CENTRE FOR MARITIME STUDIES

EXTERNALITIES OF SHIPPING IN THE GULF OF FINLAND UNTIL 2015

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European Union
European Regional Development Fund

Leverage from the EU 2007–2013

KYMENLAAKSON LIITTO
REGIONAL COUNCIL OF KYMENLAAKSO

Contents of the presentation

- What are emission externalities
- Background of the development of externalities algorithm
- Traffic growth in the Gulf of Finland (GoF)
- Externalities algorithm and results
  - Calculation of atmospheric emissions
  - Calculation of emission externalities of maritime transport
- Conclusions

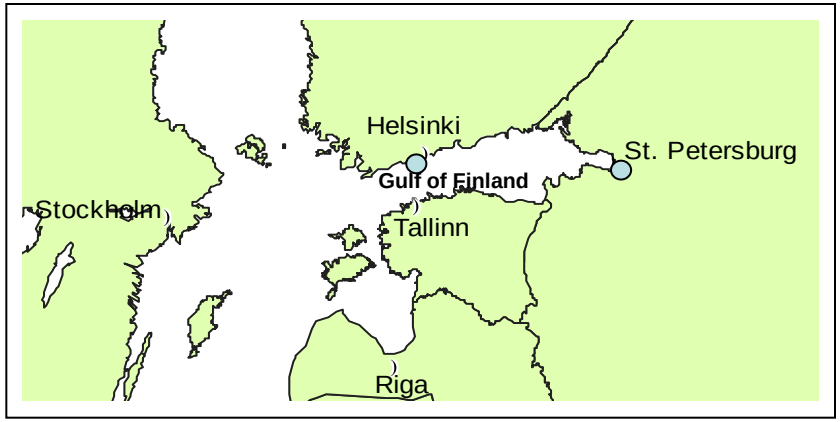
What are emission externalities

- Emission externalities (ExternE –project)
  - Cost of emitted emissions to society (in euros per ton of emission)
  - Part of the marginal social costs
- Internalisation of externalities has already started in the road transport
  - Polluter pays principle
- To calculate externalities you need:
  - Emission amounts
  - Location of emissions

Background information

- ShipNODeff –project (ship emission modelling in BSR)
  - The first system calculating the atmospheric emissions of shipping based on the Automatic Identification System
- SAFGOF –project (algorithm to calculate emission externalities, this paper)

SAFGOF -project



There are 350 - 800 ships sending an AIS signal in the Gulf of Finland depending on the time of year.

- SAFGOF - Evaluation of traffic increase in the Gulf of Finland 2007-2015 and the effect of the increase on the environment and traffic chain activities
- Project is funded by EU – European Regional Development Fund – Regional council of Kymenlaakso, City of Kotka, Cursor Ltd., Kotka Maritime Research Center Association Merikotka and Kotka Maritime Research Center Corporate Group

