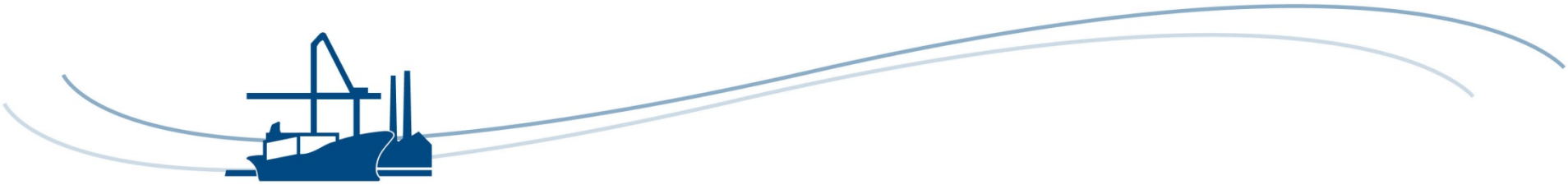
NOx emissions from ships - consequences for shipping and Baltic ports



BPO Seminar & Debate:

Baltic Ports & Environment – new regulations and challenges

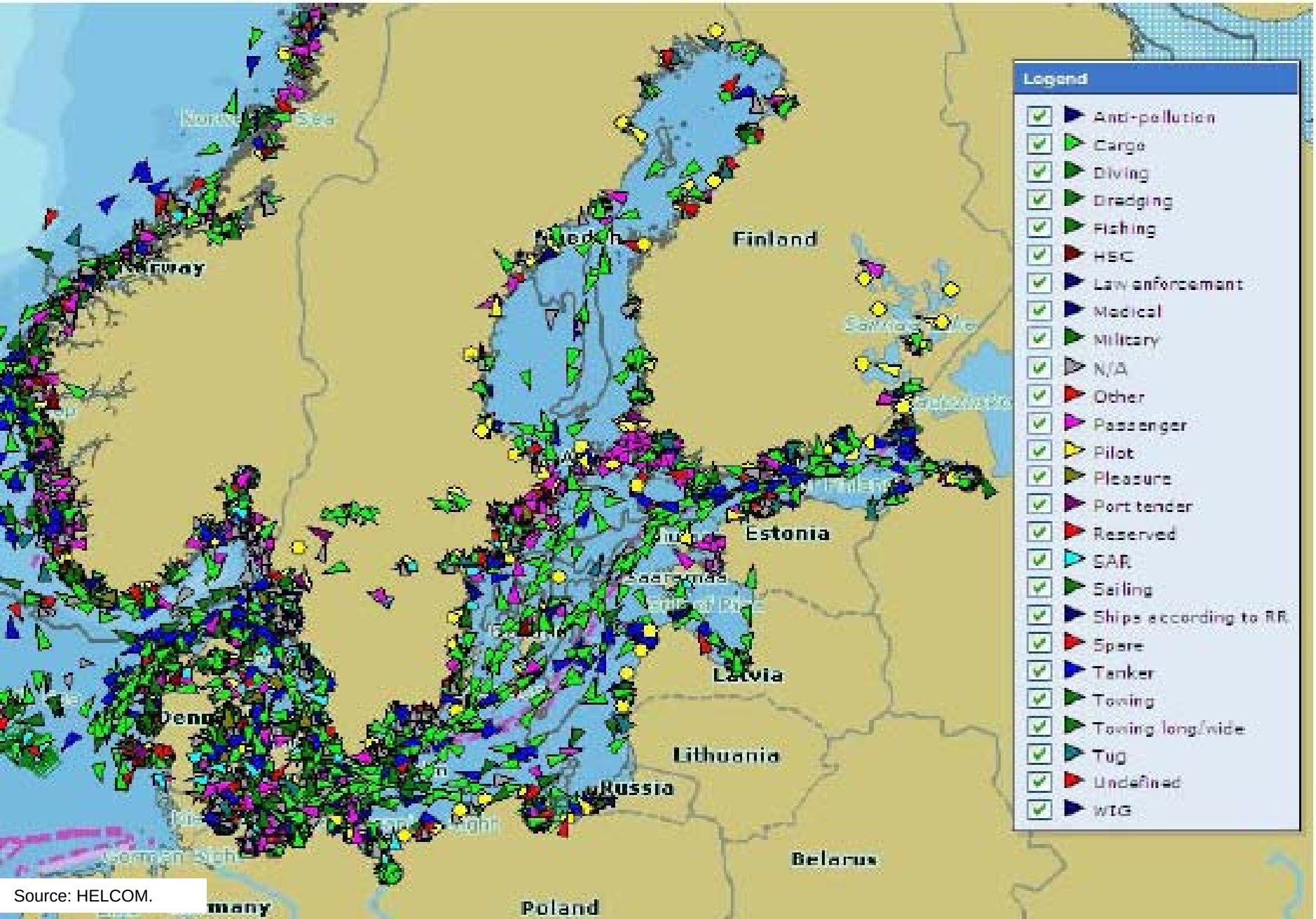
