Studies related to new IMO requirements REVIEW

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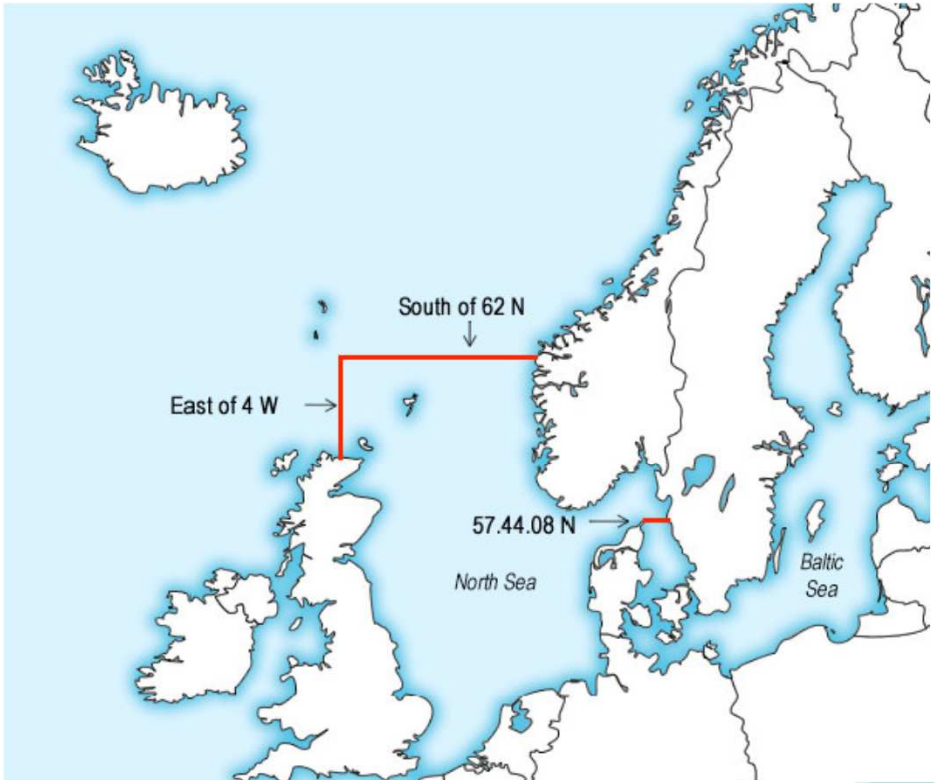
MARPOL Annex VI: Emission Control Areas



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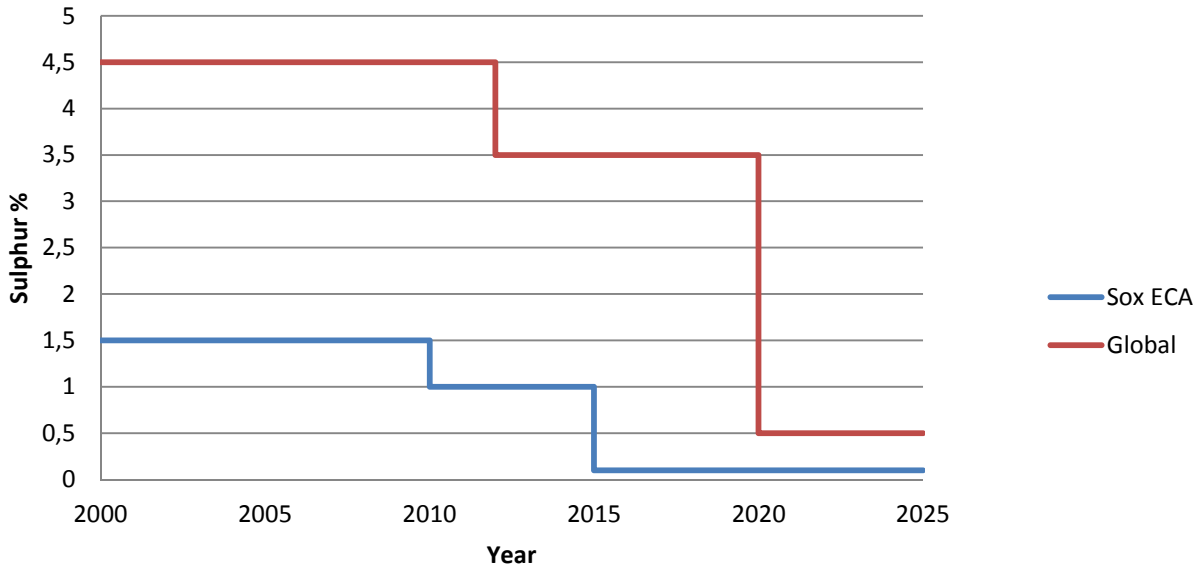
Limit of sulphur content in ship's fuel