Traffic growth in the Gulf of Finland

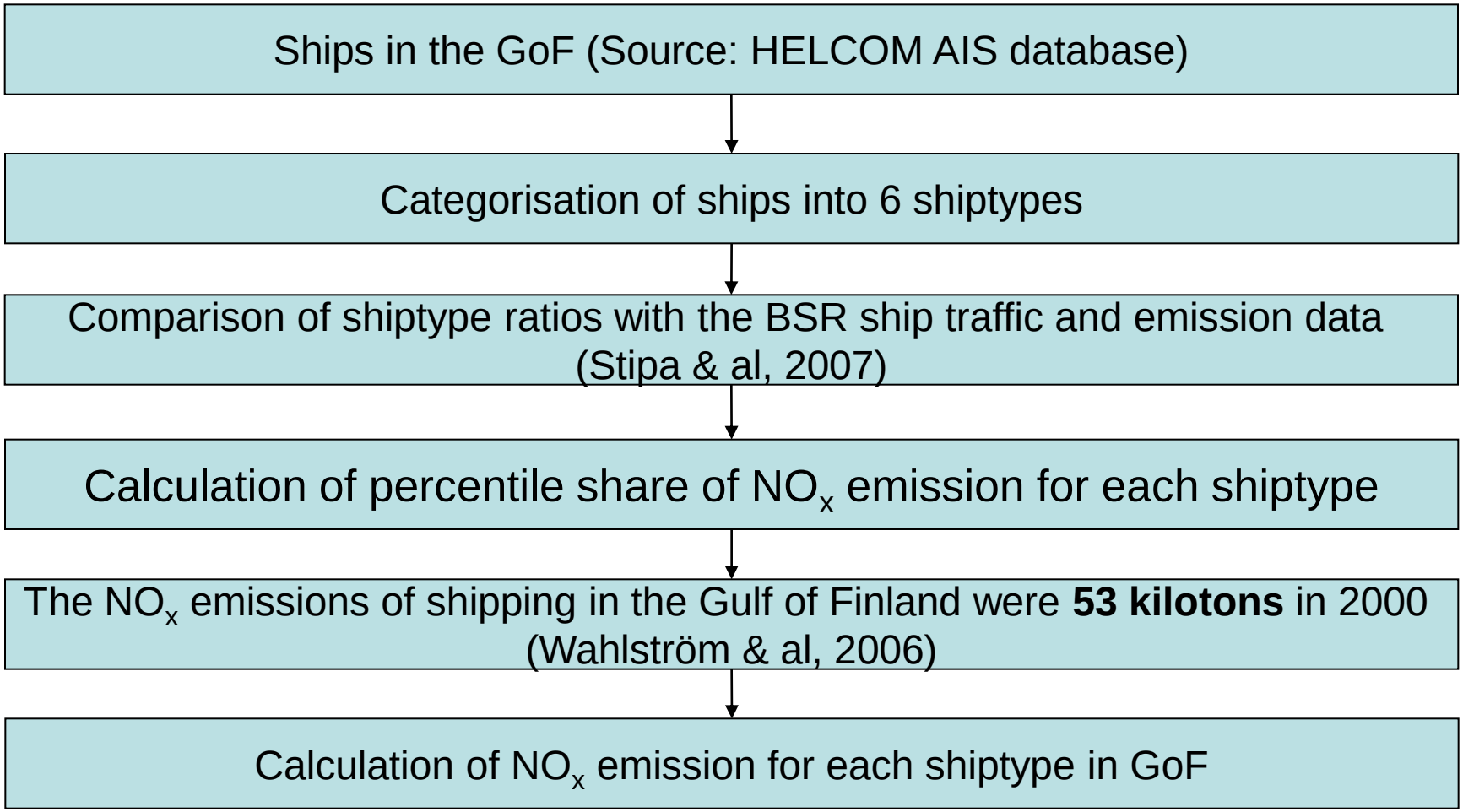
- Maritime transport has increased remarkably until the recession
- Growth of 23% expected until 2015 in maritime transport cargo volumes
- Russia is in the key role
- Strong growth estimation shows 90% increase in cargo volumes (Kuronen et al, 2008, SAFGOF)
- However, there is no linear dependency between traffic increase and the cargo transported

Traffic growth in the Gulf of Finland

- Growth estimation was based on cargo volume and port calls data
- The analysed ship types represent only 64.8% of the total amount of ships in the GoF.
- Nevertheless, they are responsible of 88% of the total ship borne NO_x emissions

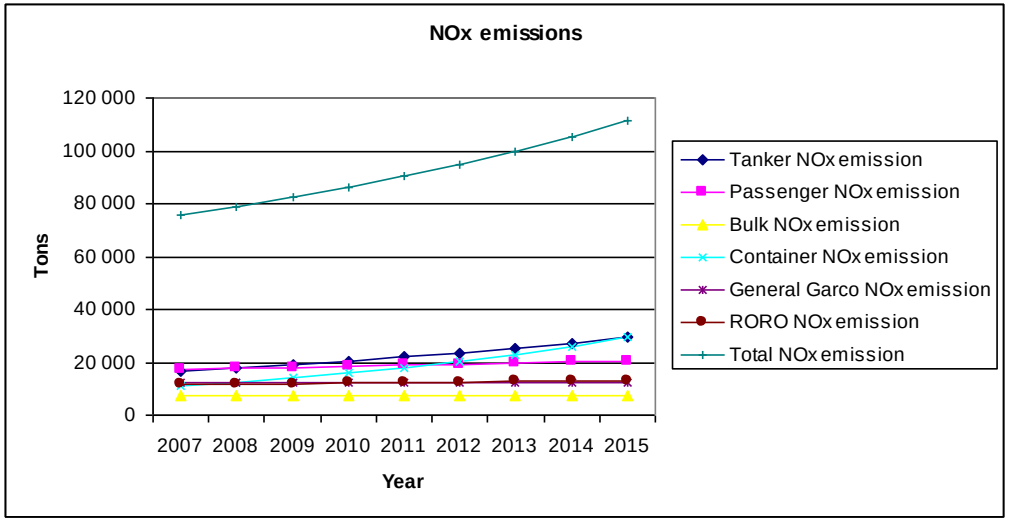
Ship type	Growth factor for 2015 compared to 2007	Growth per annum [%]	Share of ships in GOF, 2007 [%]
Tankers	1.79	7.56	15.9
Passenger	1.18	2.06	5.8
Bulk	1	0.00	7.1
General cargo	1	0.00	27.6
Container	2.68	13.1	5.7
Ro-Ro	1.10	1.24	2.5
Total			**64.8**