prof. Ulla Tapaninen

University of Turku

Centre for Maritime Studies

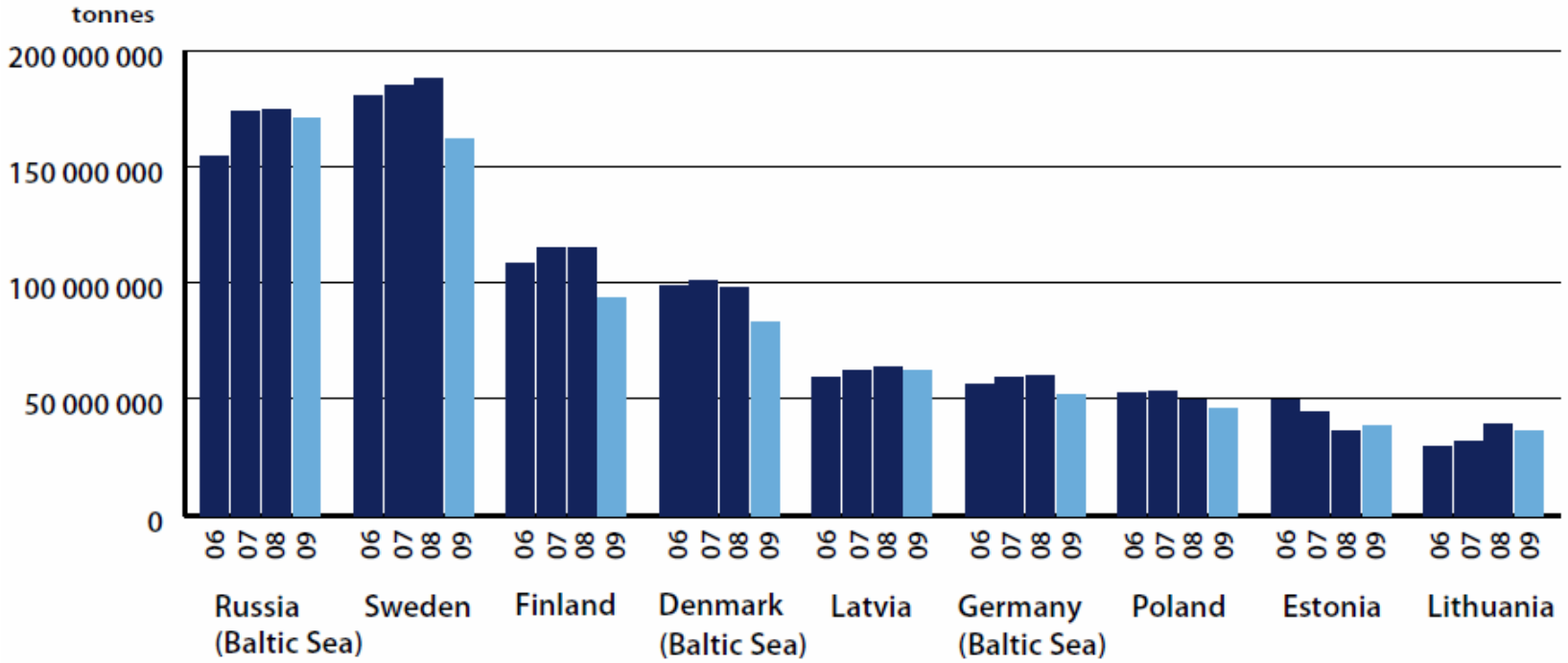
TURUN YLIOPISTO
UNIVERSITY OF TURKU

The Baltic Sea and Gulf of Finland



Source: HELCOM.

