Issues to be considered toward EEDI Phase 3 review work

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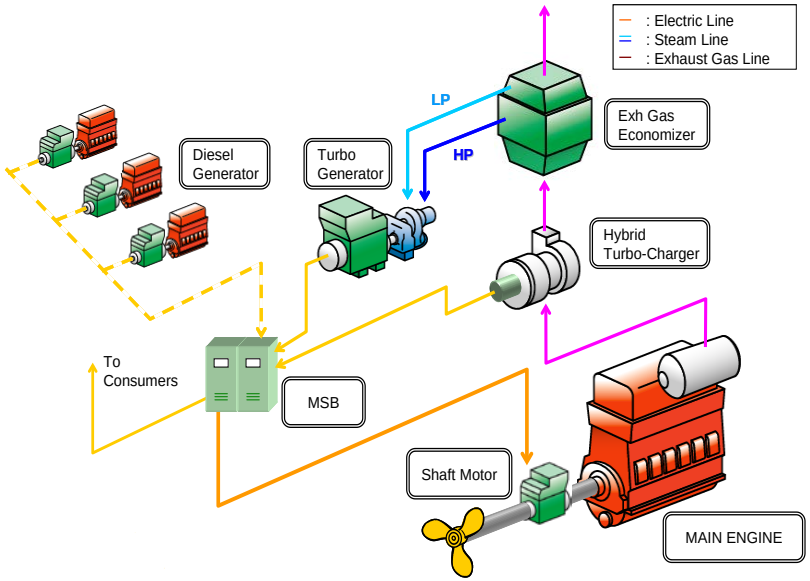
Eco-Ships built by SAJ members



- Eco-type cape size bulk carrier, built by Japan Marine United Co. since pre-Phase 0.
- Optimized hull form, High efficiency propeller and Energy saving devices improve the propulsive efficiency.
- Hybrid turbocharger and Turbo Generator generates electricity, which can satisfy the actual demand of electricity on normal seagoing. (It means zero emission from the auxiliary engine.)
- Propulsion is assisted by shaft motor utilizing surplus electricity.
- ClassNK verified that her **<u>attained EEDI satisfies the Phase 2 requirement.</u>**

Measures to satisfy Phase 3 requirement

Some of the existing Eco ships have already satisfied Phase 2, even though its building contract was to satisfy earlier phase EEDI regulation.

Have other technologies been developed at a steady pace???

→ **"No"**

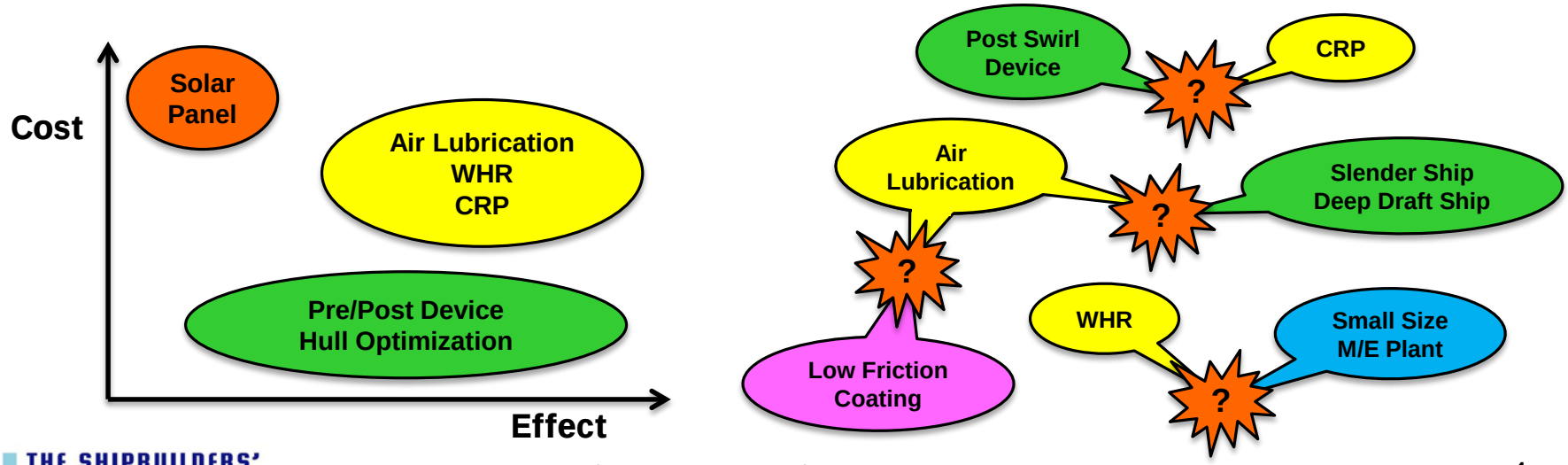
- The shipbuilders' designers aim not only to satisfy EEDI regulation, but also to get the contract under the hard competition with the other shipbuilders. Therefore, most of all ship order won through such hard competition are likely to have already incorporated the available cost effective technologies.
- Slow steaming may be a simple and effective way for some ships, but, it is difficult to apply this idea for certain type of ships because of their shipping service or the minimum propulsion power requirement for full hull form ships.

