

***EVIDENCE ON THE ENVIRONMENTAL
COSTS AND BENEFITS OF THE ITALIAN
MOTORWAYS OF THE SEA***


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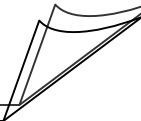
Greening Motorways of the Sea
Stockholm, 21-22 April 2005

Activities of Friends of the Earth Italy on Shipping:

1. Support the improvement of shipping environmental performance, by:

- analysing the shipping industry environmental and safety performances by **applying the external costs methodology**
 - promoting the **use of economic instruments** (environmental harbour taxes, environmental indexed charges, emission trading market, etc.)
 - promoting **environmental control regulations in the low regulated technical areas** (engine emissions, quality of the bunker fuels, etc.) and geographical areas (SECA extended to Mediterranean sea and other EU seas)
 - promoting the voluntary adoption of the **environmental management systems and environmental reports** by private ship-management companies
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Activities of Friends of the Earth Italy on Shipping:

- 2. Promoting Motorways of the Sea as long as they demonstrate to be a cost effective (low cost, quality) and environmental (low external costs) opportunity in the logistic chain, by**
 - comparing the **benefits of the present “Motorways of the Sea” lines vs All Road freight transport**
 - estimating the **external costs trends of road freight transport** along the most congested land corridors
 - evaluating the **external costs of the new proposed lines of motorways of the sea** conceived as an alternative to the congested corridors
 - promoting **measures and choices to improve the environmental performance** of the logistic chain (ports development, ship's technology development, economic instruments)
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1. Objectives of our External Costs Analysis on Domestic Motorways of the Sea

⊕ To compare the external costs of combined road-sea freight transport with all road option along specific italian corridors, assuming the same cargo transported

To find out the main factors affecting the net benefit for society of combined road-sea transport, at the levels of ship (energy consumption performance), of logistic chain competitiveness (ship's load factor), of transport decision-making (which harbour?), of environmental protection decision making (sulphur, emission standards, ecc.).

2. The Framework of the Comparison – Main Hypotesys

- ⊕ **Comparison scenario at 2008**, assumed as the projected year when Italian Motorways of the Sea Master Plan will be fully operational
- ⊕ **Our comparison includes the road segments of the combined road-sea route**, in order to include the effect of port cities population exposure to environmental impact
- ⊕ The external costs have been evaluated on a **one way trip** basis.
- ⊕ **Seven case studies in Italy**: for each of them the “All Road” route and the “Sea-Road” route have been selected with the same origins and destinations

2. Framework of the Comparison – The Case Studies and the Vehicles

The case studies have been selected in order to represent a broad range of situations:

Seven domestic “Motorways of the Sea” lines:

- four **existing** lines
- three **potential new** lines

Four ship’s types have been considered (all new modern ships complying with forecasted rules at 2008):

Type A: Ro Ro pax, big size (heavy duty vehicles and cars)

Type B: Ro Ro pax, medium size (heavy duty vehicles and cars)

Type C: Ro Ro multipurpose cargo, big size (trailers, cars and containers)

Type D: Ro Ro cargo, medium size (trailers and cars)

A representative mix (at 2008) of Heavy Duty Vehicles have been assumed: conventional, Euro1, Euro 2, Euro 3, Euro 4 Vehicles.

2. Framework of the Comparison – The Heavy Duty Vehicles Assumed to be on Board

Four ship's types have been considered:

Type A: Ro Ro pax, big size (touristic and freight traffic)

Type B: Ro Ro pax, medium size (touristic and freight traffic)

Type C: Ro Ro multipurpose cargo (no more than 12 drivers), big size (including dedicated container spaces)

Type C: Ro Ro cargo (no more than 12 drivers), medium size

The starting point of the comparison is the **number of vehicles/cargo units at 65% ship's cargo capacity**. This park of vehicles has the technological mix projected at 2008.