Date	Sulphur Limit in Fuel in ECA (%)	Date	Sulphur Limit in Fuel Global (%)
2000	1.5 %	2000	4.5 %
1 July 2010	1.0 %	2012	3.5 %
2015	0.1 %	2020*	0.5 %

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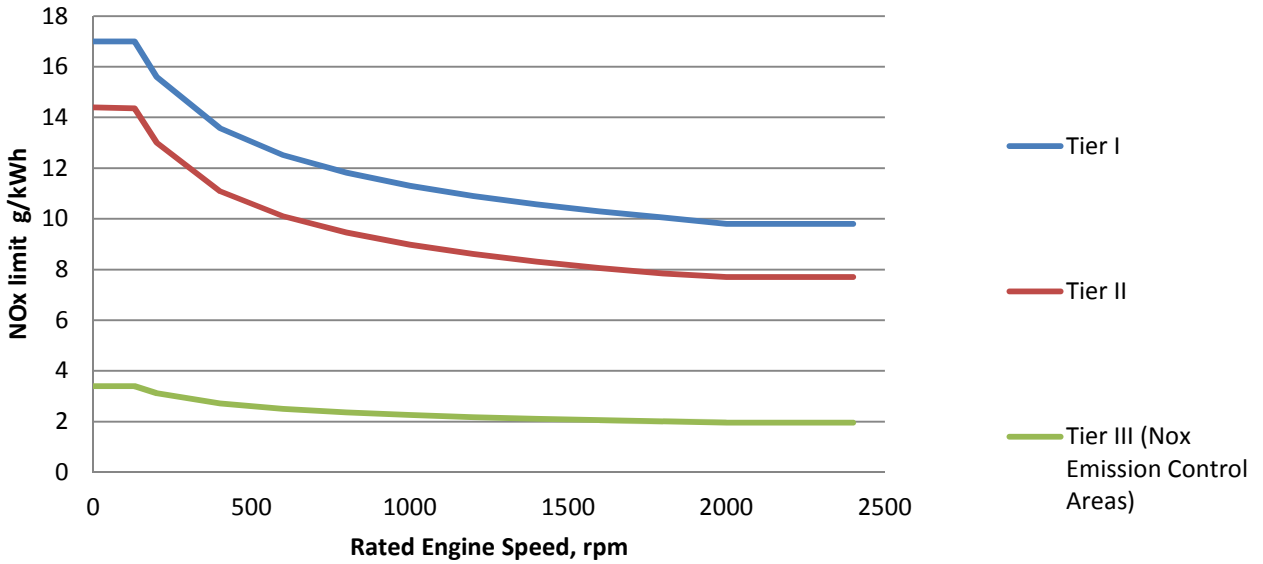
NO_x Emission Limits



Tier	Date	NO_x limit (g/kWh)		
		n <130 rpm	130 rpm ≤ n < 2000 rpm	n ≥ 2000 rpm
Tier I	2000	17.0	$45* n^{-0.2}$	9.8
Tier II	2011	14.4	$44* n^{-0.23}$	7.7
Tier III*	2016	3.4	$9* n^{-0.2}$	1.96

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EU’s Marine Fuel Sulphur Directive

According to European Union directive 2005/33/EC, valid from 1 January 2010, ships at berth in all ports of the European Community shall not use marine fuels with a sulphur content exceeding 0.1% by mass. Ships have been given a transitional period till the end of August 2010 to make the necessary technical changes.