What technologies can be adopted to existing Eco ships additionally to satisfy the Phase 3 requirement?

Measures for Phase 3

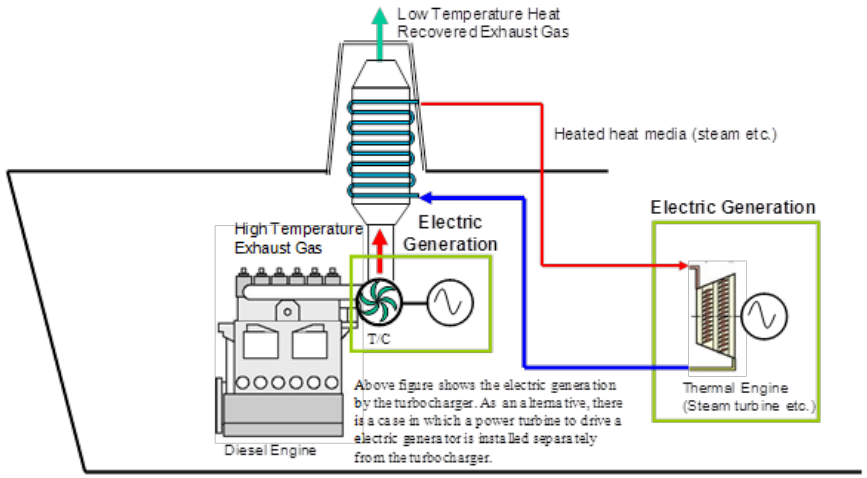
To satisfy Phase 2 is already becoming a foreseeable reality, but for satisfying Phase 3 there will be a lot more higher hurdles.

- Technologies, which have low cost and high performance, are already in use before entering into Phase 3.
- The other technologies in reserve, which are not popularly used at this moment, is bound to require too high installation cost in comparison to their potential means to reduce the GHG emission.
- Some technologies may be in conflict with their effect with other technologies in use and some technologies are not universally effective for all types and various size of vessels.
- NOx Tier III requirements will lead to deteriorating fuel oil consumption.