Calculation of atmospheric emissions



Calculation of atmospheric emissions

- Total NO_x in the GoF in 2007 was estimated to be 76 kilotons
- Emission scenarios until 2015 (produced with the traffic growth estimation)



- SO_x, PM and CO_2 emissions are calculated from the NO_x emissions with conversion factors

Emission conversion factors

	NO_x	SO_x	Source:
SO_x	0.4		Jalkanen *et al.* 2008
PM		0.11	Stipa *et al.* 2007
CO_2	48.6		Stipa *et al.* 2007
CO_2	46.2		Mäkelä *et al.* 2008
CO_2	41.3		ENTEC, 2002

Externalities of maritime transport

CO_2, NO_x, SO_x and PM emissions of each shiptype

↓

Spatial division of emissions: 1. harbour, 2. coastal, 3. open sea

↓

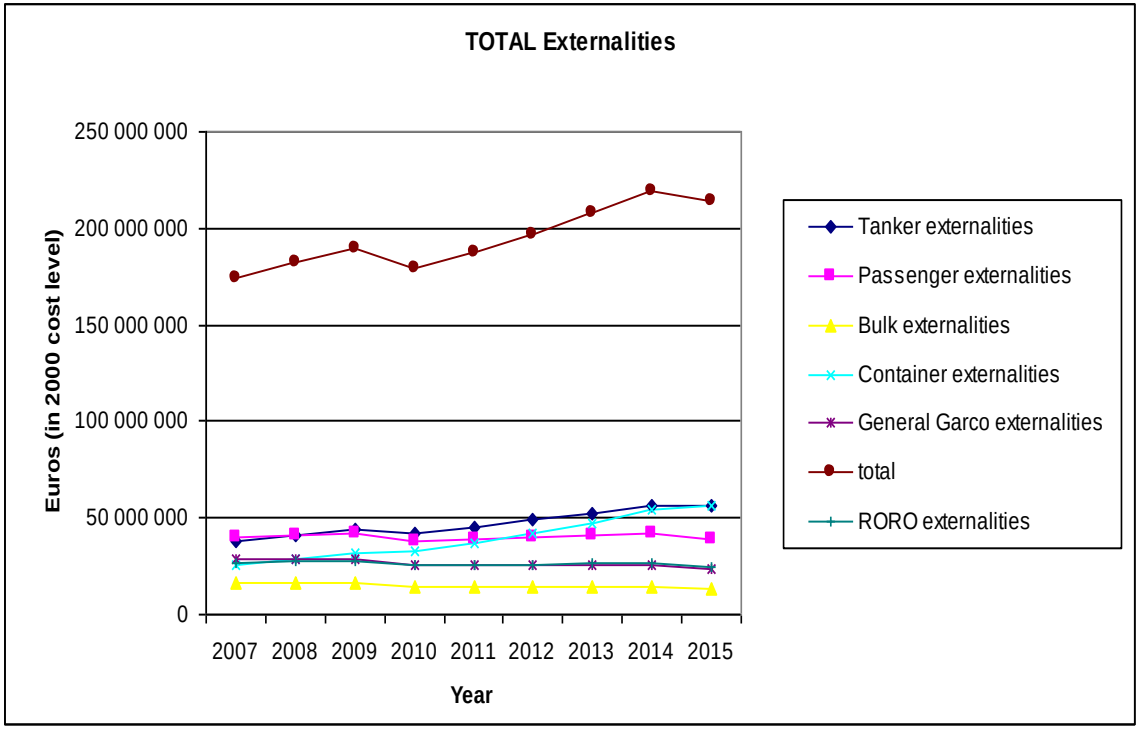
Conversion to externalities with the cost factors

↓

Compound	Open sea €/ton	Coastal €/ton	Harbour €/ton
CO	0.4	2	19
HC	137	153	148
NO_x	301	397	1062
PM	3410	5610	26880
CO_2	32	32	32
SO_2	327	547	2283

