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European trends and regional perspectives

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The impact of sulphur regulations on RoRo shipping in Northern Europe

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The RoRoSECA project

- 2 year project
- Funded by the Danish Maritime Fund (DMF)
- Industry partner: DFDS

Project full title:

- **Mitigating and reversing the side-effects of environmental legislation on Ro-Ro shipping in Northern Europe**

- Main objective: 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 Ro-Ro shipping in Northern Europe.

- Duration: 2 years (15/6/2015-14/6/2017)

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.

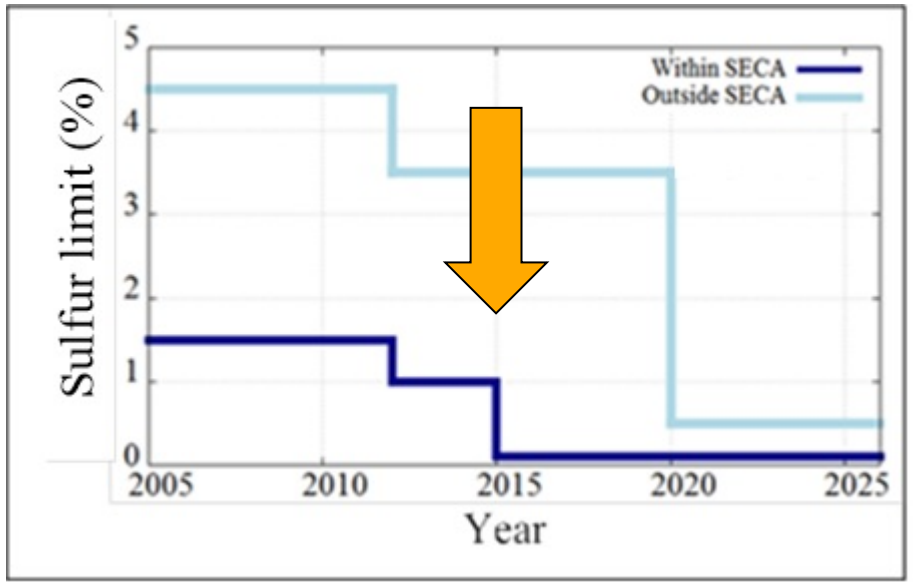
- Q: What can be done to alleviate problem?

The problem ii

- 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.

Background: Marpol Annex VI



	Year			
Areas	2005-2012	2012-2015	2015-2020	2020 on
Within SECA	1.5	1	0.1	0.1
Outside SECA	4.5	3.5	3.5	0.5

Effects to Ro-Ro operators

- Ship operators can either use low-sulphur fuel, or retrofit vessels with scrubber systems
- MGO is more expensive, while scrubbers increase overall fuel consumption, and require significant capital costs
- Increased operating costs could lead to changes in
  - vessel deployment
  - frequency of service
  - sailing speed
  - existence of certain routes
- Some of the additional costs will be passed over to clients through the Bunker Adjustment Factor (BAF – fuel surcharges)

Before 2015: many studies/papers

- Kalli et al (2009)
- Ljungström et al (2009)
- Stavrakakis et al (2009)
- Hader at al (2010)
- ECSA: Notteboom et al (2010)
- EC: Bosch et al (2009), Kehoe et al (2010), Delhaye et al (2010)
- ECSA & ICS: Grebot et al (2010)
- EMSA (2010)
- etc

- Special issue of Tr. Res. Part D on ECAs (2014)

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 [a,*], Rickard Bergqvist [b,1]

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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,*]

