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EXPERIENCE-BUILDING PHASE FOR THE REDUCTION OF UNDERWATER RADIATED NOISE FROM SHIPPING

An assessment of incentive schemes as a driver of URN reduction
A ro-pax case study

Submitted by ICS, BIMCO and ASEF

SUMMARY

Executive summary:	This document reports on implementation of an energy efficiency measure on an existing ship, and the co-benefit in underwater radiated noise (URN) reduction. For an alternative scenario whereby the ship owner implements a URN management plan, the potential financial benefits of an existing incentive scheme are also assessed. It is concluded that incentive schemes have the potential to increase the uptake of the Revised URN Guidelines (MEPC.1/Circ.906/Rev.1). However, a key incentive scheme (IAPH ESI) will not incorporate URN reduction until 2027. Considering the relevance of such schemes, the present document intends to inform the Sub-Committee when considering a two-year extension of the experience building phase (EBP), enabling the impact of such incentive schemes to be better understood.
Strategic direction, if applicable:	1
Output:	1.16
Action to be taken:	30
Related documents:	SDC 12/8 and MEPC.1/Circ.906/Rev.1

Introduction

1 This case study recounts the real-life experience of a shipowner with respect to implementation of an energy efficiency measure on an existing ship, and the realised co-benefit of URN reduction. For an alternative scenario whereby the shipowner implements a URN management plan, the potential financial benefits of an existing incentive scheme are also assessed.

Background

2 The shipping company has requested anonymity but was founded in the mid-1960s, and is based in Northern Europe. The company is currently operating a fleet of 15 vessels on five regular routes. An additional five vessels are chartered out. A total of 4,900 staff are employed across five countries.

3 The company has pledged to increase the energy efficiency of their vessels year-on-year, thus committing to a more sustainable future. Through a memorandum of understanding, the company has also pledged to contribute to a green corridor between two of its countries of operation.

4 The ship that is the subject of this document is hereafter referred to as "the ship". Table 1, below, summarizes the ship's principal particulars and its route:

Table 1: Ship characteristics

Ship type	Ro-Pax ship
Length overall	210 metres (approx.)
Beam	30 metres (approx.)
Gross Tonnage	49,000 tonnes (approx.)
Engine power	4 x medium speed diesel engines with a combined power of 32,000 KW
Propeller configuration	Twin-screw, controllable pitch propellers
Year of build	2009
Location of route	Northern Europe
Route length	260 nautical miles

Propeller modifications

5 Noting the progressive nature of the IMO GHG regulations, the shipowner has adopted a forward-looking approach to energy efficiency by reducing the ship speed to the extent practical within the operational constraints. Under such approach two of the ship's four engines are utilised for the normal operation. As a result, the propeller became sub-optimal giving rise to a contract with the propeller manufacturer, with a view to designing new propeller blades optimized for the reduced speed.

6 The new propeller blades were fitted in early September 2023, as shown in figure 1.

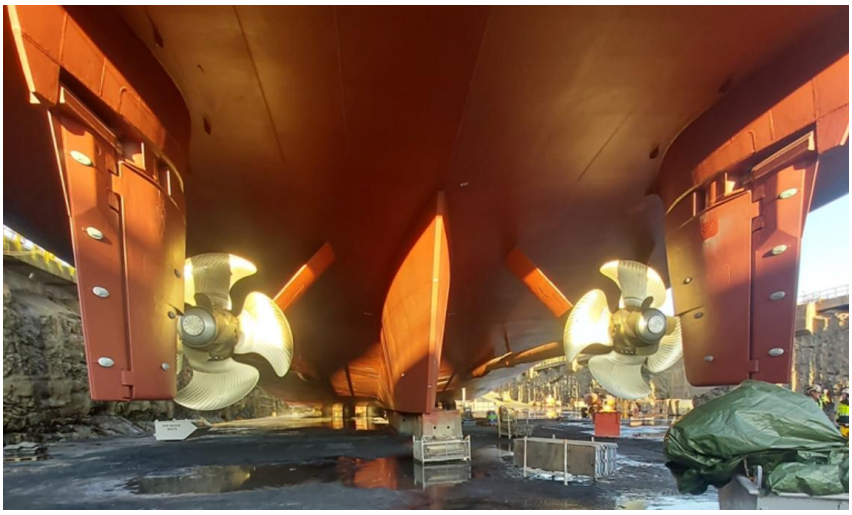

Figure 1: The new propeller blades

Fuel saving

7 The fuel consumption is routinely measured on board using Coriolis flow meters, and table 2, below, gives the consumptions in the months before and after the propeller blade changes. As can be seen, savings of between 12.3% and 21.1% were achieved, i.e. an average fuel saving of around 17%.