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List of selected studies related to new IMO requirements

Undertaken by	Consultant	year	Study
EU Commission	AEA	2009	*Cost Benefit Analysis to Support the Impact Assessment accompanying the revision of Directive 1999/32/EC on the Sulphur Content of certain Liquids Fuels*
EU Commission	Transport & Mobility Leuven	2010	*The COMPetitiveness of EuropeAN Short sea freight Shipping compared with road and rail transport (COMPASS)*
ECSA	University of Antwerp	2010	*Analysis of the Consequences of Low Sulphur Fuel Requirements*
German Shipowners' Association and Association of German Seaport Operators	Institute of Shipping Economics and Logistics.	2010	*Reducing the sulphur content of shipping fuels further to 0.1 % in the North Sea and Baltic Sea in 2015: Consequences for shipping in this area*
Maritime Coast Guard Agency	ENTEC	2009	*Impact Assessment for the revised Annex VI of MARPOL*
Ministry of Transport and communications Finland	University of Turku	2009	*Sulphur content in ships bunker fuel in 2015, A Study on the impacts of the new IMO regulation on transportation costs*
EU Commission	SKEMA	2010	Task 2 and 3 *Impact Study on the future requirements of Annex VI of the MARPOL Convention on Short Sea Shipping*
Ministry of Enterprise, Energy and Communications	Swedish Maritime Administration	2009	*Consequences of the IMO‟s new marine fuel sulphur regulations*

Most studies have centred on the same two key issues:

- what economic effects will the 0.1% sulphur limit within ECAs have by 1 January 2015?
- what consequences will those effects have on transport patterns?

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Overview of scope and focus of each study

Study	Costs	Emission	Environment	Modal shift
AEA	Fuel costs only	SO2, PM, NOx, VOCs	x	x
COMPASS	Fuel, scrubbers	SO2, PM, NOx, VOCs & CO2	v	v
ECSA	Fuel costs only	SO2, PM, NOx, CO, VOCs & CO2	v	v
Germany	Fuel costs only	Impacts on shipping emissions discussed but not quantified)	v	v
UK	fuel, scrubbers & Administrative costs	SO2, NOx, CO2, PM & VOCs	v	x
Finland	Fuel costs only	Impacts on shipping emissions discussed but not quantified)	v	x
SKEMA	Unit fuel & scrubber costs	Reductions in SO2 emissions per unit – i.e. per trailer – estimated for selection of routes & years	x	v

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Summary of cost estimates for MGO in 2015

Study	Expected price for MGO (0,1 % S) per ton in USD in 2015	Expected differential per ton between 1.5% S and 0.1% S, if indicated
COMPASS	656 EURO, 883 USD	65%
ECSA	Low:500 USD Medium: 750 USD High: 1000 USD	80%
Germany	Low: 850 USD High: 1300 USD	70-86% (price difference 1,5% to 0,1% S) 57-75% (price difference 1,0% to 0,1% S)
UK	Scenario 1: 545 USD Scenario 2: 727 USD	Scenario 1: 92 and 42% Scenario 2: 119 and 59%
Finland	470-500 EURO (historic Price used in calculation) (633-673 USD)	73-85% (historic price difference 1,5% to 0,1 % S) The historic price difference between 1,0 % and 0,1% S has been 51-62%
SKEMA	656 EURO, 883 USD	No comparable values provided.
Sweden	Low: 662 USD Medium: 1158 USD High: 1650 USD	No comparable values provided.

