Reduction of bunker oil related emissions through cooperation between two seaports

Port Infrastructure Seminar
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World Shipping Routes

Traffic density

Estimated traffic density based on data from 1996 [MARINTEK, 2000, p. 48]

- Singapore
- Rotterdam
Bunkering in Rotterdam and Singapore is attractive
• Deep Sea port
• Geographical location
• Refineries in port
• Prices
• Services

The bunkering of the ‘Emma Maersk’ by the ‘VT Vlissingen’.
Source: Port of Rotterdam Authority
Source of bunker oil

One of the outlets of the crude oil refining industry

Bottom product of several distillation columns

Complex composition

Extreme simplification of refinery process
## Market position

<table>
<thead>
<tr>
<th></th>
<th>Gas/Diesel</th>
<th>Residual Fuel Oil</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rotterdam</td>
<td>Singapore</td>
</tr>
<tr>
<td>Production</td>
<td>21122</td>
<td>14474</td>
</tr>
<tr>
<td>Imports</td>
<td>9650</td>
<td>3860</td>
</tr>
<tr>
<td>Exports</td>
<td>-21061</td>
<td>-14679</td>
</tr>
<tr>
<td>International Marine Bunkers</td>
<td>-1934</td>
<td>-1546</td>
</tr>
<tr>
<td>Stock changes</td>
<td>-546</td>
<td>-786</td>
</tr>
<tr>
<td>Domestic supply</td>
<td>-7231</td>
<td>-1323</td>
</tr>
</tbody>
</table>

In ktonnes per year source: International Energy Agency, 2008
Emissions

Source: Veronika Eyring et al. Brief summary of the impact of ship emissions on atmospheric composition, climate, and human health
Emissions

Annual premature mortality for the No Control scenario compared to a “no shipping” case using ICOADS data.
J.J. Winebrake et al. ENVIRONMENTAL SCIENCE & TECHNOLOGY VOL. 43, NO. 13, 2009
Legislation

MARPOL revised Annex VI Fuel Sulfur Limits Adopted on 10 October 2008 (Marpol, 2008)
Dilemma Competition or ..

Let’s defer the abatement of emissions or we loss our market share to Singapore

Let’s defer the abatement of emissions or we loss our market share to Rotterdam
Dilemma ... Cooperation

Let’s jointly decide to discourage the emissions related to bunker oil
## Technical options for port authorities

<table>
<thead>
<tr>
<th>Measure</th>
<th>Maximal Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exhaust gas recirculation</td>
<td>93</td>
</tr>
<tr>
<td>Fuel switching 2,7 &gt; 0,1% S residual oil fuel</td>
<td>81</td>
</tr>
<tr>
<td>Low S marine diesel 0,5 &gt; 0,1% S</td>
<td>80</td>
</tr>
<tr>
<td>Sea water scrubbing</td>
<td>75</td>
</tr>
<tr>
<td>Fuel switching 2,7 &gt; 1,5% S residual oil fuel</td>
<td>44</td>
</tr>
<tr>
<td>Improved fleet planning</td>
<td>40</td>
</tr>
<tr>
<td>Optimised hull shape / maintenance new ship</td>
<td>20</td>
</tr>
<tr>
<td>Choice of propeller / propeller maintenance new ship</td>
<td>10</td>
</tr>
<tr>
<td>Optimised hull shape / maintenance existing ship</td>
<td>5</td>
</tr>
<tr>
<td>“Just in time” routing</td>
<td>5</td>
</tr>
<tr>
<td>Optimal cargo handling</td>
<td>5</td>
</tr>
<tr>
<td>Choice of propeller / propeller maintenance existing ship</td>
<td>3</td>
</tr>
<tr>
<td>Weather routing</td>
<td>2</td>
</tr>
<tr>
<td>Constant RPM</td>
<td>2</td>
</tr>
<tr>
<td>Optimal propeller pitch</td>
<td>2</td>
</tr>
<tr>
<td>Optimal berthing, mooring and anchoring</td>
<td>2</td>
</tr>
<tr>
<td>Optimal trim</td>
<td>1</td>
</tr>
<tr>
<td>Minimum ballast</td>
<td>1</td>
</tr>
<tr>
<td>Optimal rudder</td>
<td>0,3</td>
</tr>
</tbody>
</table>

(Cofala 2007, Martinek 2000)
Policy Measures

• Measures steering towards and focussing on a emission reducing technique
• Differentiated port dues
• Distance-related emission charges
• Taxation
• Emission trading
Competition by other ports
Choosing the place of bunkering

Deciding factors for bunker purchase by ship owners:
- Shipping route
- Bunker Quality
- Price of bunker in specific port
- Type and size of vessel (port dues)
- Amount of cargo (port dues)
- Amount of bunker wanted
- Extra cost to sail to 3rd port
- Pilotage, equipment costs and other port costs
Integrated costs per route

- Bunker costs
- Port dues
- Route increase
- Bunker quality penalty
Organizational fit?

Rotterdam is a decentralized multi-actor network

Singapore is a centralized authority

Legend:
- Oned-sided arrow: hierarchical relation
- Twow-sided arrow: representation relation
- Arrow with wavy line: supervision relation
- Arrow with dotted line: influential relation
Conclusion

Reduction of bunker oil related emissions through cooperation between Rotterdam and Singapore may be considered because:

• Technical solutions are available
• Appropriate policy measures can be applied
• Financial headroom is created towards competitors

• A process towards cooperation must be carefully designed to align the organizational differences.
Thank you for your attention!