This is one of a series of Energy Saving Technologies (EST) factsheets that provide a brief description of emerging technologies which are available to ship owners and other stakeholders who are aiming to reduce fuel consumption and/or Green House Gas (GHG) emissions.

**HISTORY**

Rotor sails are not a new idea. In the 1920’s, German engineer Anton Flettner was the first person to install rotors to a vessel, the Buckau. He then designed and installed his rotors onto a new build ship, the Barbara. Flettner’s rotors achieved their intended fuel savings, but capital costs were too high at a time when fuel was relatively cheap.

With modern developments in control technologies and lightweight construction materials, coupled with increasing fuel prices and environmental focus there is a resurgence in rotor testing and use. In addition, there are now a number of vessels in service that are utilising this technology.

**HOW DO THEY WORK?**

A Flettner rotor is a large spinning cylinder mounted vertically to the deck of a ship. They use the ‘Magnus effect’ to provide a force transmitted into the ship’s hull and in turn reduce propulsive power demands. A phenomenon observed when a spinning body is in a fluid flow, the Magnus Effect is responsible for the curving flight path of a ball in many sports or the deviation of a spinning artillery shell in a crosswind.

The speed of rotation is adjusted to optimise performance and can even be used to assist with slowing and manoeuvring a vessel. Although the rotors add to the ship’s electrical load in order to spin, the thrust produced means the main engines can be operated at a lower load, thereby saving fuel and reducing emissions.
Flettner Rotors

SELECTING THIS TECHNOLOGY

Rotors generally lend themselves to auxiliary propulsion due to their size and requirement for wind. They can supplement most other types of primary propulsion systems and can be used in conjunction with other ESTs to further boost energy saving. Rotors have 10 times the thrust for a given surface area when compared to traditional sails. They can be either retrofitted or form part of a new build design propulsion configuration.

KEY INTEGRATION FACTORS

- Wind speeds & sea states drive savings & efficiencies. Studies indicate rotors work best between Beaufort 3 to 8 conditions.
- Optimal performance is generated in uninhibited air flow & open deck space away from major superstructures.
- Deck location & rotor size must be considered to meet SOLAS navigation bridge visibility requirements.
- Large forces are transmitted through the structure of the ship, requiring careful structural engineering design, Class approval & suitably strong mounting points.
- Stability is a significant influence when choosing to add Flettner rotors to a ship design due to their size, location & potential heeling movement.
- Thought to the potential impact on port operations is required including unloading, loading, cranage, navigation obstruction & bridge clearances due to rotor height.
- As a Flettner Rotor is in effect a large sail, the underwater vessel design may require modification to compensate. For example, for large rotor installations the rudder will likely be larger.

TYPICAL APPLICATIONS

- The technology lends itself to any vessel that has open deck space & a low enough operating speed.
- Especially benefits vessels operating at slower speeds with open deck space.

BENEFITS SUMMARY

- Fuel savings & greenhouse gas emission reductions.
- Auxiliary propulsion provided by the Rotors reduces the load on the main engines across the whole range of ship speeds. This is most pronounced at lower vessel speeds in moderate sea states on an optimal heading.
- Typically, average fuel savings of around 10% can be achieved by installing 2 large rotors, subject to environmental conditions & vessel operations.
- Significant investment & research already completed for this technology with systems currently in service (TRL 7 to 9 depending on specific models).
Selecting the right EST for the trades a vessel will undertake is critical to the investment decision. The Technical Financial Model at the heart of the VTAS independent assessment process will consider the technical features of the vessels, the voyage profile all in combination with candidate EST(s). This is integrated with the risk and financial evaluation using your parameters or those investors are likely to recognise. Collectively this provides an informed view of how selecting appropriate ESTs contributes to reducing fuel consumption, lowering your operating costs and reducing your greenhouse gas emissions.

To embed this core offering VTAS is able to support you with independent consulting, analysis, feasibility and design integration advice, vessel performance and whole life cost evaluation.