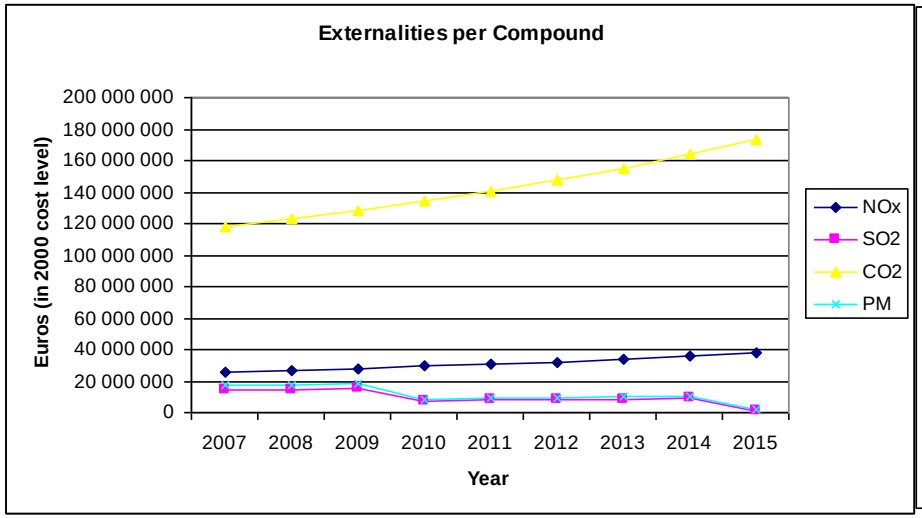
Externalities of maritime transport

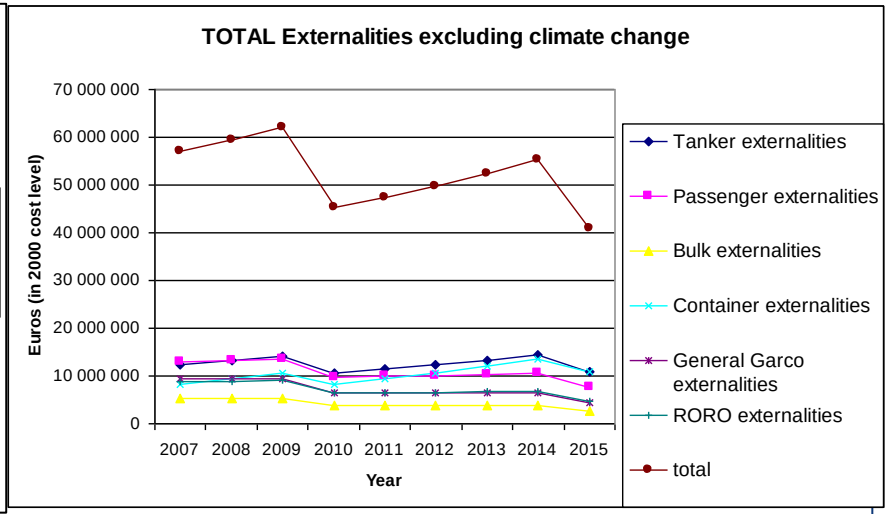
- Total externalities of shipping in the GoF was 175 million euros in 2007
- 215 million euros in 2015
- New EU and IMO MARPOL Annex VI regulations on marine fuels reduce considerably the externalities of SO_x and PM



Externalities of maritime transport

- Excluding of CO_2 from the results will show the effect of MARPOL Annex VI regulations (SO_x and PM)
- Effect of NO_x regulations (Tier 2 and Tier 3) cannot be seen in the trend because the time period is too short





