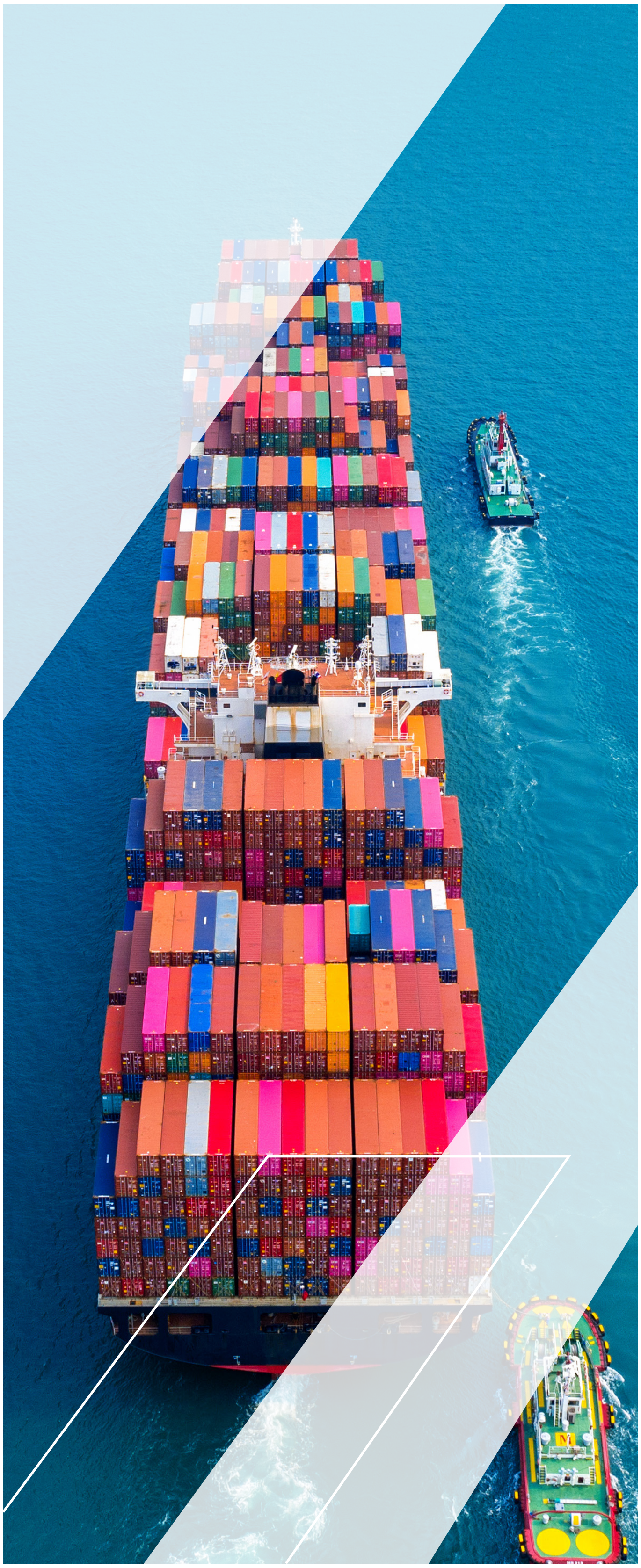
CATALOGUE

PEC

ADVANCE IN ENERGY SAVING DEVICES

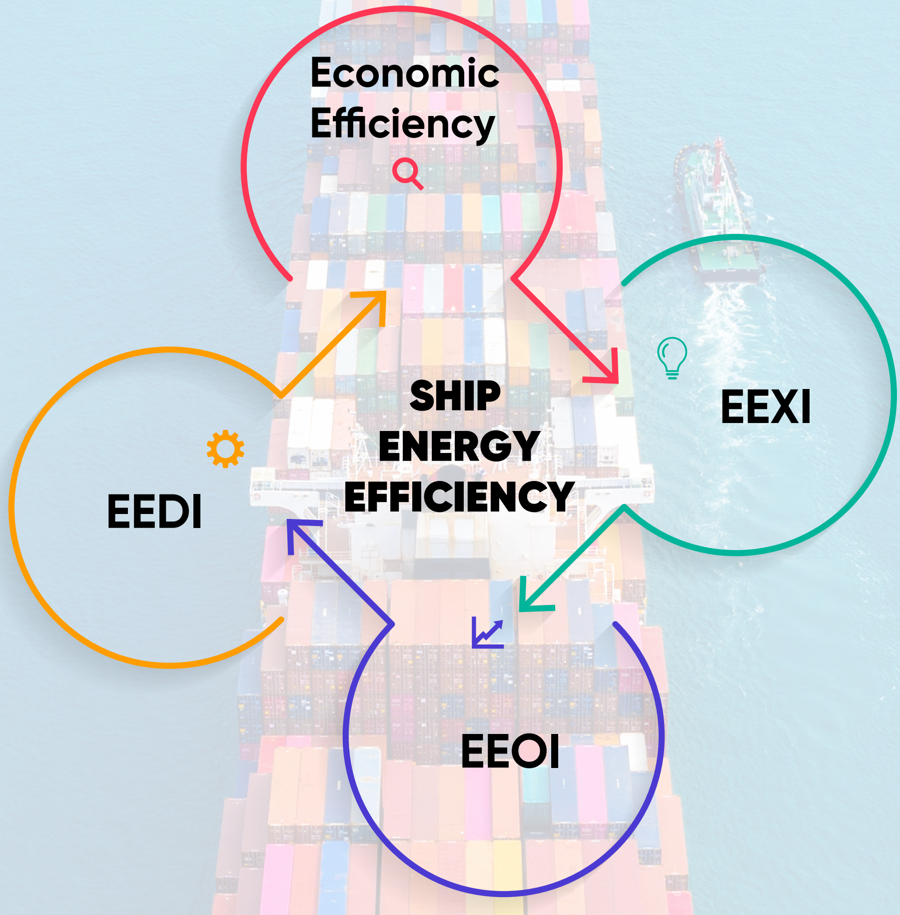
Propeller boss cap fins



CONTENT

1 GENERAL INFORMATION

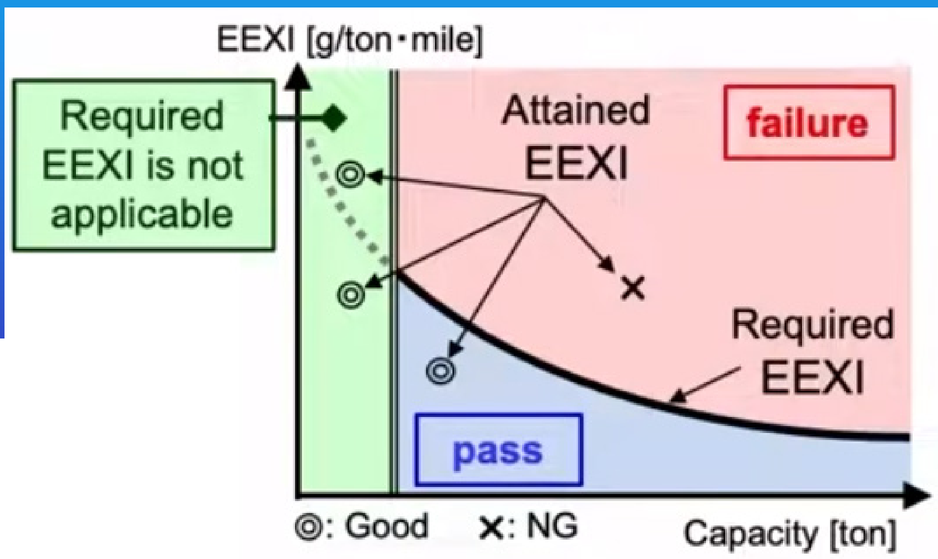
IMO put forward a series of new conventions, new codes and new standards for energy saving and emission reduction

