IENE 2013
IMO developments on GHGs

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Overview

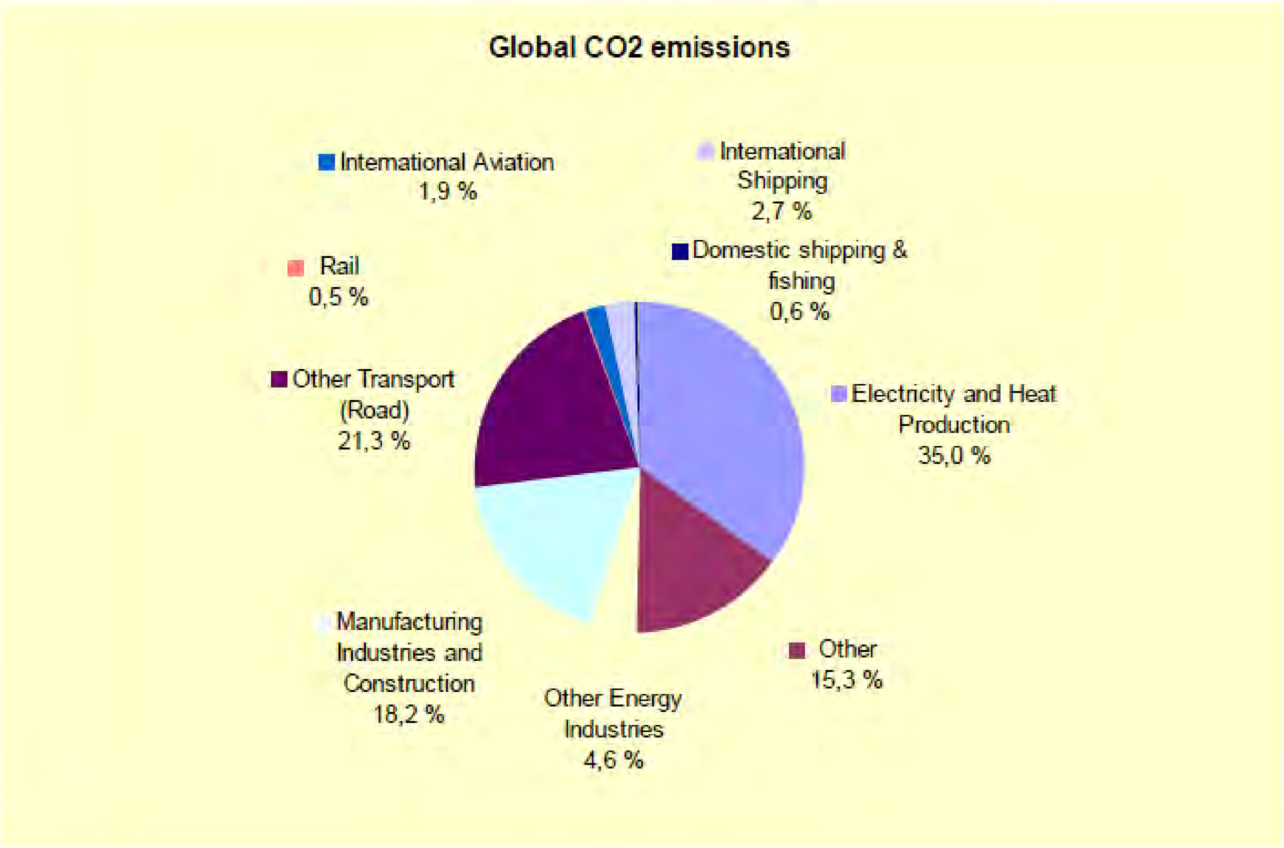
- Update of the 2009 GHG study
- Market-Based Measures (MBMs)
- EEDI

MEPC 63 (abt a yr ago)

- “Uncertainty exists in the estimates and projections of emissions from international shipping”
- “Further work should take place to provide the Committee with reliable and up-to-date information to base its decisions on”

- **LATEST ESTIMATES: 2009 IMO GHG study**

Share of global CO_2 emissions



Emissions of CO_2 from shipping compared with global total emissions for 2007 (Source: Second IMO GHG Study 2009)

Comparison among modes

(source: IMO GHG study 2009)

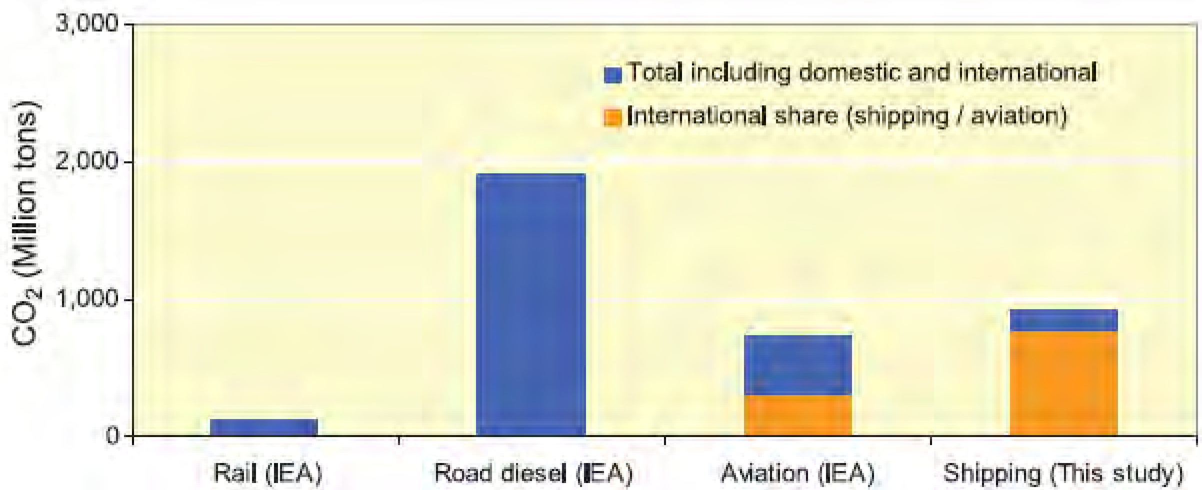


Figure 9.6 *Emissions of CO_2 in 2005 from shipping compared to other transport modes*

