Marpol Annex VI Regulations & Implications for the Shipping Industry

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MARPOL Annex VI

- MARPOL Annex VI – prevention of air pollution from ships – entered into force May 2005

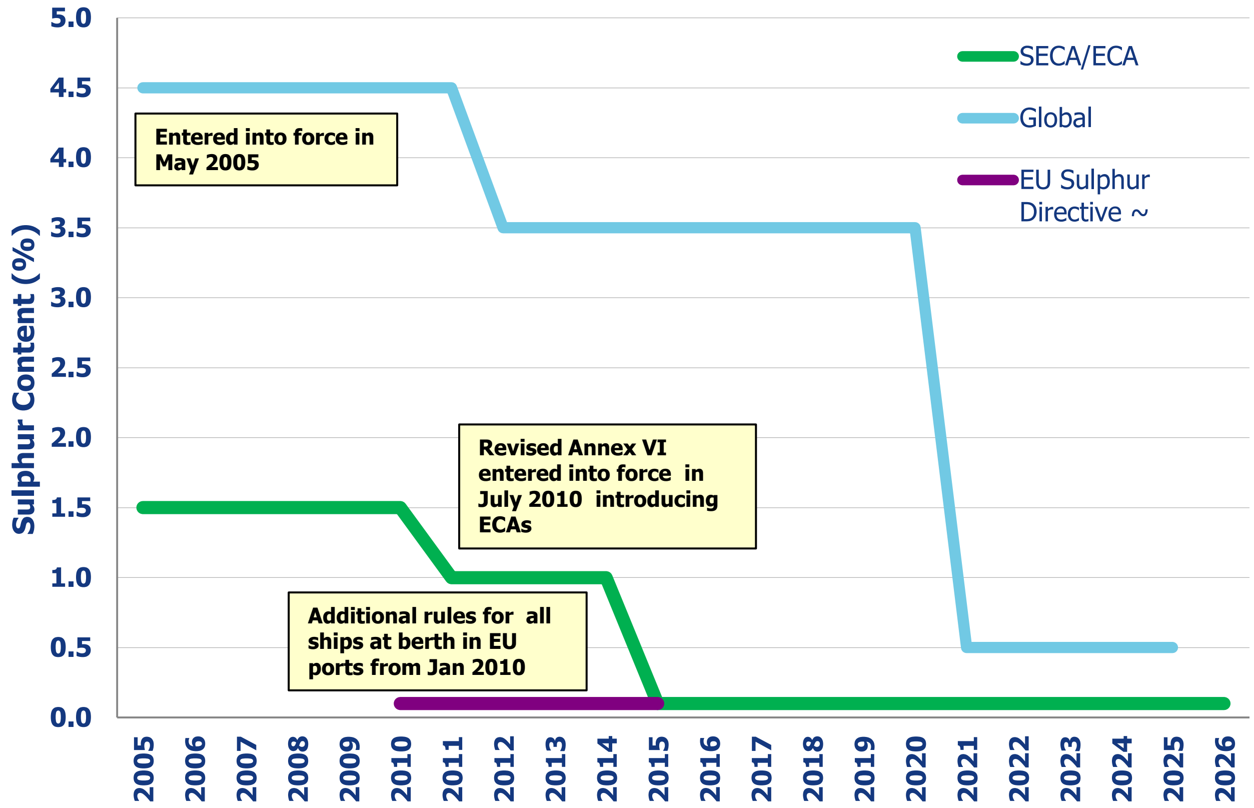
- Sets limits on sulphur oxide and nitrogen oxide emissions from ship exhausts and prohibits deliberate release of ozone depleting substances

- Revised Annex VI entered into force in July 2010 – changes included

  - progressive reduction in SOx and NOx and particulate matter (PM)

  - introduction of emission control areas (ECAs) replacing Sulphur Emission Control Areas (SECAs)

MARPOL Annex VI & EU Sulphur Directive



SOx Content:

HFO: 3.5% - 4.5%
MGO: 0.1% – 1.5%
LSFO: <1.5%

** 2020 global reduction may be delayed subject to feasibility study*
~ For inland waterway vessels and ships at berth in European Community ports

