



External Costs of Maritime Shipping in Europe

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What I want to present to you today

1. Increasing environmental impacts of maritime shipping
2. Environmental costs of maritime transport in Europe
3. Cost comparison with land based modes
4. Costs and benefits of air pollution prevention technologies

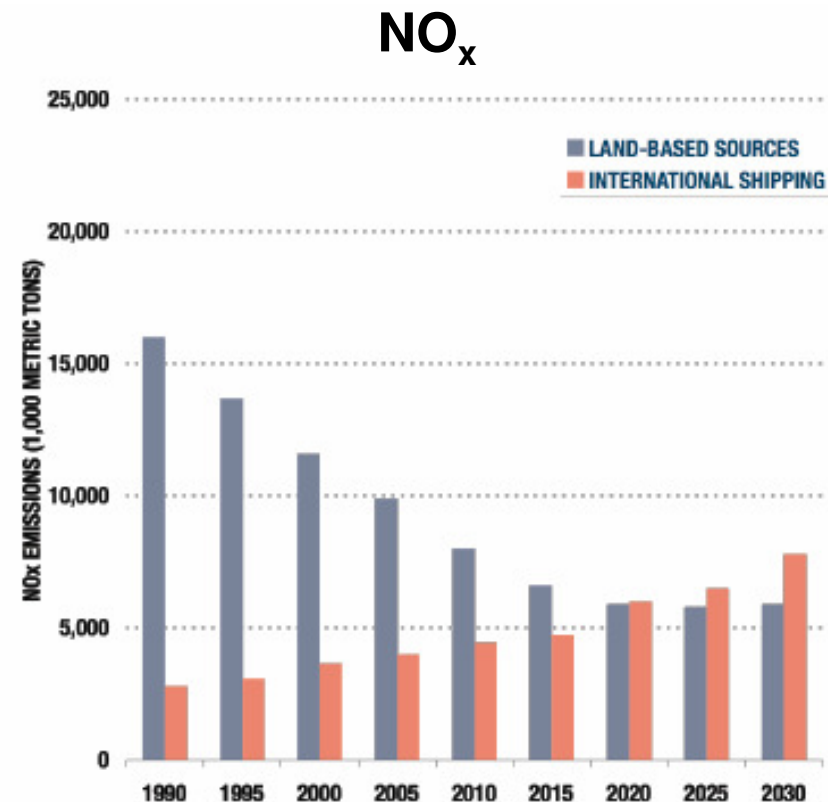
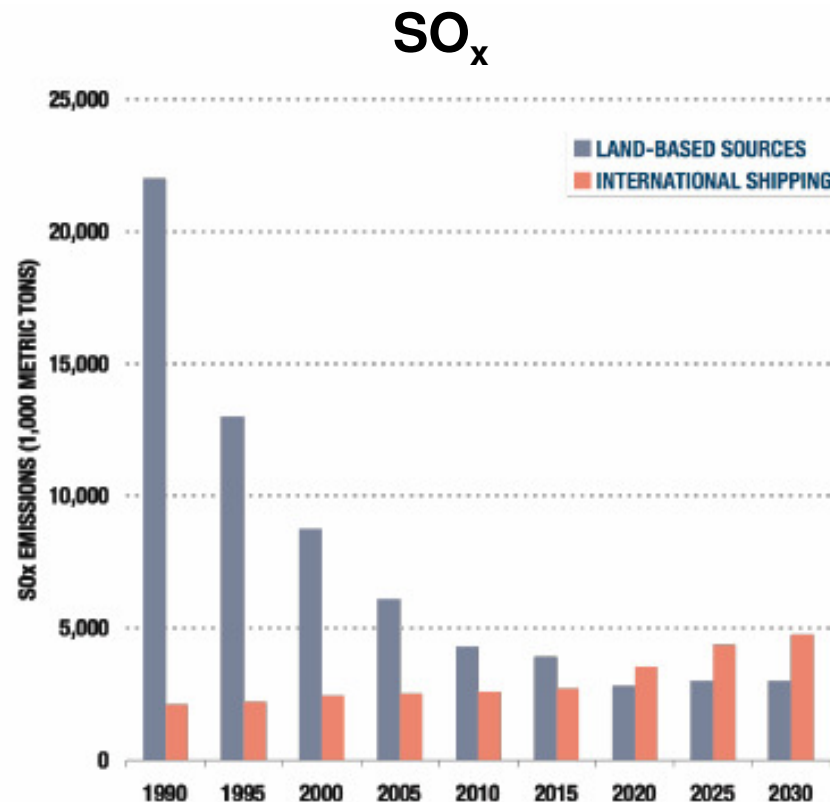


