The time for marine electrification is now

07 July 2026

Few sectors are under as much pressure to clean up as shipping. The IMO's emissions targets – a 40% reduction in carbon intensity by 2030 and net zero by 2050 – are shaping the choices owners and operators face on every new build and every major refit. Across Europe in particular, that pressure is already translating into tangible change: harbors imposing tighter air quality rules, regulators restricting conventional vessels from environmentally sensitive areas, and operators deploying hybrid and fully electric propulsion at a pace that would have looked unrealistic a decade ago.

Electrification sits at the heart of this transition, and the case for it is only getting stronger. Battery technology is advancing rapidly. Power electronics are becoming smaller, more efficient, and capable of handling higher voltages. Operators that have committed to electric and hybrid propulsion are reporting meaningful gains in efficiency, in passenger experience, and – most importantly – in their ability to operate freely in regions where conventional propulsion is increasingly restricted.

Having said that, it is also worth being clear-eyed about how this transition is playing out in practice.

Electrification is not the only path the marine sector is taking. Hydrogen, methanol, LNG, and other alternative fuels are all part of the response, and different vessel types will reach the IMO's targets through different combinations of technologies. That isn't a weakness in the case for electric and hybrid propulsion, however.

Rather, it is the reason the sector needs partners with the engineering breadth to support whatever combination an individual project actually requires. The question

is no longer whether marine electrification is happening, but where it delivers the most value and how to cleanly integrate it into the propulsion architectures already in service.

Why electric, and why now?

The principal driver behind the shift towards electric systems is regulatory. IMO Tier III emissions standards, harbor air quality rules, and the broader emissions reduction trajectory have moved from vague targets to genuine operational constraints. For an owner whose vessel needs to enter a controlled harbor, or to sail near a high-density coastal area, the question is no longer whether to reduce emissions but how. In many cases, that means at least having the option of running on electric power for part of the route.

Of course, secondary benefits matter too. Reduced noise is genuinely valued in places like the Norwegian fjords, where regulations now restrict large cruise vessels from entering under conventional power, and on smaller passenger ferries operating close to coastlines. The instant availability of torque from an electric motor is appreciated on pleasure yachts, where it produces a noticeably smoother and faster response than a diesel engine that needs to spin up to several hundred RPM before delivering meaningful power.

Hybrid first, electric where it works

As much talk as there is around new technology, the reality is that most vessels moving toward cleaner propulsion are going hybrid rather than fully electric. The reason is straightforward: batteries are heavy, and on a vessel that earns its living from cargo or passenger space, every cubic meter of battery is one that can no longer be sold. For long routes, fully electric simply does not yet add up.

Where it does add up is on short, predictable runs that allow regular charging. Inner-city passenger ferries, harbor tugs, and short-hop island services are well suited to fully electric propulsion, and some cruise operators are deploying full-electric capability for the segments of their itineraries that pass through environmentally sensitive areas.

Outside those niches, hybrid – a diesel engine paired with an electric motor and battery, with a clutch in between to disengage the diesel when not needed – offers the flexibility most operators actually need.

Vessel size draws a clear line, too. Small to mid-size vessels are leading the transition, while the largest container ships and tankers, with their two-stroke engines the size of a house, are following a different path. Typically, a combination of exhaust scrubbers, alternative fuels, and operational changes rather than wholesale electrification.

Interestingly, the pattern mirrors the construction vehicles sector, where small excavators are increasingly electric while large machines remain firmly in the diesel camp for now.

From an engineering perspective, hybridization is a more incremental change than the language around it sometimes suggests. A typical four-stroke marine engine drives a gearbox that reduces input speed to the propeller, often via an intermediate power take-off shaft for onboard generation. Adding hybrid capability means inserting an electric motor and a clutch into that arrangement – either before or after the gearbox – so that the diesel engine can be disengaged and the vessel driven on electric power alone.