Data source: IMO/EU

Impact of Regulatory Changes

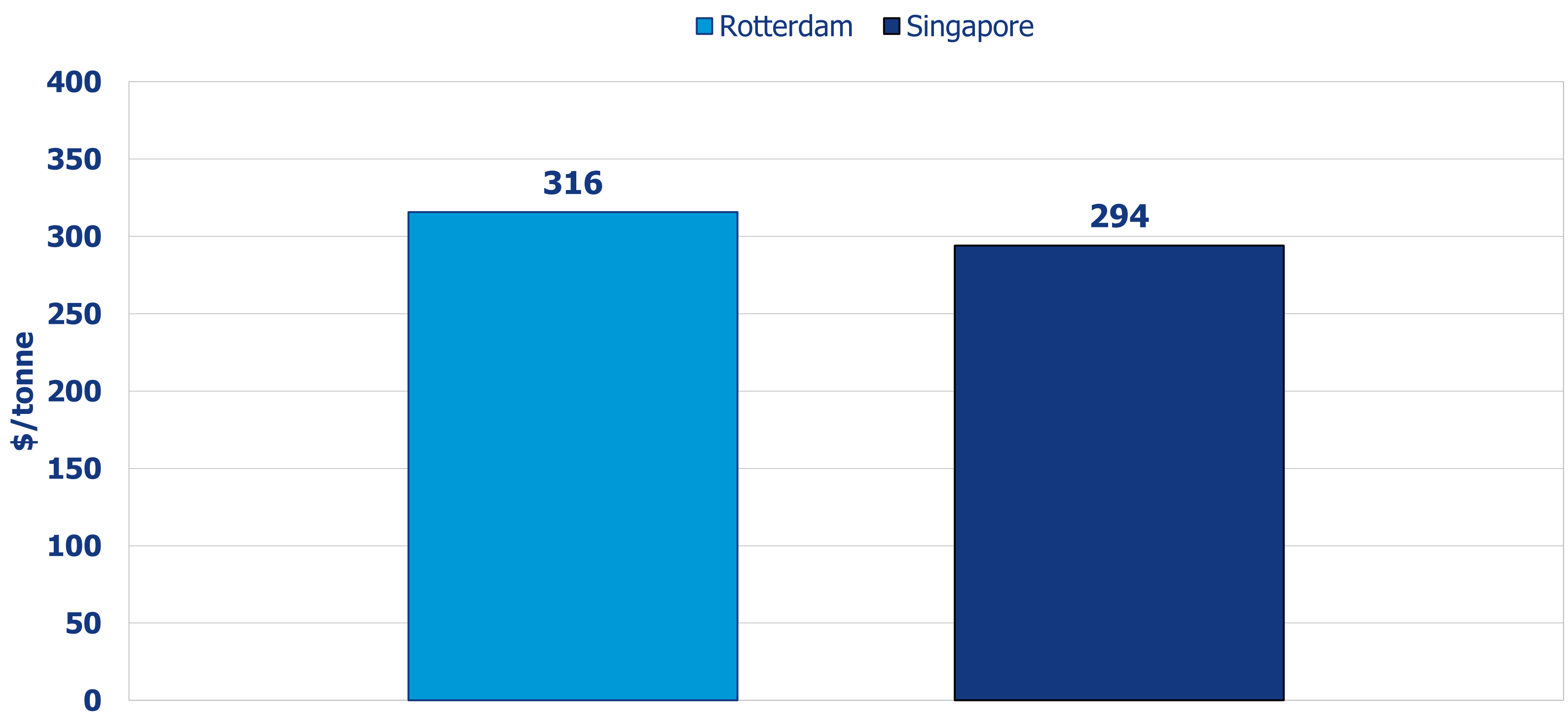
- Not considered technically feasible to reach level of 0.1% sulphur with heavy fuel oil – implies use of gasoil
  - availability
  - low CAPEX
  - price differential

- Scrubbers may be used to reduce the SOx emissions
  - cost of installation – how much trading in ECAs?
  - disposal of waste product
  - maintenance & operation
  - potential costs to adapt engine room

- LNG as a fuel
  - is more environmentally friendly than other fuels
  - price differential
  - conversion of existing ships may be challenging
  - infrastructure/supply network

Bunker Price Differentials

MGO Premiums (average over the last 12 months)



Data Source: Clarksons

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Comparing the Alternatives

	Environmental features compared to the traditional HFO alternatives				Factors influencing viability compared to the traditional HFO alternative		
Alternative	SOx	NOx	PM	CO_2	Cargo Capacity	Capital Investments	Operating Costs
LNG	++	++	++	+	Restricted	Very high	Low
MGO	+	-	-	-	Not restricted	Low	Very high
HFO/Scrubber	+	--	+	-	Slightly restricted	High	Medium [a)]

++ very good, + good, - bad, -- very bad

[a)] Fuel costs remain unchanged, a small increase (1-2%) can be expected. Cost for scrubber maintenance and waste handeling are yet unknown but may add to the total operating costs.

Data Source: North European LNG Infrastructure Project (study commissioned by the Danish Maritime Authority (DMA) within the context of the European Union financed TEN-T programme, Motorways of the Seas, October 2011)

LNG as a Fuel

LNG is probably the most environmentally friendly solution however, there are a number of challenges associated with the use of LNG as a fuel:

- Not many ports in the world at the moment have sufficiently developed supply network infrastructure
- CAPEX and OPEX associated with the conversion of the existing or the installation of the new engine and storage tanks
- Loss of cargo carrying capacity
- Safety issues need addressing
- The prices of LNG are competitive at the moment, but there are questions as to how attractive they will be in the future

Concluding Remarks

- Environmental considerations likely to impact vessel designs – rising cost base
- Likely evolution of LNG as a fuel for vessels but challenges remain
- The implementation of regulatory measures takes time – once adopted on a global scale, LNG as a fuel may become a more competitive option
- Trade flows impacted by economic growth levels, flexibility in the substitution of fuel use & also developments in shipping routes

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