Improving CII & EEXI with low TCO and fast ROI

The business case for high-performance hull coatings

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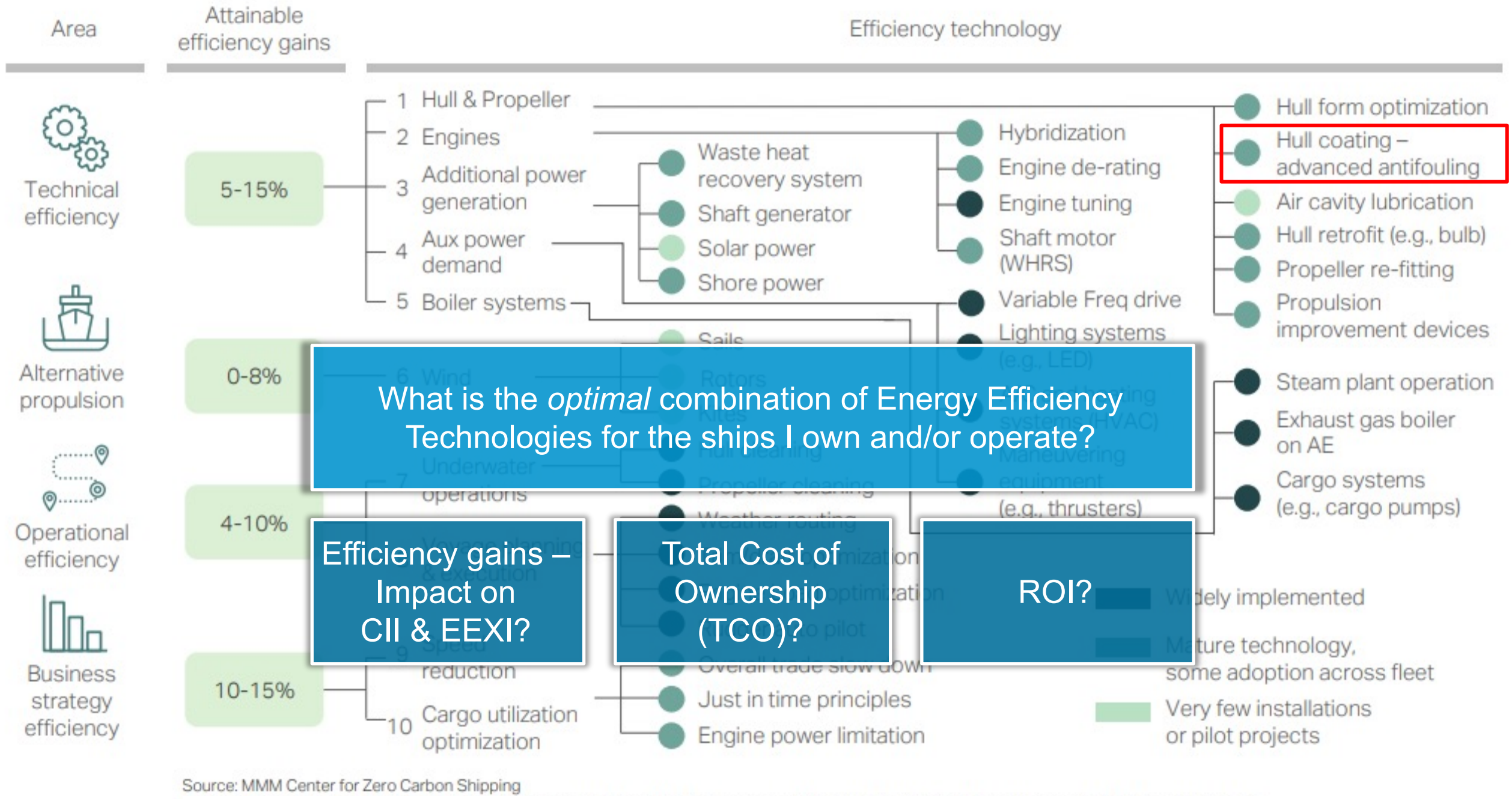
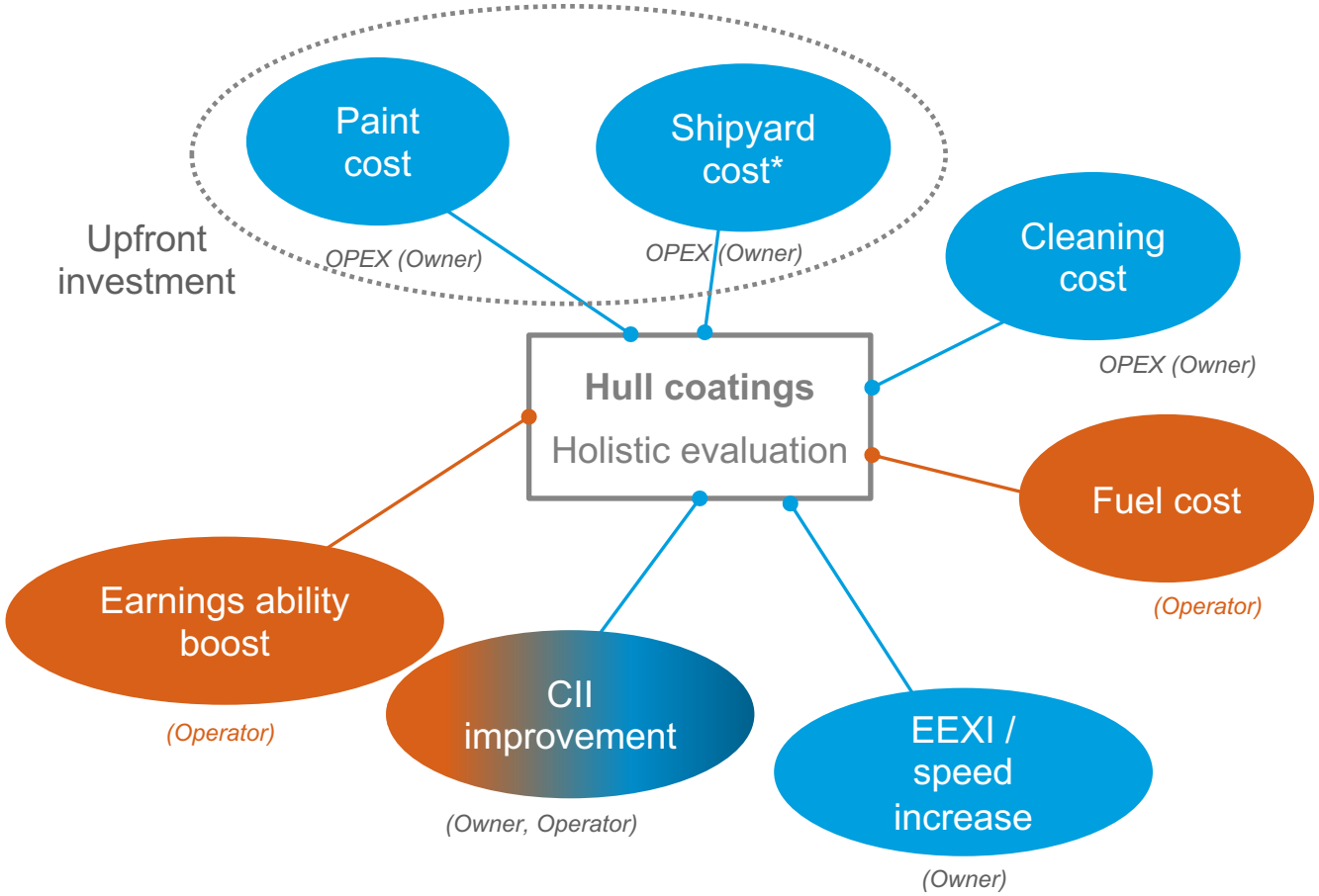


