



# **Introduction and Study on New Ships EEDI**

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1. Why did IMO develop the EEDI
2. What is EEDI
3. What is Baseline
4. How to use Baseline
5. How to reduce EEDI
6. Conclusion



## 1. Why IMO developed the EEDI

**CO<sub>2</sub> is the most important anthropogenic Greenhouse Gas(GHG)**

**CO<sub>2</sub> annual emission have grown between 1970 and 2004 by about 80%**

**The total emissions from international shipping is about 2~3%**

**While the yield of individual measures may be small, the collective effect across the entire fleet will be significant**





## 2. What is EEDI

Attained energy efficiency design index(EEDI)

$$= \frac{\text{Environmental cost}}{\text{Benefit for society}}$$

**Cost:** Emission of CO<sub>2</sub>

**Benefit:** Cargo capacity transported  
a certain distance



## 2. What is EEDI

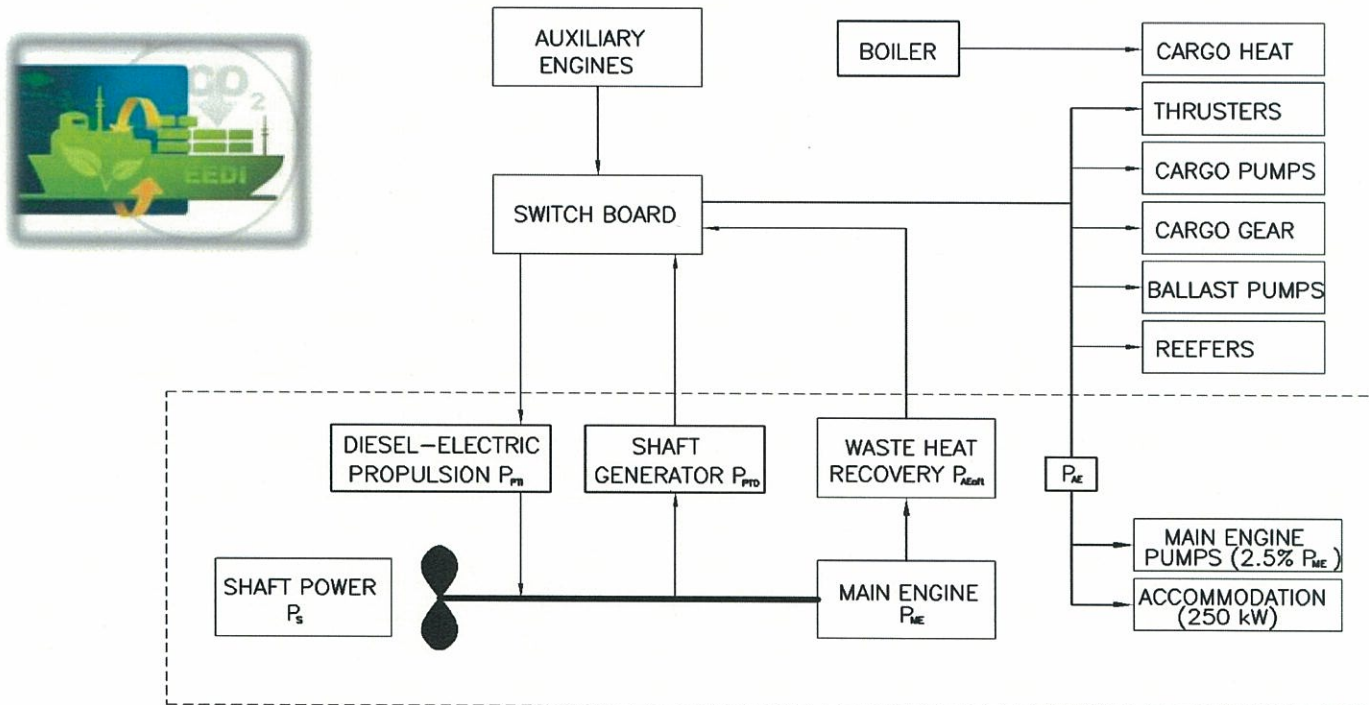
$$\text{Attained EEDI} = \frac{C_F \cdot \text{SFC} \cdot P}{f_i \cdot \text{Capacity} \cdot V_{\text{ref}} \cdot f_w}$$

- ✓ **C<sub>F</sub>**: Conversion factor between fuel and CO<sub>2</sub> emission
- ✓ **SFC**: Specific fuel consumption
- ✓ **P**, **V<sub>ref</sub>** and **Capacity**: A consistent set of engine power required to sail at a certain speed when the ship is carrying its capacity in calm weather
- ✓ **f<sub>w</sub>**: Decrease of speed in representative sea conditions
- ✓ **f<sub>i</sub>**: Capacity factor



## 2. What is EEDI

### A generic and simplified marine power plant





## 2. What is EEDI

Attained EEDI =

Main engine power reduction due to innovative mechanical energy efficient technology

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

Main engines

Auxiliary engines

Shaft motors - auxiliary power reduction due to innovation electrical energy efficient technology



## 3. What is Baseline

Average attained index for the world fleet

The baselines for cargo ships have been recalculated for ships built in the period from January 1998 to December 2007 by Denmark.

