Green Logistics for Surface Intermodal Transport

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Outline

- Background
- Measures to reduce emissions
- Green Logistics: issues and tradeoffs
- Some simple models and examples
- Conclusions

Main references

- Various projects on emissions in last 3 years (mostly maritime mode)
- New EU project "SuperGreen"
- Various recent developments

What is green logistics?

- An attempt to attain an acceptable environmental performance of the intermodal supply chain, while at the same time respecting traditional economic performance criteria.
- The concept of “Green Corridors” is being analyzed in many circles, notably in Europe, as flows of cargoes that achieve a desirable environmental performance, while at the same time being efficient logistics-wise.

Primary focus

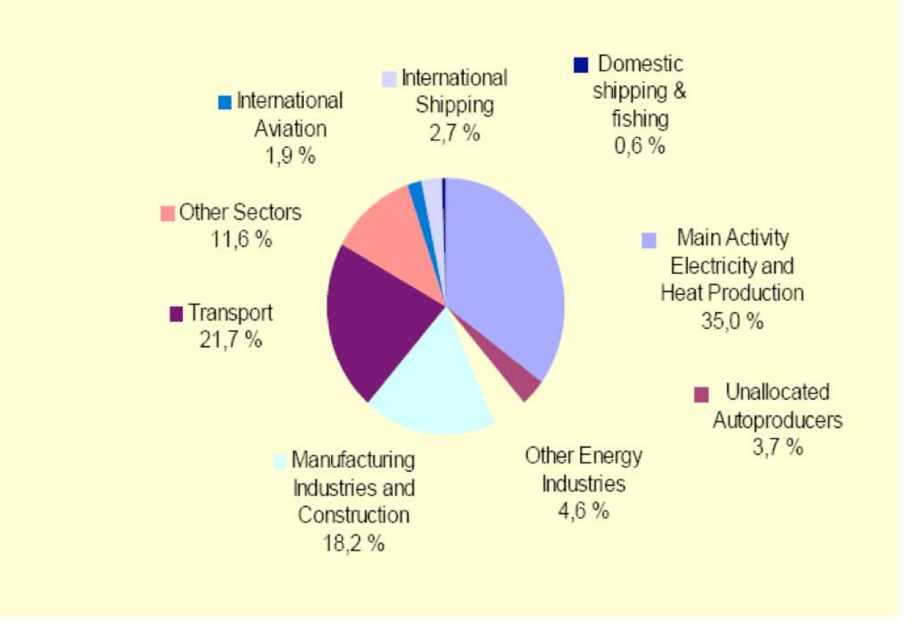
- “Good environmental performance” …→
- “Acceptable level of emissions”
- Further focus: GHG emissions

- [there are certainly additional environmental attributes of transport that create external costs, such as noise, hazardous substances, oil spills, ballast water, residues, garbage, etc]

Types of emissions

- Green House Gases-GHGs (mainly CO_2, but also CH_4 and others)
- Non-GHG (mainly SO_2, but also NO_x and others)
- P.M., etc

Share of global GHG emissions

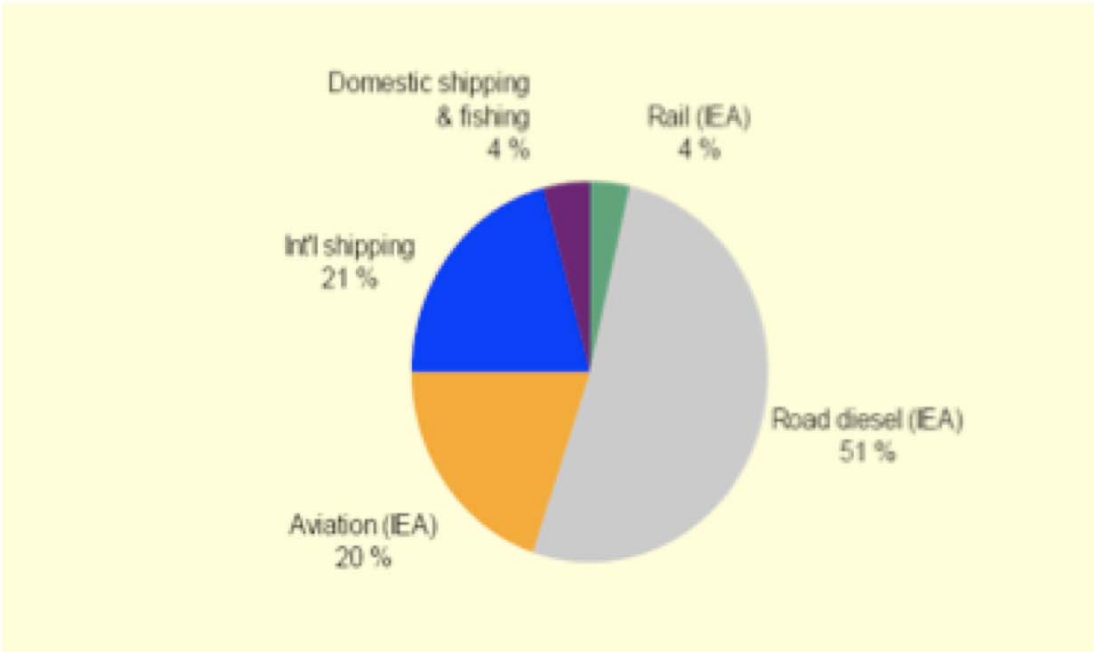


Data: International Shipping: This study. Other IEA. Reference year: 2005

MARINTEK SINTEF

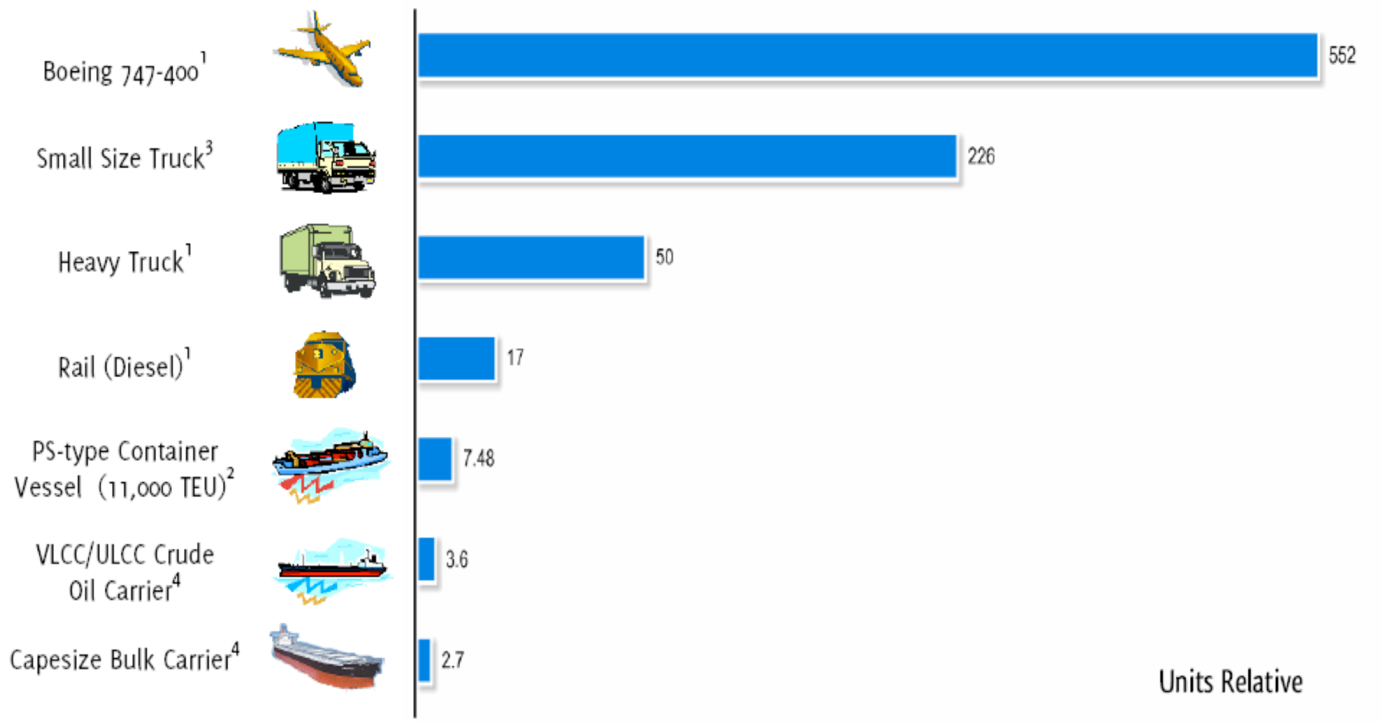
Comparison among modes

- Source: Marintek



COMPARISON OF CO_2 EMISSIONS AMONG TRANSPORT MODES

(grams per tonne-kilometer)



Sources:

1 Swedish Network for Transport and the Environment (NTM)
2 Maersk Line
3 Man B&W Diesel
4 National Technical University of Athens (NTUA)

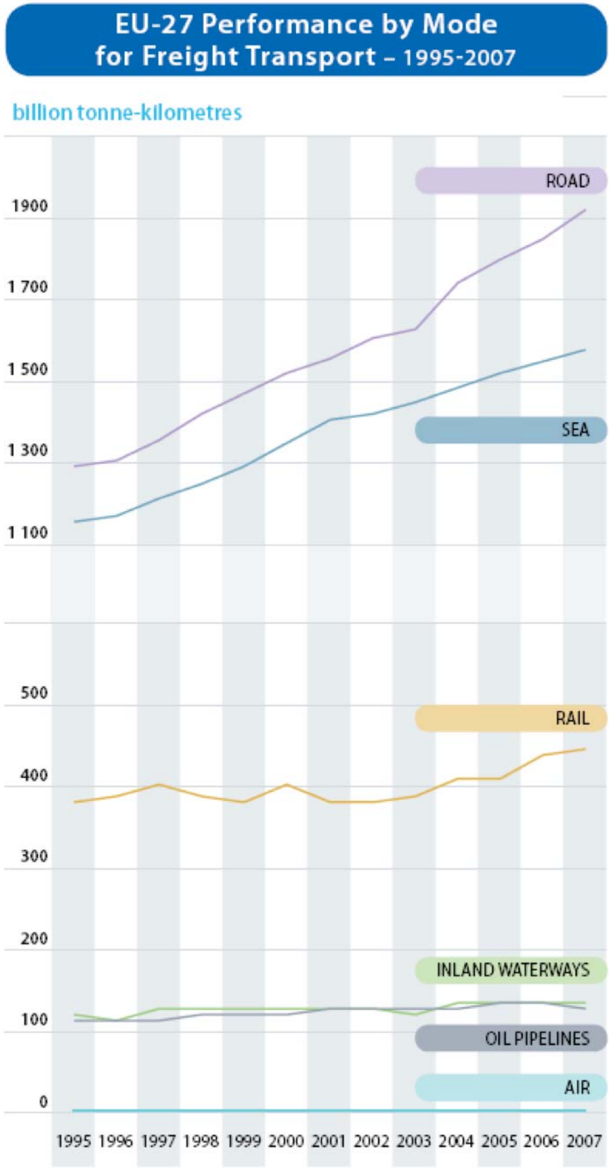
Produced by
NTUA Laboratory for Maritime Transport
www.martrans.org