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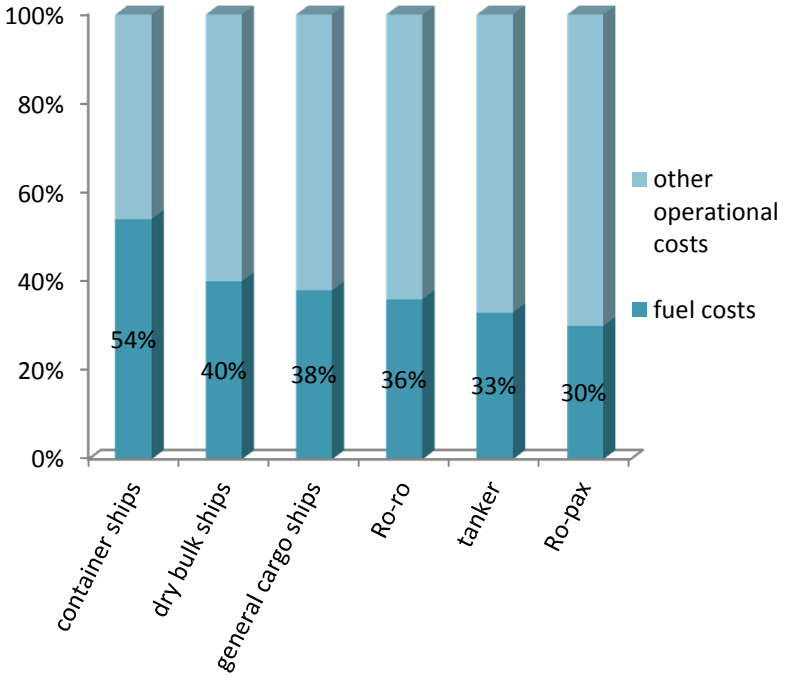
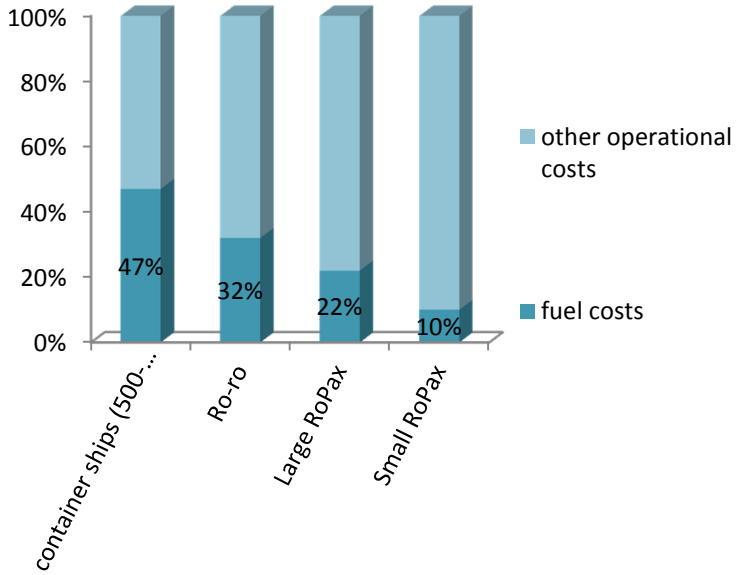
Not all ships will be similarly affected by the increased fuel prices.

Share of fuel cost in total operational costs for each type of ship



Source: Finnish study



Source: COMPASS study

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Expected increase in total costs of shipping due to the new MARPOL regulations

Year	LoLo	RoRo	Small RoPax	Large RoPax
2015	30.24%	20.52%	6.67%	13.74%
2020	31.16%	21.14%	6.87%	14.15%
2025	28.94%	19.63%	6.38%	13.14%

Source: COMPASS study

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Effects of price rise in fuel on freight charges

Freight type	Sulphur content	
	0.5 % (Global - 2020)	0.1 % (ECA -2015)
Container	8-18%	44-51%
Paper reel	6-14%	35-40%
Lorry	6-14 %	35-41%
Private car	6-14%	35-41%
Oil	5-11%	28-32%
Freight ton on bulk carriers	7-15%	39-44%
Timber	6-14%	35-40%
Steel products	6-14%	35-40%

Source: Finnish study

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Expected minimal increase in freight rates per unit as a result of the use of MGO (0.1%)

short sea vessels with an average commercial speed of 18.5 knots, except route 17 (fast ship)
Low -500 USD/tonne, Base -750 USD/tonne, High -1000 USD/tonne

