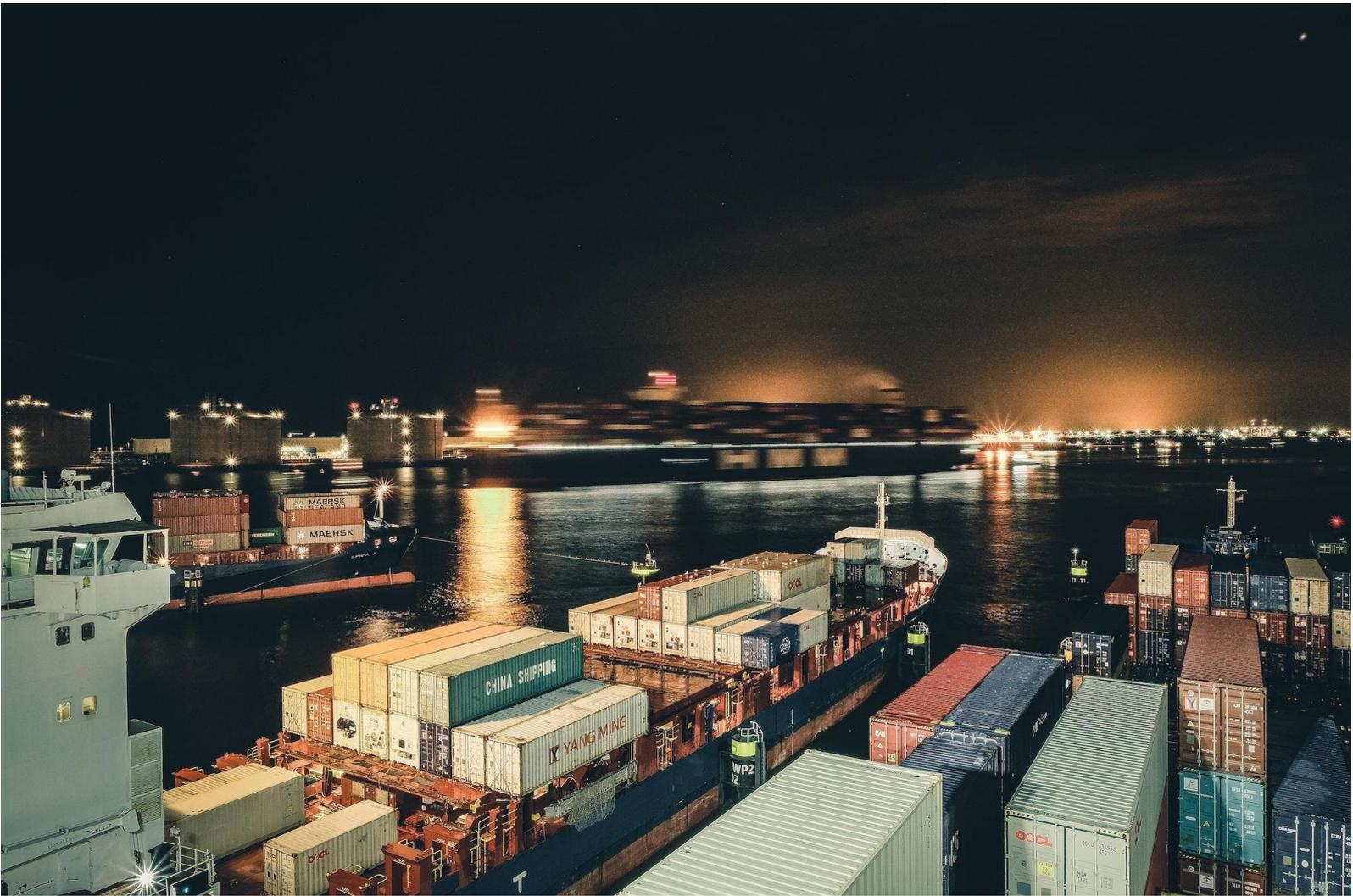




Industry series

Reading time: ~10 minutes

Reducing greenhouse gas emissions in the global shipping industry



Source: Unsplash

Introduction

This paper is part of a Sustainability series on **global industries**, which looks at the opportunities and the challenges to meeting [the United Nations Sustainable Development Goals](#) (the SDGs) by 2030.



