Operational measures to reverse the negative effects of the 0.1% sulphur limit on Ro-Ro shipping

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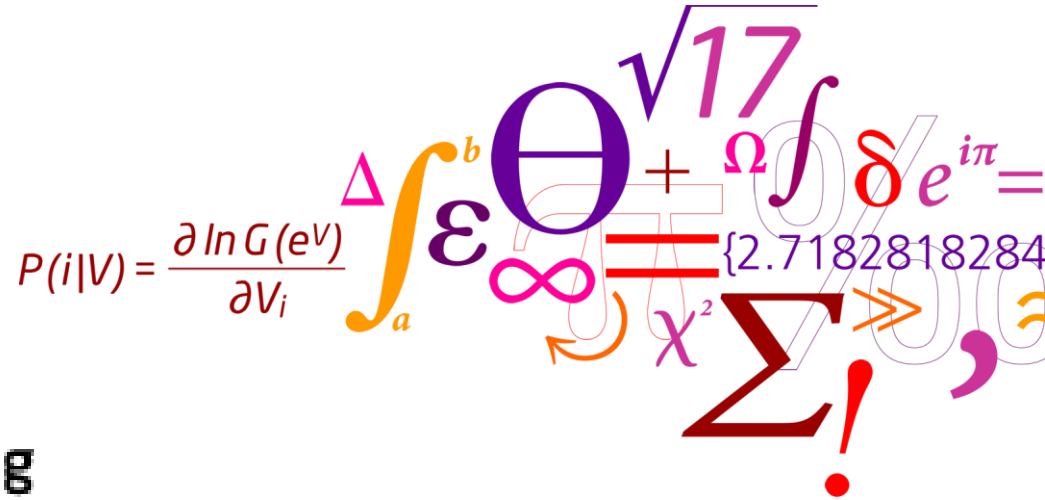


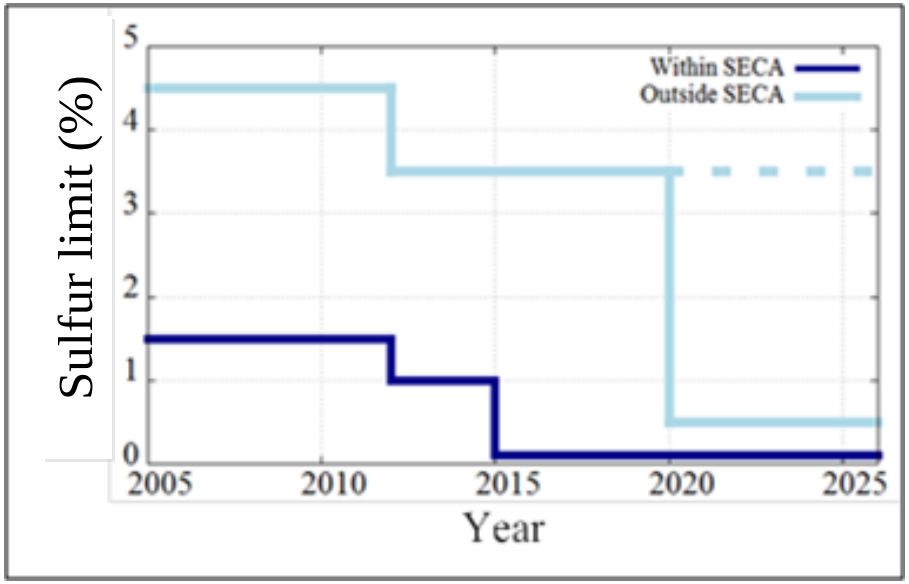
DTU Management Engineering
Department of Management Engineering

Presentation Outline

- Background
  - Effects to Ro-Ro operators
  - Anticipated Impacts
  - Market picture and Fuel Prices
  - Modelling modal shifts
- Measures from the Ro-Ro operator
  - Speed reduction
  - Sailing frequency
  - Technology
- Next Steps
  - Policy measures
  - Environmental implications of new limit

