MARINE ENVIRONMENT PROTECTION COMMITTEE
63rd session
Agenda item 4

MEPC 63/4/8
23 December 2011
Original: ENGLISH

AIR POLLUTION AND ENERGY EFFICIENCY

A transparent and reliable hull and propeller performance standard

Submitted by Clean Shipping Coalition (CSC)

SUMMARY

Executive summary:	In this document, the Clean Shipping Coalition (CSC) offers updated estimates of the impact of hull and propeller performance on individual vessel efficiency and on world fleet GHG emissions. The new data is based on an in-depth study of changes in hull and propeller performance on 32 vessels over 48 sailing intervals. Most major sub-vessel types and antifouling technologies were covered. CSC argues that a transparent and reliable standard for measuring hull and propeller performance will offer shipowners a more informed basis for their investments in seeking a better vessel performance and reduce overall greenhouse gas (GHG) emissions. Finally, CSC calls on MEPC to take an active role in the establishment of a standard for measuring hull and propeller performance that should be both transparent and reliable.
Strategic direction:	7.3
High-level action:	7.3.2
Planned output:	7.3.2.1.
Action to be taken:	Paragraph 33
Related documents:	MEPC 59/INF.10 and MEPC 62/INF.23

Introduction

1 While underwater hull and propeller performance has already been recognized by MEPC as important in the Organization's drive to reduce the industry's GHG emissions, new data suggests that the impact of hull and propeller performance on individual vessel efficiency and world fleet GHG emissions is somewhat higher than indicated in the Second IMO GHG Study 2009[1].

1 Second IMO GHG study 2009, MEPC 59/INF.10, section A2.6.3.

2 For a typical vessel in a typical trade, deterioration in hull and propeller performance is now estimated to result in a 15 to 20 per cent loss in vessel efficiency on average over a typical sailing interval for the entire world fleet (approximately 50 months). This corresponds to a 15 to 20 per cent increase in bunker consumption and GHG emissions if the vessel maintains its speed. Given that a share of the bunkers consumed is used for purposes other than propulsion, and given that speed is not always maintained, the deterioration in hull and propeller performance is broadly estimated to account for 9 to 12 per cent of current world fleet GHG emissions.

Hull and propeller performance

3 Hull and propeller performance is a term used to identify changes in the performance of a vessel's hull and propeller over time, assuming no design alterations have been made during the sailing interval. Specifically, it refers to the relationship between the condition of the hull and propeller and the propulsion power required to move the vessel through water at a given reference speed.

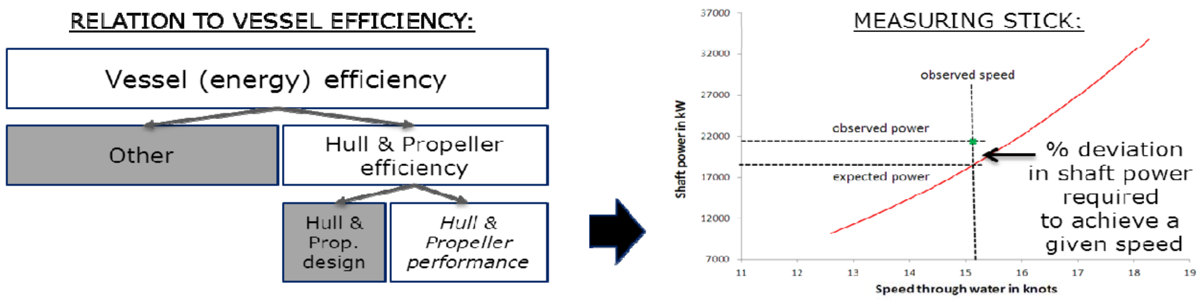

Figure 1: Hull & Propeller performance

4 By definition then, and all else being equal, the relationship between the overall vessel efficiency and hull and propeller performance is 1:1. That is, a one percentage point change in hull and propeller performance results in a one percentage point change in overall vessel energy efficiency.

5 The performance of a vessel's underwater hull deteriorates over a sailing interval (the interval between two dry-dockings). This deterioration is mainly caused by biological fouling and by mechanical damage to hull and propellers.

6 In the Second IMO GHG Study 2009[2], it was found that a typical tanker vessel experiences a speed loss of around 5 per cent on average over a sailing interval due to changes in the performance of the hull and propeller. Given a typical 1:3 relation between changes in speed and propulsion power, this means that these vessels on average will have to increase propulsion power by 15 per cent in order to maintain reference speed. This corresponds to an average vessel efficiency loss of 15 per cent over the sailing interval (a 30 per cent increase in propulsion power is needed to maintain speed at the end of the interval).