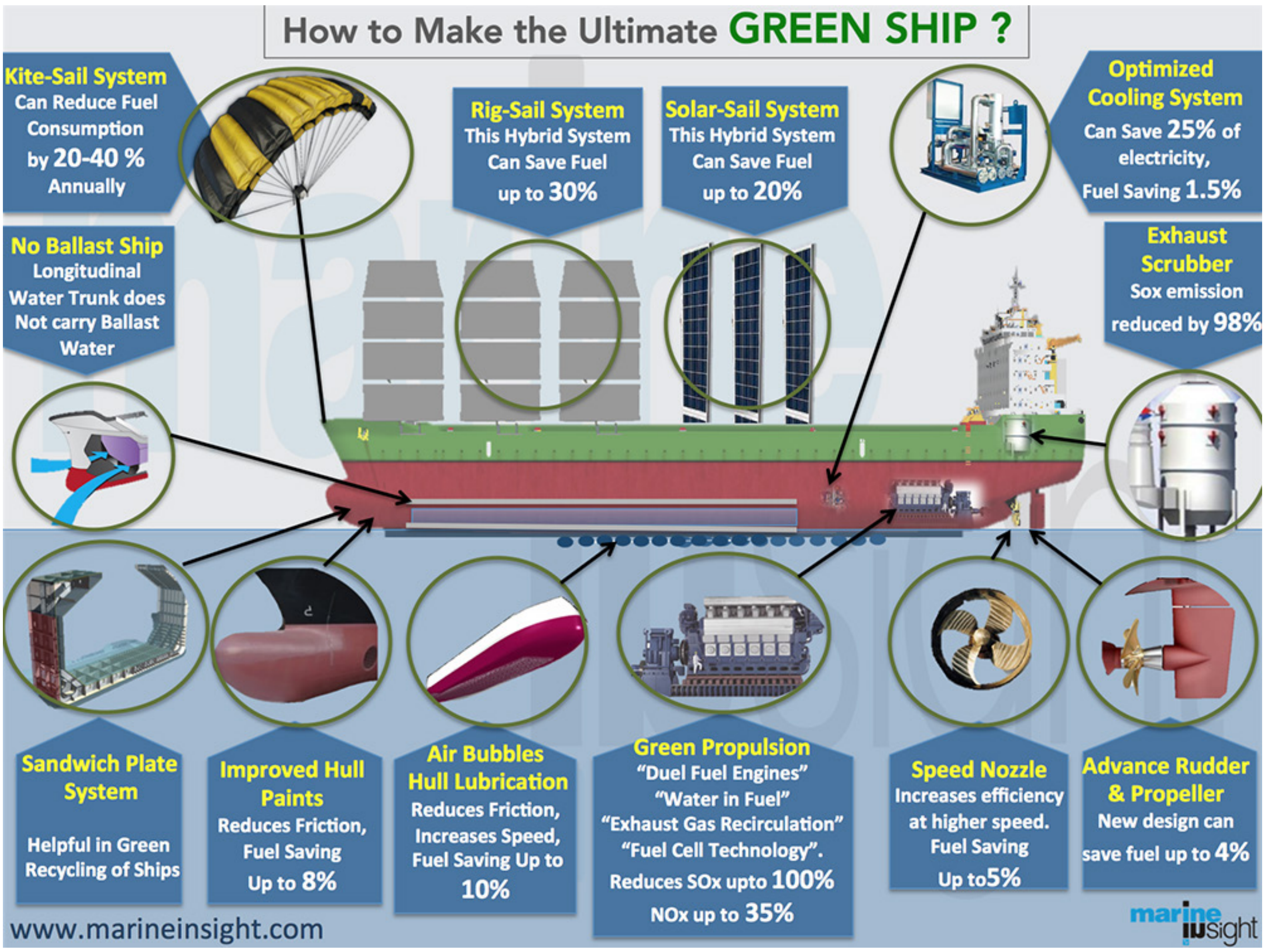


$$EEDI = \frac{CO_2 \text{ emission}}{\text{Benefit of ship}} = \frac{\Sigma P \times C_F \times SFC}{\text{Capacity} \times \text{Speed}}$$

Unit: gram CO_2/(Ton*Nautical Mile)

Attained EEDI ≤Required EEDI=(1-X/100) x reference line value


EEXI [g/ton·mile]
Required EEXI is not applicable
Attained EEXI
failure
Required EEXI
pass
◎: Good
×: NG
Capacity [ton]


How to Make the Ultimate GREEN SHIP ?
Kite-Sail System Can Reduce Fuel Consumption by 20-40 % Annually
Rig-Sail System This Hybrid System Can Save Fuel up to 30%
Solar-Sail System This Hybrid System Can Save Fuel up to 20%
Optimized Cooling System Can Save 25% of electricity, Fuel Saving 1.5%
No Ballast Ship Longitudinal Water Trunk does Not carry Ballast Water
