

Will we see batteries powering large container ships?

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When it comes to batteries, automobiles have stolen the lion's share of our attention. From there, people may naturally think about our smaller devices that also use batteries. The idea of large ships or planes being powered by batteries—many of us would have a natural intuition that there could be obstacles to widescale usage.

Maritime shipping: lots of pollution and regulations are on the horizon

Maritime shipping is responsible for the transport of roughly 11 billion tonnes annually, which, put another way, accounts for 90% of global trade by mass. This is done through the consumption of about 3.5 million barrels of low-grade heavy fuel each year¹.

This fuel contributes significantly to pollution. How much pollution?

- One estimate placed the contribution of ships to human-generated carbon dioxide in the 2018 year at 2.5%. It is possible that by 2050, ships could be responsible for as much as 17% of total carbon dioxide emissions².
- Another estimate indicated that one large ship emits as much carbon dioxide as 70,000 cars, as much nitrogen oxide as 2 million cars and as much fine dust and other carcinogenic particles as 2.5 million cars³.

The International Maritime Organisation (IMO) has indicated action to reduce maritime emissions consistent with the Paris agreement. One component: A reduction of 50% of carbon dioxide emissions by 2050⁴.

What do ships do today?

Ships are already seeking to optimise their routes or travel across the water more slowly, which can use less fuel. There is even work being done on hybrid systems. However, whether it is traveling more slowly or using methods of being 'hybrid', meaning mixing an electric motor with an internal combustion motor, it is currently thought that the reduction in emissions would be in the range of 10-15%—better than nothing, but not close to 50%⁵.

Ships vs. planes—the story of energy density

Whether one is flying through the air, taking off from the ground, or pushing a ship through the water, it is fairly simple to know how much energy is needed to do each of these things. Here, we are considering the

source of that energy, and it's important to note that any source could theoretically be used, but that there are certain trade-offs that occur with each choice.

The simplest of these trade-offs comes down to 'energy density', meaning how much energy can be extracted per unit of weight. Hydrocarbon fuels have significantly higher energy density than current batteries, and this is why people will tend to cite the weight of the battery in an electric vehicle or the fact that adding batteries to planes has a big increase in weight that is difficult to compensate for. Depending on the specific type of fuel under discussion as well as the specific battery chemistry, statistics indicate that hydrocarbon fuels are in the range of 50-100 times as energy dense as current batteries⁶.

The bottom line—with hydrocarbon fuels you can get the same energy for a lot less weight.

Now, in a giant containership, weight is a lot less of a concern than it is for a vehicle that needs to take to the skies. There could even be benefits from distributing the weight across the ship such that it sits more evenly in the water.

If one is looking at a current setup that causes a lot of pollution and where adding incremental weight may not be the biggest concern, maritime shipping could offer a lot of 'bang for the buck' so to speak.

Fleetzero—a start-up bringing battery power to maritime shipping

It's notable to see the founders of Fleetzero flipping the key question on its head—instead of trying to use batteries on the largest current ships to replace the dirty, pollution-generating fuel for power, they recognised that the reason that ships operate the way they do, with the capacity to go around the globe on a single tank, is due to the historical path of innovation that has led us to this point. Smaller ships that stop more frequently in different ports could much more easily use battery technology for power⁷.

Instead of changing ships that were optimised for fossil fuels, why not rethink how ships are built and operated around battery technology?

Fleetzero's innovation would include batteries that were the size of shipping containers that could be swapped on and off the ship and charged at times of the day when the price of electricity was lower. They are in the process of building these prototype batteries, and over time they would seek to be building entire ships. Customers are already indicating the demand for 'zero carbon shipping'—firms like Ikea, Patagonia and Amazon are already discussing this with a timeline of getting it done by 2040⁸.

It's notable that this approach would allow for further innovations in battery technology to be reflected in the batteries being swapped in and out, so as new energy storage systems gain primacy, Fleetzero's systems could reflect it and take advantage.

Energy storage represents one of the most exciting focus areas of the coming decades

With the world's focus on climate change, a catalyst is therefore created for a continual focus on different ways to effectively store energy for 'on-demand' use. Energy supplies are nearly unlimited—just think - if we could effectively corral and capture all of the sun's energy hitting earth on a given day, but the challenge is in converting it into a form that can be stored and used as and where needed. So many different technologies

are being explored that we are certain the coming decades are going to be quite interesting in terms of unpredictable breakthroughs.

1 Source: Kersey et al. "Rapid battery cost declines accelerate the prospects of all-electric interregional container shipping." Nature Energy. Volume 7. July 2022.

2 Source: Kersey et al. July 2022.

3 Source: <https://www.infineon.com/cms/en/discoveries/electrified-ships/>

4 Source: Kersey et al. July 2022.

5 Source: Kersey et al. July 2022.

6 To cite an exact figure, one would need to specify a precise type of fuel and a precise type of battery chemistry. That was not our focus here, but there are many potential sources available to drill down further.

7 Source: Peters, Adele. "This start-up designed an electric cargo ship to cross the ocean." Fast Company. 6 April 2022.

8 Source: Peters, 6 April 2022.

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