

Case study | VACON® NXP, MBC 5100, MBT 5250, MBS 5150, RT 121 and PVG 32

Future of the Fjords **meets** **2026 emission targets**, today



**Zero
emissions**

Norwegian fjords enter a zero-emission future

Future of the Fjords represents a new standard of environmentally responsible passenger transport, as the first fully electric carbon fiber vessel in the world. The development of this electric catamaran supports the company's goal of minimizing environmental impacts in the Norwegian fjords, while maximizing the experience of natural beauty for the passengers – an essential approach for its route between Flåm and Gudvangen in the pristine Nærøyfjord, part of the UNESCO World Heritage park.

In 2018 the Norwegian parliament passed a resolution to make its iconic fjords a zero-emissions zone as soon as possible and by 2026 at the latest. This defines the deadline for vessel operators in the fjords to eliminate pollution emitted by their ships – a deadline which *Future of the Fjords* has met with eight years to spare.

"It is our mission to safeguard the vulnerable environment we give access to, while providing the absolute optimal experience for our passengers," explains Rolf Sandvik, CEO of ship owner The Fjords. The undeniable success of this mission was recognized

with the award of 'Vessel of the Year' at the SMM 2018 marine trade fair in Hamburg.

Safeguarding a pristine environment

The vessel proves it's possible to maximize the travelers' experience while ensuring minimal impact on the magnificent fjord environment. Panoramic windows and mountain-like outdoor walking paths give passengers spectacular views and an experience of natural beauty unlike any other.

Innovative design for pure performance

Optimizing energy efficiency is a key strategy in ensuring the viability of the vessel and reducing its environmental impact.

Therefore, *Future of the Fjords* uses high tech solutions in a range of disciplines to achieve lowest possible energy consumption. Light carbon sandwich laminates for the hull and superstructures ensure approximately half the weight by comparison with conventional materials.

State-of-the-art catamaran design also reduces waves and washes which over time can damage the exposed shores of the narrow fjords. Its innovative propulsion system is battery powered, and the vessel also integrates upgraded IT systems for digital passenger convenience.

Solutions from Westcon Power & Automation are integrated throughout the vessel, working constantly behind the scenes to control, regulate and optimize performance. Components from Danfoss are used in several of the products from Westcon including inverters for main propulsion, auxiliary grid and chargers. They ensure reliable operation to reduce maintenance to an absolute minimum.

Heart of the vessel

The battery pack drives the two electric motors. It comprises 8 racks with 17 battery modules each, totaling



Lars Haugnes is highly satisfied with the performance of Danfoss drives and instrumentation installed in the machine room of *Future of the Fjords*, contributing significantly to protecting the pristine fjord environment.

"It is good to keep the 'green line' in mind to take care of the fantastic nature we have here. We have seen a lot of ships that pollute our environment, and it is a big step forward to operate in the fjords with electric vessels. Good for us, good for the tourists, and good for the environment"

- Lars Haugnes, Chief Engineer, Future of the Fjords

1.8 MWh power capacity. When charged, the vessel can run for more than two hours at a speed of 11 knots. No aspect of performance optimization

is left to chance: a Danfoss MBT sensor is connected to the fan ventilation control to ensure the temperature is always right in the battery room.

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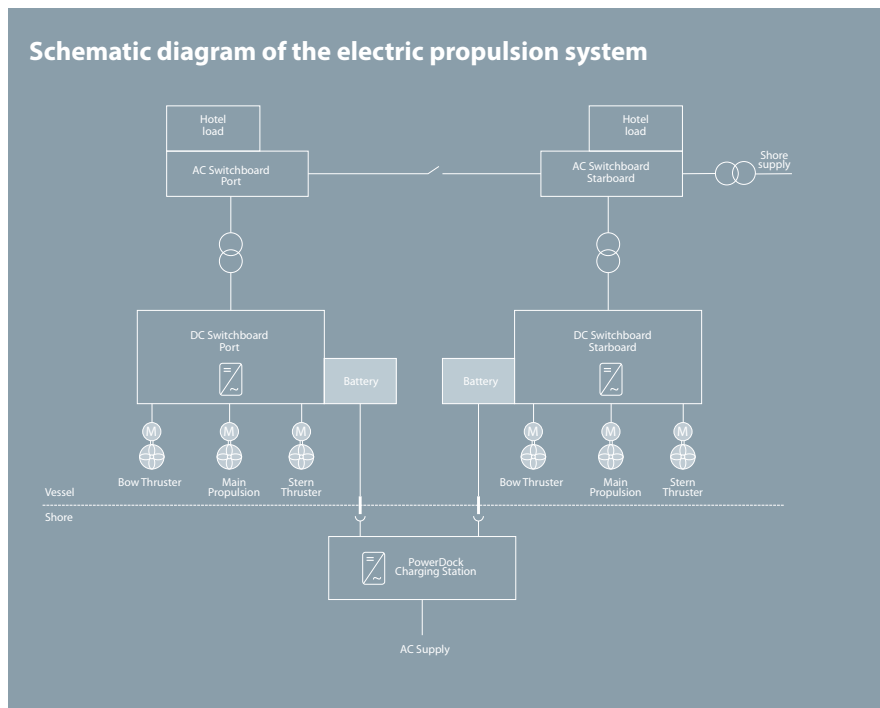
Fossil-free propulsion