Exhaust Scrubber Sox emission reduced by 98%
Sandwich Plate System Helpful in Green Recycling of Ships
Improved Hull Paints Reduces Friction, Fuel Saving Up to 8%
Air Bubbles Hull Lubrication Reduces Friction, Increases Speed, Fuel Saving Up to 10%
Green Propulsion "Duel Fuel Engines" "Water in Fuel" "Exhaust Gas Recirculation" "Fuel Cell Technology". Reduces SOx upto 100% NOx up to 35%
Speed Nozzle Increases efficiency at higher speed. Fuel Saving Up to5%
Advance Rudder & Propeller New design can save fuel up to 4%
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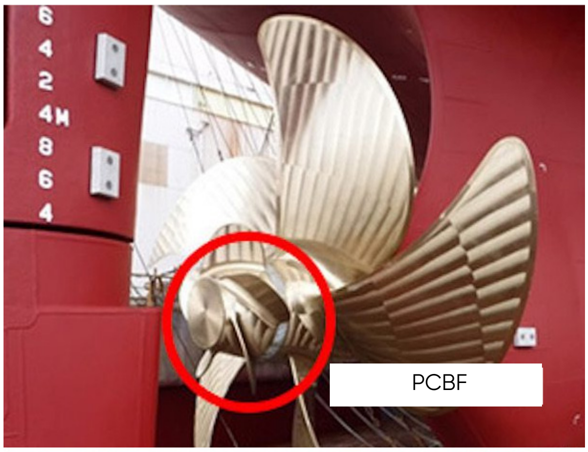
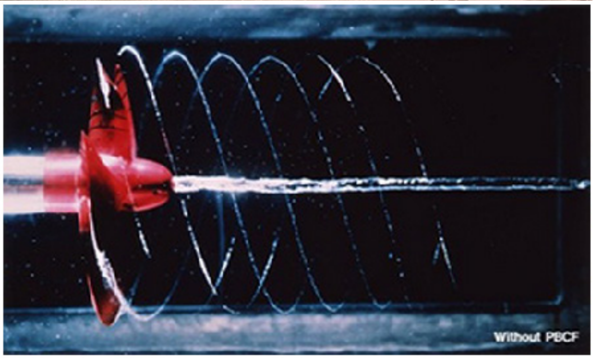
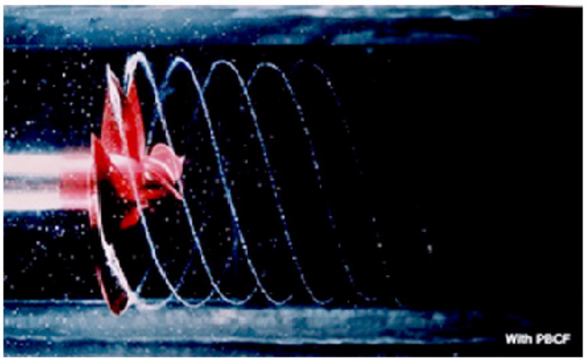
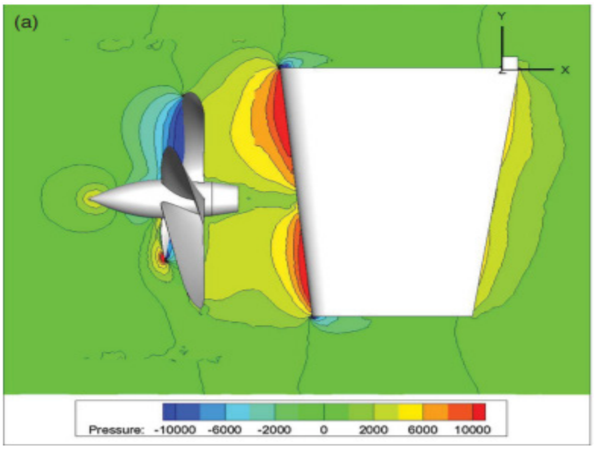
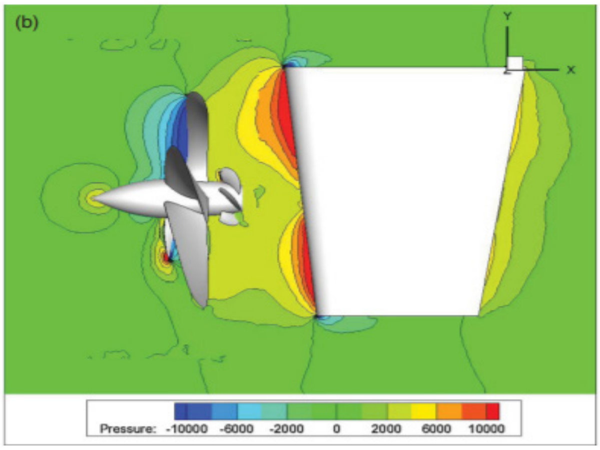
2 PROPELLER BOSS CAPS FINS