Background

- As of January 1st 2015:



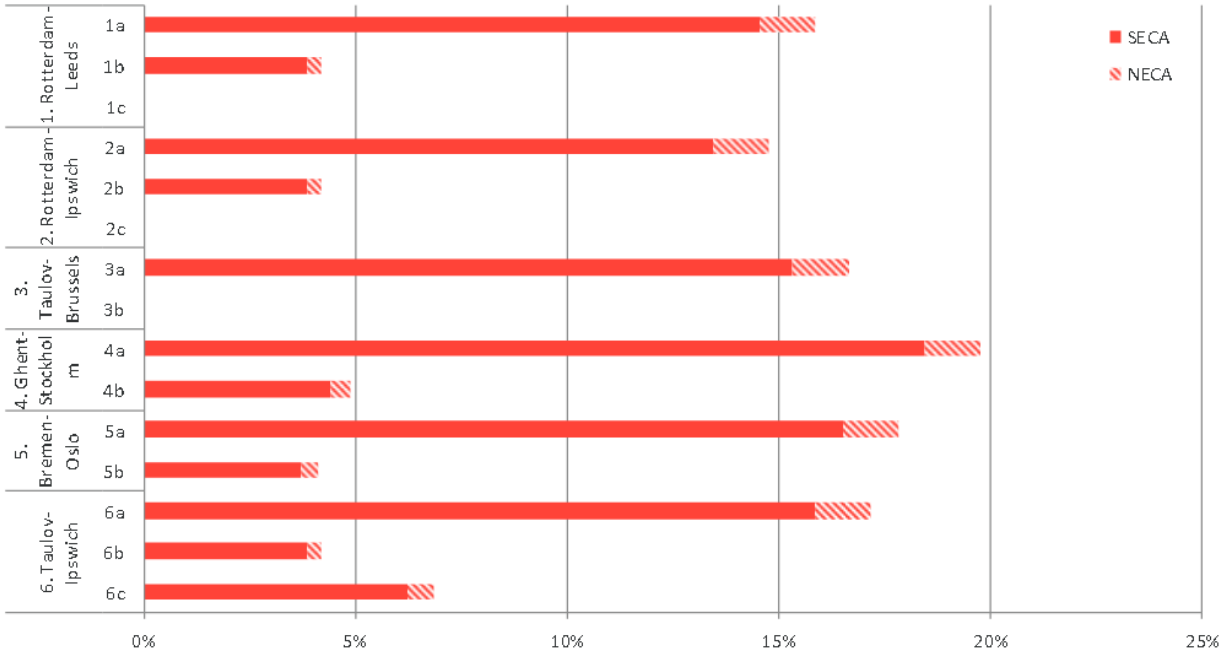
				Year
Areas	2005-2012	2012-2015	2015-2020	2020 (or 2025)-
Within SECA	1.5	1	0.1	0.1
Outside SECA	4.5	3.5	3.5	0.5

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)

Anticipated impacts from studies

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%.