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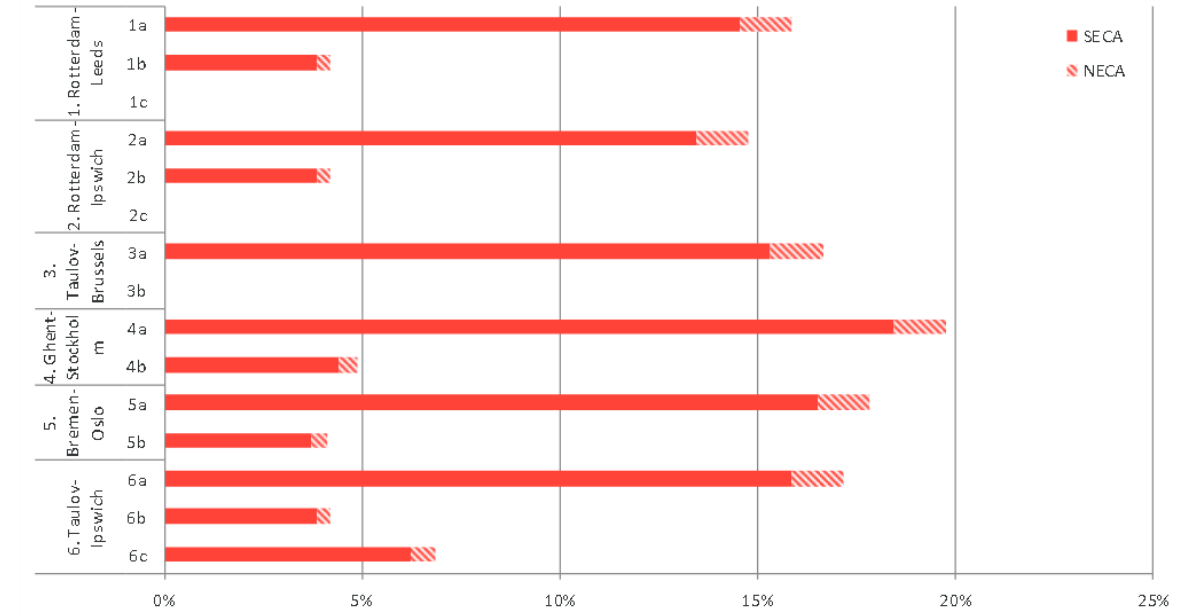
Before 2015: gloom and doom

Figure 23: Percentage cost increase in sea-based costs due to SECA and NECA in 2015 for ro/ro routes



Source: The impact on short sea shipping and the risk of modal shift from the establishment of a NOx emission control area in the North Sea (North Sea Consultation Group, 2013)

What actually happened

Stena Line records 16% yearly growth on North Sea route

Stena Britannica sails between the UK port of Harwich and the Hook of Holland in the Netherlands

DFDS Wraps Up Record Year, Expects Higher Revenue in 2016

Image Courtesy: DFDS

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%.

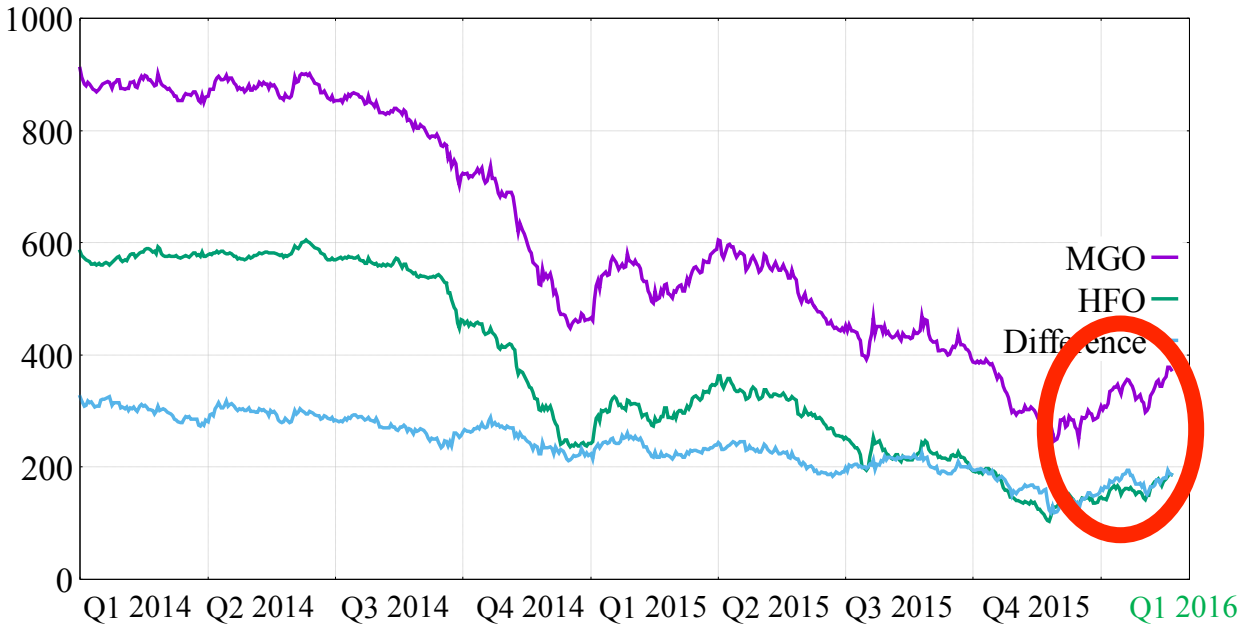
P&O breaks Channel freight record in 2015

By Charlie Bartlett from London

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.