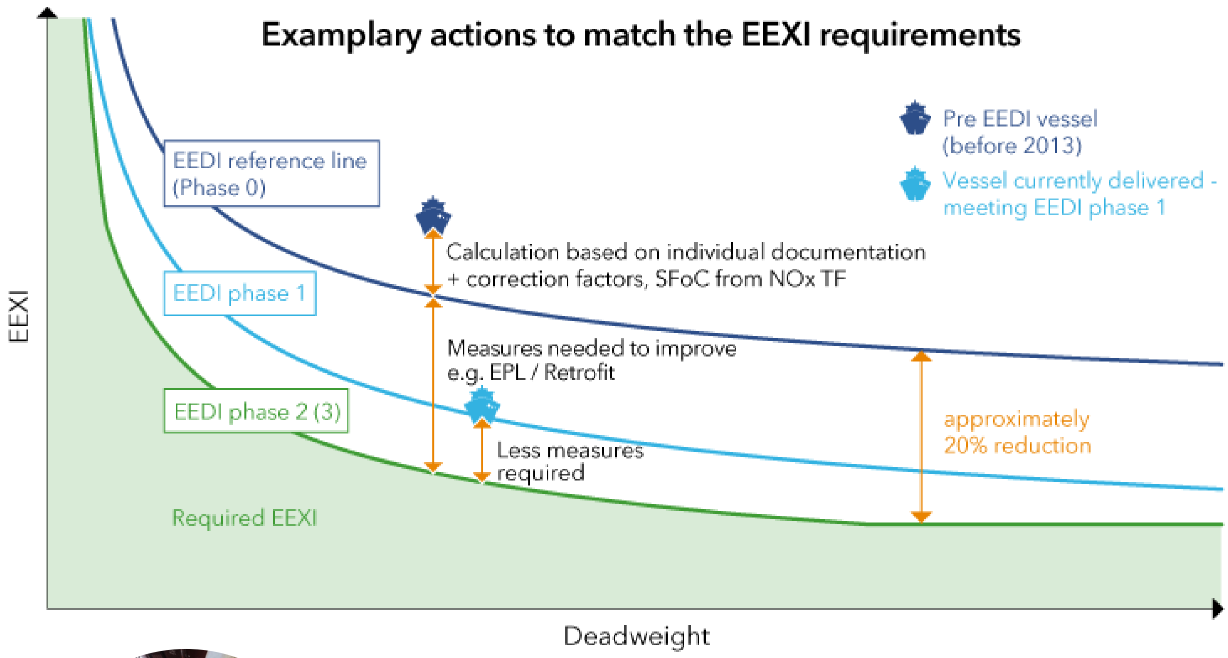






- Save 3 – 5% of ship's fuel consumption.
- Reduce noise and vibration at the stern of the ship.
- Reduce the rudder corrosion.