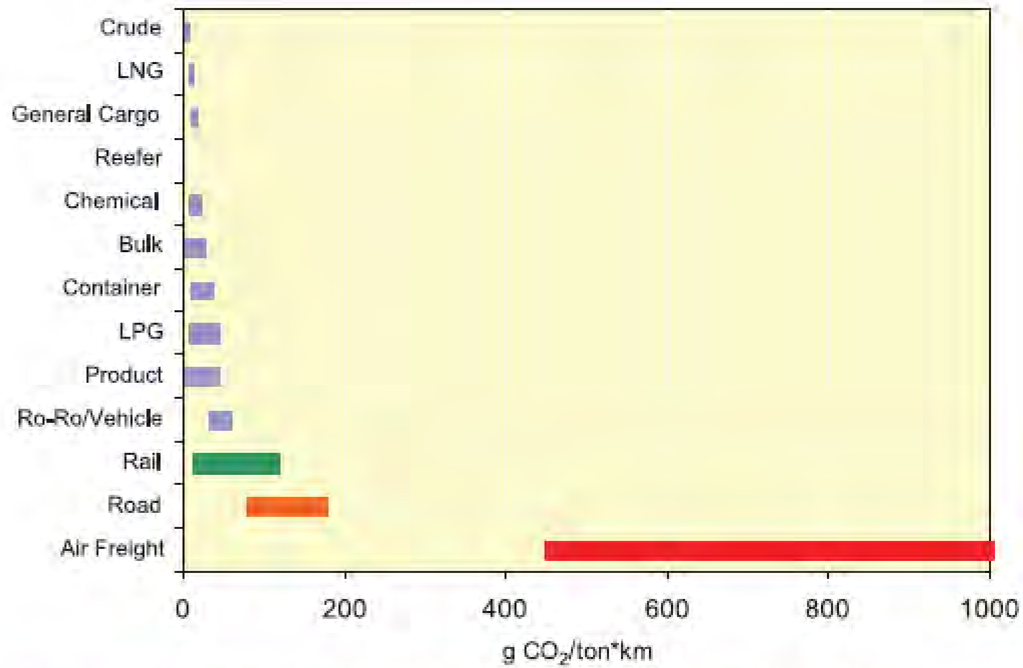


Figure 9.3 *Typical range of ship CO_2 efficiencies compared to rail, road and air freight*

MEPC 64 (last October)

- A draft outline for an update of the GHG emissions estimate for international shipping was presented.
- The outline noted that some of the assumptions used in the 2009 IMO GHG Study may need to be reconsidered.
- MEPC 64 agreed that an expert workshop, to be held in 2013, should further consider the methodology and assumptions to be used in the update.

Expert workshop held last week

INTERNATIONAL
MARITIME
ORGANIZATION

E

EXPERT WORKSHOP ON THE UPDATE OF GHG EMISSIONS ESTIMATE FOR INTERNATIONAL SHIPPING
1st session
Agenda item 2

Update-EW 1/2/1
8 February 2013
ENGLISH ONLY

PROPOSED UPDATE OF GHG EMISSIONS ESTIMATE

Comments on the methodology for the update of GHG emissions estimate from international shipping

Submitted by Greece

Basic choice

- Decide which methodology to use:
- Bottom-up (activity based)
- Top-down (fuel sales based)

Bottom-up approach

METHODOLOGY

The **main engine (ME) fuel consumption** per ship category is estimated by multiplying the number of ships in each category with the average ME power to find the installed power (kW) by category.

The **annual power outtake (kW·h)** is then estimated by multiplying the installed power with a category-specific estimate of the operating hours of the main engine and the average engine load factor.

Finally, the **fuel consumption** is estimated by multiplying the power outtake with the specific value of fuel oil consumption that is applicable to the engines of the given category (g/kW·h).

Figure 3.1 *Activity-based calculation of fuel consumption*

The same principle is applied to estimate the fuel consumption of the auxiliary engine. Emissions from boilers have been estimated for tanker ships, based on assumptions regarding frequency of carrying heated cargoes, number and length of laden voyages and the consumption of fuel per day to heat the steam boiler.

Bottom-up approach

UNCERTAINTIES

Table 3.1 *Confidence and uncertainties of calculations of fuel consumption of main engines*

Input	Source	Confidence	Comment
Number of ships, by category	Fairplay database	Very high, well known	High accuracy of registered ships. Uncertainty regarding whether all ships are actively trading or if some ships in some categories are laid up, etc.
Average main engine size	Fairplay database	Very high, well known	High accuracy expected.
Average main engine operating days	Calculated from AIS data except for ship types with low AIS coverage	Moderate, but dominates uncertainty	Accuracy depends on accuracy of AIS collection system, how representative are ships that are moving between ports with AIS network coverage, assumptions made for ship movement, cut-off and filtration of data, assumed average offhire/lay-up, port-to-port distance calculations, vessel design speed.
Average main engine load	Default values were calculated from AIS average speed and Fairplay design speed. Defaults were replaced where other data or special conditions suggested this to be appropriate.	Moderate; secondary influence on uncertainty	Calculations are sensitive to vessel design speed data from the extended Lloyd's database and errors in estimating the AIS at-sea speed. Moreover, engine load will be over-estimated when ship is in ballast or lightly loaded. Where other data suggest that the results are unreasonable, calculated values are substituted by expert judgement.
Average offhire/lay-up	Assumed	Moderate; influences the number of main engine operating days	It is assumed for all ships that the effective calendar is 355 days (on average, 10 days is spent out of active trade).
Calculations of distances between AIS observations	Calculations were based on AIS coordinates	Moderate	Used for AIS calculations of average speed. Accuracy will be affected when there is a land mass within the shortest route between AIS receivers. Where other data suggest that the results are unreasonable, calculated values are substituted by expert judgement.
Vessel design speed	Extended Fairplay database	Moderate	Used to determine cut-off between "normal" and "slow" (abnormal) voyages. Also used to estimate power factor at sea.
Average main engine SFOC	Estimated from a wide range of test-bed and other data	High, well known	While there is some variation from engine to engine, the average figure is expected to have comparatively high accuracy.