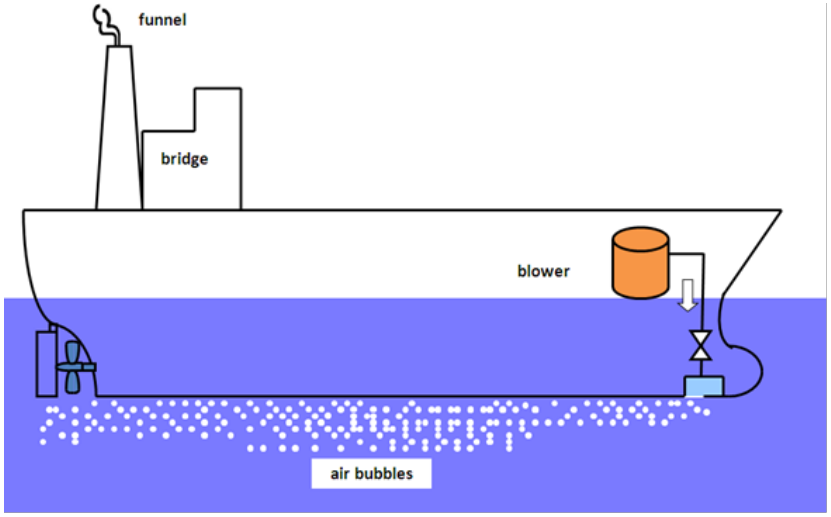
Measures for Phase 3

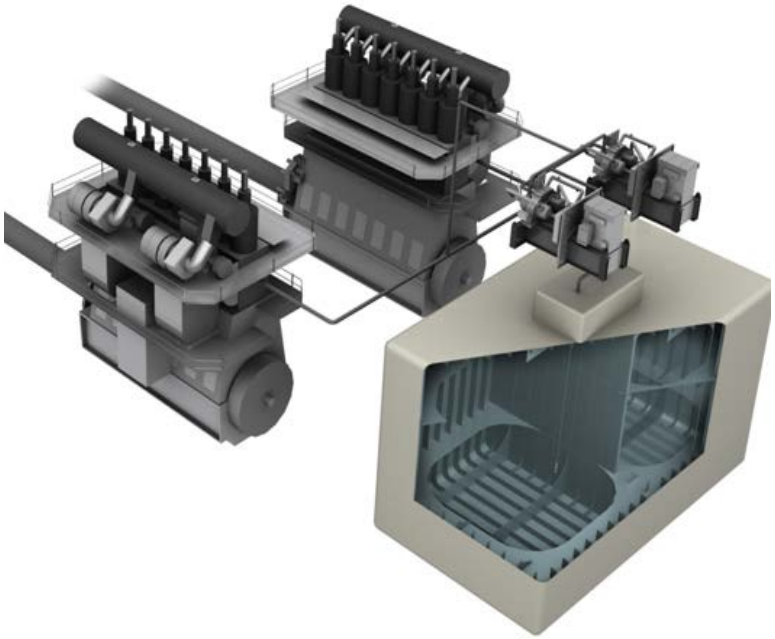
- **CRP (Contra Rotating Propeller)**
  It is a proven technology.
  But, it will require higher initial cost in comparison with the conventional propulsion system.



- **Waste Heat Recovery**
  It has already been put into practical use.
  But its effect is only to reduce the emission from auxiliary engine.
  In case of smaller ships, the effect could be disappointing in comparison with the larger ships, because the amount of waste heat will be lower than that of a larger ships.

