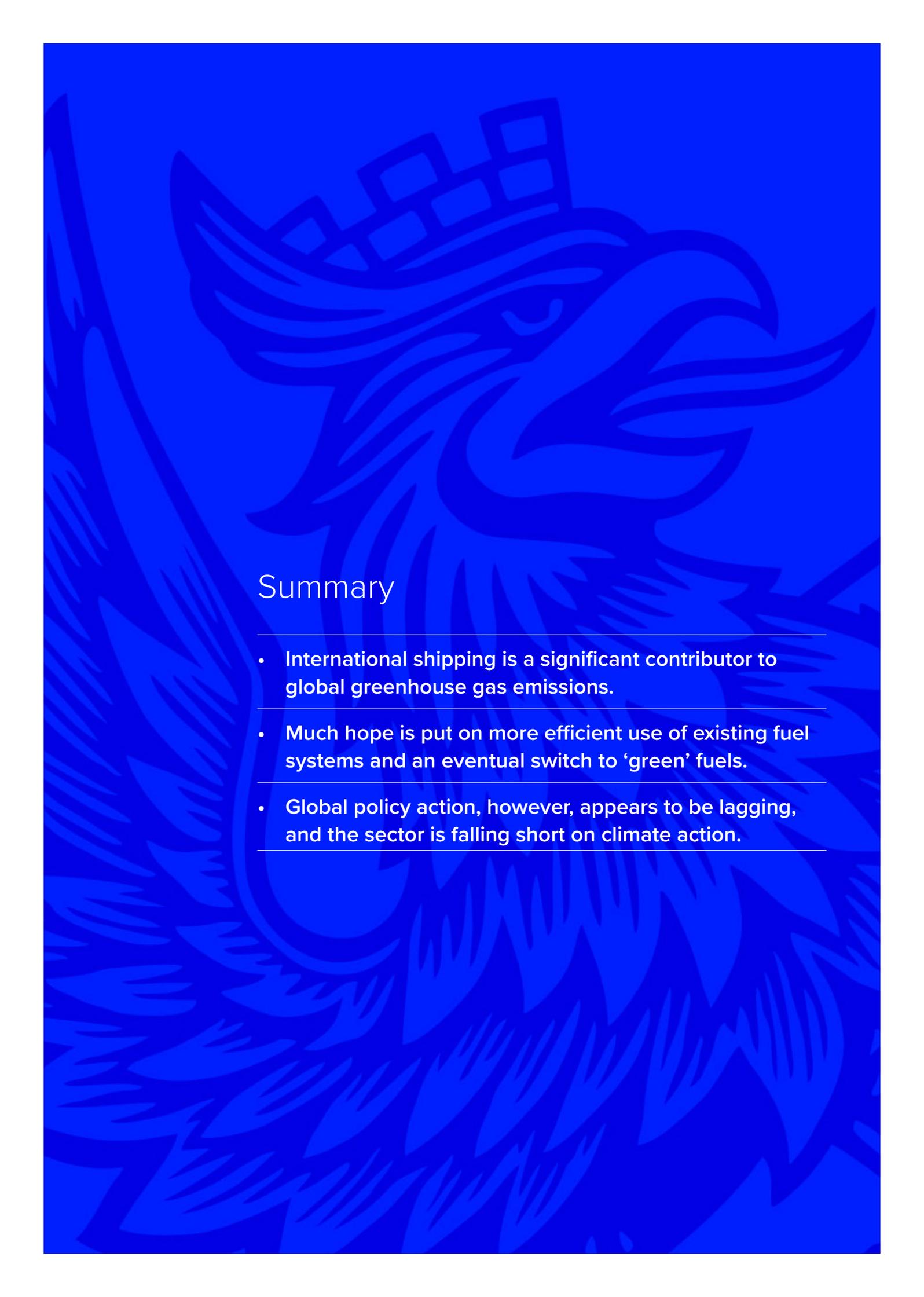




Shipping

BRIEFING MATERIAL (SMI)

The background is a solid blue color with a white line-art illustration of a ship's deck and a large, stylized wave. The ship's deck is at the top, and the wave is in the center, with a small eye-like shape within it. The bottom half of the image is filled with a dense pattern of stylized, overlapping leaf-like shapes.

