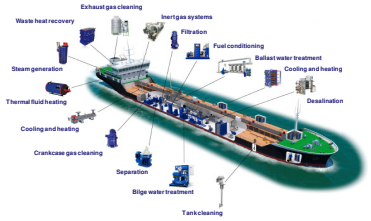
Marine – solving environmental needs and saving energy

Joakim Thölin
Head of Segment Marine & Diesel Equipment

Marine & Diesel Division

The acquisition of Aalborg Industries resulted in

- 15 main product groups
- Leader in environmental and energy saving applications



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The leader
– in solving environmental needs

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The leader
– in saving energy and reducing CO_2

Marine | Diesel power

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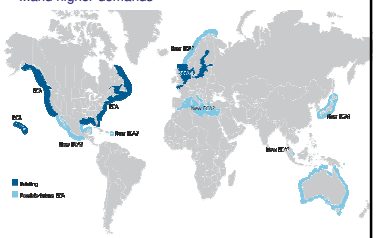
Market drivers
– Environmental legislations

More legislation

INTERNATIONAL MARITIME ORGANIZATION

...and higher demands



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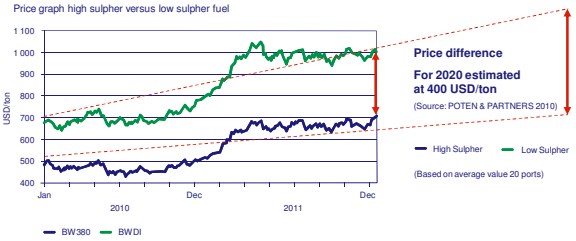
Market drivers
– Fuel prices spread and development

Price graph high sulpher versus low sulpher fuel



Price difference

For 2020 estimated at 400 USD/ton

(Source: POTEN & PARTNERS 2010)

High Sulpher Low Sulpher

(Based on average value 20 ports)

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

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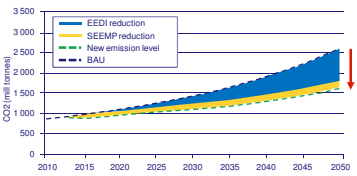
Market drivers
– IMO's energy savings regulations

World fleet – Average scenario: A1B and B2-1



World fleet CO_2 level projections (average of A1B-4 and B2-1 scenarios)

Source: "Estimated CO_2 emissions reduction from introduction of mandatory technical and operational energy efficiency measures for ships" (2011) by Lloyds Register and DNV.

$EEDI = \frac{CO_2 \text{ emission}}{\text{transport work}}$

$SEEMP = \frac{\text{Ship Energy Efficiency Management Plan}}{}$

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Ballast Water Treatment

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Ballast water treatment
– legislation

IMO

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"

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Ballast water treatment
– 36 countries have ratified and 30 needed

- Albania
- Antigua & Barbuda ~0.7%
- Barbados
- Brazil ~0.5%
- Canada ~0.5%
- Cook Islands
- Croatia ~0.2%
- Denmark
- Egypt ~0.3%
- France ~0.9%
- Iran
- Kenya
- Kiribati
- Lebanon
- Liberia ~8.5%
- Malaysia ~0.9%
- Maldives
- Marshall Islands ~1.3%
- Mexico ~0.2%
- Mongolia
- Montenegro
- Netherlands ~1%
- Nigeria
- Niue
- Norway ~4.2%
- Palau
- Republic of Korea ~1.1%
- Russia ~1.5%
- Saint Kitts & Nevis
- Sierra Leone
- South Africa
- Spain ~0.4%
- Sweden ~0.5%
- Syria
- Trinidad and Tobago
- Tuvalu

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

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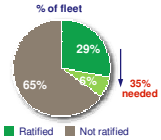
Ballast water treatment
– only 29% of the World fleet has ratified

- Panama (22.6%)
- Greece (5.3%)
- Bahamas (5.0%)
- Singapore (4.8%)
- Malta (4.4%)
- China (3.5%)



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

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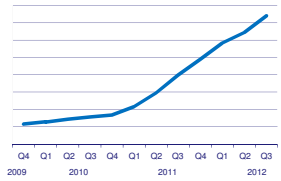
Ballast water treatment market
– until now, before ratification

Accumulated number of BWT systems sold
all suppliers



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

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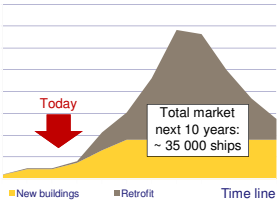
Ballast water treatment market
– development over time, rough estimate

Yearly No of BWT systems ordered



"Issues discussed"
- Ratification date and USCG
- Time plan
- Exceptions

Source: Alfa Laval analysis

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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.