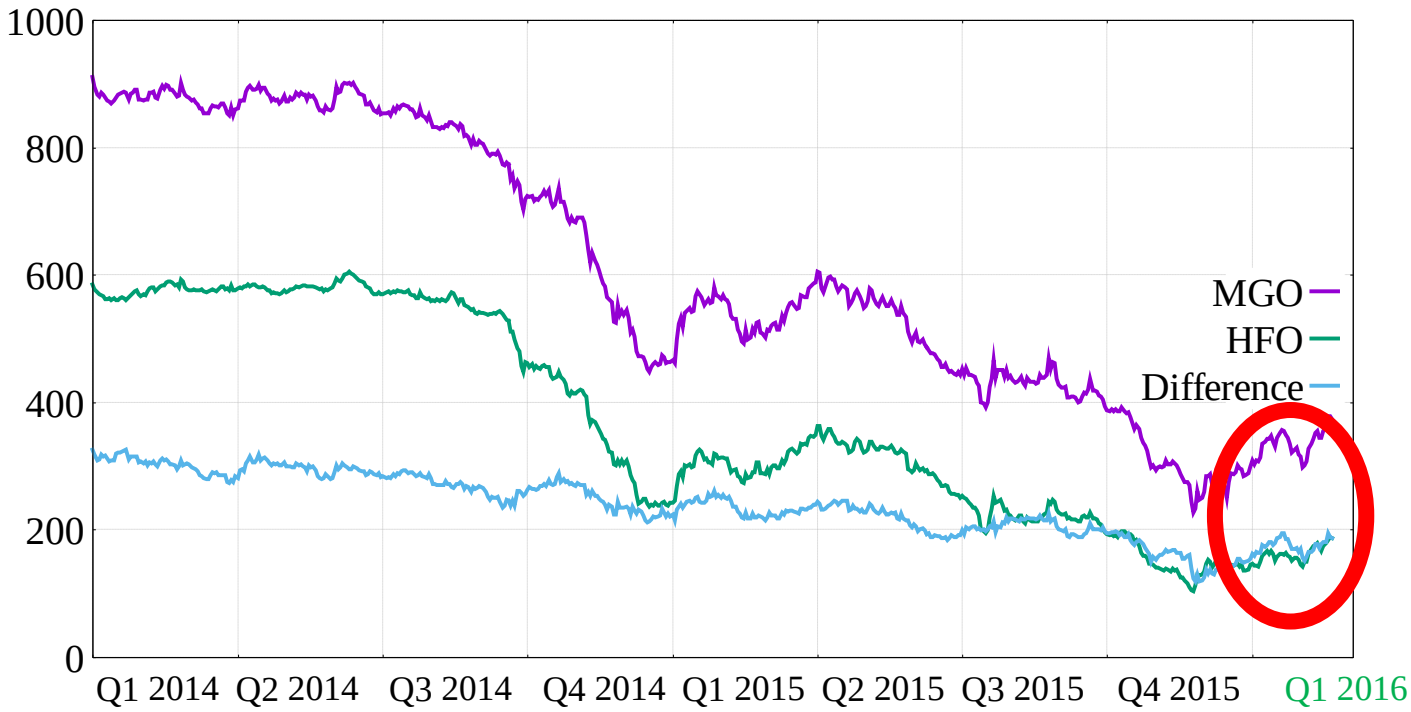
P&O breaks Channel freight record in 2015

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.

Actual Fuel prices



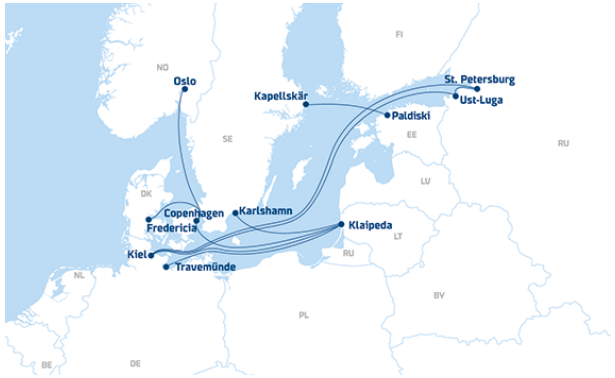
The absolute price differential would gradually decrease
Fuel prices have started going up in 2016

The RoRoSECA project

- 2 year project
- Funded by the Danish Maritime Fund (DMF)
- Case studies with DFDS
- New decision making tools

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)

