BALLARD™

FCwave™

We deliver fuel cell power for zero-emission marine solutions

Powering the transition to zero-emissions

Environmental regulations are driving the transition to zero-emission operations in the marine sector, which currently accounts for 3% of the world's greenhouse gas (GHG) emissions.

With the fast-approaching need to decarbonize, ship owners and operators are finding ways to reduce their operational emission footprint – not only on water but also in ports.

Certified to meet stringent marine regulations, Ballard's type approved hydrogen fuel cells are the most promising, reliable and scalable power solution that can meet future emission requirements and decarbonize the industry.

Now is the time for the marine industry to make the change to zero-emission solutions.

Benefits of fuel cell technology

Fuel cells can play a key role in helping the marine industry address GHG emissions on the water and in ports.

Longer range

Fuel cell powered vessels do not compromise on performance. They can sail longer and travel farther before refueling (compared to ships running solely on batteries).

Flexible refueling

The hydrogen used for fueling the ship, can be stored in large gaseous or liquid storage facilities allowing for convenient refueling at docks. When the fuel cell uses hydrogen, a surplus of heat is created onboard. This excess energy can be used for heating, ventilation and/or air condition onboard the vessel.

Modular design for scalable solutions

Fuel cell modules can be deployed in parallel, dispatchable configurations to meet variable power requirements. The flexible configurations can be adapted to vessel space constraints.

Stable, reliable power

Fuel cell modules onboard ships produce almost no noise or vibrations. They require very little maintenance, have low maintenance costs as well as a long service life.

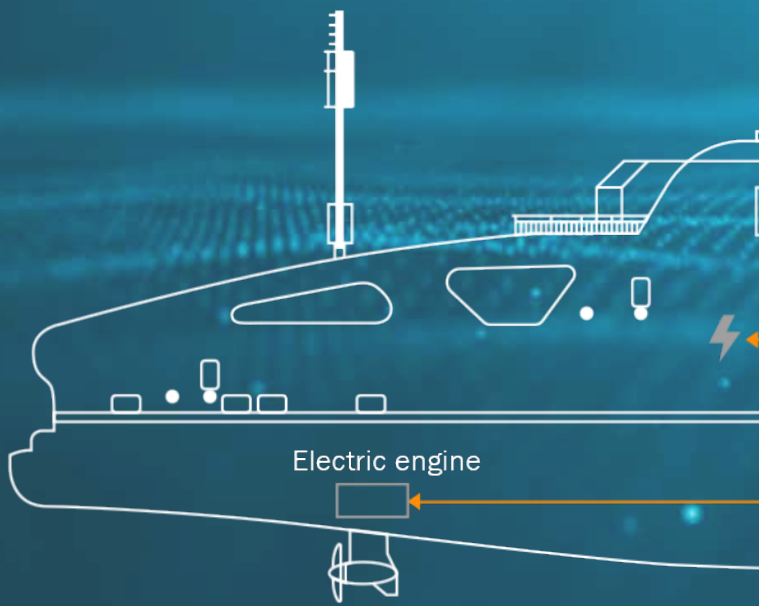
How does a fuel cell work onboard a ship?

