Will any of the emissions reduction measures work?

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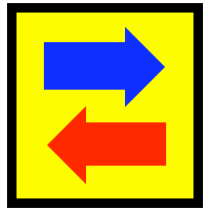
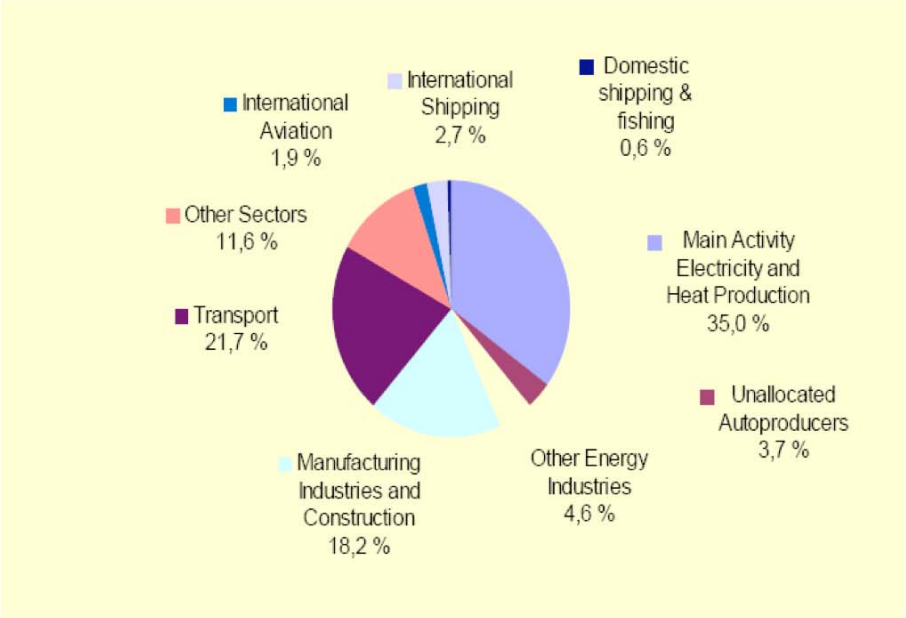


Quick answer

- Yes, some will, including doing nothing
- (others, including some actively promoted, are doubtful)

