GREEN MARITIME LOGISTICS

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Technical University of Denmark
A synthesis of work on

• Emissions from ships (GHGs, sulphur)
• Maritime logistics
• Some other interesting stuff!
What is green maritime logistics?

• Is it maritime logistics with good environmental characteristics?

• No!
What is **green** maritime logistics?

- It is an attempt to attain an acceptable environmental performance of the maritime supply chain, while at the same time respecting traditional economic performance criteria.

- ‘win-win’ solutions are sought
Parenthesis: Vasco was green
Primary focus

• EMISSIONS FROM SHIPS

• [NOTE: there are certainly additional environmental attributes of maritime transport that create external costs, such as noise, hazardous substances, oil spills, ballast water, residues, garbage, etc]
Types of emissions

- Green House Gases (GHGs) (mainly CO2, but also CH4 and others)
- Non-GHG (mainly SO2, but also NOx and others)
- P.M., etc
Maritime logistics problems

• Routing and scheduling
• Pickup and delivery
• Fleet deployment
• Fleet size and mix
• Optimal speed
• Weather routing
• Intermodal network design
• Modal split
• Transshipment
• Queueing
• Terminal management
• Berth allocation in ports
• Supply chain management
• Etc etc

• Optimize with respect to traditional criteria
• Optimize with respect to environmental criteria
• Optimize with respect to both environmental and traditional criteria
• Try to find ‘win-win’ solutions!
In search of WIN-WIN solutions

• “Win-win” is a nice set of words
• What it means is a set of solutions which are “win” with respect to both economic and environmental criteria
• Problem: Finding win-win solutions may not always be easy!
Focus here

• The GHG track
• The SOx track

• Note: these 2 tracks are typically considered separate and in parallel.
• However, important linkages do exist!
The GHG track

• Kyoto and beyond
• EEDI
• MBMs
Kyoto

- UNFCCC, 1997, Kyoto
- Committed State Parties to reduce greenhouse gas (GHG) emissions
- 192 signatories

- Maritime transport & aviation NOT included
Brought all nations into a common cause to undertake ambitious efforts to combat climate change and adapt to its effects, with enhanced support to assist developing countries to do so.
COP21 ii

- Aviation and shipping still left outside UNFCCC mandate

- Aviation: ICAO
- Shipping: IMO
Global CO2 emissions

2009 IMO GHG study
• (2007 data)

2014 IMO GHG study
• (2012 data)

• 2.7% reduced to 2.2%
• 796 million tonnes of CO2 in 2012, down from 885 million tonnes in 2007
• Mainly attributed to slow steaming due to depressed market conditions after 2008
2011 EU White Paper

(among other things)

• Sets a goal of reducing GHG emissions from transport (all modes) by 60% by 2050

• Shipping GHGs to be reduced 40 to 50%

• Main challenge: how can shipping grow and be profitable in the face of such ambitious environmental goals
The GHG track at the IMO

Subtrack I

• EEDI

Subtrack II

• MBMs
Subtrack I: Only mandated measure on GHGs

- IMO’s adoption of EEDI July 2011
- Adopted as an amendment to MARPOL’s Annex VI
- Fierce resistance by China, India, Brazil, Saudi Arabia and other developing countries
- Matter highly political
Energy Efficiency Design Index (EEDI)

• Defined as

\[
\left( \prod_{j=1}^{M} f_j \right) \left( \sum_{i=1}^{n ME} P_{ME(i)} \cdot C_{FME(i)} \cdot SFC_{ME(i)} \right) + \left( P_{AE} \cdot C_{FAE} \cdot SFC_{AE}^* \right) + \left( \prod_{j=1}^{M} f_{j'} \cdot \sum_{i=1}^{n PTI} P_{PTI(i)} - \sum_{i=1}^{n eff} f_{eff(i)} \cdot P_{AE eff(i)} \right) \cdot C_{FAE} \cdot SFC_{AE} - \left( \sum_{i=1}^{n eff} f_{eff(i)} \cdot P_{eff(i)} \cdot C_{FME} \cdot SFC_{ME} \right)
\]

where:
- \( f_j \) capacity
- \( \nu \) reference

• Ratio of CO2 produced divided by (capacity* speed) [gr CO2/ton-mile]
EEDI contd