			Total increase in freight rate per trip (in %)		
	Sub-market	Distance class	Scenario LOW	Scenario BASE	Scenario HIGH
Route 1	UK/LH-H range <-> Baltic	>750km	7.1%	10.2%	13.0%
Route 2	UK/LH-H range <-> Baltic	>750km	12.4%	17.3%	21.5%
Route 3	UK/LH-H range <-> Baltic	>750km	7.9%	11.4%	14.5%
Route 4	UK <-> LH-H range	400-750km	8.2%	11.7%	14.9%
Route 5	UK/LH-H range <-> Baltic	>750km	7.6%	10.9%	13.9%
Route 6	UK/LH-H range <-> Baltic	400-750km	7.0%	10.1%	12.9%
Route 7	UK/LH-H range <-> Baltic	400-750km	12.4%	17.3%	21.5%
Route 8	UK/LH-H range <-> Baltic	400-750km	8.2%	11.7%	14.8%
Route 9	Intra-Baltic	>750km	8.9%	12.7%	16.0%
Route 10	Intra-Baltic	>750km	18.7%	25.1%	30.3%
Route 11	Intra-Baltic	400-750km	10.7%	15.0%	18.8%
Route 12	Intra-Baltic	400-750km	11.8%	16.5%	20.5%
Route 13	Intra-Baltic	400-750km	12.1%	16.9%	21.0%
Route 14	Intra-Baltic	125-400km	8.9%	12.6%	15.9%
Route 15	Intra-Baltic	125-400km	10.3%	14.6%	18.3%
Route 16	Intra-Baltic	>750km	16.5%	22.4%	27.3%
Route 17	*Intra-Baltic (fast ship 25kn)*	*>750km*	*26.3%*	*34.0%*	*39.6%*
Average			**11.5%**	**15.9%**	**19.7%**
High			**26.3%**	**34.0%**	**39.6%**
Low			**7.0%**	**10.1%**	**12.9%**

Source : ECSA study

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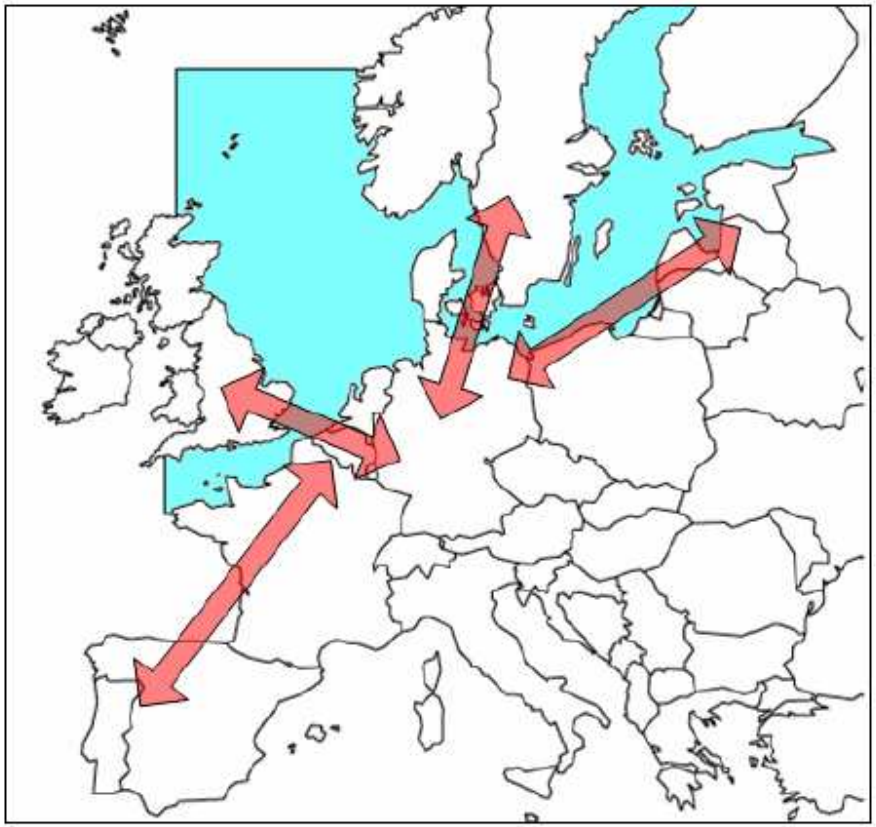
Major freight corridors where modal shift may occur



Source: COMPASS study

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Reduction in cargo volumes in SSS due to sulphur regulation of 0.1% in the ECAs

Ship Type	Ranges of Operation (km)						
	0-50	50-100	100-300	300-500	500-1000	1000-2000	>2000
Ro-ro (200 trailers and 12 drivers)	x	x	-1.18	-3.47	-3.35	-4.83	-7.58
Ropax small (30 trailers and 1000 passengers)	-6.33	-0.24	-1.20	-8.92	x	x	x
Ropax large (300 trailers and 1000 passengers)	x	-0.68	-2.74	-4.16	-0.83	-6.50	x
Lo-lo (500 and 700 TEUs)	x	x	x	-3.69	-6.06	-6.06	-7.65