Uncertainties on the data provided by Lloyd's Register – Fairplay (2007)

SFOC does not consider the differences in average age of engines, type of engine (e.g. slow or medium-speed)

Activity data :

<u>Average running hours for the main and auxiliary engines:</u>
uncertainty of AIS coverage

<u>average load on main and auxiliary engines :</u>
ME MCR: Cargo ships: 65–80% (weighted average 70)
AE MCR: All types: 16–80% (weighted average 64%)

<u>Days at sea: </u>100–285
(weighted average 240)

GHG marine emissions estimates

- IMO latest update of GHG study (2009)

Table 1.1 *Summary of GHG emissions from shipping* during 2007*

	International shipping (million tonnes)	Total shipping	
		million tonnes	CO_2 equivalent
CO_2	870	1050	1050
CH_4	Not determined*	0.24	6
N_2O	0.02	0.03	9
HFC	Not determined*	0.0004	≤6

* A split into domestic and international emissions is not possible.

Future projections

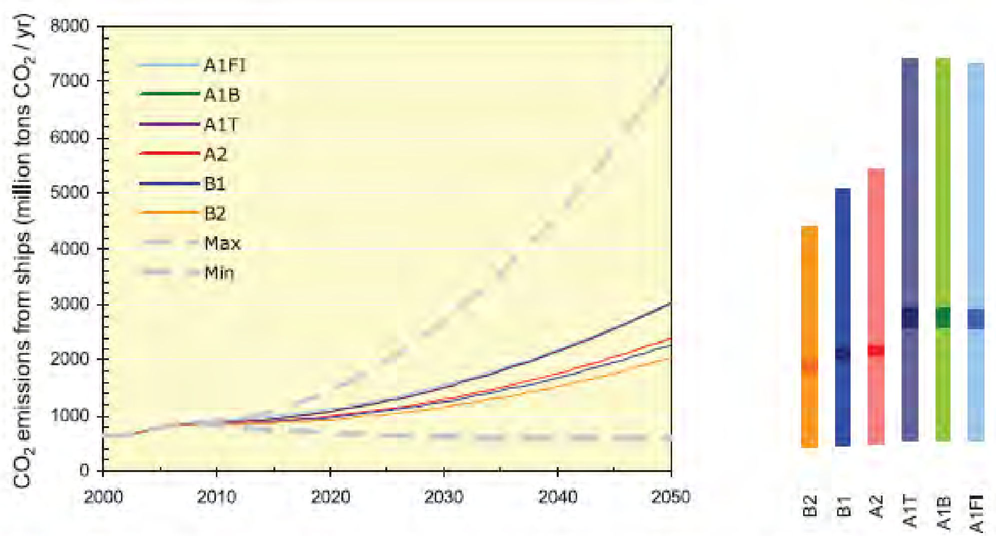


Figure 1.2 *Trajectories of the emissions from international shipping. Columns on the right-hand side indicate the range of results for the scenarios within individual families of scenario.*

- A scale of 10:1 between worst case and best case!

Deficiencies of bottom-up

- Model is complex, with many input variables
- Many of these inputs difficult or impossible to estimate

- Ship speed (typically from fleet databases)
- Ship load (→ hull immersion→ fuel consumption)

Is ship speed fixed?

- NO!
- Ships do NOT trade at predetermined speeds.
- Those who pay for the fuel, that is, the ship owner if the ship is in the spot market on voyage charter, or the charterer if the ship is on time or bareboat charter, will **choose an optimal speed** as a function of
  - (a) bunker price, and
  - (b) the state of the market and specifically the spot rate