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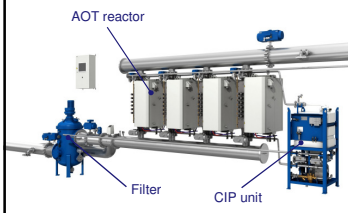
Alfa Laval PureBallast
– A market leading position



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

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Sulphur emissions

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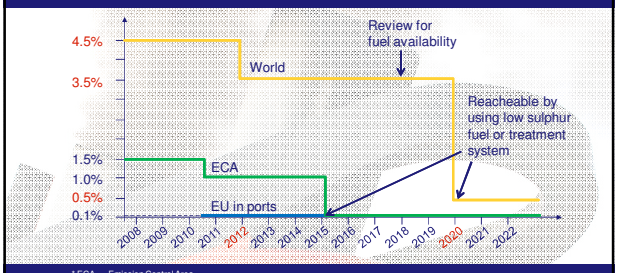
SO_X emissions requirements
– IMO convention ratified



* ECA – Emission Control Area

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Alfa Laval PureSO$_X$
– technical overview

Scrubber

Water cleaning system

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Alfa Laval PureSO$_X$

- **21 MW installation** in operation since June 2010.
- **28 MW installation** starting up Q4 2012
- Systems from 1 ~ 80 MW available to **cover all ship sizes in the market**
- Recently commercially launched and available for **all sizes for both new buildings and retrofit**

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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.

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Nitrogen emissions

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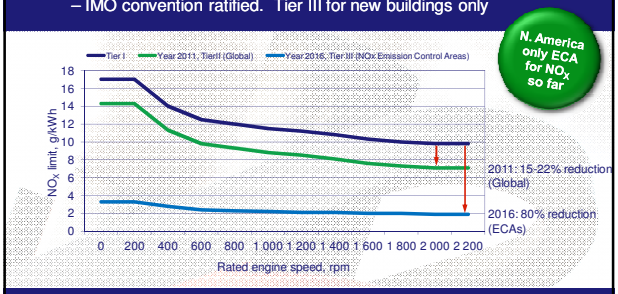
NO_X emissions requirements

– IMO convention ratified. Tier III for new buildings only



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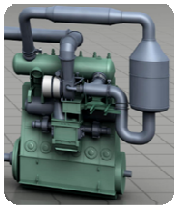
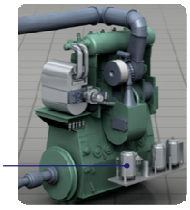
Alternatives for NO_X reduction

– IMO's tier III convention requires a technical solution

Selective Catalyst Reduction (SCR)



Exhaust Gas Recirculation (EGR)



Alfa Laval PureNO$_X$

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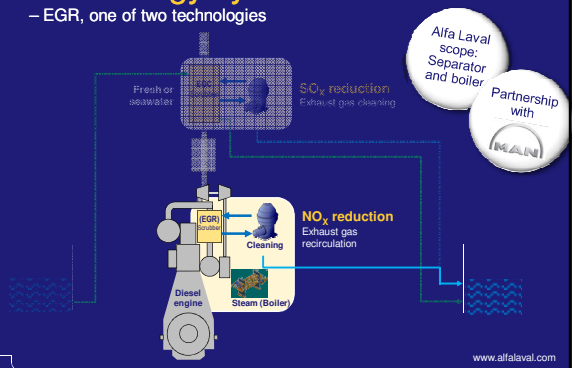
Technology/system overview

