Green Deal Validatieregeling

Validation programme

Energy saving devices

NETHERLANDS MARITIME TECHNOLOGY

TNO innovation for life

Ministerie van Economische Zaken en Klimaat

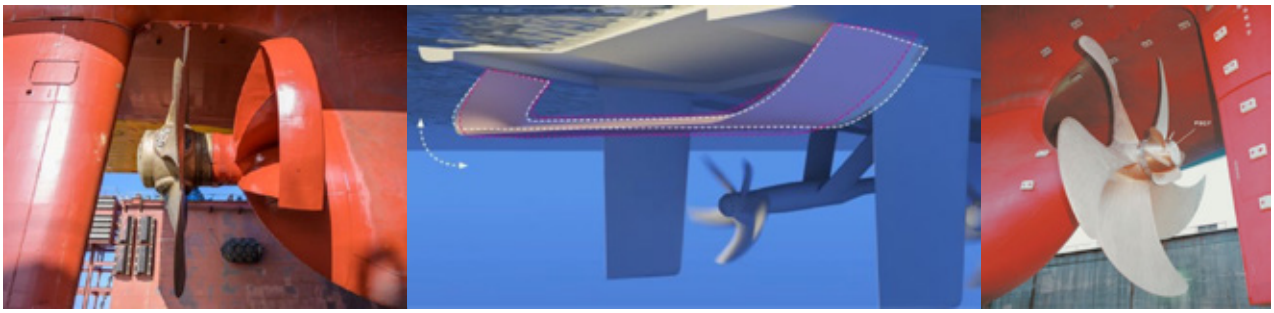
KONINKLIJKE VERENIGING VAN NEDERLANDSE REDERS

MARIN

Ministerie van Infrastructuur en Waterstaat

Description

Energy-Saving Devices (ESDs) are modifications made on a ship to reduce its hydrodynamic energy consumption. Their application either recovers hydrodynamic design losses in retrofit, or avoids them on new-builds. To do so, they have at least one of these three properties: reducing resistance forces, reducing propeller losses, or recovering lost energy.



ESDs come in many types and forms. Fins, spoilers, wedges and interceptors reduce the wave-making losses and typically apply to ships sailing a high-speed range. Ducts and pre-swirl stators optimize propulsion losses. Post-swirl devices and optimized rudders reduce or recover part of the energy losses due to the propeller action.

Most ESDs are passive and outside the hull. They can be fitted to an existing ship with limited intrusion.

Market readiness & availability

A large range of ESDs have a Technology Readiness Level (TRL) of 9 and have been deployed at a large scale since the 1980's. A large number of suppliers offer these devices, in particular shipyards and propeller manufacturers. Some concepts however are patented and only delivered by specialized companies (e.g. Hull Vane, Becker Rudder, Wartsila Gate Rudder). Most ESDs have been deployed for decades on hundreds of ships and are readily available. Installing an ESD is less intrusive and more accessible than many other emission-reduction techniques.

Applicability to reference ships

Potentially, most ships can benefit from at least one device, but not all ESDs are suitable to all ship types and the effectiveness depends on the base ship design and the operational conditions. Most ESDs are passive and non-intrusive. They require limited modification of the ship, making it a suitable solution for retrofit. The table below gives an indicative overview of the applicability of a number of energy-saving technologies to the reference ships.

	General cargo	Tug boat	Offshore supply	Crew tender catamaran	Dredger vessel	Super yacht
Wedge, interceptor			+/-	+		+
Propeller duct	+	+	+		+	
Pre-duct, spoiler	+					
Pre-swirl stator	+					
Post-swirl device	+				+	
Optimized rudder	+	+	+	+	+	+

Emission reduction effectiveness

Because of the wide use of ESDs in the fleet, their effect on the ship consumption is well-known. The table below gives an indication of the emission reduction potential of a number of solutions, based on recent overviews. Note, this rough indication can differ significantly per ship and is highly dependent on the operational profile.

Energy-Saving Device	Emission reduction
Wedge, interceptor	2-7%
Propeller duct	5-8%
Pre-duct, spoiler	1-3%
Pre-swirl stator	3-5%
Post-swirl device	1-4%
Optimized rudder	2-4%

Adding several ESDs to the same ship may be beneficial, but the cumulative effect on emission reduction will most probably be lower than the sum of individual efficiencies as listed above. The reason for that is because many of these techniques interact.

Operation and safety

Most ESDs are passive appendages of small size on the hull, and have no consequences on the ship operations. Those do not require special training of personnel, dedicated maintenance, or additional safety guidelines.

Larger appendages like spoilers may require special attention in the ship handling, in particular in restricted water and busy areas.

Costs

The installation cost depends on the technique, with a short to medium payback time. The main disadvantage is that most devices need to be installed in a dry dock, which is not happening very often for existing ships.

Most energy-saving technologies require no or limited additional operational costs.

Development prospect

The use of ESDs for newbuilds and retrofits is expected to continue at a large scale in the coming years. Due to their effect on the reduction of fuel consumption, they are a cost-effective way to reduce emissions and therefore comply with energy-efficiency regulations such as EEDI and EEXI, which will become increasingly demanding over the next years.

The efficiency of the energy-saving technologies mentioned above remain limited as they recover or prevent energy losses while sailing. Their use is closely linked to other techniques such as large-diameter low-RPM propellers, bulbous bows and air lubrication.