Source: MMM Center for Zero Carbon Shipping

Hull coatings upgrade as an investment decision

Quantifying the costs & benefits for owner and operator



Business cases: vessel-specific or full fleet

1 Costs

- Simulate **TCO in-service** for different paint system scenarios
- Estimate the extra **upfront cost** for upgrade to low-friction hull coatings
- Calculate **TCO savings & ROI** for upgrade

2 Benefits

- Quantify impact of upgrade on **CII** (AER) and **EEXI** (speed increase)
- Estimate impact of hull coating upgrade on vessel's **earnings ability**

* Standard cost assumptions for different repair yard locations (China, Dubai, Turkey): Surface preparation (Sa1, Sa2), washing cost, paint application, yard rent

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Impact of hull coating upgrade | TCO & ROI
Example

	Elements of Cost	Hempaguard X7/ Globic7000	Oceanic	Hempaguard X7/ Globic7000 Vs Oceanic
Paint	Paint purchasing cost	$342.000	$140.000	$202.000
	Service (Coating Advisor)	$0	$0	$0
Repair Yard	Surface preparation cost	$83.481	$37.030	$46.451
	Washing cost	$9.468	$9.468	$0
	Paint application	$91.906	$29.886	$62.019
	Repair Yard Rent	$40.000	$30.000	$10.000
	Off hire cost	$168.000	$126.000	$42.000
Cleanings	Diver cost	$0	$34.310	-$34.310
	Extra costs for next DD	$0	$25.759	-$25.759
	Additional fuel consumption(LSFO)	$0	$383.250	-$383.250
	Off Hire cost	$0	$21.000	-$21.000
Fuel	Fuel Cost (LSFO) 5 Years	$20.979.105	$25.550.000	-$4.570.895
	CO2 emission Tons (LSFO) 5 Years	131.869	160.600	-28.731
TCO	Total Cost of Ownership (LSFO) 5 Years	**$21.713.960**	**$26.386.704**	**-$4.672.744**
			Savings over 5 years (LSFO)	**$4.672.744**
			Savings Annually (LSFO)	**$934.549**
			Expected Payback Period (Months)	**5**

Additional upfront cost for upgrade ~ $ 360K

- Capesize bulker built in 2012
- Fuel consumption: 40 tons/day
- Speed: 11 knots
- 70% activity
- Fuel price LSFO 500 USD/t

