96%

drop in CO_2 emissions from Molslinjen's three Fanølinjen ferries

ENGINEERING TOMORROW

Danfoss

Case story | VACON® NXP Family

Navigating **sustainable change**

The situation

Maritime transport emits more than 900M tons of CO_2 every year – accounting for 2.5% of global greenhouse gas emissions. And with short-sea and inland shipping vessels wasting large amounts of energy while running idle in port, electrification offers a clear and direct route to a more efficient future for the industry.

Molslinjen, Denmark's largest domestic ferry company, has a fleet of 15 ferries operating nine routes including the 2.5km stretch between Esbjerg and Fanø, transporting approximately 1.8M people along this particular passage every year.

To reduce its carbon footprint without causing a major ripple effect across the business, Molslinjen initiated a new strategy with energy efficiency at its core: beginning with the introduction of an emission-free, fully electric ferry to its Esbjerg-Fanø route.

The challenge

To continue providing a reliable service while reducing emissions along the Esbjerg-Fanø route, which passes through World Heritage waters, Molslinjen began researching the smartest and most convenient way to build a green ferry – with electrification providing the answer.

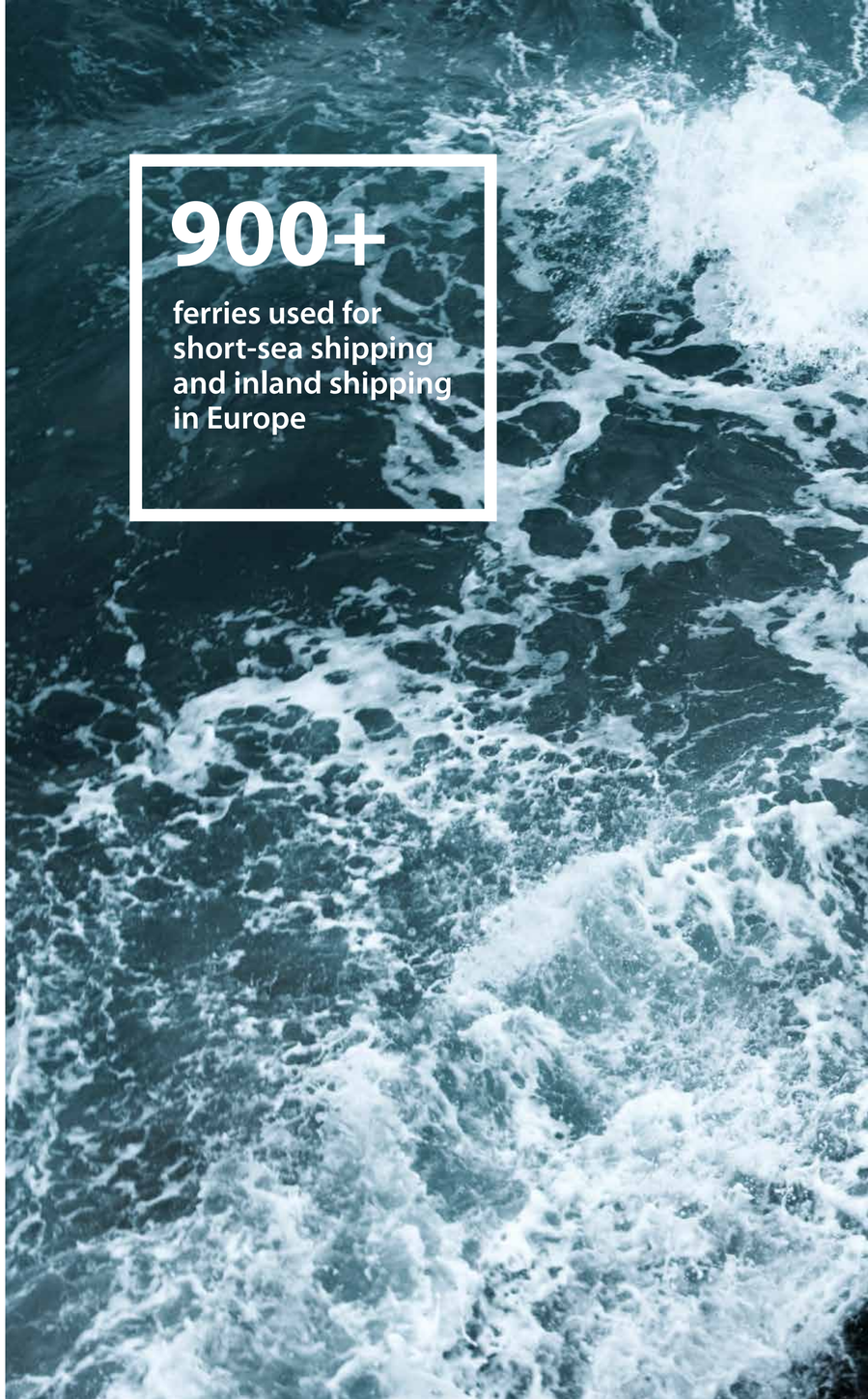
Henceforth, the challenge became how to design and build **Denmark's first commercially viable, fully electric ferry** – named Grotte.