• Mandatory for newbuildings as of 2013
• Attained EEDI ≤ Ref. line EEDI
• Ref. line EEDI = \((1-X/100) aDWT^{-c}\)

• \(X=0\%\) for ships built from 2013-2015
• \(X=10\%\) for ships built from 2016-2020
• \(X=20\%\) for ships built from 2020-2025 and
• \(X=30\%\) for ships built from 2025-2030.
**Figure 1:** Dry bulk carriers
All data: 2,259 ships. Without outliers (shown in blue): 2,218 ships

Mathematical models:

1. \( y = 804.53x^{-0.4625} \) with \( R^2 = 0.9056 \)
2. \( y = 954.46x^{-0.4779} \) with \( R^2 = 0.9251 \)
Concerns

• To be EEDI compliant, the correct solution is to optimize hull, engine and propeller
• The easy solution is to reduce installed power
• This could lead to underpowered ships
• More CO2 to maintain speed in bad weather
Compromise on safety?

• Big discussion at the IMO, how to reconcile
  – EEDI compliance
  – Minimum safe power

• Not clear how this will be resolved
Subtrack II: Market Based Measures (MBMs)

• 11 MBM proposals at MEPC 60 (March 2010)
• Expert Group formed by IMO Sec. General
• Feasibility study (300-page report)
• Work: May- August 2010
• Report presented at MEPC 61 (Sep. 2010)
• Various discussions since then
Concept

• “Polluter pays” principle
• An MBM would help internalize the external costs of GHG emissions

• **In-sector** reductions: Reduce maritime emissions

• **Out-of-sector** reductions: pay for a wind farm in Indonesia
MBM proposal groups

• International GHG Fund (Denmark et al) (LEVY)
• Emissions Trading Schemes (Norway, UK, France, Germany)
• Various hybrids, based on EEDI (Japan, USA, WSC)
• Port-based (Jamaica)
• Rebate mechanism (IUCN)
• Bahamas proposal
## Emission reductions in 2030

Modelled emission reductions across various scenarios

<table>
<thead>
<tr>
<th></th>
<th>SECT</th>
<th>VES</th>
<th>Bahamas</th>
<th>GHG Fund</th>
<th>LIS</th>
<th>PSL</th>
<th>ETS (Norway France)</th>
<th>ETS (UK)</th>
<th>RM</th>
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<tr>
<td><strong>Mandatory EEDI (Mt)</strong></td>
<td>123-299</td>
<td>123-299</td>
<td>123-299*</td>
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<td><strong>MBM In sector (Mt)</strong></td>
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<td>14-45</td>
<td>1-31</td>
<td>32-153</td>
<td>29-119</td>
<td>27-114</td>
<td>27-114</td>
<td>29-68</td>
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<td><strong>MBM Out of Sector (Mt)</strong></td>
<td>152-584</td>
<td></td>
<td>15-20%</td>
<td>13-40%</td>
<td>3-10%</td>
<td>2-8%</td>
<td>13-40%</td>
<td>13-40%</td>
<td>124-345</td>
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<td><strong>Total reductions (% BAU)</strong></td>
<td>19-31%</td>
<td>13-23%</td>
<td>10-20%</td>
<td>13-40%</td>
<td>3-10%</td>
<td>2-8%</td>
<td>13-40%</td>
<td>13-40%</td>
<td>13-28%</td>
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<tr>
<td><strong>Potential supplementary reductions (Mt)</strong></td>
<td>45-454</td>
<td>104-143</td>
<td>232-919</td>
<td>917-1232</td>
<td>696-870</td>
<td>187-517</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Included if the mandatory EEDI is adopted by the committee
• Assumptions, assumptions, & more assumptions!

• 300-page report

• No recommendation!
Greece’s proposal

• Keep on table only Levy and ETS proposals
• Put on hold hybrid MBMs* (US, Japan, WSC)
• Discard all others (Bahamas, Jamaica, IUCN)

• *MBMs embedding EEDI
Greece’s proposal

- Keep on table only Levy and ETS proposals
- Put on hold hybrid MBMs (US, Jap., WSC)
- Discard others (Bahamas, Jamaica, IUCN)

**KEEP ALL ON THE TABLE**
MEPC 63

• Draft Resolution on Technical Co-operation and Transfer of Technology

• Brought forward by developing countries (China, India, Brazil, etc)
MEPC 63

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• Brought forward by developing countries (China, India, Brazil, etc.)