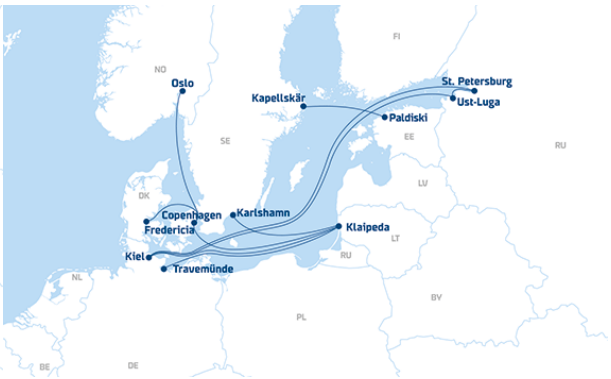
The result is a 22% year-on-year increase over 2014, and is due in part to disruptions at the channel tunnel, which caused a 172% year-on-year increase in HGVs on is separate Teesport to Zeebrugge route throughout the month of July. The group pressed a sixth ship back into service on the English Channel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

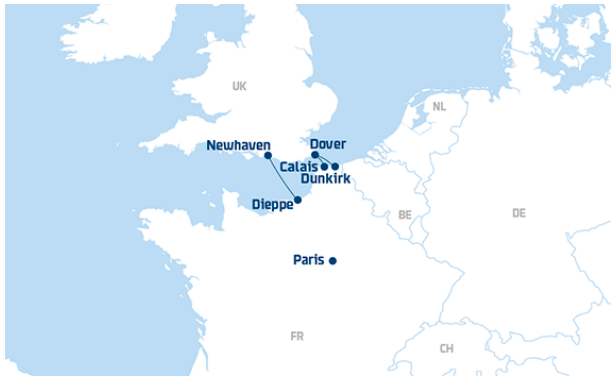
Fuel prices after mid 2014



Current 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)
  - Mediterranean (1 Route, 1-2 vessels)





Active routes to study (7)

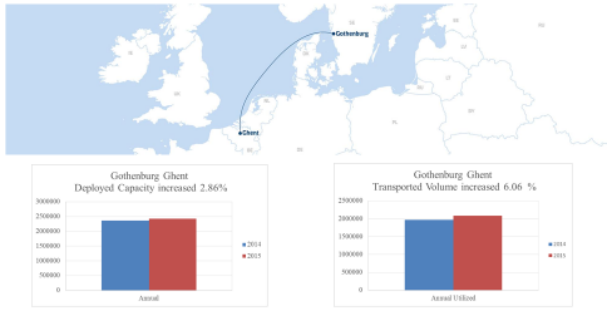
Route	Vessel		Vessel Capacity	
	Type	Tech	Lane meters	Passengers
NORTH SEA				
Gothenburg – Ghent – Brevik	RoRo	Scrubber	3831	12
	RoRo	Scrubber	3831	12
	RoRo	Scrubber	3831	12
Copenhagen – Oslo	Cruise	Scrubber	(450 cars)	1790
	Cruise	MGO	(320 cars)	1989
Esbjerg – Immingham	RoRo	Scrubber	3000	12
	RoRo	MGO	3000	12
Rotterdam – Felixstowe	RoRo	Scrubber	2772	12
	RoRo	Scrubber	2772	12
	RoRo	MGO	1680	12
BALTIC SEA				
Klaipeda – Kiel	RoPax	Scrubber	2115	328
	RoPax	Scrubber	2240	328
Klaipeda – Karlshamn	RoPax	MGO	2490	600
	RoPax	MGO	2496	600
CROSS CHANNEL				
Dover – Calais	RoPax	MGO	1784	1100
	RoPax	MGO	1949	405

Also!

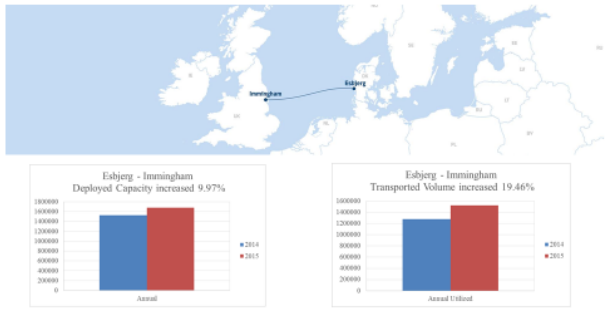
- Esbjerg- Harwich (recently shut down)
- Marseille-Tunis (outside SECA)