7 In the book titled "Advances in marine antifouling coatings and technologies"[3] published in 2009, the authors found that average speed loss over a docking interval was around 7 per cent. The estimate was based on analysis across a number of different vessel types. Given the same 1:3 relation between changes in speed and power, this corresponds to an average vessel efficiency loss of 21 per cent over the sailing interval.

2 Second IMO GHG study 2009, MEPC 59/INF.10, section A2.6.3.
3 Hellio & Yebara, Advances in marine antifouling coatings and technologies, 2009.

8 The above range is consistent with findings submitted to CSC by the main paint manufacture Jotun. They have conducted an in-depth study of changes in hull and propeller performance on 32 vessels over 48 sailing intervals. Most major sub-vessel types and antifouling technologies were covered by the analysis.

9 In the Jotun in-depth study it was found that the average speed loss per year across all sailing intervals was 2.36 per cent and that the typical length of the sailing interval was 54 months. This implies a cumulative speed loss of 10.6 per cent over a typical sailing interval. The corresponding vessel efficiency loss would be 16 per cent on average over a typical sailing interval.

10 A careful review of document MEPC 62/INF.23 by the United Kingdom, "Potential Additional Energy Efficiency Benefits Arising from Advanced Fluoropolymer Foul Release Coatings", indicates that over the sailing interval where the Advanced Fluoropolymer Foul Release Coatings were used, the average speed loss per year was 2.6 per cent for the one tanker analyzed, and 1.2 per cent for the one bulk carrier. Assuming the actual length of their sailing intervals are 54 months the corresponding vessel efficiency losses would be 18 per cent and 8 per cent on average over the respective sailing intervals for the two vessels.

11 Based on the information above, the CSC would argue that for a typical vessel in a typical trade, the impact of the deterioration in hull and propeller performance is likely to result in a 15 to 20 per cent loss in vessel efficiency on average over a sailing interval.

The aggregate effect of the deterioration in hull and propeller performance on world fleet bunker consumption and GHG emissions

12 The aggregate effect of the deterioration in hull and propeller performance on world fleet bunker consumption and GHG emissions is likely to be somewhat lower than the effect on the efficiency of individual vessels. This is because:

.1 world fleet bunker consumption figures include consumption for uses other than propulsion; and

.2 a substantial portion of the world fleet to some extent accepts a loss of speed instead of compensating for the deterioration in hull and propeller performance by increasing engine power.

13 The share of bunker consumption that is used for other purposes than propulsion differs across vessel types and trades. The share of bunker consumption used for propulsion purposes is estimated to be 90 per cent. For the purpose of this document the average share of consumption used for propulsion is assumed by CSC to be the same.

14 The exact extent to which speed loss incurred over a sailing interval is compensated for by increasing engine power is not yet known. However, if the type of trade and opportunities in the freight market justify the increase in bunker cost, and if the engine has sufficient capacity, the rational decision will be to maintain speed by increasing the applied engine power.

15 For the purpose of this document, the CSC assumes that this is the case, and that speed is maintained 50 per cent of the time. Given a typical relation of speed to power of 1:3, and assuming speed lost requires an equal increase in fleet capacity, maintaining speed 50 per cent of the time gives an efficiency-loss-to-consumption-increase-factor of 2/3.

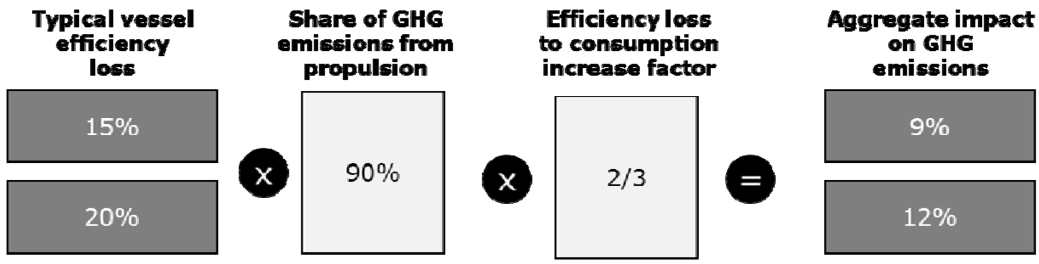

Figure 2: The aggregate impact of typical vessel efficiency loss from deterioration in hull and propeller performance on world fleet GHG emissions

16 Based on the estimate of a typical efficiency loss over a sailing interval, and given that 90 per cent of world fleet GHG emissions are related to propulsion and that speed losses are compensated for by increasing engine power 50 per cent of the time, deterioration in hull and propeller performance over an average sailing interval is broadly estimated to account for 9 to 12 per cent of current world fleet GHG emissions.

