AWARDS 2022

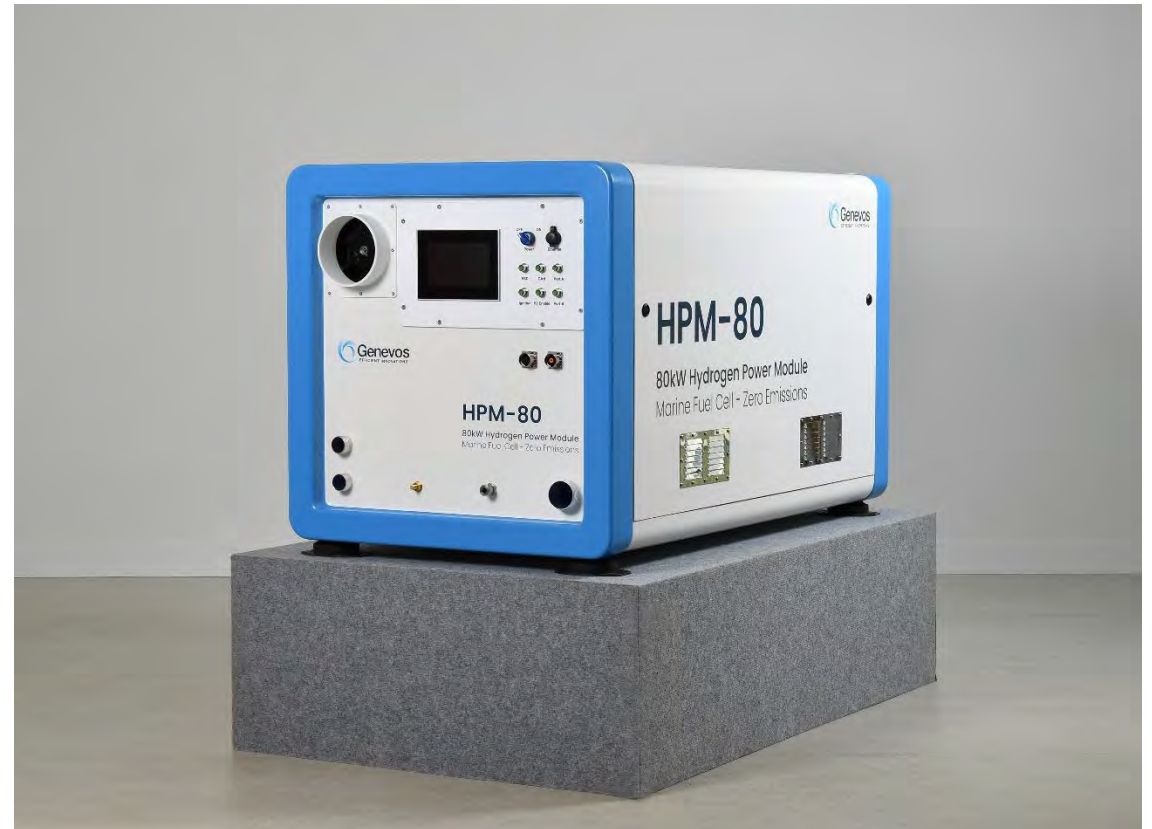
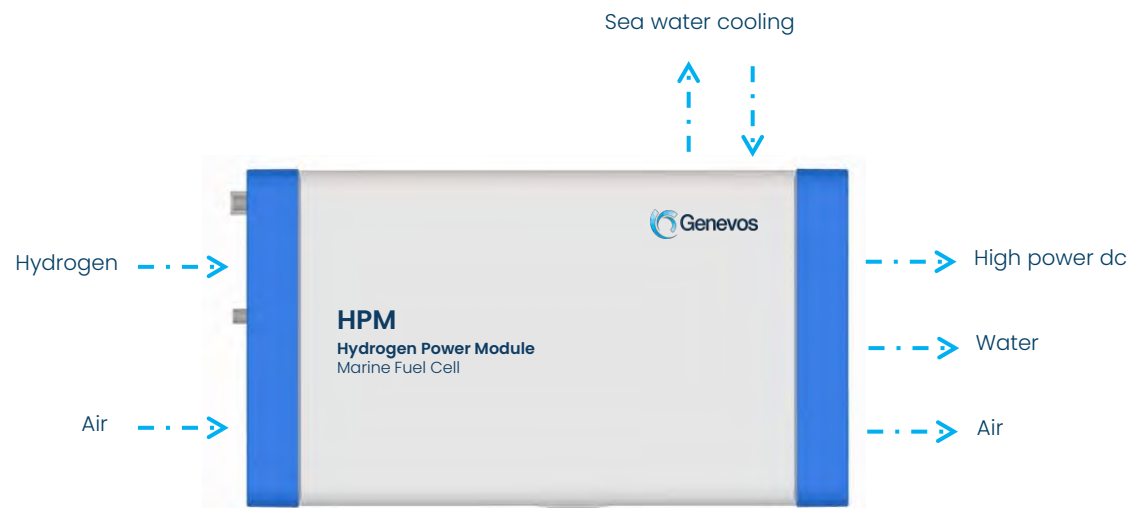