• NO CONSENSUS
MEPC 63

- Proposal for an Impact Assessment Study on MBMs
- Brought forward by the Chairman of MEPC
- Supported by developed countries
MEPC 63

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- Brought forward by the Chairman of MEPC
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- NO CONSENSUS
MBMs

- Some proposals merged (Japan, WSC)
- Bahamas proposal reformulated and then withdrawn
- US proposal reformulated
- Basically, no real progress since 2010
MBMs

• Some proposals merged (Japan, WSC)
• Bahamas proposal reformulated and then withdrawn
• US proposal reformulated
• Basically, no real progress since 2010

MEPC 65 (May 2013):
• MBM DISCUSSION SUSPENDED!
Main reason for failure?

• CBDR!
CBDR: Common But Differentiated Responsibilities

• Widely accepted principle after the Kyoto Protocol.
• Has two aspects. The first is common responsibility, which is raised from the concept of common heritage and common concern of humankind and reflects the duty of countries to equally share the burden of environmental protection for common resources.
• The second is differentiated responsibility, which addresses different social and economic situations across countries.
Monitoring, Reporting and Verification (MRV)

- Rechannelling of MBM discussion
- Only for CO2

- 2 different regimes (IMO, EU)
- Differences may create distortions and big administrative burden
Enter the EU Parliament!

• Feb. 2017
• Decision of EU Parliament to include shipping in EU ETS!
Is this a good development?

• Extensive protests from industry circles
• Big concern that an EU ETS may create
  – significant distortions and obstacles for efficient trade
  – may not be compatible with the IMO roadmap,
  – and in fact may not be a good instrument for reducing GHG emissions.
Way ahead

• Q: any measure that might work?

• MY OPINION: a significant bunker levy

• A bunker levy would
  – induce speed reduction, hence less CO2
  – also collect money for out-of-sector reductions
Speed reduction

• An obvious way to reduce maritime emissions

• Killing 3 birds with one stone?

• Pay less for fuel
  • Reduce CO2 (and other) emissions
  • Help sustain a depressed market

• Looks like win-win-win?
VLCC emissions

from Gkonis and Psaraftis (2012)
Speed reduction: dual targetting

• OPERATIONAL
  • Operate existing ships at reduced speed
  • Derate engines
  • Slow steaming kits

• STRATEGIC (DESIGN)
  • Design new ships that cannot go very fast
  • Use smaller engines
3E is green

Længde: 398 meter.  
Bredde: 59 meter.  
Højde: 73 meter.  
Dødvægt: 165,000 tons.  
Marchhastighed: 17,8 knot. (31,5 km/t.)  
Tophastighed: 25 knot. (42,5 km/t.)  
Vægt: 60,000 ton  
Pris: 1,033,293,000 kr.

Gron transport
Så mange gram CO₂ bruges der til at transportere et ton gods en km.

Luftfrakt  
Lastbil  
Tog  
Maersk Triple-E
Side effects of speed reduction

To maintain same level of throughput, you will need:

- Either more ships
- Or bigger ships
- Or both

This will come at a cost
More side effects

- Building more ships to match demand throughput
- Implications on safety due to more ships sailing around
- Increasing freight rates due to a reduction in ton-mile capacity
- Increased inventory costs for the shippers
More side effects ii

- Cargo may shift to land-based modes, if these are available
- This may result in more CO2

- European short-sea shipping
- Even in deep-sea shipping
Tran-siberian railway example

NEW project: Satellite Integrated MetOcean Service (SIMOS)

- New project on maritime weather routing
- DTU Space leader
- Several partners

Funded by Innovation Fund Denmark
The SOx track: Marpol Annex VI

<table>
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<tr>
<th>Areas</th>
<th>2005-2012</th>
<th>2015</th>
<th>2015-2020</th>
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<tr>
<td>Within SECA</td>
<td>1.5</td>
<td>1</td>
<td>0.1</td>
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<tr>
<td>Outside SECA</td>
<td>4.5</td>
<td>3.5</td>
<td>3.5</td>
<td>0.5</td>
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</table>