Technological mix for the heavy duty vehicles (%)

	2004	2008
Conventional	26.6	9.9
Euro 1	11.4	8.7
Euro 2	34.1	26.1
Euro 3	27.9	35.1
Euro 4	-	20.2
ALL	100.0	100.0

2. The Framework of the Comparison: the External Costs

What are the External costs? The costs of an activity that fall on the society and that are not beared by the responsible of the activity

The evaluated external costs cathegories are those traditionally suggested by the EC Papers and High Level Groups:

- green-house gases emissions (CO_2)
- local and regional pollutants: SO_2 , NO_x , $\text{PM}_{2,5}$ (road vehicles) and PM_{10} (ships), CO e VOCs
- noise
- accidents
- congestion

In the case of transport by ships, the external costs of noise, accidents and congestion have been considered negligible on the basis of literature review; thus they haven't been evaluated.

3. Methodology

We have used a simplified version of the Impact Pathways Approach, based on environmental factors estimation (f.e. emissions estimation) and on the use of damage values taken from a broad review of the scientific literature results:

- Emissions of air pollutants: ExternE methodology and country specific results as published in the data base BeTa by Netcen (2001)
- The external costs evaluation of noise, accidents and congestion of the heavy duty road vehicles has been based on the marginal external costs results of another european research project post-ExternE, called Recordit, coordinated by ISIS

It must be said that until now there is very little impact pathways research applied to maritime transport, so more EC research should be developed on external costs of shipping

