

ENGINEERING
TOMORROW

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Case story | VACON® NXP Drive

Hybrid ferries connect the city of Amsterdam nonstop

24/7

hybrid ferry
operation is
powered by
VACON® NXP Drives

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Amsterdam's waterfront, the IJ River, is one of the busiest Dutch waterways connecting the Port of Amsterdam with the North Sea. Every day many passengers cross the IJ River with bicycles, mopeds or on foot, on the 6 free ferry routes which are operated by GVB – the public transport company of Amsterdam.

GVB has a policy of reducing the emissions and environmental impact from its ferries, trams, buses and cars to an absolute minimum. So when GVB ordered 2 new ferries from Holland Shipyard they decided to use battery hybrid technology to improve fuel efficiency and reduce pollution.

Peak shaving reduces generator size

The ferries operate 24 hours 365 days per year. It takes about 4 minutes to cross the IJ River and the ferries are docked for only about 2 minutes before departing on the next trip. A 100% battery-powered electric ferry was not possible as the time spent docked in port was too short to charge the batteries from a shore power connection. Instead, GVB decided to use electric propulsion with diesel-powered generators and Lithium-Ion batteries to shave the power peaks. This allowed them to downsize the generators, as these batteries enable the generators to run very efficiently with an almost constant load.



Left: Mr. Casper van der Werf, Project manager, GVB (Public Transport Company of Amsterdam). Right: Mr. Kees Bark, Electric ship design consultant



Project manager at GVB, Casper van der Werf explains: „We selected a hybrid solution from Holland Shipyard and their electrical propulsion partner, Holland Ship Electric which has very good experience using VACON® NXP drives for their electric propulsion systems“.



Hybrid improves air quality ...

To reduce the remaining air pollution the diesel engines are fitted with efficient exhaust gas cleaning systems, also known as SCR (selective catalytic reactor), which remove toxic gases and particles.

The IJ Ferries 60 and 61 already fulfil the new stricter air pollution rules, which will apply from 2019/2020. This contributes to improving the air quality and reduces noise for the citizens of Amsterdam and for the millions of tourists using the ferries.

... and maneuverability

The skippers are very happy with the new ferries: The ferries are just as easy to handle as the conventional diesel-powered sister ships, but they are much quieter. The low noise level makes the ride a pleasure for both passengers and crew.

In normal weather conditions, there are 2 generators operating at constant load. The batteries are charged when the ferries are at standstill or running at low speed. When the ships accelerate, the peak power is drawn from the batteries. In battery mode, with generators turned off, the ferries can run 10-11 round trips which corresponds to approximately 1 hour's operation. Under normal conditions with the generators running, the state-of-charge of the batteries rises and falls by only a few percentages during a round trip.

24/7 uptime

The city of Amsterdam considers the ferries to be “floating bridges” – which help to tie the northern and southern parts of Amsterdam ferries. The floating bridges are free of charge for the passengers.