Sulphur content in %m

Year

- ECA zones
- Global
Emissions Control Areas (ECAs): SECAs and NECAs
Special issue

Transportation Research Part D xxx (2014) xxx–xxx

Contents lists available at ScienceDirect

Transportation Research Part D

journal homepage: www.elsevier.com/locate/trd

Editorial

Emission control areas and their impact on maritime transport

Kevin Cullinane\textsuperscript{a,\,*}, Rickard Bergqvist\textsuperscript{b,\,1}

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\textsuperscript{b} Logistics and Transport Research Group, Department of Business Administration, School of Business, Economics and Law at University of Gothenburg, P.O. Box 610, SE 405 30 Göteborg, Sweden
The possible designation of the Mediterranean Sea as a SECA: A case study

George P. Panagakos a,1, Eirini V. Stamatopoulou a,2, Harilaos N. Psaraftis b,∗

aLaboratory for Maritime Transport, National Technical University of Athens, 9, Iroon Politechniou Str., Zografos, Greece
bDepartment of Transport, Technical University of Denmark, Bygningstorvet 1, 2800 Kgs Lyngby, Denmark
The RoRoSECA project

• Funded by the Danish Maritime Fund (DMF)

• Supplementary funding: Orients Fund

• Industry partner: DFDS
The problem

- Higher fuel prices due to 0.1% sulphur content as of 1 Jan. 2015 risk making Ro-Ro shipping less competitive vis a vis land based modes.
- Possible modal shifts.
- Risk of route closure.
- Some operators have shut down some of their routes.

- Q: What can be done to alleviate problem?
Press releases before 01/01/2015:

GLOOM AND DOOM

SECA SHUTS DOWN TRANSFENNICA IBERIAN SERVICE

The Dutch-owned short-sea shipping line Transfennica (part of the Spleiethoff Group) has announced that it is to cease its “Motorways of the Sea” ro-ro service between Bilbao, Portsmouth and Zeebrugge at the end of this month (December).

The decision is a direct result of the introduction of stricter new low-sulphur emission controls from 1 January 2015 in the Baltic Sea, the Kattegat, the North Sea and English Channel. A further SECA extends in a 200 nautical miles wide belt along the coasts of the USA and Canada.

SECA requirements lead to new European rail link

CARRIERS: Railway company ERS is opening a new route in Europe in light of rising customer demand following the implementation of new sulphur regulations. Many customers and countries are willing to change their mode of transport in order to save money.

DFDS closes Sassnitz-Klaipeda connection

Publication date: 2013-08-30
Tags: maritime, germany, denmark, lithuania

DFDS Seaways has decided to close the ferry service between Sassnitz, Germany and Klaipeda, Lithuania with effect from the end of September.

Previously a busy connection, the route has over the years become economically unviable. As Vice President of DFDS, Anders Reesgaard, stated: “We have fought hard to get new customers and improve revenue and profit, but unfortunately without success”. He added, that with the outlook on continued decline in profits, and in light of the new sulphur regulations to be introduced from 1 January 2015, the company does not believe that it will be possible to turn the tide on the crossing.
What actually happened

Stena Line records 16% yearly growth on North Sea route

DFDS Wraps Up Record Year, Expects Higher Revenue in 2016

Danish shipping and logistics company DFDS posted a profit of DKK 1.07bn (USD 151m), up by 89pct when compared to last year’s DKK 571 million.

For the full-year 2015, the group reported revenue increase of 5% to DKK 13.5bn. Organic revenue growth, adjusted for route closures and acquisitions, was 7% mainly driven by 7% higher freight shipping volumes and 8% more passengers. In the fourth quarter, organic revenue growth was 10%.

P&O breaks Channel freight record in 2015

P&O Ferries transported more freight between Dover and Calais in 2015 than any other year in its “modern history,” amounting to 1,340,317 trucks.