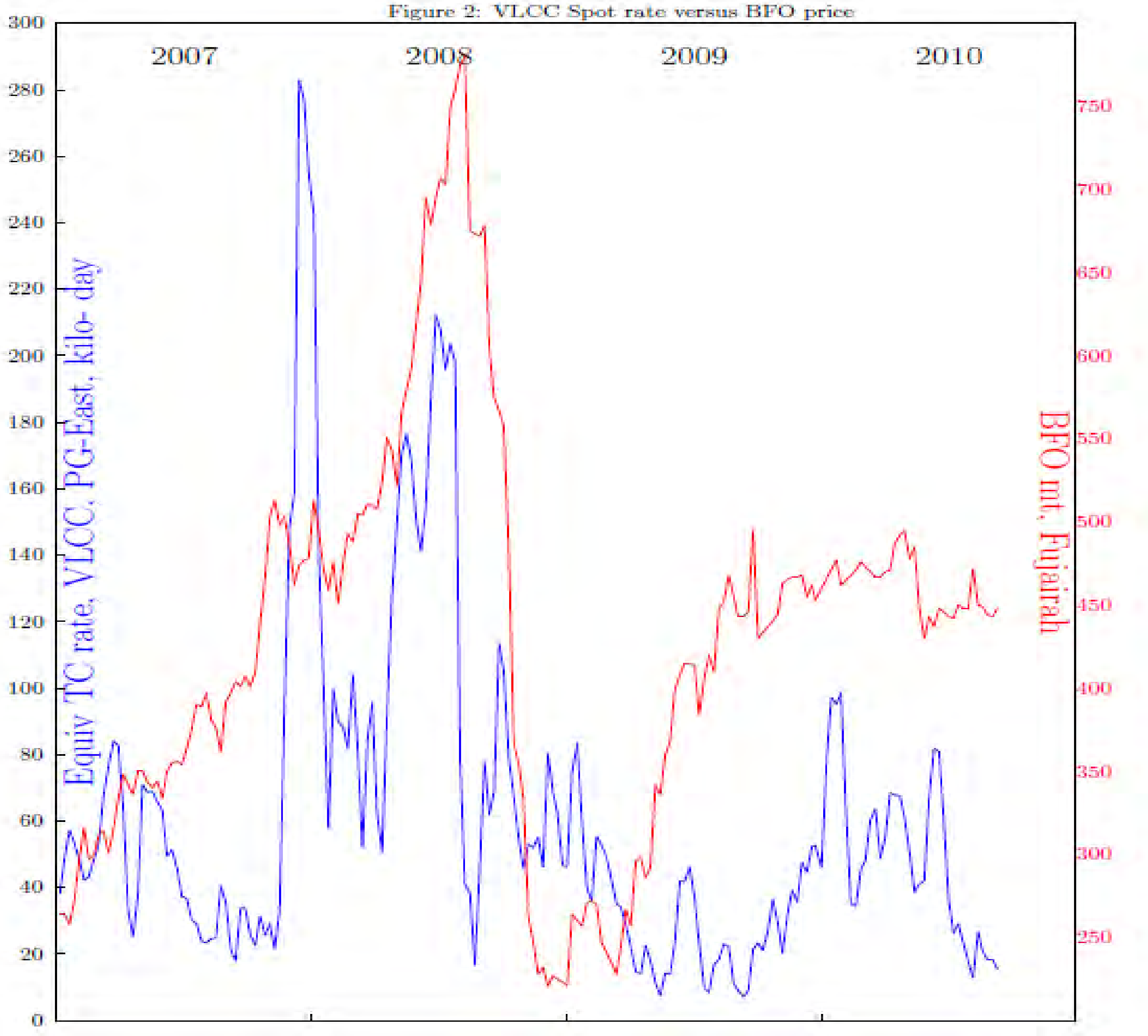
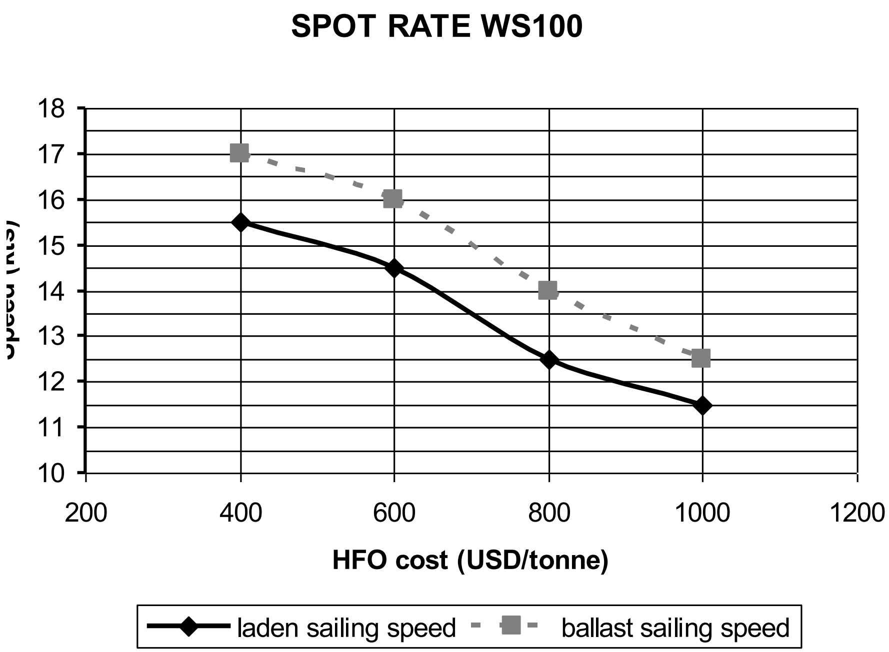


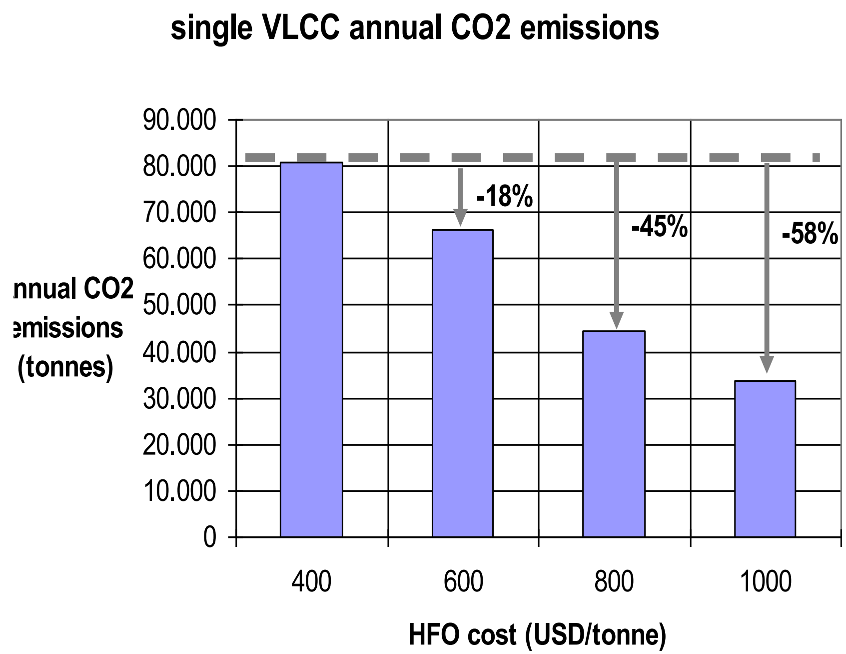
Figure 2: VLCC Spot rate versus BFO price
2007
2008
2009
2010
Equiv TC rate, VLCC, PG-East, kilo- day
BFO mt, Fujairah
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
750
700
650
600
550
500
450
400
350
300
250

VLCC SPEED OPTIMIZATION

#1: Impact of bunker price (or of a bunker levy)