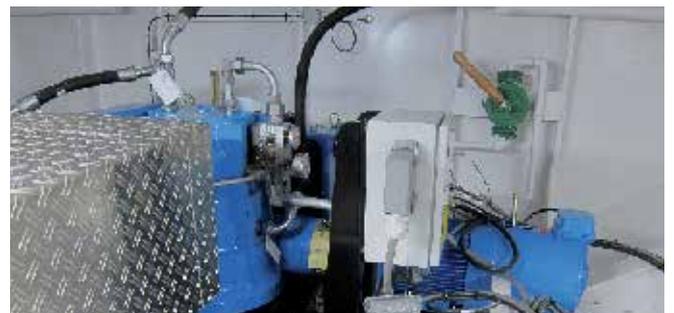
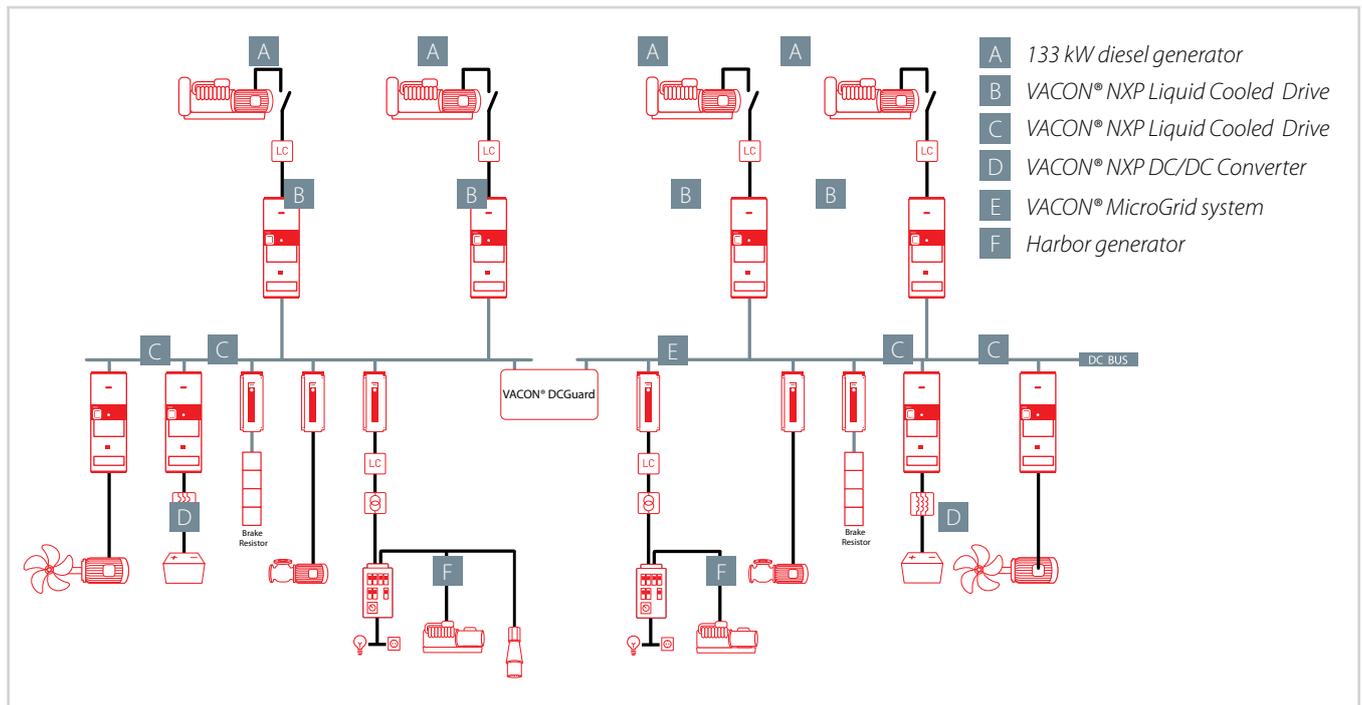
The two redundant DC grid systems were chosen for safety reasons – but the short circuit protection was a challenge.

GVB is satisfied with the solution and will consider the same hybrid ships the next time there is a need for new ferries.



René Stout of Holland Ship Electric (HSE) demonstrates the HSE touch screen control for the hybrid power and propulsion system.

Schematic of the hybrid propulsion system



There are two 133 kW JohnDeere/Stamford generators in each engine room, four in total. The 2 engine rooms are located one at each end of the ship. The Solfic SCR exhaust gas filter removes toxic gases and particles.

The ZF azimuth thruster (blue) is powered by an Oswald high-efficiency PM motor (green). Azimuth thrusters are often used in small ferries due to the good manoeuvrability they provide.



The 2 x 65 kWh Li-Ion EST-Floatch Battery system with battery management system.

GVB hybrid ferries

The IJ Ferry 60 was taken into service in October 2016 and the IJ Ferry 61 was taken into service in March 2017. The two new ferries use state-of-the-art diesel-electric-battery hybrid propulsion.

IJ Ferries 60 and 61:

Type of ship:	Ferry for passengers (max. 310), bicycles and mopeds
Ship owner:	GVB – Public Transport Company of Amsterdam.
Shipyard:	Holland Shipyards, Hardinxveld-Giessendam, NL
Electrical System Integrator:	Holland Ship Electric, Rotterdam, NL
Waterways:	The IJ river in Amsterdam
Propulsion and power generation system:	<p>2 x 250 kW electric azimuth thrusters with Oswald PM motors controlled by VACON® NXP Liquid Cooled Drives.</p> <p>4 x 133 kW floating frequency Stamford generators powered by John Deere diesel engines. The AC power is converted to DC using VACON® NXP AFE drives.</p> <p>2 x 68 kWh EST-Floatch Lithium-Ion Polymer battery systems.</p> <p>The 50 kW, 50 Hz electrical ship grid is generated by a VACON® NXP Liquid Cooled drive with MicroGrid functionality.</p> <p>The main power grid is a 750 V DC grid connecting the power generators, batteries and consumers. There are 2 redundant DC grids for safety reasons. The 2 grids are connected via a VACON® DCGuard which ensures safe separation of the 2 grids in the event of a short circuit in one of them.</p>
Year:	2016 and 2017
Length:	33.60 m
Breadth:	9.00 m
Draught:	1.66 m