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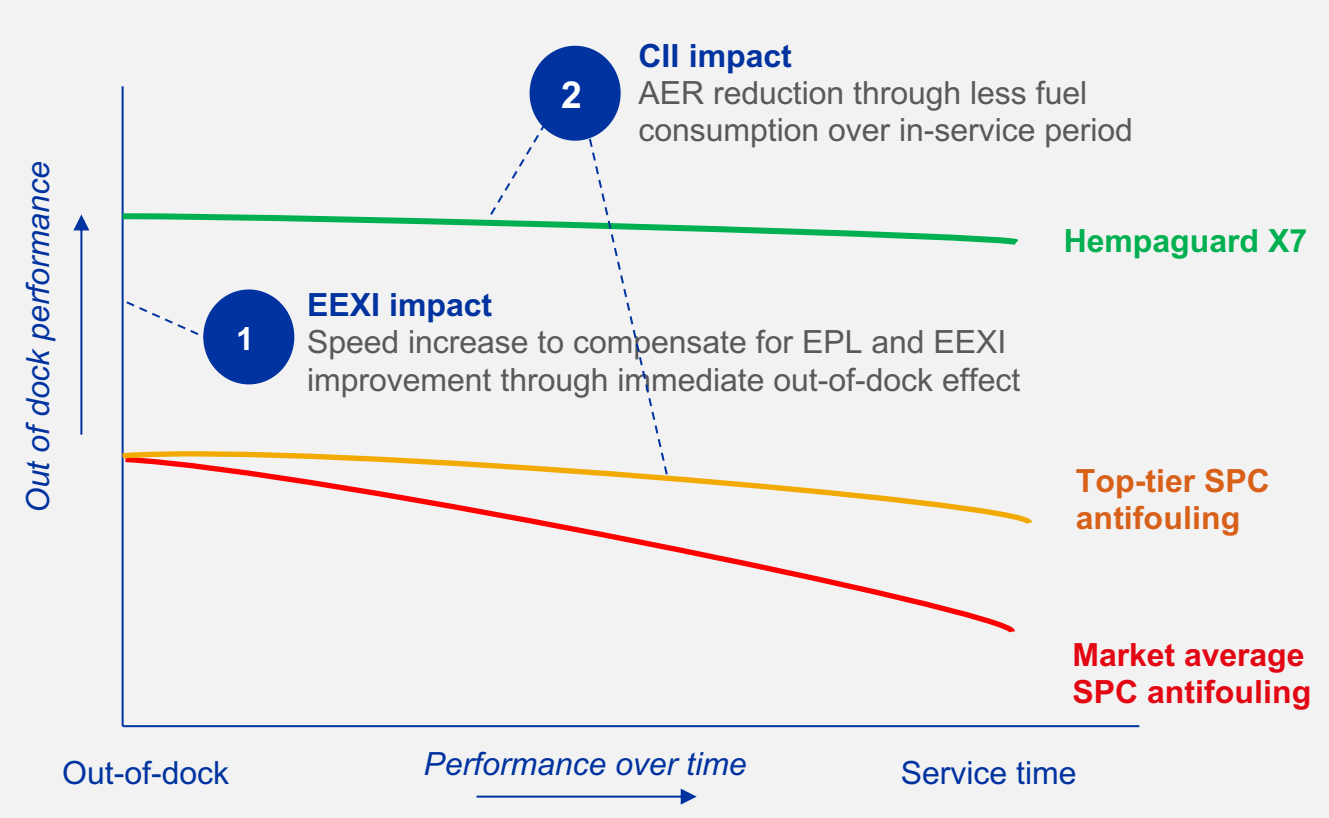
Impact of hull coating upgrade | EEXI & CII



Quantifiable on project basis

Out-of-dock power gain	Speed loss over time	EEXI improvement *one-time*	CII improvement *5-yr avg*
6%*	1.4%**	2% speed increase Vs any NB antifouling	20% Vs mrk avg 7-10% Vs top tier
0%	1.5-2.5%	No impact	10-13% Vs mrk avg
0%	5.9%	No impact	-

* Proved based on frictional studies, towing tank tests and model large scale tests run by independent partners. Confirmed by actual data from ships in service using performance monitoring equipment.

** Full hull application.
1% speed loss requires 3% power increase to maintain speed

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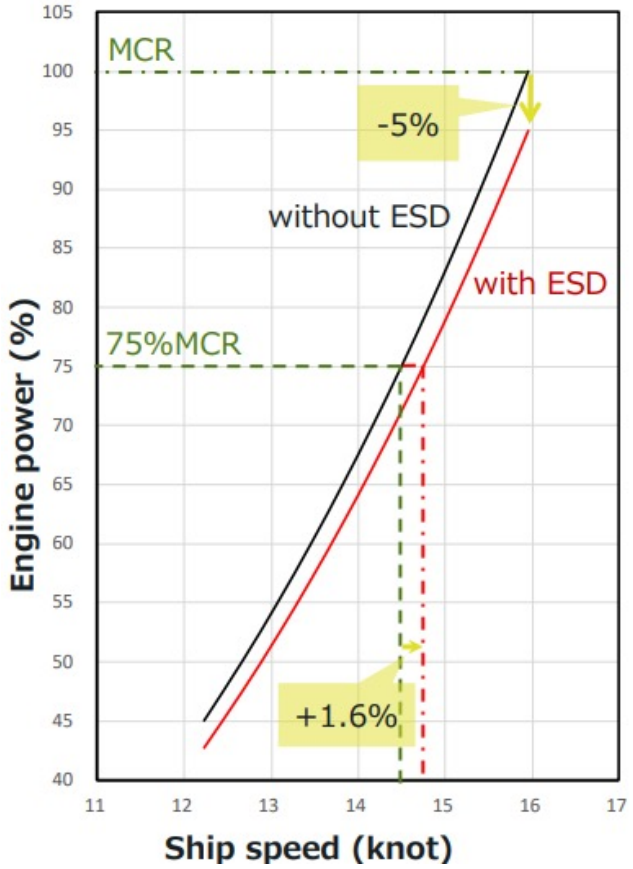
Impact of hull coating upgrade | EEXI (speed increase)
Example