Shipping’s challenge to lower greenhouse gas emissions

The international shipping industry has a key role to play in tackling climate change. Research over the past few years indicates that it is currently responsible for close to 3% – [over one billion tonnes annually](#) – of global greenhouse gas emissions (GHGs).⁶ For context, these emissions are higher than all but the top-five greenhouse-gas emitting countries.²

Shipping is a key enabler of international trade, accounting for about three-quarters of total freight transport around the world. It is the most energy-efficient way to carry cargo in terms of energy use per tonne-kilometre (tkm).¹ However, direct CO₂ emissions from shipping have increased over the past decade in response to greater global demand for the shipping of goods, materials and resources.

Furthermore, continued growth and changing patterns in the global shipping industry is expected, which will lead to increased emissions if nothing is done to change.

In April 2018 the International Maritime Organization(IMO) [published an IMO GHG Strategy](#) to reduce GHG emissions from international shipping and align the sector with Paris Agreement climate goals.⁵ The strategy put forward is (1) to reduce CO₂ emissions per transport work (“carbon intensity”), as an average across international shipping, by at least 40% by 2030, pursuing efforts towards 70% by 2050 (compared to the 2008 baseline) and (2) a reduction of the total annual GHG emissions from international shipping by at least 50% by 2050 compared to 2008, and pursuing efforts to phase them out entirely.⁵

In July 2020 the IMO submitted its fourth IMO GHG Study to the Marine Environment Protection Committee (MEPC).⁴ Six years after its third report, it is seen as a critical scorecard in measuring actions of the shipping industry towards the reduction of GHGs.⁵

A key finding of the report, produced by an international consortium of research institutes and universities, is that the industry’s GHGs increased by almost 10% between 2012 and 2018. The authors forecast that emissions due to shipping could increase by up to 50% until 2050 relative to 2018 emissions despite continued efficiency gains being made, because shipping demand is expected to continue to grow.⁴ The goals of the IMO GHG Strategy are therefore vital.

Countries around the world are working towards common ground for “goal-based operational efficiency” inn shipping. If the international community can agree on targets for the maximum amount of carbon dioxide that each type of ship may emit per tonne of cargo per mile travelled, and such caps agreed and enforced, shipowners will have to implement solutions to meet the required carbon emission reduction targets. Critical to this is for all nations to agree to appropriate targets, and to do so soon.

A bold target to significantly reduce GHG emissions needs to be set, and the shipping industry to work out how to achieve emissions reductions whilst responding to the anticipated increased demand for its services in the coming years.²



Three main areas are of interest – first, reducing ship design speed, second, fitting ships with energy-efficient technologies, and third, switching to low-carbon fuels.

1. Ship speed

Even if shipowners cannot currently afford new innovative measures, a report carried out for campaign groups Seas at Risk and Transport & Environment in 2019 states that reducing a vessels' speed by 20% could reduce its GHGs – and also its fuel costs (thus adding an economic incentive) – by approx. [24-34%](#).⁷

A 20% speed reduction would cut greenhouse gases but also curb pollutants that damage human health such as black carbon and nitrogen oxides. How a speed reduction will work with shipping schedules and itineraries is an open question.

2. Energy-efficient technologies

An [OECD delegation submitted a proposal to the IMO](#) in September 2017 which included proposals to align international shipping with [the Sustainable Development Scenario](#) (SDS). It discusses the possibility for all new ships to be at least 60% more efficient than the baseline by 2030 (50% for container ships) and an operational efficiency standard to ensure that ships that are still in service by 2030 are nearly 20% more efficient than the baseline (around 15% for container ships).³

Shipowners have a range of [options](#) to meet such targets, for example:

- [Air-lubrication systems](#) can reduce emissions by over 10%.
- [Flettner rotor sails](#) can cut fuel consumption by more than 8%.