The result is a 22% year-on-year increase over 2014, and is due in part to disruptions at the channel tunnel, which caused a 172% year-on-year increase in HGVs on its separate Zeebrugge route throughout the month of July. The group pressed a sixth ship back into service on the English Channel that month in order to increase capacity.
Fuel prices after mid 2014
Lucky with fuel prices

• The fact that fuel prices have dropped precipitously since the summer of 2014 has somehow alleviated the repercussions of the new regulations.
• This has also masked the extent of the problem.
• However, the risk of route closure still exists, particularly if fuel prices rise again in the future.

→ Need to be on the alert.
Project challenge

• Q: Can one isolate the effect of the sulphur legislation from that of other developments that happened in parallel?
  – Precipitous drop in fuel prices
  – Russian economic crisis
  – Others

• A: YES!

• First attempt to examine the effect of the new SECA limits, and dissect it from the record low fuel prices that were observed in the last two years
DFDS network

- 18 Routes (22 links)
- ~38 vessels
- Up to 535 departures/week, 13 countries, 30 ports
- 4 main areas
  - North Sea (9 Routes, 20 vessels)
  - Baltic Sea (5 Routes, 7 vessels)
  - Cross-Channel (3 Routes, 6-7 vessels)
# Active routes to study (7+2)

**Main**

<table>
<thead>
<tr>
<th>Route</th>
<th>Vessel</th>
<th>Vessel Capacity</th>
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<tbody>
<tr>
<td></td>
<td>Type</td>
<td>Lane meters</td>
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<tr>
<td></td>
<td>Tech</td>
<td>Passengers</td>
</tr>
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<td><strong>NORTH SEA</strong></td>
<td></td>
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<tr>
<td>Gothenburg – Ghent – Brevik</td>
<td>RoRo</td>
<td>3831</td>
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<tr>
<td></td>
<td>Scrubber</td>
<td>12</td>
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<td></td>
<td>RoRo</td>
<td>3831</td>
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<tr>
<td></td>
<td>Scrubber</td>
<td>12</td>
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<tr>
<td>Copenhagen – Oslo</td>
<td>Cruise</td>
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<tr>
<td></td>
<td>Scrubber</td>
<td>(450 cars)</td>
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<td>Cruise</td>
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<td>MGO</td>
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<td>Esbjerg – Immingham</td>
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<td><strong>BALTIC SEA</strong></td>
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<tr>
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<td>MGO</td>
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</tbody>
</table>

**plus**

Esbjerg- Harwich (shut down)
Marseille-Tunis (outside SECA)
Modal split model development and calibration

**Task 2.2**
- **Shipping Company**
  - **COSTS**
    - Scrubber
    - Port Costs
    - Vessel Staff
    - Capital
    - Maintenance
    - Fuel Costs
  - **BENEFITS**
    - Revenue
    - Services

**Perspective of Shipper**
- **Maritime Mode (DFDS)**
  - Time
  - Inventory
  - Cost

- **Land Mode**
  - Time
  - Inventory
  - Cost

**Maritime Mode (Competitor)**
- **(Generated Cost for comparison)**

**Set of Routes Served by DFDS**
- Select Route
- OD pairs using DFDS link
- Maritime Competitor?
- Market Share
- YES
- NO
- Assign all Maritime?

**Road/Rail Alternative?**
- YES
- NO

**Data for Maritime Leg:**
- Distance (NM)
- Sailing Speed (knots)
- Time at each Port (hr)
- Capacity (Lane meter)
- MGO or scrubber
- Ship Specs

**Fuel Prices (MGO, HFO)**
- Potential source: SHIPPAX journal

**Scrubber CAPEX**
- Potential source: SHIPPAX journal

**Task 2.3**
- **Environmental Balance of the System**
  - Emissions for each mode in Selected Route

**Check Route Profitability**
- Benefits > Costs?
  - YES
  - Route Profitable
  - New Economic Balance
  - New Environmental balance
  - New Modal Split (Recalculate CBA) (New Env. Balance)

- NO
  - Shut Down?
    - Assign all Road/Rail?
      - YES
      - New Values:
        - Fuel Costs
        - Revenue
        - Time in Maritime Mode
        - New Transit Time
        - Cost of Transport
    - NO
      - Higher Costs may lead to Changes in Overall Demand for Transport

