Future sailors: what will ships look like in 30 years?

With a target to halve its huge carbon footprint, the race is on to find new technologies to green the world's shipping fleet

Fred Pearce Thu 3 May 2018 09.00 EDT

Low-tech solutions can deliver big emission cuts: sails could once again become the norm. Photograph: Courtesy of Elomatic Oy/NYK

Watch out for the return of the sailing ship.

After a commitment last month to cut greenhouse gas emissions from shipping by at least 50% by 2050, the race is on to find new technologies that can green the 50,000-strong global shipping fleet. Wind power is one of the options being discussed.

International shipping accounts for more than 2% of global carbon dioxide

emissions, roughly the same as aircraft. But the 2015 Paris agreement to fight climate change left control of the shipping industry's emissions to the International Maritime Organisation.

While environment groups applauded the agreement to cut hard and deep by 2050, they pointed out that it falls far short what is technically achievable.

A report published just before the meeting by the International Transport Forum (ITF), a thinktank run by the Organisation for Economic Co-operation and Development (OECD), found that the industry could achieve up to 95% decarbonisation as early as 2035 using "maximum deployment of currently known technologies."

Low-tech solutions

The good news is that easy-to-do low-tech solutions can deliver a lot. Maersk, the world's largest container shipping line, has already discovered it can cut fuel use 30% simply by steaming more slowly.

Because of the wide availability of cheap (and often dirty) fuel, shipping has traditionally been wasteful. Most merchant ships are made of heavy steel rather than lighter aluminium, and don't bother with obvious energy-saving measures like low-friction hull coatings or recovering waste heat.

More slender ship designs alone could cut fuel use — and hence emissions — by 10-15% at slow speeds and up to 25% at high speeds, says the ITF. But replacing the existing fleet would take time. The average age of today's shipping fleet is 25 years. Rules of energy efficiency for new ships introduced by the IMO in 2013 will only fully come into force from 2030, meaning that any switch to slender ships would not apply to most ships at sea until mid-century or beyond.

But much could be done more quickly by retrofitting existing ships with technology to cut their fuel use and hence emissions, according to the ITF. Here are just four:

- Fitting ships' bows with a bulbous extension below the water line reduces drag enough to cut emissions 2-7%;
- A technique known as air lubrication, which pumps compressed air below the hull to create a carpet of bubbles, also reduces drag and can cut emissions by a further 3%;
- Replacing one propeller with two rotating in opposite directions recovers slipstream energy and can make efficiency gains of 8-15%,
- Cleaning the hull and painting it with a low-friction coating can deliver gains of up to 5%.

Entirely new ships

Putting together better designs and better fuel will create entirely new kinds of ships in future. And the blueprints are already being drawn up.

The Aquarius Ecoship, a cargo ship devised by a Japanese company called Eco Marine Power, is driven by a phalanx of rigid sails and solar panels. The same system could power oil tankers, cruise ships and much else. It would not, the designers admit, entirely eliminate the need for conventional fuel: Even with large batteries to store the solar and wind energy, back-up would be needed. But it could cut emissions by 40 percent.

The Aquarius Eco Ship concept design incorporates the innovative solar and wind power. Photograph: Courtesy of Eco Marine Power

Going one better, the Japanese shipping line NYK boasts that its design for a 350m-long container ship, the Super Eco Ship 2030, would use LNG to make hydrogen to run fuel cells. Backed up by solar panels covering the entire ship and 4,000 square metres of sails to catch the wind, the combination could cut emissions by 70%. Or for a completely zero-carbon option, engineers at Wallenius Wilhelmsen, a Scandinavian shipping line, offer the E/S Orcelle, a lightweight cargo ship designed to transport up to 10,000 cars (electric, we trust) on eight decks.

It would be powered by electricity, half coming directly from wind, solar and wave energy, and the other half from converting some of that energy into hydrogen to power fuel cells. The company says the ship could be afloat by 2025.

Today's ships are in many respects almost indistinguishable from those of a century ago. But the IMO decision to finally get with the global climate agenda has fired the starting gun on what is set to be a race to create a new standard for low-carbon shipping that should be the norm just a few decades from now.

Banishing conventional fuel

Some of the biggest gains will require banishing conventional petroleum-based fuel, says the Sustainable Shipping Initiative, a progressive industry ginger group whose members include cruise lines and commodities shipping lines. Innovations ranging from biofuels to liquefied natural gas (LNG), nuclear reactors to sails to catch the wind, and hydrogen to solar panels have been proposed.

Each has its benefits and drawbacks, and nobody is putting all their money on one solution. Biofuels are problematic because they take land to grow, though specially engineered crops such as algae could change that, says the ITF. While electric engines already operate on some short ferry journeys, the sheer weight and space taken up by batteries on oceangoing ships make them unviable until there are breakthroughs in lithium-ion batteries. Solar power can only augment other power sources.

One innovation already underway is converting ships to run on LNG. There are already more than a hundred LNG-fuelled ships globally. A new generation of giant cruise ships powered this way and carrying up to 7,000 passengers will be launched by MSC Cruises starting in 2022. Some LNG ships claim a reduction in CO_2 emissions of 15%, though that depends crucially on keeping leakage of the greenhouse gas methane to a minimum in ships and bunkers.

LNG-powered Viking Grace boasts the first ship-based 'rotor sail'. Photograph: Tuukka Ervasti/Lloyd's Register

The first LNG-powered cruise ship is the Viking Grace, operating between Finland and Sweden. This vessel has another claim to fame. As of this April it also boasts the first ship-based "rotor sail" to capture power from the wind. Rotor sails have a large spinning cylinder amidships. Wind hitting the rotor creates a vertical force that can be used to power the ship, a phenomenon known as the Magnus effect. The Viking Line says the extra power will reduce the ship's CO_2 emissions by 900 metric tonnes (1,000 tons) per year.

We've got an announcement...

... on our progress as an organisation. In service of the escalating climate emergency, we have made an important decision – to renounce fossil fuel advertising, becoming the first major global news organisation to institute an outright ban on taking money from companies that extract fossil fuels.

In October we outlined our pledge: that the Guardian will give global heating, wildlife extinction and pollution the urgent attention and prominence they demand. This resonated with so many readers around the

world. We promise to update you on the steps we take to hold ourselves accountable at this defining point in our lifetimes. With climate misinformation rife, and never more dangerous than now, the Guardian's accurate, authoritative reporting is vital – and we will not stay quiet.

We chose a different approach: to keep Guardian journalism open for all. We don't have a paywall because we believe everyone deserves access to factual information, regardless of where they live or what they can afford to pay.

Our editorial independence means we are free to investigate and challenge inaction by those in power. We will inform our readers about threats to the environment based on scientific facts, not driven by commercial or political interests. And we have made several important changes to our style guide to ensure the language we use accurately reflects the environmental emergency.

The Guardian believes that the problems we face on the climate crisis are systemic and that fundamental societal change is needed. We will keep reporting on the efforts of individuals and communities around the world who are fearlessly taking a stand for future generations and the preservation of human life on earth. We want their stories to inspire hope.

We hope you will consider supporting us today. We need your support to keep delivering quality journalism that’s open and independent. Every reader contribution, however big or small, is so valuable. **Support the Guardian from as little as $1 – and it only takes a minute. Thank you.**