Few of the world's commercial vessels, which number approx. 60,000 in quantity, currently have new innovation measures fitted / being trialed. The economics of greening the shipping industry is a challenge when many say they are struggling to make profits.

3. Switching to low-carbon fuels

Low-carbon fuel options offer much promise. Some of the options currently being considered include biofuels, "green" hydrogen (produced by renewables), ammonia, fuel cells, batteries and synthetic fuels produced from renewables.¹

Due to a lack of policy, low-carbon fuel use in international shipping in 2019 was virtually zero. At just 0.1% of final energy consumption in the industry, biofuels are the only non-fossil alternative that have been adopted so far. According to the current policy framework, low- and zero-carbon fuels are projected to make up just 3% of total energy consumption in international shipping by 2030 and perhaps roughly one-third by 2050. This falls way short of the 3% and 9% estimated requirements of the SDS, and highlights the need to demonstrate and scale up the deployment of vessels powered with low-carbon fuels. Because such fuels cost more than fossil-fuels, innovative policy action is required to encourage the advancement of emerging technologies and to make them commercially viable.¹

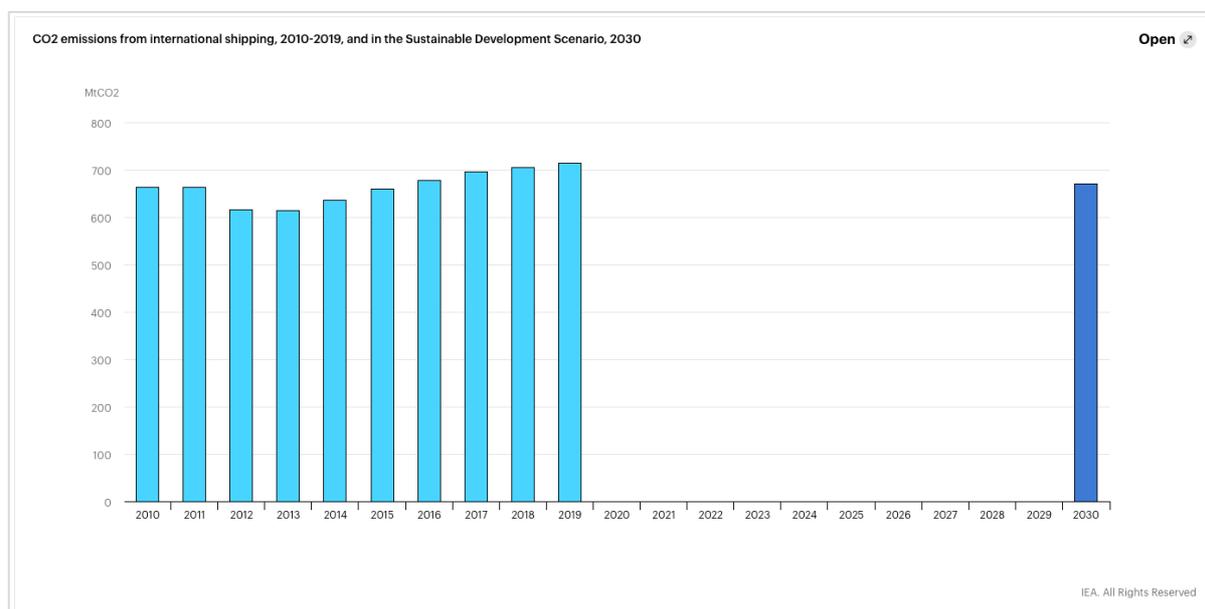


How is the global industry responding?