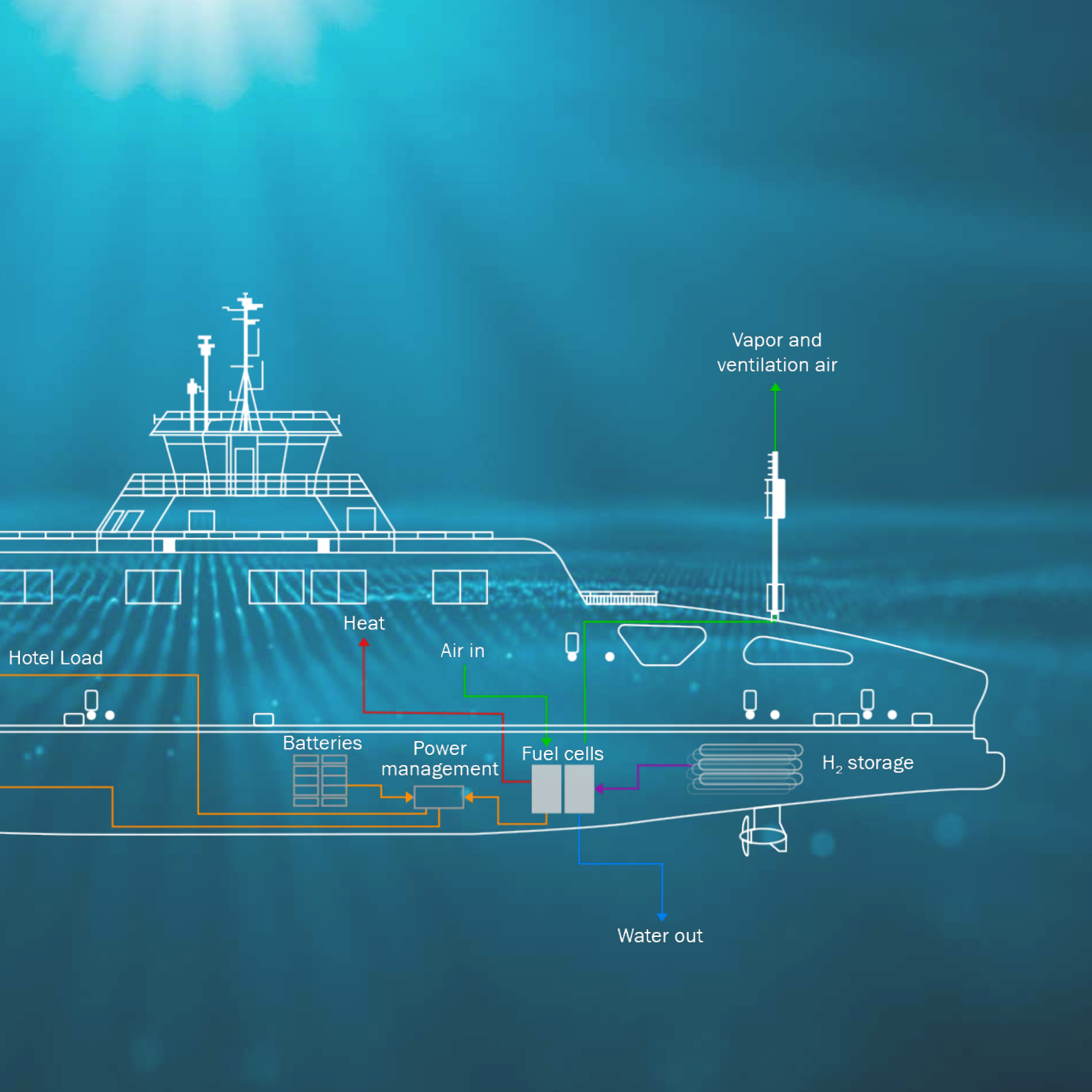
A fuel cell vessel is powered by a hybrid electric system that includes fuel cells and batteries working seamlessly together to provide efficient zero-emission power. Hybrid systems are designed to enable the fuel cells to operate at a steady state for optimal fuel efficiency, and the batteries are sized for transient power requirements.

Just like batteries, fuel cells produce electricity with high efficiency through an electrochemical process. The difference is, with fuel cells, that energy is stored separately in the form of hydrogen fuel.

Therefore, as long as fuel is available, the fuel cell modules will produce electricity.

The only by-products of its use are water, water vapor and heat, and when fueled with hydrogen produced from renewable energy sources, a fuel cell solution is a true well-to-wake zero-emission power source.




Vapor and
ventilation air
Heat
Air in
Hotel Load
Batteries
Power
management
Fuel cells
H_2 storage
Water out

Introducing FCwave™

Designed with the industry to withstand the rigors of the marine environment, Ballard's 200kW certified marine fuel cell module is developed, tested and prepared for installation. FCwave™ is a true plug-and-play solution, providing an optimal zero-emission replacement for conventional combustion engines on board ships.

FCwave™ uses proven components from Ballard's heavy duty fuel cell module portfolio to deliver reliable, safe performance, high power density and favorable economics.

FCwave™

Design & Develop

Build & Validate

Certify

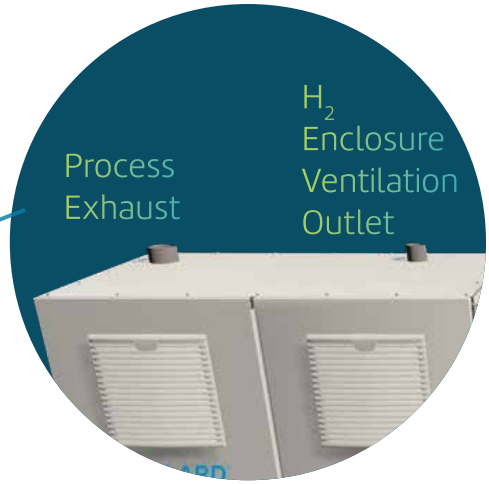
The world's first DNV type approved fuel cell module

FCwave™ is the first fuel cell module of its kind to be type approved by DNV. The certification confirms the module meets the stringent safety, functional, design and documentation requirements necessary for the marine sector to take the next step in deploying zero-emission operations.

