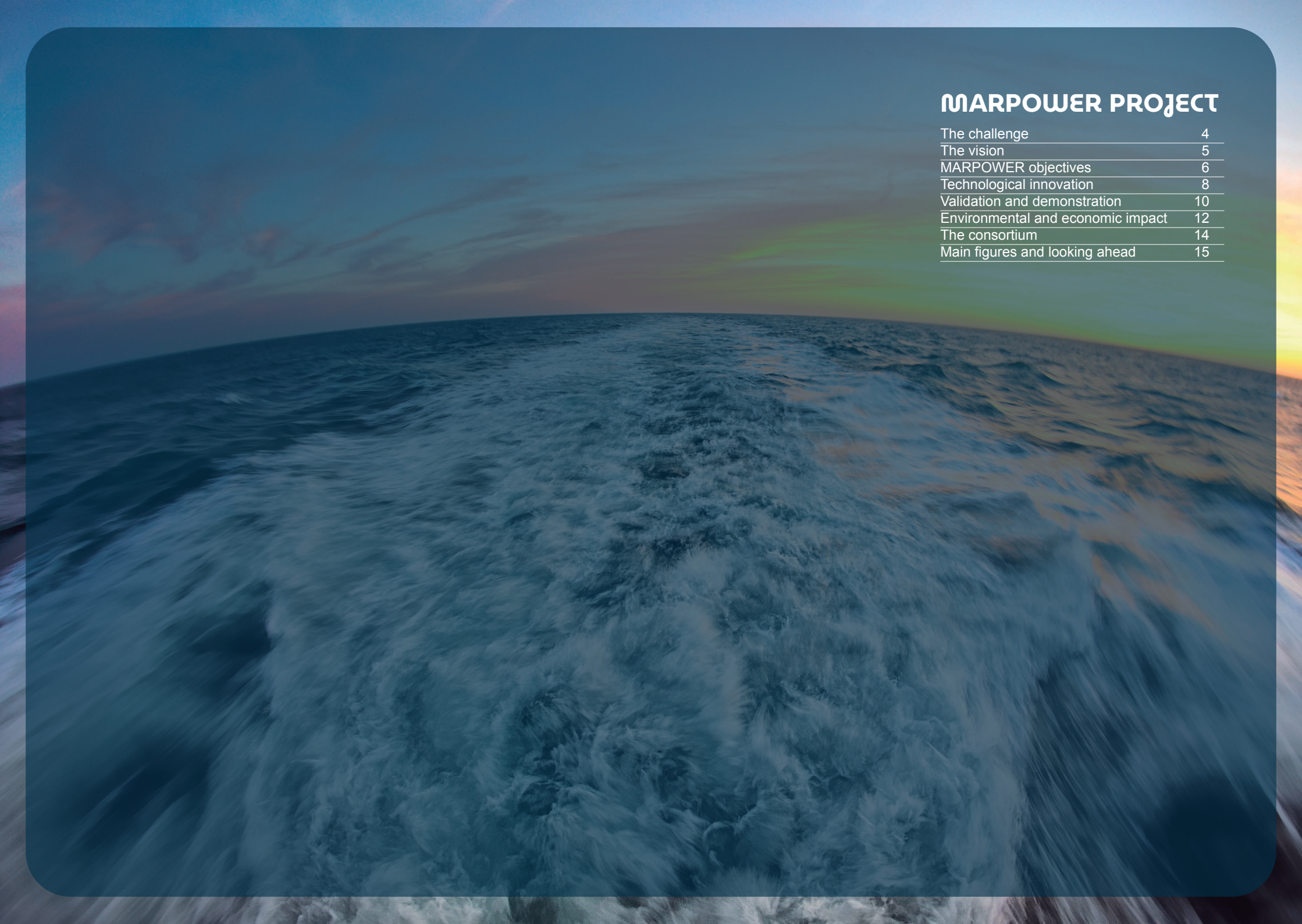




**MARPOWER PROJECT: Efficient zero-emissions gas
turbine POWER system for MARitime transport**

www.marpowerproject.eu



MARPOWER PROJECT

The challenge	4
The vision	5
MARPOWER objectives	6
Technological innovation	8
Validation and demonstration	10
Environmental and economic impact	12
The consortium	14
Main figures and looking ahead	15