Table 2: Measured fuel savings

kg/nm	kg/nm	kg/nm	kg/nm		kg/nm		kg/nm		kg/nm		kg/nm	
Q1 23 AVG	Q2 23 AVG	2023 AVG	Jan 24	vs Q1 23	Feb 24	vs Q1 23	March 24	vs Q1 23	April 24	vs Q2 23	May 24	vs Q2 23
180,90	165,39	150,29	149,5	-17,36%	144,1	-20,34%	142,7	-21,12%	145,1	-12,27%	144,4	-12,69%

URN measurements

8 The shipowner contracted a local university to measure the URN emitted by the ship. The total cost of the noise measurement trials, including the measurements before and after the propeller modifications, was €13,640.

9 The measurements were conducted in accordance with the standard ANSI-ASA S12.64-2009, which defines three possible measurement methods: the Precision, Engineering and Survey methods, denoted as A, B and C, respectively. Methods A and B require measurements with three hydrophones and at a depth of 3 or 1,5 times the length of the vessel. Survey method C allows measurement with a single hydrophone. It is less accurate than the other methods, allowing a maximum uncertainty of about 4 dB.

10 The sound was measured using an RTSys Sylence sound recorder equipped with a calibrated Teledyne RESON TC 4032 hydrophone (figure 2). The hydrophone was positioned 3 m above the seabed.

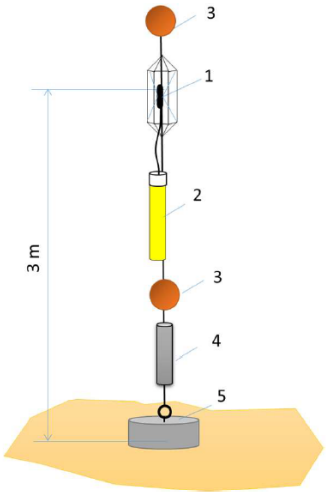

Figure 2: Setup: 1-hydrophone, 2-recorder, 3-floats, 4-acoustic release, 5-anchor

11 The recorder was deployed on 30 August 2023 adjacent to a shipping lane on the ship's normal route. The recorder was recovered on 25 September 2023.

12 Between 30 August and 4 September, 4 passages were recorded with the old propellers and between 4 September and 25 September, 11 passages were recorded with the new propellers. For each passage, the vessel's closest point of approach was determined by interpolation of coordinates from AIS data.

13 Figure 3 shows a comparison of decidecade source levels for the starboard passages before and after the change of the propeller. Both passages took place at the same speed of 7.6 knots. It can be seen that the low-frequency source level in the decidecades 40-125 Hz was significantly reduced (up to 15 dB). In addition, the sound level at frequencies above 3 kHz was reduced by up to 5 dB. Taking into account the whole calculated ship spectrum (20 – 20 000 Hz), the broadband source level of the ship was reduced by about 8 dB after the refit.