Many stakeholders involved

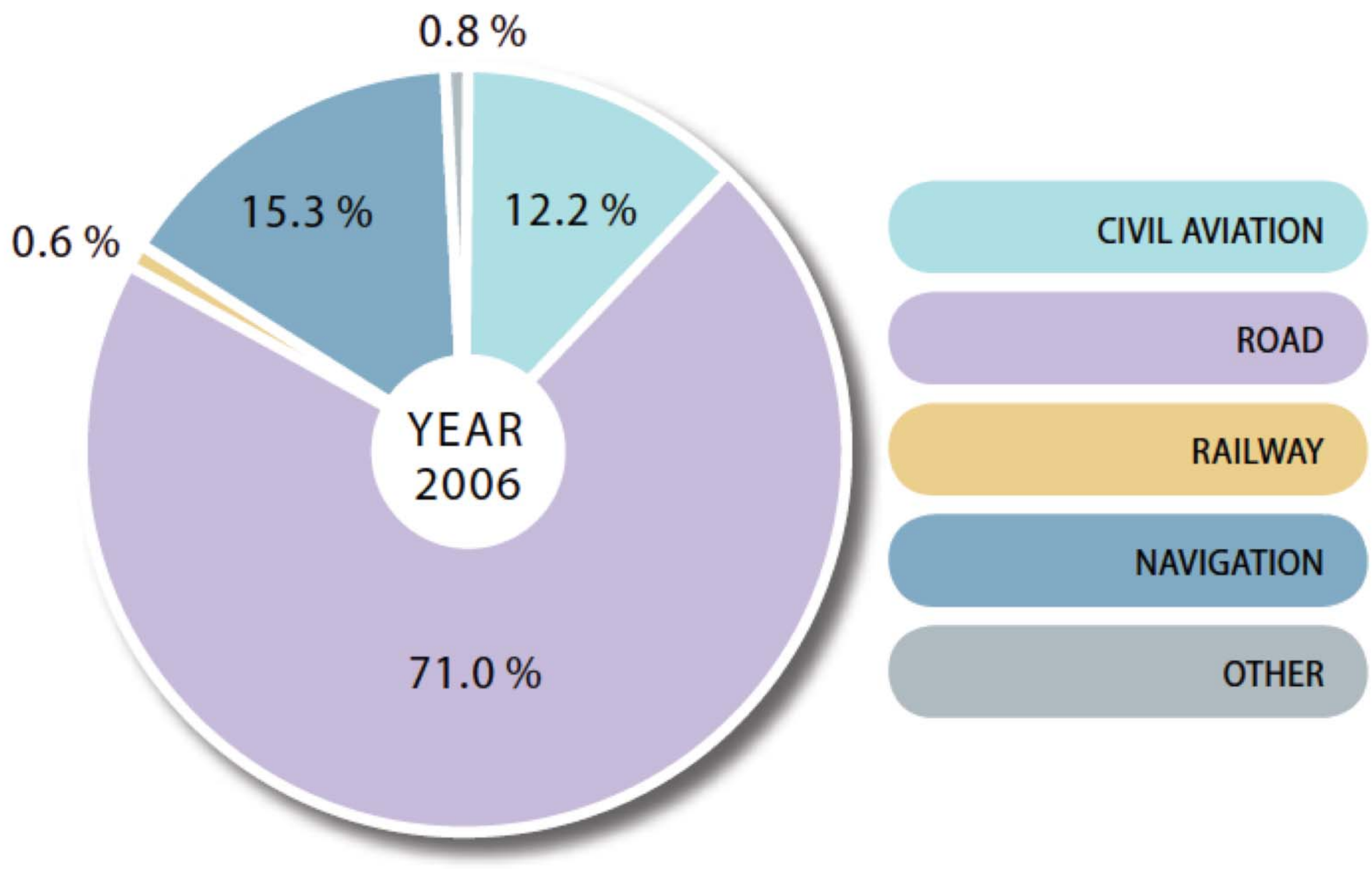
- transport operators
- terminal operators including ports
- infrastructure operators
- cargo owners (shippers)
- industry/consultants
- non Governmental Organisations (NGOs)
- environmental organisations
- authorities responsible for social and spatial planning
- R&D organisations and universities

EU surface modes growth

- Road
- Rail
- Sea
- Inland Navigation

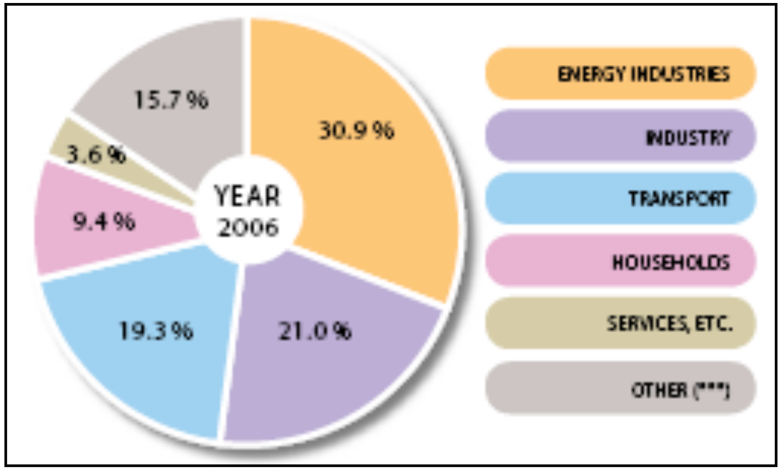


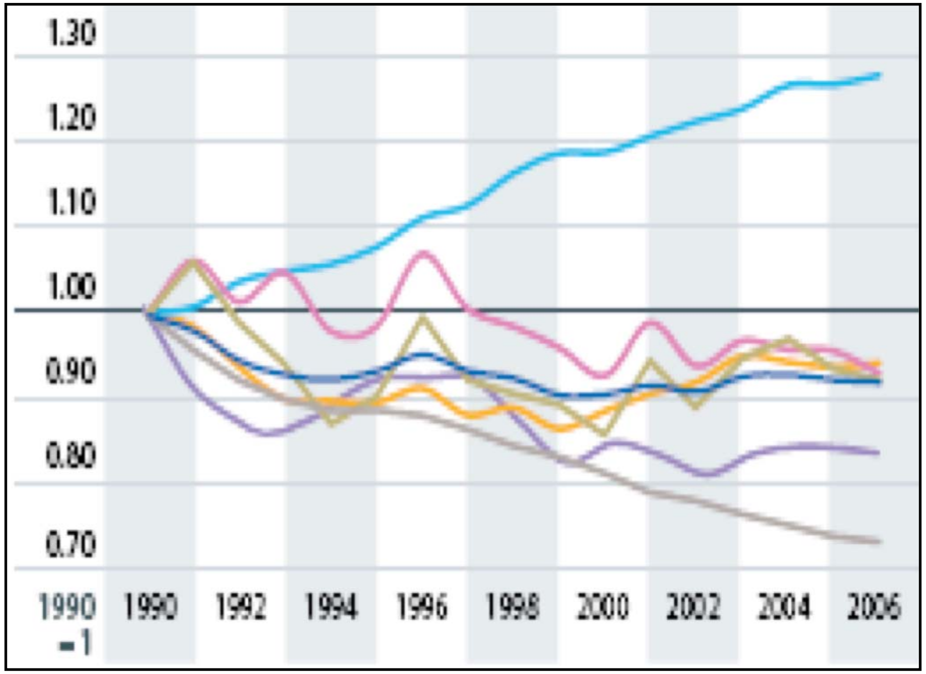
CO_2 emissions shares (source: Eurostat)



GHG emissions growth per sector

Source: European Commission (DG-MOVE)





In Europe:

Freight Transport Logistics Action Plan (2007)

- Green transport corridors for freight.
- Green Corridors should in all ways be environmentally friendly, safe and efficient.
- Emissions, internal as well as external costs should be considered.

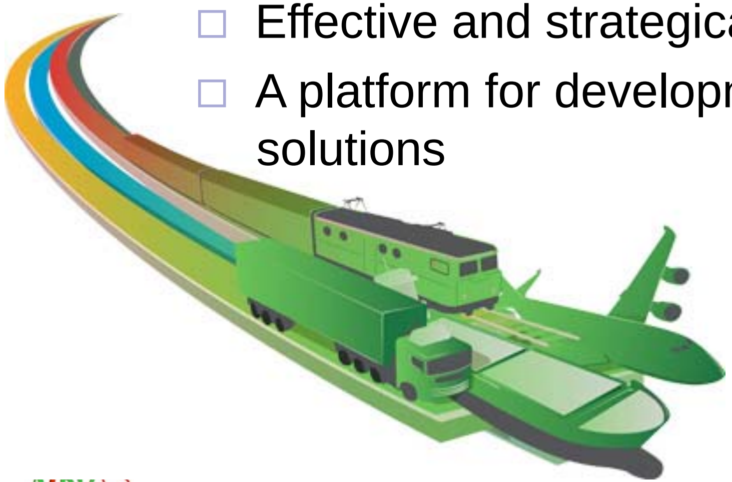
What is a green corridor?

EU Commission:

- Green Corridors are a European concept denoting long-distance freight transport corridors where advanced technology and co-modality are used to achieve energy efficiency and reduce environmental impact.

What is a green corridor?

- Definition by the Swedish Ministry:
  A green transport corridor is characterised by:
  - Sustainable logistic solutions
  - Integrated logistic concepts with utilisation of comodality
  - A harmonised system of rules
  - National/international goods traffic on long transport stretches
  - Effective and strategically placed transshipment points and infrastructure
  - A platform for development and demonstration of innovative logistic solutions



Measures contemplated

- Technological
  - More efficient (energy-saving) engines and propulsion
  - More efficient vehicle designs
  - Cleaner fuels (low sulphur content)
  - Alternative fuels (fuel cells, biofuels, etc)
  - Devices to trap exhaust emissions (scrubbers, etc)
  - Energy recuperation devices
  - "Cold ironing" in ports

- Market-based instruments
  - Emissions Trading Scheme (ETS)
  - Carbon Tax/Levy on Fuel
  - Others

- Logistics-based
  - Speed reduction
  - Optimized routing
  - Others


SkySails
BELUGA PROJECTS

Brenner corridor (Munich-Verona)

Energy from tunnels

Recovered heat from tunnels will be utilized from the villages, cities: green energy

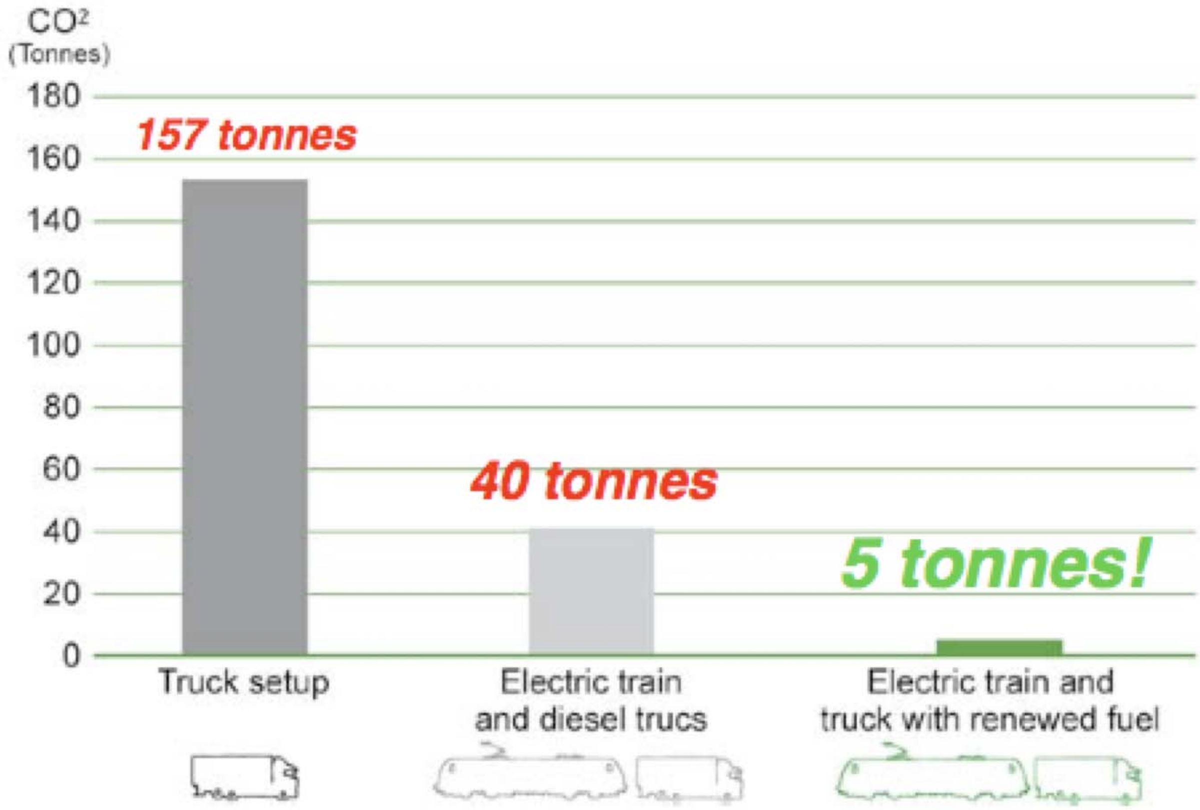
Inn-valley (Innsbruck – Kufstein): inner walls of tunnels: installing elements with thermal exchanging capacities: no additional cost

Periadriatic tectonic line from east - west: temperature gradient > 3,5°C/100m ⇒ deep geothermic

Pilot tunnel can be used afterwards for energy transport: 5 GW electrical line in gas-cooled 50 cm tube (research financed by DG TREN): low maintenance, no landscape disturbance)