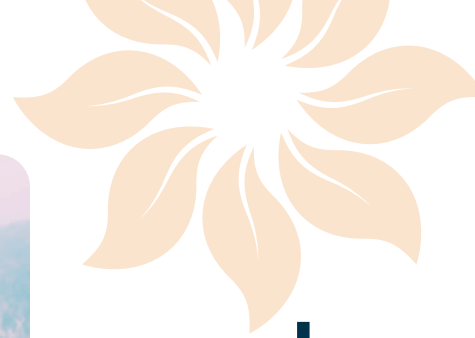


THE CHALLENGE

Decarbonising maritime transport

Maritime transport carries around 90% of global trade, yet it remains one of the hardest sectors to decarbonise. As international and European regulations grow increasingly ambitious, the industry faces an urgent need for cleaner, more efficient power systems capable of adapting to sustainable fuels.

Achieving zero-emission maritime transport will require innovative solutions that deliver efficiency, reliability, and flexibility, enabling ships to operate sustainably without compromising performance.



THE VISION

Redefining how ships generate and use energy

The MARPOWER project is redefining how ships generate and use energy. It is developing an advanced, fuel-flexible and hydrogen-ready intercooled and recuperative two-shaft gas turbine equipped with a bottoming cycle for waste-heat recovery.

Above
50%
ELECTRICAL
EFFICIENCY

Over
70%
OVERALL
EFFICIENCY



The system can achieve more than 50% electrical efficiency and over 70% overall efficiency in combined heat and power (CHP) mode, simultaneously producing electricity and heat on board vessels. Designed for flexibility, it can operate with multiple sustainable fuels – including hydrogen, green methane, green methanol, and ammonia – requiring no or only minor modifications to the combustion system.

By combining high performance with adaptability, the MARPOWER project provides a scalable solution for a wide range of vessels, helping Europe move towards its 2050 climate-neutral goals.



THE OBJECTIVES

Supporting European Green Deal and Fit-for-55 targets for maritime transport

01 Advance sustainable maritime transport

Position Europe as a global leader in innovative, energy-efficient, and environmentally responsible propulsion systems. The MARPOWER project targets up to a 21% reduction in greenhouse gas emissions and aims to achieve around 50% electrical efficiency, which is significantly higher than that of current marine power systems.



02 Accelerate the transition to clean energy use

Reduce the maritime sector's dependence on fossil fuels by enabling operation with renewable and low-carbon fuels.



03 Strengthen economic competitiveness

Deliver a cost-effective and high-performance alternative to fossil-based propulsion systems, reducing operating and maintenance costs while maintaining performance.



05 Inform policy and future regulatory frameworks

Provide robust technical evidence and data to guide future regulatory frameworks that support the adoption of alternative maritime fuels.



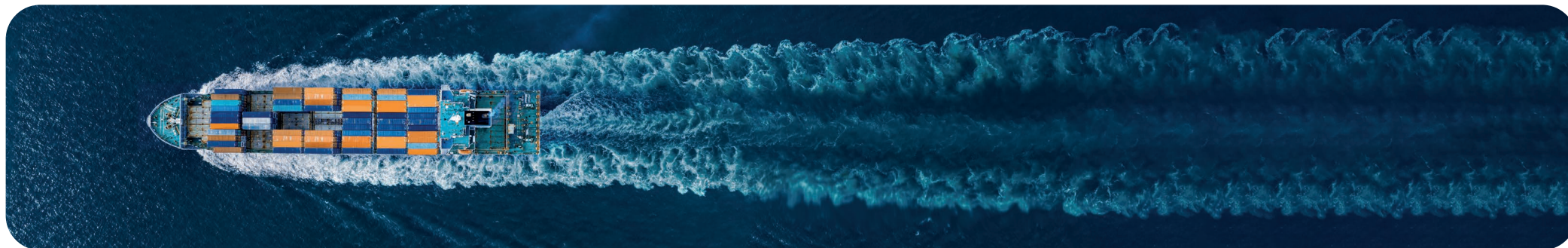
04 Support port infrastructure for alternative fuels

Promote the development of port infrastructure for fuel storage, supply, and distribution, making clean maritime operations widely accessible.

THE CORE

The MARPOWER Energy Conversion System (MECS)

At the core of the MARPOWER project is the MARPOWER Energy Conversion System (MECS), a fuel-flexible and high-efficiency power generation concept for onboard electricity and cogeneration. It integrates several key innovations into a compact, modular, and adaptable system.