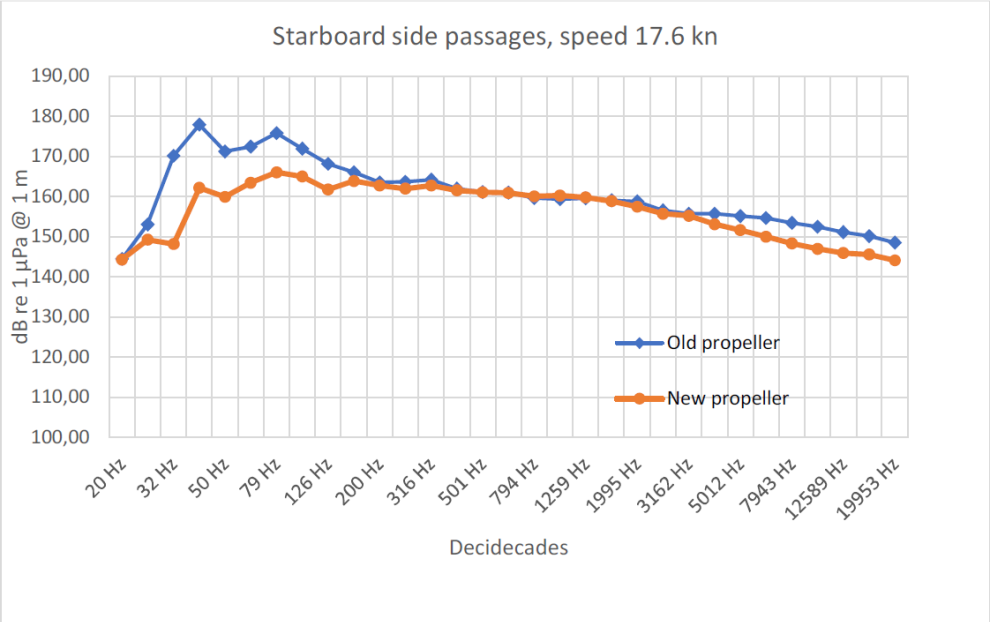

Figure 3: Comparison of sound levels, in both cases the ship speed was 17.6 knots

14 Taking into account the guidance within ANSI-ASA S12.64-2009, and the water depth limitation, the University summarised the accuracy of the results as follows:

.1 with the new propeller 40 Hz decidecade ship source level is 16 ± 5 dB lower when compared to having the old propeller (at speed 17.6 knots); and

.2 broadband (decidecades 20 Hz to 20 000 Hz) source level with new propeller is 8 ± 5 dB lower (at speed 17.6 knots).

The International Association of Ports and Harbours (IAPH) – Environmental Ship Index (ESI)

15 The shipowner participates in the IAPH ESI scheme and this is one of a number of schemes* that provide incentives for ships to improve their environmental performance. It is at the discretion of the incentive providers (typically port authorities) to allocate appropriate rewards based on the ESI points rating. Often this provides reductions in harbour dues.

* Other similar schemes include Green Marine, Green Award, the PIAQUO Noise Ship Index (NSI) and the Vancouver Port Authority Echo program.

16 A total of 6,700 ships and 60 incentive providers are currently registered for IAPH ESI. The below graphic identifies the participating ports.

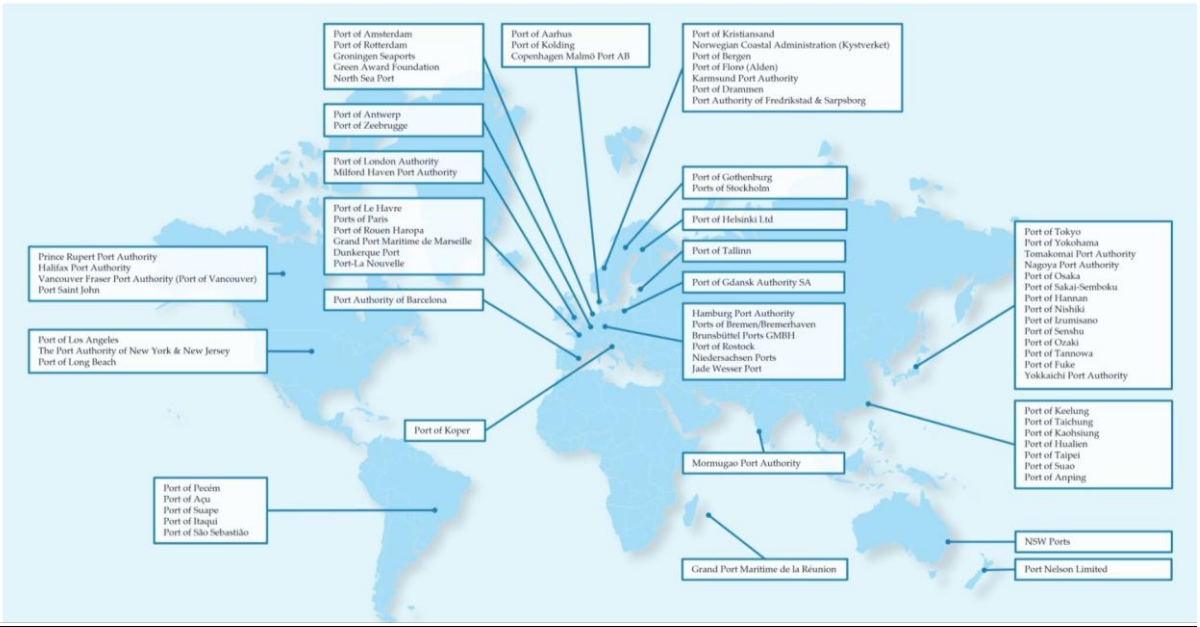

Figure 4: ESI incentive provider ports

17 IAPH is considering how the reduction of URN can be incorporated into ESI, and anticipates completion of this process by 2027. Based on their preliminary work, IAPH has advised the co-sponsors that a maximum of 20 points may be awarded for various aspects of URN reduction, potentially as a bonus to the existing ESI score.