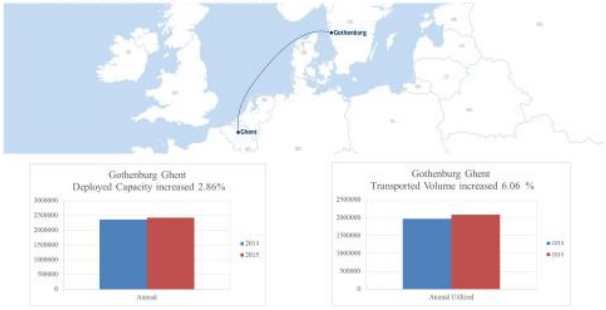


Route selection criteria

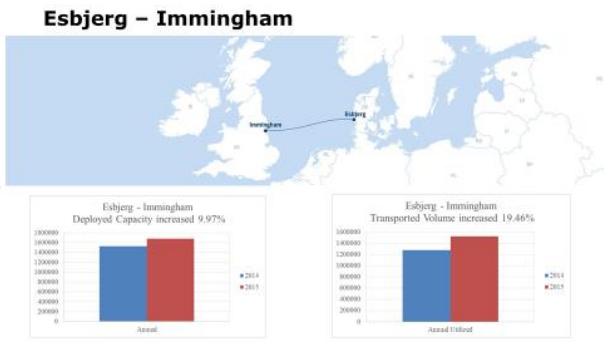
- Geographical balance → Proportion by Region
- Chain configuration → By Sailing Distance & Frequency
- Volume → By Vessel and Route Capacity
- Commodity mixture → Cargo type and value
- Vessel types → Ro-Ro, Ro-Pax, Cruise, abatement
- Data availability