Share of global GHG emissions

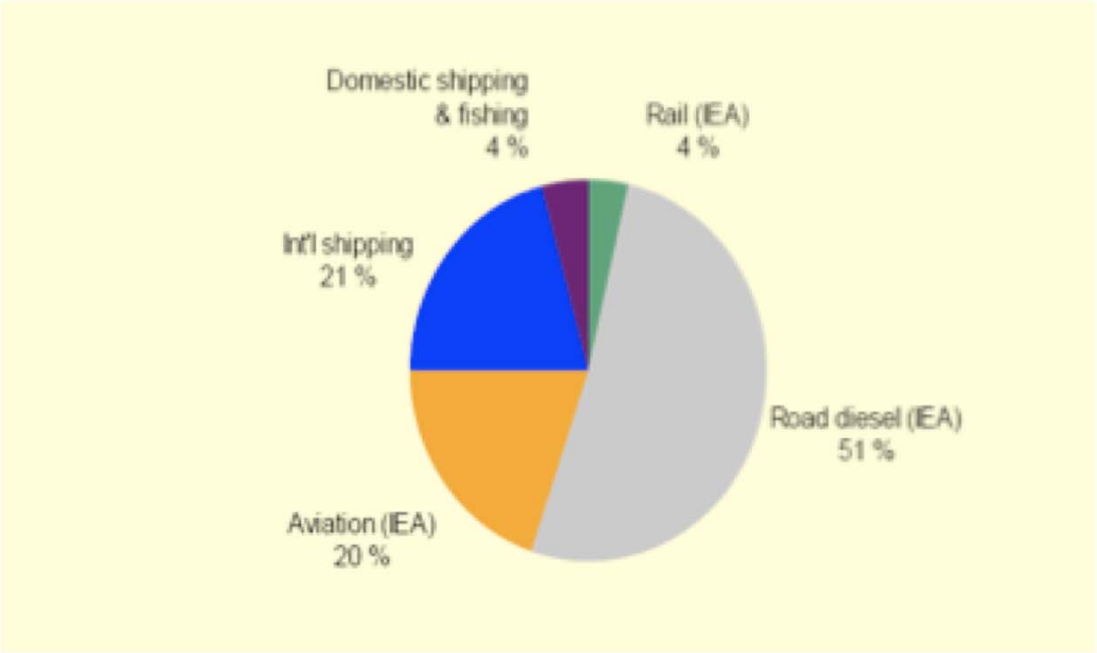


Data: International Shipping: This study. Other IEA. Reference year: 2005

MARINTEK SINTEF

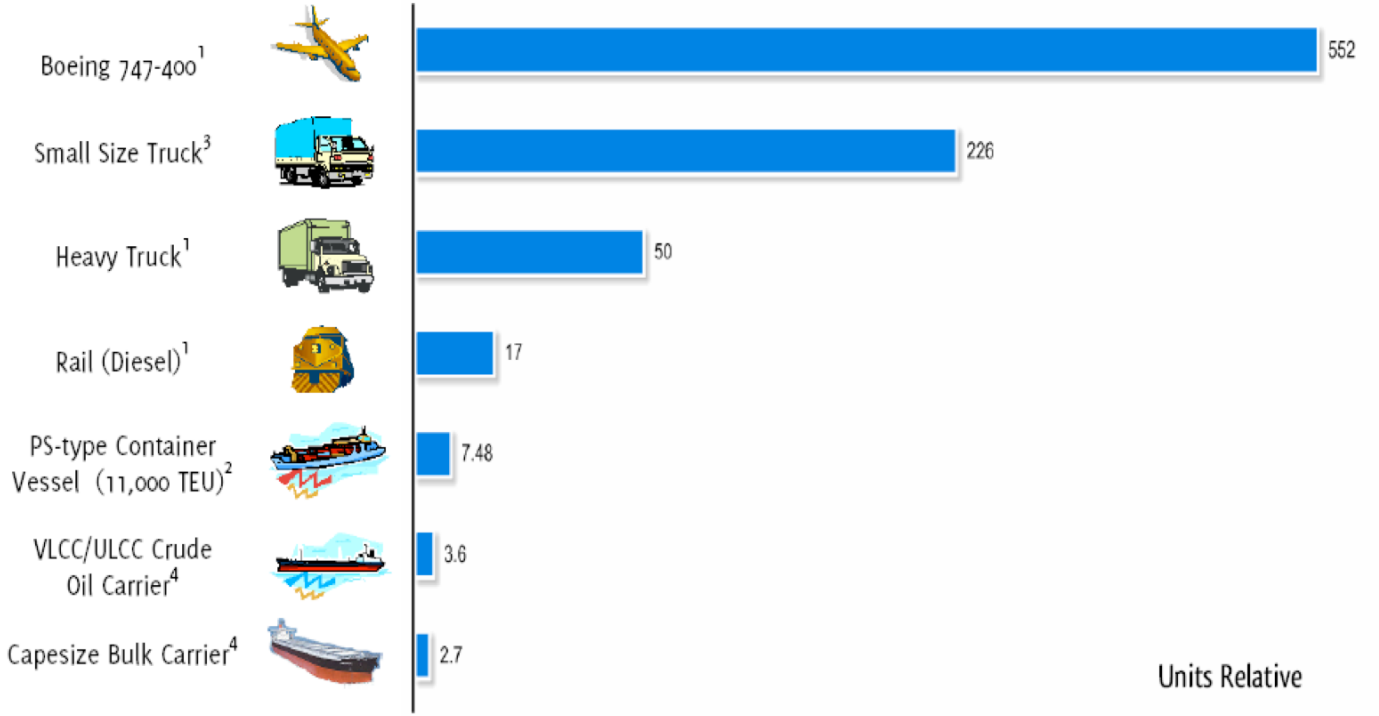
Comparison among modes