The baselines for cargo ships to be calculated using assumption

Baseline value

$$= a \text{ Capacity}^{-c}$$

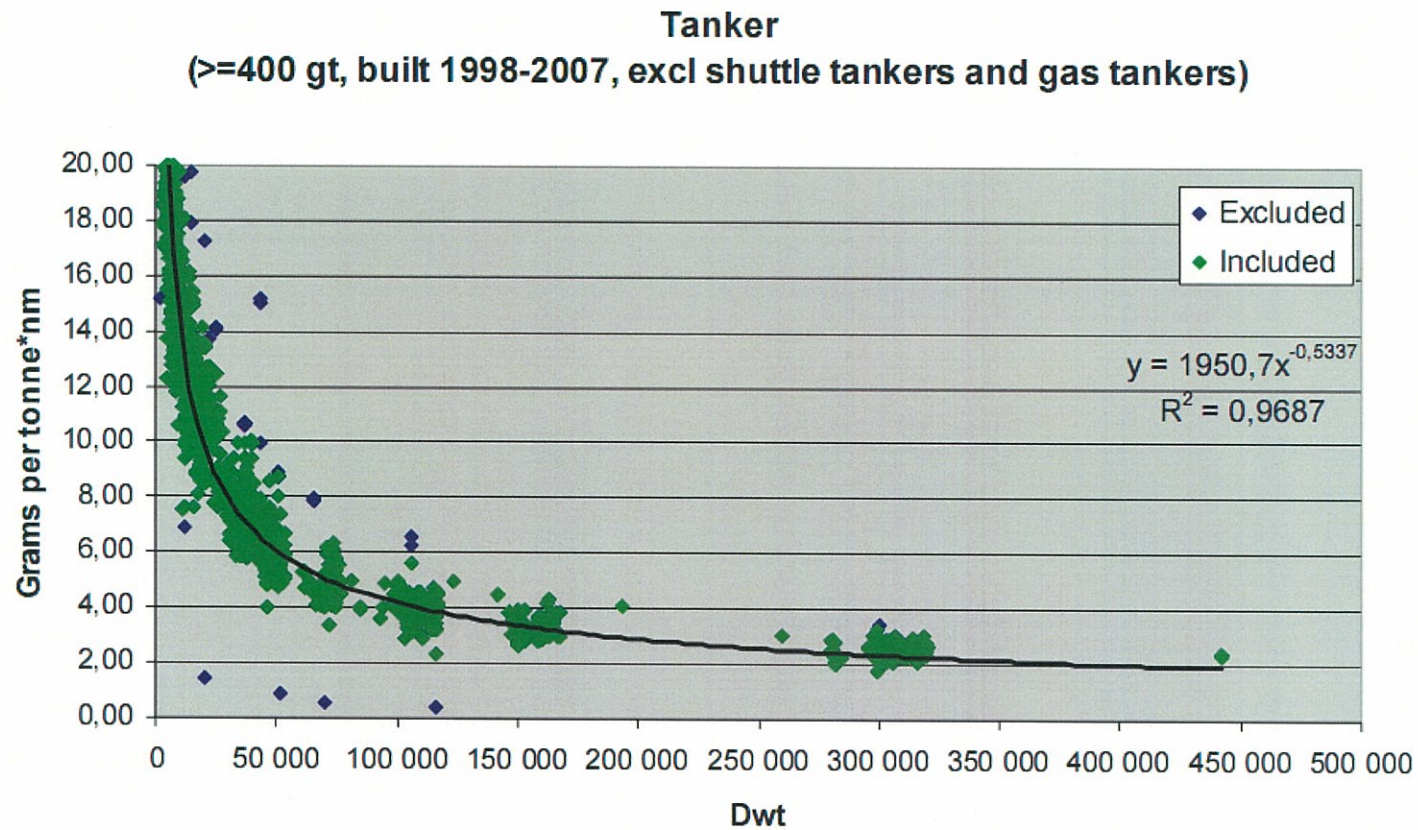




### 3. What is Baseline

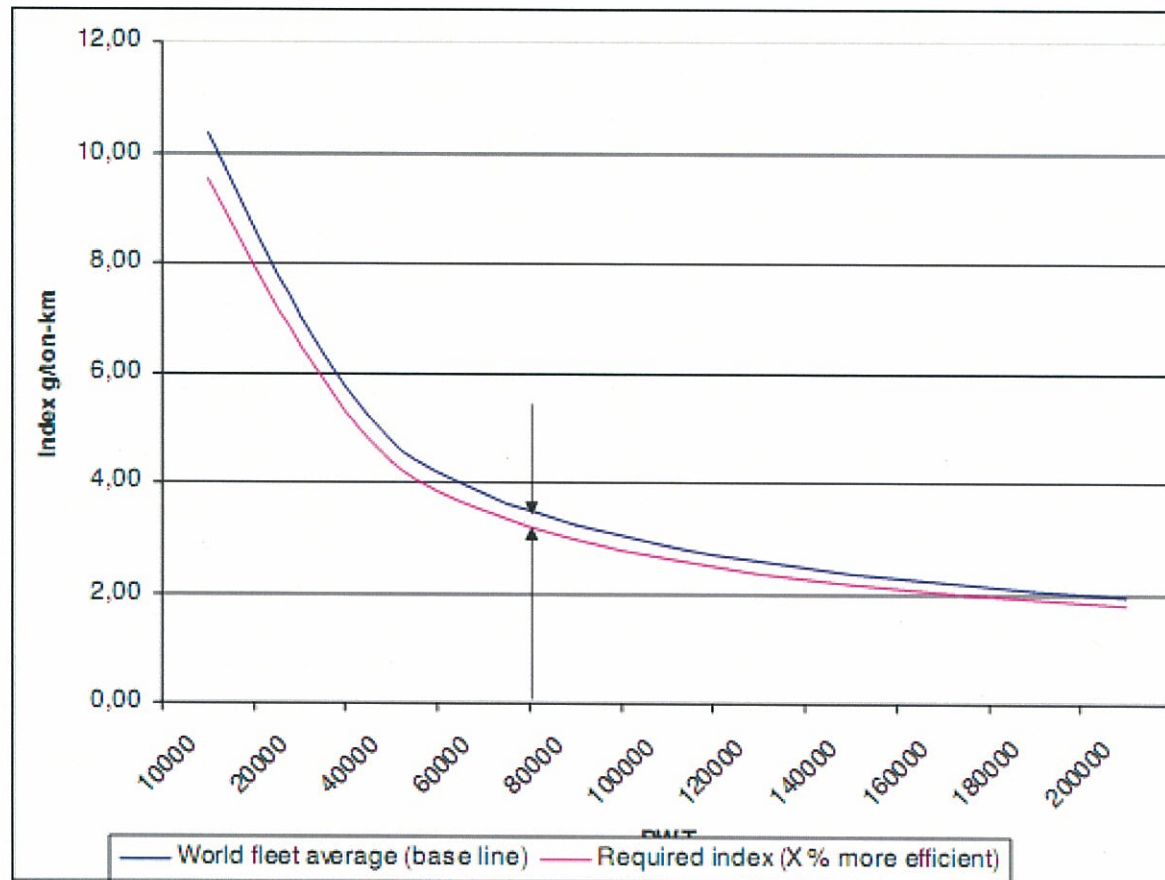
Ship type	a	Capacity	c	R <sup>2</sup>
Dry bulk carriers	1354.0	DWT	0.5117	0.93
Tankers	1950.7	DWT	0,5337	0.97
Gas carriers	1252.6	DWT	0.4597	0.93
Container ships	139.38	DWT	0.2166	0.66
General cargo ships	290.28	DWT	0.3300	0.63
Ro-ro cargo ships	19788	DWT	0.7137	0.80

## 3. What is Baseline





## 4. How to use Baseline



value

nan



## 4. How to use Baseline

In case of

**Attained EEDI  $\geq$  Required EEDI**

The design cannot be approved, possible solutions may be:

- ✓ Optimize design to increase the speed available for the same engine size, or
- ✓ Reduce engine size