$$\text{EEXI [g/ton·mile]} = \frac{\text{Conversion Factor} \times \text{SFC} \times \text{Engine Power (75\%MCR)}}{\text{Capacity} \times \text{Ship Speed at 75\%MCR}}$$

No change (Fixed)

Reflect the effect of ESD

Reduction rate of power	Increase rate of speed	Speed without ESD (knots) Vref at 75% MCR	Speed with ESD (knots) Vref at 75% MCR	Increase speed (knots)	Improvement rate of EEXI
- 3%	+1%	14.5	14.6	+0.1	+1%
-5%	+1.6%	14.5	14.7	+0.2	+1.6%
-6%	**+2%**	**14.5**	**14.8**	**+0.3**	**+2%**

➡ **Hempaguard X7**

Source: ClassNK

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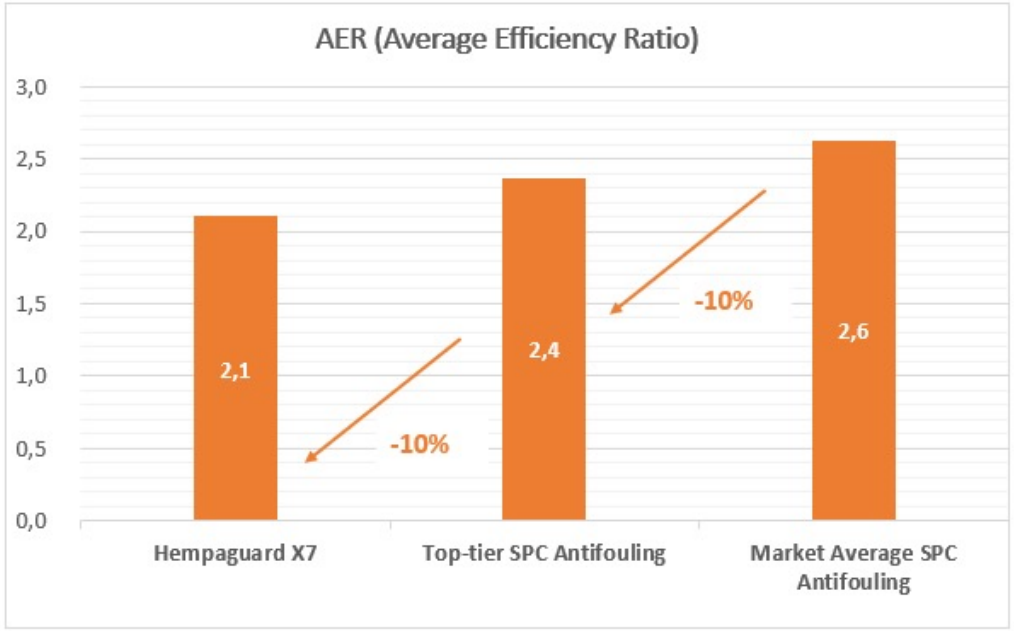
Impact of hull coating upgrade | CII (AER)
Example



AER benchmarking Vs Poseidon Principles trajectory values

		2020	2021
Type	**Size**	**AER trajectory value**	**AER trajectory value**
Bulk carrier	0-9999	25,6	25,0
Bulk carrier	10000-34999	6,9	6,7
Bulk carrier	35000-59999	4,8	4,7
Bulk carrier	60000-99999	3,8	3,7
Bulk carrier	100000-199999	2,4	2,4
Bulk carrier	200000-+	2,4	2,3

AER is measured in g CO2 / (dwt X NM). CO2 is calculated based on expected efficiency gain from upgrade over in-service period.