- 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
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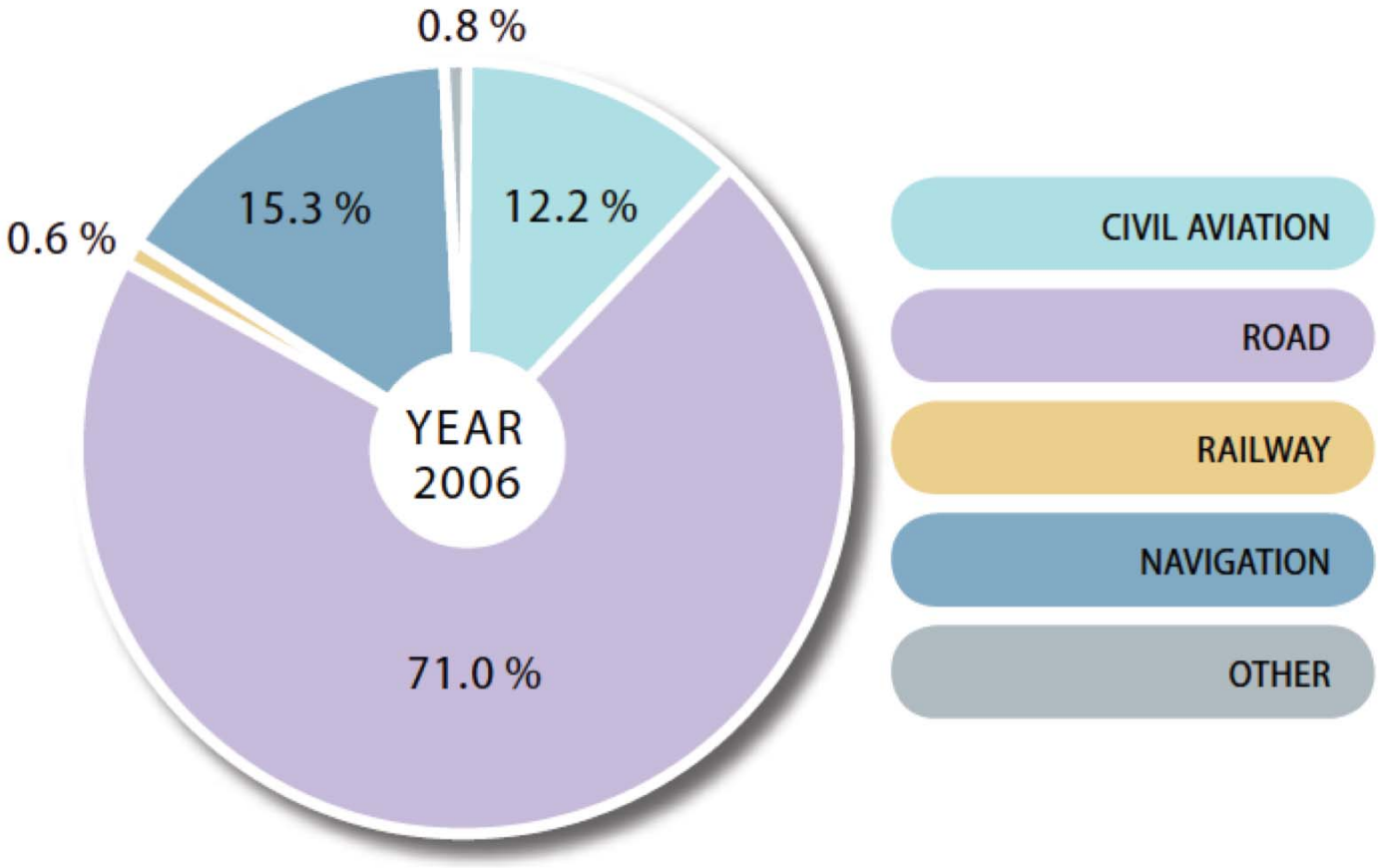
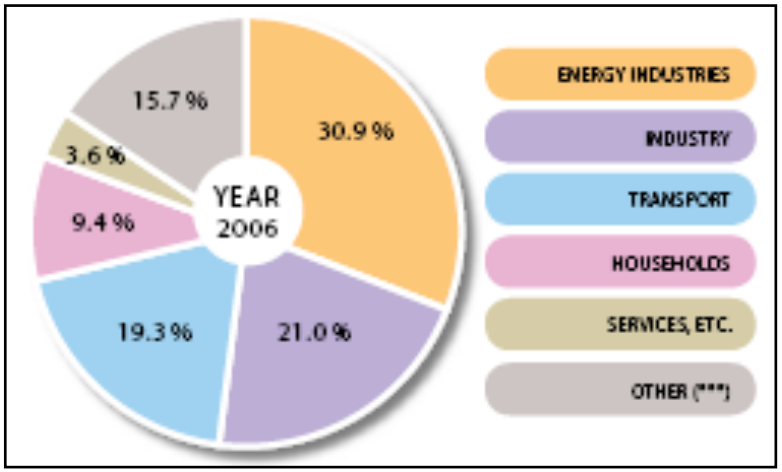
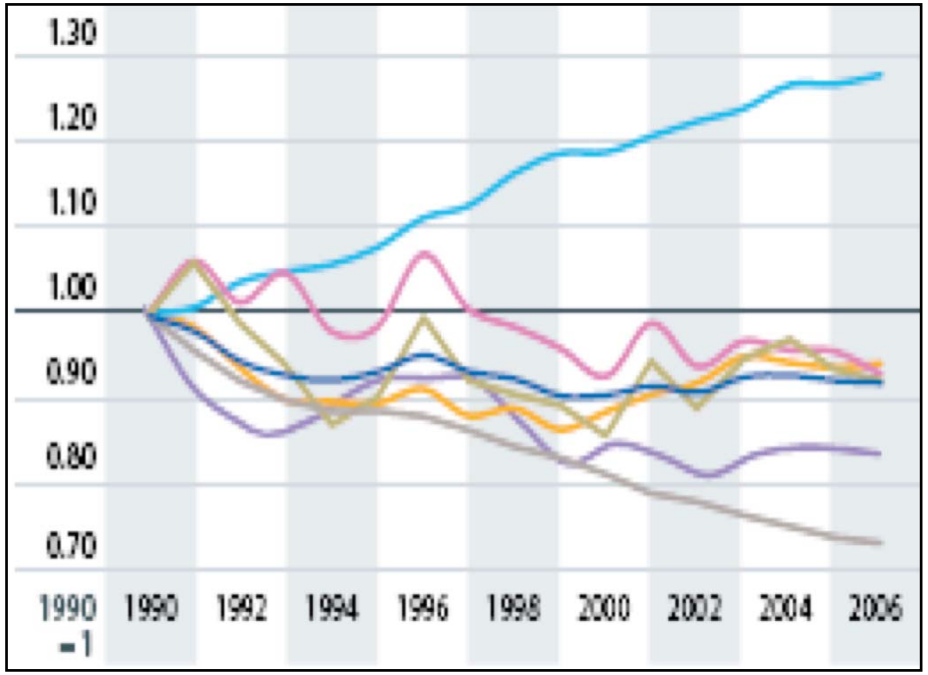
CO_2 emissions shares (source: Eurostat)