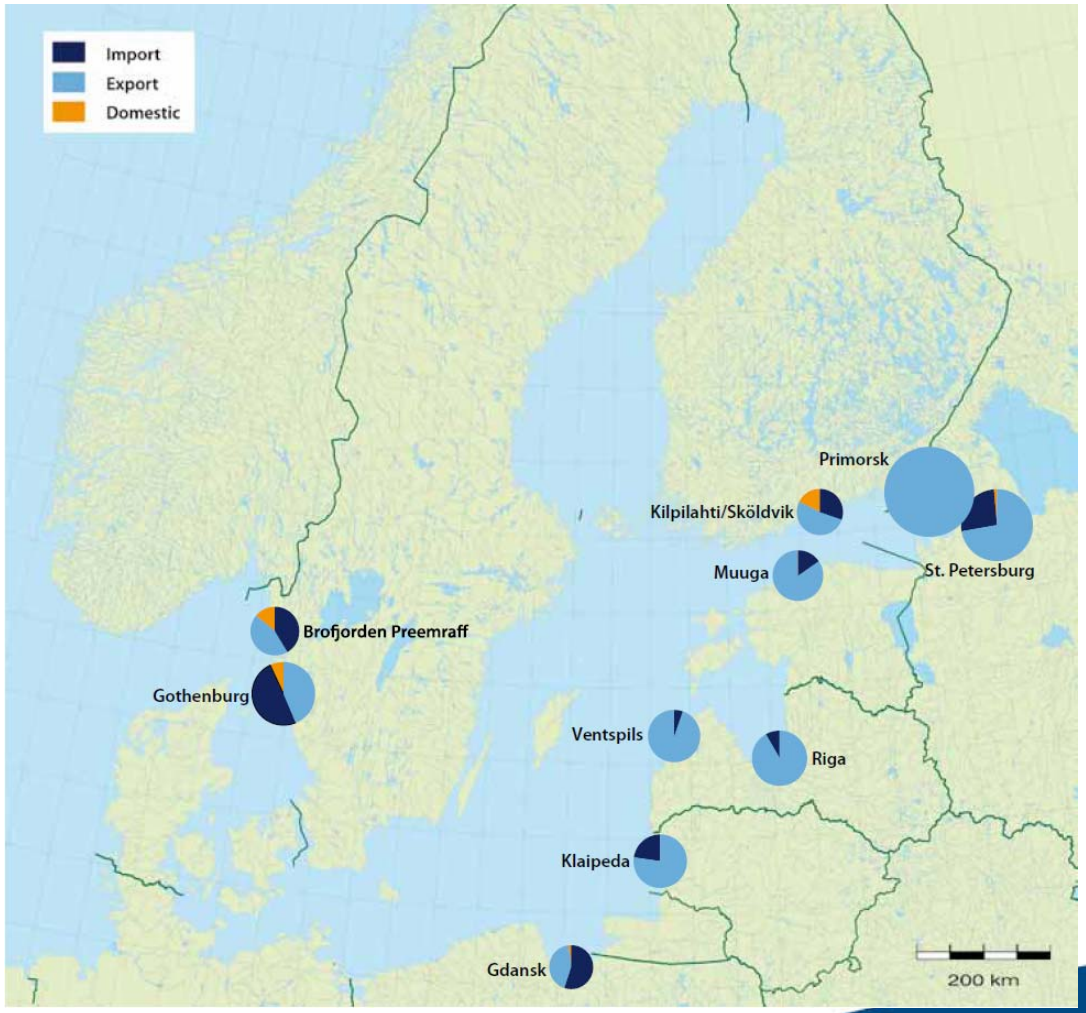
Volumes at Baltic ports 2006-2009



- 2009 Volumes decreased 9,9 % at Baltic ports
  - Export -3,8 % and import -17,5 %
- Finland - 18,7 %, Sweden – 14, Denmark – 15,5 %