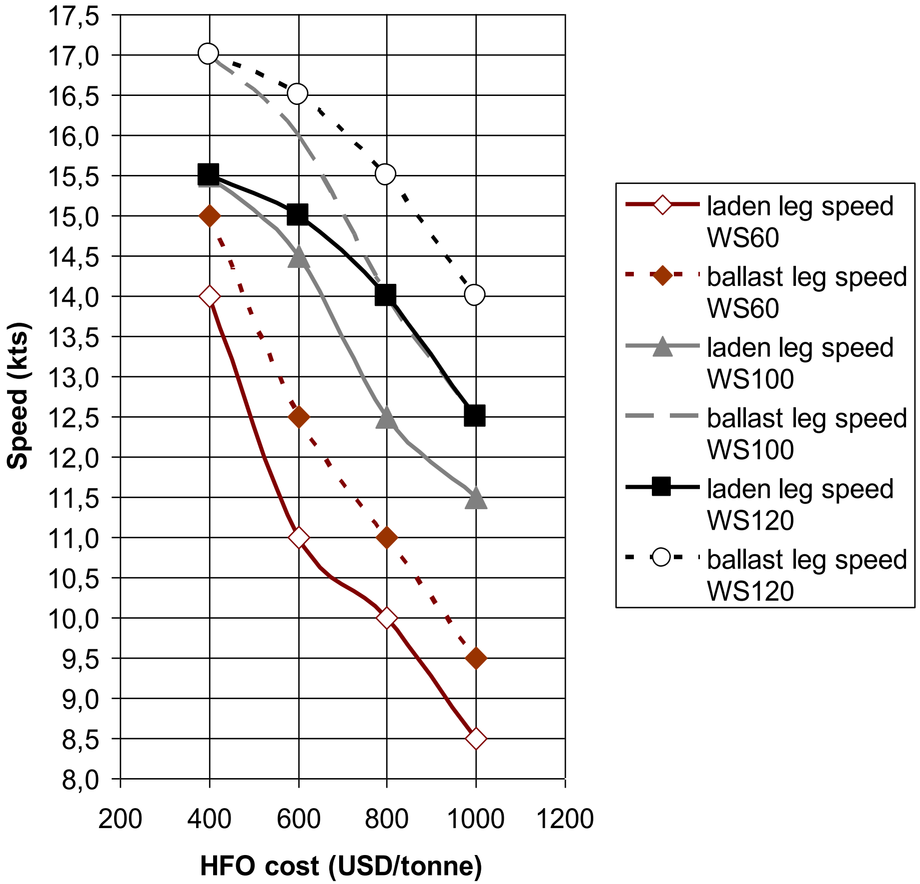
Gkonis & Psaraftis (2012): modern VLCC capable of sailing at 8.5/9.5 knots (laden/ballast)