GHG emissions growth per sector

Source: European Commission (DG-MOVE)





Measures contemplated

- Technological
  - More efficient (energy-saving) engines
  - More efficient ship designs
  - More efficient propellers
  - 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
  - Several others
- Logistics-based
  - Speed reduction
  - Optimized routing
  - Several others


SkySails
BELUGA PROJECTS

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]

EEDI contd

- Mandatory for newbuildings
- Will have to have: EEDI ≤ EEDI baseline
- Baseline = f (ship type, DWT)
- Baseline more stringent in future years

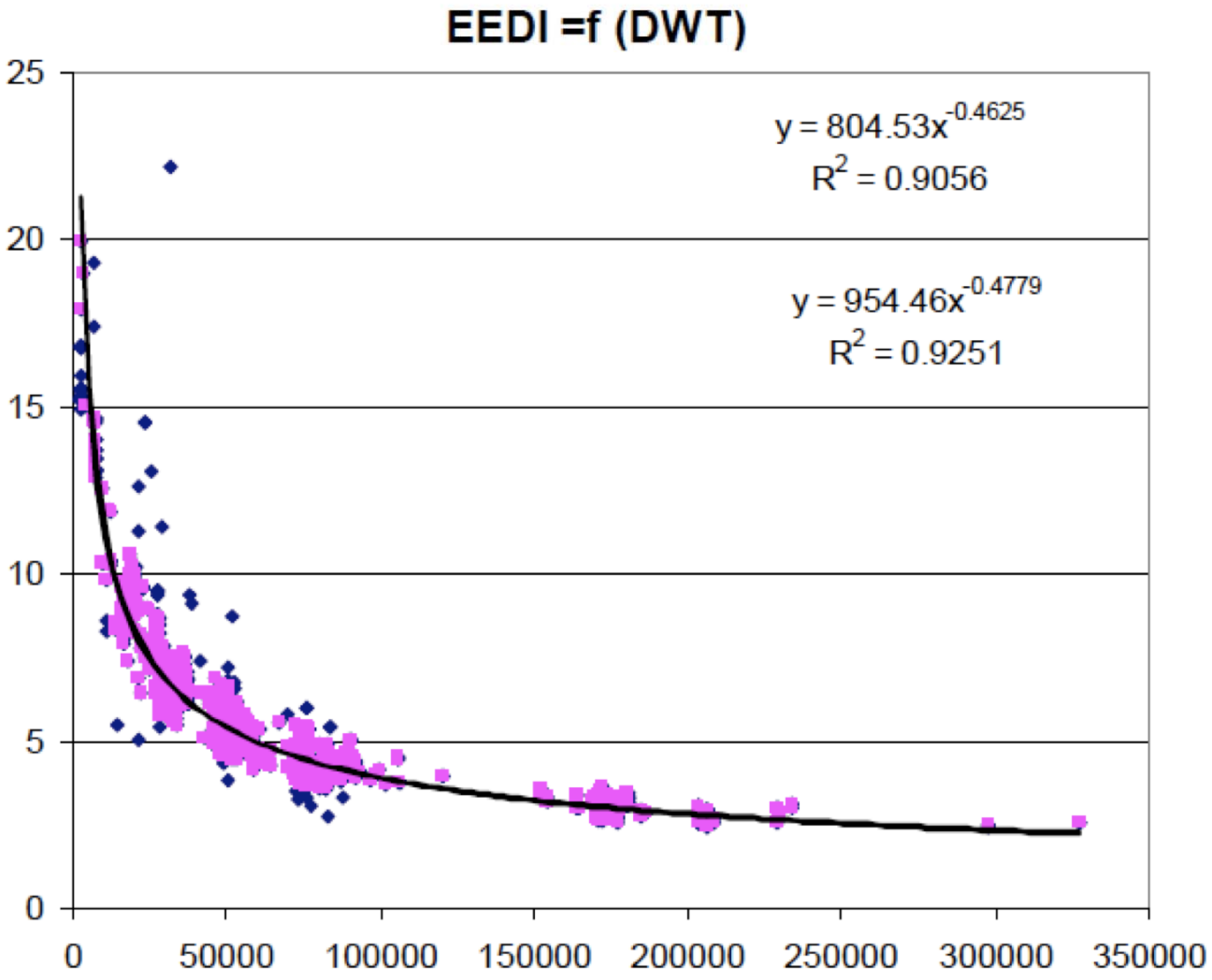


Figure 1: Dry bulk carriers
All data: 2,259 ships. Without outliers (shown in blue ◆): 2,218 ships

Concerns

- To reach required EEDI would mandate reducing design speed (or a speed limit)
- This could lead to underpowered ships, with negative implications on safety
- CO2 reductions marginal or even negative as smaller engine ships may emit more CO2 to maintain speed in bad weather
- It could also lead to modal shifts

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 CO2, less fuel, better rates

Side-effects: Inventory costs, charter more ships, potential cargo shifts

Trans-siberian railway cont'd

Far East to Europe by boat

- 43,000 km