Improving hull and propeller performance

17 Hull and propeller performance is affected by decisions made by the yard and vessel owner at the new build stage, and by the vessel owner (or their appointed representative) at every subsequent dry-docking.

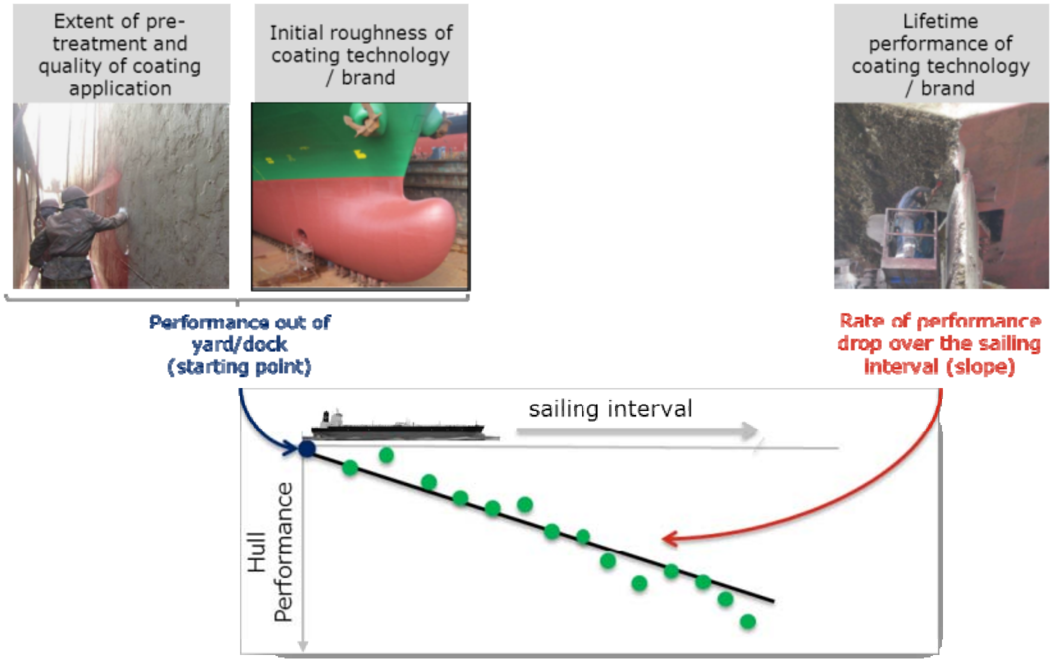

Figure 3: Improving hull performance

18 Out-of-dock hull and propeller performance is primarily determined by paint application quality and, in the case of a dry-dock, by the level and quality of pre-treatment. The antifouling system also has an impact but this impact is relatively moderate[4] on out-of-dock performance. A blasted hull with no coating applied would at the point in time of leaving the dry-dock be equally efficient for a short duration.

4 In "The importance of using effective anti-fouling coatings in relation to greenhouse gas emission from shipping", 2010, IMO has estimated the impact of a typically as applied antifouling system as compared to a hydraulically smooth surface on vessel efficiency to be in the range of 2%. The difference between different antifouling systems must be significantly lower.

19 Changes in hull and propeller performance over the sailing interval are primarily affected by the choice of antifouling system. In the cases where the antifouling system does not offer adequate protection, performance over the sailing interval is affected by the frequency and quality of underwater hull and propeller cleanings.

Barriers to action

20 All antifouling makers claim to have antifouling systems and solutions that improve hull and propeller performance and reduce bunker cost. However, the lack of a transparent and reliable standard for measuring the effects of these systems and solutions on actual hull and propeller performance has made it difficult for vessel owners (or their appointed representatives) to make informed decisions on which antifouling system to select. If vessel owners cannot measure the return of investment by choosing a specific product, they are left to qualified guesswork or simply choosing the least expensive product.

21 Claims by some coatings manufacturers (often based on studies that lack rigorous methodologies or utilize small samples) fail to disclose or define what benchmark is used as the basis for comparison. Furthermore, they do not address the extent and type of pre-treatment (for example touch-up or full sand blasting) in between the two sailing intervals affects findings.

22 Comparing hull performance data immediately before a vessel enters into dry-dock with how the hull performs with a new coat of paint (or completely stripped of paint) immediately after produces predictable results, but does not address the crux of the issue: hull performance over time. This has understandably led to some measure of confusion among vessel owners.