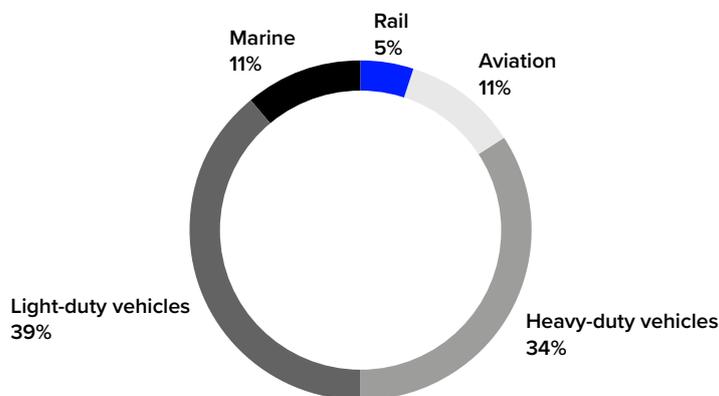
Summary

- International shipping is a significant contributor to global greenhouse gas emissions.
- Much hope is put on more efficient use of existing fuel systems and an eventual switch to 'green' fuels.
- Global policy action, however, appears to be lagging, and the sector is falling short on climate action.

Key facts and figures

- **Shipping accounts for about 3% of global annual CO₂ emissions.**¹
 - International shipping emits approximately 1bn tonnes of greenhouse gasses (GHG) per year. Were it a country, it would be the sixth largest emitter, producing more emissions than Germany.²
 - Shipping-sector GHG emissions have been increasing notwithstanding improvements in operational efficiency for many ship classes, and are driven by rising demand for shipping and the associated consumption of fossil fuels.
 - Under a 'business as usual' scenario, global shipping emissions could be expected to grow by 50%-250% by 2050.³
 - As other sectors reduce their GHG emissions, the international shipping sector will account for an increasingly large proportion of global climate pollution. Without further action, it could account for around 17% of global CO₂ emissions in 2050.⁴
- **Marine transport accounts for around 11% of global transport sector CO₂ emissions.**⁵ (Fig 1).

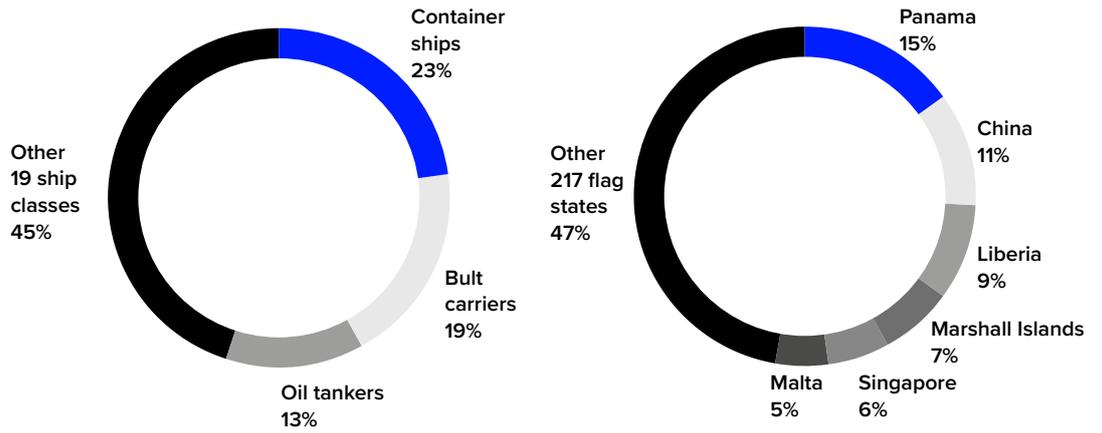
Figure 1: Global transport sector CO₂ emissions



Source: ICCT (2014)

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- Container ships, bulk carriers, and oil tankers account for over half of total shipping CO₂ emissions.
 - Panama and China are the biggest flag-state emitters. (Fig 2).