**New Values:**
- Fuel Costs
- Revenue
- Time in Maritime Mode
- New Transit Time
- Cost of Transport

**Potential source:**
- DFDS Logistics,
- Volvo, other?
- SHIPPAX journal

**LEGEND on Data confidentiality**
- Publicly available
- Some Confidential
- Confidential
Modal split model development and calibration

**Task 2.2**

- **Set of Routes Served by DFDS**
- **Select Route**
- **OD pairs using DFDS link**
- **Maritime Competitor?**
- **Road/Rail Alternative?**
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**Shipping Company**

**COSTS**
- Scrubber
- Port Costs
- Vessel Staff
- Capital
- Maintenance
- Fuel Costs

**BENEFITS**
- Revenue
- Services

**Perspective of Shipper**

- **Maritime Mode (DFDS)**
  - Time
  - Inventory
  - Cost

- **Land Mode**
  - Time
  - Inventory
  - Cost

**Maritime Mode (Competitor)**

- (Generalized Cost for each option)

**Calibrate Multinomial Model Using Market shares**

**New Economic Balance**

Environmental Balance of the System Emissions for each mode in Selected Route

**Task 2.3**

- **Check Route Profitability**
  - **Benefits > Costs**
    - YES
    - Route Profitable
  - NO
    - Shut Down?
      - Assign all Road/Rail?
      - New Modal Split (Recalculate CBA) (New Env. Balance)

**Alternative Policies:**
- Speed reduction
- Change Fuel surcharges
- Change Frequency
- Change Policy?
- Change Fleet?
- Other technology?

**New Values:**
- Fuel Costs
- Revenue
- Time in Maritime Mode
- New Transit Time
- Cost of Transport

**Higher Costs may lead to Changes in Overall Demand for Transport**

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- DFDS Logistics
- Volvo, other?
- SHIPPAX journal
- MGO or scrubber
3 scenarios on Fuel Price

• **Fuel case 1**: What actually happened (MGO with actual prices)

• **Fuel case 2**: What would happen if MGO prices returned to 2014 levels

• **Fuel case 3**: What would happen if HFO was still allowed (Actual prices)
Conclusions i

• Maritime shares actually increased due to observed low prices

• Maritime shares would have increased further if HFO were still allowed

• Maritime shares would drop if fuel levels returned to 2014 levels

• Profitability of ship operator is masking the negative effects of the sulphur regulation
Measures to mitigate or reverse modal shifts

• Measures from the Ro/Ro operator
  • Speed reduction
  • Service frequency and schedule reconfiguration
  • Fleet and network reconfiguration
  • Alternative fuels such as LNG
  • Other technical measures such as scrubbers
  • Appropriate pricing policies

• Measures from policy makers
  • Full or partial internalization of external costs, all modes
  • Easing of port dues/fairway dues/ice dues for relevant shipping
  • Public funding or subsidies
  • Any other potential policy measure
Speed Reduction
## Effects of speed on fuel consumption