Source: Baltic Port List, **Centre for Maritime Studies**

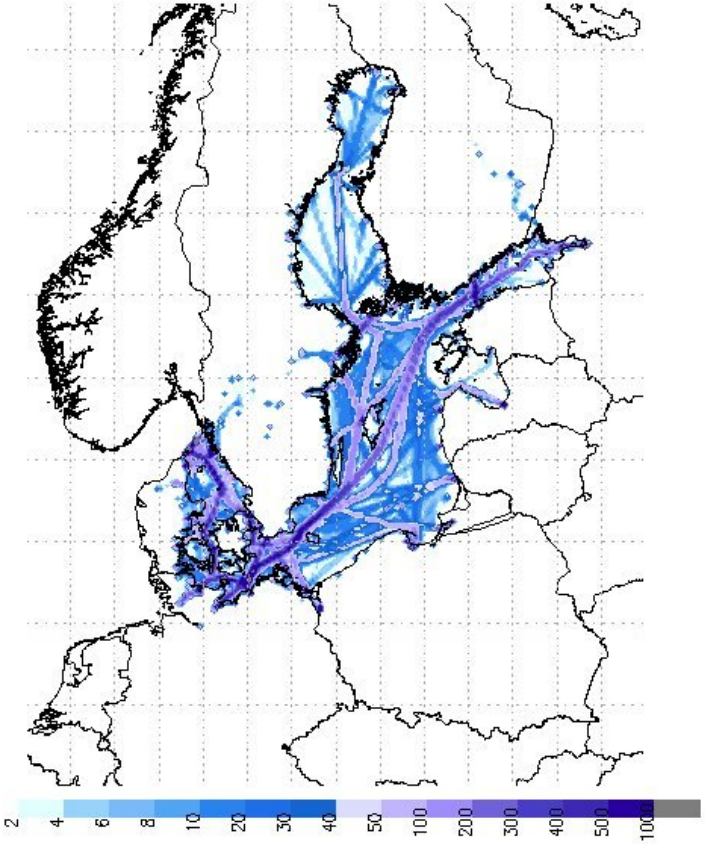
TOP 10 ports

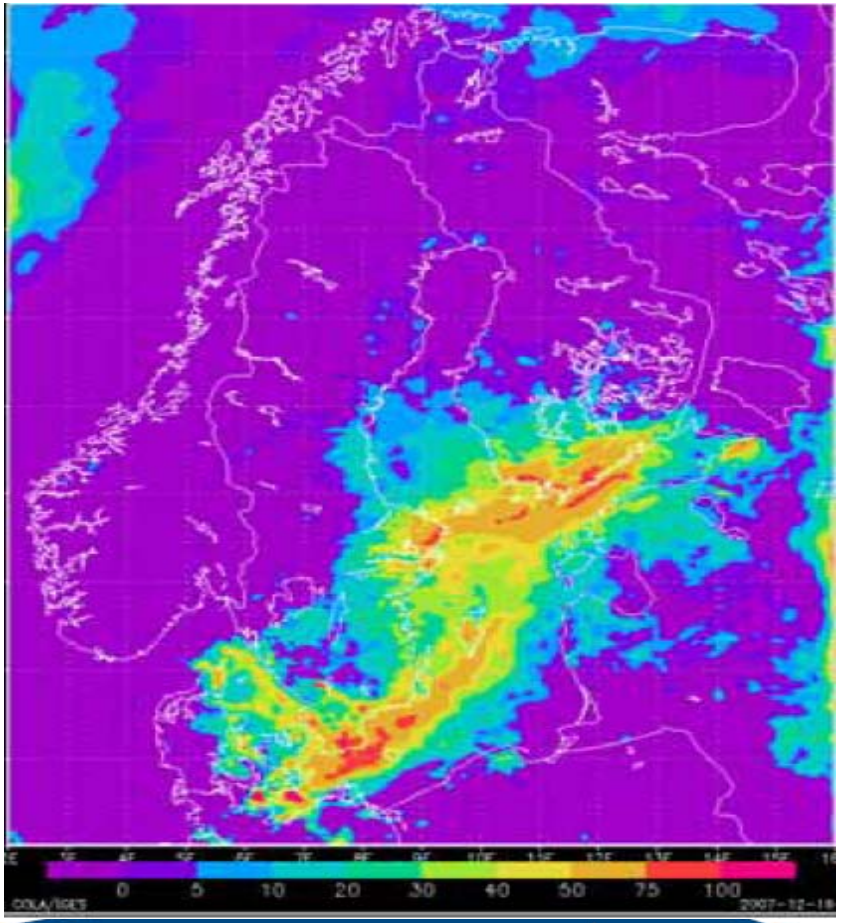


- Focus on east and Gulf of Finland
- Russia
- Oil
- Export

Source: Baltic Port List, **Centre for Maritime Studies**

Total NOx emission 2008





Source: Jukka-Pekka Jalkanen, Finnish Meteorological Institute

MARPOL Annex VI

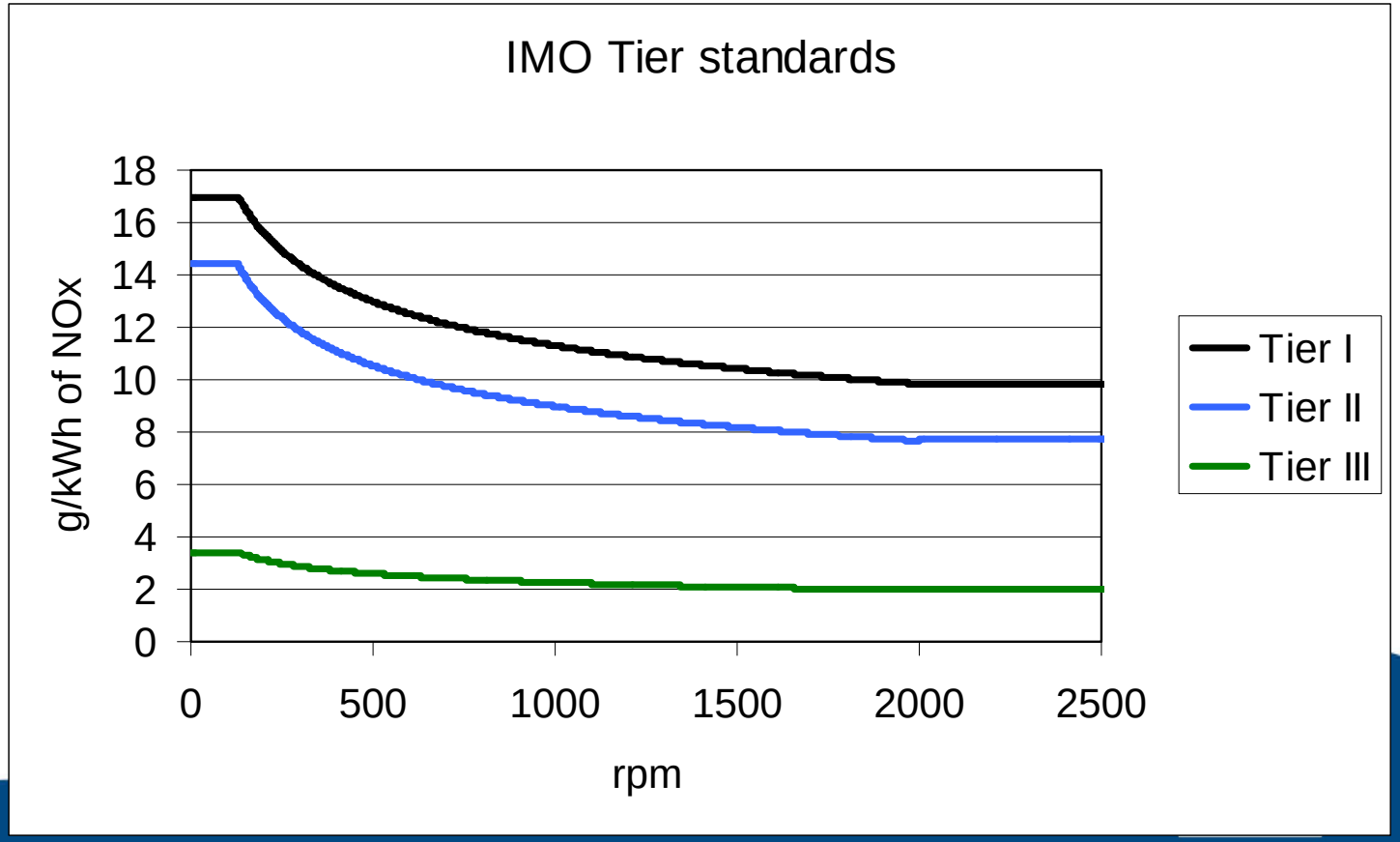
- IMO accepted the new regulations 9.10.2008 for nitrogen oxide emissions

- Nitrogen oxides (NOx)
  - causes eutrophication process in water systems
  - degrade air quality and create health problems for humans.
  - create harmful ozone to the troposphere.

Source: Kalli, Repka, Karvonen 2010: **Baltic NECA – economic impacts. University of Turku, Centre for Maritime Studies**

Nitrogen emissions from engines

- The three-tier IMO emission standards
- Engines must pass tests without exceeding the
- maximum NOx emission limit given in g/kWh
- Tier I, engines installed on or after 1.1.2000
- Tier II, engines installed on or after 1.1.2011
- Tier III, engines installed on or after 1.1.2016.