Increasing Environmental Concerns about Shipping

- 90% of the EU's World trade volume and 40% of its internal commodity exchange by maritime transport.
- Between 1970 and 2006 seaborne trade nearly tripled and in the future annual growth rates of 2.5% are estimated.
- Expected increase of shipping emissions 2000-2020 in Europe:
 - SO₂ => 40 %
 - NO_x => 47%
 - PM_{2.5} => 56%



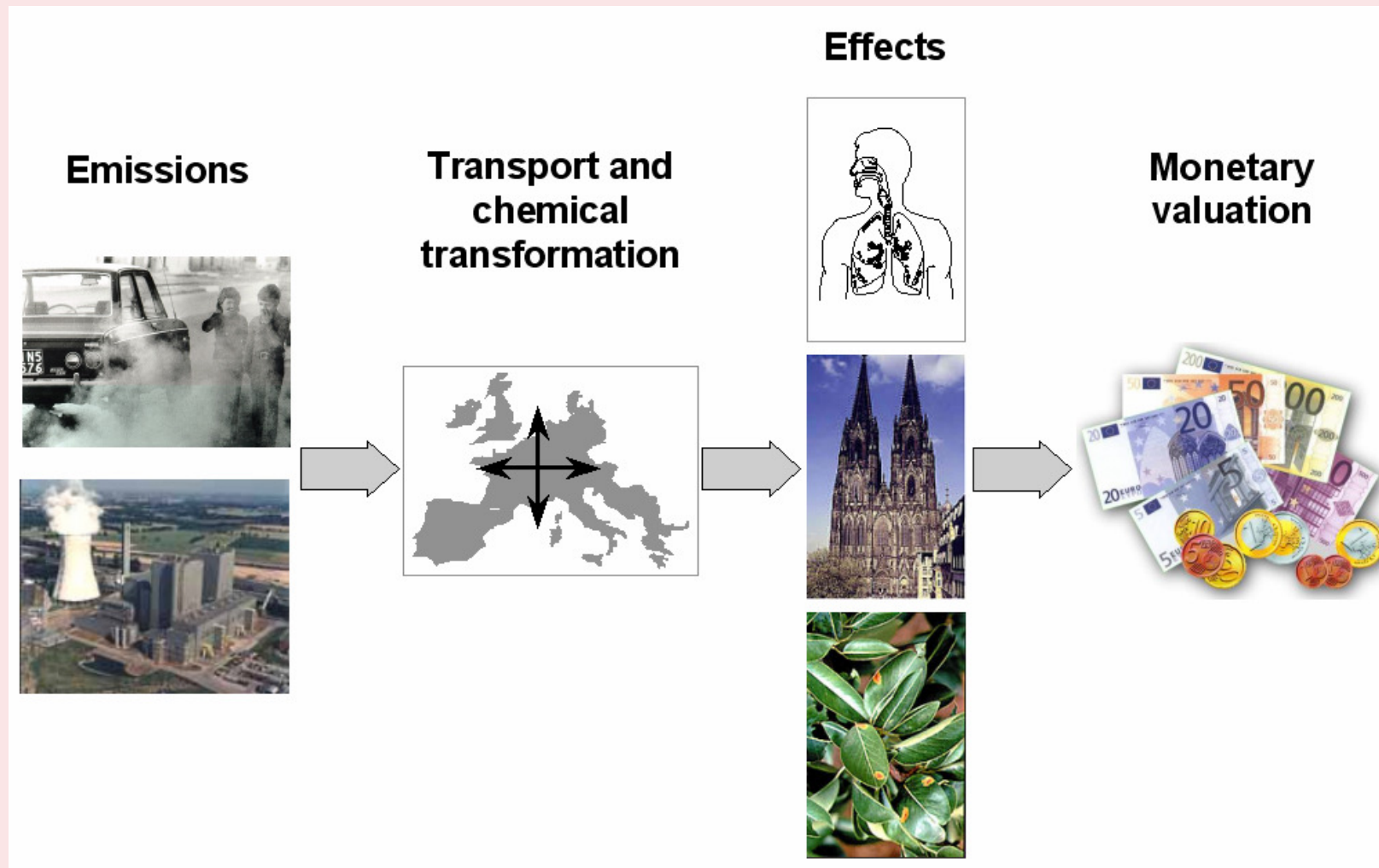
Projected SO_x and NO_x Emissions in EU 25



