



Scrubbers

Gothenburg May 16 2018

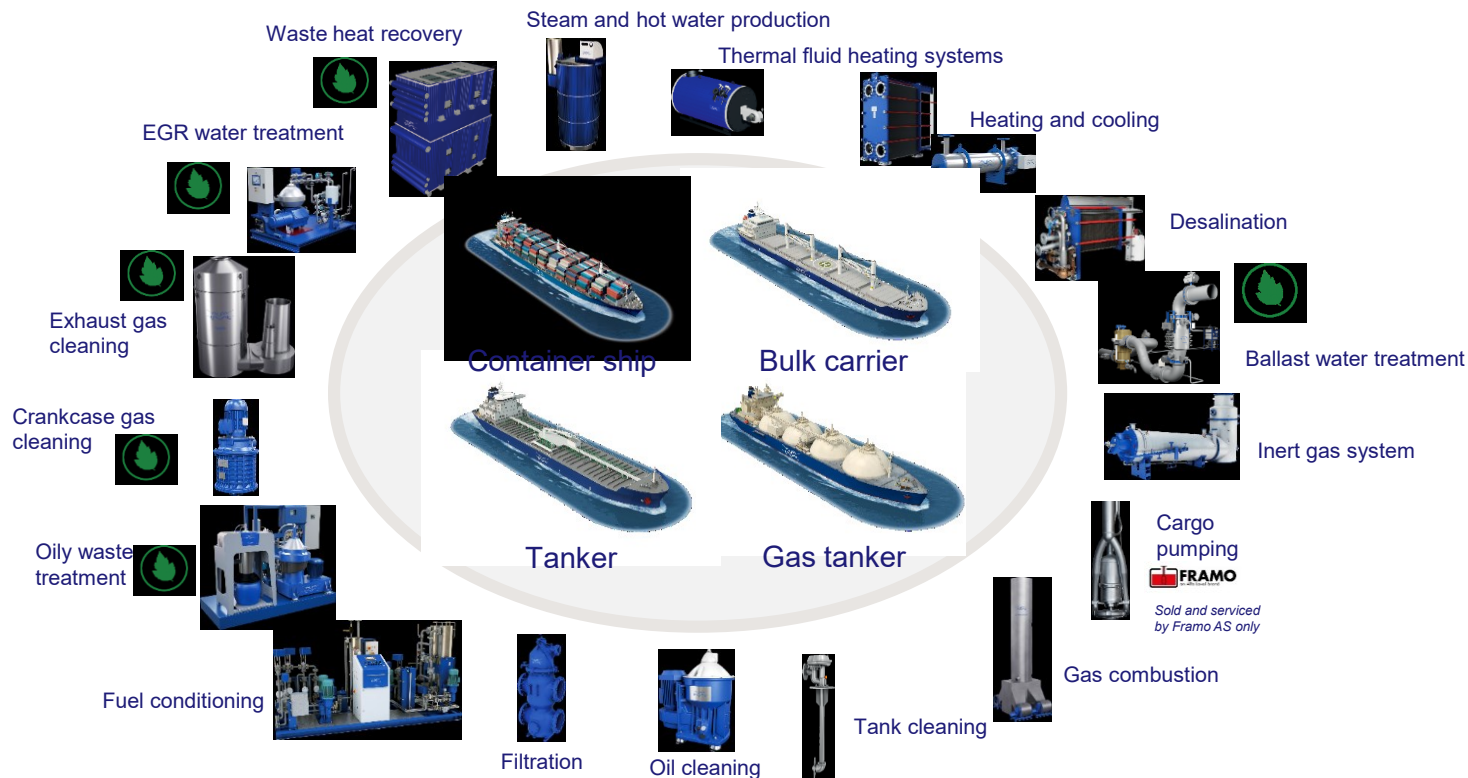
Peter Leifland

President Marine division

Alfa Laval on board



Environmental protection
- 25% of our capital sales



Sulphur emissions - Compliance options

SWITCH TO LNG



- Always in compliance
- ➖ High investment cost
- ➖ Limited infrastructure
- ➖ Price uncertain