Vehicle-fuel technologies

source: SCANIA



Indicative greening potential of some measures

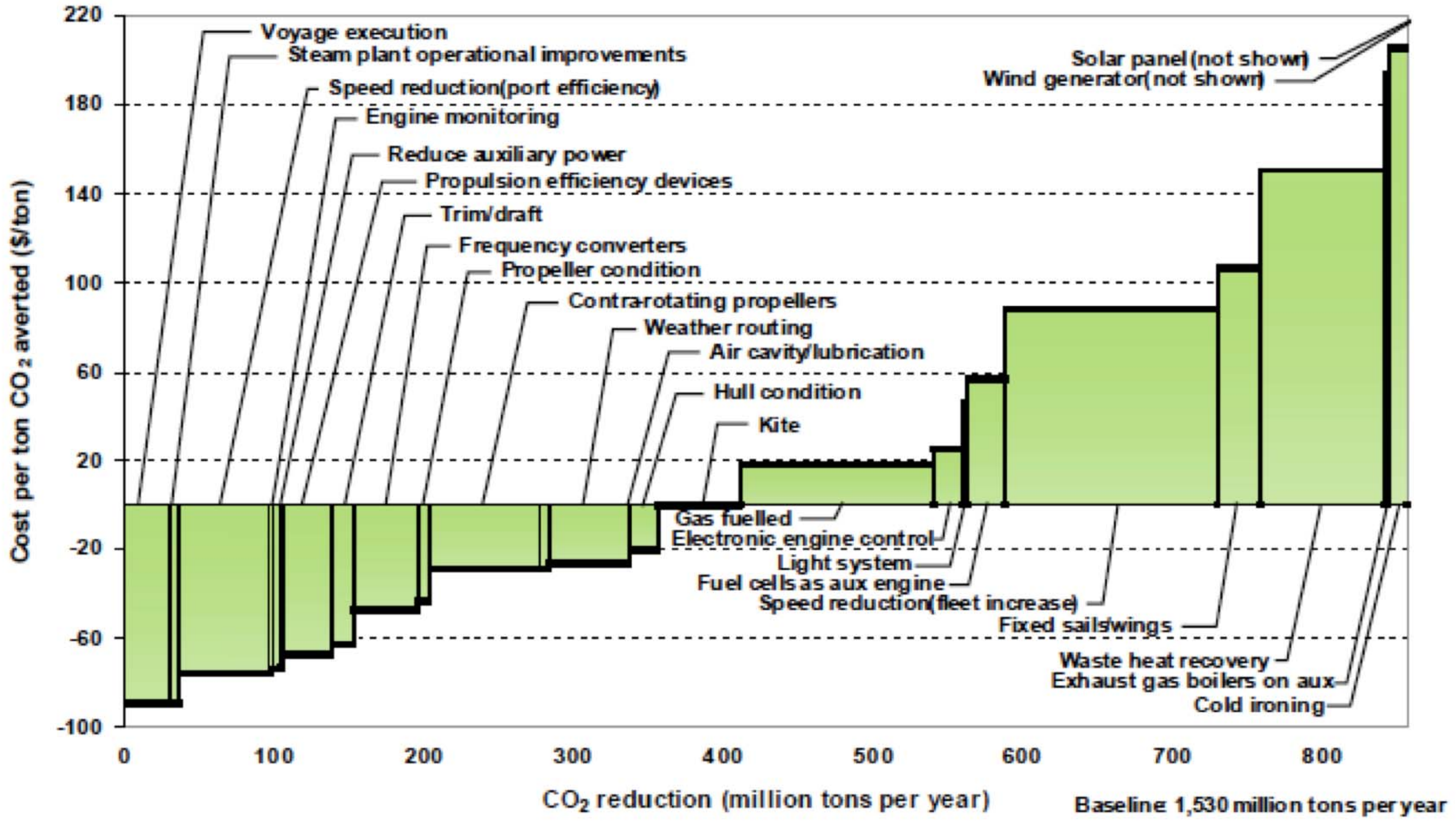
- Downsizing of passenger cars and traffic avoidance – major potential
- Hybridisation – up to 20-25%
- Fuel efficient driving – 10% (road, maritime)
- Improved traffic management through ICT – 10%
- Improved aerodynamics – 5%
- Electrification of rail – 20-40%
- Empty running and poor load factors – ??%
- Congestion charging and planning – ??%
- Weight and length of vehicles – ??%
- Modal shift – ??%

Source: *FreightVision*, *EU Transport Greenhouse Gases: Routes to 2050?, Future of Mobility Roadmap*, and *Supply Chain Decarbonization*

Marginal abatement costs

source: DNV

Figure 1 – Average abatement curves for world shipping fleet 2030



Green logistics problems

- Routing and scheduling
- Pickup and delivery
- Warehouse location
- Fleet deployment
- Fleet size and mix
- Optimal speed
- Weather routing
- Intermodal network design
- Modal split
- Transshipment
- Queueing
- Terminal management
- Berth allocation in ports
- Supply chain management
- Etc etc

- Optimize with respect to traditional criteria
- Optimize with respect to environmental criteria
- Optimize with respect to both environmental and traditional criteria
- Try to find 'win-win' solutions!

External costs of emissions

- Not faced by private operator
- Internalizing them would produce different solutions
- Market based measures aim to do that
  - Cap-and-trade
  - Carbon tax (levy)
  - Others

Kyoto Protocol

- United Nations Framework Convention on Climate Change -UNFCCC (1997)
- COP-15 Copenhagen 2009
- Urgent measures to reduce CO_2 emissions are necessary to curb the projected growth of GHGs worldwide
- Some transport modes thus far escaped being included in the Kyoto global emissions reduction target for CO_2 and other GHGs (mainly: shipping and aviation)
- Some regulation exists for SO_2, NO_x

Era of GHG non-regulation:

- Rapidly approaching its end!
- Measures to curb future CO_2 growth are being sought with a high sense of urgency.
- As CO_2 is the most prevalent of these GHGs, any set of measures to reduce the latter should primarily focus on CO_2.

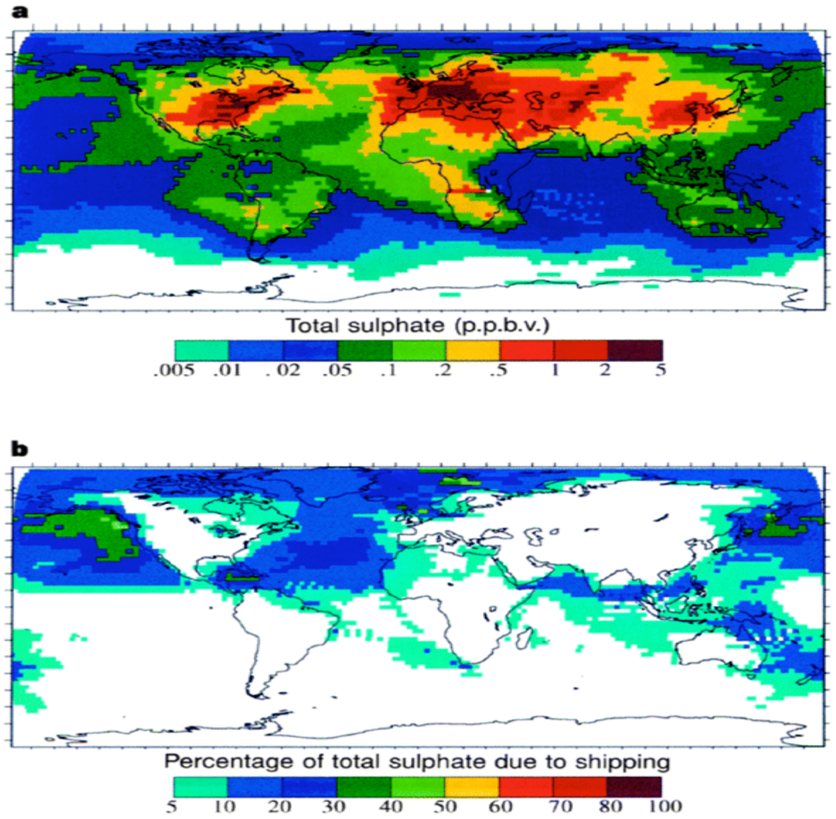
Next UNCCC

- Cancun, Mexico, Dec. 2010
- Serious disagreement still exists
  - Mainly between developed and developing nations
  - Concept of Common but Differentiated Responsibilities

Emissions literature: vast

R&D and studies on:

- Estimation of emissions
- Impact of emissions on world climate
- Technological means to reduce emissions



Emissions 101

- Q: If we burn a ton of fossil fuel (Heavy fuel oil, diesel, or other), how much CO2 is generated?

- A: Between 3.02 and 3.11 tons, depending on the fuel

Some difficulties are basic

- Most global emissions estimates are based on modelling
- Example: Even estimates of past marine bunker sales are difficult to make
- Not much on logistical dimension!

GHG marine emissions estimates

- IMO latest update of GHG study

Table 1: Consensus estimate 2007 CO_2 emissions (million tonnes CO_2). Source: Buhaug et al (2008)

	Low bound	Consensus estimate	High bound	Consensus estimate % Global CO_2 emissions
Total ship emissions[1]	854	**1019**	1224	3.3
International shipping[2]	685	**843**	1039	2.7

1 Activity based estimate including domestic shipping and fishing, but excluding military vessels.

2 Calculated by subtracting domestic emissions estimated from fuel statistics from the activity based total excluding fishing vessels.

Laboratory for Maritime Transport | SHIP EMISSIONS - LABORATORY F...

NATIONAL TECHNICAL UNIVERSITY OF ATHENS
LABORATORY FOR MARITIME TRANSPORT

Ship Emissions Calculator

VESSEL DETAILS

SELECT SHIP TYPE	Dry Bulk Carrier	SELECT SHIP SIZE	Handysize BC	Slow Speed Eng
ROUTE	Tubarao-Rotterdam	TRIP DISTANCE	4974 nm	9232 km
PAYLOAD (tonnes)	25000	DWT (tonnes)	27000	

OPERATIONAL DETAILS

STATE	TIME (days)	SPEED (knots)	FUEL OIL S %	FUEL OIL Consumption (tonnes/day)	DIESEL OIL S %	DIESEL OIL Consumption (tonnes/day)
SEA LADEN	15.94	13	3.5	24	1.5	0
SEA BALLAST	15.94	13	3.5	24	1.5	0
PORT (loading,discharging)	4		3.5	4.5	1.5	0

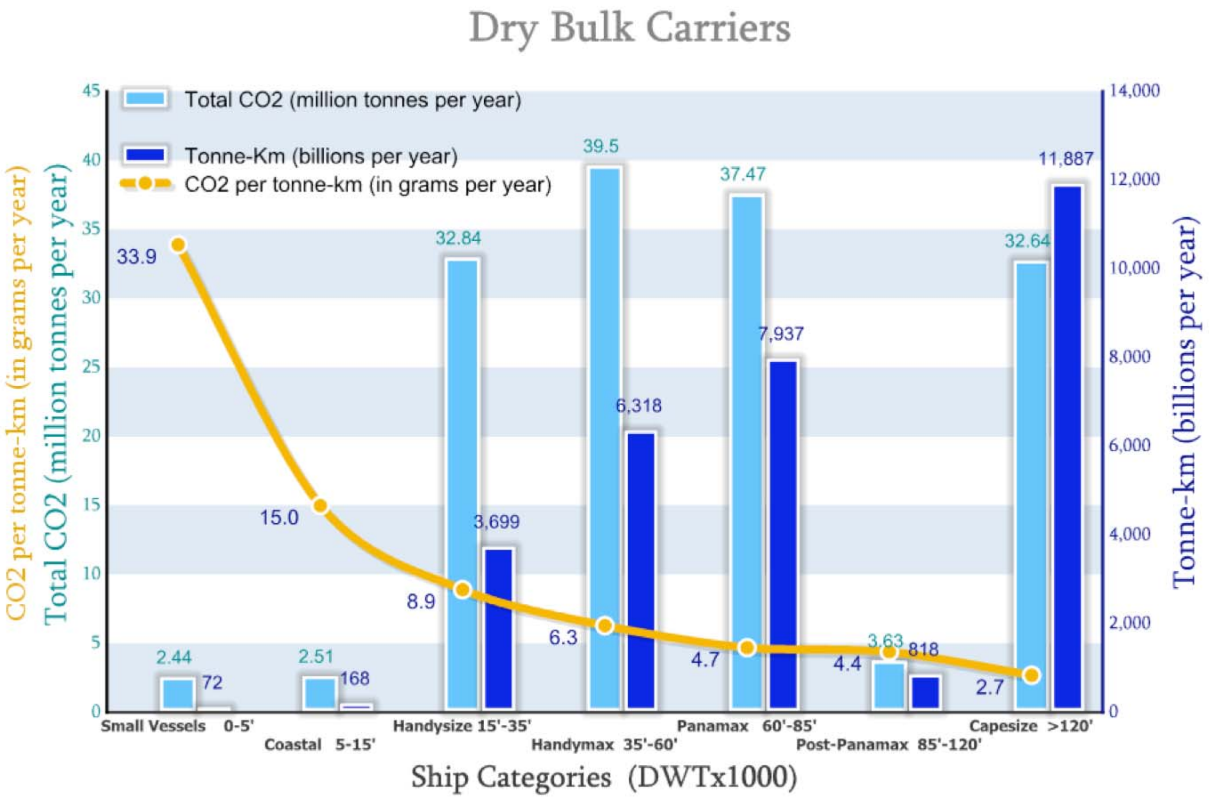
EMISSIONS

	CO2	SO2	NOx
ROUNDTRIP EMISSIONS KG PER tonne TRANSPORTED	99.31	2.19	2.73
ROUNDTRIP EMISSIONS GRAMS PER LADEN tonne-MILE	19.97	0.44	0.55
ROUNDTRIP EMISSIONS GRAMS PER LADEN tonne-KM	10.76	0.24	0.30

