

Safety and tech developments in marinised batteries

Lowering operational costs and emissions, without compromising safety, is a common goal for shipowners and charterers worldwide. The general transition towards an energy mix applies equally to the global fleet, which means more companies are coming to grips with the complexity around using marinised batteries. The rise of the hybrid and all-electric ship is not without challenge, but the rewards could be great.

Ships have a lifespan measured in decades, which is why those investing in them wish to future-proof their assets. At the time of writing this article, tens of thousands of people will converge at COP28 to discuss environmental targets and the practicalities of how to meet them. As we move to an age of carbon intensity indicators and emission trading schemes, shipowners and charterers alike will increasingly look to alternative fuels as a way of reducing costs and avoiding penalties. The operational profile of the vessel, and the available infrastructure to support it, can determine whether batteries for propulsion purposes are suitable. However, safety concerns are paramount and batteries present their own inherent set of risks.

The Club has previously published guidance on [fire mitigation and safety practices](#) which highlighted the challenges around the carriage of lithium batteries. Therefore, it is understandable that many will have concerns installing high-energy-density batteries in ships' engine rooms. It is crucial that the battery compartment design, fire detection and suppression systems, shutdown and isolation systems, maintenance, training, and compliance with set standards, are sufficiently developed in parallel with the technological advancement of the batteries themselves.

Furthermore, investors will be aware that the goal of greener and more cost-efficient ships can be called into question if the Capital Expenditure (CapEx) costs or battery degradation are too great. Technology is playing a vital role in increasing the power of the batteries as well as the number of achievable cycles, with the aim of reducing the quantity of batteries required in the first place and keeping those batteries working for longer.

In the latest article from our [Technology in Shipping series](#), we invited [Echandia](#), a company that develops and manufactures electric propulsion systems and who say they can provide the market with safe, efficient, and relatively long-life marinised batteries, to explain why electric powered ships can be an attractive prospect if proper consideration is given.



Background

Electrification of all modes of transport is gaining in popularity, driven primarily by tightening legislation, including taxation and the clear operational benefits stemming from lower operating costs. When considering emission reduction or zero emission solutions, batteries are preferred for their technical maturity, wide applicability, and high efficiency. The industry is already witnessing the hybridisation of larger vessels (predominantly in the offshore energy markets), as well as full electrification on several short sea routes (predominantly in the passenger ferry markets and for near-shore craft such as tug boats).

Electrification of vessels vs. Cars

An Electric Vehicle (EV) battery depletes the equivalent of its capacity once every 300-400 km or over 3-5 days under normal use. When batteries are used in the maritime context for propulsion, their capacity is cycled at least once per day but usually several times per day. This puts unique stress on the materials within the cell causing a more rapid capacity fade. Vessels are typically also owned for longer periods, often decades longer than EVs are. The increased requirement of cyclability and longer ownership means that cycle life is more crucial for the maritime industry than for automotive applications.

Concerns associated with batteries

Material consumption

Li-ion batteries account for most batteries in operation today for transport applications. These typically require materials such as graphite, lithium, nickel, manganese and cobalt with other variants utilising other metals such as titanium and iron. While vast quantities of materials will be

required as the battery footprint continues to grow, studies have shown that the high degree of material recyclability will reduce the environmental impact of batteries going forward. One study found that the weight of fuel that is burned during the lifetime of an average petrol or diesel vehicle is around 300-400 times more than the total quantity of battery cell metals that are lost during the lifetime of an electric vehicle ([Transport & Environment \(2021\). From dirty oil to clean batteries](#)). This difference is only more significant in the maritime context given the comparatively longer life of maritime batteries.

Fire safety

Even though fires from EVs are proportionately less frequent than with conventional fossil alternatives, there has been an increased focus on battery associated fire risks amongst the general population. For ships transitioning to electric power propulsion, one key consideration is the increased potential fire risk.

New considerations for battery powered vessels

For maritime installations, Class rules require anti-propagation protection between cells or, failing that, between modules, in addition to fire-fighting measures. Class rules mandate that batteries on board vessels are installed in battery rooms and that the total capacity is limited to 5 MWh per room. It is important to note that once a fire emanating from an energy storage system (of significant size) is initiated, it may be particularly difficult to extinguish. This is why the containment strategy for fires emanating in stationary battery installations are designed around preventing the spread of fire between battery containers, whilst frequently allowing the container on fire to burn through. For maritime installations, significant progress has been made on fire safety. For example, commercially available fire prevention systems now exist that detect flammable gases and inject foam to cool the system and thus prevent the fire from breaking out and spreading.



How Echandia's battery technology can be more sustainable, improve efficiency and mitigate risk

The best way to prevent fire-based accidents is to prevent their initiation. This begins with the

chemistry and quality of the battery cell *i.e.*, using chemistries that are relatively resistant to external heat and do not internally short circuit, such as Lithium-titanium-oxide. LTO cells are preferable from a safety standpoint. Additionally, high cell quality, pack design and manufacturing as well as accurate control of the battery's behaviour under all conditions are instrumental in ensuring that the batteries do not exceed their operating scope. By taking these factors into account and ensuring long life under even the most demanding conditions, Echandia's energy storage solutions can deliver a safer and more sustainable alternative for maritime electrification.

Conclusion

New battery systems will only become increasingly common on board maritime vessels. Safety and longevity remain especially relevant parameters within the maritime context, necessitated by high onboard safety requirements and the long duration of operation for a typical maritime asset. By balancing high safety with low total cost of ownership and reliability, Echandia's energy storage solutions are bringing the goals of the IMO's Marine Environment Protection Committee a step closer to shipowners, without increasing day-to-day operational risks or compromising on sustainability