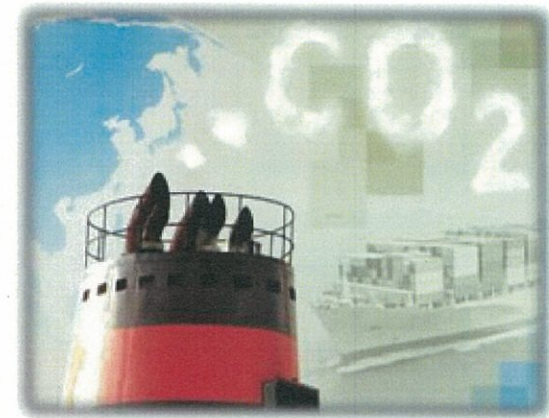
**To reduce attained EEDI**





## 5. How to reduce EEDI

- ❑ Ship design
- ❑ Propulsion
- ❑ Machinery
- ❑ Operation & Maintenance



## 5. How to reduce EEDI

### ■ Ship design

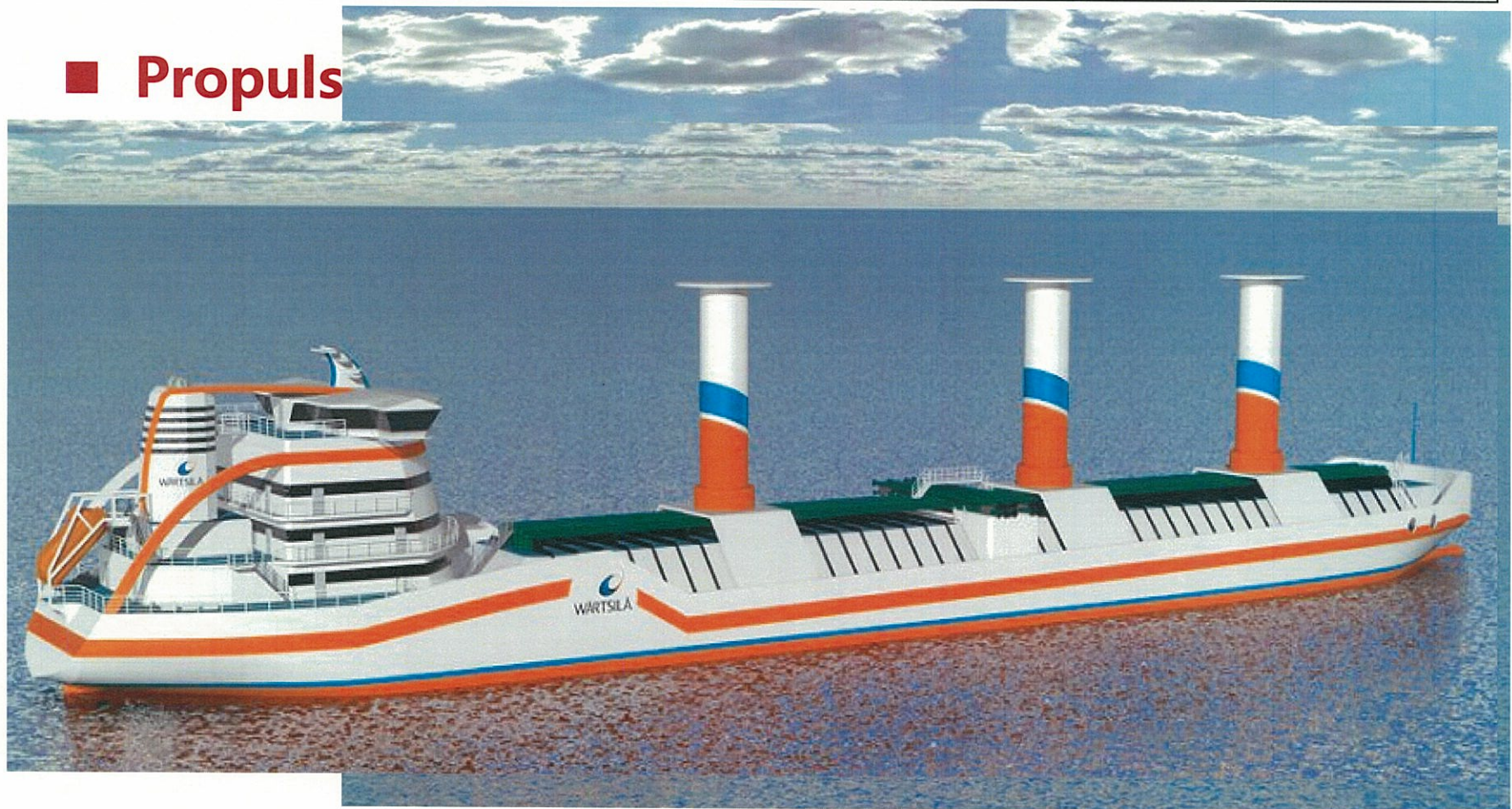
- Optimum main dimensions
- Reduce ballast water
- Lightweight material construction
- Apply innovated technology such as energy saving device, air lubrication, etc.