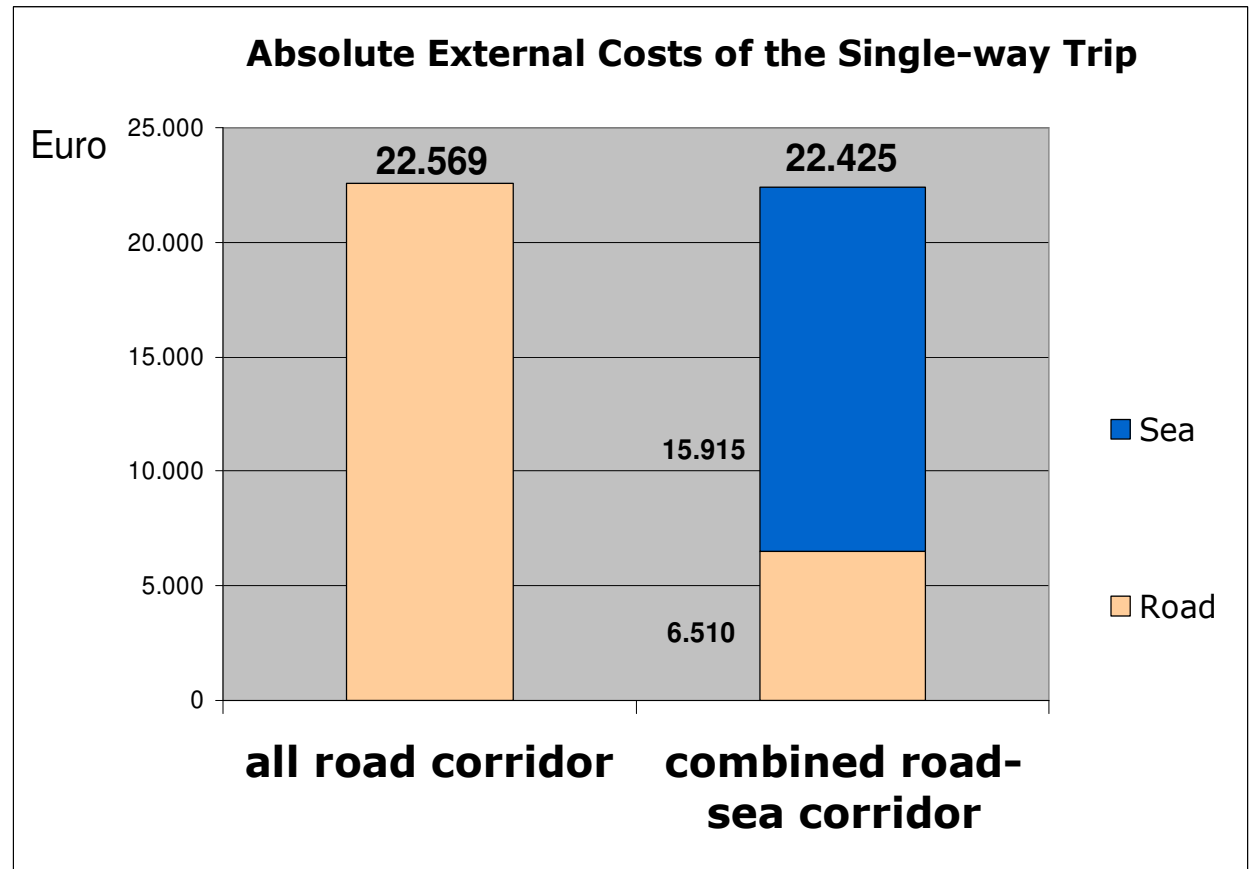
Route 1

**(Caltanissetta)-
Palermo-Genoa-
(Bergamo)**

**Big harbour
cities case**

Results:

- 1) Total Net Benefit for every ship's trip: 144 euro**
- 2) Benefit for every Road Vehicle** subtracted by Combined Road-Sea to the All Road Corridor: 1,48 euro/vehicle
- 3) Average external costs of the trip along the corridors:**
 - All Road Corridor: 1,12 cent euro/tkm
 - Combined Road-Sea Corridor: 1,45 cent euro/tkm