Measures for Phase 3



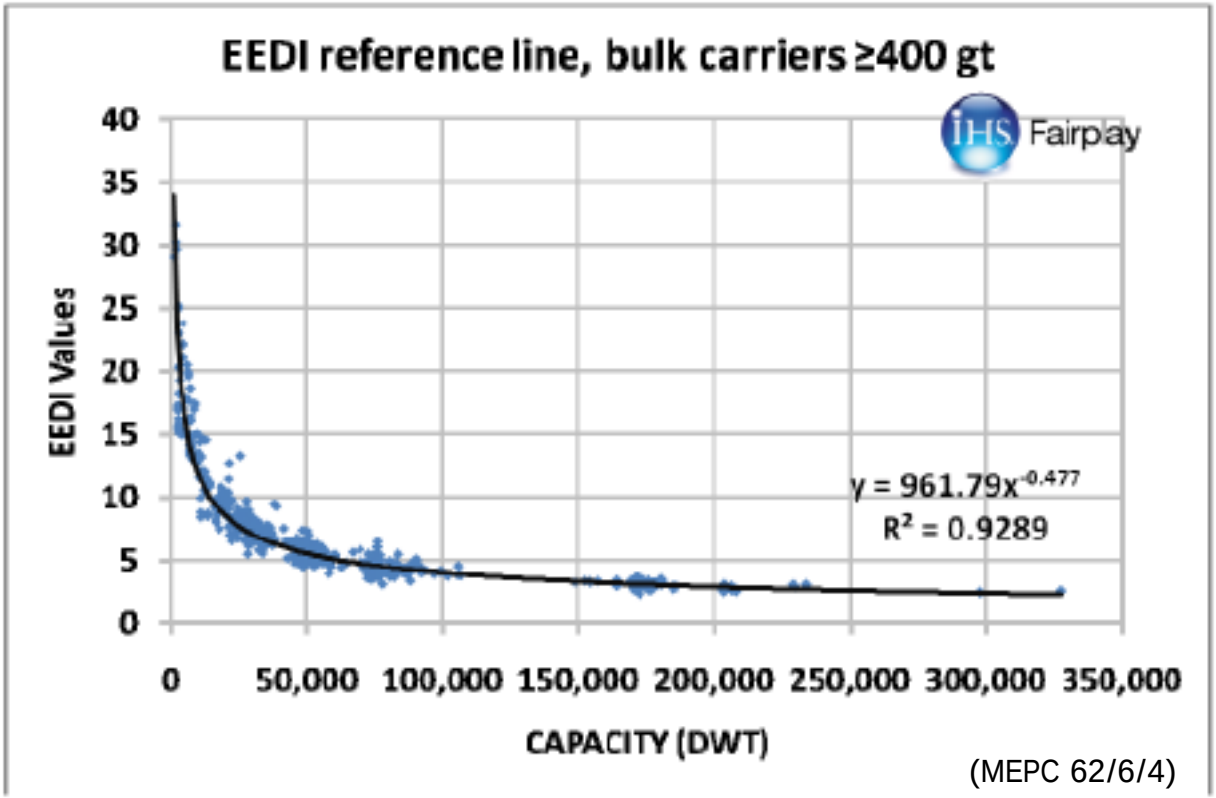


- **Air Lubrication System**
  It is already a proven technology to reduce the frictional resistance for the shallow draught ship.
  In case of large ships with deep draught, sufficient effect cannot be expected, because big energy is necessary to generate air bubbles around the deep flat bottom of the ship.

- **LNG fuel engine system**
  Quite a big effect can be expected. (**SFC** and **CF** are reduced.)
  But it requires high cost to install (large gas tank, high pressure pump system and so on) and infrastructure of the LNG supply system.

Statistics issues of reference line (ex. Bulk Carrier)

- EEDI reference line was determined by the statistical analysis for estimated EEDI index values of existing ships, which were delivered during the period from 1 Jan. 1999 to 1 Jan. 2009.
- Calculation method of estimated EEDI index value is described in MEPC.215(63).