Delegates at a high-level meeting in London in November 2020 agreed new guidelines intended to make shipping compatible with UN climate change goals. The talks, organised by the International Maritime Organization (IMO), concluded with a plan to align the industry with the Paris climate treaty. ⁶

The proposals were backed by the majority of delegates. However, many delegates complained about the lack of ambition of the plans and that, at best, today's outcome was "a small step". ⁶ So, is the industry doing enough?

CO2 emissions from international shipping, with the SDS, to 2030:



Source: IEA – [International Shipping Report, June 2020](#)

The consequences of the strategy and plan are far-reaching, with changes required right across the industry value chain for it to succeed.

A number of policies aiming to reduce air pollution from shipping have been announced in the past decade, many of which have already been enforced. The [global sulphur cap](#) mandated by the IMO came into effect in January 2020. This cap requires shipping vessels to either use maritime fuels with a maximum sulphur content of 0.5% or to install a “scrubber” to comply with sulphur dioxide emissions regulations. ¹³

A year earlier, in January 2019, the IMO’s [Data Collection System \(DCS\) regulation](#) for the fuel oil consumption of ships entered into force. The regulation requires all ships with a gross tonnage of 5,000 tonnes and above to prepare annual reports on their fuel oil consumption and transport activities.

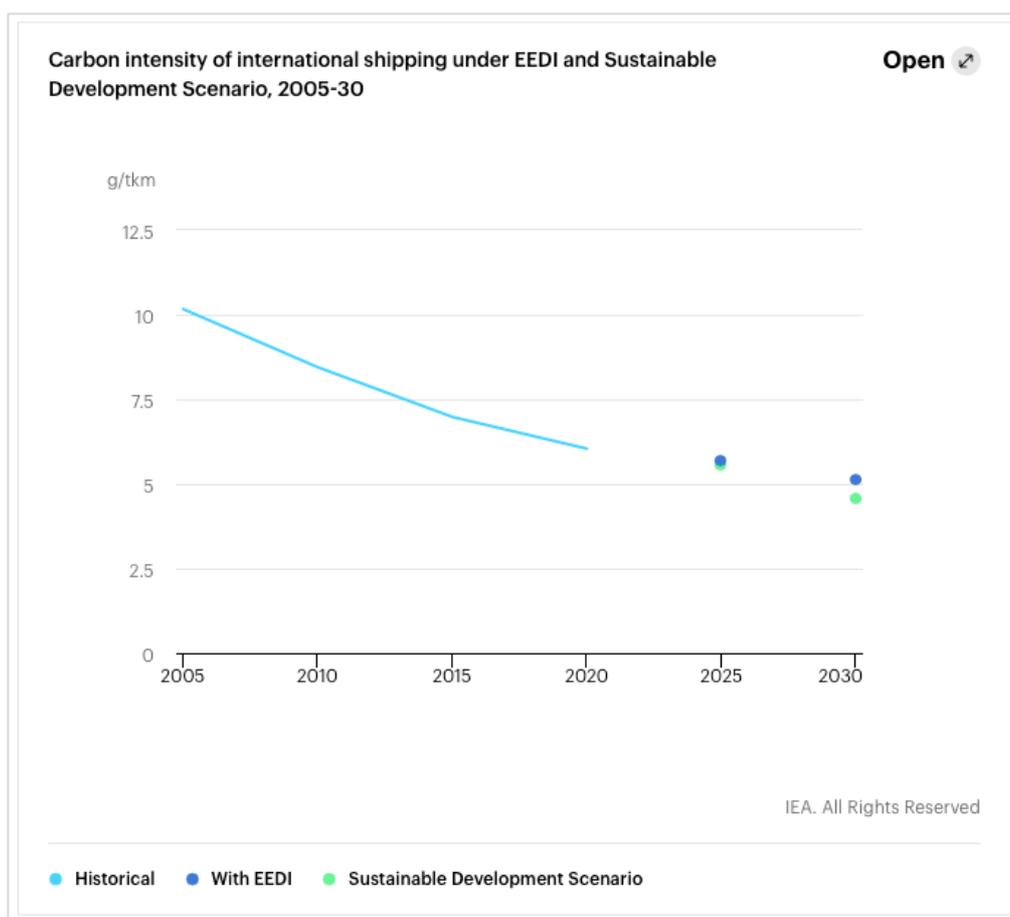


The aim of this system is to create a database to track and monitor energy consumption from international shipping as well as calculate CO₂ emissions. It should harmonise emissions estimates from different organisations.