- 7.8 gr CO2/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 CO2
-

Far East to Europe by rail

- 12,000 km
- Cargo arrives 26 days earlier
- Lower inventory costs
- 18 gr CO2/tkm
- Various technological and institutional barriers
- 150,000 tons of cargo produce 32,000 tons of CO2

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

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

$$C_i = p_i + kt_i$$

Net result

- ΔCO2 may be >0 or <0, depending on scenario
- Result unclear for more complex network scenarios
- Reducing CO2 in one mode may result in more CO2 overall

Market Based Measures

- IMO tasked to look into subject
- Expert Group formed
- 11 MBM proposals
- Report to MEPC 61

MBM classes

- Emissions Trading Schemes (Norway, UK, France, Germany)
- International Fund (Denmark)
- Various hybrids, based on EEDI (Japan, USA, WSC)
- Port based (Jamaica)
- Rebate scheme (IUCN)
- Bahamas proposal

Bahamas proposal

- Essentially: do nothing
- Q: will do-nothing reduce emissions?
- A: yes!

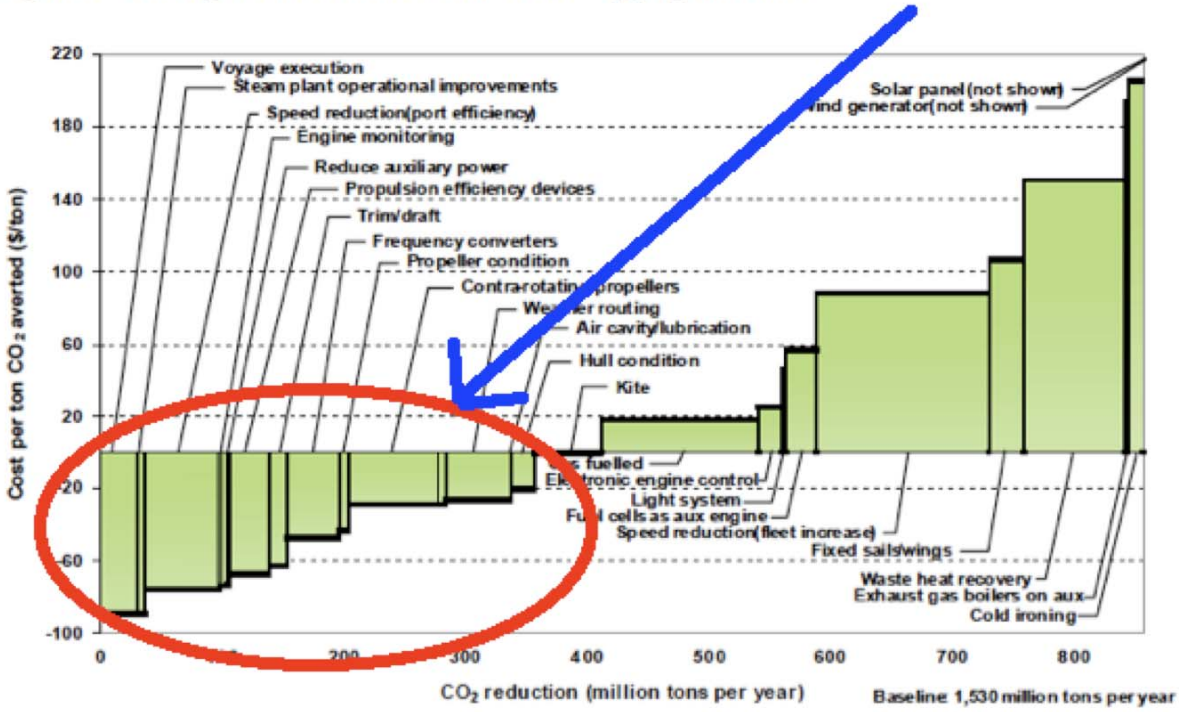
Critical parameter: fuel price

- Much of the CO2 reduction will come because of measures that become cost-effective as fuel prices go up
- It is very likely that fuel prices will be much higher in the future
- Ship owners would implement these measures without being forced to do so