Source: ICCT, EMEP 2002

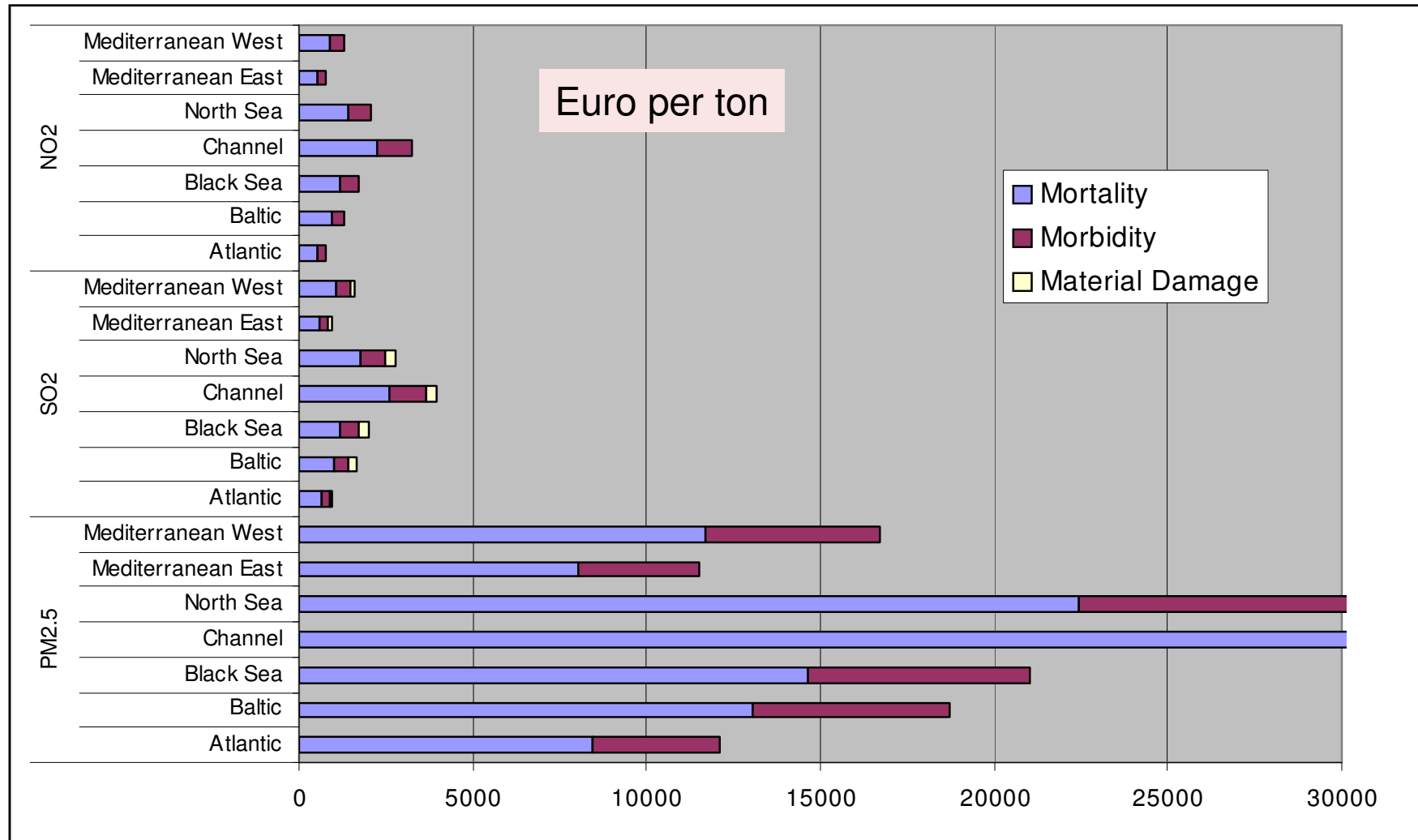


Impact Pathway Approach: ECOSENSE Tool





Damage Factors assessed with ECOSENSE