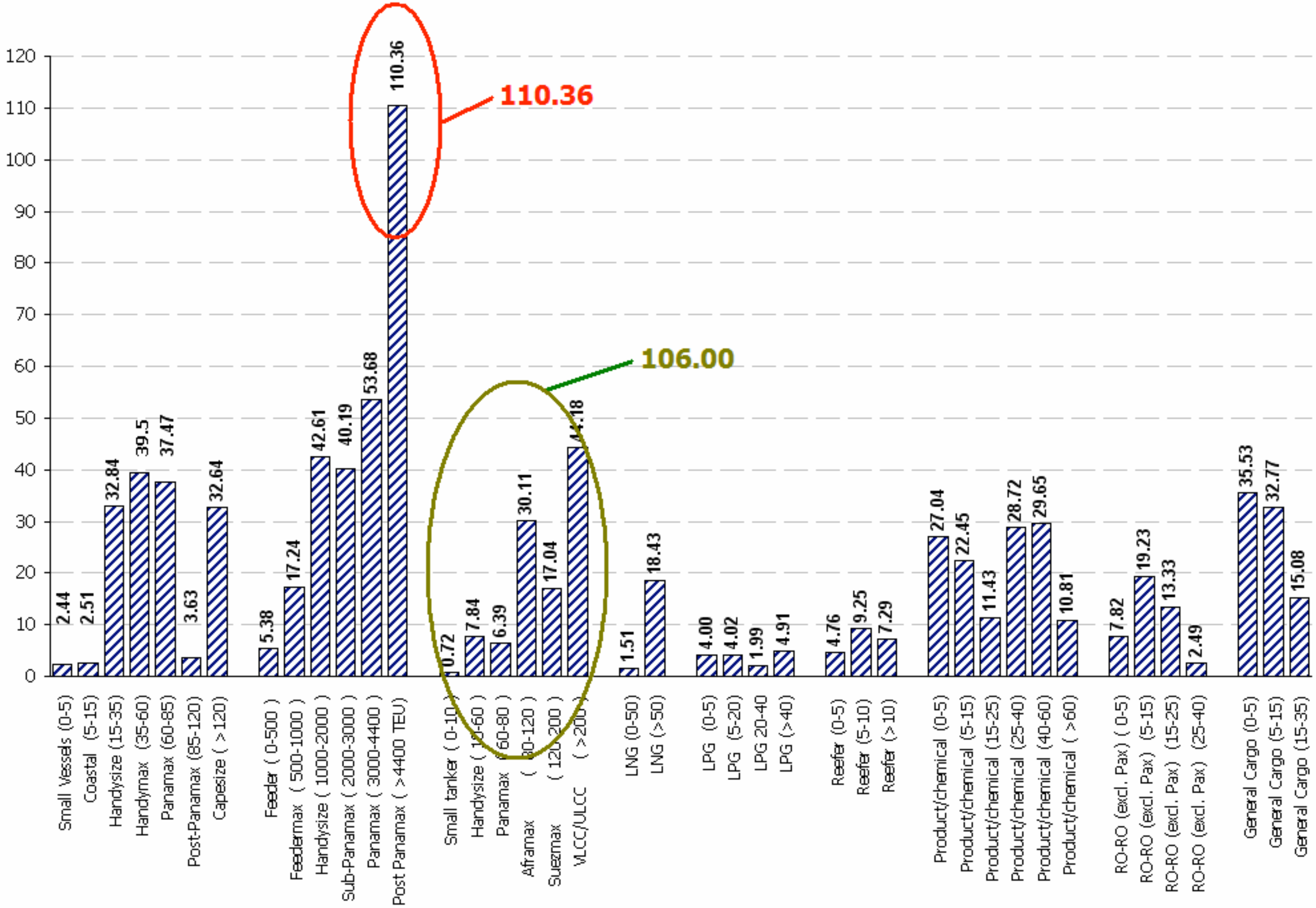
SHOW/HIDE DETAILED RESULTS | CALCULATE | HELP | ABOUT

DETAILED RESULTS

TOTAL BALLAST-LADEN DISTANCE		nm	9,948.00			
LADEN tonne-MILES		tonne*nm	124,350,000.00			
TIME IN PORT		days	4.00			
TRIP DURATION	SEA-LADEN	days	15.94	EMISSIONS		
TRIP DURATION	SEA-BALLAST	days	15.94	CO2	SO2	NOx
TOTAL RTRIP DURATION		days	35.88	tonnes	tonnes	tonnes
CONSUMPTION FO	SEA LADEN	tonnes	382.62	1,212.89	26.78	33.29
CONSUMPTION DO		tonnes	0.00	0.00	0.00	0.00


Dry Bulk Carriers
Total CO2 (million tonnes per year)
Tonne-Km (billions per year)
CO2 per tonne-km (in grams per year)
CO2 per tonne-km (in grams per year)
Total CO2 (million tonnes per year)
Tonne-km (billions per year)
45
40
35
30
25
20
15
10
5
0
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
33.9
15.0
8.9
6.3
4.7
4.4
2.7
2.44
72
2.51
168
32.84
3,699
39.5
6,318
37.47
7,937
3.63
818
32.64
11,887
Small Vessels 0-5'
Coastal 5-15'
Handysize 15'-35'
Handymax 35'-60'
Panamax 60'-85'
Post-Panamax 85'-120'
Capesize >120'
Ship Categories (DWTx1000)

CO2 emissions per vessel category (million tonnes)



Energy Efficiency Design Index (EEDI)

- Defined as

$$\frac{\left(\prod_{j=1}^{M} f_j\right)\left(\sum_{i=1}^{nME} P_{ME(i)} \cdot C_{FME(i)} \cdot SFC_{ME(i)}\right) + \left(P_{AE} \cdot C_{FAE} \cdot SFC_{AE} *\right) + \left(\left(\prod_{j=1}^{M} f_j \cdot \sum_{i=1}^{nPTI} P_{PTI(i)} - \sum_{i=1}^{neff} f_{eff(i)} \cdot P_{AEeff(i)}\right) C_{FAE} \cdot SFC_{AE}\right) - \left(\sum_{i=1}^{neff} f_{eff(i)} \cdot P_{eff(i)} \cdot C_{FME} \cdot SFC_{ME}\right)}{f_i \cdot Capacity \cdot V_{ref} \cdot f_w}$$

- Ratio of installed power divided by (capacity* speed) [gr CO2/ton-mile]

Logistics trade-offs

- Operational measures to reduce emissions may have ramifications as regards the logistical supply chain
- Measures such as speed reduction or others will generally entail costs, such as in-transit inventory and others (eg, bigger fleet to carry the same cargo).

Boomerang effect?

- Cleaner, low-sulphur fuel may make some modes of transport (and in particular short-sea shipping) more expensive and induce shippers to use land-based alternatives (mainly road)
- That might increase overall GHG emissions!
- [the Baltic is a prime example here]

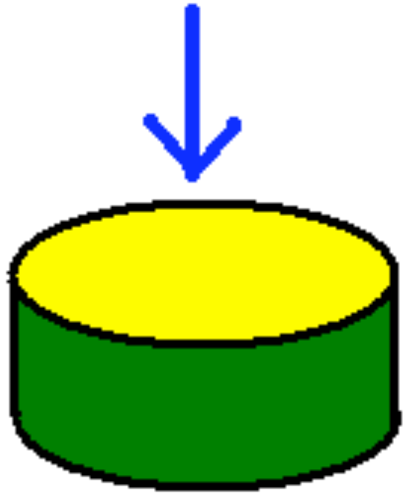
In search of WIN-WIN policies

- “Win-win” is a nice set of words

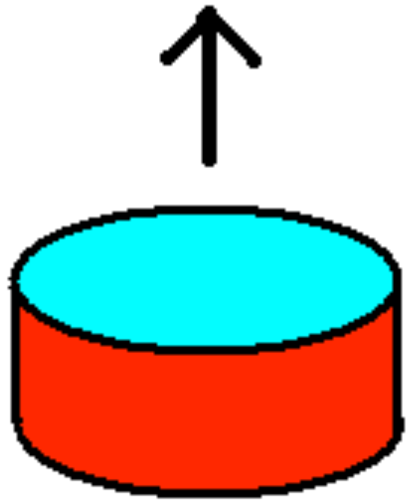
- Finding win-win solutions may not always be easy.

The ‘push-down, pop-up’ principle

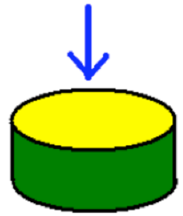
- If you push one button down,



- At least another one will pop up



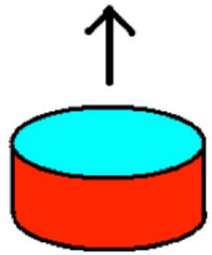
Button no. 1: speed reduction in maritime mode



- Big savings in fuel costs
- Means to reduce emissions
- Pick up slack in containership overcapacity

- Killing 3 birds with one stone?

‘Pop-up’ effects of speed reduction



Will need:

- Either more ships
- Or bigger ships
- Or both

To maintain same level of throughput

In-transit inventory costs

- Hauling cargo at a reduced speed will entail additional in-transit inventory costs for the shipper.
- Such inventory cost is incurred during the time the cargo is in transit, and is equal to a factor of IC ($/tonne/day), times the transit time, times the amount of cargo.
- IC =P*R/365, where P is the CIF price of the cargo, and R is the cargo owner's cost of capital.

Example (high-valued cargoes)

- Assume CIF = $20,000/tonne
- And R = 8%
- Each day of delay in the delivery of one tonne of that cargo incurs a cost of $4.38 to the shipper
- Total can be in the hundreds of millions of dollars

100 CONTAINERSHIPS GOING 21 KNOTS (case A)

- Transit time (one way) = 100 hrs = 4.17 days
- Round trip = 8.33 days
- Number of round trips per year (assuming 365 days operation): 43.8
- Tonnes carried each year (per ship): 43.8*50,000 = 2,190,000.
- Times 100 ships = 219,000,000.
- Total fuel burned/year/ship: 115 tonnes/day*365 = 41,975 tonnes
- Times 100 ships = 4,197,500 tonnes
- Total fuel cost (x$600) = $2,518,500,000.

105 SHIPS GOING 20 KNOTS (case B)

- Transit time (one way) = 105 hrs = 4.375 days
- Round trip = 8.75 days
- Number of round trips per year (assuming 365 days operation): 41.714
- Tonnes carried each year (per ship): 41.714*50,000 = 2,085,714.
- Times 105 ships = 219,000,000 tonnes.
- Total fuel burned/year/ship: 100 tonnes/day*365 = 36,259 tonnes
- Times 105 ships = 3,807,256 tonnes
- Total fuel cost (x$600) = $2,284,353,741, **REDUCED**.

A or B better?

- B reduces CO_2 emissions by 1,237,073 tonnes per year (versus A)
- Fuel cost difference: $128,299 per additional ship per day
- If sum of additional cargo inventory costs plus other additional operational costs of these ships (including the time charter) is less than $128,299 a day, then case B is overall cheaper.

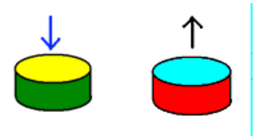
Case of expensive cargo, high fuel prices, high charter rates (2007)

- If P= \$20,000/tonne (CIF price of cargo)
- p=\$600/tonne (price of fuel)
- OC= \$20,000/day (charter rate for Panamax ship- 2007)
- Cost of capital = 8%
- Then Δ(inventory costs)= \$200,000,000/yr
- Δ(charter costs)=\$45,625,000/yr
- Then case B is more expensive!

Unit Value of the Top 20 Containerized Imports at Los Angeles and Long Beach Ports, 2004

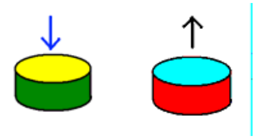
HS#	Category of Import	Value (Billions of dollars)	Weight (Thousands of short tons)	Unit Value (Thousands of dollars per ton)
84	Machinery, Boilers, Reactors, Parts	38.0	698.6	54.3
85	Electric Machinery, Sound and Television Equipment, Parts	31.7	677.0	46.8
87	Vehicles and Parts, Except Railway or Tramway	12.1	337.4	35.8
62	Apparel Articles and Accessories, Not Knit or Crochet	9.9	132.4	74.6
95	Toys, Games, and Sports Equipment and Parts	9.4	377.1	25.0
94	Furniture, Bedding, Lamps, Etc.	9.3	739.8	12.6
61	Apparel Articles and Accessories, Knit or Crochet	9.0	132.1	68.4
64	Footwear	7.8	181.4	43.0
39	Plastics and Articles Thereof	5.2	409.0	12.8
73	Articles of Iron or Steel	4.4	467.0	9.4
42	Leather Articles, Saddlery, Handbags	3.8	117.2	32.1
90	Optic, Photographic, and Medical Instruments	3.6	41.8	86.2

Another 'push down, pop up' effect:



- In the short run, freight rates will go up once the overall transport supply is reduced because of slower speeds
- This may help the market,
- but shippers will foot the bill!
- [this fact is seldom mentioned in any of the discussions on green policies].

