



ROI & ENERGY PAYBACK ANALYSIS

Marine VIG ROI & Energy Payback

Vessel | Mixed Global Route

APPLICABLE STANDARDS & REFERENCES

- ASHRAE HVAC Applications 2023 §11
- IMO MARPOL Annex VI
- DNV Rules for Ships Pt.4 Ch.6
- IMarEST Marine HVAC Benchmarks
- IMO MEPC.1/Circ.684 (EEDI)

KEY RESULT

Annual Cost Savings

\$0

Simple payback: N/A

30.0 m2 glazing | Eff. deltaT 15 degC | 280 days/yr

Baseline U: 2.8 W/m2.K | VIG U: 0.6 W/m2.K | HVAC COP: 3 | Fuel: Electric



RESULTS SUMMARY

Vessel | Mixed Global Route

Area: 30.0 m2	Eff. dT: 15 degC	Days/yr: 280	COP: 3	Fuel: Electric	Cost: \$0.14/kWh
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ANNUAL ENERGY SAVINGS

ANNUAL COST SAVINGS \$0 per year	HVAC ENERGY SAVED 0 kWh/yr per year
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PAYBACK & INVESTMENT

SIMPLE PAYBACK N/A Check inputs	INCREMENTAL COST \$10,500 \$350/m2 x 30.0 m2
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NET PRESENT VALUE

NPV AT 10 YR \$0 net of incremental cost	NPV AT 15 YR \$0 net of incremental cost	NPV AT 20 YR \$0 net of incremental cost
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CARBON IMPACT

ANNUAL CO2 REDUCTION 0 kg CO2 per year	LIFETIME CO2 (20 YR) 0 kg CO2 total avoided emissions
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DISCLAIMER

Steady-state conduction model per ASHRAE HVAC Applications 2023 §11 and DNV Rules for Ships Pt.4 Ch.6. Route deltaT profiles are weighted annual averages. Covers conduction only. Use as a comparative planning tool - not a certified energy audit.



METHODOLOGY & ASSUMPTIONS

ENERGY MODEL

Effective deltaT accounts for the mix of heating and cooling operation:

$$\text{deltaT_eff} = f_{\text{heat}} \times \text{deltaT_heat} + (1 - f_{\text{heat}}) \times \text{deltaT_cool}$$

$$E_{\text{hvac}} (\text{kWh/yr}) = U (\text{W/m}^2.\text{K}) \times A (\text{m}^2) \times \text{deltaT_eff} \times \text{days} \times 24\text{h} / \text{COP} / 1000$$

HFO/MGO fuel costs converted to effective \$/kWh at generator efficiency (38% HFO, 36% MGO).

ROUTE DELTA-T PROFILES (degC)

Arctic / High Latitude: heat 35 / cool 0 | 100% heating

North Atlantic / Baltic: heat 22 / cool 5 | 75% heating

Mixed Global Route: heat 18 / cool 12 | 55% heating

Mediterranean / Caribbean: heat 10 / cool 18 | 30% heating

Tropical / Equatorial: heat 0 / cool 25 | 0% heating

FINANCIAL MODEL

Annual cost savings = Energy saved (kWh/yr) x effective energy cost (\$/kWh)

Simple payback = Incremental cost / Annual cost savings

NPV = Annual savings x $[(1 - (1+r)^{-n}) / r]$ - Incremental cost

CO2 reduction = Energy saved x CO2 factor (HFO: 0.72, MGO: 0.65, grid: 0.35 kg/kWh)

REFERENCES

ASHRAE HVAC Applications Handbook 2023, Chapter 11 - Ships

DNV Rules for Ships 2024, Pt.4 Ch.6 - HVAC systems

IMO MEPC.1/Circ.684 - EEDI technical file guidance

IMO MARPOL Annex VI - Energy Efficiency Design Index (EEDI)

IMarEST (2023) - Marine HVAC energy benchmarks