USE LOW-SULPHUR FUEL



- Low investment cost
- ➖ Higher price than HFO
- ➖ Fuel quality issues

INSTALL A SCRUBBER



- Continued use of HFO
- ➖ Payback time depends on fuel price delta

PureSOx - the Alfa Laval scrubber



IN GENERAL

- > Quality, reliability
- > Technical support & service presence

Σ A major supplier to the industry

SPECIFICALLY

- > Systems in compliance since 2009
- > Vast experience with PureSOx projects
- > Continuous product development

Scrubbers and the environment

- Further distillation of HFO at the refineries will be costly.
- SO_x is a result of combustion and is harmful. The scrubbing process converts SO_x to harmless sulphate salts which are naturally present in the oceans. The world oil reserves contain 0,0002% of the sulphate in the oceans.
- Particulate matters (unburned HFO, lube oil, soot, calcium, nickel, vanadium = PM) is caught in the scrubber. The scrubber catches 50-70% of PM in open loop and 95% of PM in closed loop operation.

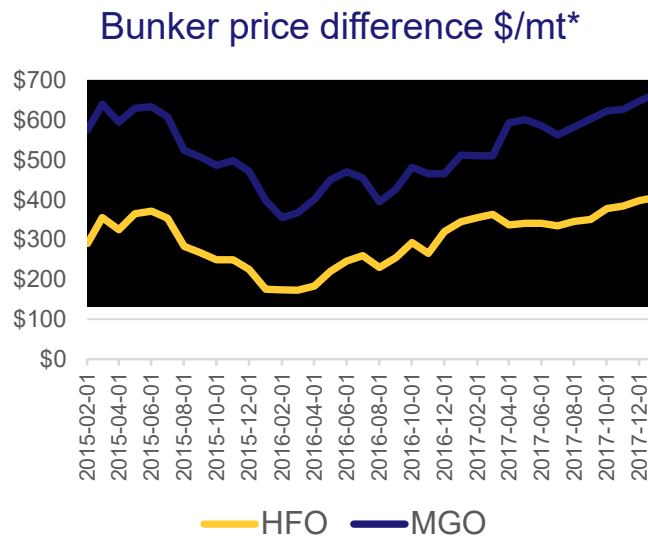


Fuel availability and price development

- Low-sulphur fuel availability might be under pressure after 2020
- Fuel prices are difficult to predict

“The economics for scrubbers are going to become very clear in January 2020 – and very compelling.”

Iain White, ExxonMobil



*Based on global average per mt at Bunkerworld.com as per 1-02-2018

In the top 4 ports the price difference between HFO and MGO is \$225.00 - \$285.00 /mt

	IFO380		MGO	
	\$/mt	+/-	\$/mt	+/-
Singapore	399.00	▸ 0.00	623.50	▲ 2.50
Rotterdam	374.50	▸ 0.00	611.50	▲ 0.50
Houston	371.50	▲ 2.00	639.50	▲ 7.00
Fujairah	396.00	▲ 2.00	680.00	▲ 7.50

