

Ship Energy Performance Framework

Case Study: CII Rating Improvement Investigation of a Bulk Carrier

Tier 3: Improvement Investigation



Case

A ship manager asked ABS to investigate options for improving a 15-year-old Supramax bulk carrier's alignment with the IMO Carbon Intensity Indicator (CII) requirements through 2030. Under the business-as-usual scenario, the vessel has an attained CII rating of C in 2025, which is projected to decline to D in 2026 and E in 2029.

Methodology

ABS used the vessel's verified 2025 IMO Data Collection System (DCS) data as the baseline and developed a vessel-specific performance model to estimate how each improvement option would affect the attained CII.

- **Fuel Consumption Split:** Analyzed operational profile records to divide fuel consumption among propulsion, sea auxiliaries, port stays, and idle periods.
- **Speed-Power and SFC Modeling:** Evaluated the propulsion power under laden and ballast conditions.
- **CII Rating Forecasting:** Projected attained CII values and corresponding ratings from A to E through 2030 using the MEPC 83 reduction factors and the rating boundaries in MEPC.339(76).
- **Scenarios:** Calculated the required parameters and fuel blends to maintain acceptable ratings up to 2030.

Deliverables

- Projection of required and attained CII values from 2025 through 2030.
- Sensitivity analysis with operational and technical attributes.

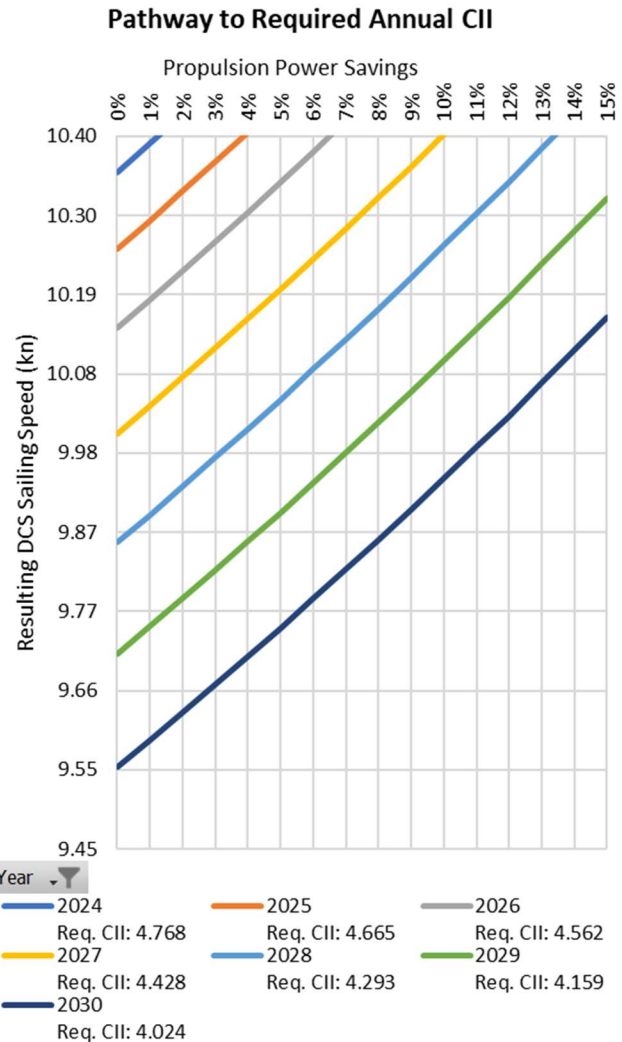
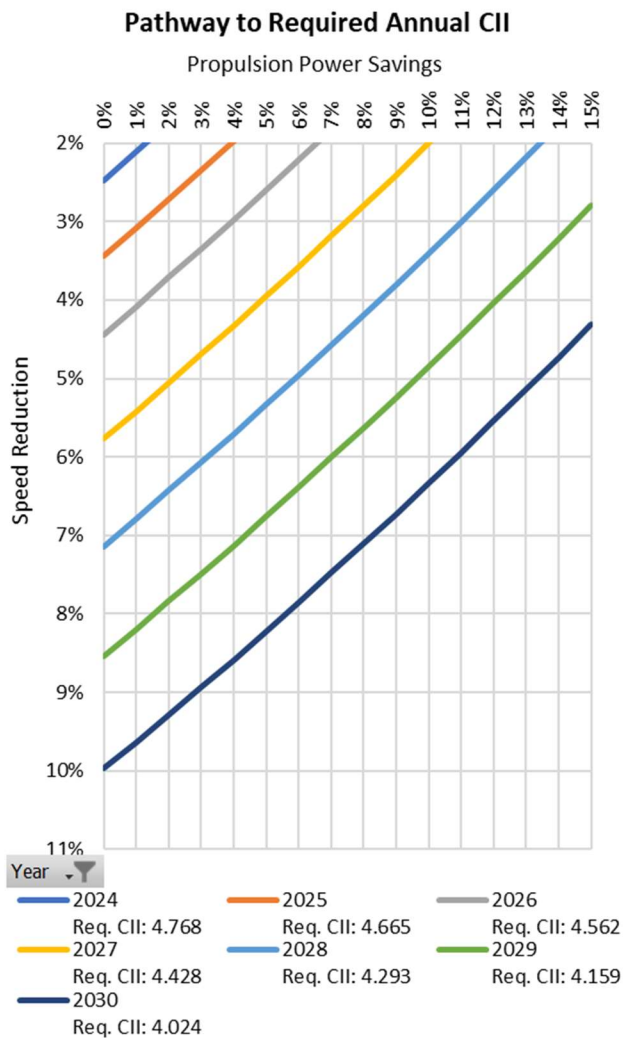
Operational Segment	Fuel Consumption Rate	Total Annual Fuel Split (%)
Propulsion (Main Engine)	19.2 t/day	83.9%
Auxiliaries at Sea	1.63 t/day	6.7%
Idle Periods (72.3 days)	3.35 t/day	4.8%
Port Stays (86.6 days)	2.50 t/day	4.6%