While these regulations should help to reduce air pollution, reduce adverse health impacts on populations living at or near major ports, and lessen the environmental impact on the world’s oceans, work is required to ensure they do not delay a transition to carbon-neutral fuels.

The key international regulations currently in place to encourage greater shipping efficiency are the [Energy Efficiency Design Index \(EEDI\)](#) and the [Ship Energy Efficiency Management Plan \(SEEMP\)](#). Both are enforced by the IMO, with the EEDI aimed at energy efficiency standards for new ships and the SEEMP aimed at the efficiency of ship operations. ¹

The EEDI requires average annual efficiency improvements of approx. 1.5% for new ships from 2015 to 2025. This takes into account that energy use by the global shipping fleet per tkm fell by an average 1.6% annually between 2000 and 2017. Some organisations are pressing the IMO to tighten the EEDI standards to encourage the uptake of new technologies to improve ship energy efficiency further.



Source: IEA – [International Shipping Report, June 2020](#)



What innovations are industry players working on?

In response to industry and inter-governmental actions, the private sector is adopting strategies to align with the new regulatory framework.

For example, in 2019, a consortia of banks jointly representing around US\$150 billion in shipping financing signed the [Poseidon Principles](#), which commit them to integrate climate risk considerations into financial decision-making in the maritime industry. Businesses in the shipping, fuel and infrastructure segments of the industry have set up the [Getting to Zero Coalition](#) which is focused on commercialising deep-sea zero-emission vessels (ZEVs) by 2030.

Maersk Tankers announced plans in 2020 to spin off its data-analytics department into a separate division, to help speed up digitisation and make the industry greener. *ZeroNorth* will assist ship operators to maximise performance while minimising fuel consumption and emissions. They believe that if the world's 33,000 [tramp freighters](#) adopt its technology, the industry could prevent 50 million tonnes of CO₂ emissions and increase revenues by US\$12 billion over the next five years.

As stated earlier, fuels and technologies will play a key role in reducing GHGs. Fuels and technologies to get shipping on track with the Sustainable Development Scenario (SDS) are not yet commercially viable. To help fund research and development (R&D), in December 2019 several shipowners proposed to the IMO a levy of US\$2 / tonne on bunker fuel (raising the cost of bunker fuel by less than 1%) to [fund R&D on zero-emission vessels and fuels](#). Estimates are that the levy could generate almost US\$500 million per year to fund research. Around 250 million tonnes of fuel are burned by ships annually. The International Chamber of Shipping (ICS) says that 90% of owners globally back the US\$2 levy on fuel. ⁸

An example of new fuel R&D: hydrogen

Green hydrogen (refer to [an associated paper about this energy carrier](#)) is increasingly being seen as a future energy source for a variety of purposes, including potentially the shipping industry. ¹⁴

The use of “green hydrogen” is an attractive prospect to industrial users, including ship owners and energy companies, if it can be made commercially viable. However, it poses challenges. It is far less dense than other fuels, which means that more onboard storage capacity is required. As a result, it is best suited to short voyages. ⁹ This might turn out to be feasible and economic, if potential changes to shipping patterns (for example, in the global container industry) take place.

Green hydrogen currently costs between four to eight times the price of very low sulphur fuel oil, according to risk management firm DNV GL. ⁹ Other types of hydrogen are cheaper, but they are produced using fossil fuel, which means they are not emissions free. Green hydrogen is expected to fall in price over the next couple of decades as the cost of renewable energy and electrolyzers falls.