With the Type Approval, many of the major barriers for adoption have been removed by ensuring a one-time design approval avoiding repetitive design reviews. It reduces risks impacting product safety and simplifies integration planning, complexity and time.

Product Features

EASE OF INTEGRATION



Air Intake

Control and communication

Process Water

Cooling System

Electrical DC output

Ventilation Air

H_2 Inlet

Connections below floor level

Putting fuel cells to work

Ballard's fuel cells have already proven their performance in a variety of applications including buses, trucks, trains and stationary power supply. Now, in close collaboration with the marine industry, fuel cells are also powering vessels. Early applications include:

- Coastal and inland ferries and barges
- Service vessels
- Cruise ship hotel loads

Just as hydrogen fuel cells can replace the current power sources at sea, they are also an excellent zero-emission solution for ship operations at berth. With a cold ironing solution, powered by hydrogen and fuel cells, ship operators are able to turn off the auxiliary engine while at port, resulting in reduction of vibration and noise pollution, and reduced maintenance frequency and lower overall maintenance costs.

Vessels and marine applications powered by Ballard's fuel cells

Ship name/application		Location	Fuel cell power (product)
MF Hydra – the world's first liquid-powered hydrogen ferry, owned by Norled AS.		The ferry entered into passenger service in spring 2023, and sails on the triangular route between Hjelmeland–Skipavik–Nesvik in Norway.	400kW 2 x FCwave™
Zulu06 – the world's first commercial cargo transport vessel operating on compressed hydrogen.		The vessel is expected to go into operation in 2023, and will ply the river Seine in Paris.	400kW 2x FCwave™
FPS Waal – a retrofitted inland container cargo vessel.		The vessel is expected to sail in 2023, and will operate on the Rhine River (Rotterdam – Duisburg).	1.2MW 6 x FCwave™
Elektra – the world's first zero-emission hydrogen push boat		Since 2022, Elektra has been tested in the waterways around Berlin. In 2023, testing will be extended to routes towards Hamburg.	300kW 3 x FCveloCity™
H2Ports – The first terminal tractor to be powered by hydrogen and fuel cells		Currently testing in real operation at the port of Valencia.	70kW FCmoveHD

Service and Support

Customers will benefit from Ballard's Customer Care program, developed to support thousands of fuel cell vehicles operating globally.

Integration

Insights from our many years of experience help accelerate and optimize our customers' overall fuel cell vessel design work. We provide on-site support during integration, certification and commissioning.

Service

Ballard provides comprehensive and flexible service packages that cover the module's lifetime. Service includes preventative maintenance, remote monitoring, spare parts and on-site service.

Support

Ballard's highly professional technicians with extensive product knowledge are available to provide technical support. The team is accessed through a global call centre 24:7.

Training

Ballard offers a training program to support the installation, operation and maintenance of FCwave™. Upon completion of the training program, attendees will be certified as a qualified technician, able to service the fuel cell module.

Marine Center of Excellence

Combining our 40+ years of experience in designing, manufacturing and servicing fuel cells to meet the requirements of the industry, Ballard's FCwave™ is a future-proof zero-emission fuel cell solution for marine applications.

FCwave™ is built at Ballard's Marine Center of Excellence in Hobro, Denmark. Established in 2019, the Center has an annual production capacity of more than 40MW fuel cell modules.

Do you want to learn more about our zero-emission fuel cell solutions?
Get in contact with Ballard today.

PROVEN

FCwave™ is powering the world's first liquid hydrogen-powered ferry, MF Hydra

PERFORMANCE

FCwave™ is the first marine fuel cell module to receive DNV Type Approval

PROMISE

We deliver end-to-end support throughout the whole customer journey

We deliver fuel cell power for a sustainable planet

When it comes to product lifecycle management, Ballard is at the leading edge of innovation in applying the three "Rs" to its fuel cell stacks. Our expertise in refurbishing, reusing, and reclaiming fuel cell components means our solution is both zero-emission and zero-waste.

Here for life™

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