Marine – solving environmental needs and saving energy

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The acquisition of Aalborg Industries resulted in
- 15 main product groups
- Leader in environmental and energy saving applications
The leader – in solving environmental needs

The leader – in saving energy and reducing CO₂

Market drivers – Environmental legislations

More legislation and higher demands
Market drivers
- Fuel prices spread and development

Price graph: high sulphur versus low sulphur fuel

<table>
<thead>
<tr>
<th>Year</th>
<th>USD/ton</th>
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<tbody>
<tr>
<td>2010</td>
<td>400</td>
</tr>
<tr>
<td>2011</td>
<td>500</td>
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Price difference:
For 2020 estimated at 400 USD/ton (Source: POTEN & PARTNERS 2010)

High Sulpher
Low Sulpher

Note: Nov 9 2012 BW380 = $622 and BWDI = $974 (Bunkerworld)

Market drivers
- IMO's energy savings regulations

Source: “Estimated CO2 emissions reduction from introduction of mandatory technical and operational energy efficiency measures for ships” (2011) by Lloyds Register and DNV.

Ship Energy Efficiency Management Plan (SEEMP) vs BAU CO2 emission

<table>
<thead>
<tr>
<th>Year</th>
<th>CO2 level projections (average of A1B-4 and B2-1 scenarios)</th>
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<tbody>
<tr>
<td>2010</td>
<td>700</td>
</tr>
<tr>
<td>2015</td>
<td>500</td>
</tr>
<tr>
<td>2020</td>
<td>300</td>
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Ballast Water Treatment
Ballast water treatment

- legislation

Treatment systems on-board
- New built vessels from 2009/2012
- Existing vessels after 2014/2016

"USCG has "aligned" rules to IMO, and already in force"

Ballast water treatment

- 36 countries have ratified and 30 needed

*Note: convention requires minimum 30 countries representing 35% of the World tonnage

Ballast water treatment

- only 29% of the World fleet has ratified

*Note: convention requires minimum 30 countries representing 35% of the World tonnage

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Ballast water treatment market – until now, before ratification

Accumulated number of BWT systems sold

- 15-20% of contracted vessels were specified with BWT systems in 2011 – 2012
- 10% of systems sold were for retrofit 2011 - 2012

Ballast water treatment market – development over time, rough estimate

Yearly No of BWT systems ordered

“Issues discussed”
- Ratification date and USCG
- Time plan
- Exceptions

Market potential – BWT

- Alfa Laval estimates that 35,000 ships will be affected over a ten-year period. About 15,000 newly built and 20,000 existing.
- Estimated average order value per ship: EUR 200-250,000 over time.
- Alfa Laval has and intends to keep a market leading position.
Alfa Laval PureBallast
– A market leading position

- First prototype installed 2003
- First system to receive "type approval" in 2008
- Preferred choice by major shipowners

Sulphur emissions

SO\textsubscript{X} emissions requirements – IMO convention ratified

Reachable by using low sulphur fuel or treatment system

World

Review for fuel availability

ECA - Emission Control Area

© Alfa Laval
Alfa Laval PureSOx

- technical overview

Scrubber

Water cleaning system

www.alfalaval.com

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21 MW installation in operation since June 2010.
28 MW installation starting up Q4 2012.
Systems from 1 – 60 MW available to cover all ship sizes in the market.
Recently commercially launched and available for all sizes for both new buildings and retrofit.

www.alfalaval.com

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Market potential – SOx

- Alfa Laval estimates that 5,000 ships will be affected, i.e. ships sailing >50 percent in the Northern European ECA. In this group, Alfa Laval focuses on bigger, and newer existing vessels as well as newly built ships, representing 1,000-2,000 ships over a five-year period.
- Alfa Laval PureSOx, average order value per ship: EUR 2-3 million.
- Alfa Laval intends to take a market-leading position.

www.alfalaval.com
Nitrogen emissions

NOx emissions requirements
- IMO convention ratified. Tier III for new buildings only

Alternatives for NOx reduction
- IMO’s tier III convention requires a technical solution

Selective Catalyst Reduction (SCR)
Alfa Laval – PureNOx

Exhaust Gas Recirculation (EGR)
Technology/system overview
- EGR, one of two technologies

Installations
MAN’s test engine in Copenhagen (7.5 MW)
On board - Alexander Maersk - APMM 6S80ME-C9-EGR2 (23 MW)

Waste Heat Recovery
Waste Heat Recovery
– saving >10% fuel for large ships

Heat balance example for RTA6C diesel engine – ISO conditions, 100% load

- Standard diesel engine

- Diesel engine with waste heat recovery

Yearly savings, ex
- Fuel oil: ~4 000 tonnes*
- CO₂: ~12 000 tonnes
- Fuel: MUSD 2.4

*Container vessel with WHR’s producing 3 MW power. Ex. typical investment MUSD 4.2 and annual savings MUSD 2.4
Waste Heat Recovery
– after auxiliary engines introduced in 2012

Yearly savings
★ Fuel oil ~100 tonnes
★ CO₂ ~300 tonnes
★ Fuel: KUSD 60

*Container vessel with 3 MW gen sets installed. Ex. typical investment KUSD 150 and annual savings KUSD 60

Market potential – WHR

★ WHR for main engines: this is an already existing market. Alfa Laval’s current volume is approximately EUR 30-40 million per year.
★ WHR for auxiliary engines: This is a new product. Many oceangoing vessels could benefit from this type of solution. Price level around EUR 70,000.

Olly Waste
PureBilge and PureDry
– integrated system for oily waste and fuel recovery

- Recovers up to 2% fuel
- Certified for 5 ppm (only HSS system)

Up to 2% fuel lost

The sources
Fuel oil 20-30%
Oil polluted water, 70-80%
Suspended solids, ~1%

Waste oil tank

2012

PureDry
– waste fuel recovery

© Alfa Laval
The technology
– Unique combination of decanter and high speed separator technology creates unique results

Market potential – PureDry

- Alfa Laval expects to sell 100 units in 2013. Over time this product will be attractive to most oceangoing vessels.
- The price level of this product is >EUR100,000.
- Alfa Laval is alone in the market with this product
April 2012

In November 2010, the Baltic ferry MS Silja Symphony installed PureDry, a new high-speed separator from Alfa Laval with the capability to recover reusable fuel from waste fuel oil. Symphony’s Chief Engineer Mats Göras relates that since commissioning, the PureDry unit has recovered more than 150 m³ of oil, which has been returned to the bunker tanks for reuse. “With bunker oil at today’s prices, this has meant a significant reduction in fuel costs for us,” says Göras, “we have also cut our costs for landning waste oil.”

“Optimizes customer processes”

Aalborg acquisition has strengthened our position
Leading position in solving environmental needs and saving energy and CO₂
We are continuously bringing new innovations to the market