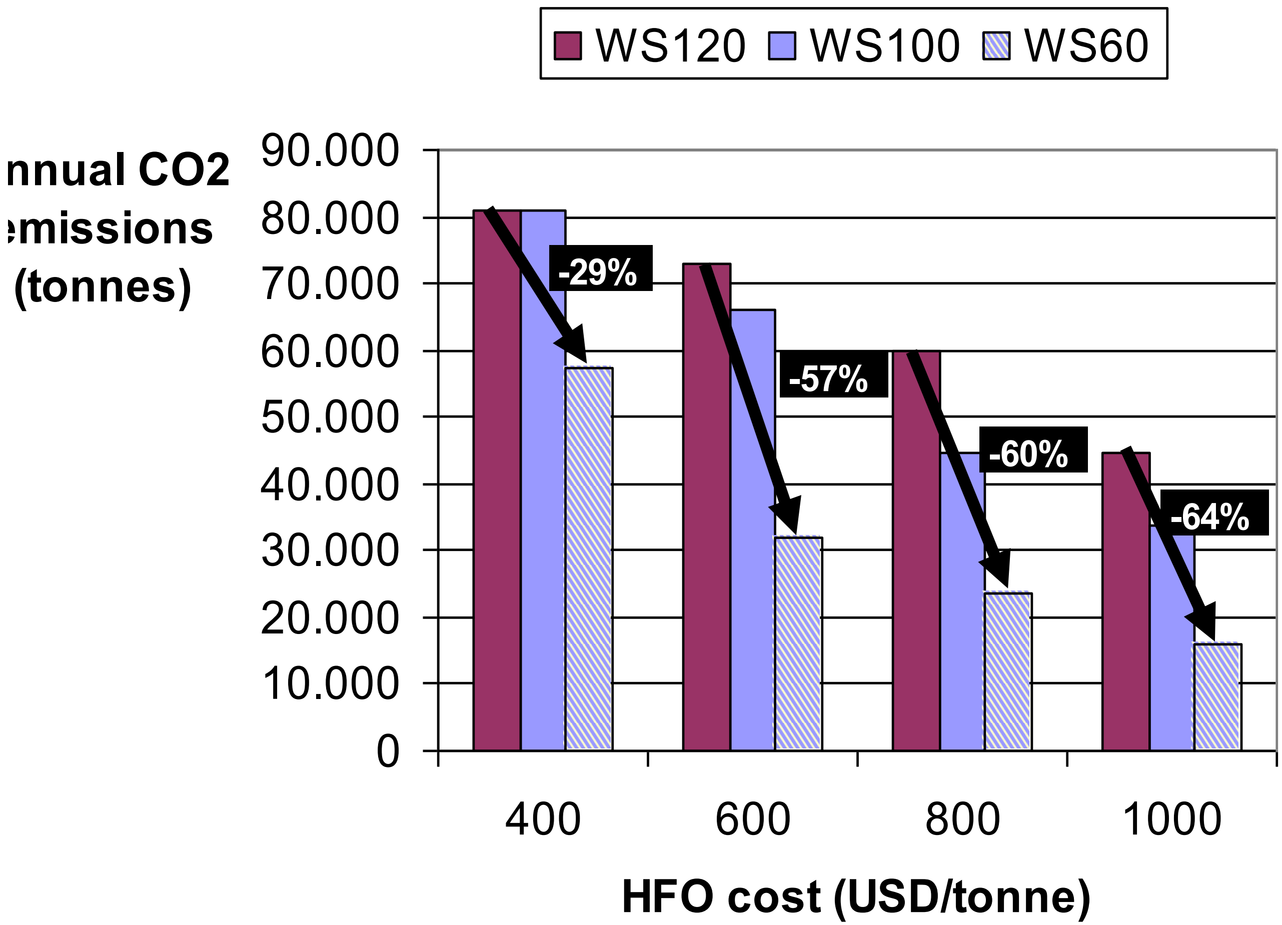
VLCC cont'd

#2: Impact of freight rates



VLCC: FROM SINGLE SHIP TO FLEET

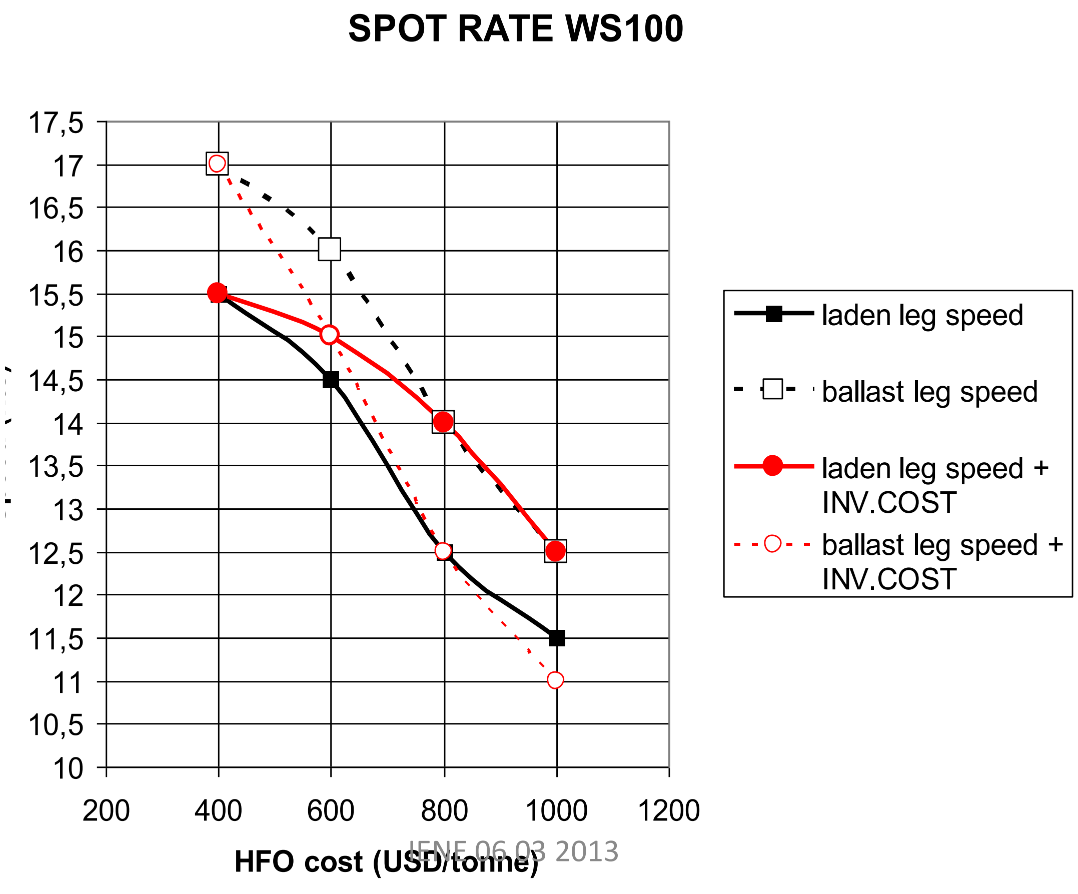
Impact on fleet emissions



VLCC cont'd

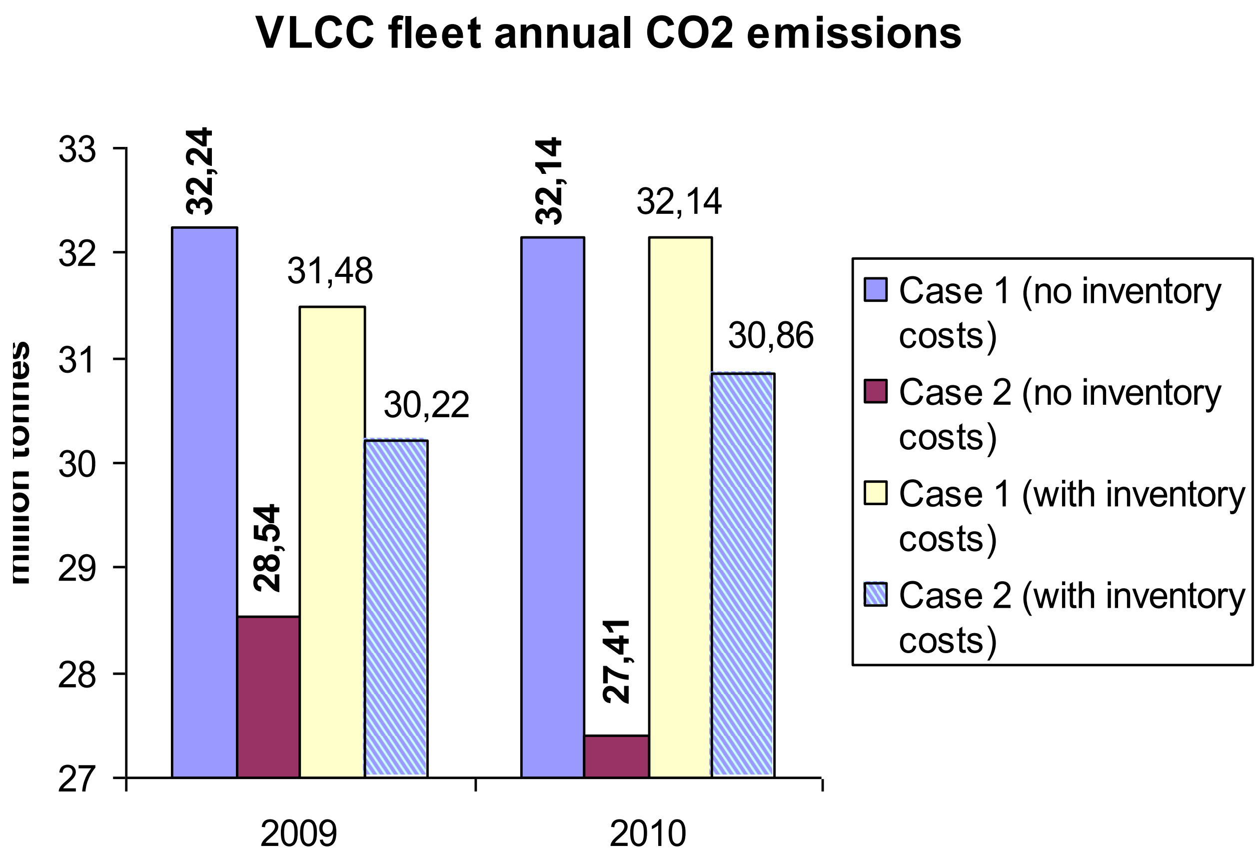
#3: Impact of inventory costs

'IN TRANSIT' INVENTORY COSTS INCLUDED IN COST EQUATION



VLCC cont'd

Impact of inventory costs cont'd



Greece's proposal

- Avoid an even more complex bottom-up model that would have to incorporate factors like the previous (at a minimum)
- Use top-down: estimate based on fuel sales

Top-down approach

METHODOLOGY

Emissions are calculated without respect to location by means of quantifying the fuel consumption by power production first and then multiplying the consumption by emission factors.

One approach uses total fuel consumption from worldwide sales of bunker fuel by summing up by country.