Transported volume and deployed capacity 2014 vs 2015

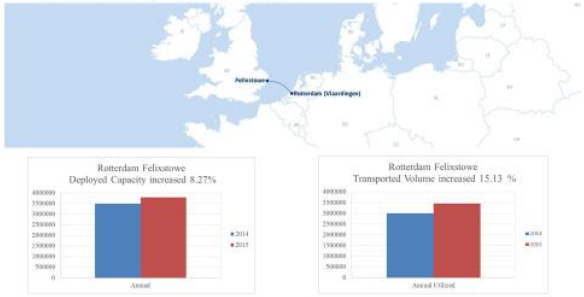
Gothenburg – Ghent



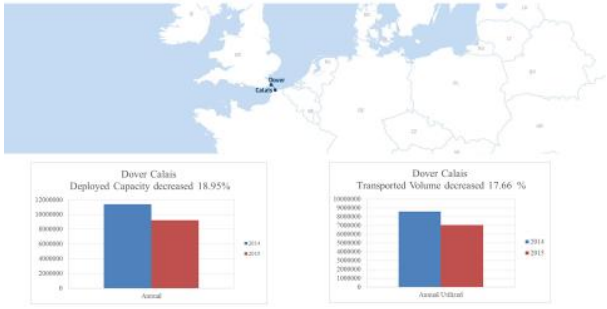
Esbjerg – Immingham



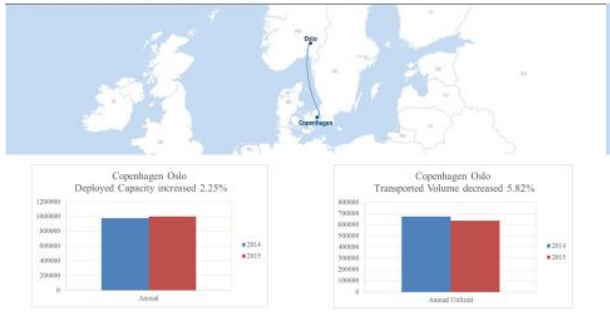
Rotterdam – Felixstowe



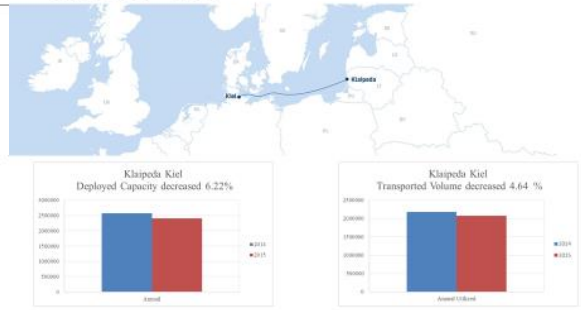
Dover – Calais



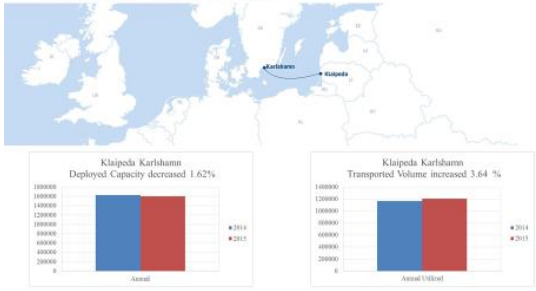
Copenhagen – Oslo



Klaipeda – Kiel



Klaipeda – Karlshamn



Summary of new market picture

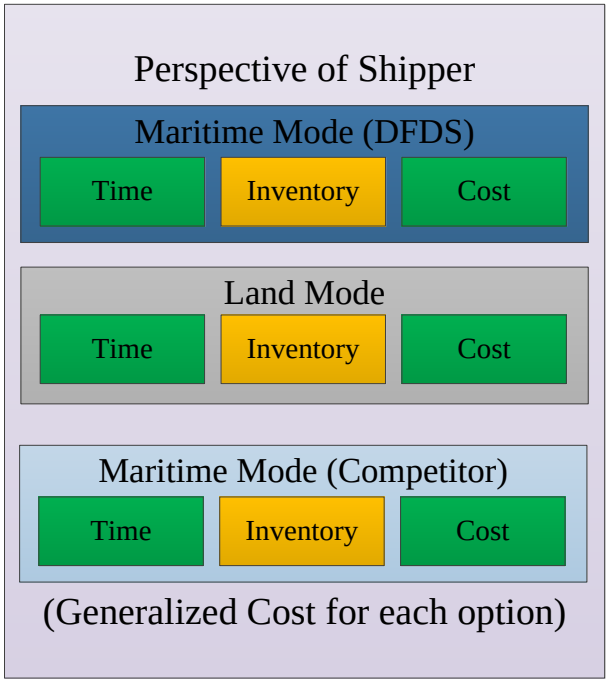
Route	Year	Trips Total	Freight Utilization Rate (%)	Transported Cargo Volume change (%)	Cargo Rate change (%)	Revenue Change (%)	Annual Fuel Cost Change (%)
Gothenburg Ghent*	2014 2015	553 569	83.37 85.95	6.06	-5.62	0.09	-52.89
Esbjerg Immingham	2014 2015	512 580	83.53 90.73	19.46	-0.5	18.85	-15.29
Rotterdam 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