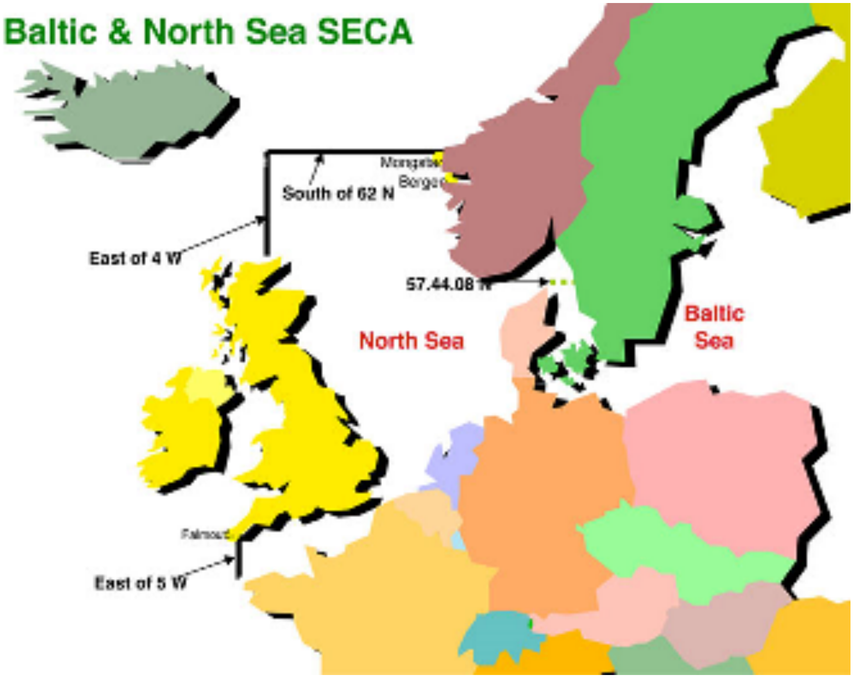
Yet another ‘push-down, pop-up’ situation:



- Slow down at SECAs
- Use cleaner fuel at SECAs
- [ramifications as regards other modes]

Sulphur Emissions Control Areas: SECAs

- SO2 reduction: high on IMO agenda
- Regional policies
- Big question: how to limit SO2 emissions
- Various measures (cleaner fuel, scrubbers)



SO_2

- Produces acid rain
- 1 ton of fuel produces 0.02*S tons of SO_2, where S is the % of sulphur content in fuel
- IMO: progressive reduction in SO_2 emissions from ships, with the global sulphur cap reduced initially to 3.50%, effective 1 January 2012; then progressively to 0.50%, effective 1 January 2020.

How about speed reduction?

- Can speed reduction at SECAs work, as a measure to reduce SO_2 emissions?
- Less speed, less fuel, less SO_2

- An easy question, for which the answer is not so easy.

Turns out that

- Speed reduction in SECAs will result in more total emissions (of all gases, including SO2) and more total fuel spent if speed is increased outside SECA to make up for lost time.
- The reduced emissions within the SECA will be more than offset by higher emissions outside (for all gases).
- The fuel bill will also be higher.

Use cleaner fuels in SECAs

- If a ship is forced to use low sulphur fuel at a SECA, to reduce SO_2 emissions.
- This fuel is more expensive than high sulphur fuel. Hence freight rates go up.
- This may induce shippers to use land transport alternatives (trucking), which will increase CO_2 emissions thru the logistics chain!

Use cleaner fuels in SECAs

Handymax Bulk Carrier W=45,000 tn

Ship (A->B)

V=14 Kn, 30 tn/day HFO
Fuel. Cons: 33.13 tonnes
CO2 : 105.01 tn of CO2
3,39 grams per tonKm

Truck

(w=40 tonnes v=60 km/h)
Fuel cons=43 lt per 100 Km

We need
1,125 truck trips
that produce
6 times more CO2
230 times more than
SO2 saved

Cargo that will shift to road depends on :

- the unit fuel costs of each of the two options (both for low-sulphur and for high-sulphur fuel)
- how the road option is exercised
  (e.g., it could be 1,125 trucks doing one trip each, a fleet of 563 trucks doing two trips each, or any other combination)
- the transit times of each of the two options
- the inventory costs of the cargo

How to find out?

- Develop a model that examines these tradeoffs.
- Use the concept of generalized cost (taking into account value of time) and multinomial logit model to determine modal split.

Tran-siberian railway example

TRANS EURASIA EXPRESS

Modal alternatives

- Ship (mainly)
- Rail

- (road)
- (air)

Scenario

Ships reduce speed due to higher fuel prices and fleet overcapacity

Result: Reduced CO_2

Side-effect: Potential cargo shifts

Trans-siberian railway cont'd

Far East to Europe by boat

- 43,000 km
- 7.8 gr CO_2/tkm at full speed
- Reduced in a quadratic fashion for lower speeds
- 150,000 tons of cargo at 60% of max. speed produce 18,000 tons of CO_2

Far East to Europe by rail

- 12,000 km
- Cargo arrives 26 days earlier
- Lower inventory costs
- 18 gr CO_2/tkm
- Various technological and institutional barriers
- 150,000 tons of cargo produce 32,000 tons of CO_2

How much cargo will be shifted?

Modal split model

2 modes, 1 and 2

- Lengths of routes L1, L2
- What happens if mode 1 reduces speed from V to V-ΔV?
- L1=40,000 km
- V=18 knots, reduced to 12.6 knots (by 30%)

Assume multinomial logit

$$x_i = \frac{e^{-\lambda C_i}}{e^{-\lambda C_1} + e^{-\lambda C_2}}$$

$$C_i = p_i + kt_i$$

New fraction

$$x_1^* = x_1 e^{-\lambda(p_1^* - p_1) + k\frac{L_1 \Delta V}{V(V - \Delta V)}}$$

Table 2
x_1^*/x_1 as a function of k and the price difference.

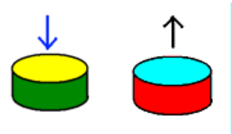
$k/(p_1^* - p_1)$	0	-$100/tonne	-$200/tonne
$2/day/tonne	0.958	1.059	1.170
$5/day/tonne	0.898	0.993	1.097
$10/day/tonne	0.807	0.892	0.986

Net result

- ΔCO_2 may be >0 or <0, depending on scenario
- Result unclear for more complex network scenarios
- Reducing CO_2 in one mode may result in more CO_2 overall

The role of ports

- No sense to have a ship burn a lot of fuel to go fast, only to have the ship wait in line to be served by a congested port.



- Yet, in the various discussions, this particular aspect has not received the attention it deserves.
- Ports are typically treated independently.
- Work at IAPH, ESPO, etc: significant

Port Equipment Emissions

CHE Emissions by Equipment Type for Container Terminal
(Source: POLB 2008, POLA 2009)

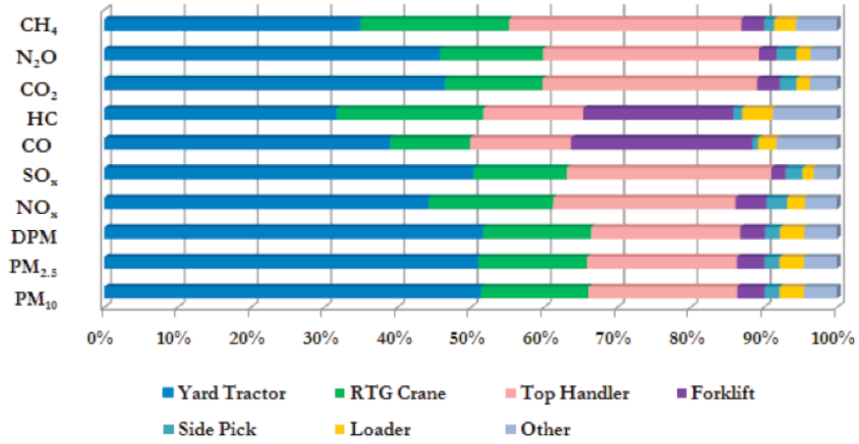
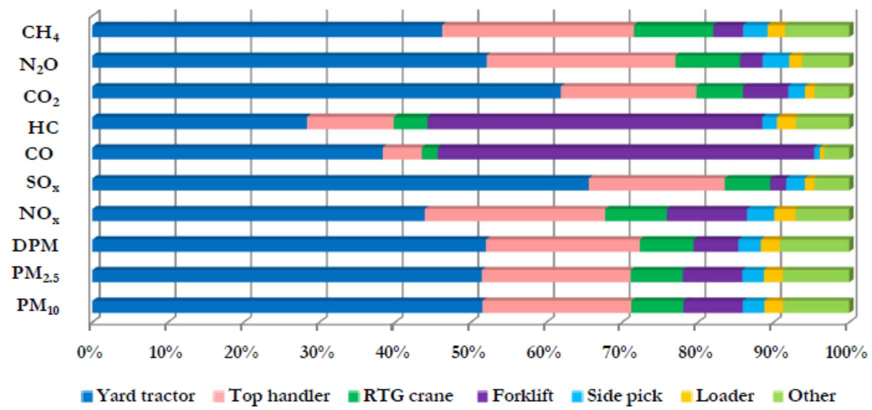


Figure 5.5: 2009 CHE Emissions by Equipment Type, %



Yard Tractors, Top Handlers, RTG Cranes, Forklifts and Side Pickers are the top polluters.

Yard tractors are the top emitters due to their huge population in a container terminal and their high average annual operating hours.

Top handlers are second in population and have also a high amount of operation time.

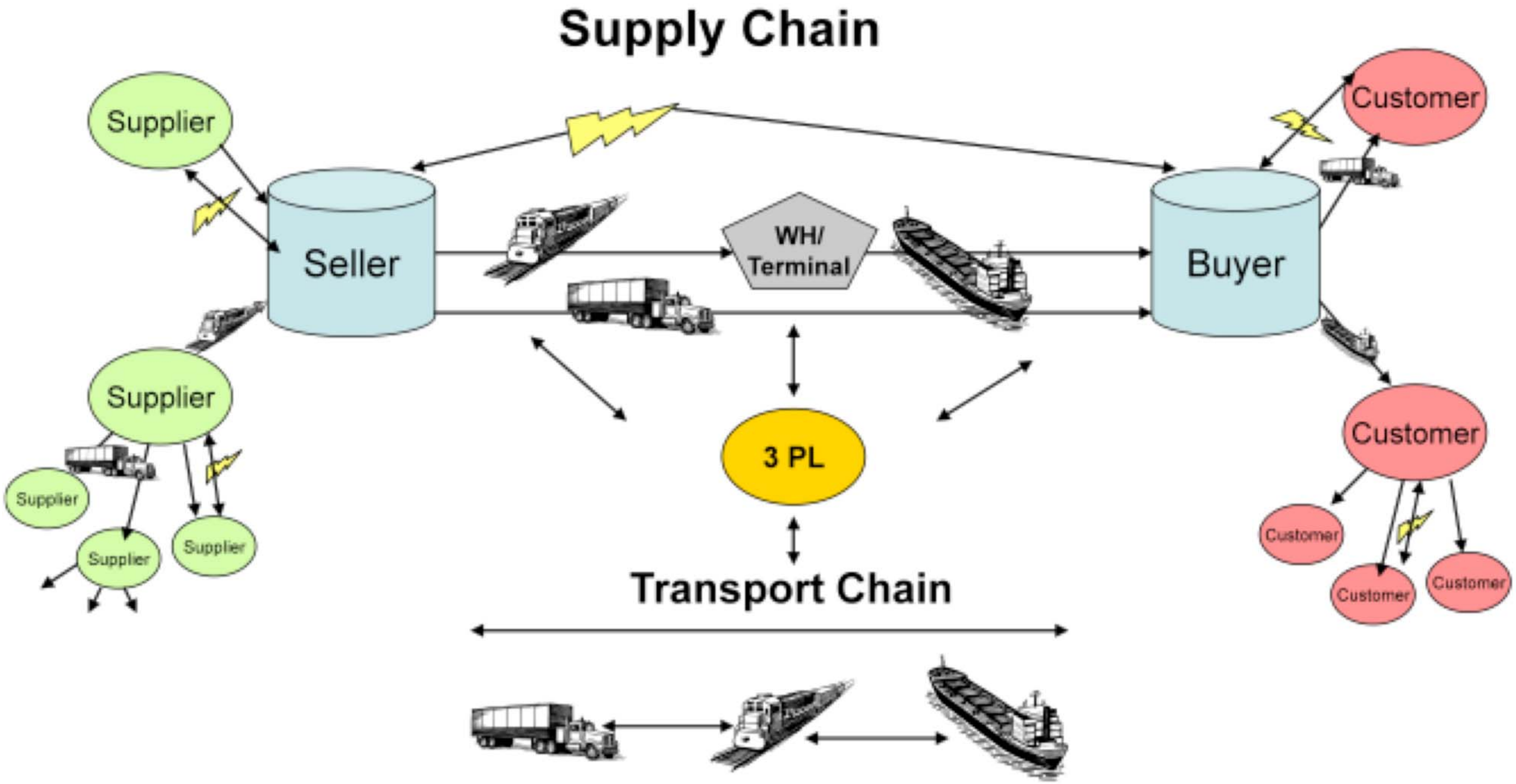
RTG cranes although are not that many, however they do have the highest nominal horsepower of all CHE.

