How Y Combinator-backed Seabound is using carbon-capture tech to tackle the shipping industry's problematic emissions

in International Shipping News,Shipping: Emission Possible 28/08/2023

Alisha Fredriksson didn't expect to be living on a cargo ship this summer. Luckily, she and her team are taking the three-month stints in turns.

Fredriksson is the cofounder and CEO of Seabound, a climate-tech startup that aims to lower the greenhouse-gas emissions produced by the shipping industry.

Seabound, backed by the famed accelerator Y Combinator, has built a carbon-capture machine that can be retrofitted onto ships. It absorbs CO2 from the exhaust gas and turns it into limestone pebbles, which can then be sold as a building material.

From avocados to clothing, about 90% of traded goods are carried on the ocean. As the backbone of global trade, shipping is responsible for 3% of annual greenhouse-gas emissions — a figure the industry must slash. The UN's International Maritime Organization recently set a goal for the sector to reach net zero "by or around" 2050.

Net zero means to balance out the amount of emissions that are emitted with those that are removed from the atmosphere. Shipping, along with aviation and steelmaking, is considered a hard-to-abate industry because of its global complexities and reliance on fossil fuels.

It could cost up to $1.9 trillion to decarbonize shipping, a 2020 study by University College London and the environmental consultancy University Maritime Advisory Services found.

"Shipping now faces a much harder challenge than it would have done had it been better at adapting and improving over the last 10 to 20 years. It's become very urgent now," said Stephen Turnock, the head of the engineering school at Southampton University, of the International Maritime Organization's latest guidance.

Some form of carbon capture will be needed for shipping to "keep the world spinning" as it moves toward more sustainable practices, said Ed Phillips, a partner at the impact-investment fund Future Planet Capital.

Piloting the technology on board

Seabound's end goal is to capture 95% of the carbon produced by a ship, though its current prototype captures only a small fraction of that. Having tested it on land, Seabound is now using a commercial container ship as its lab in a pilot project with the London-based shipping company Lomar Shipping.

Seabound moved the prototype from its London research-and-development facility to a shipyard in Yalova, Turkey, where it has been installed on a midsize ship that can carry about 3,200 containers, Fredriksson said. Her team will take turns living on board to test the equipment in a real maritime environment.

The equipment connects to the ship's exhaust, which flows through a reactor full of pebbles made of calcium-oxide – otherwise known as quicklime, limestone without the CO2. Then a mineralization process takes place where carbon dioxide binds to the pebbles to essentially become limestone. The fumes, now cleaner, are released through an outlet pipe. The limestone is temporarily stored on board and replaced with fresh calcium-oxide pebbles when the ship docks.

The startup's opportunity is threefold: Seabound sells the carbon-capture device to ship owners, runs a subscription service for pebble collections to make it easy for shipowners to source new pebbles and offload used ones, and then sells the limestone pebbles to be used as a building material or to be sequestered.

If the pilot goes well, the team will start designing and testing a new, bigger version of the device that will be its first product.

"We will need some time to basically build that first product, so we want to move out of prototyping land and into actually having a product at a meaningful scale for our customers," Fredriksson said. "Then once we have really tested that on land, that's when we put the first full-scale version on a ship again."

Energy and weight challenges

Ships usually get lighter through their voyage because they use up fuel, but capturing carbon means storing it on board in some form, which adds weight, according to Turnock. "It might need a little more power to go through the water," he said.

It's likely a small amount of power, he added, but it's compounded by the weight and size of the carbon-capture device itself. "If it's quite heavy, then it usually has to be low down on the ship, and then there might be difficulty to find the necessary volume to actually fit the system in without losing cargo capacity."

"Shipowners are loath to lose cargo-carrying capacity because that's what makes them their money," Turnock said.

In its first pilot, Seabound placed its equipment into five shipping containers stacked on top of each other on the ship. It may require owners to sacrifice "a little bit of cargo" within the ship's max capacity, and "fuel consumption is relative to that capacity," Fredriksson said.

Fredriksson added that Seabound's reaction was exothermic, meaning it needed an injection of heat to get started but then was self-sustaining. It has a "very negligible energy consumption on board," she said.

Decarbonization requires all hands on deck

There are a handful of other approaches to maritime carbon capture, such as using the captured carbon to charge a CO2 battery, but overall it's a very nascent space. "It's not an industry, it's an emerging category," Fredriksson said.

"What's interesting is that we're actually all trying different approaches," she added. "It's our responsibility as technology innovators or developers to figure out how we can work strategically or creatively within existing infrastructural constraints."

Fredriksson said there were a host of creative ways being pursued to address the shipping industry's emissions. "If we were all trying the same thing, it would be kind of silly."

Carbon capture aside, electric ships or alternative fuels are favored by others. Maersk, one of the largest container carriers in the world, is betting on green methanol as a fuel, while other startups hope electrification will take off.

"We're focused more on the opportunity with e-methanol, with ammonia, hydrogen, and electrification; it's just avoiding being leapfrogged," said Future Planet Capital's Phillips. "As an investor with a long-term view, sometimes backing a technology that solves an issue in the short-term can be a risk in itself." Still, Seabound's tech looks "pretty elegant" to the outsider.

Leapfrogging doesn't make sense when most ships today run on fossil fuels and are still being ordered, Fredriksson said. Ships typically have a 30-year lifespan, she added. The cost of a complete overhaul to an electric fleet or one that runs on alternative fuel would be "prohibitively expensive" while the technologies themselves are still immature, she added. At scale, Seabound intends to retrofit ships when they are in dry docks for routine maintenance.

Turnock expects to see a patchwork of technologies emerge. The best solution will depend on whether it's a short-distance ferry or a cargo ship sailing the high seas, he said. "I don't think there's a magic

bullet out there."

"We should be thinking about solutions which are overall good for the environment and make sense, not just ways of bookkeeping CO2 so we're just displacing the problem," he added.
Source: Business Insider