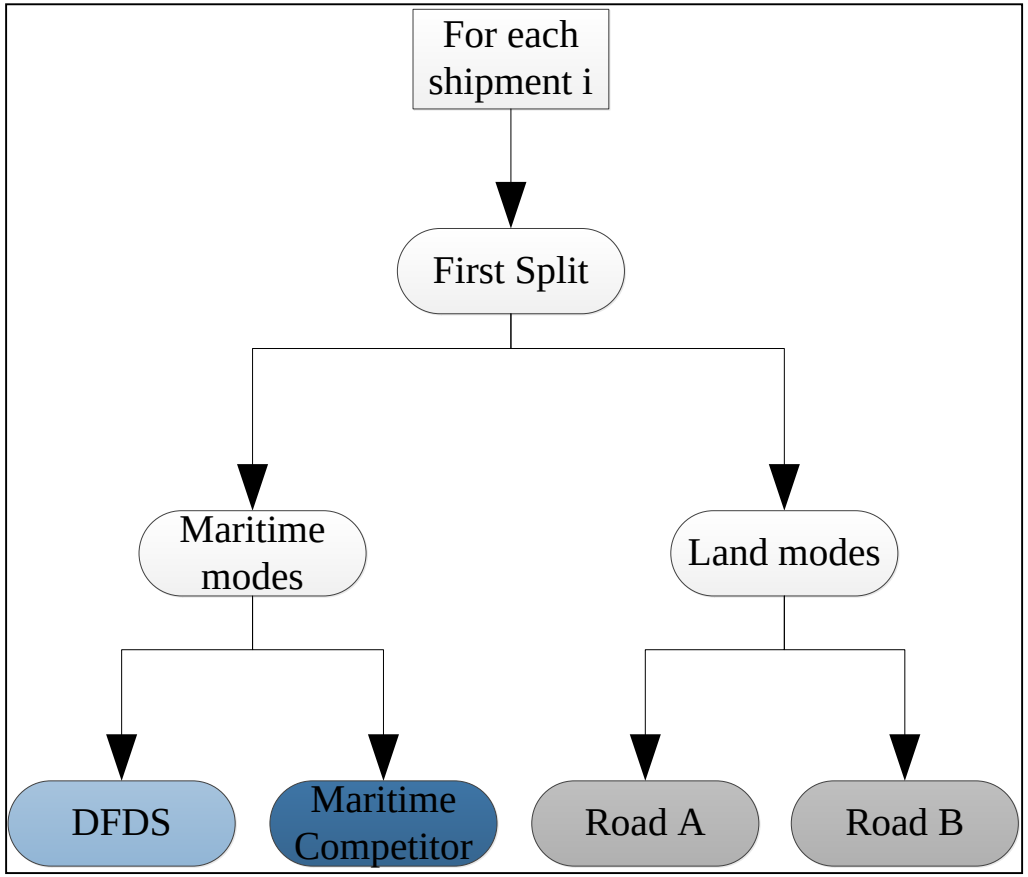
Objectives:
Understand the wider implications of the new limit..

- 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

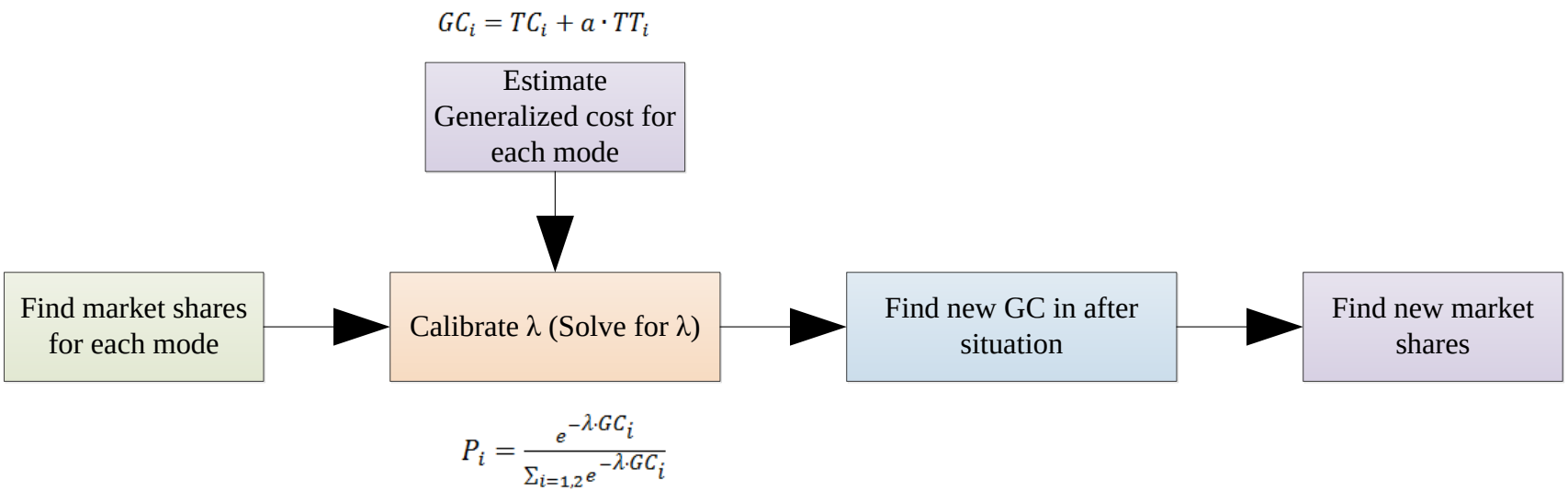
Modal Shifts based on generalized cost of transport