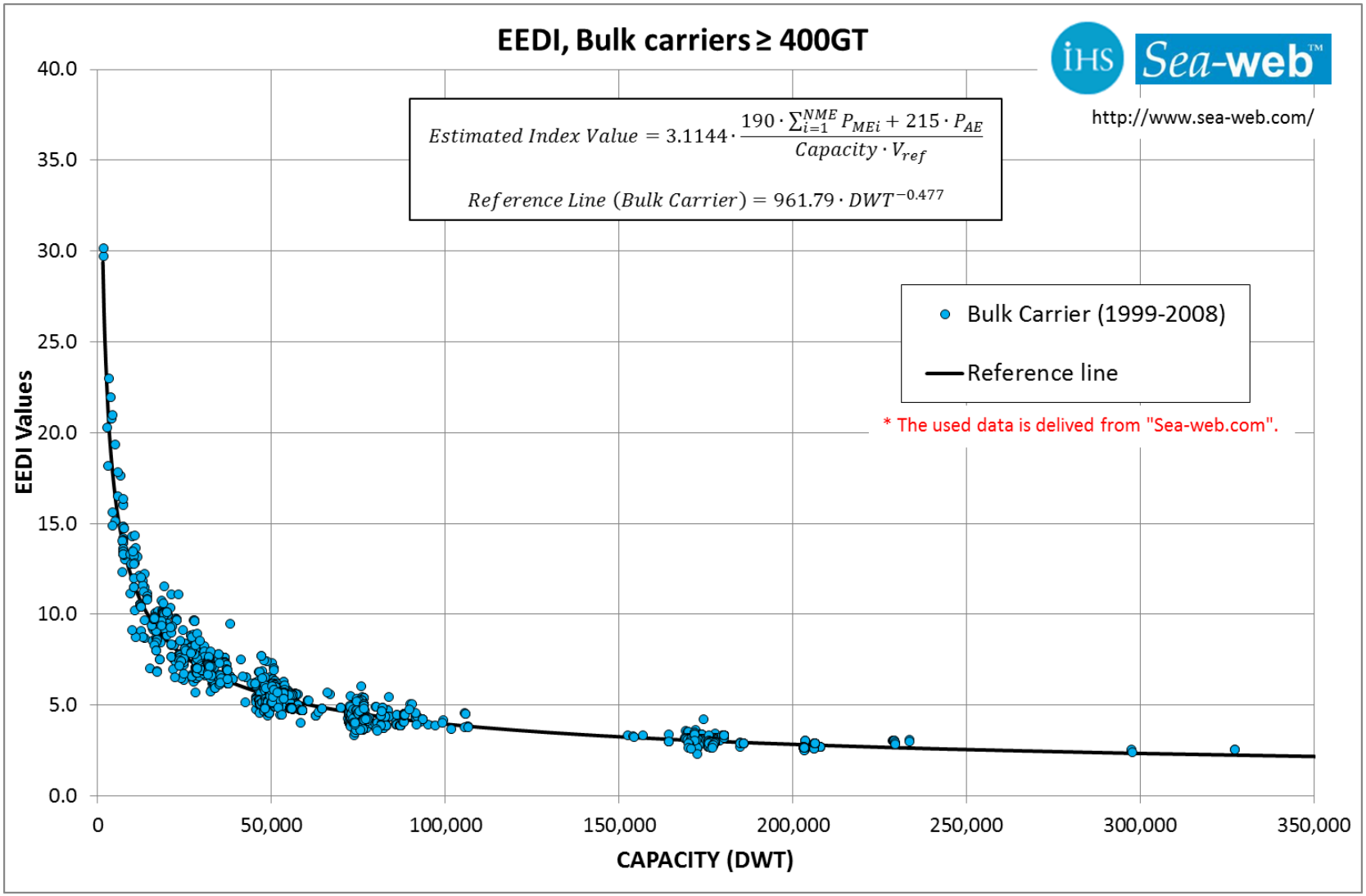


(MEPC 62/6/4)

Statistics issues of reference line (ex. Bulk Carrier)

