

GREENER AND MORE PROFITABLE SHIPPING

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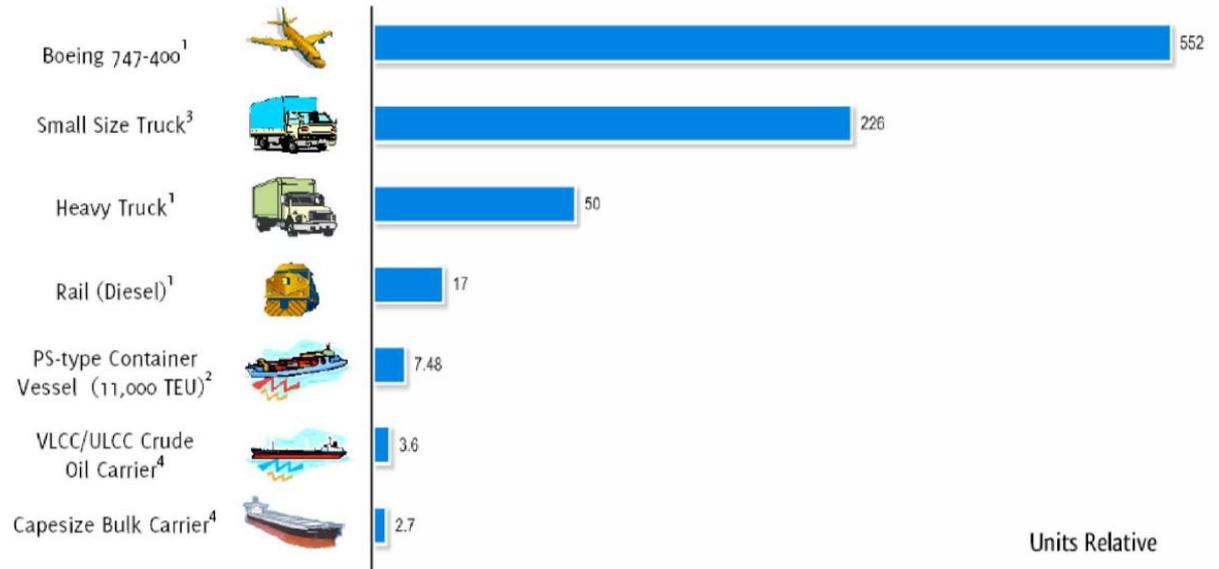


Shipping has always been the most environmentally friendly form of transport emitting only 2.7% of the world's Green House Gases.

Shipping contributes only 12% to marine pollution

COMPARISON OF CO₂ 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

Shipping conforms to:

The laws of nature, which are well thought through and consistent

Manmade regulations which, not being as inspired, some times create more problems than they solve despite the fact that knowledge and experience is ever expanding

This presentation is mostly about the latter.

Shipping reacts to cost inputs and profitability criteria

To improve shipping's already good environmental performance we must think clearly, free of ideological constraints and avoid meaningless, unnecessary complications.

LARGER SHIPS ARE MORE ENERGY EFFICIENT PER TON OF CARGO(*)

A 400.000 Bulk Carrier is about 50% more energy efficient per ton of cargo carried than an 180.000 Cape size.

A 180.000 Bulk Carrier is about 47% more energy efficient per ton of cargo carried than an 73.000 Panamax Bulk Carrier.

A 73.000 Panamax Bulk Carrier is about 25% more energy efficient per ton of cargo carried than an 51.000 Supramax Bulk Carrier.

A 51.000 Supramax Bulk Carrier is about 37% more energy efficient per ton of cargo carried than an 31.000 Handysize Bulk Carrier.

Larger ships are also more cost efficient than smaller ships. **Their use depends on port infrastructure and facilities.**

(*) Assuming similar EE design and technology

“BACK TO THE FUTURE”

The **EEDI** is the Energy Efficiency Design Index. Its purpose is to promote the **design** of energy efficient ships. **That means improved hulls (the platform)**. The simplified formula is as follows:

The formula →
$$\frac{P \cdot SFC \cdot C_f}{dw \cdot v} = EEDI \leq a \cdot dw^{-c}$$
 ← the reference line

As formulated, all it will succeed in doing will be to build ships travelling at **World War II** speeds. This will increase transit time from Brazil to China from about **34.5 days** at **13.5 kn** to about **49 days** at **9.5 kn**!! Crews will suffer, interest and inventory costs will rise, more ships will be built and market fluctuations will be more violent, for lack of the elasticity derived from being able to steam through a greater speed range.