Transported volume and deployed capacity 2014 vs 2015

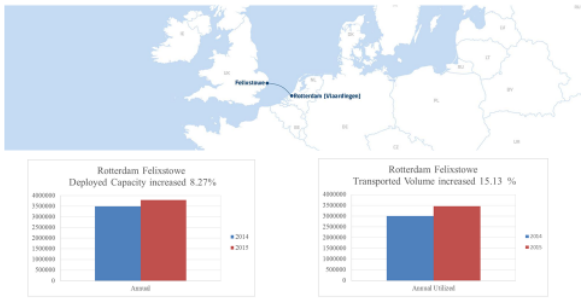
Gothenburg – Ghent



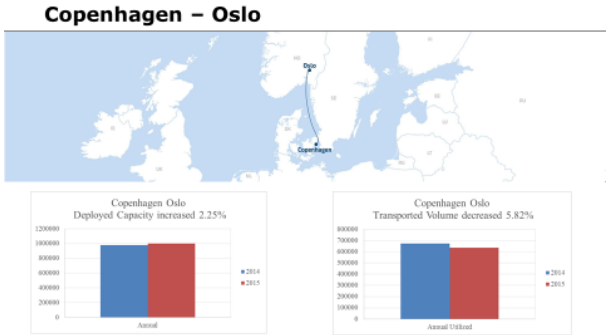
Esbjerg – Immingham



Rotterdam – Felixstowe

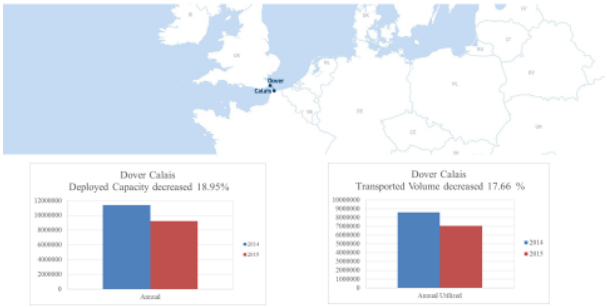


Copenhagen – Oslo

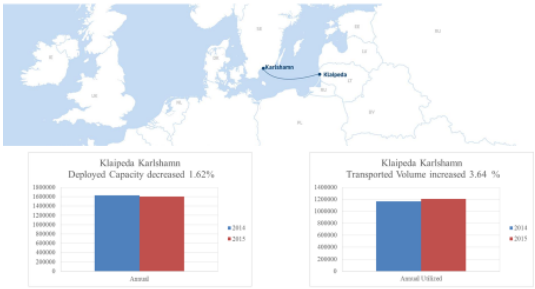


Transported volume and deployed capacity 2014 vs 2015

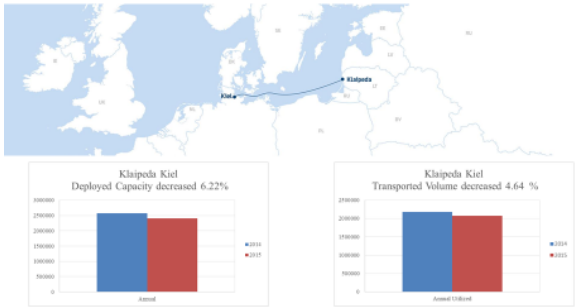
Dover – Calais



Klaipeda – Karlshamn



Klaipeda – Kiel



Summary of new market picture

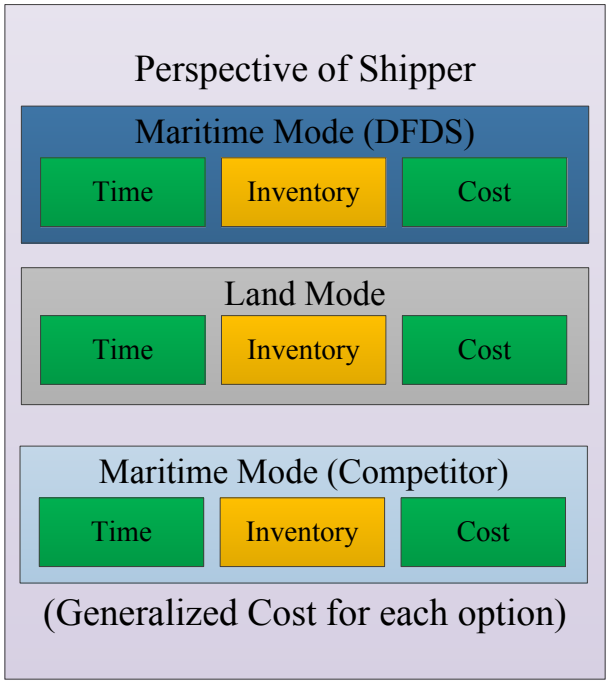
Route	Year	Trips Total	Freight Utilization Rate (%)	Transported Cargo Volume change (%)	Cargo Rate change (%)	Revenue Change (%)	Annual Fuel Cost Change (%)
Gothenburg Ghent*	2014 2015	553 569	83.37 85.95	6.06	-5.62	0.09	-52.89
Esbjerg Immingham	2014 2015	512 580	83.53 90.73	19.46	-0.5	18.85	-15.29
Rotterdam Felixstowe	2014 2015	1514 1637	85.96 91.40	15.13	0.5	15.71	-24.34
Copenhagen Oslo	2014 2015	687 702	68.74 63.32	-5.82	1.58	4.28	-9.36
Klaipeda Kiel*	2014 2015	611 615	84.69 86.12	-4.64	-7.71	-8.89	-30.05
Klaipeda Karlshamn	2014 2015	717 710	71.44 75.26	3.64	-2.32	3.73	-22.99
Dover Calais	2014 2015	6210 4994	75.13 76.33	-17.66	9.36	-18.04	-50.35