The electric propulsion system enables the vessel to sail emission-free at a cruise speed of 16 knots. Two electric permanent-magnet motors capable of 450 kW output at 1180 rpm drive the vessel. Motors and propulsion control systems are delivered by Westcon.

The battery-powered propulsion system eliminates NO_x and CO₂ emissions, and reduces noise and vibrations. The feathering position capabilities

of the system reduce the propulsion power required, by further minimizing resistance and speed loss.

The main propulsion and also bow and stern thrusters are equipped with VACON® drives to control speed and optimize power consumption and maneuverability. Also the grid converter is a VACON® drive supplying the auxiliary switchboards with reliable power. All drives ensure safe and high efficiency power conversion from the battery pack.



Sufficient lubrication

Converting the power produced by the electric motor into a controlled thrust in the most efficient way also contributes to cutting down energy consumption to a minimum. Sufficient lubrication is the key to high propulsion efficiency and this can only be achieved with accurate control of pressure and temperature under all operating conditions.

In the propeller reduction gear, a Danfoss MBC 5100 pressure switch, MBT 5250 temperature sensor, MBS 5150 pressure transmitter and the PVG 32 high-performance proportional valve are installed in the propulsion system to ensure optimal lubrication and reduce energy consumption to a bare minimum.

“Quality suppliers such as Danfoss and Westcon give us good working conditions and a nearly maintenance-free ship to operate in this area”

- Lars Haugnes,
Chief Engineer, Future of the Fjords



VACON® drives power the main propulsion and thrusters

Lightweight power conversion delivers full thrust

The power system designed by Westcon is 2 tons lighter in weight than the next best alternative, which lowers the propulsion power required. This huge benefit for efficiency was only possible due to the freedom of design Danfoss VACON® drives offer, explains Frode Skaar, Business Development Manager at Westcon:

“Thanks to the versatility of Danfoss AC drives which are fully compatible with many alternative technologies, we were able to design both the power system and the shore supply in a very agile manner. Compared to our closest competitor, we could find equipment doing the same job which was 2 tons lighter, required fewer components, and ensured lower power losses, resulting in a better system”

- Frode Skaar, Business Development Manager, Westcon

The VACON® drives also enabled Westcon to overcome challenges in heat management of the power conversion systems, resulting from versatile components and a problem-solving process where shipbuilder and owner worked positively and flexibly together throughout:

- VACON® NXP DC/DC Converter
- VACON® NXP Grid Converter: AFE and MicroGrid variants
- VACON® NXP Air Cooled
- VACON® 100 FLOW

Vessels recharge
in just

20
minutes

The PowerDock serves both fully-electric Future of the Fjords and its sister ship, the diesel-electric hybrid vessel Vision of the Fjords.

World's first floating power dock

The local mains grid does not have sufficient capacity to charge Future of The Fjords directly. Instead, the vessel recharges its battery at the PowerDock, a floating fiberglass dock with 2.4 MWh charging capacity: 1.2 MWh sourced from a battery pack and 1.2 MWh from the grid. Power Dock charges steadily throughout the day, powered by the local mains grid. Recharging the vessel takes just 20 minutes, during which the dock delivers about 800 kWh of power. Westcon equipped the power dock with 2.4 MW VACON® drives and their own control system, ensuring everything is seamlessly integrated.

Future of the Fjords

Length: 42 m

Width: 15 m

Materials: Carbon fibre sandwich

Seats: 400 passengers

Class: DNV GL light craft

Electric motors:
2x 450 kW output at 1180 rpm

Gearboxes:
2x Servogear HD220H gearboxes
Propeller: Servogear Ecoflow controllable-pitch propeller (CPP) propeller with diameter of 1475 mm; propeller shaft diameter 100 mm

Battery pack: 1.8 MWh



Systems integrator Westcon Power & Automation AS designed and delivered the power and automation system eSEAMatic BLUE on board Future of the Fjords to meet stringent operational and environmental demands. The systems comprise:

- Power and automation systems for vessel and charging stations
- Electric motors, controlled by the eSEAMatic Blue energy management system
- e-SEA® Drive power conversion and manoeuvring control systems
- Integrated automation systems (IAS)
- Battery system
- Propulsion control system
- Main switchboards