The gearbox itself does not need to be redesigned. The propulsion architecture remains familiar. What changes is the addition of components that allow the engine

to be cleanly decoupled when running electric and recoupled when it isn't. For new builds and retrofits alike, this is well-understood territory.

We can see an excellent example of this in a project we carried out to help build Switzerland's first climate-neutral cruise ship[1]. The 63.5-metre, 5-deck vessel runs on a parallel hybrid system in which each of its two propeller shafts is driven by a 405 kW diesel engine paired with a 180 kW electric motor. Sitting between the diesel and the marine gear on each shaft is a compact 2-in-1 unit that combines a flexible coupling — connected to the diesel flywheel to damp torsional vibration — with an electromagnetic clutch that cleanly engages and disengages the diesel from the driveline.

The result is a ship that consumes around 20% less energy than a conventional equivalent, without any radical reinvention of the underlying propulsion architecture.

Looking further ahead, more radical changes are possible. Some cruise vessel concepts under development would replace conventional propellers with azimuth thrusters driven directly by generators, eliminating the gearbox altogether. Whether this becomes mainstream is an open question, but it is one of several signs that the drivetrain conventions of the past century may not all survive intact.

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[1] https://www.stromag.com/en/newsroom/2021/8/ap-periflex-vn-mwu-coupling-clutch-propulsion-system

Retrofit as the near-term reality

One factor often underappreciated outside the industry is the sheer practical impossibility of meeting emissions targets through new builds alone. Global shipyard capacity simply cannot deliver enough new vessels to replace existing fleets on the timeline that regulations demand. A substantial portion of the response will therefore

come through retrofitting existing diesel vessels with hybrid systems, alternative fuel capability, or other emissions-reducing technologies.

That has some major implications for powertrain component design. Solutions that integrate cleanly into existing propulsion arrangements – without requiring a redesign of the gearbox or significant rework of the surrounding installation – are far easier to specify into a retrofit project. So are solutions that consolidate multiple components into a single, factory-assembled unit, simplifying installation and reducing the time a vessel spends in dock.

A divided world

Marine electrification is not a single, globally synchronised movement, and it is unlikely to become one anytime soon. European operators and regulators are leading the way, with Nordic countries particularly advanced, while North American operators in coastal ferry services are moving quickly behind them. Other regions are taking a more cautious approach, and recent geopolitical shifts around energy security have introduced new variables that did not feature prominently a few years ago.

What ties these different trajectories together, however, is the underlying direction of travel. The next five to ten years will see more fully electric short-route ferries enter service, more hybrid systems specified into both new builds and retrofits, and more cruise and pleasure craft adopting electric capability for at least part of their operating profile. Even where diesel remains in service across the largest vessels, it will increasingly do so in combination with cleaner technologies rather than alone.

For everyone involved, from shipyards and naval architects to owners, and operators, that creates a real opportunity.

Vessels designed and built today will operate well into the 2040s and beyond, which means the decisions being made now will shape the sector for decades. Getting those decisions right calls for partners who can bring the full engineering picture into view: who understand the propulsion architectures already in service, who can integrate hybrid and electric solutions cleanly into them, and who can support both new builds and retrofits with the same confidence.

Image captions:

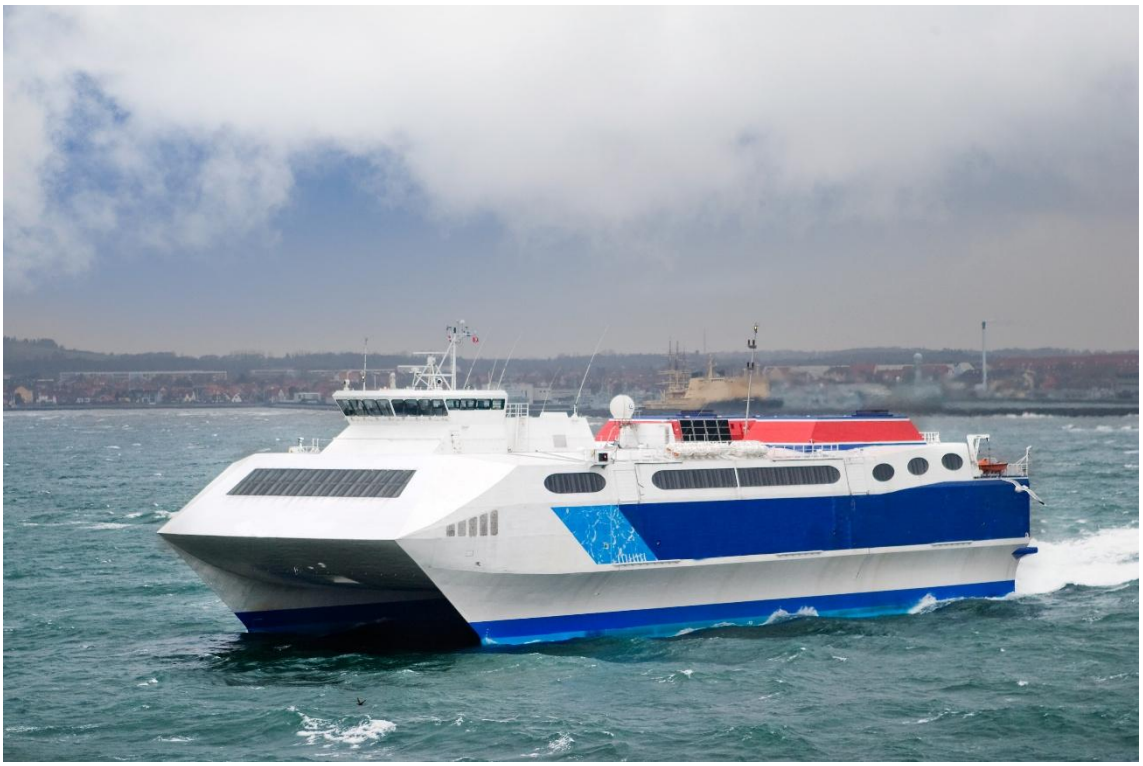

Image 1: Inner-city passenger ferries are well suited to fully electric propulsion.