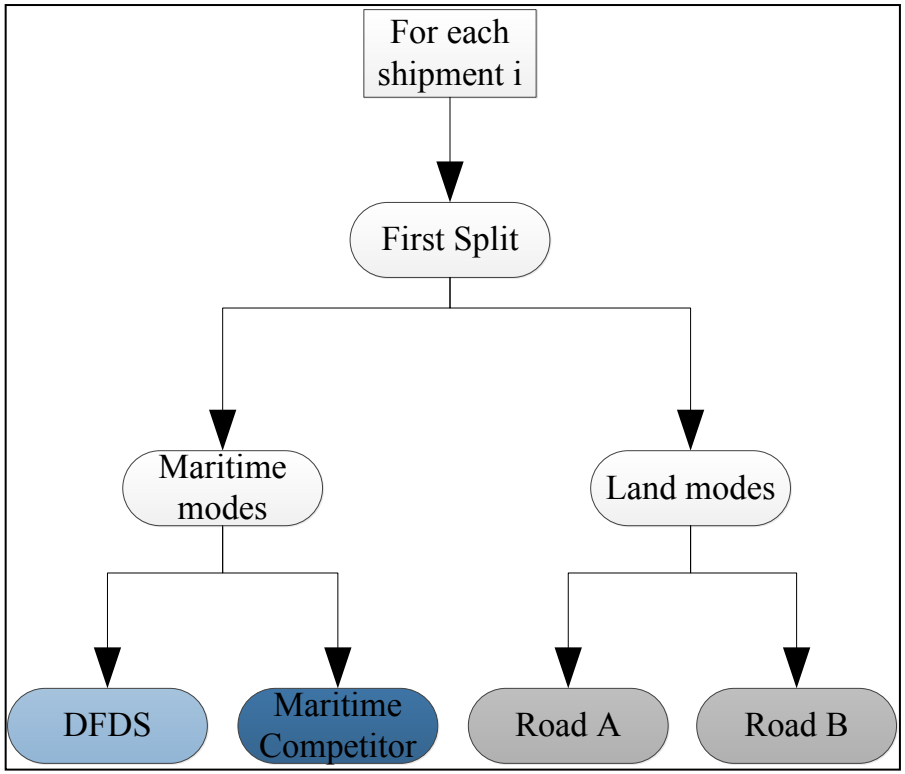
Objectives:
Understand the wider implications of the new limit

- On SECAs (is the environmental improvement significant?)
- How is Short Sea Shipping affected
- Model modal shifts
- Identify the negative impacts of the regulation
- Propose measures to mitigate and reverse these

Modal shifts model, based on generalized cost of transport

- General Case – Hierarchical Structure





Process of estimating the impacts of SECA

$$GC_i = TC_i + a \cdot TT_i$$

Estimate Generalized cost for each mode

Find market shares for each mode → Calibrate λ (Solve for λ) → Find new GC in after situation → Find new market shares

$$P_i = \frac{e^{-\lambda \cdot GC_i}}{\Sigma_{i=1,2} e^{-\lambda \cdot GC_i}}$$

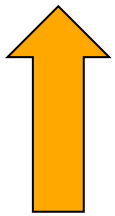
3 scenarios on Fuel Price

- **Case 1: What actually happened (MGO with actual prices)**
- **Case 2: What would happen if MGO prices returned to 2014 levels**
- **Case 3: What would happen if HFO still allowed (Actual prices)**

WP3 Measures to mitigate or reverse modal shifts

- *Task 3.1 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



- *Task 3.2 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 potential policy measure recommended by the ESSF and its subgroups