DNV's MAC curves

- MAC<0

Figure 1 – Average abatement curves for world shipping fleet 2030



Report to MEPC 61

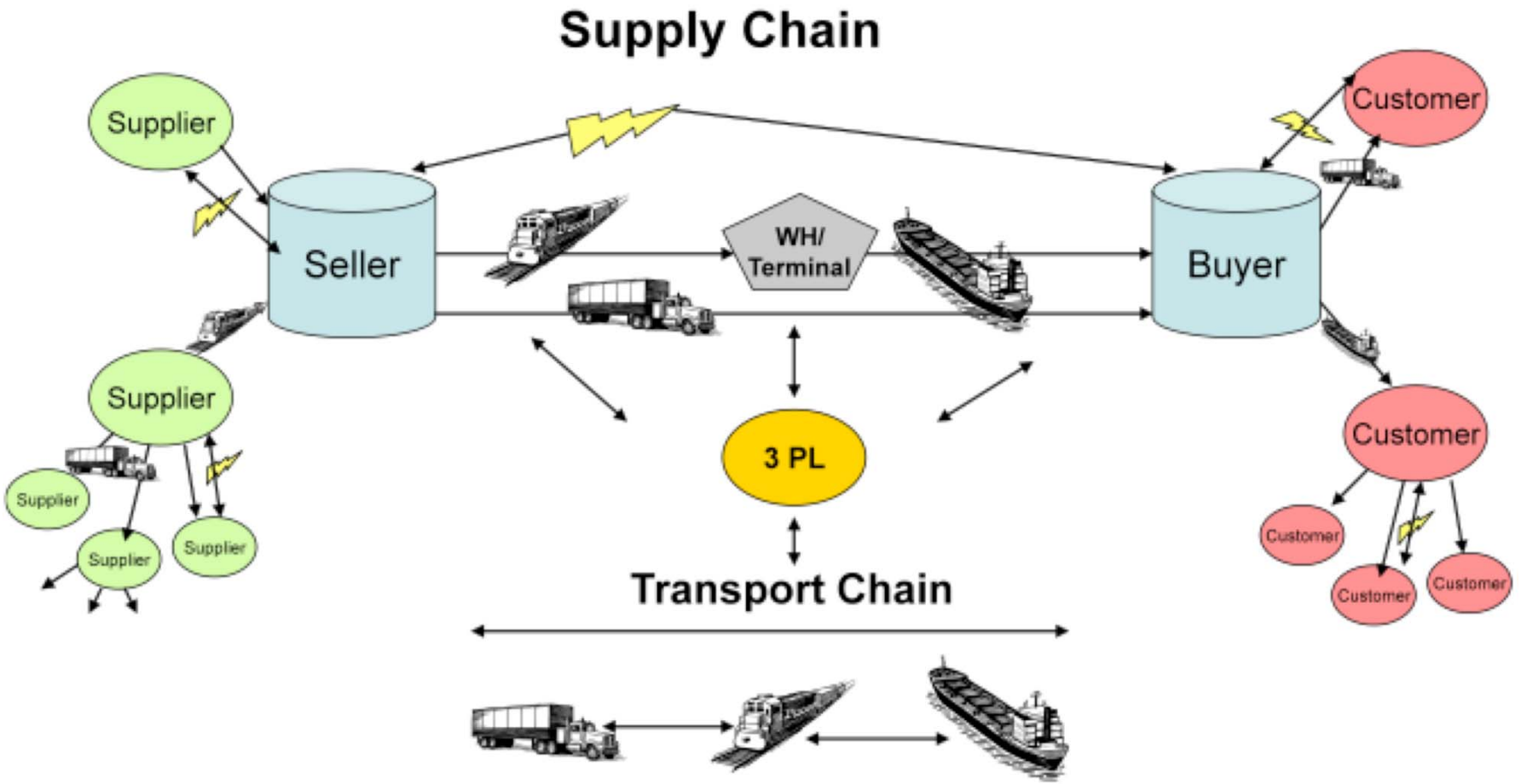
- > 300 pages
- Extensive modelling
- No comparative assessment
- No winner or loser