Source: COMPASS study

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Results of ECSA study

Table 4.15. Expected shifts in the competitive balance between short sea/truck and truck solutions as result of a change from HFO (1.5%) to MGO (0.1%) for the 30 O-D relations – Cost difference in % between the 'truck only' option and short sea alternatives – HIGH scenario

Cost differ. (%) — > +20 | +10 to +20 | +10 to -10 | -10 to -20 | < -20

shortsea dominant | competitive | 'truck only' dominant

Average difference with 'truck only' / Positive = roro x% cheaper / Negative value = truck only x% cheaper	Alternat. 2		Alternat. 3		Alternat. 4	
	HFO	MGO	HFO	MGO	HFO	MGO
Germany/Denmark to Sweden	Travemünde-Trelleborg		Putgarten-Rödby		P-R + Hels.-Hels.	
1.1. Dortmund - Göteborg	26	23	-7	-9	-2	-4
1.2. Dortmund - Stockholm	22	19	-4	-5	0	-2
AVERAGE	**24**	**21**	**-5**	**-7**	**-1**	**-3**
English Channel	Calais-Dover		Rotterdam-Harwich		Rotterdam-Hull	
2.1. Rotterdam - Tilbury	-7	-13	20	14		
2.2. Rotterdam - London	-7	-13	20	14		
2.3. Rotterdam - Portsmouth	-6	-11	23	18		
2.4. Düsseldorf - Tilbury	-6	-12	16	10		
2.5. Düsseldorf - London	-6	-12	16	11		
2.6. Düsseldorf - Portsmouth	-5	-10	8	3		
2.7. Brussels - Tilbury	-8	-16	-5	-12		
2.8. Brussels - London	-8	-16	-5	-12		
2.9. Brussels - Portsmouth	-7	-14	-9	-15		
2.10. Dortmund - Tilbury	-6	-11	18	13		
2.11. Dortmund - London	-6	-11	18	13		
2.12. Dortmund - Portsmouth	-5	-10	11	6		
2.13. Rotterdam - Manchester	-4	-8	33	29	44	39
2.14. Düsseldorf - Manchester	-4	-8	17	13	39	35
2.15. Brussels - Manchester	-5	-10	7	3	32	27
2.16. Dortmund - Manchester	-4	-7	18	15	40	36
AVERAGE	**-6**	**-11**	**13**	**8**	**39**	**34**
West Europe-Baltic States	Lübeck-Riga		Kappelski Ar-Paldiski		Karlshamn-Klaipeda	
3.1. Dieppe - Tallinn	10	3				
3.2. Dieppe - Kaunas	-17	-26				
3.3. Antwerpen - Tallinn	18	10				
3.4. Antwerpen - Kaunas	-7	-17				
3.5. Amsterdam - Tallinn	15	7				
3.6. Amsterdam - Kaunas	-12	-23				
3.7. Hamburg - Tallinn	31	22				
3.8. Hamburg - Kaunas	1	-12				
3.9. Esbjerg - Tallinn	26	18	30	27		
3.10. Esbjerg - Kaunas	2	-9			22	18
AVERAGE	**7**	**-3**	**30**	**27**	**22**	**18**
West Europe-Scandinavia	Ghent-Göteborg		Travemünde-Trelleborg		Putgarten-Rödby	
4.1. Rotterdam - Oslo	27	19	17	15	-7	-8
4.2. Rotterdam - Stockholm	19	11	17	15	-6	-8
AVERAGE	**23**	**15**	**17**	**15**	**-6**	**-8**

Table 4.16. Expected shifts in the competitive balance between short sea/truck and truck solutions as result of a change from HFO (1.5%) to MGO (0.1%) for the 30 O-D relations – Cost difference in % between the 'truck only' option and short sea alternatives – LOW scenario

