



The (interwoven) propulsion crossroads

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When I started 21 Knots in 2014, the conversations I had in yards and boardrooms were mostly about ship design effectiveness and cost-efficiency. Those same conversations are now shaped as much by economics and energy markets as by hydrodynamics and engineering. Pathway flexibility – the ability to adapt as fuels and shore infrastructure evolve – while also complying with green regulations, will become critical for shipowner success. That changes the calculus! Choices made today could lock a vessel into decades of expensive retrofits and compliance penalties, or create resilience and value through lower emissions and higher marketability.

Shipowners want clear, prescriptive answers about compliance pathways. They ask us whether their current designs will meet FuelEU Maritime's (FEUM) reporting and fuel uptake requirements and how the net-zero targets of the International Maritime Organization (IMO) will translate into operational constraints.

Concerning the former, if you're operating in EU waters, expect increasing fuel intensity standards and administrative reporting. You should focus on improving your ships' energy efficiency, adopt alternative fuels where feasible, and secure green bunker contracts with guarantees of origin.

As for the latter, which sets a 2050 horizon, the imperative is to reduce life-cycle greenhouse gas (GHG) emissions intensity by investing in energy-efficiency technologies and selecting propulsion architectures that enable fuel transition – and reserve space and structural strength in newbuilds for future retrofits.

Owners are also concerned about timelines and capital allocation: when will green fuels be available at scale, and is it sensible to pay a premium now? For most trades, a staggered investment is optimal risk management: implement low-risk efficiency measures immediately, and when renewing your fleet, select propulsion systems that offer flexibility (e.g., dual-fuel or methanol-ready engines). This reduces the risk of stranded assets while keeping upgrade pathways open as fuel availability and price parity evolve.

Finally, owners-operators ask about resale value and charter market impact. My experience is that eco-vessels almost always command a premium. As we've recently started to see with the lower age profile of vessels in European waters, ships with fuel flexibility and lower emissions profiles are also likely to enjoy wider employment opportunities as green regulation limits the opportunities for unimproved, vintage tonnage.

Recommendations for today...

For existing fleets, pursue high-return retrofits first and avoid irreversible changes that would preclude future fuel conversions. For newbuilds, design with modularity in mind: reserve space, structural support, and piping corridors for alternative fuel tanks and fuel cell modules. Prioritise energy-efficiency measures such as optimised hull forms, waste-heat recovery, and shaft & propeller efficiency. Implement hybridisation and battery buffers where operational profiles suit them.

The propulsion choice for the next generation of ships is not a single technology decision but a portfolio strategy that harmonises regulatory compliance, commercial realities, and technical feasibility. Owners should pursue staged investments: immediate efficiency upgrades, selection of propulsion systems that deliver short-term gains and allow for future fuel transitions, and strategic retrofits that maximise return without foreclosing options. That balanced approach



Photo: 21 Knots

protects asset value, supports regulatory compliance, and provides owners with the flexibility to seize commercial advantages wherever they can find them.

...and for tomorrow

Many of Zeroqu's clients are leaning towards dual-fuel engines capable of burning liquefied natural gas (LNG) as well as conventional marine gas or heavy fuel oil. For newbuilds, dual-fuel marine gas engines offer a pragmatic bridge: they reduce CO₂ and almost eliminate SO_x and particulate emissions when running on methane, and they can switch to conventional fuels when gas bunkering is unavailable. The capital expenditure is higher than for a simple diesel installation, and methane slip remains a concern for life-cycle GHG accounting, but it also provides operational flexibility. For trades with established LNG bunkering corridors, dual-fuel newbuilds are a defensible choice that meets near-term regulatory requirements while keeping retrofit options open for future low-carbon fuels.

Ammonia is attracting serious attention for its zero-carbon-at-point-of-use profile when produced from renewable electricity. However, the technology is still immature:

ammonia engines and fuel cells are under development, ammonia bunkering infrastructure is sparse, and there are safety and toxicity considerations that influence ship design and crewing. If your vessels will operate in European waters, this is a strong long-term option – though it's unlikely to be a viable one soon.

Using truly green methanol is well rewarded under FEUM, and you are likely to be able to monetise any overcompliance you achieve here by selling your credits to other shipowners and operators. Moreover, refueling logistics are comparable to traditional bunkers. The challenge is the limited availability and higher cost of genuinely renewable methanol. In trades where shore-side supply can be developed at a reasonable cost and you can guarantee its origins, methanol is a solid step towards lower carbon intensity.

Battery-electric and hybrid propulsion clearly suit short-sea services, ferries, and

offshore support vessels, where predictable routes and shore charging make them operationally practical. All-electric ships covered by FEUM also benefit from a zero-GHG intensity rating for on-board energy. For large ocean-going cargo ships, battery-only propulsion is not yet workable. However, hybrid systems – using batteries for peak shaving, hotel-load support, and transient manoeuvring – already deliver tangible fuel savings and emissions reductions, and those benefits will be recognised under FEUM.

Zeroqu's practical advice, based on my 23+ years as Chief Engineer and former head of Maersk's vessel performance team, is to run staged retrofit programmes that target the high-impact measures first, while planning to renew the fleet with fuel-flexible newbuilds. This blended approach balances near-term compliance and emissions reductions with long-term strategic positioning. □

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