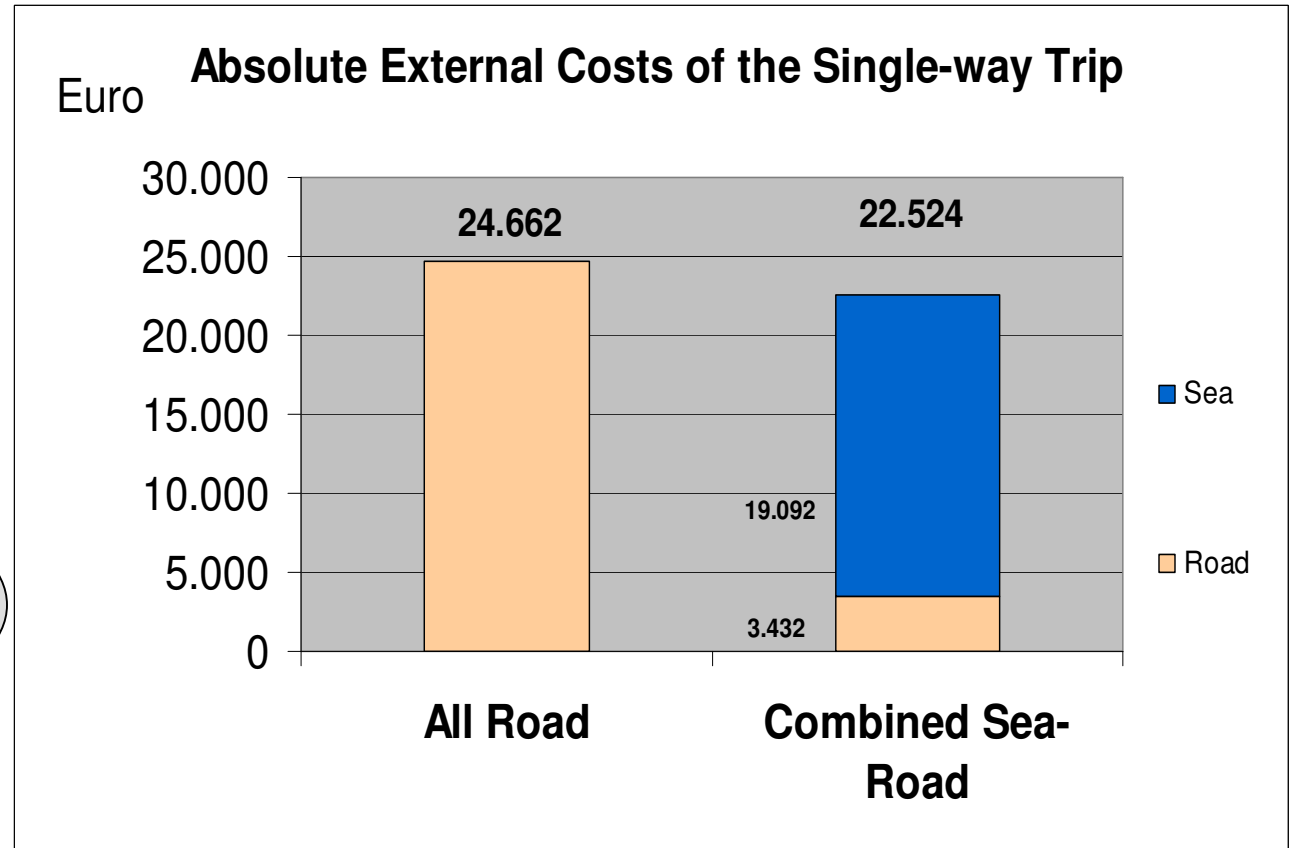
Route 2

**(Caltanissetta)-
Termini Imerese-
Genoa Voltri-
(Asti)**

**Small
harbour cities
case**

Results:

- 1) Total Net Benefit for every ship's trip: 2.138 euro**
- 2) Benefit for every Road Vehicle** subtracted by Combined Road-Sea to the All Road Corridor: 21,17 euro/vehicle
- 3) Average external costs of the trip along the corridors:**
 - All Road Corridor: 1,22 cent euro/tkm
 - Combined Road-Sea Corridor: 1,66 cent euro/tkm



5. Conclusions: CO2 Emissions from the Comparison at 65% of Ship's Load Factor

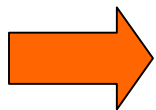
In all the seven routes examined, the CO2 emissions of All Road Transport are lower than Combined Transport (at a range of 20-50% of emission lower).

This result is obtained even if:

- Combined Transport route distances are shorter than All Road routes
- the role of passenger transport by Ro Ro pax is taken into account by allocating part of ship's energy consumption to passenger and part to goods (on the basis of dedicated ship's volumes)

Even increasing ship's load factor to 80-90%, the CO2 comparison can hardly turn to positive

Motorways of the Sea CO2 emissions gains start for ship's specific emission levels under 22 gep/tonn-km: a value that is difficult to reach.



At such ships' high specific energy consumption levels, domestic Motorways of the Sea cannot contribute to reduce CO2 emissions under Kyoto protocol

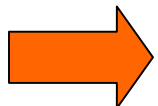
5. Conclusions: Air Emissions from the Comparison at 65% of Ship's Load Factor

In all the seven routes the overall *damage* due to air pollution (SO₂, NO_x, PM, VOCs) of the “All Road Transport” will be **lower** in 2008 than Combined Transport.

Heavy Duty Vehicles SO₂ *emissions* are already now more than 1.000 times lower than Combined Transport.

Heavy Duty Vehicles NO_x *emissions* at 2008 will be 75-85% lower.

The negative air pollution net performance of Ships as compared to Heavy Duty Vehicles is so high (at a ship's load factor of 65%) that it is not compensated by the negative performance of All Road transport as to noise, accidents and time lost in the high congested italian road network.