Effects of speed reduction on fuel consumption: Gothenburg- Ghent

Ship	Hours at berth	Hours sailing	Weekly fuel consumption (tonnes)	Reduction (%)
Baseline Sailing Speed **18.06 knots**				
Ship A	38	130	294.354	NA
Ship B			305.564	
Ship C			270.198	
Ship D			277.407	
Increase Trip by **1 hour**, New Sailing Speed **17.26 knots**				
Ship A	32	136	264.585	-10.11
Ship B			273.453	-10.51
Ship C			245.181	-9.26
Ship D			253.777	-8.52
Increase Trip by **2 hours**, New Sailing Speed **16.53 knots**				
Ship A	26	142	240.315	-18.36
Ship B			247.638	-18.96
Ship C			222.784	-17.55
Ship D			231.167	-16.67
Increase Trip by **3 hours**, New Sailing Speed **15.86 knots**				
Ship A	20	148	191.740	-34.86
Ship B			196.167	-35.80
Ship C			177.715	-34.23
Ship D			185.196	-33.24

Effects of speed reduction on cargo volumes, revenue, fuel cost

Baseline Sailing Speed **18.06 knots**			
	Transported lm	Capacity Utilization (%)	Cost of Fuel (€)
Fuel Case 1	42331	85.95	Confidential
Fuel Case 2	39533	79.8	
Fuel Case 3	43724	89.01	
Increase Trip by **1 hour**, New Sailing Speed **17.26 knots**			
	ΔTransported lm (%)	Capacity Utilization (%)	ΔCost of Fuel (%)
Fuel Case 1	-0.05	85.99	-9.98
Fuel Case 2	-0.36	79.8	
Fuel Case 3	-0.11	89.01	
Increase Trip by **2 hours**, New Sailing Speed **16.53 knots**			
Fuel Case 1	-0.1	85.87	-18.32
Fuel Case 2	-0.7	79.71	
Fuel Case 3	-0.15	88.92	
Increase Trip by **3 hours**, New Sailing Speed **15.86 knots**			
Fuel Case 1	-0.16	85.82	-34.99
Fuel Case 2	-0.76	79.66	
Fuel Case 3	-0.21	88.88	

Effects of change in sailing frequency

	New sailing frequency	New Transported lm	New capacity utilization	ΔRevenue (€)	ΔFuel Cost (€)
Fuel Case 2	5	29060	96.86	-112273	-33579
Fuel Case 3	7	34475	82.02	39897	16569

Klaipeda – Kiel (Normal frequency 7 sailings per week)

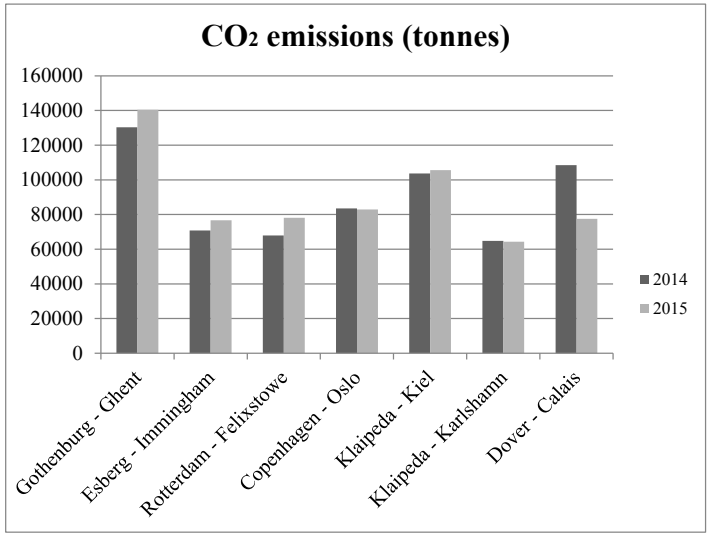
	New sailing frequency	New Transported lm	New capacity utilization	ΔRevenue	ΔFuel Cost
Fuel Case 1	6	26900	97.36	-32419	-28172
Fuel Case 2	6	25950	96.19	-25082	-57093

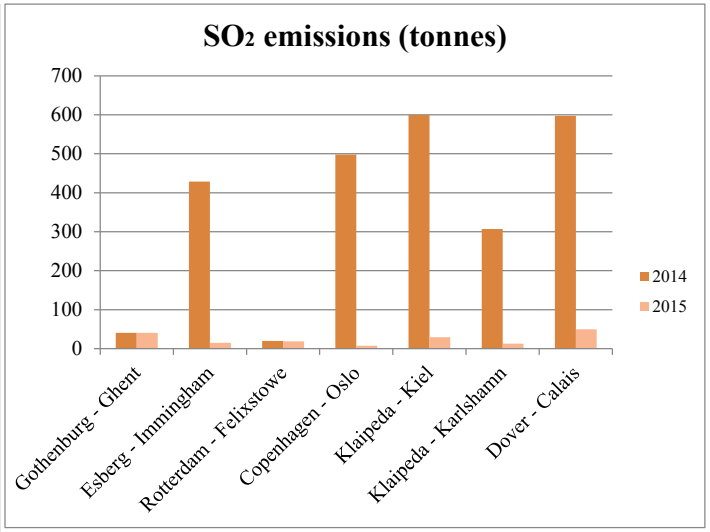
Dover – Calais (Normal frequency 99 sailings per week)