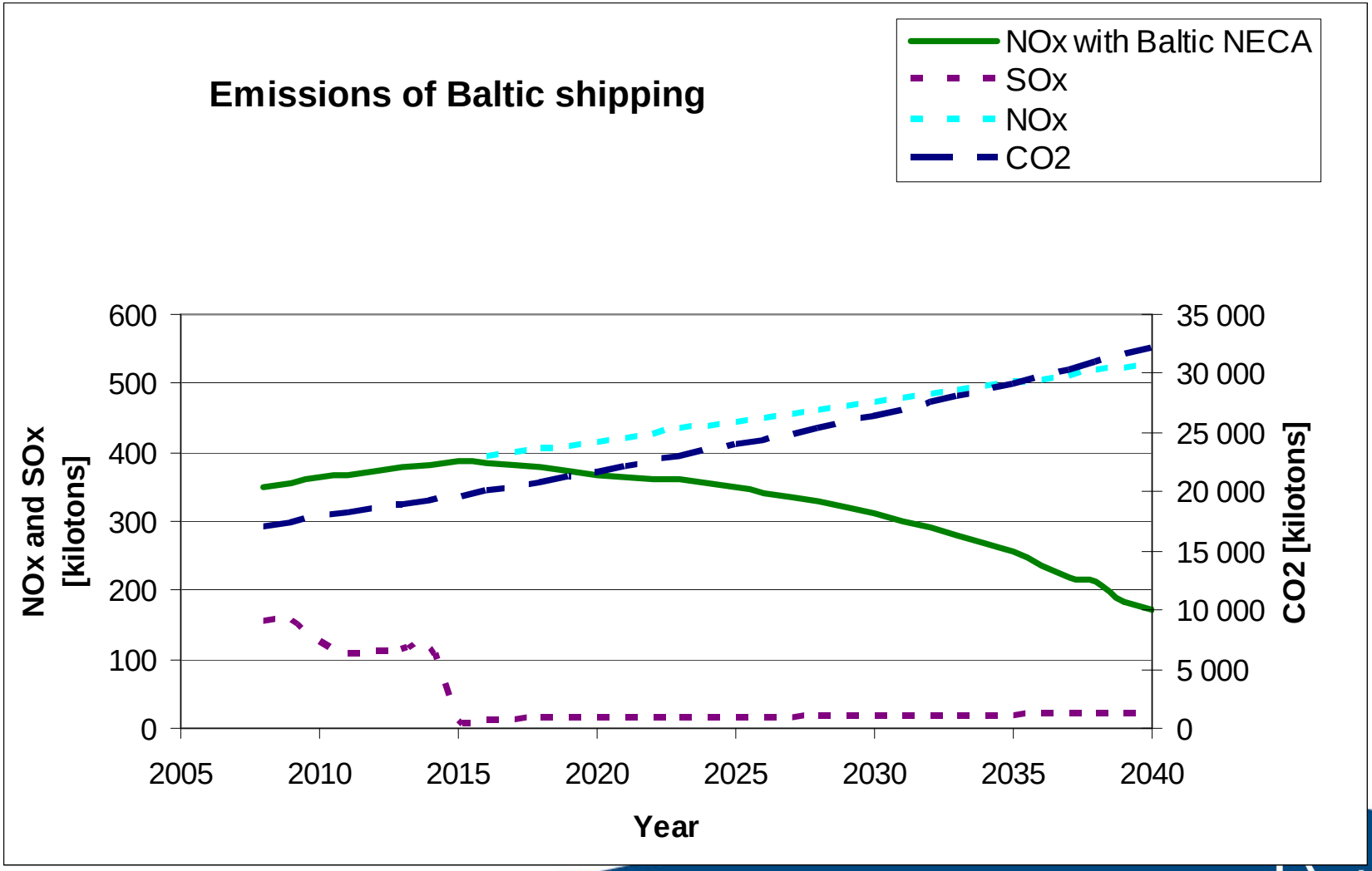


Potential technologies

- Selective catalytic reduction (SCR)
- Gas engine and fuel conversion
- High pressure turbocharger (TC) sys. (2-stage) (ca. NOx -40 %)
- Low NOx combustion tuning (ca. NOx -10 %)
- EGR system (ca. NOx -60 %)
- Charge air humidification (ca. NOx -40 %)
- Water Fuel Emulsion (ca. NOx -25 %)
- Direct Water Injection (ca. NOx -50 %)