## 5. How to reduce EEDI

### ■ Propuls

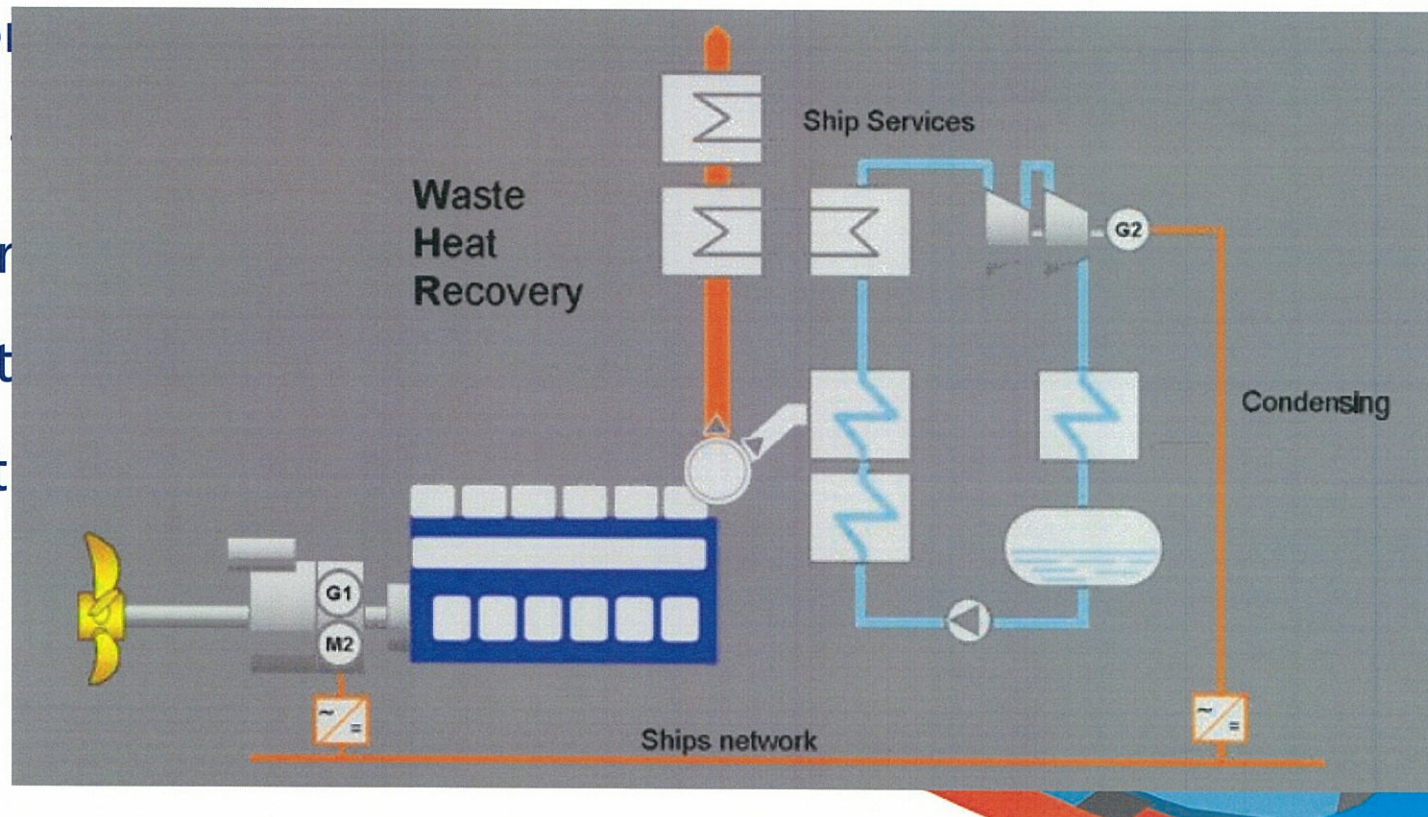




## 5. How to reduce EEDI

### ■ Machinery

- Hybrid
- Fuel
- Solar
- Waste
- Elect





## 5. How to reduce EEDI

### ■ Operation and Maintenance

- Propeller surface finish/polishing
- Hull surface-Hull coating
- Voyage planning-weather routing
- Hull cleaning
- Condition Based Maintenance (CBM)



## 6. Conclusion

- ✓ The new ship EEDI is the key point of CO<sub>2</sub> emission reduction from source and initial design procedure
- ✓ IMO has a unique position in the maritime industry and is the most effective means for regulating CO<sub>2</sub> emissions
- ✓ The EEDI is a complicated technical issue, which needs great efforts made by the parties related shipping industries





***The End***

***Thanks for Your Attention***