	New sailing frequency	New Transported lm	New capacity utilization	ΔRevenue	ΔFuel Cost
Fuel Case 1	75	131724	94.63	-56039	-58844
Fuel Case 2	75	130760	88.25	-74580	-119255

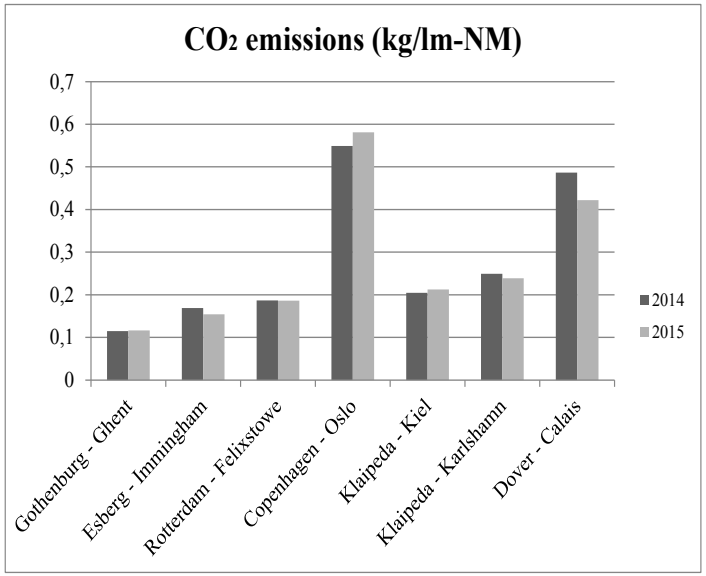
Environmental impact of new sulphur limits 2014 vs 2015

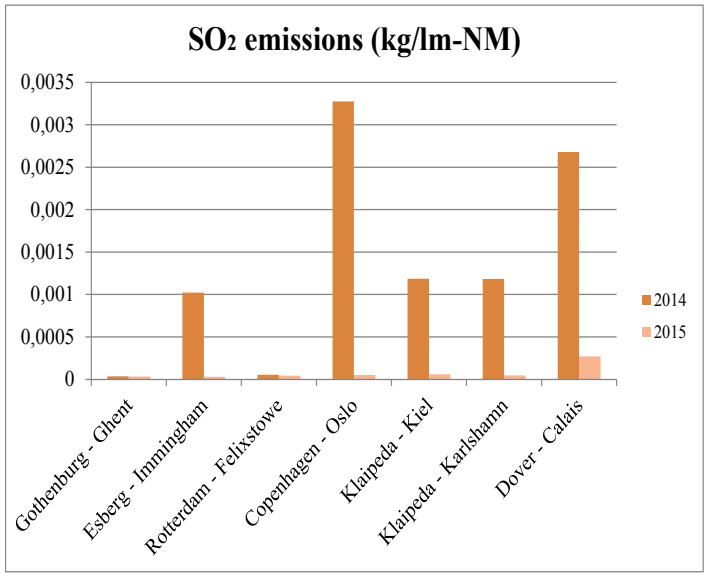
- Total emissions





Environmental impact of new sulphur limits 2014 vs 2015





Conclusion and further work

- **Freight Rate** is the most important component
- **Time** is **not crucial**, except for high-value cargoes. **Speed reduction** can help in times of high fuel prices
- Changes in **sailing frequency** can help with capacity utilization rates
- Technology investments depend on fuel prices, and returns are currently delayed
- **Profitability** of ship operator is **masking the negative effects** of the regulation – a happy coincidence

Still to be investigated

- *Task 3.2 Measures from policy makers*

- Full or partial internalization of external costs, all modes
- ECOBONUS type subsidy
- Easing of port dues/fairway dues/ ice dues for relevant shipping
- Other public funding or subsidies
- Any potential policy measure recommended by the ESSF and its subgroups

STAY TUNED

- FINAL PROJECT WORKSHOP
- JUNE 2017, DTU

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2016

- Zis T. and Psaraftis H. N. (2016), "**The DTU RoRoSECA project: economic, environmental and modal shift considerations**"
  Presented at Workshop with Atlantis Ecobonus (Towards a common EU external cost of transport calculator) in Seville, Spain om **22-23. of September 2016**.

