In Search of Solutions: Technical and Regulatory Instruments

Dr. Axel Friedrich
Germany
TOTAL FLAG BY DWT

- Panama
- Liberia
- Marshall Islands
- Hong Kong
- Singapore
- Malta
- Bahamas
- Greece
- China
- Cyprus

Note: all vessels 10,000 dwt or greater

http://www.mondaq.com/x/461234/Marine+Shipping/Flag+State+2015+Top+10+Ship+Registers
REGISTRATIONS BY VESSEL TYPE

Panama takes the top spot for bulk registrations, but Liberia enjoys a lead in containers while Marshall Islands is top in tankers.

TOP FLAGS BY VESSEL NUMBER

- Panama: 4,891
- Liberia: 2,871
- Marshall Islands: 2,585
- Hong Kong: 2,022
- Singapore: 1,846
- Malta: 1,312
- Bahamas: 993
- Greece: 592
- China: 1,269
- Cyprus: 559

Data supplied by Lloyd's List Intelligence
Contracting Parties to the Barcelona Convention

http://web.unep.org/uneppmap/
<table>
<thead>
<tr>
<th>Year</th>
<th>SECA</th>
<th>Global</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>1.5%</td>
<td>4.5%</td>
</tr>
<tr>
<td>2010</td>
<td>1.0%</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>0.1%</td>
<td>3.5%</td>
</tr>
<tr>
<td>2015</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2020</td>
<td></td>
<td>0.5%</td>
</tr>
</tbody>
</table>

a - alternative date is 2025, to be decided by a review in 2018
FIG. 15. Absolute masses as extracted from filters sampled at 100% load with both fuels.
Justification for an improved Fuel Quality for Marine Vessels

1. Fast reduction of air pollution \((\text{SO}_x \text{ and Particles})\)
2. Eliminate toxic residues
3. Eliminates fuel processing on board
4. Precondition for the use of particle filter and SCR
5. Improve the health of the crew and of passengers
HFO Accidents

By the increasing use of heavy oils as ship fuels, it comes for about three decades also to a growing share of the heavy oils in the accident-related oil pollution on sea.

Only during the last years heavy fuel oil is also transported as a load by tank ships. The accidents such as BALTIC CARRIER, Erika HEATHER, PRESTIGE EVOIKOS, NAKHODKA, VOLGONEFT show that there are since then also oil disasters which are caused by heavy oils.
MDO - ADDITIONAL BENEFITS

- ENVIRONMENTAL:
  - Lower fuel consumption from ALL ships
  - Reduces CO2 emissions from ALL ships
  - No heating and pre-treatment of bunkers = further reduction of CO2 emissions from ALL ships
  - Eliminates fuel generated waste = further reduction of CO2 emissions from ALL ships
  - No heavy metals and PAH in MDO – no need to clean up and dispose hazardous PMs
  - Use of in-engine solutions for further exhaust gas cleaning = no further additional waste & no need of further waste disposal
  - Potential bunker spills significantly less harmful
December 9 – December 8  High: $919.00  Low: $604.00  Spread: $315.00  Change: $-300.00

Rotterdam Trend is a linear regression of Rotterdam price indications for LSMGO in the specified time period, quickly showing you the overall direction that the market is moving.

WTI prices are converted from USD/bbl to USD per metric tonne at a rate of 7.62 barrels per metric tonne.

Brent prices are converted from USD/bbl to USD per metric tonne at a rate of 7.53 barrels per metric tonne.
<table>
<thead>
<tr>
<th>Grade</th>
<th>IFO380</th>
<th>IFO180</th>
<th>MDO</th>
<th>MGO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fujairah</td>
<td>394.50</td>
<td>437.50</td>
<td>863.00</td>
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<tr>
<td>Houston</td>
<td>370.00</td>
<td>504.50</td>
<td>748.50</td>
<td></td>
</tr>
<tr>
<td>Rotterdam</td>
<td>350.50</td>
<td>374.00</td>
<td>596.00</td>
<td></td>
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</tbody>
</table>
Swedish port cuts fees for less polluting ships

5th December 2014 16:51 GMT

In Sweden, the Ports of Stockholm are to apply a new set of 'environmentally differentiated' port fees to encourage shipping companies to go beyond their legal obligations in cutting pollution.