The reason: The Propeller Boss Cap Fins (PBCF) eliminate the vortex at the water exit area behind the propeller. This vortex is the cause of propeller efficiency losses, noise, vibration, and rudder corrosion.



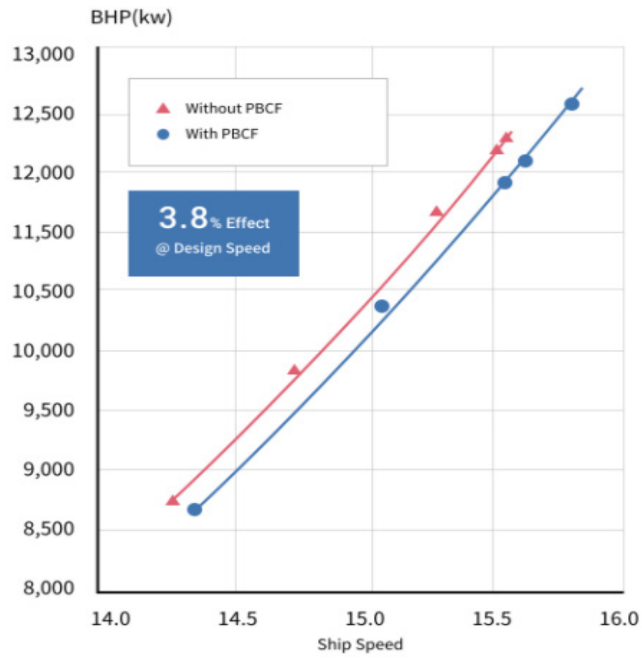
The required EEXI is almost the same level as required EEDI for new ships as of 2023

EXPERIMENTAL RESULTS

Analyzed results of PBCF FOC saving effect on actual vessels in recent few years

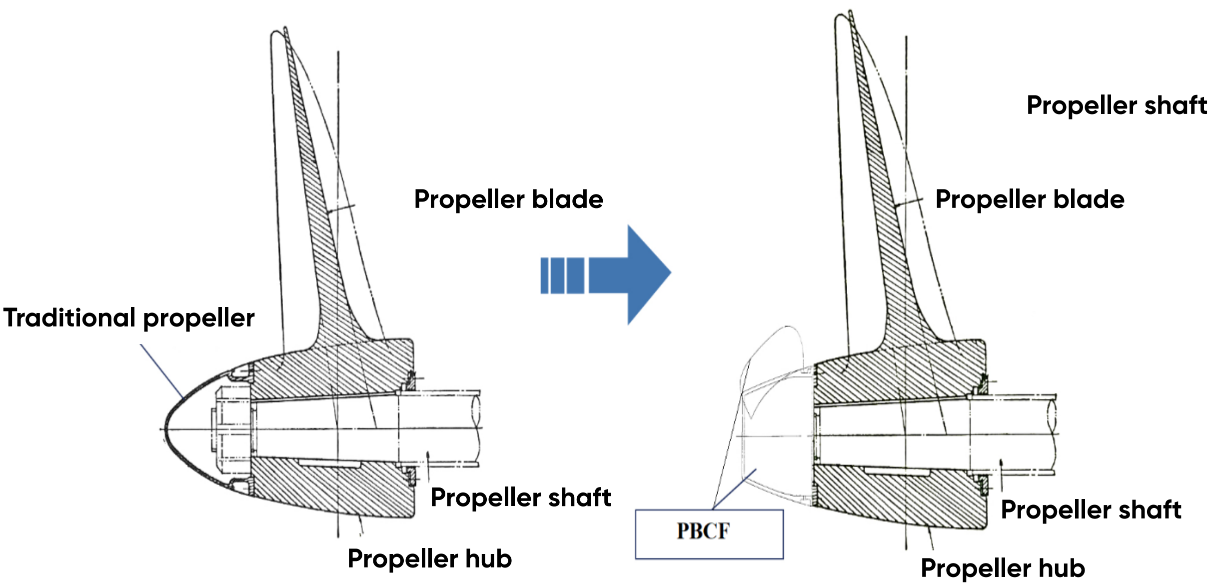
Vessel Type	Lpp (m)	MCO (ps)	Δ η s	Comparison
CNT(5500TEU)	263.0	74,700	4. 2% (V)	Sister Ship
CNT(4250TEU)	256.5	49,680	3. 0% (T) 4. 2% (V)	Sister Ship
CNT(4250TEU)	246.0	49,720	3. 5% (V)	Sister Ship
CNT(3800TEU)	264.2	46,800	7. 5% (V)	Self
91 BC	228.0	15,000	1. 8% (T) 5. 8% (V)	Sister Ship
88BC	221.3	16,640	5. 3% (T)	Sister Ship
56 BC	280.6	20,200	4. 1% (V)	Self
152 BC	261.8	15,680	4. 9% (V)	Self
VLCC	332.95	34,640	5. 6% (V)	Self
Chemical	138.0	7,200	6. 7% (V)	Self
Product	219.0	16,640	12% (T)	Sister Ship
Chemical	141.2	9,626	4. 0% (T) 2. 0% (V)	Sister Ship
LNG	259.0	23,303	3. 9% (V)	Self
Multi Purpose	129.9	7,200	2. 0% (V)	Self
General Cargo	72.8	2,400	3. 2% (V)	Self
Cement Carrier	61.0	1,000	4. 3% (V)	Self