TABLE A: HORIZONTAL ASSESSMENT OF ALL MBM PROPOSALS
By Harilaos N. Psaraftis

PART I

Main criterion	GHG Fund (Denmark)	Leverage Incentive Scheme (Japan)	ETS (Norway, UK, France)	SECT (USA)
1. Environmental effectiveness (how certain is MBM to achieve a specific reduction target)	There may be less certainty of CO2 reductions than ETS, but MAC curves of DNV can give an estimate. If price is same, CO2 reductions are same with ETS. Offsets can contribute meeting a cap. See also criterion 2 below.	Lower than GHG Fund, but may have side-effects due to possible distortions induced by misuse of EEDI (eg, an underpowered ship has a low EEDI but may emit more CO2).	There may be higher certainty of CO2 reduction, but reduction target is arbitrary (or very difficult to determine). Plus, enforcing the cap can be difficult and carbon price may skyrocket if we are close to the cap. Significant carbon leakage risks exist (eg, if not all ships are covered, some countries like LDCs excluded, etc).	Low. CO2 reduction certainty does not exist, as scheme trades on EEDI. No attempt to compute CO2 directly. Variant to use actual fuel burned instead of EEDI has merit.
2. Cost effectiveness	High. Costs are known as price is known. Simplest scheme (except Bahamas). Option 2 is probably better than Option 1. According to US CBO study, Levy is most efficient way to reduce emissions[1].	High, but lower than GHG Fund, due to costs of tracking EEDI.	Low. High administrative costs, very unpredictable carbon prices.	Low. Combines problems of ETS with EEDI distortions and other problems.
3. Incentives to technological change	High. Investors will respond to known price.	High, but lower than GHG Fund, due to possible mixed EEDI signals (eg, invest in underpowered ships).	Low. Investors will not know what future prices they will encounter and will pay high administrative costs.	Same as above. May provide the wrong signals in favor of low-EEDI ships than may emit more CO2.
4. Practical feasibility	Reasonable. Can be modeled from IOPCF.	Lower than GHG Fund, due to tracking of EEDI for existing ships.	Low. All GHG Fund (option 2) processes, plus auction permits, monitor allowance market, enforce compliance, indentify fraud, etc.	Worse than ETS. Combines problems of ETS with tracking EEDI for existing ships and estimating activity levels.
5. Impact on LDCs and SIDS	Neutral. From a revenue perspective, if prices are same, revenue is same as	Same as GHG Fund- although scheme will likely benefit	Distortions likely, as traffic to LDCs-SIDS countries is excluded.	Neutral.

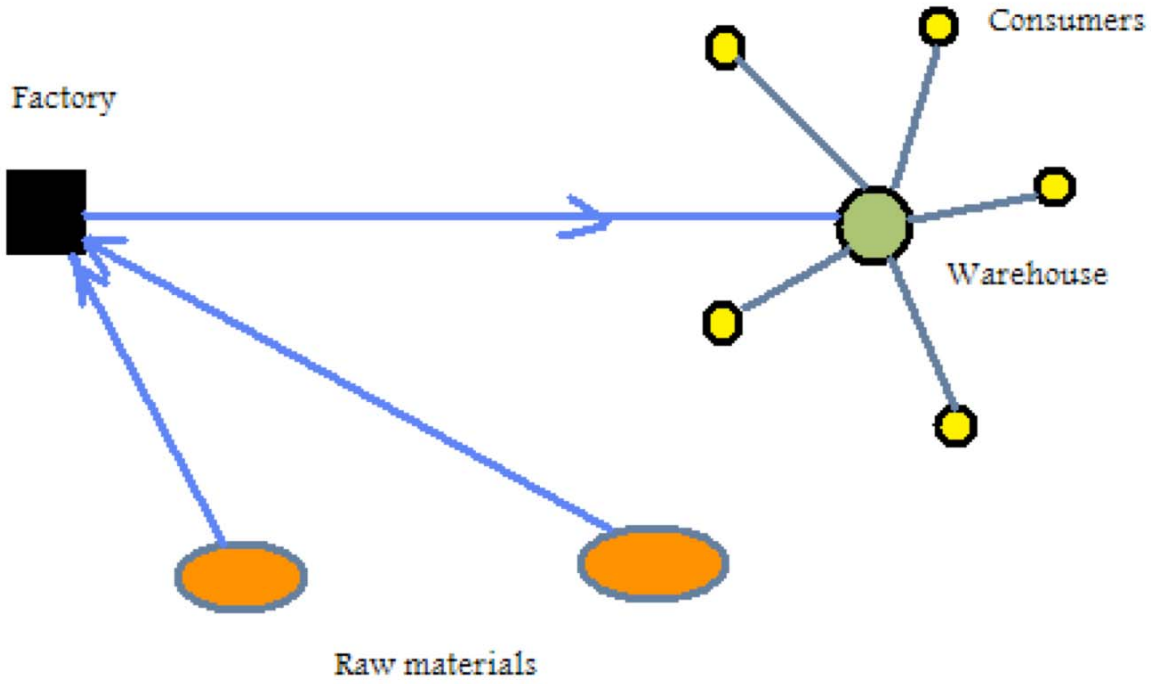
[1] See "Policy Options for Reducing CO_2 Emissions," Congress of the United States, Congressional Budget Office, February 2008 (reference no. 18 in the 'other document' list of the report).