Assumptions:
- Typical voyage: Hedland – Ningbo, 14 days → Nautical miles traveled ~67,000
- Current fuel consumption: 40 tons/day at 11 knots → 160K tons CO2 in 5-yr interval

Impact of hull coating upgrade | Summary
Vessel-specific example

	Upgrade to Hempaguard X7/Globic 7000
Additional upfront cost for upgrade incl. paint & repair yard cost	$ 360K
TCO savings (5-yr)	$ 4.7m
Payback period	5 months
CO2 reduction (5 yr)	29K tons
EEXI impact (mitigation measure for EPL)	5% out of dock savings → 1.6% speed increase from day 1 → 1.6% EEXI improvement
CII impact (average AER)	From 2.7 to 2.2
Daily earnings (TCE) average increase	$ 3,300

TCO savings include overall paint-related savings for in-service period calculated as the balance from paint purchasing cost, repair yard cost, cost of cleanings and fuel cost.

Scenarios used:

1) Current system: Oceanic + spot-blast 40%
2) Upgrade system: Hempaguard X7/Globic 7000 + full-blast

Assumptions:

- Speed and consumption: 40 tons/day at 11 knots
- Typical voyage and NM based on AIS data
- Charter rates based on avg full-year 2020 figures from Clarkson
- Standard cost assumptions: repair yard costs for surface preparation and paint application, cleaning costs, Fuel price LSFO 500 USD/t

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Impact of hull coating upgrade | Summary
Whole fleet example

	Company containerships			Full fleet 12 vessels
	Neo Panamax 2 vessels	**Intermediate** 7 vessels	**Feeders** 3 vessels	
Additional upfront cost for upgrade incl. paint & repair yard cost	$ 785K	$ 1.5m	$ 515K	**$ 2.8m**
TCO savings (5-yr)	$ 6m	$ 14.8m	$ 3.9m	**$ 24.8m**
Payback period	7 months	6 months	7 months	**6 months**
Fuel savings (annual)	$ 1.4m	$ 3.3m	$ 885K	**$ 5.5m**
CO2 reduction (annual)	10K tons	23K tons	6K tons	**39K tons**
EEXI impact (mitigation measure for EPL)	6% out of dock savings → 2% speed increase from day 1 → 2% EEXI improvement			
CII impact (average AER)	From 3.3 to 2.9	From 5.6 to 4.9	From 5.9 to 5.1	**From 5.3 to 4.6**
Daily earnings (TCE) average increase	$ 2,200	$ 1,500	$ 1,000	**$ 1,500**

TCO savings include overall paint-related savings for in-service period calculated as the balance from paint purchasing cost, repair yard cost, cost of cleanings and fuel cost.

Scenarios used:
1) Current system: Globic 9500 + spot-blast 40%
2) Upgrade system: Hempaguard X7 + full-blast

Assumptions:
- Speed and consumption based on historical average data
- Typical voyage and NM based on AIS data
- Charter rates based on avg full-year 2020 figures from Clarkson
- Standard cost assumptions: repair yard costs for surface preparation and paint application, cleaning costs, Fuel price LSFO 500 USD/t

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How we can support you in implementing your EEXI & CII compliance plan

Impact of paint upgrade on EEXI & CII

Quantify the expected impact of upgrade on:

- EEXI: Speed increase Vs New Building coating
- CII: AER improvement Vs current coating

Business case (TCO & ROI)

- Define upfront cost for paint upgrade incl. shipyard cost
- Quantify TCO savings and ROI for in-service and charter period

Performance Technical Statement

- Provide Technical Statement to be used for EEXI verification by Class including:
  1) Average Hull Roughness of each paint system
  2) Reduction in frictional coefficient (ΔCf) – Frictional coefficient values to be used for CFD simulations

AER reporting

- Provide regular CII (AER) reporting as part of our hull performance monitoring service

Decision support tools (Pre-Sales)

Supporting material for implementation (After-Sales)

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Thank you!

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