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Background and current status

- Norsepower has brought to market the first proven auxiliary wind propulsion system
- The first Rotor Sail was tested on land during 2014
- The first commercial project with two Rotor Sails was delivered in 2014-2015 to Bore's M/S Estraden
- The results from M/S Estraden have confirmed the expected performance of the Rotor Sail Solution. Average fuel savings exceed 6% on the route between Rotterdam and Teesport (UK)
Physical phenomena - Magnus Effect

- When wind meets a spinning object, a high and low pressure differential is created, creating thrust at 90 degree angle to the wind
- Flettner (DE) and Savonius (FI) discovered the fundamentals of a “Flettner rotor” in 1920s
- Norsepower has modernized the technology entirely by introducing high tech materials and automated operation
Norsepower Rotor Sail Solution

• Push-button controlled auxiliary wind propulsion – based on renewable energy
  – Adjusts automatically to wind conditions
  – Enables throttling back engines to reduce fuel costs without lowering the cruising speed
• Savings are typically 5-20% of fuel costs and related emissions
Optimal operating conditions

- The Rotor Sails perform best when the wind speed is high and wind is coming from the beam.
- Examples of routes and areas with a high savings potential:
  - Northern Pacific crossing
  - Northern Atlantic crossing
  - North Sea and Baltic Sea areas
Rotor Sails on board M/S Estraden
Installation of Rotor Sails

- 2 foundations and cabling were installed earlier during 5 days of docking
- Installations took place in November 2014 and November 2015
- The complete installation from the start to a rotating rotor took only 7 and 5 hours (respectively) and were made during normal harbour stays - including mechanical, electrical and automation systems
Results from M/S Estraden

- Thrust production is in line with expectations
- Mechanical construction proven - system availability exceeds 99%
- Noise and vibrations are on low level
- The automation system works as intended
- The rotor has a stabilizing effect on the roll motion of the vessel
- No recognizable effect on rudder angles or leeway (as expected)
- The system is easy to operate and the crew is able to use it after a short training, comments: “Operating the system does not increase my workload at all. I just turn it on and forget it.”
Verified savings of M/V Estraden with two Norsepower Rotor Sails

- Average net savings (with two rotors): 6.1% (400 tons fuel and 1200 tons CO2/year)
- Payback period (MGO, 400 USD/t): 5 years

“We are proud to be the first shipowner to install the Norsepower Rotor Sail, and demonstrate that wind propulsion technology has verifiable 5% fuel savings on a yearly basis, can be retrofitted without any off-hire costs, and is extremely easy to use in practice.”, **Jörgen Mansnerus, Vice President, Bore.**
Video from M/S Estraden

Visit http://tinyurl.com/qduztmr
Illustration of tilting Rotor Sails
The next projects

The Viking Line new build design was published on 23 November 2016

Norsepower has signed an agreement to install a Rotor Sail onboard the Viking Line cruise ferry Grace in 2018
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