Cost differ. (%) — > +20 | +10 to +20 | +10 to -10 | -10 to -20 | < -20

shortsea dominant | competitive | 'truck only' dominant

Average difference with 'truck only' / Positive = roro x% cheaper / Negative value = truck only x% cheaper	Alternat. 2		Alternat. 3		Alternat. 4	
	HFO	MGO	HFO	MGO	HFO	MGO
Germany/Denmark to Sweden	Travemünde-Trelleborg		Putgarten-Rödby		P-R + Hels.-Hels.	
1.1. Dortmund - Göteborg	28	26	-5	-6	0	-2
1.2. Dortmund - Stockholm	23	22	-3	-4	1	0
AVERAGE	**25**	**24**	**-4**	**-5**	**1**	**-1**
English Channel	Calais-Dover		Rotterdam-Harwich		Rotterdam-Hull	
2.1. Rotterdam - Tilbury	-3	-6	24	21		
2.2. Rotterdam - London	-3	-6	24	21		
2.3. Rotterdam - Portsmouth	-2	-5	27	24		
2.4. Düsseldorf - Tilbury	-3	-6	19	16		
2.5. Düsseldorf - London	-3	-5	19	17		
2.6. Düsseldorf - Portsmouth	-2	-5	11	9		
2.7. Brussels - Tilbury	-4	-8	0	-4		
2.8. Brussels - London	-3	-7	-1	-4		
2.9. Brussels - Portsmouth	-3	-6	-5	-8		
2.10. Dortmund - Tilbury	-2	-5	21	19		
2.11. Dortmund - London	-2	-5	21	19		
2.12. Dortmund - Portsmouth	-2	-4	13	11		
2.13. Rotterdam - Manchester	-2	-4	36	34	46	44
2.14. Düsseldorf - Manchester	-2	-4	19	17	41	39
2.15. Brussels - Manchester	-2	-4	10	8	35	33
2.16. Dortmund - Manchester	-2	-3	21	19	42	40
AVERAGE	**-2**	**-5**	**16**	**14**	**41**	**39**
West Europe-Baltic States	Lübeck-Riga		Kappelski Ar-Paldiski		Karlshamn-Klaipeda	
3.1. Dieppe - Tallinn	14	10				
3.2. Dieppe - Kaunas	-12	-17				
3.3. Antwerpen - Tallinn	22	18				
3.4. Antwerpen - Kaunas	-2	-7				
3.5. Amsterdam - Tallinn	19	15				
3.6. Amsterdam - Kaunas	-7	-12				
3.7. Hamburg - Tallinn	36	31				
3.8. Hamburg - Kaunas	9	2				
3.9. Esbjerg - Tallinn	30	26	31	30		
3.10. Esbjerg - Kaunas	8	2			25	22
AVERAGE	**12**	**7**	**31**	**30**	**25**	**22**
West Europe-Scandinavia	Ghent-Göteborg		Travemünde-Trelleborg		Putgarten-Rödby	
4.1. Rotterdam - Oslo	32	28	19	18	-6	-7
4.2. Rotterdam - Stockholm	24	20	18	17	-5	-6
AVERAGE	**28**	**24**	**19**	**18**	**-6**	**-6**

	HFO (1.5%) LOW	MGO (0.1%) LOW	HFO (1.5%) BASE	MGO (0.1%) BASE	HFO (1.5%) HIGH	MGO (0.1%) HIGH
USD	278	500	417	750	556	1000
Euro	193	348	290	521	386	695

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Swedish study main results:

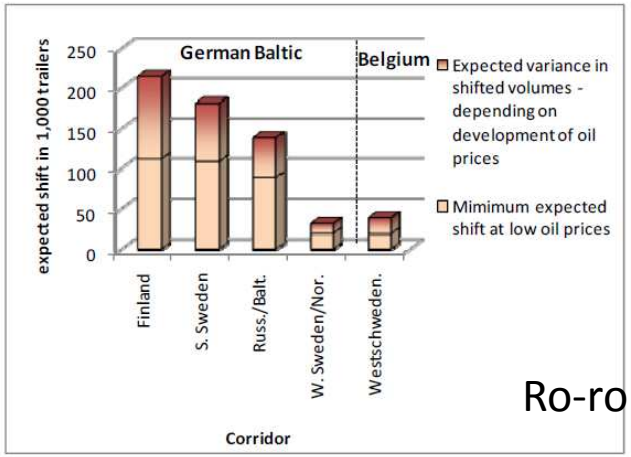
Transport to and from Sweden:

