Energy efficiency solutions
Simple steps to reduce fuel consumption
and your environmental footprint
A simple way to get started with green shipping...

Energy efficiency has traditionally not been a key focus in vessel design and construction. To minimize CAPEX, energy efficient technologies have not been highly prioritized. But today the shipping industry is adapting to a new reality with stringent environmental regulations and high, uncertain fuel prices.

**A large potential for energy savings**
As global trade steadily expands, ship emissions represent an ever-increasing environmental concern. Without action from the industry, emissions will continue to escalate (see graphs below).

There are basically three ways to reduce ship exhaust emissions:
- using improved, cleaner fuels
- cleaning of exhaust gases, such as scrubbing
- reducing fuel consumption

All of these measures reduce SOx and NOx emissions but the most effective way to reduce CO₂ emissions is by cutting fuel consumption. Therefore, developing and implementing new methods and technologies for fuel reduction must be highly prioritized.

There is a large potential for retrofitting existing ships with new fuel-reducing technologies. For example, only around 2% of the global fleet is currently equipped with Variable Speed Drives for their seawater cooling pumps, which means that 98% of the fleet is missing an opportunity for high fuel savings and environmental rewards.

---

**Fig. 1 - Trends for land-based vs. shipping SOx emissions**

![Graph showing trends for land-based vs. shipping SOx emissions](image1)

*Fig. 1 - Source: IIASA for the Clean Air for Europe program (CAFE), 2004. Scenario for development of SOx emissions in Europe.*

**Fig. 2 - IMO projected growth of CO₂ emissions from ships**

![Graph showing IMO projected growth of CO₂ emissions from ships](image2)

*Fig. 2 - Source: IMO GHG Study 2009. Each color represents a different scenario for global CO₂ emissions from shipping.*
Case example
Seawater cooling pumps

Variable Speed Drives vs. manual control
The configuration drawing below represents a typical seawater cooling system. Like most pump applications, these pumps are often greatly over-dimensioned to handle the most extreme operating conditions with good margin.

For example, seawater pumps are often designed for water temperatures of 32°C although the actual average seawater temperature may typically be around 15°C. This temperature difference alone provides an energy savings potential of up to 75% with use of VSDs.

In the example below we have taken a conservative approach, estimating that during 40% of the operating time only 60-70% of the available pump capacity is utilized - but even then, energy savings are large.

The diagram shows power consumption for different flow control methods. The grey area represents the energy savings generated by using a VSD instead of manual throttling.

<table>
<thead>
<tr>
<th>Application data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seawater cooling pump 90 kW</td>
</tr>
<tr>
<td>Electric motor power 100 kW</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operating profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>5300 hrs/year (40% of the time operating at 60-70% flow)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Energy consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOL with throttle 426 MWh</td>
</tr>
<tr>
<td>VSD 193 MWh</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Energy savings per year:</th>
</tr>
</thead>
<tbody>
<tr>
<td>233 MWh corresponding to ~29,000 USD</td>
</tr>
<tr>
<td>CO₂ reduction 117 ton</td>
</tr>
</tbody>
</table>
Your partner in energy efficiency
Complete retrofit packages - system modifications, equipment and installation

With a single purchase order, ABB customers know in advance the total cost and scope of the energy efficiency project and are assigned a dedicated partner with responsibility for planning, implementing and overseeing the complete VSD project.

Fast and simple projects
ABB provides specialized solutions and services for energy efficiency projects onboard ships and has extensive process knowledge combined with in-depth system competence in VSD's, motors pump and fans. We take full responsibility for complete energy efficiency retrofit projects - ensuring quick and simple project execution which saves customers time and money.

ABB can prepare a complete VSD upgrade solution so that onboard installation and commissioning give minimal interruption to normal ship operations.

The scope of work and equipment required to upgrade a pump or fan for VSD operations will of course vary from case to case. Evaluations must be made to determine if the existing motor is suitable for VSD operations and if the control system requires modifications or may be used "as is".

"Best in class" technology and competence
ABB is the world’s leading manufacturer of Variable Speed Drives and has extensive competence and experience from the process industry. We offer a complete range of low- and high-voltage drives that are designed and certified for demanding marine environments. With unmatched performance, quality and ease of use, our drives represent technology that adds value through safer, greener, more reliable and profitable ship operations.

Intelligent Pump Control is an optional software in ABB drives that incorporates all functions commonly required for pumping applications, eliminating the need for external PLC control. This easy-to-use software developed by ABB helps save energy, reduce downtime and prevent pump jamming and pipeline blocking.

Compact and easy-to-install ABB ACS800-01 marine drives offer proven performance and reliability.
... installing Variable Speed Drives on large pumps and fans gives significant savings in CO₂, SOx, NOx and dollars

The fuel emissions and savings generated by Variable Speed Drives may surprise you. As shown on the next page, a single seawater cooling pump can save USD 29,000 and 117 tons of CO₂ per year. When applied ship-wide and fleet-wide these savings can be tremendous.

Over-dimensioned and under-utilized
The onboard ship systems most suitable for improving energy efficiency are systems with large pumps and fans that are not required to run continuously at full capacity. Examples of these types of applications include seawater cooling pumps, chilled water pumps and engine room ventilation.

These pumps and fans are vital for ship operations and are often greatly over-dimensioned and designed to meet the most unfavorable conditions in which the vessel may operate. Everyday operations seldom come close to such conditions.

Without a VSD the pump and fan motors will always operate at full load, consuming maximum electric power continuously. Flow from the pump/fan is reduced by throttling and bypass loops, and only a fraction of the produced flow is utilized.

A typical VSD retrofit installation provides a payback on equipment and installation from fuel savings in less than one year.

10% speed reduction = 27% fuel reduction
By equipping a pump/fan motor with a VSD, the pump/fan will always run at the correct speed to meet current flow and pressure requirements. This greatly reduces energy usage because power consumption of the pump is related to the volumetric flow according to affinity laws. A reduction of pump speed affects system pressure by the power of two and electric power consumption by the power of three.
Contact us

ABB Oy
Marine
Merenkuikijankatu 1
P.O. Box 185
FI-00981 Helsinki
Finland
Phone: +358 10 2211
Fax: +358 10 222 2350

ABB AS
Marine
Bergerveien 12
P.O. Box 94
NO-1375 Billingstad
Norway
Phone: +47 03 500
Fax: +47 22 35 36 80

www.abb.com/marine