– EGR, one of two technologies



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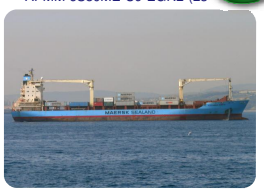
Installations

Market launch 2014

MAN's test engine in Copenhagen (7.5 MW)

On board
- Alexander Maersk
- APMM 6S80ME-C9-EGR2 (23



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Waste Heat Recovery

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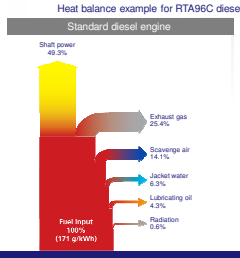
Waste Heat Recovery
– saving >10% fuel for large ships

Heat balance example for RTA96C diesel engine – ISO conditions, 100% load



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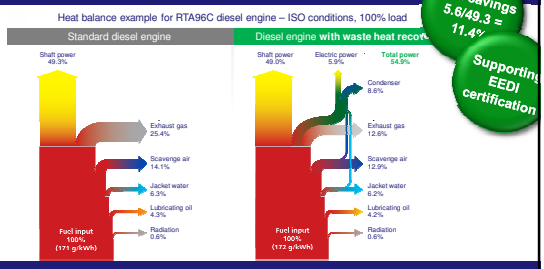
Waste Heat Recovery
– saving >10% fuel for large ships

Heat balance example for RTA96C diesel engine – ISO conditions, 100% load



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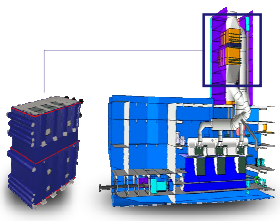
Waste Heat Recovery
– after main engines



Payback time 1.5-3.5 years

Yearly savings, ex
- Fuel oil ~4 000 tonnes*
- CO_2 ~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

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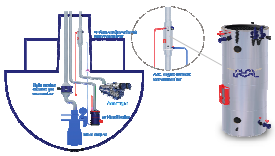
Waste Heat Recovery

– after auxiliary engines introduced in 2012

Payback time 1-1.5 years



Yearly savings

- Fuel oil ~100 tonnes
- CO_2 ~300 tonnes
- Fuel: KUSD 60

*Container vessel with 3 MW gen sets installed. Ex. typical investment KUSD 100 and annual savings KUSD 60

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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.

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Oily Waste

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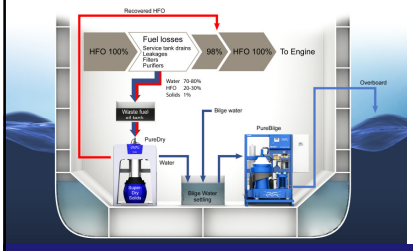
PureBilge and PureDry
– integrated system for oily waste and fuel recovery



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

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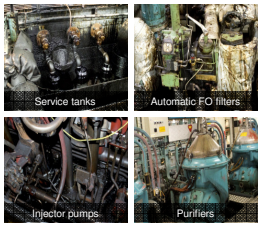
Up to 2% fuel lost

The sources



Waste oil tank

Fuel oil 20-30%

Oil polluted water, 70-80%

Suspended solids, ~1%

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PureDry
– waste fuel recovery

2012

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The technology

– Unique combination of decanter and high speed separator technology creates unique results

XCavator

Separator insert

Superdry solids

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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

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"Optimizes customer processes"

PureDry Case Study: Silja Symphony April 2012

Savings up to ~1 000 €/day for a large ship

Pay-back <1 year for larger ships

PureDry recovers more than 150 tons of fuel oil onboard Silja Symphony

In November 2010, the Baltic ferry MS Silja Symphony installed PureDry, a new high-speed separator from Alfa Laval with the capability to recover re-usable fuel from waste fuel oil. Symphony´s Chief Engineer Mats Göras relates that since commissioning, the PureDry unit has revocered more than 150 m³ of oil, which has been returned to the bunker tanks for re-use. "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 landing waste oil."

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- **Aalborg** acquisition has strengthened our position
- Leading position in **solving environmental needs** and **saving energy and CO_2**
- We are continuously bringing **new innovations** to the market

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