Potential financial benefit from a URN Management Plan

18 Although the ship does not currently have a URN management plan, the propeller modifications and noise measurements could have been part of such a plan and it is possible that URN reduction measures managed by such a plan could be eligible for some of the aforementioned ESI bonus points.

19 Both of the ports served by the ship participate in the ESI scheme, and their reward policies are summarized in table 3, below:

Table 3: Comparison of ESI-based incentives for two ports served by the ship.

Port A	Tonnage charge for staying in harbour is €0.496 per GT per call	• Discount for ESI score of 65 to 79.9 = 8% • Discount for ESI score of 80 and above = 14% Noting the ship already achieves an ESI score of 94 points, it is unlikely that a URN management plan could further increase the reward received from port A.
Port B	The port has a table of discounts extending from an ESI score of 50 points up to 100 points. The discount applies to the port dues.	• For an ESI score of 93 to 96.9, port B gives a discount of €0.015 per gross ton per visit. • For an ESI score of 97 to 100, port B gives a discount of €0.017 per gross ton per visit

20 Therefore, post 2027, when URN becomes part of the ESI, if the ship were to be awarded just three bonus ESI points due to URN reduction measures, the ship would be eligible for the next highest tier of ESI discount, i.e an increased discount of €0.002 per gross ton per visit. Noting that under IAPH's existing proposals, up to 20 points would be awarded for URN reduction measures, achieving the three point bonus appears a reasonable prospect.

Assuming a total of 150 port visits per year, the discount would then amount to:

150 x 0.002 x €49,000 = €14,700

N.B. - as the ship was already participating in the ESI scheme, it has been assumed that no additional monthly subscription fee would be attributable.

Cost of implementing a URN management plan

21 The costs of a URN management plan are principally the noise measurements and also the administrative cost of preparing and regularly updating the plan.

22 If the plan is developed alongside the ship owner's efforts to achieve compliance with the IMO GHG regulations, then with careful selection of the energy efficiency measures the necessary URN reduction can be achieved at no additional capital cost, i.e. by simply leveraging the strong synergies between energy efficiency and URN reduction.

23 Table 4, on the next page, presents the estimated cost of the initial URN management plan:

Table 4: Estimated cost of the initial URN management plan

Item	Estimated cost
Noise measurements	€15,000
Drafting of the noise measurement plan	€5,000
Total	**€20,000**

24 Assuming the review period for the plan is four years, then the annualised cost for the plan is about €5,000, versus the potential discount from ESI of about €14,700. Hence on this basis it appears possible for a URN management plan to be implemented with a modest financial benefit.

Conclusions

25 The strong synergies between energy efficiency and URN reduction are well documented. For example the report by the consultancy VARD titled "Ship Energy Efficiency and Underwater Radiated Noise" lists over 100 energy efficiency measures. For two thirds of these there is a clear co-benefit. For about a quarter there is insufficient data to decide, and for very few of the measures an actual conflict between energy efficiency and URN reduction can be derived.

26 Although the shipowner's incentive for the propeller modifications was compliance with the IMO GHG regulations, a substantial reduction in underwater radiated noise has been achieved at no additional capital cost. Hence, this case study exemplifies the potential for readily reversing the increases in global ambient URN, simply by careful selection of energy efficiency measures by ship owners and managers to leverage this co-benefit.

27 Although the incorporation of URN reduction within the IAPH ESI scheme will not be fully complete until 2027, on the basis of preliminary information the estimated annual discount in port fees for the ship resulting from the adoption of a URN management plan amounts to about €14,700. Comparing with the annualised cost of a URN management plan of about €5,000 it appears that such schemes do have the potential to incentivise the increased uptake of the Revised URN Guidelines and the implementation of URN management plans.

28 The IAPH ESI is one of the most well-established of the incentive schemes. However, noting the incorporation of URN reduction will not be fully complete until 2027, there will be insufficient time to take account of its impact within the initial three year EBP of the *Revised guidelines for the reduction of underwater radiated noise from shipping to address adverse impacts on marine life* (MEPC.1/Circ.906/Rev.1). Therefore, the co-sponsors recommend the optional two-year extension is implemented allowing for a total EBP duration of five years.

29 The co-sponsors extend their sincere thanks to the shipowner for the support they provided in the development of this submission.

Action requested of the Sub-Committee

30 The Sub-Committee is invited to note the information within this document and to take into account the conclusions within paragraphs 25 to 28 when considering the possibility for a two-year extension of the Revised URN Guidelines' EBP.