Source: Reuters [news article](#) The Energy Observer, a hydrogen-powered boat, sails from Amsterdam's harbour after testing a new device that allows it to produce fuel from wind, in Amsterdam, Netherlands, April 20, 2019. Eva Plevier / File Photo

Hydrogen also plays an integral role as a building block in the production of several carbon-neutral fuels such as e-ammonia, blue ammonia and e-methanol, all of which gain significant uptake under the decarbonisation pathways. ¹⁰

For investors and companies to invest in green hydrogen as a fuel option, the infrastructure for refuelling and transportation, including electrolyzers, compressors, storage, tanks and pipelines, must be in place. ⁹ This is no small undertaking, but examples of R&D are taking place.

- The international business ABB is working on hydrogen fuel cell systems, including those for passenger and cargo ships. One such project involves developing a fuel cell-based power and propulsion system for a new-build river vessel along the Rhone river in France. ⁹
- In Norway, regulations mean that cruise ships and ferries sailing through the country's heritage-protected fjords must be emissions-free by 2026, and in response shipping companies are looking at fuel options, including hydrogen.
- Belgium's Compagnie Maritime Belge (CMB) built a hydrogen-powered passenger shuttle boat in 2017. They are involved in a tugboat project with the port of Antwerp and are building a hydrogen ferry for Japan in 2021 – the first such ferry in Asia. ⁹

When it comes to long-distance container shipping and resources shipping and the drive to commercialise deep-sea zero-emission vessels (ZEVs), a big challenge is the stock volume onboard that would have to be taken up by the hydrogen required for long voyages. Because of this, it remains to be seen if green hydrogen can be a viable economic option for long-distance shipping at volume. ⁹



How is deep-sea shipping shaping up?

Changes to deep-sea shipping could help the industry introduce measures to reduce GHGs – even as the forecast for shipping demand increases. In early 2020, the COVID-19 pandemic led to record drops in cargo and oil demand reduced maritime shipping activity. Many oil tankers have been effectively serving as floating storage to temporarily hold reserves off the market to limit the effect of a drop in oil prices.

Stagnating demand for goods in early 2020 reduced the global trade of products carried by container and cargo ships. Shipping companies responded quickly, with many vessels dry-docked, and those still operating reduced speed to cut fuel consumption, or served as floating storage. This had an effect on shipping fuel markets – the price of very-low-sulphur fuel oil (VLSFO) fell to US\$150/tonne by the end of April, closing the price gap with high-sulphur fuel oil. This in turn had an effect on how shipping companies chose to comply with the IMO 2020 sulphur cap. The most economical option was thought to be to install on-board scrubbers to capture SOX exhaust emissions, but the collapse in VLSFO prices led some ship owners and operators to cancel or reconsider their scrubber orders in 2020. ¹

Is this short-term thinking? While reduced short-term shipping activity cut shipping emissions in 2020, it might hamper maritime shipping efforts to transition to low-carbon operations and technologies. Also, if oil prices remain low it may have the effect of widening the price gap with pricier low-carbon fuels, which could discourage ship owners from adopting them and stretch out the timeline to adopting new technical and operational measures to reduce fuel consumption.

The long-term effects of 2020 and COVID-19 on maritime shipping's low-carbon transition are still unclear. Will revitalised profits stimulate ship owners to invest? Will their investors demand that they take action? Stimulus packages to assist the shipping industry could be an opportunity to accelerate towards a clean future, provided that incentives are granted to operators that prove they are making efforts to implement low-carbon technologies and fuels, and look at shipping speed options.

Will the container industry play a lead role in reducing emissions?

The US\$180bn-a-year container industry is a large segment of the global shipping industry. Whilst the industry has a recent record of weak profits and overcapacity, alliances have taken place and it has demonstrated resilience during 2020, as the rise in ecommerce has boosted demand for smaller goods to be shipped around the world. Profits are looking positive for 2021. As 2020 progressed, global freight rates increased, following a mid-year slump, in response to an increased demand for goods. ¹¹ The industry is working hard to ensure containers are available where they are required (whilst also having to deal with various other impacts of the COVID-19 pandemic, including sailors stuck at sea).