V: Voyage Data Analysis, T: Trial Data Analysis



Sea trial results on an Aframax oil tanker with a deadweight of 115,000 DWT.

- The installation process, which takes place during drydocking, is similar to that of traditional propellers.
- Installation is straightforward and simple.
- Installation duration: 1-2 days.
- It is applicable to both new and old vessels across all types of ships



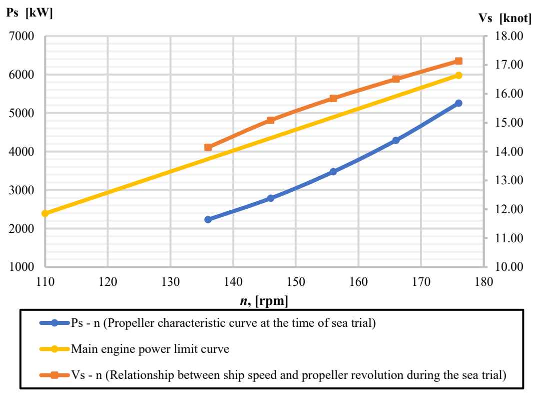
03 IMPLEMENTATION PLAN TO DESIGN PBCF

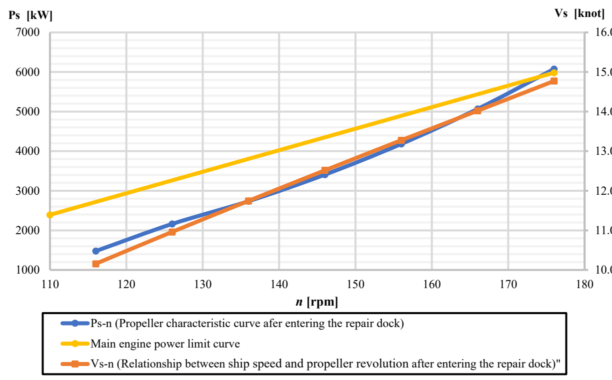
STEP 1

Calculate the relationship between power, ship, and propeller revolution during sea trials to compare these with the sea trial data, which are considered the most reliable. This comparison is essential to validate the accuracy of the CFD model against the actual sea trial outcomes.

STEP 2

Calculate the relationship between power, ship, and propeller revolution after drydocking for repairs (including hull and propeller cleaning), in cases where a PBCF (Propeller Boss Cap Fins) has not yet been installed (step 2 to facilitate the comparison of fuel savings achieved by installing additional PBCF on the vessel compared to before its installation).





STEP 3

The geometric parameters of the PBCF need to be optimized:

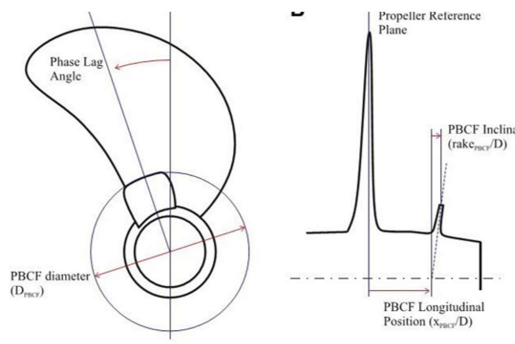
- Diameter (DPBCF);
- Length of the PBCF blade (PBCF chord);

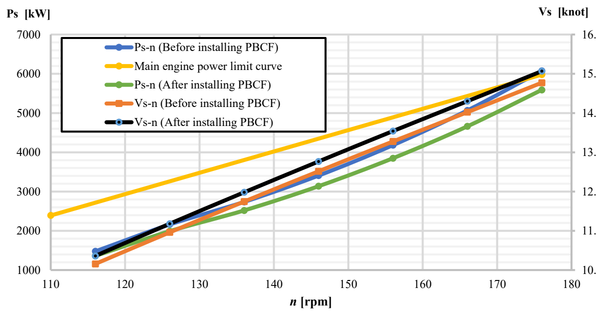
Phase lag angle between the main propller and PBCF;

Pitch of the PBCF (BPCF Pitch);

Position along the length of the PBCF (xPBCF/D);

- Blade rake angle (rakePBCF/D);
- Blade thickness.