# Drop-in Fuel Cell Solution

*Genevos' plug & play marine power solution*

## COMPONENTS/SYSTEMS INTEGRATED

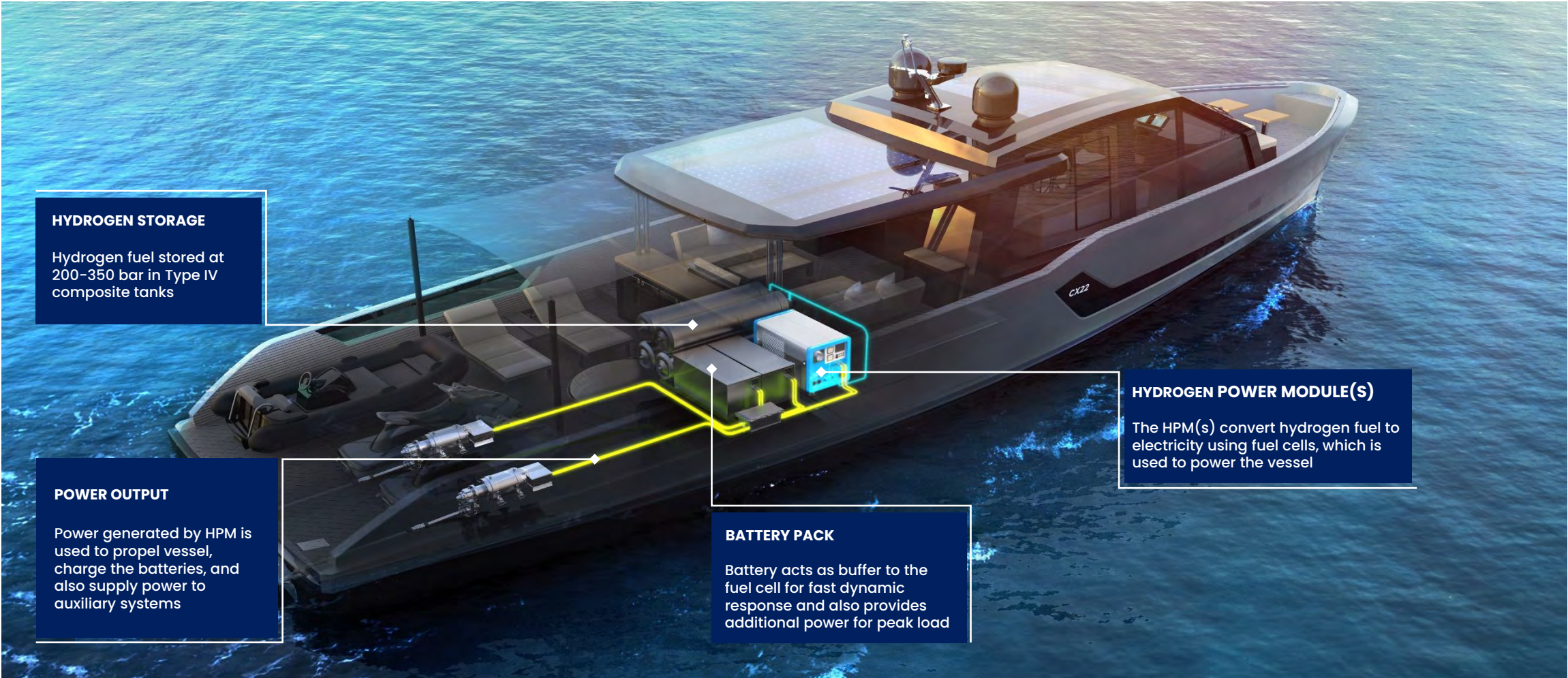
- Hydrogenics (Cummins) graphite PEM fuel cell stack
- Air filtration and compression
- Cooling system with heat exchanger
- DC-DC converter
- Energy Management System
- Safety monitoring system
- User interface & data logger