- The transfer from routes via the Port of Gothenburg to routes via the Öresund bridge is the single largest effect.
- The transfer to road is estimated to take place primarily in southern and central Sweden.
- For shipping, the results show that a transfer of freight transport from Sweden's east coast to west coast will take place.
- Transfers are also expected to take place from ports in northern Sweden to ports in central and southern Sweden. This leads to longer connecting transport journeys on land
- More advantageous to wholly avoid SECA, i.e. to choose the port of Narvik [Norway] instead of the ports in northern Norrland [Sweden]
- Within Sweden, a marginal increase of transport operations on road and rail and a decrease in marine transport operations of around one billion tonnekilometres, equivalent to about 2% of the combined marine transport performance.

German study main results

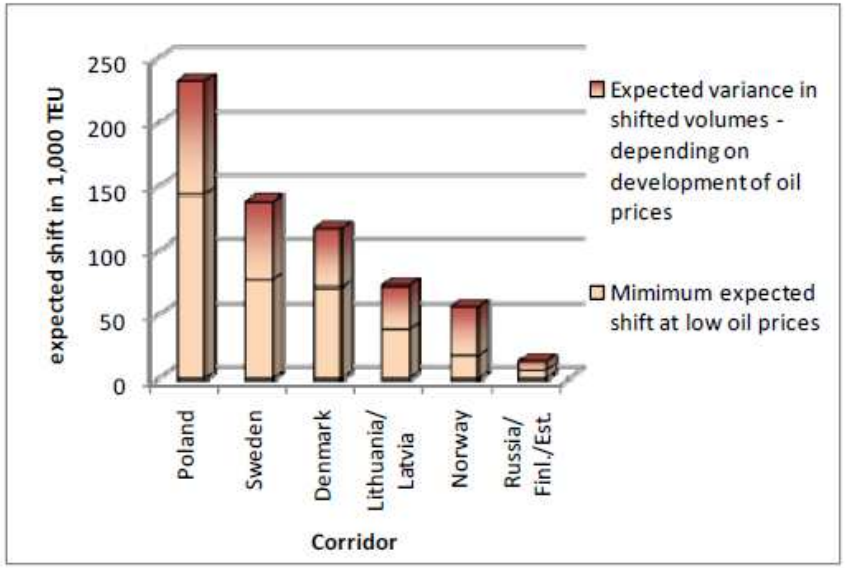
Expected shifted volumes (onto land routes or routes with a smaller sea transport portion) with the introduction of the 0.1 % limit in 2015

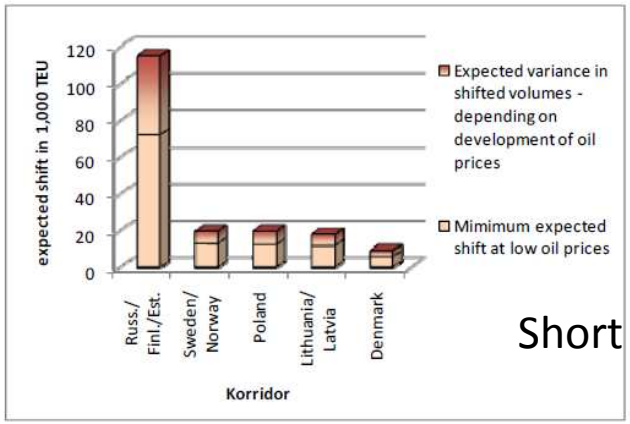
Relation: German Baltic ports – Baltic countries



Ro-ro shipping

Feeder shipping





Short sea shipping

Source: ISL

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Conclusions

- There are certain risks for shifting from the sea transport to other transport modes
- The higher the price of MGO the greatest risk for shifting
- Sea connections that are competitive in comparison with truck or rail only option will remain competitive. Sea links that have competitions problems would still have problems
- Medium routes are more likely to be affected than short and long routes
- Routes at risk of losing shares have mostly been found to lose to other shipping routes with a shorter sea-leg and a longer road and rail option in between.
- Feeder shipping will be the most strongly affected segment of the shipping sector in absolute terms as a result of the shifts.

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MGO not the only one option to meet new IMO regulations

Other solutions:

- Scrubbers

- LNG as ship's fuel

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Thank you for attention

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