Source: GRACE D4, Annex, 2006



SO_x – Emissions of Maritime Shipping

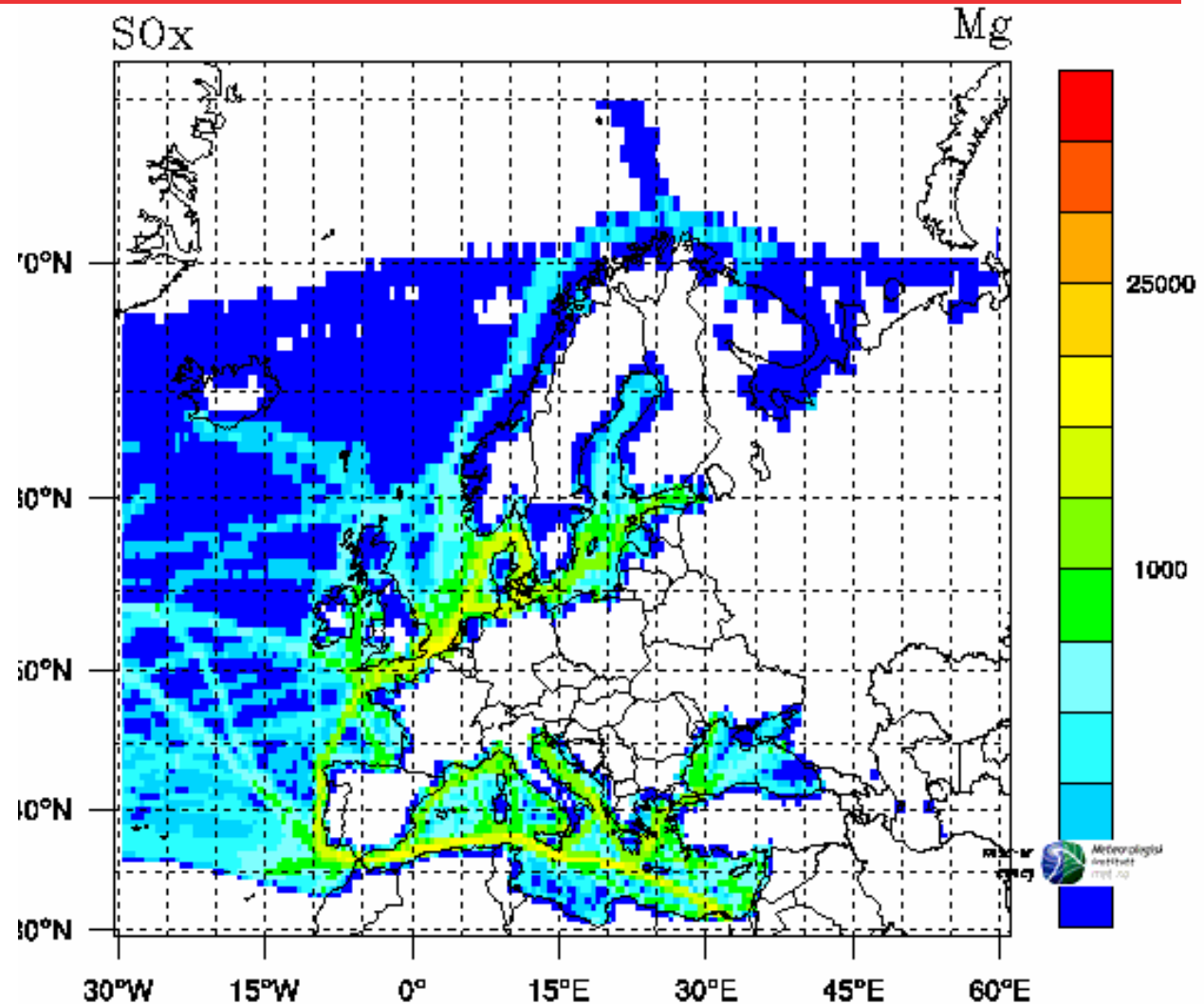
Source:

EMEP

(<http://www.emep.int>)

UNECE:

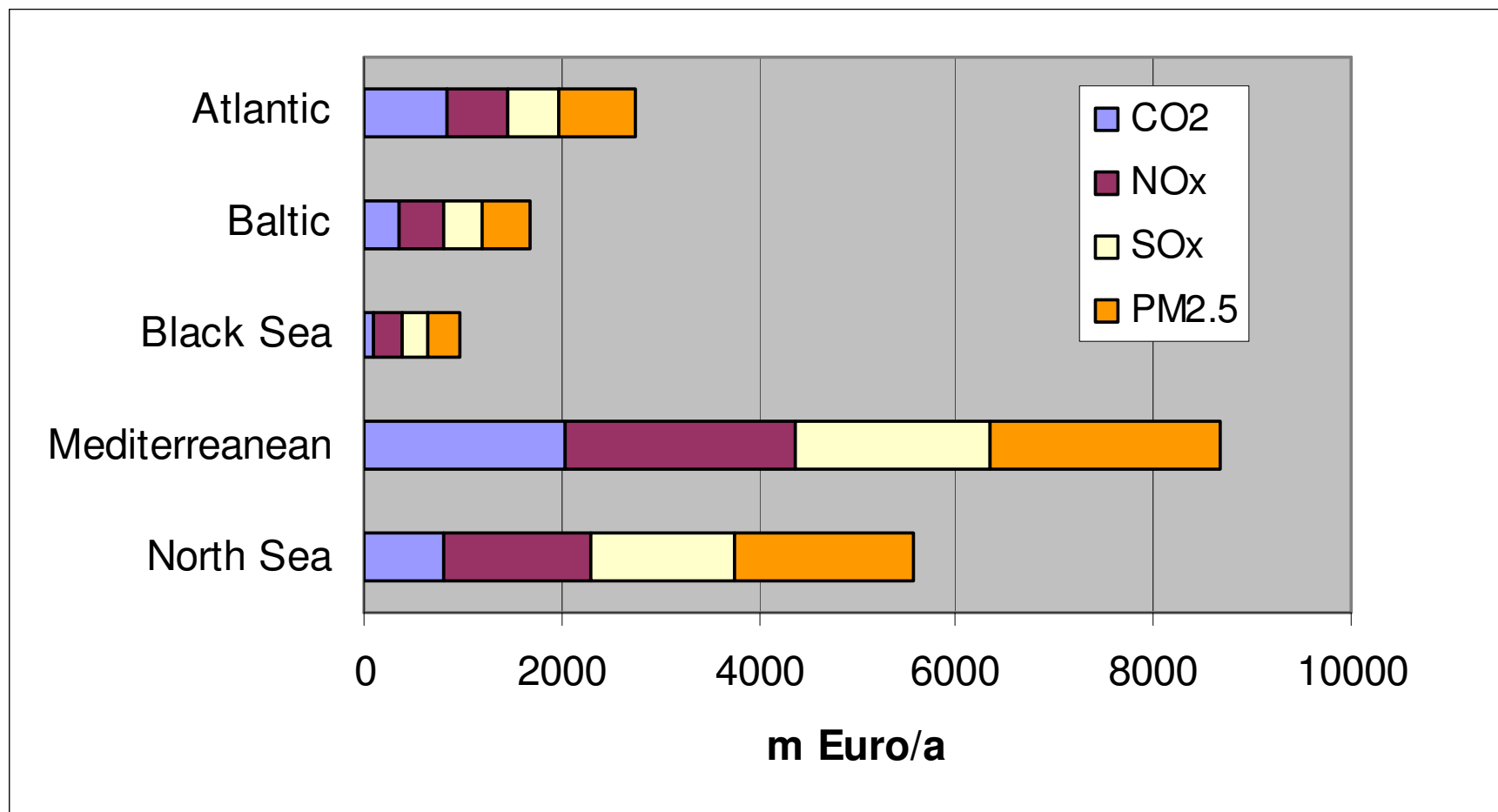
Convention on
Long-range
Transboundary Air
Pollution





Costs of Airborne Shipping Emissions in Europe

Environmental Costs: 19.6 bn Euro/a



Own calculations, emission data: EMEP 2005, IIASA 2007



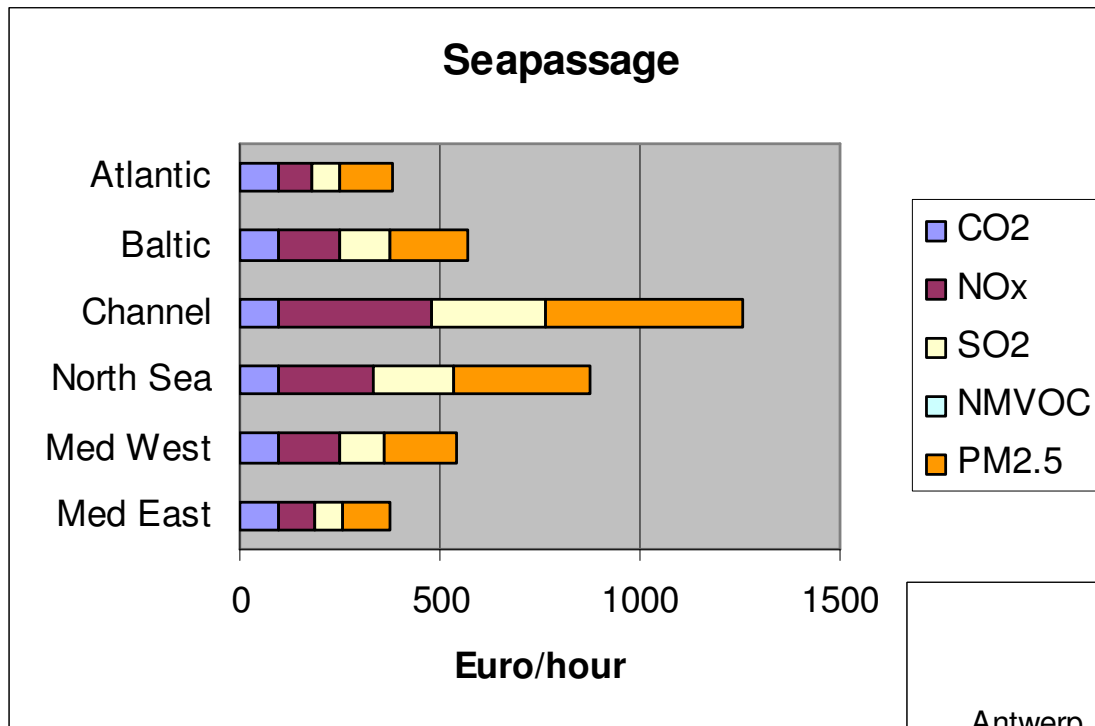
EU Research Project GRACE: Environmental Costs of Selected Sea Passages