- Zis T. and Psaraftis H. N. (2016), "**The implications of the lower sulphur limits on Ro-Ro shipping in Northern Europe**"
  Presented at IAME, Annual conference of the International Association of Maritime Economists in Hamburg, Germany on **23-26. of August 2016**.

- Zis T. and Psaraftis H. N. (2016), "**Modal shifts and decision models under the new sulphur limits within Emission Control Areas**"
  Presented at EURO INFORMS 28th European Conference on Operational Research in Poznan, Poland on **3-6. of July 2016**.

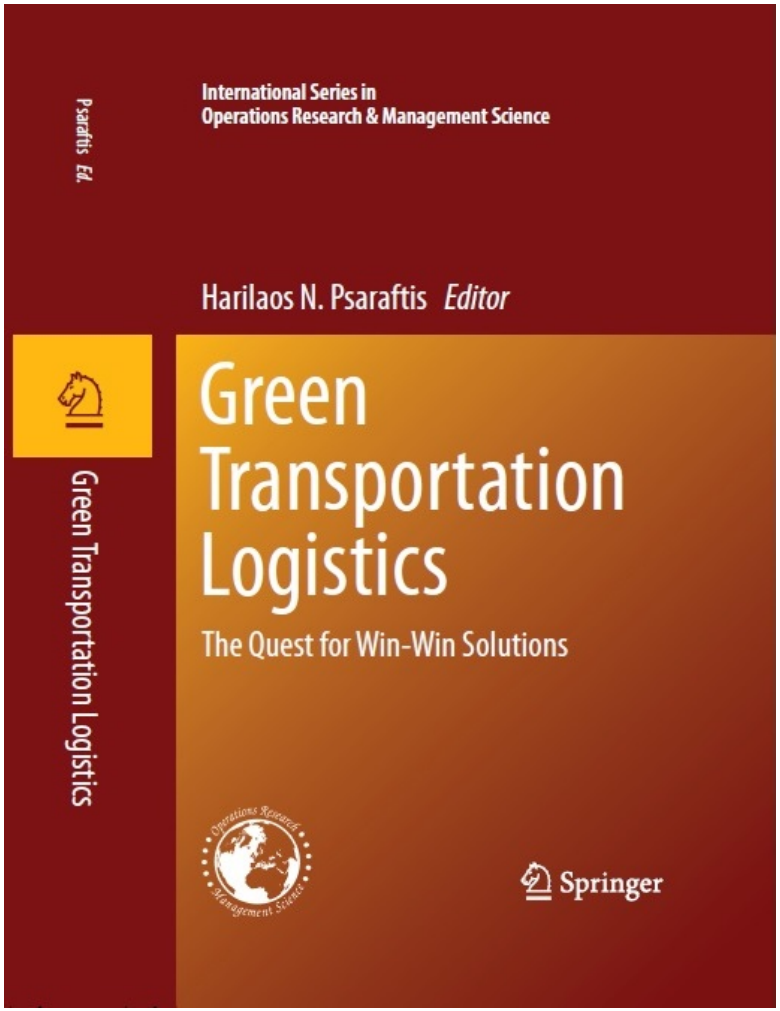
- Zis T. and Psaraftis H. N. (2016), "**The indirect effects of the new low sulphur requrements in ECAs in RoRo shipping**"
  Presented af Devport International Conference SHORT-SEA SHIPPING: Myth or Future of Regional Transport in Le Havre, France on **19-20. of May 2016**.

- Psaraftis H. N. (2016), "**Environmental KPIs for the Motorways of the Sea**"
  Presented at the 1st MoS Forum on Environment in Brussels, Belgium on **15. of March 2016**.

- Psaraftis H. N. (2016), "**Short sea-shipping: a serious contender in the European transport contest?**"
  Presented at the 7th Annual RoRo Shipping Conference in Gothenburg, Sweden on **17. of February 2016**.

- Psaraftis H. N. (2016), "**RoRo Seca: A new research project at DTU**"
  Presented at the OECD/ITF Workshop on Project Impact of MARPOL Annex VI (International Transport Forum) in Paris, France on **1. of February 2016**.

New Book



- 15 chapters, 548 pages
- Covers all modes of transport
- Plus green corridors, TEN-Ts, etc

Acknowledgments

- Danish Maritime Fund
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- Poul Woodall, DFDS

Thank you

See more: www.roroseca.transport.dtu.dk

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RoRoSecA