23 It should also be noted that in some segments of the industry, the entity investing in the paint (owner) is often different from the one paying for the fuel (3rd party charterer or internal chartering department). While increased fuel efficiency represents a competitive advantage for owners and helps charterers reduce costs, these contract mechanisms result in inadequate incentives to focus on hull and propeller performance. In combination with the lack of a reliable method for measuring changes in performance, this "principle agent" issue makes it very difficult for owners/charterers to take action to improve hull and propeller performance.

24 The ability to measure performance based on a reliable and unbiased method is a critical requirement to making an informed investment decision.

The improvement potential with best available technology applied

25 This submission outlines a methodology for measuring changes in hull and propeller performance over a sailing interval. A number of antifouling manufacturers are now working on ways to verify energy efficiency improvements by using their products. Using logged ship data from a range of sensors in combination with statistical models enable antifouling makers to guarantee a given level of hull and propeller performance over the sailing interval. A cursory look at the various performance guarantees offered today, uncovered that the most ambitious guarantee promises a maximum speed loss on average over the sailing interval are as low as 1.5 per cent.

26 If one can achieve an average speed loss over a five-year sailing interval not exceeding 1.5 per cent, this corresponds to a maximum vessel efficiency loss of around 4 per cent over a 54 months sailing interval. The vessel efficiency improvement

potential associated with selecting a better antifouling system can be estimated to be between 11 and 16 per cent.

27 Assuming that 90 per cent of world fleet GHG emissions are related to propulsion and that speed losses are compensated for by increasing the engine power by 50 per cent of the time. With best available technology, the potential for reducing GHG emissions from the world fleet by improving hull performance is thus estimated to be between 7 to 10 per cent.

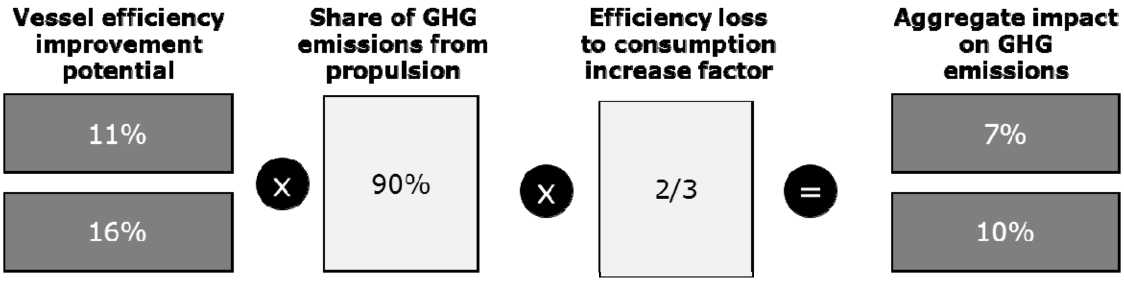

Figure 4: The aggregate impact of vessel efficiency improvement potential associated with selecting a better antifouling on world fleet GHG emissions

28 CSC would encourage all antifouling manufacturers to agree on a uniform performance measurement system, which will further ensure customers an informed choice. Better performance through reduced fuel consumption translates directly to reductions in GHG emissions.

A call for standardized and transparent measurement of hull and propeller performance

29 While the CSC does not specifically endorse any commercial marine paint manufacturer, the CSC does support the development of a standardized and reliable hull and propeller performance measurement scheme. Such a scheme would allow owners and the MEPC to gather valuable information over time, which would support better decisions about hull performance and help the MEPC more accurately quantify potential reductions of GHGs. At the same time, the scheme would encourage more detailed contract provisions on performance, thus addressing the "principle agent" issue, as noted above.

30 It should also be noted that a uniform and reliable hull and propeller performance measurement scheme is consistent with the primary goal of both the EEDI and SEEMP. The scheme does not represent a "stand alone" programme, but is linked to these initiatives by a common goal – improving the energy efficiency of ships.

31 The CSC is confident that once the impact of hull and propeller performance on fuel consumption can be accurately quantified, owners will recognize the benefits and invest accordingly. At the same time, the mechanics of hull and propeller performance will play a larger role in the technical development and innovations of marine paints.

32 As more information becomes available, charterers are likely to include provisions regarding hull and propeller performance in charter agreements. These commercial incentives, based on quantifiable reductions in fuel usage and carbon emissions, will continue to drive developments in improving hull and propeller performance in the years to come.

Action Requested of the Committee

33 The Committee is invited to consider the establishment of a transparent and reliable standard for measuring hull and propeller performance.

____