Origin	Destination	Distance [sea miles]	Type of Vessel	Capacity
Antwerp	Gdynia	966	General Cargo	45,000 dwt
Felixstowe	Bordeaux	674	Container	3,000 TEU
Genoa	Bordeaux	1854	Container	600 TEU
Bordeaux	Antwerp	748	General Cargo	2,500 dwt
Antwerp	Felixstowe	141	Tanker	2,500 dwt
Genoa	Piraeus	972	Passenger	1,500 pass

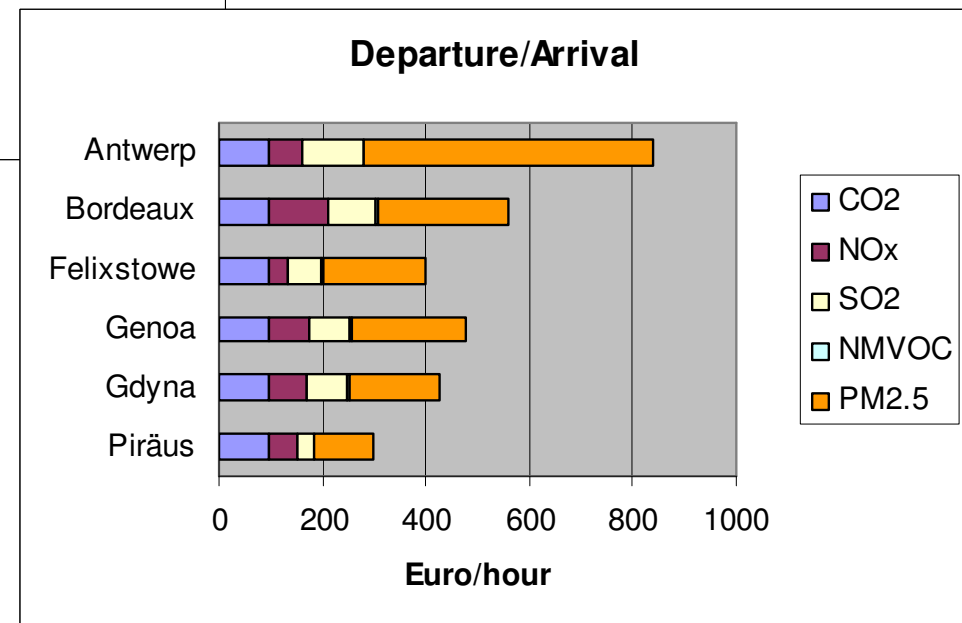
Assumption: Capacity Utilisation = 90%



Costs of Air Pollutant Emissions per hour



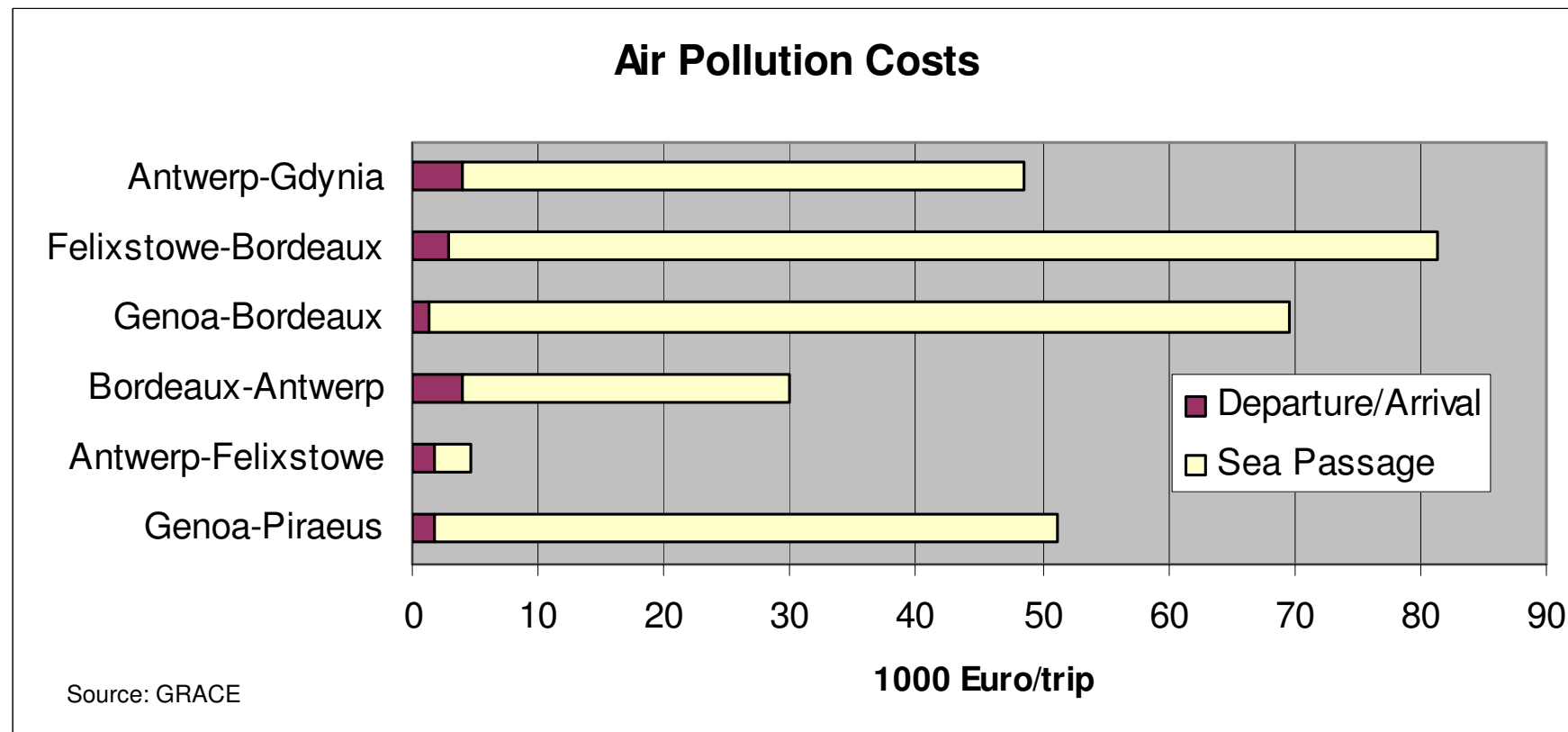
600 TEU
Container Ship



Source:GRACE



Cost of Air Pollution on Selected Sea Passages





Other Environmental Costs of Shipping

Effect	Description	Monetary Quantification
Oil Pollution	Accidents, oil leakage due to regular operations, illegal tank cleaning	Valuation using specific compensation costs (IOPC-Funds)
Influx of Foreign Species	Transport in dead weight water tanks	Not yet researched
Dredging	Deepening of harbours and canals	Not yet researched
Harbour Noise	Noise nuisance through harbour operations	Locally very different
Impacts on fish and marine mammals	Accidents, especially with high speed vessels; Underwater noise	Not yet researched