The activity-based model cannot separate domestic shipping from international shipping, figures from bunker statistics for emissions from domestic shipping have been used in the calculation of emissions from international shipping in the 2nd IMO GHG study.

- ✓ The **2000 Study of GHGs** from ships estimated the emissions using a fuel-based inventory approach, under the assumption that world-wide sales of bunker fuel represent total consumption of fuel. The 2000 study reviewed different data sources for global consumption of bunkers by ships, including the IEA and the United States Energy Information Administration (EIA).

- ✓ **2nd IMO GHG Study:** The figures for fuel consumption during 2005 recorded by the IEA were used, scaled forward to 2007, using Fearnleys data for global seaborne trade

Top-down approach

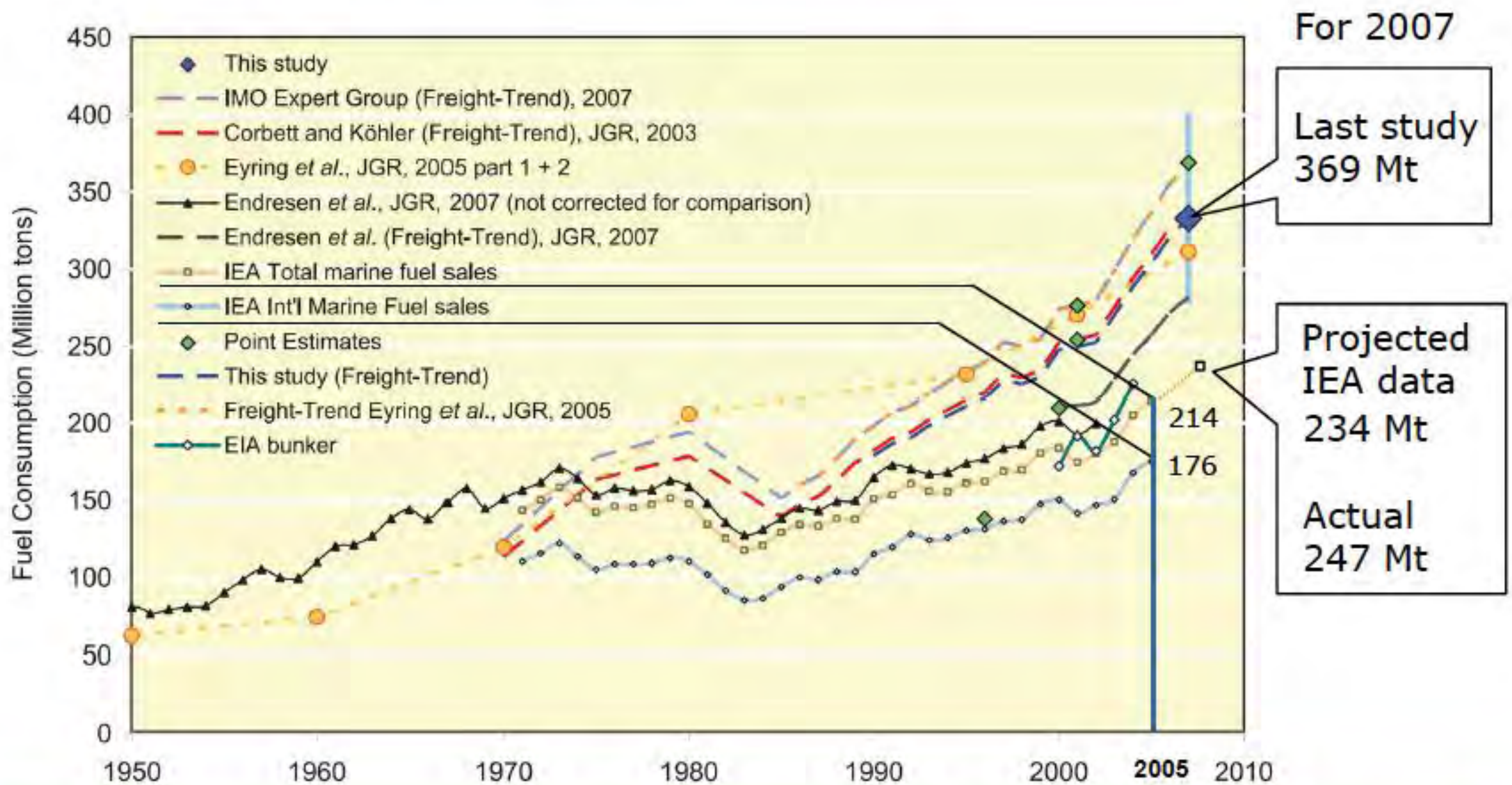
International Energy Agency (IEA)