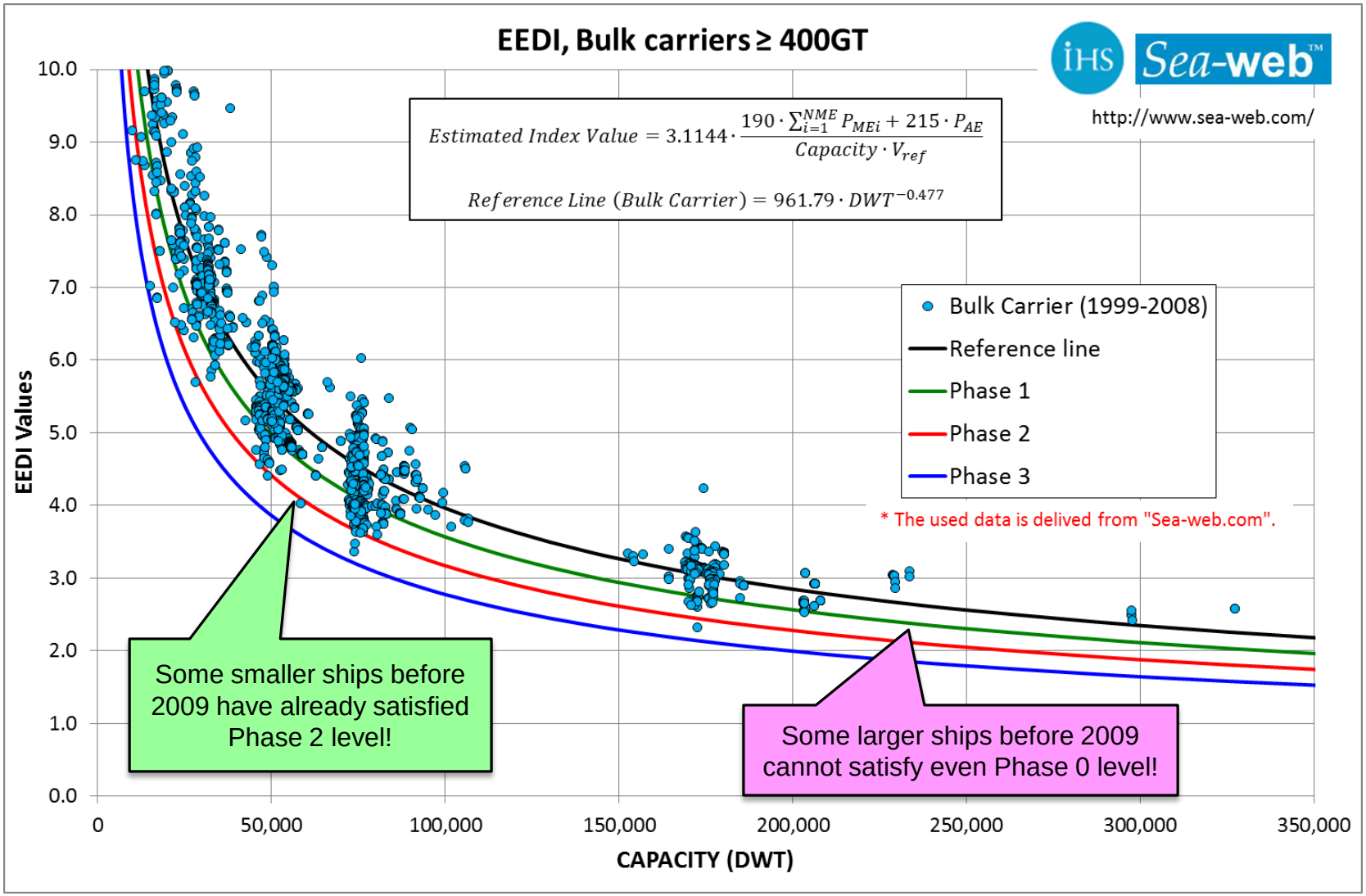
Here, almost the same database from “Sea-web”(*) is used.

(*) maritime.ihs.com



Statistics issues of reference line (ex. Bulk Carrier)

Zoom-Up over 20,000DWT and comparing with reduction line of each phase



Statistics issues of reference line (ex. Bulk Carrier)

- The EEDI reference line was determined by the statistical analysis of estimated index values for all sizes of existing ships fitting power approximation function.
- The smaller ships have a wider range of estimated index value, and some ships are already satisfying Phase 2 to Phase 3 level requirements.
- There are small number of data for the larger ships in the database and their index value cannot satisfy even Phase 0 level.
- It is a mathematical problem of the reference line to be represented by only one function even though the distribution of data are not uniform between ship sizes.
- There are about 100 bulk carriers over 180,000DWT in the database for defining the reference line and all of them were built by Korean, Chinese and Japanese shipyards. Those ships were ordered through harsh competition and already apply some energy saving technologies such as various energy saving devices or high efficiency propeller, therefore, there is but little room for improvement of EEDI.

Conclusions

- The shipbuilders have already adopted the cost effective energy saving technologies into their design in order to survive in the tough global market. As a result, their design can likely satisfy the Phase 2 level already.
- The remaining technologies represent high cost systems in comparison with the current ship's market price and require additional maintenance reference work or building infrastructures as well. It requires not only shipbuilder's attention but also the understandings of the whole shipping industry.
- The possibility of the reduction ratio of EEDI is different between ship size or ship type. In comparison with small ships, large ships are faced with a severe situation to reduce EEDI. (This could well be a problem due to definition of the reference line.)
- EEDI regulation is mandatory scheme stipulated as MARPOL Annex VI, therefore, the EEDI review work for Phase 3 shall be examined carefully taking into account the above facts.

Thank you very much for your kind attention!

경청 해 주셔서 감사합니다

谢谢您的聆听

Active Shipbuilding Experts' Federation
ASEF

THE SHIPBUILDERS' ASSOCIATION OF JAPAN

JMU Japan Marine United Corporation