"To motivate and encourage our customers to reduce their environmental impact we are introducing new environmental discounts for onshore power supply in port, for liquefied natural gas (LNG) vessels and for reduced nitrogen oxide emissions," said Ports of Stockholm Deputy Managing Director Henrik Widerstahl.
Rotationspartikelfilter Typ «KEBAP»

Einsatzbereich

- Motoren: Viertaktmotoren ab ca. 2'500 bis 18'000 kW
- Brennstoff: MDO/MGO
- Abgastemperatur: 300 bis 550°C
- Ausschaffung: bis 150 mg/m³
- Schmierstoff: - keine Einschränkung bei automatischer Aschereinigung (Option)
- Low ash – Öl, ohne Aschereinigung
Die Lösung für Motoren > 2,5 MW

Rotationsfilter, «Kebap» Anordnung
(Kontinuierlich, einflutig beaufschlagter Abscheider für Partikel)

- Einzeln separierbare Filtersegmente für partielle Regeneration

- Möglichkeit der Umkehr der Durchflussrichtung für Aschereinigung (optional)

- Hohe schlanke Bauform mit vertikaler Durchströmung

- Gute Zugänglichkeit der Filterelemente für Servicezwecke
  (können in Servicestellung gedreht werden)
Eigenschaften

- PM Abscheiderate >95% (Masse)
- Partielle Filterregeneration (im Teilstrom)
- Automatische Aschereinigung (optional)  
  Erhöhte Serviceintervalle (6’000 bis 8’000h, oder ein Service alle zwei Jahre)
- Hohe, schlanke Bauform
- Optimale Zugänglichkeit der Filterelemente (drehbarer Filterrotor)
- Druckverlust für Auslegung: 40 mbar
- Interner Not-Bypass (optional, für höchste Verfügbarkeit des Motors)
### Cost Effectiveness Comparison of NOx Controls for Various Sources


<table>
<thead>
<tr>
<th>Source</th>
<th>Cost Effectiveness (US $/metric ton of NOx)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobile sources</td>
<td></td>
</tr>
<tr>
<td>Ocean-going ships (US)</td>
<td>$729</td>
</tr>
<tr>
<td>HDV (US)</td>
<td>$522</td>
</tr>
<tr>
<td>LDV (Tier2) (US)</td>
<td>$1,893</td>
</tr>
<tr>
<td>LDV (EU)</td>
<td>$2,43</td>
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<tr>
<td>HDV (EU)</td>
<td>$7,203</td>
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<tr>
<td>LDV (EU) (Tier2)</td>
<td>$10,223</td>
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<tr>
<td>HDV (EU) (Tier2)</td>
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<tr>
<td>Ind. Comb. (EU)</td>
<td>$3,563</td>
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<tr>
<td>Ind. Proc. (EU)</td>
<td>$4,310</td>
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<tr>
<td>Stationary sources</td>
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<tr>
<td>Power plants (EU)</td>
<td>$5,542</td>
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<tr>
<td>Av. (US)</td>
<td>$1,433</td>
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<tr>
<td>Av. (EU)</td>
<td>$7,31</td>
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<tr>
<td>Av. for all sources (US)</td>
<td>$10,685</td>
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</table>

$14,330
Governmental ships

New construction of Germany’s No. 1 science ship „Polarstern“ will get a SCR-catalyst and a particulate filter (first science ship in world).

Source: German Ministry of Science, October 10 2014
Ships in the Rotterdam Harbour with Particle Filter and SCR

Pilot ship

Fire fighter ship

Pilot ship
axel.friedrich.berlin@gmail.com
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Comparison SOX Emissions</td>
<td>376.030.220</td>
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<tr>
<td>Comparison NOX Emissions</td>
<td>421.154</td>
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<tr>
<td>Comparison Particle emissions</td>
<td>1.052.885</td>
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<tr>
<td>Comparison CO2 Emissions</td>
<td>83.678</td>
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