Total primary energy supply

million tonnes of oil equivalent

	1971	1975	1980	1985	1990	1995	2000	2005	2008	2009	2010	% change 90-10
World *	**5 527.6**	**6 188.9**	**7 214.4**	**7 738.6**	**8 772.8**	**9 235.1**	**10 008.9**	**11 451.6**	**12 263.0**	**12 171.7**	**12 764.7**	**45.5%**
Annex I Parties	..	..	..	..	*5 582.3*	*5 480.7*	*5 767.8*	*5 991.1*	*5 947.9*	*5 635.5*	*5 857.2*	*4.9%*
Annex II Parties	*3 113.6*	*3 306.2*	*3 661.4*	*3 680.2*	*4 010.3*	*4 307.4*	*4 655.5*	*4 807.4*	*4 712.8*	*4 487.7*	*4 617.0*	*15.1%*
North America	*1 728.8*	*1 819.5*	*1 997.3*	*1 967.1*	*2 123.5*	*2 298.0*	*2 524.8*	*2 591.1*	*2 541.8*	*2 415.7*	*2 468.2*	*16.2%*
Europe	*1 058.7*	*1 112.5*	*1 241.0*	*1 266.2*	*1 348.3*	*1 405.7*	*1 486.6*	*1 564.7*	*1 534.0*	*1 456.5*	*1 509.0*	*11.9%*
Asia Oceania	*326.1*	*374.2*	*423.1*	*446.9*	*538.4*	*603.7*	*644.1*	*651.6*	*637.0*	*615.5*	*639.8*	*18.8%*
Annex I EIT	..	..	..	..	*1 518.6*	*1 111.0*	*1 035.2*	*1 098.4*	*1 135.8*	*1 049.3*	*1 134.3*	*-25.3%*
Non-Annex I Parties	..	..	..	..	*2 990.0*	*3 525.6*	*3 969.3*	*5 143.2*	*5 969.6*	*6 203.0*	*6 551.8*	*119.1%*
Annex I Kyoto Parties	..	..	..	..	*3 568.3*	*3 326.5*	*3 392.7*	*3 560.1*	*3 543.4*	*3 345.3*	*3 507.2*	*-1.7%*
Intl. marine bunkers	**108.1**	**104.2**	**109.3**	**93.6**	**114.2**	**132.1**	**153.8**	**177.7**	**194.5**	**188.9**	**202.0**	**76.9%**
Intl. aviation bunkers	**56.5**	**58.0**	**67.4**	**74.9**	**86.2**	**96.8**	**118.1**	**139.6**	**150.9**	**144.3**	**153.6**	**78.3%**
Non-OECD Total **	**1 990.7**	**2 409.2**	**2 969.4**	**3 446.8**	**4 049.9**	**4 133.2**	**4 444.5**	**5 619.1**	**6 444.3**	**6 608.8**	**7 003.2**	**72.9%**
OECD Total ***	**3 372.3**	**3 617.6**	**4 068.3**	**4 123.3**	**4 522.5**	**4 873.1**	**5 292.5**	**5 515.1**	**5 473.2**	**5 229.7**	**5 405.9**	**19.5%**

IEA statistics much lower than estimates based on activity based, bottom-up approach



Source: IMO, Second IMO GHG study, 2009, p.175.

Risk of leakage?

- Bunker fuel is tax free world wide.
- It is unrealistic to assume that there would be leakage from the higher cost taxed fuel being delivered to some local consumer to shipping.
- Probably the reverse would happen.
- In such a case ship bunkers leaving the refinery would probably overestimate the bunker consumption of shipping, not the reverse.
- There is ample documentation of short deliveries to ships which are then sold on the black market ashore.

Compatibility with MBMs

- Both Levy and ETS approaches rely on accurate info. on bunker fuel sales.
- Same with Japan's EIS MBM.

- It is unclear how any of the proposed MBMs would work efficiently vis-a-vis a bottom-up approach.

European Commission

- Vice-President of the European Commission Siim Kallas and EU Commissioner for Climate Action Connie Hedegaard:
- *The EU wants an internationally agreed global solution to decrease greenhouse gas emissions from ships.*
- We need "a simple, robust and globally-feasible approach towards setting a system for Monitoring, Reporting and Verification of emissions **based on fuel consumption.**"

ICS

ICS Board Meeting in London, 5 February 2013, Press Release

ICS Chairman: *"Our meeting agreed that ICS will fully support the concept of MRV, provided* ***that any measure adopted is developed and agreed at IMO****, and that it will be simple to administer and* ***based primarily on fuel consumption measured by bunker delivery notes.****"*

ECSA

POSITION PAPER (No 13/2, February 2013

"Any MRV system must be accurate, simple, cost-effective and exclusively based on the vessels fuel consumption. ***ECSA believes that the Bunker Delivery Notes (BDN)****, already available onboard all ships and the entries in the oil record book, constitute the appropriate legal, certified and verifiable input to a MRV system. BDN and oil record book are mandatory according to the MARPOL convention and subject to verification during Flag State and Port State inspections. Furthermore, ECSA is of the opinion that* ***the relevant authority for CO2 data collection should be the Flag State****."*

Recommendation of expert group

- Do both (bottom-up and top-down)
- Explain differences, if any

- Base new bottom-up on extensive use of AIS data

- Decision at MEPC 65 (May 2013)

MBMs

- Some proposals merged (Japan, WSC: EIS)
- Bahamas proposal withdrawn
- US proposal reformulated
- Basically, no real progress since 2010

Greece's position

- Keep on table only Levy and ETS proposals
- Put on hold hybrid MBMs (US, EIS)
- Discard all others

Greece's position

- Keep on table only Levy and ETS proposals
- Put on hold hy[illegible] (US, EIS)
- Discard all others
- **KEEP ALL ON THE TABLE**

EEDI

- Fundamental conflict between EEDI compliance and minimum safe power (or speed).
- Unclear how conflict can be resolved.

- (Looks like it will be messy)

Thank you very much!