01 Fuel-flexible and hydrogen-ready gas turbine

The turbine is designed for exceptional fuel flexibility, operating with both carbon-neutral and zero-emission fuels, such as hydrogen, green methane, green methanol, and ammonia. It maintains stable and high-efficiency performance across different fuel types or qualities, with minimal system modification required, ensuring smooth adaptability to future sustainable fuel options and supporting the transition toward zero-emission maritime transport.

02 Integrated waste-heat recovery (WHR)

A compact radial-outflow turbine recovers and reuses exhaust energy, boosting overall efficiency while keeping the overall system compact and suitable for maritime integration.

03 Active magnetic bearings (AMB)

Advanced AMB technology ensures frictionless and stable high-speed operation, reducing wear, vibration, and maintenance needs while increasing reliability under challenging marine conditions. A moving-platform test bench will replicate real ship motion to validate AMB system performance in realistic sea conditions.

04 Digital twin for smart control and optimisation

Digitalisation is key to the MARPOWER project's innovation strategy. A digital twin continuously mirrors the physical system in real time, enabling predictive maintenance, performance optimisation, and safety assessment. By integrating data from design, testing, and operation, it supports data-driven decision-making, maximising efficiency and reliability throughout the system's lifecycle.



THE TESTING Validation and Demonstration

To ensure the validation of the MECS system under relevant operating conditions, the MARPOWER project combines experimental testing, advanced simulations, and case studies representative of actual maritime operations.



Case study 01 Medium-sized cargo vessel

Focusing on regional freight and short-sea shipping routes, this study assesses how the MARPOWER system performs under frequent port operations and varying loads, demonstrating its ability to deliver optimal efficiency and low emissions in dynamic operating conditions.



Case study 02 Cruise vessel with hotel and long-range operation

Targeting long-distance navigation and continuous onboard energy demand, this study validates the system's ability to manage complex energy needs for propulsion and hotel services, ensuring passenger comfort, reliability, and fuel efficiency.

Subsystem tests, including laboratory and prototype experiments for the combustor, recuperator, and low-pressure shaft, confirm the technology's efficiency, scalability, and safety, preparing it for future commercial use.

THE BENEFITS

Environmental and economic impact

The MARPOWER project develops innovative technologies that enable measurable environmental, economic, and sustainability benefits, while ensuring high standards of safety for future maritime applications.



Sustainability and Safety

Comprehensive Life Cycle Assessment (LCA) and Life Cycle Cost (LCC) analyses evaluate both environmental and financial performance. These ensure that the solutions delivered by the MARPOWER project are not only efficient but also sustainable and economically viable for long-term commercial adoption.



Environmental impact

- Enables the use of carbon-free and carbon-neutral fuels, including hydrogen, ammonia, green methane and green methanol.
- Avoids more than 2.3 million tonnes of carbon dioxide (CO₂) emissions over approximately 15 years of deployment, compared with conventional liquefied natural gas (LNG) systems.
- Eliminates methane slip and reduces other harmful pollutants.
- Supports full compliance with European Union (EU) and International Maritime Organization (IMO) decarbonisation goals.

Economic impact

- Cuts operational and maintenance costs through higher efficiency and lower fuel consumption.
- Strengthens European competitiveness and leadership in sustainable maritime technologies.
- Provides a viable and cost-effective pathway for compliance with future regulations.



THE CONSORTIUM

European expertise driving maritime energy innovation

The MARPOWER project brings together 11 organisations from six European countries, representing the full maritime value chain. The consortium unites leading academic, research, and industrial partners, combining expertise in design, testing, regulation, and innovation management.



Universidade de Vigo



CHANTIERS
DE L'ATLANTIQUE

zabala
INNOVATION

MAIN FIGURES

TOTAL FUNDING

€8

MILLION

DURATION

48

MONTHS

September 2024–August 2028

LOOKING AHEAD

The MARPOWER project marks an important milestone on the path to sustainable maritime transport. Its advances in fuel-flexible turbine systems, renewable fuel integration, and digital performance optimisation create the technological foundation for a new era of clean, energy-efficient shipping. Beyond innovation, the project's results will guide ship design development, support fuel infrastructure planning, and help position Europe at the forefront of the global move to climate-neutral shipping.



**Pioneering sustainable
maritime transport**

www.marpowerproject.eu

STAY CONNECTED



MARPOWER Project



@MARPOWERproject



**Funded by
the European Union**

Funded by the European Union under grant agreement No 101138341. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union. Neither the European Union nor the granting authority can be held responsible for them.