External Costs of different Transport Modes [Euro/1000 tkm]

Origin	Destination	Type of Vessel	Capacity (Load 90%)	Environmental Costs*
Antwerp	Gdynia	General Cargo	45 000 dwt	0.9
Felixstowe	Bordeaux	Container	3 000 TEU	2.7
Genoa	Bordeaux	Container	600 TEU	4.0
Bordeaux	Antwerp	General Cargo	2 500 dwt	9.9
Antwerp	Felixstowe	Tanker	2 500 dwt	8.4
For comparison: External Costs (INFRAS/IWW 2004)**				
LGV	Light Goods Vehicle			250.2
HGV	Heavy Goods Vehicle			71.2
Rail	Goods Transport by Rail			17.9
* Only airborne emissions and oil pollution. Not included dead weight water, noise, dredging, impact on animals, etc				
** External Costs of air pollution, climate change, noise, nature and landscape, congestion, additional urban effects, up- and downstream processes.				

Quelle: Own calculations, INFRAS/IWW 2004



Increasing Problems through faster Ships

Type	Tons [tdw]	Speed [knots]		Fuel Consumption
		Slow	Fast	Slow ship = 100
Bulker	70,000	12.7	14.2	136
Container	40,000	22.0	24.0	153
RoPax	10,000	21.3	25.0	178
Feeder	7,000	16.0	23.7	256