The databases that produced the regressions which formulate the reference line are plagued with inconsistencies:

Table from IMO MEPC 62/5/6 of May 5, 2011 submitted by Greece

MO/YEAR	YARD	DWT (Ton)	Engine (HP)	Speed (kn)	EST EEDI
Feb-95	YARD 1	68519	9799	15.00	3.388 (3.730)
Jun-94	YARD 1	68621	9800	13.90	3.652 (4.019)
Jul-81	YARD 2	65337	15200	15.50	5.334 (5.871)
Jul-81	YARD 2	65020	15202	16.80	4.946 (5.444)
Aug-99	YARD 3	73725	10261	14.00	3.533 (3.889)
Sep-99	YARD 3	73659	10261	15.50	3.194 (3.516)

The above sister ships built by the same yard within a few months of each other have 8%-10% differences in EEDI.

For ships to avoid incorrect environmental classification and in order to maintain their cost efficiency, the EEDI must compare ship design energy efficiency at a fixed speed. (Precedent: The efficiency indexes used in the automotive industry i.e. a well defined cycle applicable to all cars).

Shipowners and Charterers in their negotiations incorporate the ship's consumption at different speeds (and drafts) at which the ship may trade at. It is clear from the EEDI formulation that same ship will have a different EEDI at different speeds (and drafts).

The market rates ships by running computerized simulations of profitability for the envisaged voyage for each candidate ship at the described and legally binding speed and consumption figures given by owners.

Only bureaucrats and others that have every interest to cloud the issue are satisfied with an EEDI based on 75% MCR at an unspecified speed.

If this convoluted thinking is to prevail then minimum power requirements should be established for each ship. This eventuality would unfortunately add complications and uncertainty. It will also require simulations to make meaningful comparisons between ships.

The IMO Stability Code Severe Wind criterion requires testing in winds of 26 m/sec plus gusts (10+ Beaufort)

Any powering requirements to meet lesser weather conditions would result in the ship grounding in an upright position in bad weather!!

Energy efficiency and profitability go hand in hand

Similar ships with a smaller C_B burn less. The tradeoff of a small loss in deadweight to reduce consumption, increases annual profits in a high energy cost environment.

Example:

A Panamax shedding 500 tdw to gain 3 tons/day fuel saving at sea would gain:

\$ 250,000/year at bunker prices of \$ 600/ton

\$ 330,000/year at bunker prices of \$ 900/ton

Ship hulls should be designed to operate profitably in the envisaged energy cost environment.

THE TECHNOLOGIES HAVE BEEN KNOWN FOR A LONG TIME

Hull form is very important

- A racing skiff does ~ 10 kn with 1 M-P
- A rowboat does ~ 2 kn with 1 M-P

Slow speed engines and propellers

“Propeller efficiency usually increases with increasing diameter” ... “A reduction of the RPM tends to be beneficial” “Muntjewerft in 1983 mentions a possible increase of propulsive efficiency of 10 to 15 pct” (PNA-1988)



In 1981 Burmeister & Wain produced their MKIII 65.000 tdw Panamax bulk carrier with improved hull, engine and a slow turning propeller doing 82 RPM @75% MCR, thus creating a very energy efficient ship.

Its consumption was about 25% less than other ships built at the time. The ship had excellent cubic capacity but was a little short on dwt.

MARKET BASED MECHANISMS

Ships trade at the speed at which profits are maximized. Ship emissions vary with the cube (or more) of ship speed. Ship speed varies with the ratio of the Freight Market level to the Bunker price.

The average loaded trading speed of the bulk carrier fleet in 2012 appears to be 20% lower than that of 2007. This has reduced ship emissions by about 50%. **Because of these fluctuations, trying to create data bases and benchmarks for average yearly ship emissions is an exercise in futility.**

Furthermore bunkers sold to shipping are reported by the IEA. Because ship bunkers are tax free, leakage of bunkers to shipping from other (taxed) sources is improbable.