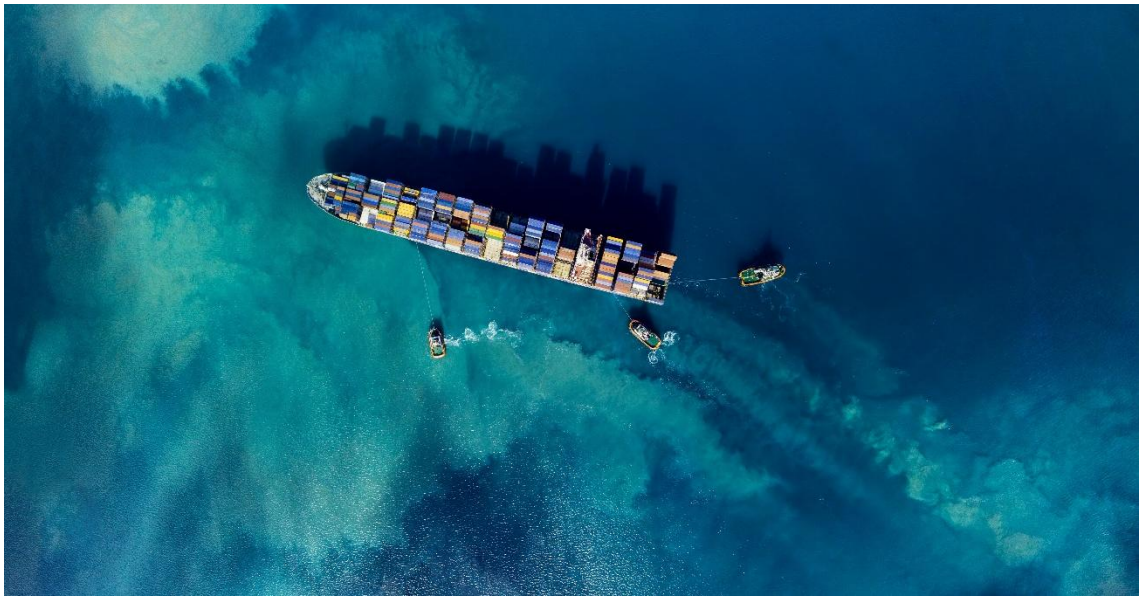

Image 2: For an owner whose vessel needs to enter a controlled harbor, or to sail near a high-density coastal area, the question is no longer whether to reduce emissions but how.

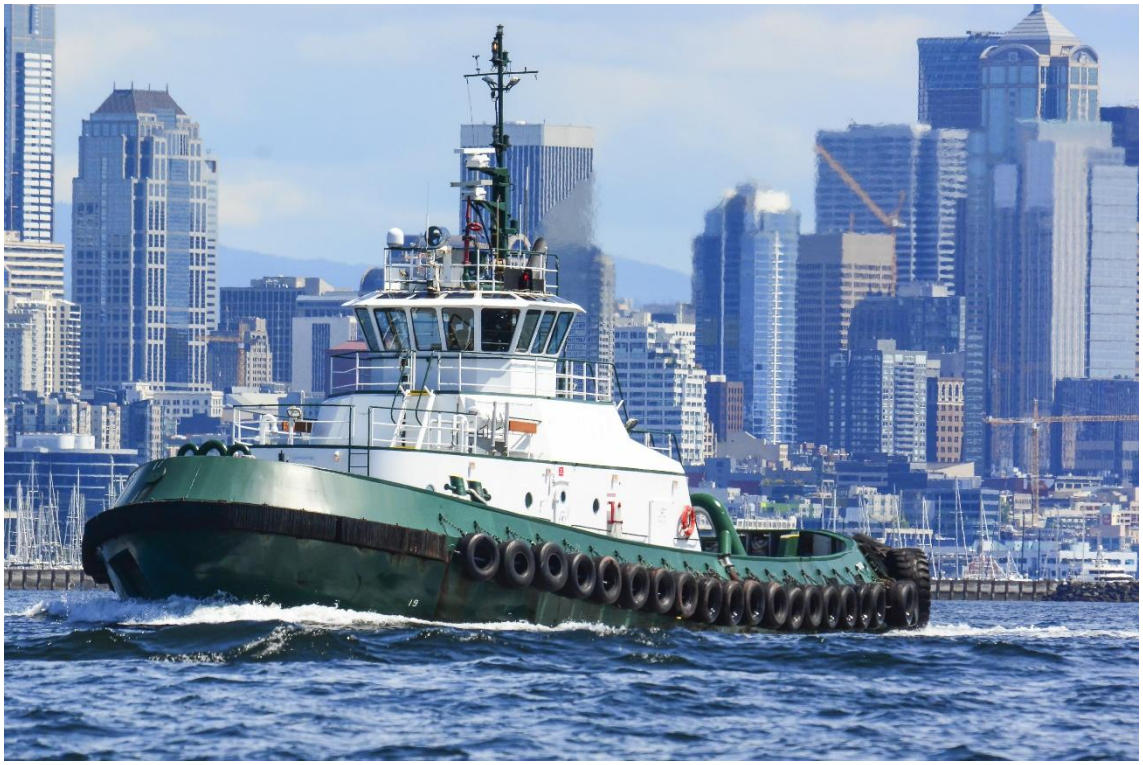

Image 3: Vessels designed and built today will operate well into the 2040s and beyond, which means the decisions being made now will shape the sector for decades.

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