

# Decarbonizing the International Maritime Shipping Sector



## The Challenge Ahead

A look at some of the measures and opportunities to help the international maritime shipping sector decarbonize.

**International maritime shipping is critical to the global economy.** Ships carry more than 80 percent of the world's trade by volume and over 70 percent by value.<sup>1</sup> But with the benefits come the costs. Ships are a growing source of air pollution and greenhouse gas (GHG) emissions. Globally, air pollution from ships causes tens of thousands of premature deaths per year, and recent estimates suggest that it might be more like hundreds of thousands.<sup>2</sup> Ship emissions also contribute to climate change. Currently, shipping is responsible for 2–3 percent of global anthropogenic carbon dioxide (CO<sub>2</sub>) emissions,<sup>3</sup> but that share is expected to grow as countries work to achieve the goals of the Paris Agreement. In fact, by 2050 international shipping could account for 17 percent of all anthropogenic CO<sub>2</sub> emissions if nothing is done to limit them.<sup>4</sup>

The international shipping and aviation sectors were left out of the final Paris Agreement, leaving two specialized United Nations agencies, the International Maritime Organization (IMO) and International Civil Aviation Organization (ICAO), to develop their own plans for addressing GHGs from ships and planes. ICAO developed a not-so-ambitious strategy for international aviation, but at least they have a plan. You can learn more by reading Dan Rutherford's article elsewhere in this issue.

Now, international shipping is the only major sector without a plan to address its GHG emissions. However, the IMO is currently developing a strategy that could meaningfully reduce ship emissions and achieve zero emissions by mid-century or soon thereafter—but only if it's designed properly. By the time this issue is published, IMO delegates will have agreed, in April, on an initial strategy to reduce GHGs from ships, with a revised strategy slated for 2023.

## Decarbonization

Make no mistake: decarbonizing shipping will be a monumental task. Under a business-as-usual scenario, shipping's emissions are expected to grow about 2 percent per year, doubling from 2012 to 2050.<sup>5</sup> Instead, the IMO strategy will aim to substantially reduce ship emissions by 2050 and to completely decarbonize in the second half of the century.<sup>6</sup> While this ambition is nice, and necessary, it's the measures to achieve this target that really matter. Two measures stand out as obvious candidates to help shipping decarbonize: reducing speed and strengthening energy efficiency standards for new ships.

### Reducing Ship Speed

Reducing speed exponentially reduces fuel consumption and emissions. In fact, reducing speed by 10 percent reduces a ship's hourly emissions up to 27 percent and, accounting for a

now-longer journey time, reduces net emissions by 19 percent.<sup>7</sup> One consideration: if we slow all ships down, we considerably reduce shipping's transport supply. To compensate, existing ships can be filled more, laid-up ships can re-enter the market, and new ships can be built. As you might imagine, this eats away at the GHG reductions you get from a speed reduction policy, going from exponential reductions to something more linear.<sup>8</sup> Nevertheless, for many advocates, speed reduction is an attractive first step toward decarbonizing the shipping sector because it seems to be the only measure that can immediately reduce emissions from the existing fleet.

### Strengthening Energy Efficiency Standards

For the new fleet, new and stronger energy efficiency standards can help. The IMO already has energy efficiency standards for new ships through its Energy Efficiency Design Index (EEDI). The EEDI regulations mandate that new ships be more efficient than a baseline of similarly sized older ships according to the year in which new ships are built: 2015 (10%), 2020 (20%), and 2025 (30%). But environmental advocates have criticized the EEDI as being too weak to drive meaningful energy efficiency improvements.<sup>9</sup>

Fortunately, the EEDI has a built-in review mechanism, meaning that new, more stringent EEDI phases can be adopted. Right now, there's a push to accelerate the implementation of "phase 3" standards (i.e., 30% more efficient) from 2025 to 2022 and to establish a new "phase 4" standard for 2025. Importantly, new EEDI phases can drive innovation in the marine sector. For example, a 2025 phase 4 standard and a 2030 phase 5 standard requiring 40% and 60% efficiency improvement, respectively, would send a strong signal to the sector that advanced technologies (e.g., wind-assist, hull air lubrication, advanced hull coatings) and transformative technologies (e.g., biofuels, batteries, fuel cells) need to be developed and deployed. Pair that with a mandate for zero-emission vessels (ZEVs) to make up a growing share of the new-build fleet over time and you're on your way to making new ships part of the decarbonization solution. Even better, because the EEDI is enshrined in the International Convention for the Prevention of Pollution from Ships (MARPOL), which is an international treaty, the EEDI is legally binding.