Source: Kalli, Repka, Karvonen 2010: **Baltic NECA – economic impacts. University of Turku, Centre for Maritime Studies**

Estimates



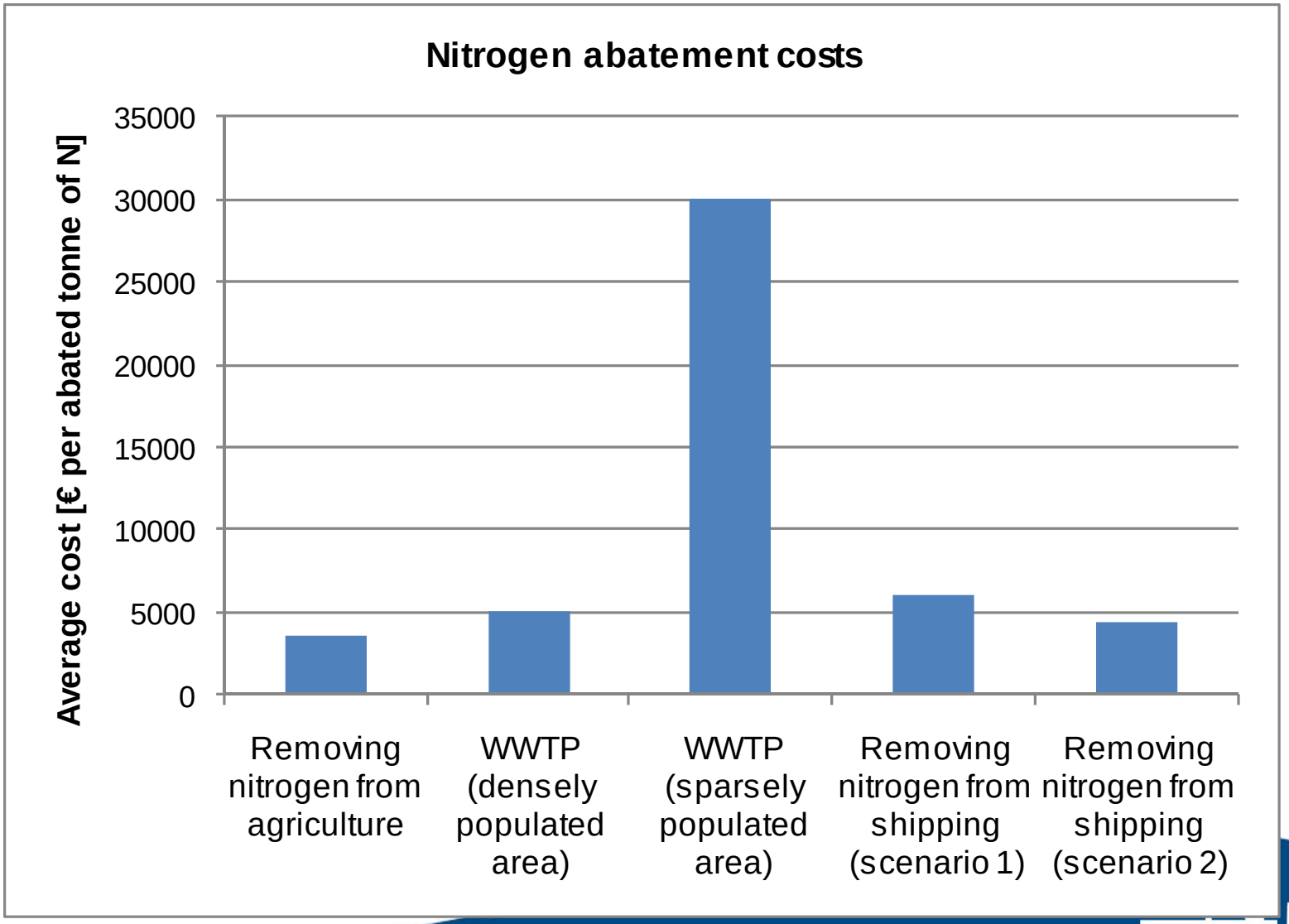
Source: J.Kalli, SNOOP-project, University of Turku