The Levy is the only Market Based Mechanism (MBM) which is directly and identifiably applicable to the cost of fuel for any trip, thus triggering an automatic profitable speed balancing mechanism. Systems that rely on average yearly emissions such as the ETS and others fail to capture this.

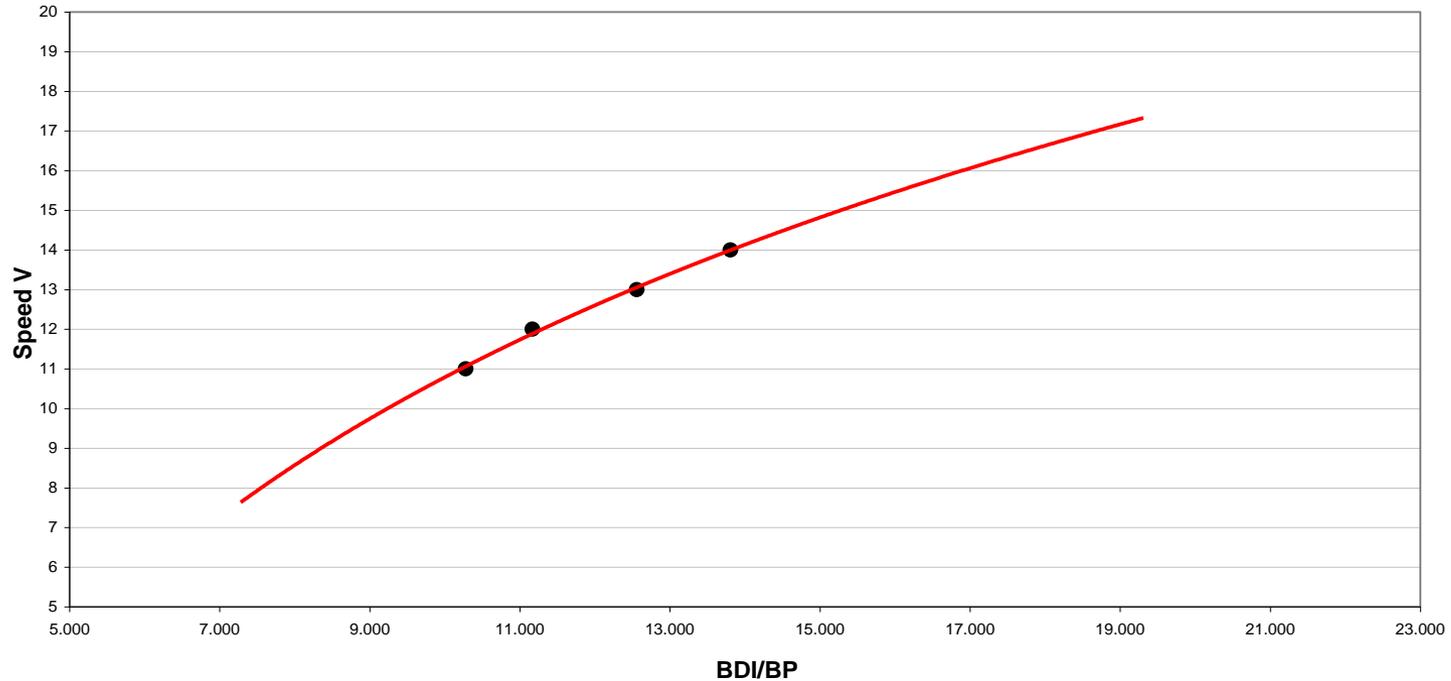
The Levy, because of its simplicity, is 2 to 5 times more cost efficient than the ETS (USA CBO), providing greater environmental benefits at a lower cost. It will therefore disrupt globalization, world growth, trade and prosperity less.