Cold ironing

- provision of electricity to the ship by plugging into the port's electricity supply system
- Shut down auxiliary engines
- an idea that is likely to be the norm for many ports in the future

Questions

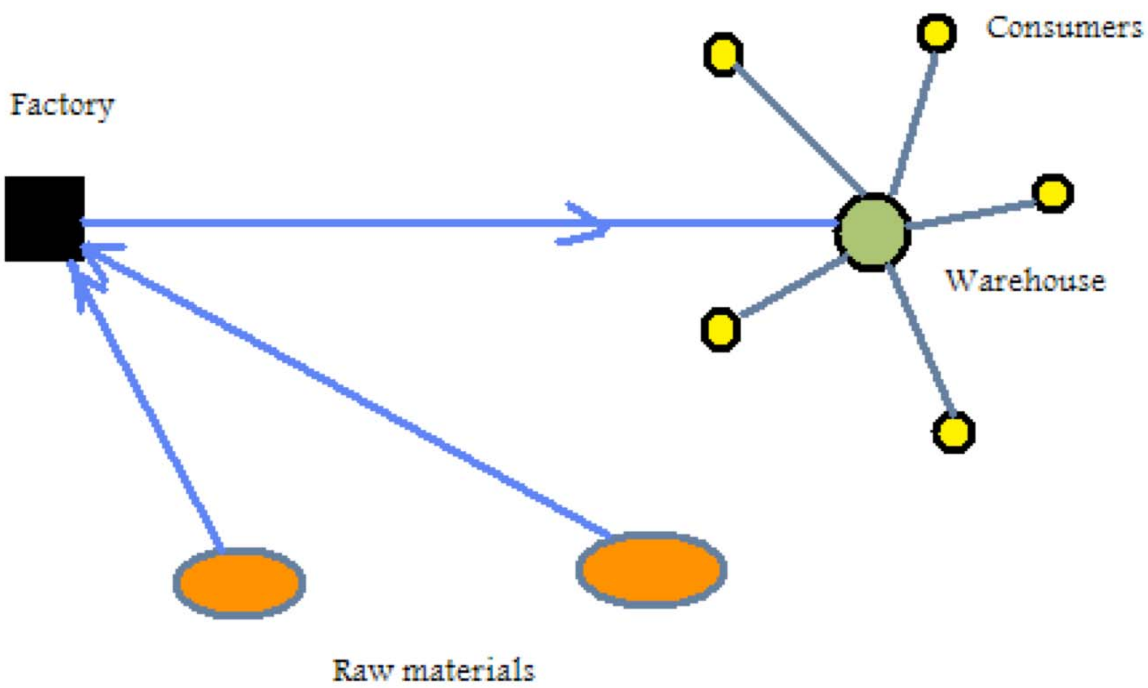
- How much air pollution will be produced by the generation of the extra shore electricity necessary for the cold ironing?
- Is that less than the emissions saved by switching off the ship's auxiliary power at port?



Part loads/Groupage: Line traffic - > terminals, consolidation, 3PL

Full loads/ FTL,FCL: Bulk, Tramp Traffic, Contracted containers/tankers/rail cars

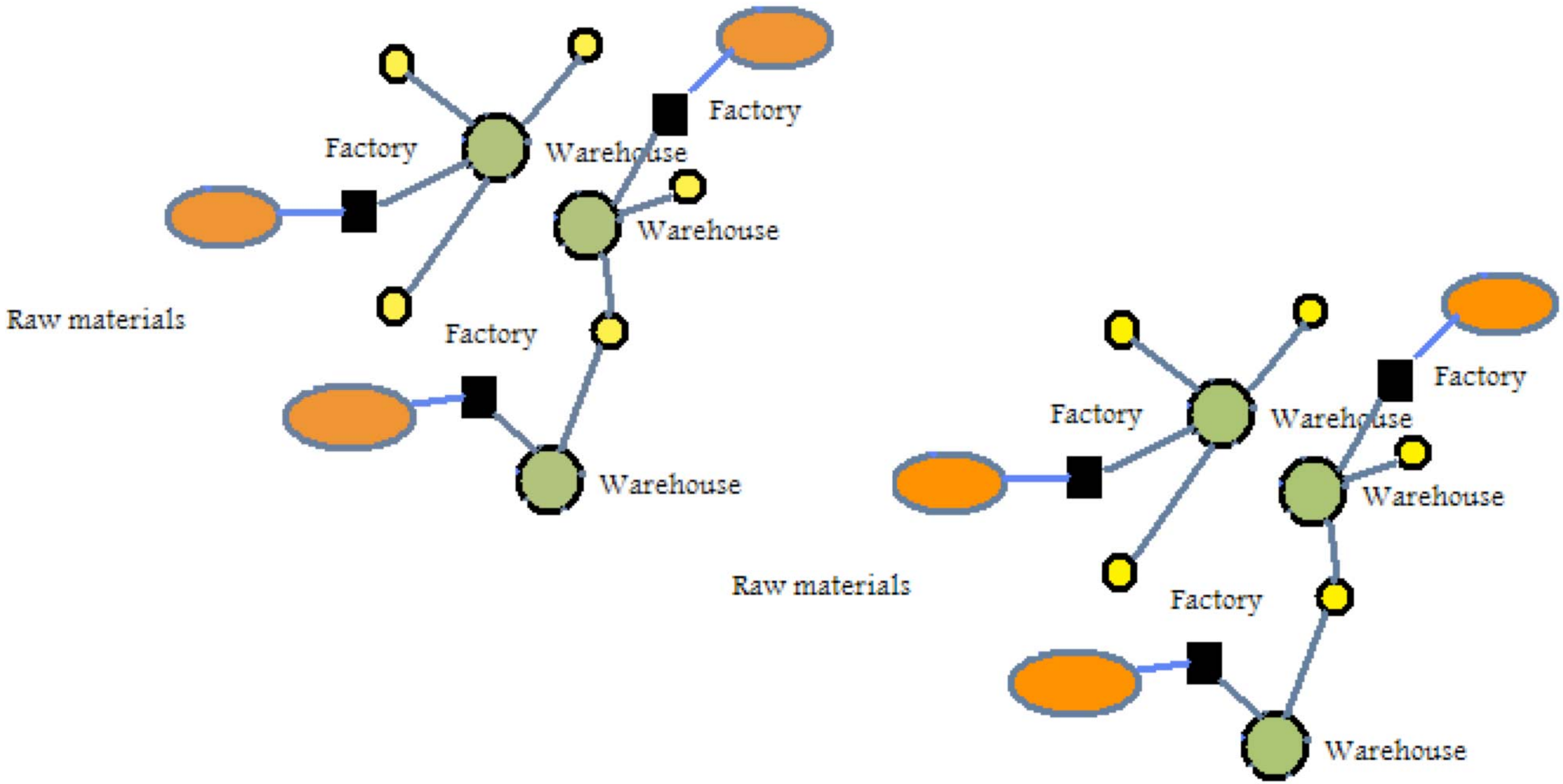
Which model?



- Long-haul model

Short haul model

(if cost of transport emissions is high enough)



Is this green enough?

- Globally, ruminant livestock produce about 80 million metric tons of CH_4 annually, accounting for about 28% of global CH_4 emissions from human-related activities

(source: US EPA)

Green corridors: great interest!

supergreen

The SuperGreen project

A new EU FP7 project

7th Framework Programme

- Theme title: Transport (including Aeronautics)
- Type of project: Coordination and Support Action
- Project full title: Supporting EU's Freight Transport Logistics Action Plan on Green Corridors Issues
- Project acronym: SuperGreen

Objectives

- ***Support and recommendations*** on Green Corridors to EU's Freight Transport Logistics Action Plan.
- ***Encourage co-modality*** for sustainable solutions.
- ***Overall benchmarking*** of Green Corridors based on selected KPIs covering all aspects related to transport operations and infrastructure (emissions, internal and external costs).
- Conduct a programme of ***networking activities between stakeholders*** to facilitate information exchange, dissemination of research results and communication of best practises and technologies.

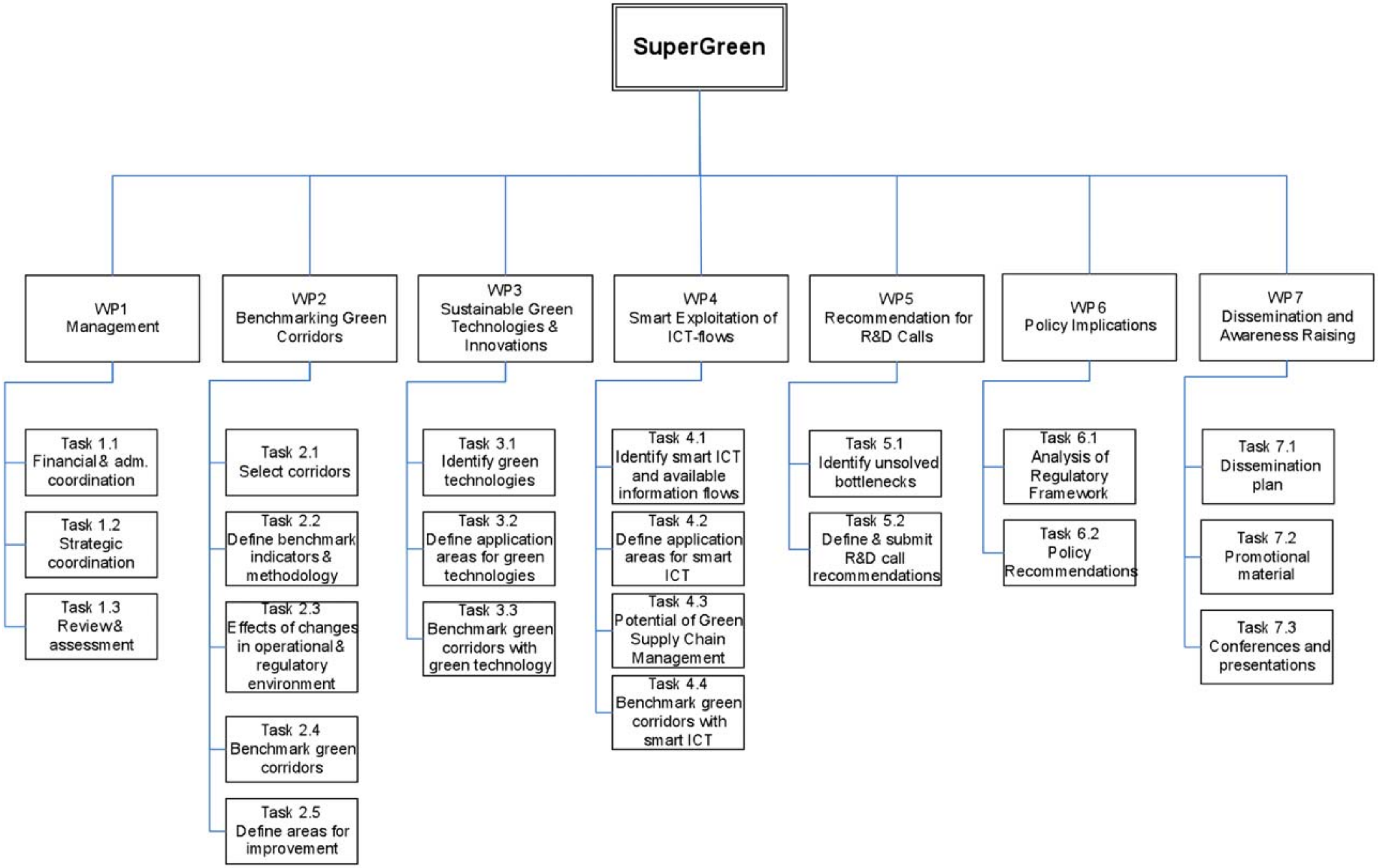
Objectives, contd.

- ***Deliver studies*** addressing topics important for the further development of Green Corridors.
- ***Deliver policy recommendations*** at a European level for the further development of Green Corridors.
- Provide ***recommendations concerning new calls for R&D*** proposals to support development of Green Corridors
(eliminate bottlenecks).