# Hydrogen-Electric System

*Providing a low weight, zero emission propulsion solution for vessels*



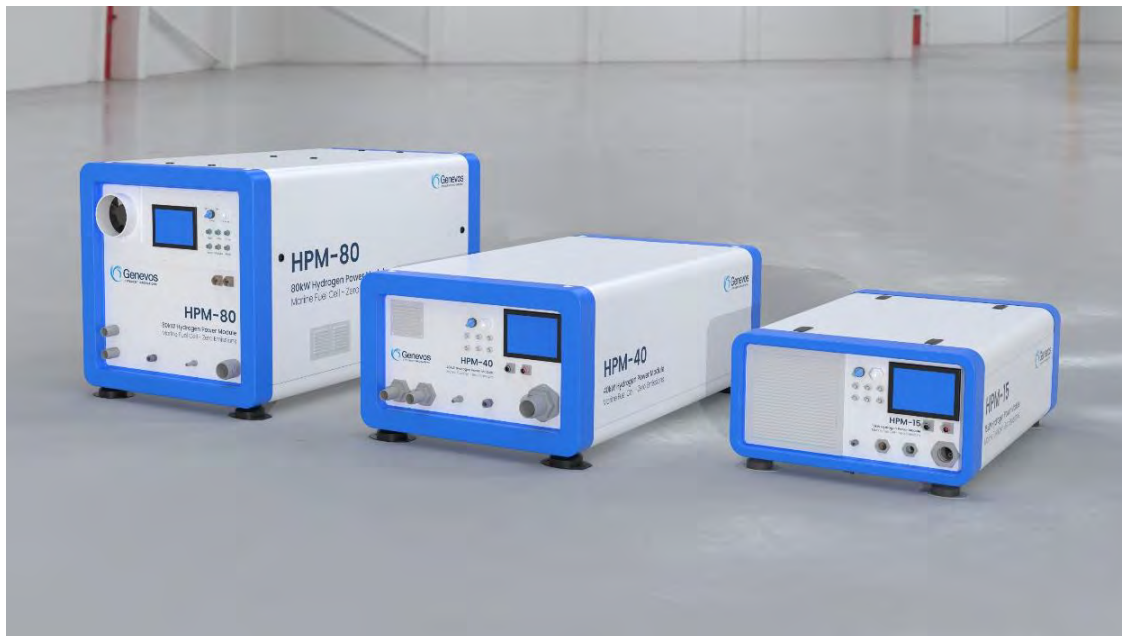
# Scalable Power Solutions

*Modularity to enable power systems tailored specifically to vessel*

## HPM FAMILY

Genevos offers power modules from 15 kW to 80 kW to meet exact power requirements of a wide range of vessels.

80 kW modules can be stacked to provide power solutions up to MW scale.