Quelle: Isensee 2007, 2008

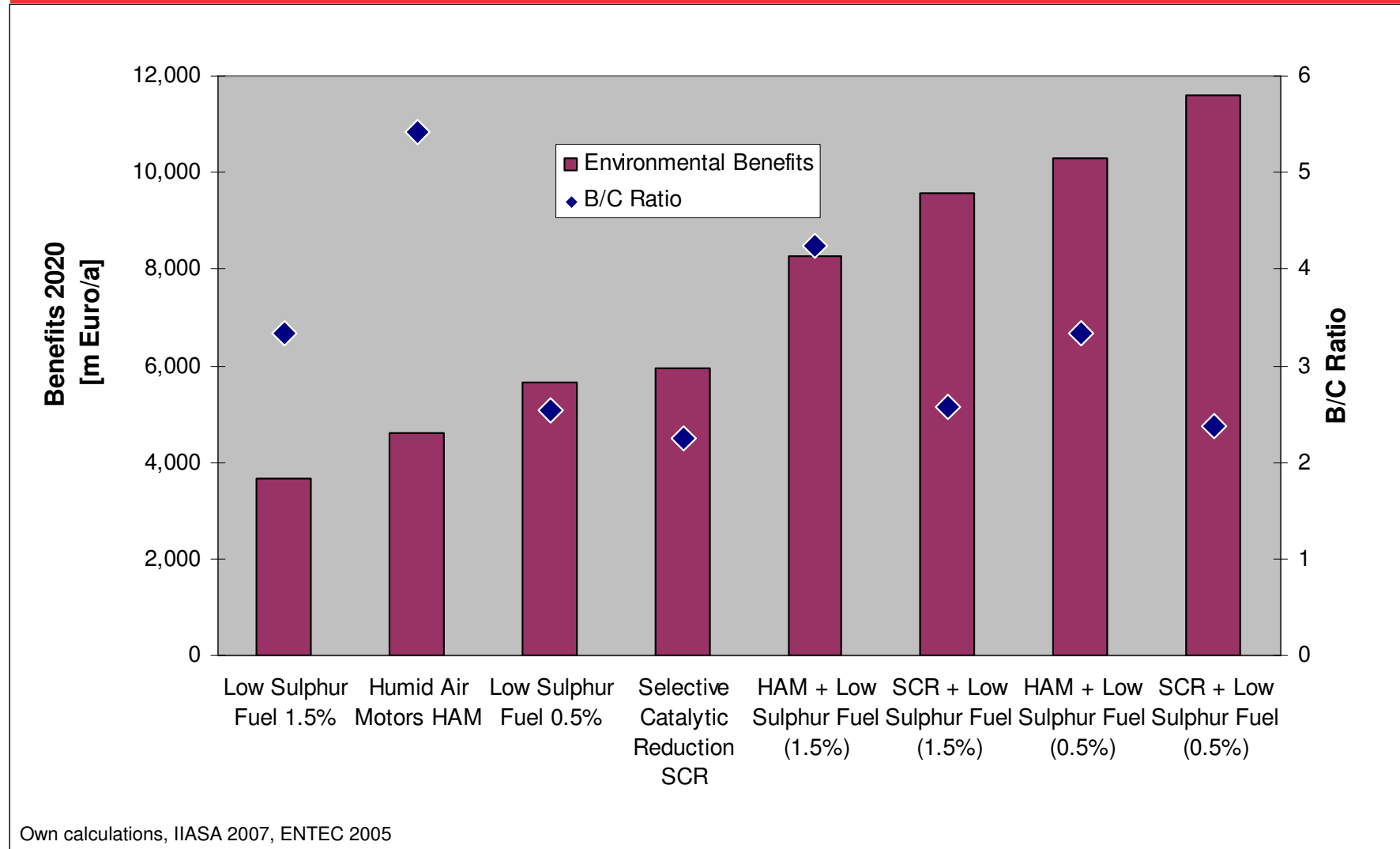


Costs and Benefits of Prevention Technologies

- Scenarios for the prevention of air pollution
- Technologies ready for the market :
 - Humid Air Motor (HAM)
 - Selective Catalytic Reduction (SCR)
 - Low Sulphur Fuels (1.5% and 0.5%)
- Emission reductions of 80-90% are technically feasible



Costs and Benefits 2020





Environmental Economics of Low Sulphur Fuels

- Allowable Sulphur Content of Fuels:
Marine Fuels: 45,000 ppm Road Fuels: 10 ppm
- Investment needs for Oil industry: 126 bn US\$
 - ⇒ Increase of transport costs by 0.15 Euro/1000 tkm
 - ⇒ Example cost increase:
A 20ft container from Shanghai to Hamburg on a 3,000 TEU container vessel, would cost only 18 Euro more.
 - ⇒ Prevention of 50,000 premature death annually by the use of low Sulphur Fuels (0.5%).
- IMO Decision in October 2008 expected.



Conclusions

- Maritime air pollution costs in Europe amount to 19.6 bn Euro p.a.
- Specific costs (per tkm) of maritime shipping are significantly lower than land based modes.
But: High growth rates and the trend for faster ships tend to compensate for these advantages.
- Market-ready prevention technologies can reduce environmental costs up to 11.6 bn Euro/a.
- Environmental benefits exceed costs by two to five fold.
- The most important step is the worldwide reduction of the sulphur content of marine fuels. This would only entail a minor increase in transport costs.



Thank you for your attention!