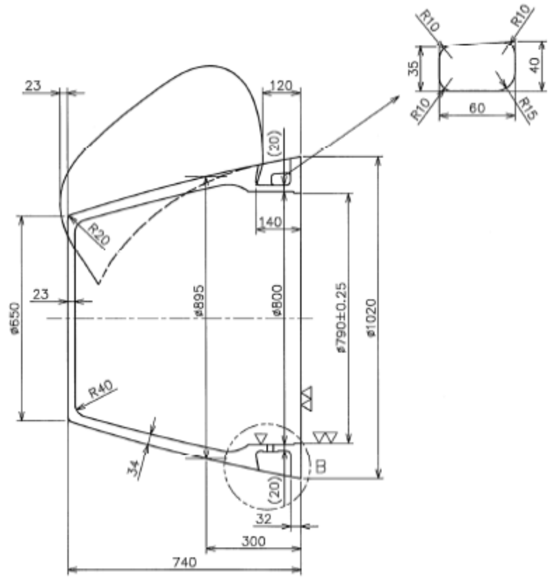


	n [rpm]	Vs [knots]	Ps [kW]	ΔPs [kW]	Δm_{nl} [tấn]/ngày	Amount of money saved [USD]/day
Before PBCF installation	146	12.52	3420	0	0	0
After PBCF installation	140	12.52	3000	420	1.74	870

Comparing the correlation amongst Ps-Vs-n before and after installing PBCF

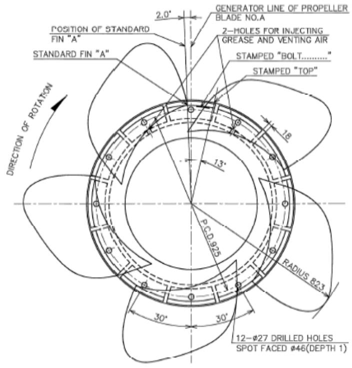
STEP 4

Implement the 2D design drawings and construction drawings for the PBCF arrangement



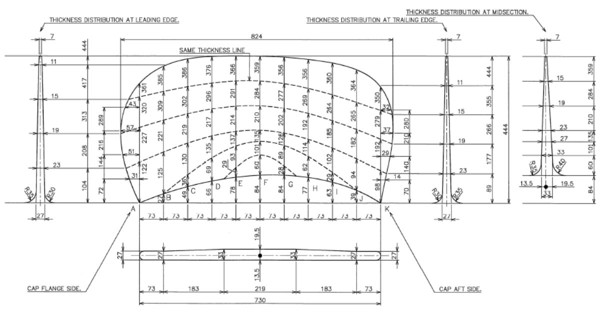
STEP 5

Establish a technical procedure for the deployment and installation of Propeller Boss Cap Fins (PBCF) on the vessel.



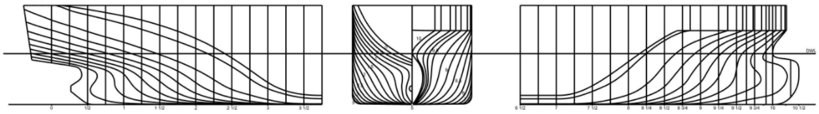
STEP 6

In collaboration with our partners, assess the efficiency of PBCF solution by comparing pre-installation and post-installation performance, utilizing actual onboard measurement data.



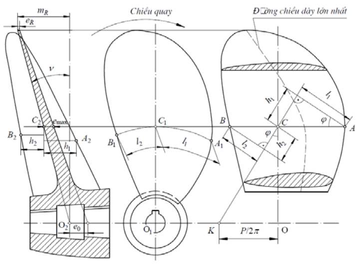
Mandatory ship profiles for designing PBCF

1



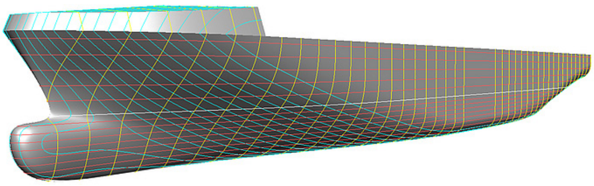
Hull line

2



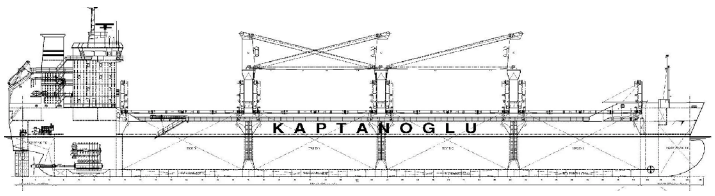
Propeller drawing

3



Ship gereral arrangement

4



Shaft arrangement

5

Rudder drawing (If any)

6

Provide details on the current operational RPM of the main engine (or current cruising speed) and the vessel's operating waterline draft.