The economic and social *benefit potential* of Motorways of the Sea is spoiled by the ship's huge SO₂ and NO_x emissions and related damages: reducing these emissions should become the priority of Short Sea Shipping policy

5. Conclusions: Main Results from the Comparison at 65% of ship's load factor (today italian average is about 50%)

In five of the seven routes examined, the overall external costs of Combined Transport are lower than “All Road Transport”. This is mainly due to the shorter travel distance by sea of the Combined transport routes.

If we assume the same travel distance (this means comparing the average external costs in cent euro / tonn-km), **in only one of the seven routes** examined the average external cost (per tonn-km) of Combined Transport is lower than “All Road Transport”.

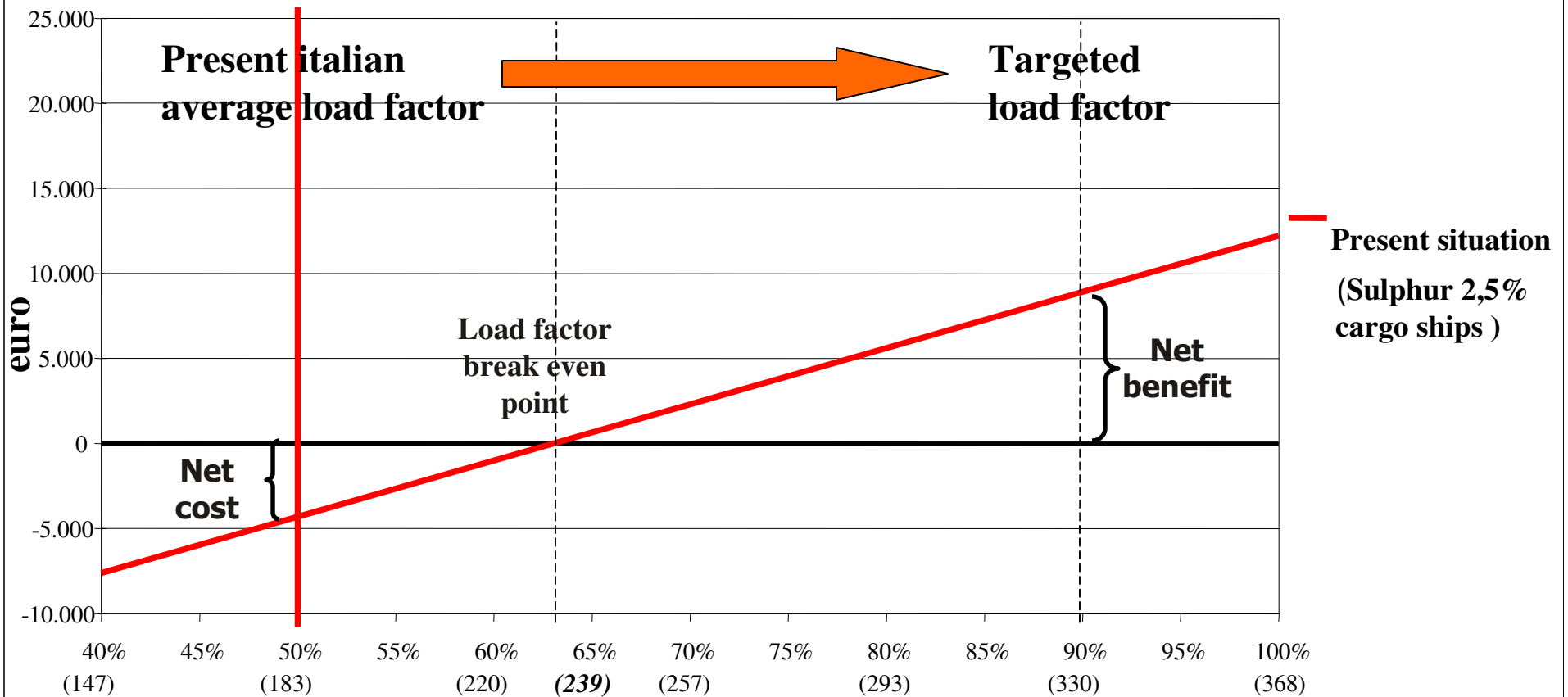
There are two main explanations of these results:

1. Heavy Duty Road transport is engaged in an on going improvement of air emissions performances, while maritime transport is lagging behind (Annex VI, approved in 1997, enters into force only this year).
2. In the Combined Transport routes the Heavy Duty Vehicles pass through **densely populated areas** (higher damages per impact factor)

In the same time we must say that the technical and environmental POTENTIAL of maritime transport is very high, thus turning the Benefits of Motorways of the Sea to quite high values

A sensitivity analysis based on ship's load factor

Route 7 Melfi-La Spezia: Net Benefits of the intermodal transport under various assumptions on load factor (euro per trip)



**Ship's load factor (break even point at 63% load factor)
(Number of trailers on board: break even point at 231 trailers)**

A sensitivity analysis based on environmental measures

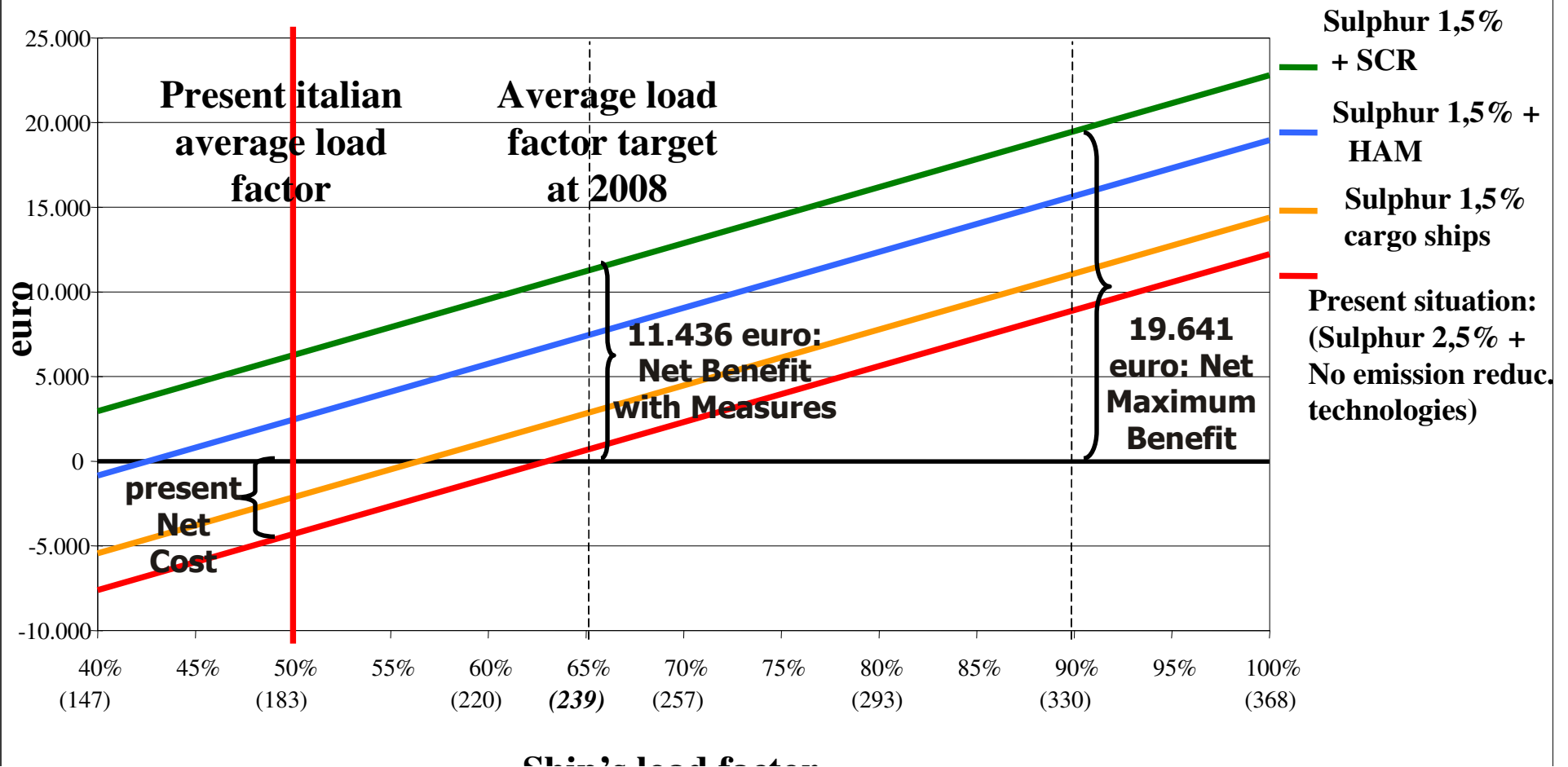
We have done a sensitivity analysis on route 7 (Melfi-La Spezia, Ro Ro cargo ship 2,5% sulphur) based on the following environmental optional measures:

1. 1,5% limit on the fuel oil sulphur content in navigation extended to Ro Ro cargo (EU directive proposed 1,5% applies only to Ro Ro pax)
2. 1,5% S limit to Ro Ro cargo + **Humid Air Motor (HAM)**, a technology allowing for a 50% NO_x reduction
3. 1,5% S limit to Ro Ro cargo + **Selective Catalitic Reduction (SCR)**, allowing for a 90% NO_x reduction

More technological options and routes could be analysed by applying the external costs methodology to cost/benefit analysis

A Sensitivity Analysis: Route 7 Melfi - La Spezia.

Net External Costs Benefits of the Intermodal Transport under various Assumptions on Load Factor and Environmental Measures (euro per trip)



5. Conclusions: Main Factors Affecting Net Social Benefits of Combined Road-Sea Transport

Main influencing factors:

- ⊕ Ship's **Load Factor** and the **Loading Capacity** of the ship (lane meters, car spaces, container dedicated spaces);
- ⊕ Ship's **Specific Energy Consumption** (gep/tkm); in our analysis net benefits of Combined Transport start from Ship Energy Consumptions under 28 gep/tonn-km;
- ⊕ The **quality of the logistic organization** (% of trailers on total vehicles onboard);
- ⊕ **Emissions Reduction Technologies** and engine environmental management;
- ⊕ **Sulphur content** of the fuels used during cruise and in port phases;
- ⊕ The location of maritime lines in terms of **population** of the harbour cities (Intermodal Transport shouldn't pass through populated ports);
- ⊕ The **congestion degree** on the alternative all road corridor.

5. **Conclusions: the Role of External Costs Evaluation in the Short Sea Shipping Policy**

Some of the influencing factors on the Motorways of the Sea Social Benefit depend from the markets, others are environmental but still they have an economic profile. What does it mean?

Short Sea Shipping policy cannot rely only on logistic competitiveness targets (as it has been until now) but it should start to integrate cost effective environmental targets:

- **Lower the sulphur content on *at least* the three main types of ships *when used* on EC Motorways of the Sea (Ro-Ro cargo, Ro-Ro pax, Container ships).** At present EC has absurdely targeted only a) passenger ships on b) any type of EC lines (not only on lines in competition with road)
- **Use of harbour taxes (Taxes not Charges) in an environmental efficient way:** at least a 20% of harbour taxes levels should be differentiated (neutral income differentiation) in order to make it convenient to invest on energy/carbon efficient engines (CO₂/tkm) and on NO_x/PM emissions abatement technologies
- Use of **external costs evaluation** in the Motorways of the Sea projects (decision-making on which ports and lines should be developed)

**More can be done, but
for the moment that's all,
Thank you for the attention!**

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