## HIGH POWER SYSTEMS

- Fully-integrated, independent modules for high redundancy
- Optimised durability – through advanced system control
- Optimised fuel cell efficiency – through advanced system control





# HPM Technical Specifications

*A compact and low weight solution designed for vessels*



TECHNICAL DATA	HPM-15	HPM-40	HPM-80
Continuous Peak Power (BOL)	13.5 kW	40 kW	80 kW
Rated Power (EOL)	11.5 kW	35 kW	70 kW
Output Voltage (Controllable)	48 V <sub>dc</sub>	250 – 900 V <sub>dc</sub>	400 – 900 V <sub>dc</sub>
Weight	100 kg	200 kg	330 kg
Peak Efficiency	52 %	54 %	54 %
Dimensions (L x W x H)	111 x 71 x 42 cm	140 x 80 x 50 cm	140 x 80 x 80 cm
Communication	CAN bus		
FC Stack Estimated Lifetime	> 20,000 hrs		
Fuel	Gaseous Hydrogen ISO14687-2		
Ambient Air Temperature Operation	-25 to 45°C		
Environmental Rating	IP54 – IP56		



# Low Power Applications

Water taxis and pleasure craft: 15 kW – 200 kW vessels

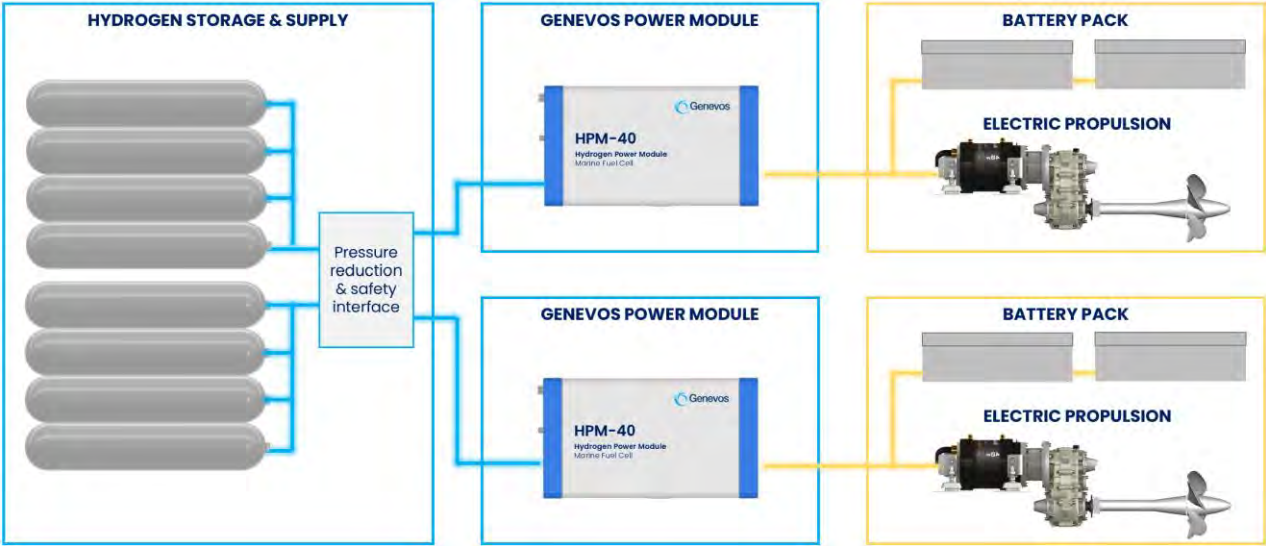
HPM-15



HPM-40



## LOW POWER SYSTEM



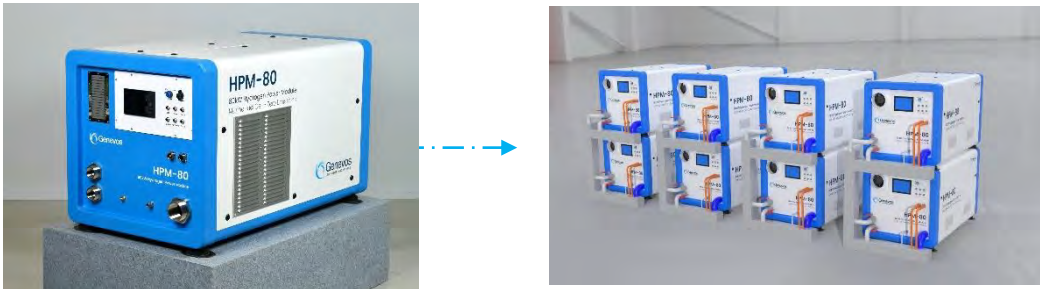
VESSEL EXAMPLES



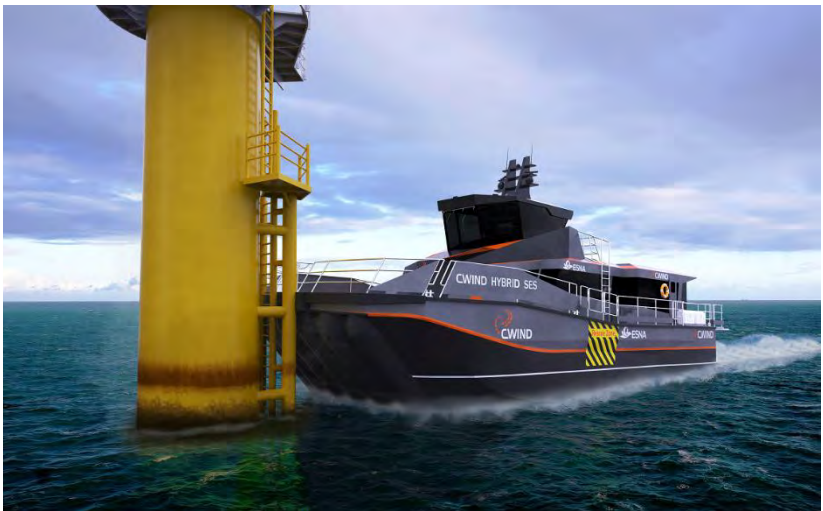
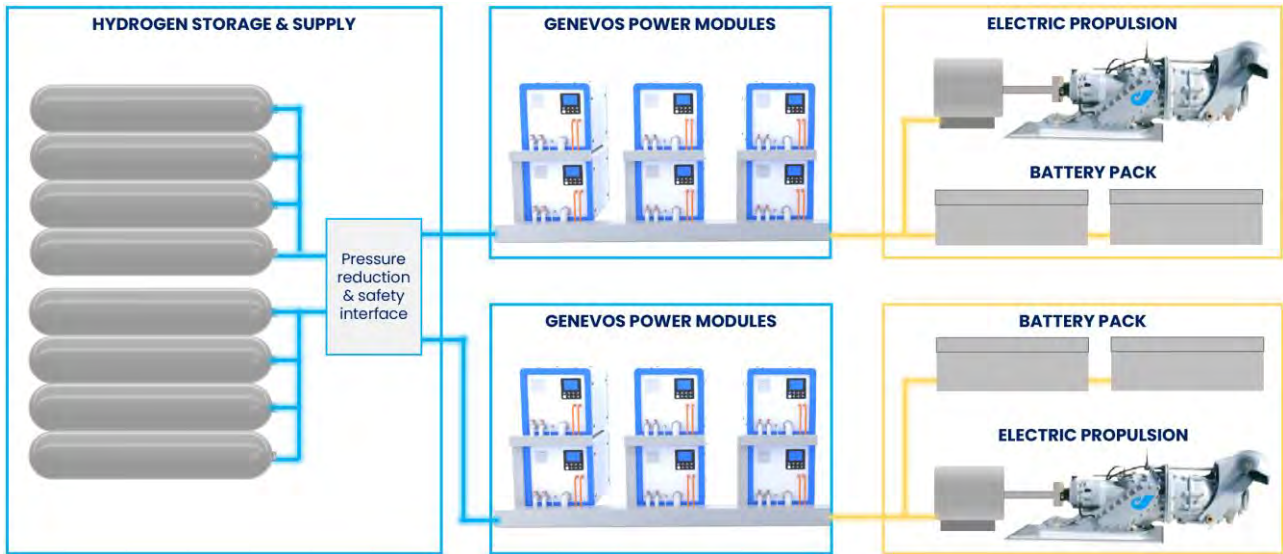
# High Power Applications