For the project to succeed, the new ferry would have to live up to a lot of requirements: from being able to charge quickly while in port, to matching the power capacity of its sister ferries – all while generating zero emissions.

At fifty meters long and 14 meters wide, Grotte was commissioned and built with help from Danfoss, Vest-El A/S and Hvide Sande Shipyard.

"We are going from trot to gallop, with many of the new projects in our pipeline moving towards electrification. Our customers want to implement electrical solutions on board their ships because the technology is available and so is the renewable energy."

David B. Thorstensen, Project Manager, Hvide Sande Shipyard



The solution

Danfoss supplied inverters to control the power current on board Grotte, in addition to installing 375 kW propulsion electric motors at either end of the ferry.

A common DC system, the set-up was split over two main panels. Each panel runs independently of the other and consists of the following:

- VACON® NXP DC/DC Converter for DC/DC battery control
- VACON® NXP Air Cooled drives to control liquid-cooled motors
- VACON® NXP DCGuard for internal DC busbar protection
- VACON® NXP Grid Converter to supply power to AC voltage systems that control navigation, sub systems and lighting

By providing the above **power conversion technology**, Danfoss proved key in helping Molslinjen meet its green goals – generating electric propulsion from Grotte's engine room while installing a vessel charging system at Esbjerg Port complete with charging tower.

"We have gone from a diesel-fueled generator to an electrified system and it's doing something good for the climate. That's exciting. This is our first electric ferry and in this project my team relied on well proven and tested products from Danfoss."

Steen Christensen, Partner, Vest-El A/S

The outcome

With all the elements in place – including 15 tons of lithium-ion-batteries – Molslinjen launched Grotte on October 1, 2021, as the first commercially viable and fully electric ferry to be built in Denmark.

In addition, the vessel charging system at Esbjerg Port has charging capacity of 2,600 kW with all power sourced from green energy, meaning Grotte can easily recharge during her seven-minute stopovers before heading back to Fanø on a **zero-emission** trip.

This also means that alongside Grotte's two sister ferries Fenja and Menja, both of whom operate using fossil-free biofuel, Molslinjen's Fanølinjen ferries are as close to being CO_2 neutral as possible. Additionally, all three ferries are expected to reduce annual emissions by an astounding 96% compared to their fossil-fuel counterparts.

And so, with power capacity of 1,107 kW/h, a maximum speed of roughly 20 kph and zero emissions, it's clear skies ahead for Grotte.

"It's fantastic to be sailing on board Grotte and our passengers will experience a quieter journey compared to that offered by a conventional ferry which uses a diesel engine. If we are to reach the climate targets that have been set, we need to start transforming the rest of our fleet now."

Ole Berg-Hansen, Chief Engineer, Molslinjen