Our commitments

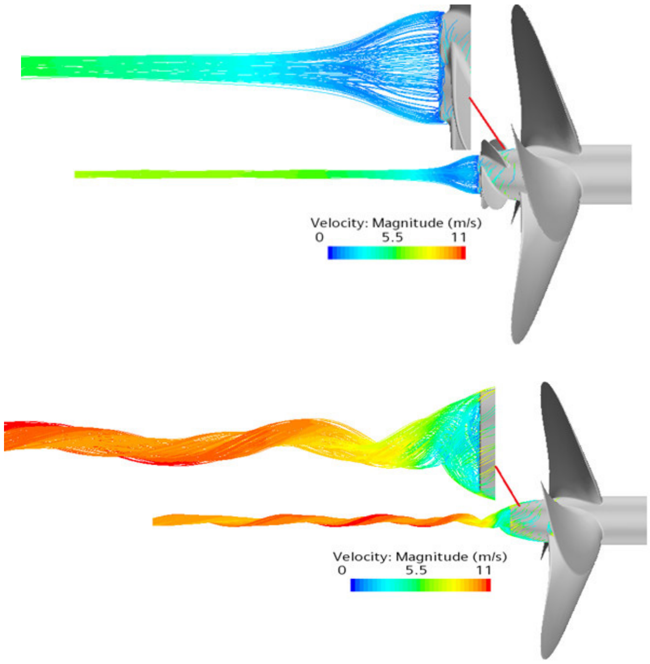
QPEC commits that our propeller boss cap fins products designed, manufactured and installed by QPEC ensure the following issues:

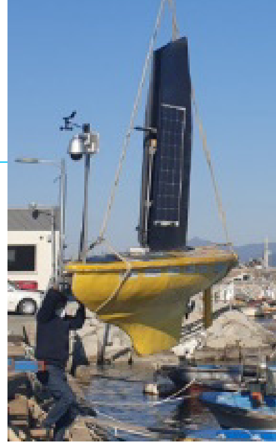
- Save about 3-5% of ship's fuel consumption when installing additional flow guide tubes;
- Ensuring sufficient durability like PBCF products from other companies in the world;
- In case of any deficiencies in the propeller boss cap fins manufacturing materials, or errors during the installation process, QPEC will be obliged to repair or replace the equipment;
- Product warranty period is 2 years. For repaired or replaced parts, the new warranty period of 6 months shall commence upon completion of the repair or replacement, but shall not exceed the total warranty period of two years thereafter.

Projected Timeframe

02 months	1.5 months	1-2 days
Estimated time for designs	**Estimated time for manufacturing**	**Estimated time for installation**

04 OUR CORE COMPETENCIES





Research

1. Research Target

• Design, Hydrodynamic, Hydrostatic and Structural

• Analysis for Ship and Ship Hull.

• Design, Hydrodynamic, Hydrostatic and Structural

• Analysis for Yachts, Boat, Fishing Boat,...

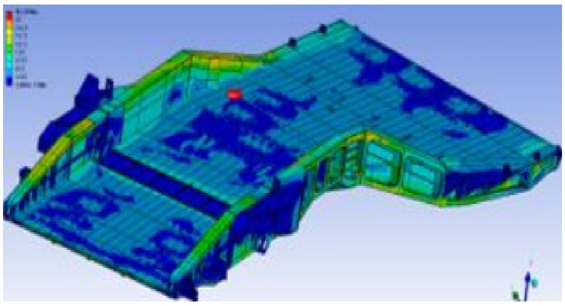
• Optimizing the Ship Hull Shape using CFD.

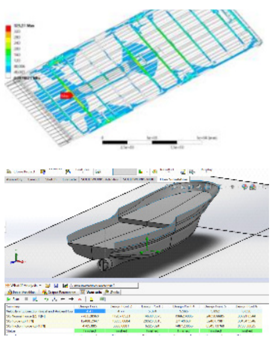
• Optimizing the Ship Propeller (PBCF) using CFD.

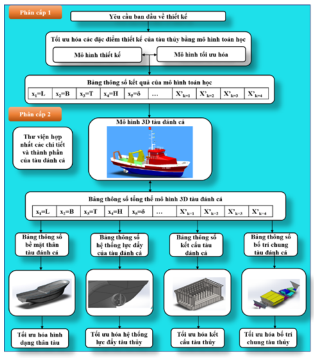
• Optimizing the ESD (Energy Saving Device) using CFD.

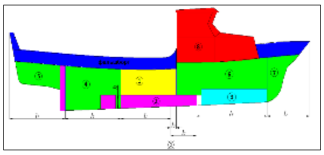
• Static and Transient Structural Analysis.

• Structure Buckling Capacity Calculation.









2. Main Products

• Optimized Ship Hulls and Propeller (PBCF)

• Optimized Ship Structure such as: cargo hold analysis, crane pedestal, local reinforcement.

• Pre-fabrication steel structure.

• Ship's equipment such as: car deck panels, ramps, quarter ramp, watertight – non watertights doors

The Team

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Associate Professor

Ph.D of Engineering

Members

Phan Van Hung

Associate Professor

Ph.D of Engineering

Pham Van Trieu

Ph.D of Engineering

Hoang Quoc Dong

Ph.D of Engineering

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Quality - Productivity - Efficiency - Collaboration