Ship speeds fluctuate with the ratio of the freight rate to the bunker price

(Example for a Panamax BC)

VOYAGE: QUANGDAO - DAMPIER - QUANGDAO				TOTAL MILES		7096		
SPEED	DAYS AT SEA	DAYS IN PORT	TOTAL DAYS		TOTAL BUNKERS			
11 knots	26.9	5	31.9		548 tons			
12 knots	24.6	5	29.6		650 tons			
13 knots	22.7	5	27.7		760 tons			
14 knots	21.1	5	26.1		875 tons			
BUNKER PRICES								APPX
FREIGHT RATE	\$ 200/T	\$ 300/T	\$ 400/T	\$ 500/T	\$ 600/T	\$ 700/T	\$ 800/T	BDI *
5	5561	3843	2159	408	-1310	-3028	-4746	2603
6	7818	6100	4382	2665	947	-771	-2489	2842
7	10169	8357	6639	4922	3204	1486	-232	3081
8	12671	10614	8897	7179	5461	3743	2025	3320
9	15326	12871	11154	9436	7718	6000	4282	3559
10	18084	15270	13411	11693	9975	8257	6539	3798
11	20843	17726	15668	13950	12232	10514	8756	4037
12	23602	20325	17939	16207	14489	12771	11053	4276
13	26360	23008	20372	18464	16746	15028	13310	4515
14	29119	25766	22804	20721	19003	17285	15567	4754
15	31877	28525	25379	23041	21260	19542	17824	4993
16	34636	31284	27978	25473	23517	21799	20081	5231
17	37393	34042	30690	27905	25775	24053	22339	5470
18	40153	36801	33448	30433	28142	26313	24596	5709
19	42912	39559	36207	33032	30754	28571	26853	5948
20	45670	42318	38966	35632	33007	30828	29110	6187
21	48429	45077	41724	38372	35487	33243	36367	6426
22	51188	47835	44483	41130	38087	35676	33624	6665
23	53946	50594	47241	43889	40686	38108	35912	6904
24	56705	53352	50000	46648	43295	40541	38345	7143
25	59464	56111	52759	49406	46054	43141	40775	7382
26	62222	58870	55517	52165	48812	45740	43205	7621
27	64981	61628	58276	54923	51571	48339	45642	7860
28	67739	64387	61034	57682	54330	50977	48195	8099
29	70498	67146	63793	60440	57088	53736	50794	8338
30	73257	69904	66552	63199	59847	56494	53394	8577

SHIP SPEEDS vs BDI/BP(Bunker Prices)



With this natural correlation of speed vs BDI/BP ships will proceed at the speed at which they maximize their time charter earnings.

They will automatically slow down in poor markets or high bunker prices and speed up in good markets or low bunker prices.

GLOBALIZATION, THE COST OF FUEL AND THE PRICE OF CARBON

The price of HFO presently fluctuates around **\$650/ton**. Going forward it is more likely to increase than decrease. **To this one must also estimate a price for carbon emissions** which is presently being discussed in the form of a Market Based Mechanism (MBM). This will influence trade and globalization.

According to IMO MBI study “International Shipping & Market Based Instruments 2009” co-authored by the University of Cambridge, UK, Cambridge Econometrics (CE), UK, MARINTEK, Norway, Manchester Metropolitan University, UK, Deutsches Zentrum für Luft und Raumfahrt e.V. (DLR), Germany, the price of carbon adjusted to represent tons of fuel is estimated to be **\$177/ton in 2020** and **\$3,229 in 2050**.

A **\$100/ton** increase in price of fuel would increase the round trip cost of freight in a Cape size bulk carrier **from Brazil to China by \$2.27** or about 10% of present rates. It will increase the cost of freight **from Australia to China at normal speed by \$0.71** also about 10%. It is clear that if the price of fuel is **increased through the price of carbon by \$1,000/ton this will double present freight rates**.

Without improvements in ship hull design the much a higher total fuel cost will change sourcing, slow or possibly even reverse globalization thus increasing costs to the society. This will slow world growth, trade and prosperity.

ADVANTAGES OF A BUNKER LEVY

A bunker Levy alone could act as both:

- A ship design improvement mechanism, and
- An automatic speed regulating mechanism

It would do this while reducing emissions, increasing ship profitability, eliminating unnecessary complexities and uncertainty.

It is also 2 to 5 times more cost efficient thus increasing environmental benefits at a lower overall cost to society.

Both emissions and the world transport system are very complex. Their interaction is obviously even more complicated.

Governments should carefully study the repercussions of their regulations before they inflict irreversible damage to society with inappropriate legislation. Our society has developed substantial analytical capabilities to help guide us.

**Regulations should be supported by
facts not feelings**

**ATTEMPTS TO DATE ARE NOT
IMPRESSIVE**

THE ENVIRONMENT CAN'T WAIT

Thank you

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