### The Need for Regulation

Legally binding measures to clean up the shipping sector are critical, especially when you realize that there are five coal-powered ships still in operation<sup>10</sup> and, not much better, the rest of the fleet mostly burns heavy fuel oil, a dirty tar-like sludge. Ironically, upcoming 2020 fuel quality regulations

that cap the sulfur content of marine fuels at 5,000 parts per million (ppm; down from 35,000 ppm)<sup>11</sup> are actually bad for the climate. Sulfur oxide (SO<sub>x</sub>) emissions harm human health, contribute to acid rain, and exacerbate ocean acidification, but they also help form light-reflecting particles that cool the planet. Unfortunately, climate warming pollutants, like black carbon and methane (from liquefied natural gas [LNG]-powered ships), remain unregulated<sup>12</sup> even though black carbon accounts for more than 20 percent of shipping's CO<sub>2</sub>-equivalent emissions on a 20-year timescale and LNG is an increasingly popular marine fuel.<sup>13,14</sup>

In the end, like every other sector, international shipping must strive to completely eliminate its GHG emissions. But, like a fast-moving oil tanker trying to turn around, it will take the sector time to slow down, break from its current

path of increasing emissions, and chart a new course toward decarbonization. In the meantime, we can immediately reduce emissions by slowing ships down. We can also insist that new ships be much more efficient than their predecessors and mandate that some proportion of the new fleet be ZEVs.

In the long-run, we'll need nearly all new ships to emit zero carbon. It is possible. There's increasing interest in wind-assist, innovative hull designs, solar power, biofuels, batteries, and fuel cells, all of which will help. But what we really need is a regulatory driver to give the industry certainty that new investments in low and zero-carbon fuels and propulsion technologies will pay off. Without that, an industry that is wholly reliant on fossil fuels, with ships that last for decades, will be like that fast-moving oil tanker: going too fast to turn itself around. **em**

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5. Smith, T.W.P.; Jalkanen, J.-P.; Anderson, B.A.; Corbett, J.J.; Faber, J.; Hanayama, S.; O'Keeffe, E.; Parker, S.; Johansson, I.; Aldous, L.; Raucchi, C.; Traut, M.; Ettinger, S.; Nelissen, D.; Lee, D.S.; Ng, S.; Agrawal, A.; Winebrake, J.; Hoen, M.; Chesworth, S.; Pandey, A. *Third IMO Greenhouse Gas Study 2014*; International Maritime Organization: London, 2015; available online at <http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Documents/Third%20Greenhouse%20Gas%20Study/GHG3%20Executive%20Summary%20and%20Report.pdf>.
6. As I write, IMO delegates are debating what will be included in the initial strategy, including if, and by when, to completely eliminate emissions from international shipping. Visit [www.imo.org](http://www.imo.org) to read about the initial strategy.
7. Faber, J.; Huigen, T.; Nelissen, D. *Regulating speed: A short-term measure to reduce maritime GHG emissions*; CE Delft: Delft, The Netherlands, 2017; available online at <http://www.cleanshipping.org/download/Slow-steaming-CE-Delft-final.pdf>.
8. For example, slowing the container ship fleet down 10% would reduce emissions 13% after accounting for the longer time it takes for a given ship to complete its journey, bringing laid-up ships back into service, and building new ships to compensate for lost transport supply (per Reference 7). The actual emissions reduction could be higher if existing ships are filled more or if improved logistics reduce the time ships spend waiting to enter and exit a port.
9. *Statistical analysis of the energy efficiency performance (EEDI) of new ships*; Transport and Environment: Brussels, 2017; available online at <https://www.transportenvironment.org/sites/te/files/publications/Statistical%20analysis%20of%20the%20energy%20efficiency%20performance%20%28EEDI%29%20of%20new%20ships.pdf>.
10. Ships whose main fuel source is coal that I can confirm are still operating today based on information in IHS Fairplay's Register of Ships, available at [shipfinder.org](http://shipfinder.org); a subscription is required.
11. MARPOL Annex VI Regulation 14, available at [http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Pages/Sulphur-oxides-\(SOx\)-Regulation-14.aspx](http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Pages/Sulphur-oxides-(SOx)-Regulation-14.aspx).
12. The IMO is not currently considering regulating methane emissions but is considering regulating black carbon. That decision, however, is some years off. More information on progress on defining, measuring, and controlling black carbon available from the International Council on Clean Transportation's series of workshops, the most recent of which can be found here: <https://www.theicct.org/events/4th-workshop-marine-black-carbon-emissions>.
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14. Ibid at 3.