### Gothenburg – Ghent (Normal sailing time 32 hours)

<table>
<thead>
<tr>
<th>Ship</th>
<th>Hours at berth</th>
<th>Hours sailing</th>
<th>Weekly fuel consumption (tonnes)</th>
<th>Reduction (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Baseline Sailing Speed 18.06 knots</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ship A</td>
<td>38</td>
<td>130</td>
<td>294.354</td>
<td>NA</td>
</tr>
<tr>
<td>Ship B</td>
<td></td>
<td></td>
<td>305.564</td>
<td></td>
</tr>
<tr>
<td>Ship C</td>
<td></td>
<td></td>
<td>270.198</td>
<td></td>
</tr>
<tr>
<td>Ship D</td>
<td></td>
<td></td>
<td>277.407</td>
<td></td>
</tr>
<tr>
<td><strong>Increase Trip by 1 hour, New Sailing Speed 17.51 knots</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ship A</td>
<td>32</td>
<td>136</td>
<td>264.585</td>
<td>-10.11</td>
</tr>
<tr>
<td>Ship B</td>
<td></td>
<td></td>
<td>273.453</td>
<td>-10.51</td>
</tr>
<tr>
<td>Ship C</td>
<td></td>
<td></td>
<td>245.181</td>
<td>-9.26</td>
</tr>
<tr>
<td>Ship D</td>
<td></td>
<td></td>
<td>253.777</td>
<td>-8.52</td>
</tr>
<tr>
<td><strong>Increase Trip by 2 hours, New Sailing Speed 16.99 knots</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ship A</td>
<td>26</td>
<td>142</td>
<td>240.315</td>
<td>-18.36</td>
</tr>
<tr>
<td>Ship B</td>
<td></td>
<td></td>
<td>247.638</td>
<td>-18.96</td>
</tr>
<tr>
<td>Ship C</td>
<td></td>
<td></td>
<td>222.784</td>
<td>-17.55</td>
</tr>
<tr>
<td>Ship D</td>
<td></td>
<td></td>
<td>231.167</td>
<td>-16.67</td>
</tr>
<tr>
<td><strong>Increase Trip by 3 hours, New Sailing Speed 16.51 knots</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ship A</td>
<td>20</td>
<td>148</td>
<td>191.740</td>
<td>-34.86</td>
</tr>
<tr>
<td>Ship B</td>
<td></td>
<td></td>
<td>196.167</td>
<td>-35.80</td>
</tr>
<tr>
<td>Ship C</td>
<td></td>
<td></td>
<td>177.715</td>
<td>-34.23</td>
</tr>
<tr>
<td>Ship D</td>
<td></td>
<td></td>
<td>185.196</td>
<td>-33.24</td>
</tr>
</tbody>
</table>
Policy measures

• Consider the following policy measures to reverse/mitigate negative effects
  
  – Full or partial internalization of external costs, all modes
  – Easing of port dues/fairway dues for relevant shipping
  – ECO bonus-like system, with refund to freight haulers boarding a vessel
  – Subsidies for environmental investments (LNG, scrubbers, others)
  – Additional tax on land-based modes
The implications of the new sulphur limits on the European Ro-Ro sector
Thalis Zis, Harilaos N. Psaraftis
Technical University of Denmark, Copenhagen, Denmark
Global conclusion of project

- RoRo shipping got lucky on SECAs
- But needs to be on the alert
Project title: Mitigating and reversing the side-effects of environmental legislation on Ro-Ro shipping in Northern Europe...

Period: 15/06/2015 → 14/06/2017

The main objective of this project is to identify and assess possible technical, operational, regulatory and financial measures for the mitigation and reversal of the negative repercussions of environmental legislation to the market shares of RoRo shipping in Northern Europe. This problem is already a serious source of concern not only to RoRo operators in the Baltic and North Sea, which have or are contemplating shutting down some routes as unprofitable, but also to manufacturing, mining and forest industries in the area.

To address this problem, the Danish Maritime Fund has awarded a two-year research project to DTU Transport. Sulphur regulations are the specific focus of this environmental legislation. RoRo operator DFDS is an industry partner to the project, which also bears endorsements from Interferry and the European Community Shipowners Association (ECSA).

This website provides information on the project. It also provides additional information, not directly related to the project, but related to the general issues addressed by the project. We hope you find the contents of this website useful.

The project is funded by the Danish Maritime Fund (DMF)
To sum up

• Green maritime logistics is an exciting area
• Many challenges and opportunities
• “Win-win” may be difficult to achieve, but not impossible

• Policy fragmentation may be an obstacle
• Political issues are definitely an obstacle
• Sound analysis can support policy makers
Maybe of interest

• 15 chapters
• All modes covered
• Also green corridors (EU project SuperGreen)
Appendix

• What are the GHG-SOx linkages?
GHG-SOx linkages

- Producing low S fuel emits CO2
- SOx trapping devices like scrubbers increase fuel consumption hence CO2
- More expensive low S fuel may cause modal shifts (mainly to road) hence more CO2
- SOx causes radiative cooling, hence reducing SOx may increase global warming!
GHG-SOx linkages

• Producing low S fuel emits CO2
• SOx trapping devices like scrubbers increase fuel consumption hence CO2
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• SOx causes radiative cooling, hence reducing SOx may increase global warming!
Additional conclusion

• TAKE A HOLISTIC VIEW
Thank you very much!

- hnpsar@dtu.dk