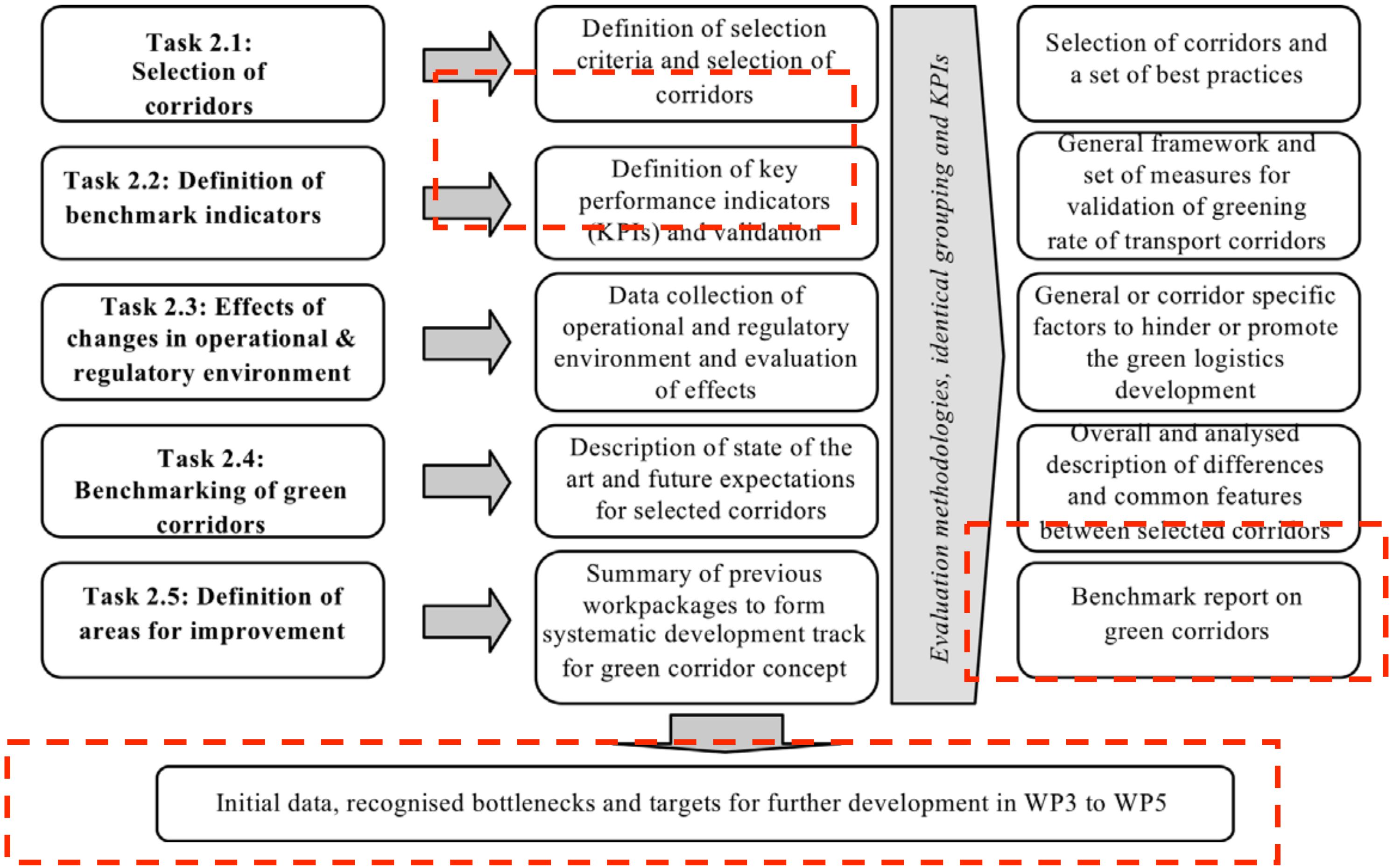
The consortium

Partner Number *	Partner name	Partner short name	Country
1 (Coordinator)	National Technical University of Athens	NTUA	Greece
2	Norsk Marinteknisk Forskningsinstitutt AS, MARINTEK	MAR	Norway
3	Sito Ltd (Finnish Consulting Engineers Ltd)	SITO	Finland
4	D'Appolonia S.p.A.	DAPP	Italy
5	Autoridad Portuaria de Gijon Gijón Port Authority-	PAG	Spain
6	DNV Det norske Veritas	DNV	Norway
7	via donau Österreichische Wasserstraßen-Gesellschaft mbH	VIA	Austria
8	NewRail - Newcastle University	UNEW	UK
9	CONSULTRANS	CONS	Spain
10	PSA Sines	PSAS	Portugal
11	Finnish Transport Agency	FMA	Finland
12	Straightway Finland Ry	SWAY	Finland
13	SNCF Fret Italia	SFI	Italy
14	Procter & Gamble Eurocor	PG	Belgium
15	VR Group	VRG	Finland
16	Lloyd's Register-Fairplay Research	LRFR	Sweden
17	Hellenic Shortsea Shipowners Association	HSSA	Greece
18	Dortmund University of Technology	DUT	Germany
19	TES Consult Ltd	TES	Ukraine
20	Turkish State Railways	TCDD	Turkey
21	DB Schenker AG	SCH	Germany
22	Norwegian Public Road Administration	NPRA	Norway

SuperGreen work package structure



WP2: benchmarking green corridors



Preselection Process

1. Each corridor scored for each criterion of the following list on the basis of a score range from 1 to 5

2. The scores of a corridor against all criteria were summed to form the total score of this corridor (equal weights)

3. Corridors inside each geographical area were ranked based on their scores

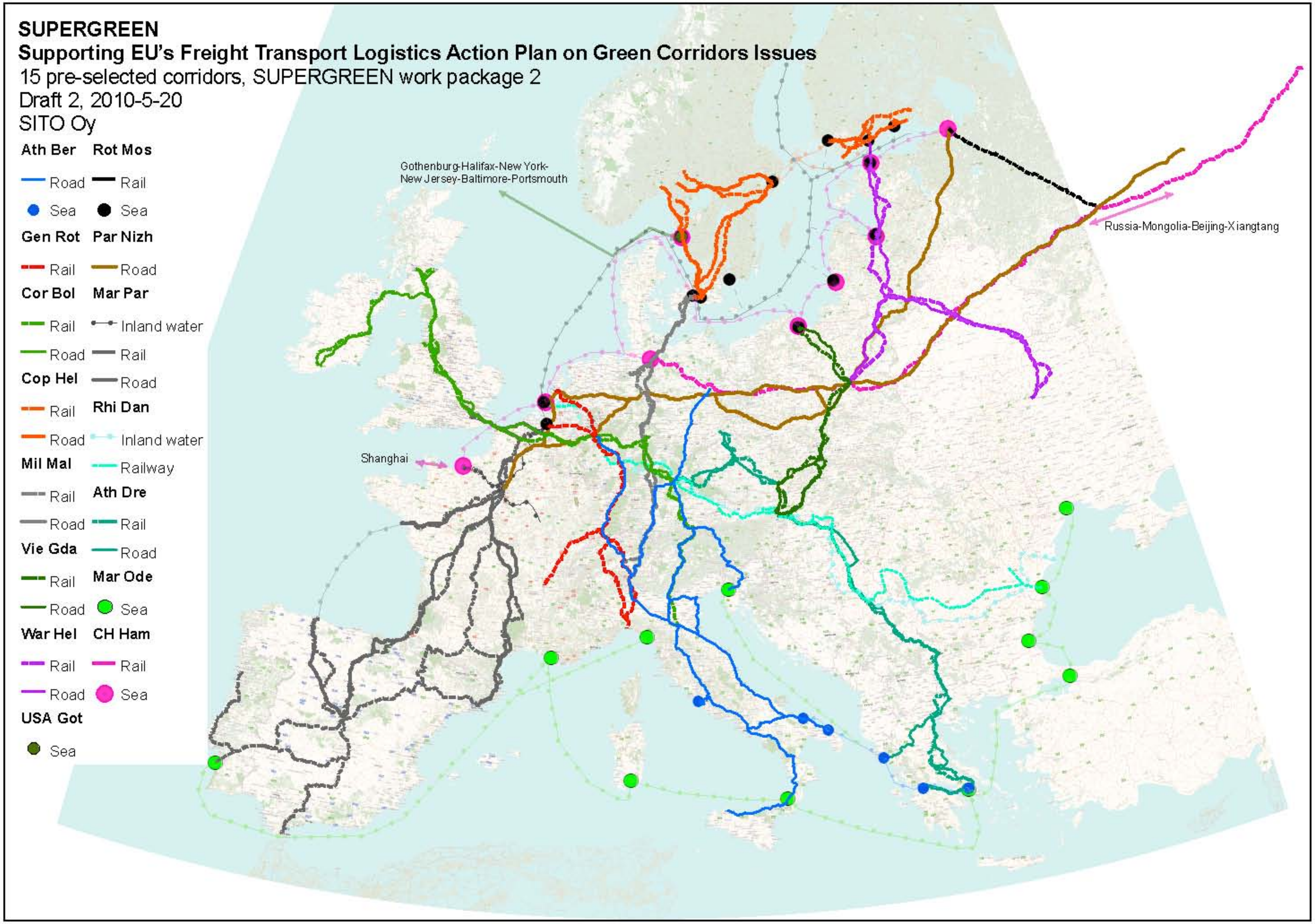
4. The corridor exhibiting the highest score in each geographical area was pre – selected (9 corridors)

5. Following a final round of consolidation among the remaining corridors, six more were added in a way ensuring modal balance

PRE – SELECTION OF 15 CORRIDORS

Pre-selected 15 corridors

BerPal	Berlin-Munich-Salzburg-Verona/Milan-Bologna-Naples-Messina-Palermo, Branch A: Salzburg-Villach-Trieste (Tauern axis) Branch B: Bologna-Ancona/Bari/Brindisi-Igoumenitsa/Patras-Athens
MadPar	Madrid-Gijon-Saint Nazaire-Paris Branch A: Madrid-Lisboa
GenRot	Lyons/Genoa-Basle-Duisburg-Rotterdam/Antwerpen
CorBol	Cork-Dublin-Belfast-Stranraer Branch A: Munchen-Friedewald-Nuneaton Branch B: West Coast Main line
CopHel	Nordic triangle railway/road axis including the Oresund fixed link
MilMal	Malmö-Milan via Fehmarnbelt
VieGda	Gdansk-Warsaw-Brno/Bratislava-Vienna
WarHel	Warsaw-Kaunas-Riga-Tallinn-Helsinki + extension Kaunas-Minsk-Kiev
RotMos	Motorway of Baltic sea, St. Petersburg-Moscow
ParNizh	Berlin-Warsaw-Minsk-Moscow-Nizhny Novgorod Branch A: Warsaw-Lodz-Paris Branch B: Mechelen-Rotterdam-Amsterdam-Hanover-Warsaw-St. Petersburg-Moscow
RhiDan	Rhine/Meuse-Main-Danube inland waterway axis Branch: Betuwe line
AthDre	Igoumenitsa/Patras-Athens-Sofia-Budapest-Vienna-Prague-Nurnberg/Dresden
SinOde	Odessa-Constanta-Bourgas-Istanbul-Piraeus-Gioia Tauro-Cagliari-La Spezia-Marseille-(Barcelona/Valncia)-Sines Branch: Piraeus-Trieste
CNHam	Shanghai-Le Havre/Rotterdam-Hamburg/Gothenburg-Gdansk-Baltic ports-Russia Branch:Xiangtang-Beijing-Mongolia-Russia-Belarus-Poland-Hamburg
USAGot	Gothenburg-Halifax-New York-New Jersey-Baltimore-Portsmouth


SUPERGREEN
Supporting EU's Freight Transport Logistics Action Plan on Green Corridors Issues
15 pre-selected corridors, SUPERGREEN work package 2
Draft 2, 2010-5-20
SITO Oy
Ath Ber
Road
Sea
Gen Rot
Rail
Cor Bol
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Cop Hel
Rail
Road
Mil Mal
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Road
Vie Gda
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War Hel
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Road
Mar Par
Inland water
Rail
Road
Rhi Dan
Inland water
Railway
Ath Dre
Rail
Road
Mar Ode
Sea
CH Ham
Rail
Sea
Gothenburg-Halifax-New York-New Jersey-Baltimore-Portsmouth
Russia-Mongolia-Beijing-Xiangtang
Shanghai

9 selected corridors (Helsinki workshop, June 2010)