Commercial marine applications: 200 kW – 5 MW vessels

HPM-80



HIGH POWER SYSTEM

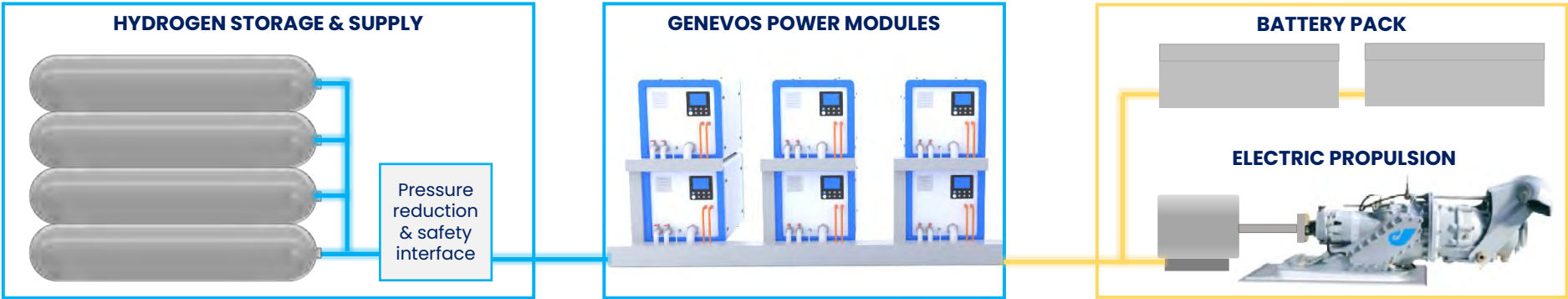


VESSEL EXAMPLES

# Compatibility with Future E-Fuels

*Modularity enables compatibility with liquid e-fuels for future retrofits or new vessels*

## COMPRESSED HYDROGEN



## FUELS

- Green hydrogen
- Blue hydrogen

## HYDROGEN E-FUELS



## FUTURE FUELS

- Methanol
- Liquid hydrogen
- LOHC
- Ammonia



# HPM Benefits

*Accelerating the clean power transition*

## ADVANCED

- Hydrogenics (Cummins) graphite stack technology, world-leaders in hydrogen fuel cells
- Marinised – resistant to saline environment

## EFFICIENT

- Up to 55% net fuel efficiency – twice that of a diesel genset
- Advanced energy management optimising fuel efficiency
- 4 – 6 times lighter than batteries

## ENVIRONMENTAL

- Zero emissions: No CO<sub>2</sub>, NO<sub>x</sub> or SO<sub>x</sub>
- No vibration, low noise
- High recyclability (>90%)

## PRACTICAL 'PLUG & PLAY'

- Rapid refuelling
- Low maintenance
- Modular – multiple units to attain required power
- Fully integrated system for practical installation



# Technology Comparison



***A scalable cost-effective zero-emissions solution for marine***

Comparison of different powertrain technologies, based on a 30 kW marine propulsion system with a 12 hour range.

	LIFETIME (YRS.)	EFFICIENCY	REFUELLING TIME	WEIGHT (GENERATOR + FUEL)	EQUIPMENT COST	COST OF OWNERSHIP (5 YRS.)	TOTAL VOLUME
HYDROGEN	15 - 20	<div><div></div><div></div></div>	15 mins	<div><div></div></div>	<div><div><div></div><div></div></div><div><div></div><div></div></div></div>	<div><div></div><div></div></div>	<div><div><div></div><div></div></div><div><div></div></div></div>
BATTERY	5 - 10	<div><div><div></div><div></div></div><div><div></div><div></div></div></div>	5 - 10 hrs	<div><div><div></div><div></div></div><div><div></div><div></div></div><div><div></div><div></div></div></div>	<div><div><div><div></div><div></div></div><div><div></div><div></div></div></div><div><div><div></div><div></div></div><div><div></div><div></div></div></div></div>	<div><div><div></div><div></div></div><div><div></div></div></div>	<div><div><div></div><div></div></div><div><div></div><div></div></div></div>
DIESEL	15 - 20	<div><div></div></div>	15 mins	<div><div></div></div>	<div><div></div></div>	<div><div></div><div></div></div>	<div><div></div></div>