More frequent and shorter trips within regions, using vessels that could be smaller in size and nimbler than the current giants, might be how the industry adapts as globalisation changes. ¹² Could this help the industry to combat climate change?



The world's largest ports show how the container industry is evolving. The ten largest shipping hubs shipped a combined 250 million TEUs (twenty foot equivalent units) in 2019, a growth of 85% since 2005. Seven of these hubs are in China, and two others are in the Asia-Pacific region (only Rotterdam is outside APAC).¹⁵



Source: Pixabay

Considerations for businesses and societies

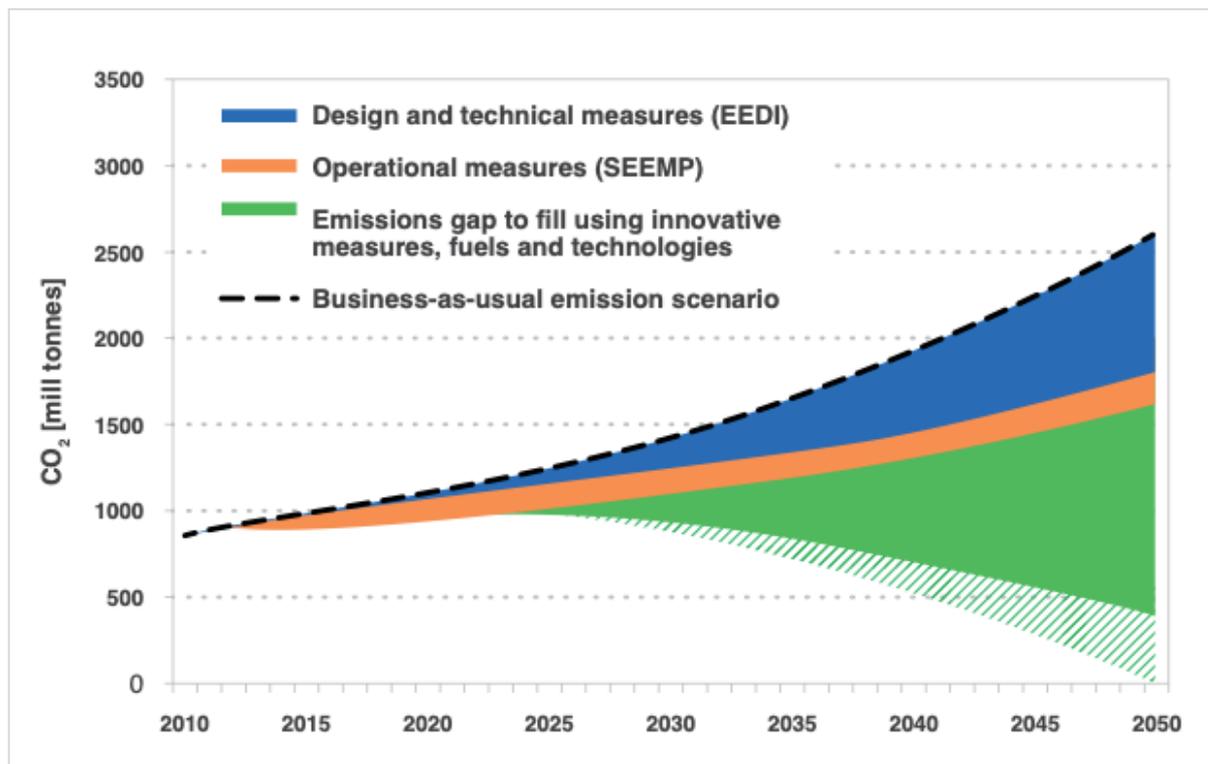
The international shipping industry has a key role to play in tackling climate change. Businesses and organisations that are involved in procuring and managing infrastructure and the shipment of goods should think about the following:

1. Do you know how much maritime shipping you commission, either directly or indirectly through suppliers?
2. If you own vessels, are you looking at options to reduce their emissions?
3. If you are involved in financing the shipping industry, are you requesting to see innovation to see a greener industry and the reduction of GHG emissions?
4. Are you asking maritime shipping operators you engage with what they are doing to reduce their emissions?
5. If you are involved in shipping infrastructure and facilities such as ports, are you ensuring they support the drive for sustainability of the shipping industry?