Estimated percentage rise in freight rates of new vessels due to the use of Tier III NOx emission reduction equipment

Ship type	Size category Small	Size category Medium	Size category Large
Container vessel	2.8 %	4.2 %	4.6 %
General dry cargo vessel	2.4 %	3.6 %	3.7 %
Dry bulk vessel	3.4 %	3.3 %	3.2 %
Oil tanker	2.0 %	3.1 %	3.4 %
Ro-ro and ropax vessel	3.1 %	3.3 %	3.4 %

Source: Kalli, Repka, Karvonen 2010: **Baltic NECA – economic impacts. University of Turku, Centre for Maritime Studies**

Costs of alternative methods



Source: Kalli, Repka, Karvonen 2010: **Baltic NECA – economic impacts. University of Turku, Centre for Maritime Studies**

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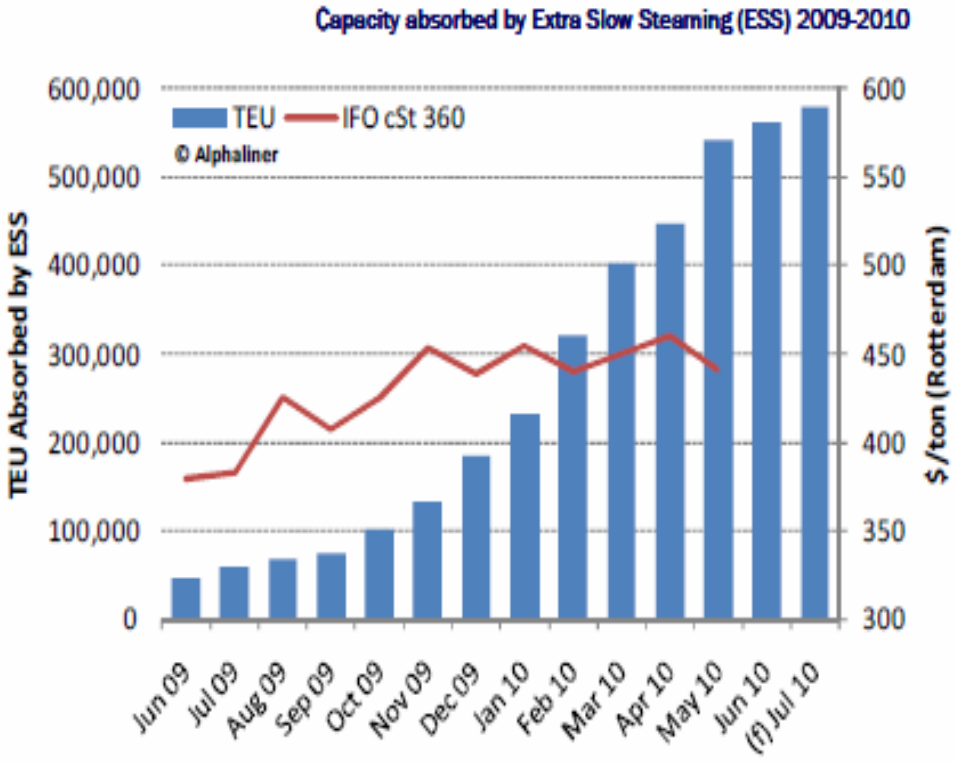
Chart of the week



Extra Slow Steaming to absorb 580,000 teu

Extra slow steaming (ESS) has created employment for almost 100 ships with a total capacity of 554,000 teu as at the end of May. It has grown from only 5 ships for 46,000 teu 12 months ago. The additional capacity employed through

Comparison sea and land: Helsinki - Travemünde

	Ropax	Trailer
Lenght km	1268	2682
Speed	33,4 km/h (18kn)	49 km/h
Trailer capasity	300	1
Time	38 hours	48 hours
NOx (g/km)	5164	7,1
SOx (g/km)	2137	0,0065
NOx total (kg)	6548	19
SOx	2710	0,02
NOx / trailer	22	19
SOx / trailer	9	0,02
Fuel total (t)	100	0,95
Fuel / trailer (kg)	334	952

Source: Taavi Lukin, Kymenlaakso University of Applied Sciences, 2010, Source of data: http://www.lipasto.vtt.fi/indexe.htm

Thank you for your attention!

For background:

http://www.helcom.fi/shipping/emissions/en_GB/emisions/

and http://snoop.fmi.fi/