The Genevos HPM is around 1/3 of the weight of a typical diesel generator

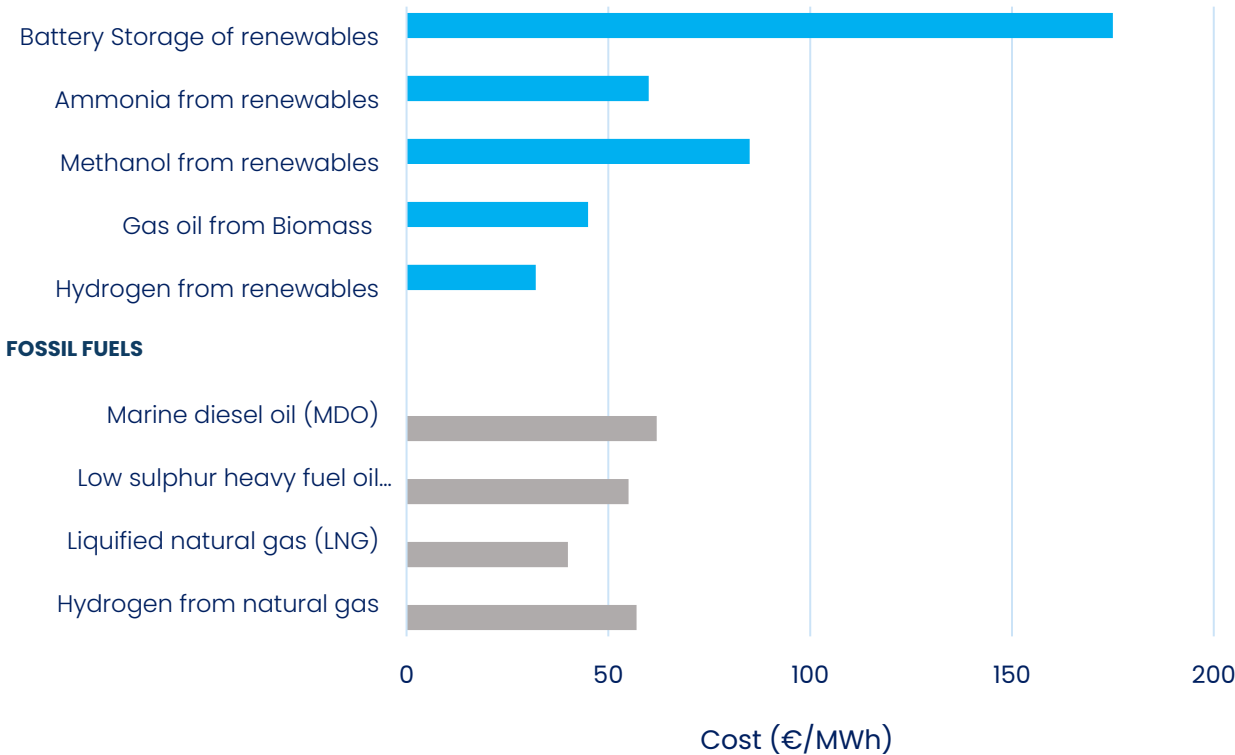


# Hydrogen – A Vital Future Fuel for Marine

*Incentivising global H2 infrastructure to access clean hydrogen*

## PROJECTED FUEL COSTS – 2030 ^

### RENEWABLE FUELS



### PROFITABLE

- Payback after 6 years with over 20% of savings after 10 years in operation relative to diesel system
- Cost of equipment is 50% less than all-lithium battery system for 20 hr system range



^ Source: Zero-Emission Vessels - Transition Pathways 2019

# Engineering for Efficiency

## ***System sizing, installation design, power management***

Genevos offers engineering services for clients exploring and applying HPM solutions through the provision of in-house simulation tools and expertise in power management, control, and hydrogen.