A general information guide by the IMO about how the shipping industry contributes to the SDGs is available [on their website](#).



IMO action to reduce greenhouse gas emissions from international shipping



Source: the IMO – [IMO action to reduce greenhouse gas emissions from international shipping](#)

About the author

Gareth Byatt is Principal Consultant of [Risk Insight Consulting](#). He works around the world with clients in various industries and sectors, including many who are major users of the global shipping industry.



The International Maritime Organization and the SDGs (source: [the IMO](#))



References:

- 1 The IEA, June 2020 – International Shipping report
<https://www.iea.org/reports/international-shipping>
2. World Economic Forum, 23 Oct 2020 – Here's how we can reduce emissions from the shipping industry
<https://www.weforum.org/agenda/2020/10/shipping-industry-carbon-emissions-climate-change-environment-ocean/>
3. IMO, 22 Sept 2017 – intersessional meeting of the working group on reduction of ghg emissions from ships
<https://www.itf-oecd.org/sites/default/files/docs/imo-ghg-emissions-reduction-shipping-oecd-submission.pdf>
4. The Maritime Executive, 5 Aug 2020 – Emissions Projected to Rise 50 Percent by 2050 in IMO Fourth GHG Study
<https://www.maritime-executive.com/article/emissions-projected-to-rise-50-percent-by-2050-in-imo-fourth-ghg-study>
5. IMO – Reducing greenhouse gas emissions from ships
<https://www.imo.org/en/MediaCentre/HotTopics/Pages/Reducing-greenhouse-gas-emissions-from-ships.aspx>
6. BBC, 18 Nov 2020 – Small steps taken to make shipping greener
<https://www.bbc.com/news/science-environment-54985109>
7. Seas at Risk, 6 Nov 2019 – multi-issue speed report
<https://seas-at-risk.org/24-publications/988-multi-issue-speed-report.html>
8. BBC, 18 Dec 2020 – \$5bn fund unveiled for climate-friendly shipping
<https://www.bbc.com/news/science-environment-50827604>
9. Reuters, 30 Oct 2020 – First wave of ships explore green hydrogen as route to net zero
<https://www.reuters.com/article/shipping-energy-hydrogen-focus-int-idUSKBN27F18U>
10. H2 view, 24 Sept 2020 – DNV GL highlights limited uptake of hydrogen as a ship fuel
<https://www.h2-view.com/story/dnv-gl-highlights-limited-uptake-of-hydrogen-as-a-ship-fuel/>
11. Financial Times, 10 Dec 2020 – Pandemic triggers 'perfect storm' for global shipping supply chains
<https://www.ft.com/content/eb21056b-5773-422a-ab78-92e59cddc1b5>
12. Financial Times, 17 Sept 2020 – Coronavirus and globalisation: the surprising resilience of container shipping
<https://www.ft.com/content/65fe4650-5d90-41bc-8025-4ac81df8a5e4>
13. IMO – Sulphur 2020 – cutting sulphur oxide emissions
<https://www.imo.org/en/MediaCentre/HotTopics/Pages/Sulphur-2020.aspx>
14. Risk Insight Consulting – Hydrogen
https://irp-cdn.multiscreensite.com/8bbcaf75/files/uploaded/MRS-7_hydrogen_June20.pdf
15. Visual Capitalist, 30 Dec 2019 – World's largest shipping hubs
<https://www.visualcapitalist.com/worlds-largest-shipping-hubs/>