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

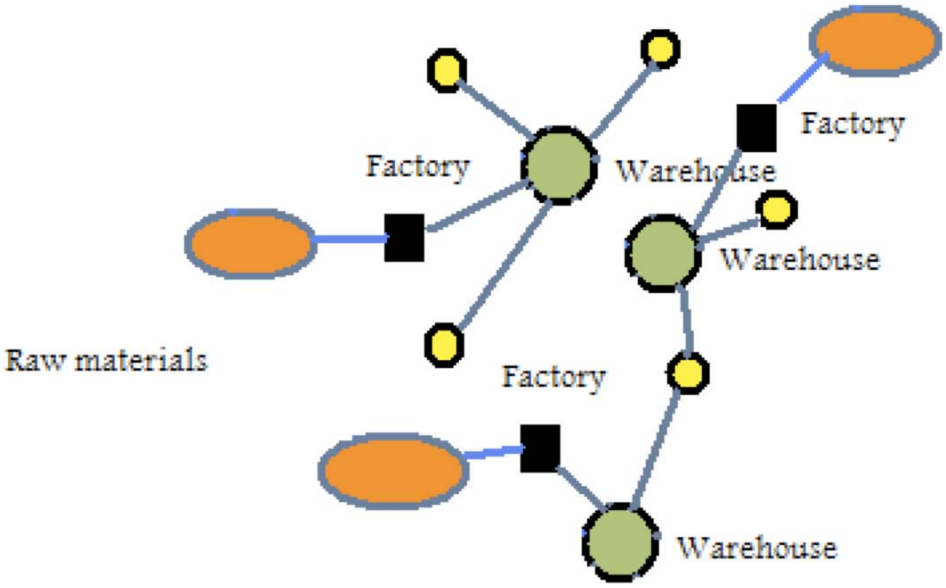
Full loads/ FTL,FCL: Bulk, Tramp Traffic, Contracted containers/tankers/rail cars

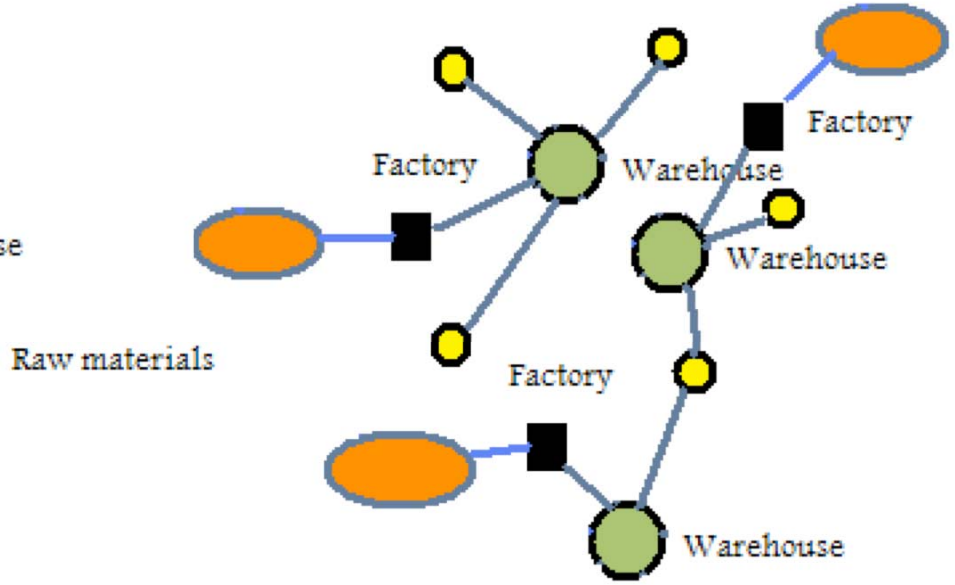
Which model?



- Long haul

Short haul (if cost of emissions is high enough)





Is this green enough?

- Globally, ruminant livestock produce about 80 million metric tons of CH4 annually, accounting for about 28% of global CH4 emissions from human-related activities

(source: US EPA)

Conclusions

- Some measures will indeed recuce emissions
- However, have to be careful, as some measures may not work as well as anticipated
- Be careful of boomerang effects

Thank you very much!

- www.martrans.org