❖ Improvement attribute 1: Annual Speed Reduction

If no technical modifications or biofuels are introduced, the vessel's annual average speed will need to be reduced to remain compliant.

❖ Improvement attribute 2: Propulsion Power Savings

Energy efficiency technologies and measures such as biofouling management and optimum weather routing can significantly avoid the operational speed reduction.



❖ **Improvement attribute 3: Engine & Auxiliary Systems Optimization**

- **SFC Optimization:** Main engine tuning or derating that improves SFC by 3 percent provides a minor reduction in attained CII but is insufficient on its own to prevent a D rating from 2026 onward.

SFOC Improvement Investigation							
SFOC Improvement	Average propulsion savings (t/year), HFO	2025 Req. CII: 4.665	2026 Req. CII: 4.562	2027 Req. CII: 4.428	2028 Req. CII: 4.293	2029 Req. CII: 4.159	2030 Req. CII: 4.024
0.0%	0.0	5.035	5.035	5.035	5.035	5.035	4.936
0.5%	20.5	5.014	5.014	5.014	5.014	5.014	4.928
1.0%	41.0	4.993	4.993	4.993	4.993	4.993	4.92
1.5%	61.5	4.972	4.972	4.972	4.972	4.972	4.911
2.0%	82.0	4.951	4.951	4.951	4.951	4.951	4.903
2.5%	102.5	4.929	4.929	4.929	4.929	4.929	4.895
3.0%	123.0	4.908	4.908	4.908	4.908	4.908	4.887
3.5%	143.5	4.887	4.887	4.887	4.887	4.887	4.879
4.0%	164.0	4.866	4.866	4.866	4.866	4.866	4.871

- **Auxiliary Efficiency:** Improving auxiliary engine efficiency by up to 15 percent yields negligible CII improvements due to auxiliary consumption representing only 6.7 percent of the total fuel split.

Aux. Efficiency Improvement Investigation							
Auxiliary Efficiency Improvement	Average auxiliary fuel savings (t/year), Diesel / Gas Oil	2025 Req. CII: 4.665	2026 Req. CII: 4.562	2027 Req. CII: 4.428	2028 Req. CII: 4.293	2029 Req. CII: 4.159	2030 Req. CII: 4.024
0%	0	4.936	4.936	4.936	4.936	4.936	4.936
1%	7.6	4.928	4.928	4.928	4.928	4.928	4.928
2%	15.2	4.92	4.92	4.92	4.92	4.92	4.92
3%	22.8	4.911	4.911	4.911	4.911	4.911	4.911
4%	30.4	4.903	4.903	4.903	4.903	4.903	4.903
5%	38	4.895	4.895	4.895	4.895	4.895	4.895
6%	45.7	4.887	4.887	4.887	4.887	4.887	4.887
7%	53.3	4.879	4.879	4.879	4.879	4.879	4.879
8%	60.9	4.871	4.871	4.871	4.871	4.871	4.871
9%	68.5	4.863	4.863	4.863	4.863	4.863	4.863
10%	76.1	4.855	4.855	4.855	4.855	4.855	4.855

CII Ratings: A B C D E

❖ Improvement attribute 4: Carbon factor

Use of biofuel blends can improve CII rating immediately without additional measures:

Biofuel Blend Scenario	2025	2026	2027	2028	2029	2030
Business-As-Usual	D	D	D	D	E	E
10% Carbon Reduction	C	C	C	C	D	D
20% Carbon Reduction	B	B	B	B	C	C
30% Carbon Reduction	A	A	A	A	A	B

Conclusion and Recommendations

- CII improvement studies are vessel-specific, as the attained rating depends strongly on the vessel's design and operational profile.
- Compatible lower-carbon fuel blends can provide an immediate compliance benefit. However, their desirability should be assessed together with availability, cost exposure and the compliance margin required in future years.
- For this vessel, propulsion-related consumption dominates the total fuel use. Measures such as optimum weather routing and propulsion efficiency technologies form the basis for improving its CII performance.
- Retrofit options should be evaluated through life-cycle cost analysis to align operational, technical and fuel-pathway measures with the vessel's remaining service life and the overall fleet strategy.

WORLD HEADQUARTERS

1701 City Plaza Drive | Spring, TX 77389 USA

P 1-281-877-6000

ABS-WorldHQ@eagle.org

www.eagle.org



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