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## Electrification

Scandlines operates two short-distance ferry routes between Germany and Denmark with high frequency and large capacity. In 2013, Scandlines introduced the groundbreaking hybrid system on M/V Prinsesse Benedikte, a diesel-electric ferry, operating the Puttgarden-Rødby route. In 2014, we converted the remaining three passenger ferries on this route to hybrid vessels as well.

Scandlines' hybrid system combines traditional fuel power with electric battery power. In normal service, only two or three of the ferry's originally five diesel generators are working, at a load of 40 to 55 % at sea and 8 to 10 % in the port. However, the generators work most efficiently at a load of 85 to 90 %. By replacing one of the five diesel generators with a battery bank of 1.6 MWh, corresponding to approximately 400 hybrid cars, and coordinating this with the diesel generators, the generators are always working at an optimal load of 85 to 90 %.

As the first shipping company in the world, we are able to make large-scale use of an on-board hybrid system, which stores energy in batteries and enables optimized operation of the ship's engines, ensuring maximum fuel efficiency. Consequently, the ferries operating the Puttgarden-Rødby route are expected to cut CO<sub>2</sub> emissions by up to 15 %, corresponding to approximately 15,000 t p.a. On our Rostock-Gedser route, the vessels' fuel consumption has reduced by a third per crossing per car, compared to the former ferries on the route. Meanwhile

the scrubbers on our fleet clean the engine exhaust gasses of pollutants such as sulphur and particulate matter, decreasing these emissions by at least 90 % and hereby ensuring that Scandlines is in full compliance with the 2015 SECA rules for the Baltic Sea. We are constantly evaluating the energy consumption profiles of our fleet and looking to find further ways to reduce energy use. We are currently working to collect mass data to create a database-optimized operations profile.

The hybrid ferries are just the successful first step of Scandlines' green strategy and our objective is to operate zero emission ferries on the Puttgarden-Rødby route within a few years. Our current focus is on reducing the energy consumption per crossing as much as possible. With 34,000 annual departures on the Puttgarden-Rødby route alone, we may achieve big energy savings through small improvements. Meanwhile we are working on the infrastructure enabling a sufficient power supply in the ports as well as the technical solutions required to make the Zero Emission initiative feasible in all aspects.

Compared to the Puttgarden-Rødby route, the journey on Rostock-Gedser is longer and therefore results in an increased energy consumption. Hence, in order to sail entirely emission free between Rostock and Gedser new technology is required. A possible solution could be a hybrid ferry that combines hydrogen and battery power, but that is a determination we will make at a later stage.