BRIEF DESCRIPTION- BRANCHES	NICKNAME
Malmö-Trelleborg-Rostock/Sassnitz- Berlin-Munich-Salzburg-Verona-Bologna-Naples-Messina-Palermo Branch A: Salzburg-Villach-Trieste (Tauern axis) Branch B: Bologna-Ancona/Bari/Brindisi-Igoumenitsa/Patras-Athens	Brenner
Madrid-Gijon-Saint Nazaire-Paris Branch A: Madrid-Lisboa	Finis Terrae
Cork-Dublin-Belfast-Stranraer Branch A: Munich-Friedewald-Nuneaton Branch B: West Coast Main line	Cloverleaf
Helsinki-Turku-Stockholm-Oslo-Göteborg-Malmö-Copenhagen (Nordic triangle including the Oresund fixed link)- Fehmarnbelt - Milan - Genoa	Edelweiss
Motorway of Baltic sea Branch: St. Petersburg-Moscow-Minsk-Klapeida	Nureyeev
Rhine/Meuse-Main-Danube inland waterway axis Branch A: Betuwe line Branch B: Frankfurt-Paris	Strauss
Igoumenitsa/Patras-Athens-Sofia-Budapest-Vienna-Prague-Nurnberg/Dresden-Hamburg	Two Seas
Odessa-Constanta-Bourgas-Istanbul-Piraeus-Gioia Tauro-Cagliari-La Spezia-Marseille-Barcelona-Valencia-Sines Branch A: Valencia-Marseille-Lyons Branch B: Piraeus-Trieste	Mare Nostrum
Shanghai-Le Havre/Rotterdam-Hamburg/Göteborg-Gdansk-Baltic ports-Russia Branch:Xiangtang-Beijing-Mongolia-Russia-Belarus-Poland-Hamburg	Silk Way

Main groups of KPIs

- Economy/efficiency
- Service quality
- Environmental sustainability
- Infrastructure sufficiency
- Social issues

KPI Area: Economy/Efficiency

- Relative Costs Measured in € per tonkm
- Absolute Costs Measured in € per ton (m^3)

Service/ Quality KPIs

- Total transport time
  - either in total hours or days,
  - or the average km/hr between origin and destination
- Reliability/“time precision”
  - Percentage delivered on time
  - On time; within X minutes/hours (expected vs actual)
  - Redundancy- resiliency
- ICT applications (e.g. to track cargo)
  - Degree of availability
- Frequency of service
  - No of services per day /week
- Cargo Security (damage due to crimes/unlawful acts)
  - Insurance cost
  - Incident rate
- Cargo Safety (incidents/accidents harming goods)
  - Insurance cost
  - Incident rate

Environmental sustainability KPIs

- Greenhouse gases - global
  - KPI: Grams of CO_2 equivalent pr tonkm
- Polluters - local & regional effects
  - KPI: Grams emissions per tonkm
    - NO_X
    - SO_X
    - $PM_{2,5}$

Infrastructure sufficiency KPIs

- Congestion
  - average delay in minutes/hours
  - value of time lost/marginal social cost in € per tonkm
- Bottlenecks
  - Number per type and seriousness
  - Latest report: TEN-T conference in Zaragoza

Social issues KPIs

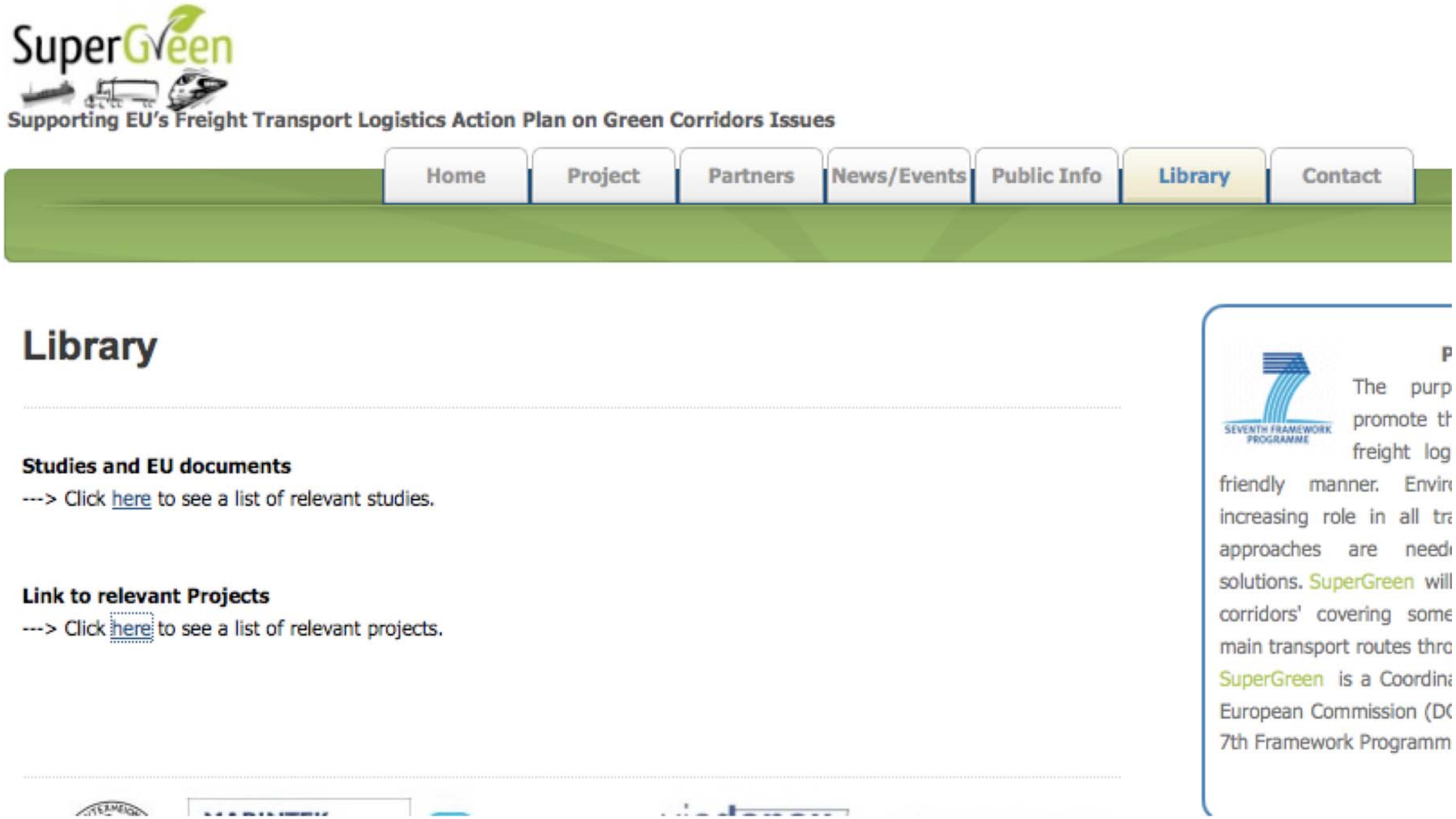
- Population affected
- Safety
  - Number of accidents or fatalities
- Noise
  - Percentage of stretch where noise level is <50 dB/ <55dB (trains)
- Corridor description in terms of land used in percentage of the entire stretch that passes through different areas:
  - Natural sensitive areas
  - Areas with endangered species (“frog factor”)
  - Urban areas
  - Inter urban areas

Get connected

- www.supergreenproject.eu

- Send an email to
  supergreen@martrans.org
  (SuperGreen friends email list: keeping track of the project)

Library section of site



Links to projects

SuperGreen

Supporting EU's Freight Transport Logistics Action Plan on Green Corridors Issues

Home | Project | Partners | News/Events | Public Info

Library/Projects

ALL MODES / LOGISTICS

BELOGIC: Improve the quality and efficiency within and across different modes of transport, by means of benchmarking in logistics and co-modality

BESTLOG: Establish an exchange platform for the improvement of supply chain management practice across Europe

BRAVO: Develop and demonstrate an action strategy on intermodal rail-road transport services comprising major scientific and technological as well as pragmatic activities along the Brenner corridor

CAESAR: CA for the European Strategic Agenda of Research on Intermodalism and Logistics

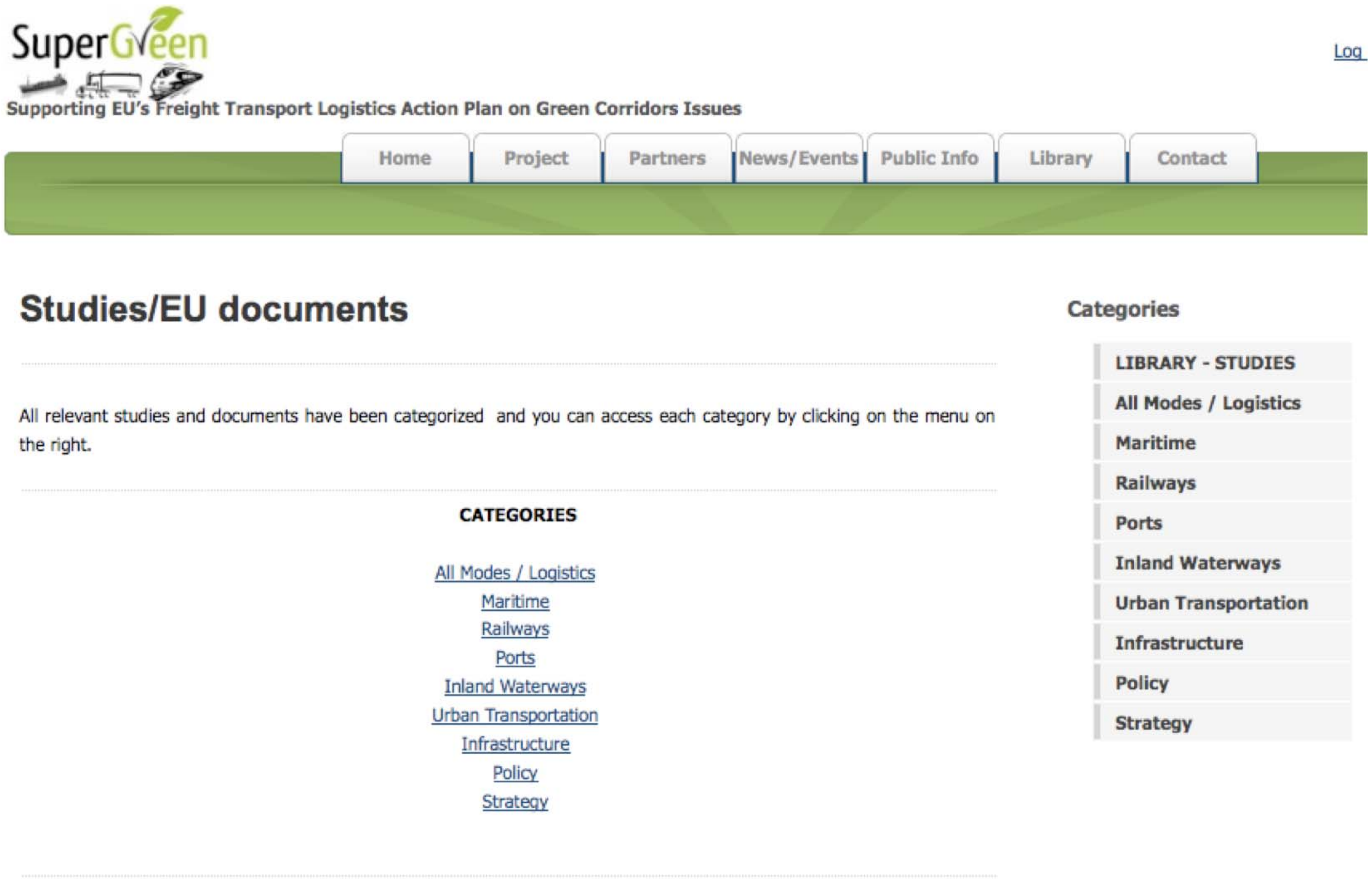
CHINOS: Support transport operators by employing innovative IT technology solutions

DE-LIGHT TRANSPORT: Develop new solutions, methods and tools for the design, production and integration of complex modular lightweight structures in ships, intermodal transport containers and railway vehicles

e-FREIGHT: Denotes the vision of a paper-free, electronic flow of information associating the physical flow of goods with a paperless trail built by ICT, including the ability to track and trace freight along its journey across transport modes and to automate the exchange of content-related data for regulatory or commercial purposes.

EU TRANSPORT GHG: ROUTES TO 2050?: Take a first step in developing a long-term strategic approach to ensuring the compatibility of transport's GHG emissions with the EU's long-term climate goals.

Links to studies/EU docs



First Regional SuperGreen Workshop
Naples, Italy, October 19, 2010

REGISTRATION FORM

IMPORTANT NOTE: Advance registration to the workshop is necessary due to limited space. Registrations will be processed on a first-come, first-served basis. Confirmation will be sent to you by email.

Pre-registration deadline: October 8, 2010.

PLEASE SEND THIS FORM BY EMAIL TO Francesca Russolillo at Francesca.russolillo@cis.it

NAME ____

COMPANY ____

PHONE ____

FAX ____

EMAIL ____

YES, I PLAN TO ATTEND THE WORKSHOP

Date:

Conclusions

- Green intermodal logistics is an area whose importance will increase
- Limiting emissions in one part of the intermodal chain may increase emissions in another
- Holistic approaches are necessary
- 'Win-win' solutions are sought
- Great opportunities for OR/MS models!

Acknowledgments

- Hellenic Chamber of Shipping
- Det Norske Veritas
- American Bureau of Shipping
- European Commission
- The Lloyds Register Educational Trust

Thank you very much!

- www.martrans.org