- General Case – Hierarchical Structure





Process of estimating the impacts of SECA



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)**

Effects of Speed on fuel consumption

Gothenburg – Ghent (Normal sailing time 32 hours)

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 on cargo volumes, revenue, fuel cost

Gothenburg – Ghent (Normal sailing time 32 hours)

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 new sailing frequency

Esbjerg – Immingham (Normal frequency 6 sailings per week)

	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

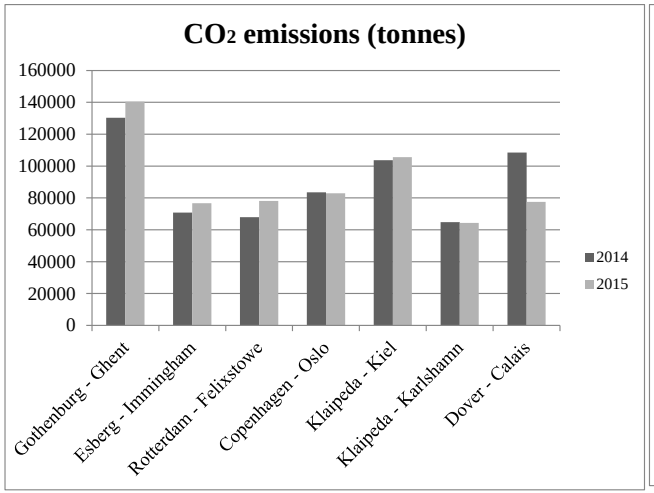
Payback period of scrubbers

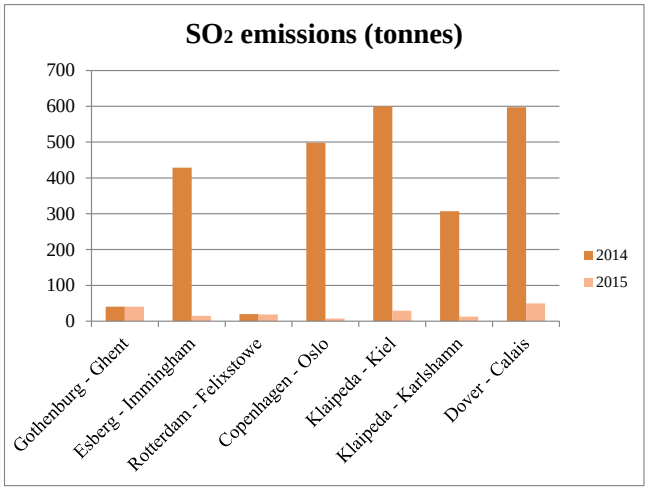
- DFDS has retrofitted 18 of its vessels.
- In the examined routes there are 9 vessels running on low-sulphur fuel
- Assumed a retrofit on the ship with the highest fuel consumption (Ro-Ro)

Fuel prices	*HFO (€/ton)*	*MGO (€/ton)*	*Annual Savings (M€)*	*Payback period (years)*
December 2015	135	304	1.21	4.3
October 2015	237	480	1.731	2.9
November 2014	590	880	1.998	2.4
February 2014	803	1212	2.825	1.3

- Considering the global cap coming in 2020, perhaps waiting is an option
  - Different fuel price differential
  - Newer technologies
  - New subsidies to operators may come

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
- Requirements for policy measures to mitigate potential modal shifts

Thank you - Questions?

The work presented has been in the context of the project:

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

funded by the Danish Maritime Fund.

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

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