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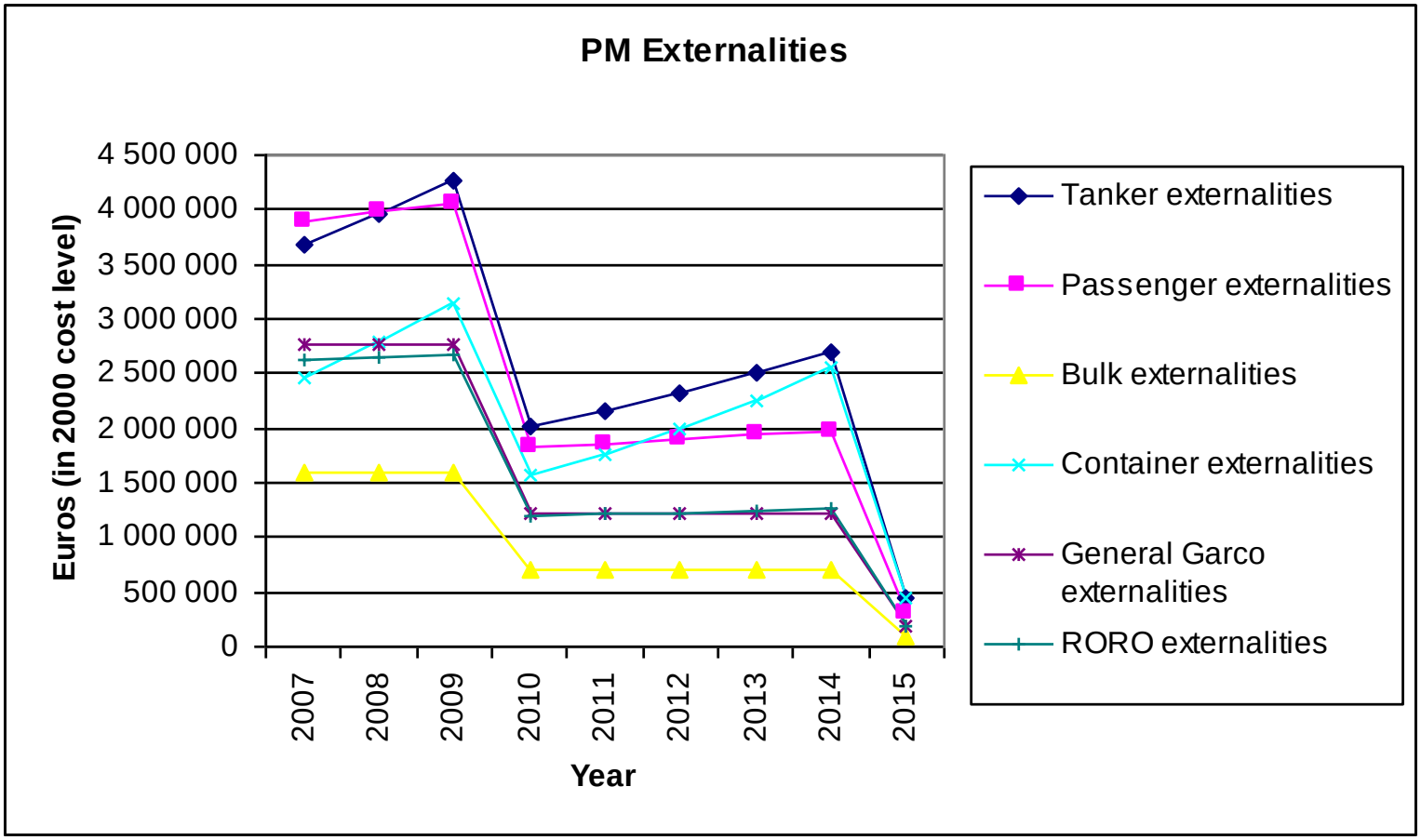
Externalities of maritime transport



Conclusions

- Emission externalities calculation reveals a lack of cost efficiency in the MARPOL Annex VI fuel quality regulations
- A decrease of sulphur content in ship fuels after 2010 to 0.1 %-S will in practice mean switching from cheaper heavy fuel oils to much more expensive distillates (Marine Gas Oil, MGO)
  - If the price difference of 1.0%-S fuel and MGO would be 88 euros per ton (price difference of LS180 less than 1.5%-S and MGO was 88 euros on 16 March 2009), the cost of the fuel switch would be **150 million euros per annum**, and the savings in the externalities of PM and SO_x combined only **16.4 million euros** in the GoF.

Conclusions

- After reducing the SO_x and PM emissions, it is time to reduce CO_2 and NO_x
  - MARPOL Annex VI Tier 2 and Tier 3 (Baltic Sea ECA)
  - Emission trade or bunker levy (MEPC 59 in July 2009), EEDI etc.
  - COP15 (Copenhagen Protocol in December 2009?)
  - EU emission trade?

- Cost efficiency of these tools could be evaluated by using emission externalities approach

Conclusions

- Calculation of emission externalities and future scenarios suits well for the evaluation of maritime regulations
- Method could be developed with integration of emission dispersion modelling and Geographic Information System (GIS)
- The emission externalities approach offers new insights for assessing multiple traffic modes.

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Thank you for your attention!

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