Following installation of the HPM system, Genevos provides support services for efficiency and performance optimisation, along with an annual service package.

## **SERVICES OFFERED – THE COMPLETE PACK**

### Offsite

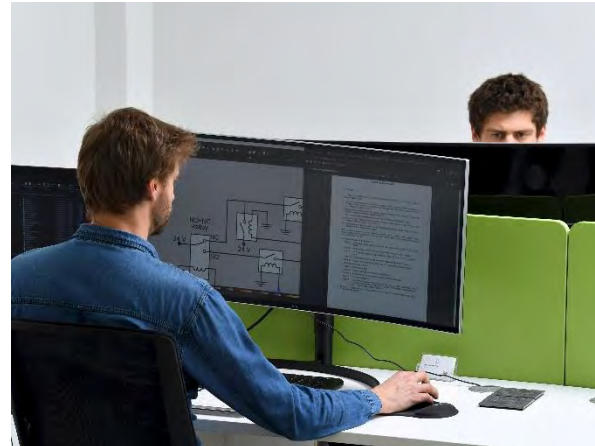
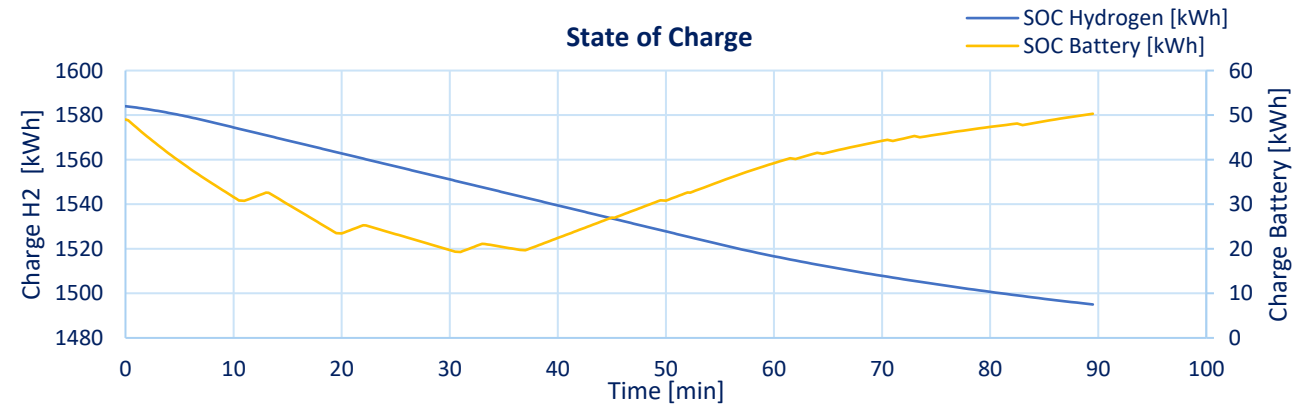
- Preliminary sizing studies based on vessel operational profile
- Hydrogen system integration design
- Safety & risk assessment

### Onsite

- Commissioning support
- System installation

### After-Sales

- Cloud connectivity & remote monitoring
- Power Management System (PMS) upgrades and performance optimisation
- Annual Service Package





# Recent Awards

## Accelerating the clean hydrogen transition

Genevos' award-winning and drop-in marine fuel cell revolutionises maritime power by offering an environmentally friendly solution with high scalability and redundancy.



Propulsion System of the Year 2022



Monaco Price for Innovation in Hydrogen & Transportation



# Partners & Associations

Collaborating for the clean transition



## GLOBAL SERVICE



## PROPULSION



## GREEN HYDROGEN



## CERTIFICATION



## PROJECT



RÉGION  
Nouvelle-Aquitaine



## R&D



## NETWORKS



## AWARDS





# Contact Us

*Find out more about how to decarbonise your vessel or fleet*



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Innovating zero emission power solutions to enable clean and resilient mobility on our oceans

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