ECO FLETTNER™

An innovative Wind Propulsion System for greener Shipping

Technical Description

The Eco-Flettner rotor is designed to combine optimized aerodynamic performance with a robust and costs saving technology. Special features are the high aspect ratio (6:1) and the integration of a lower end plate in addition to the commonly applied upper end plate. The Rotor is built of lightweight fibre composite reducing the impact on ship stability. Wind tunnel tests have proved the high aerodynamic lift at reduced drag, thus improving propulsion performance especially in upwind conditions. This is statistically the most common sailing situation.

Main Characteristics:

-	**Cylinder Height**	18 m
-	**Cylinder Diameter**	3 m
-	**Upper/Lower End Plate Diameter**	6 m
-	**Electric Drive Motor**	70 kW
-	**Max. RPM**	280
-	**Power Consumption (Average)**	20 - 30 kW
-	**Cylinder Material**	Fibre Composite

Figures 1 &2: Rotor assembly at the land-based test stand
(Source: Oltmanns)

Basic Principle

The Eco-Flettner rotor system is based on the utilization of the Magnus-effect. Contrary to conventional sail systems the Flettner rotor actively generates a rotating air cushion around the cylinder to superimpose the wind. This results in an intensified pressure distribution as indicated in figure 3, creating impressive aerodynamic performance. The rotor thrust in sailing direction contributes to the ship's propulsive power.

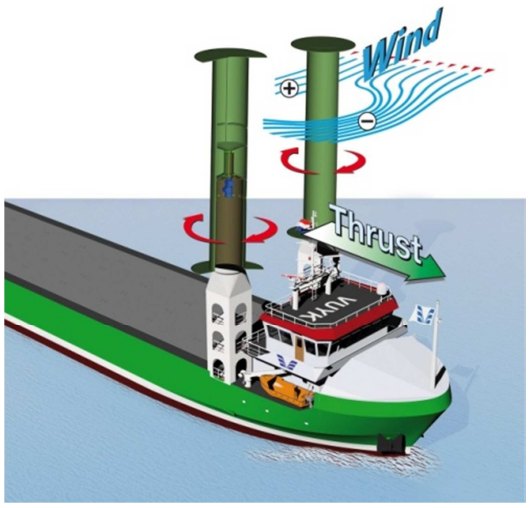

Figure 3: Basic principle of Flettner-rotors
(Source: Oltmanns)

Developers

The Eco-Flettner wind propulsion system was developed by a Dutch-German joint industry project partnership of 15 maritime companies and research institutions under the framework of the European Interreg programme[1]. The second project phase is currently being implemented. In 2017 the rotor will be installed and trialed on board the coastal vessel "*Fehn Pollux*" owned by Fehn Shipping based in Leer, Germany. The main objectives of the second phase will be performance validation in real shipping practice and the refinement of control, automation and routing elements to increase overall efficiency.

Return on Investment: Retrofit and Newbuild

The Eco-Flettner system is suitable for both retrofit and newbuild. The cost structure is dependent on the amount of additional steel work for the installation on the ship.

An initial estimation of production costs indicates that the price for a complete Eco-Flettner system (comprising 2 rotors and the bridge control unit) will be EUR 800,000.

Voyage simulations conducted by the Hochschule Emden/Leer (University of Applied Sciences) indicate an energy saving potential of approximately 200 kW shaft power from a system comprising two 18 metre rotors (corresponding to 15-20 per cent fuel consumption, depending on applied power). This is an average estimate for one year for a coastal ship design. The basis of the simulations was a route along the western European coast line from Denmark to Spain. The results are subject to this specific route, wind statistics and ship performance modelling and should therefore be understood as initial indicative figures.

Assuming fuel oil consumption of 200 g/kWh and a yearly sailing performance of 280 days, the fuel oil savings add up to approximately 270 t in one year. For ships operating in SECAs with low sulfur MGO, the yearly savings would be in the range of EUR 135,000 (assuming a bunker price of about 500 EUR/t, 2017). It must also be noted that ROI is subject to the oil price and the levy on CO_2 which may be introduced in the future.

Contact

Prof. Capt. Michael Vahs
Head of Research

Hochschule Emden/Leer
University of Applied Sciences
Bergmannstrasse 36
26789 Leer
Germany
Mobile: +49 170 4477351
Fon: +49 491 92817-5022
Fax:+ +49 491 92817-5011
E-Mail: michael.vahs@hs-emden-leer.de
Internet: www.hs-emden-leer.de

Ralf Oltmanns
Regenerative Antriebstechniken
Project Coordinator

Inh. Dipl. Ing. Ralf Oltmanns
Mühlenweg 5
26789 Leer
Germany
Fon: +49 491 9 25 55 23
Fax: +49 491 9 25 55 26
Mobile: +49 172 4 25 50 28
E-Mail: r.oltmanns@grafik-team.de

[1] http://www.maritim-de-nl.eu/projekte/wind-hybrid-coaster/