Exhaust Gas Cleaning on board VLCC

Payback
time
2 years

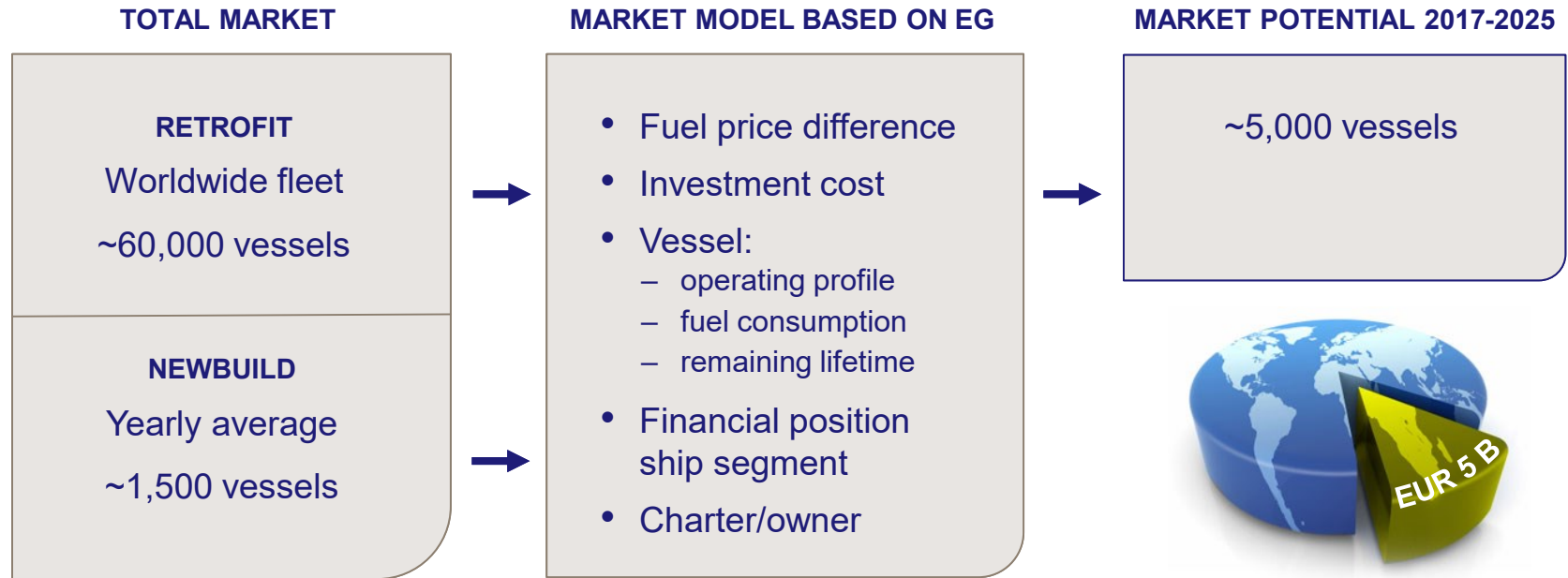
- Yearly fuel cost low Sulphur mix
9 MUSD
- Install a scrubber as retrofit
 - **3.7 MUSD** (open loop) or
 - **4.2 MUSD** (closed loop)

Yearly fuel cost HFO plus
scrubber **7 MUSD**



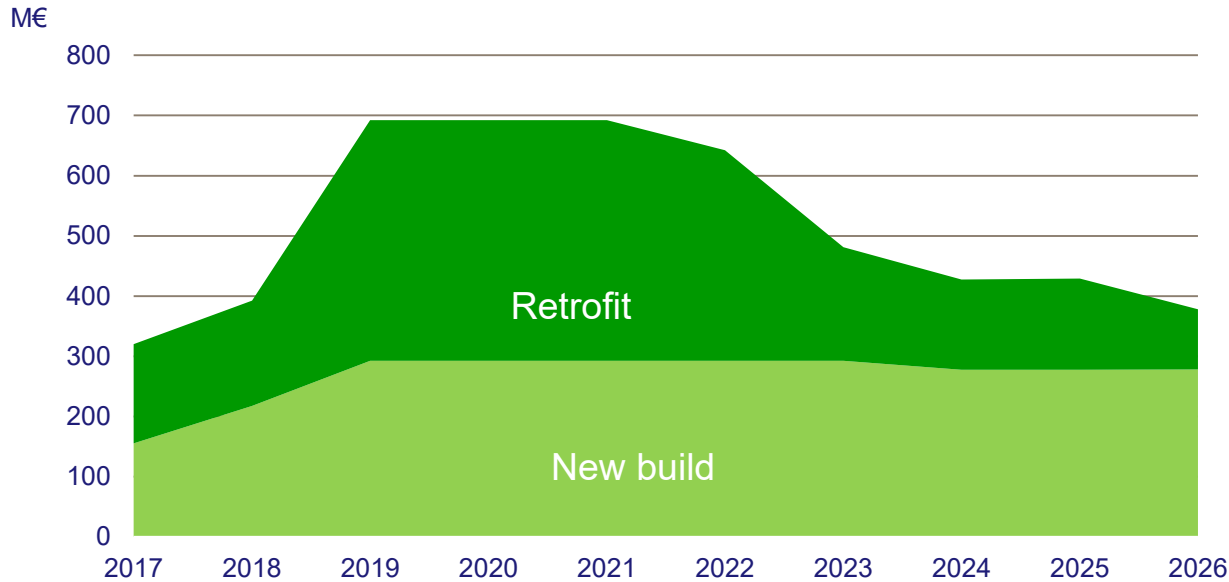
Scrubber market potential

- How many vessels will install a scrubber?



Scrubbers

- Expected market development, (MEUR)



ALFA
LAT