Figure 2: Global transport sector CO2 emissions

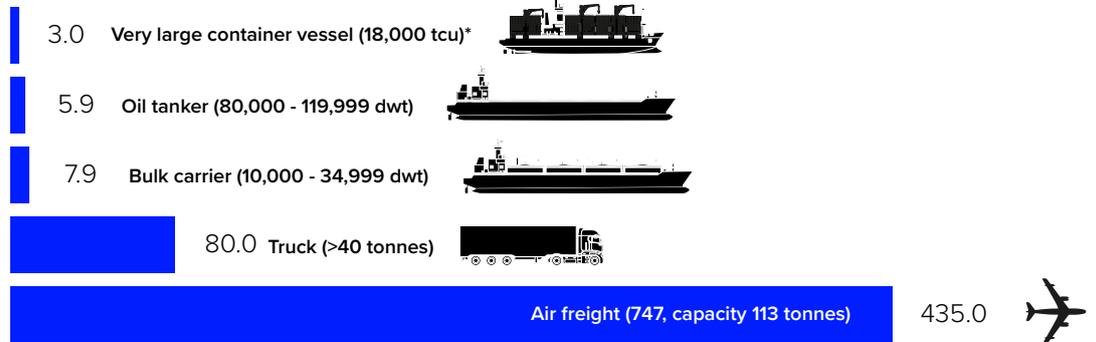


Source: ICCT

- On a like-for-like basis, however, shipping is a less CO₂-intensive mode of transport than either road cargo or air freight (Fig 3): it is the scale of global marine transport that makes the sector a significant contributor to global emissions.
- The international shipping industry is responsible for carrying approximately 90% of world trade, measured on a tonne-miles basis.⁶

Figure 3: CO2 emissions intensity by type of transport

Grams per tonne-km



Source: International Maritime Organization (IMO)

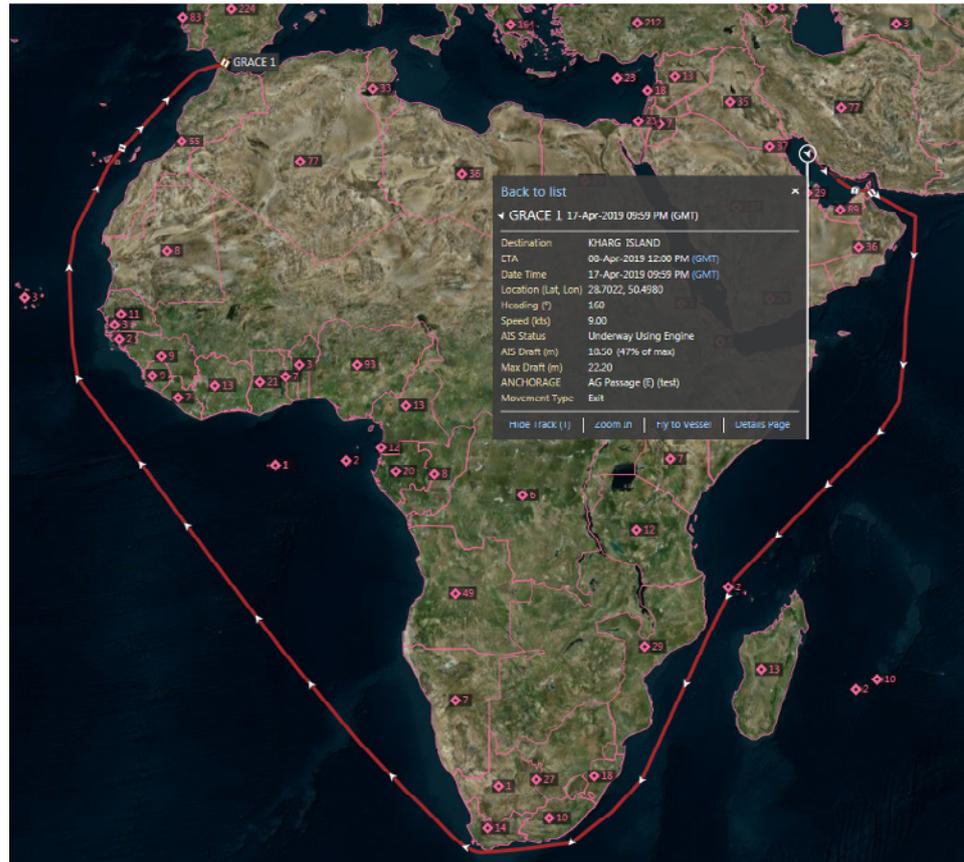
- **Ships use particularly ‘dirty’ fossil fuels**, such as heavy fuel oil (HFO), thereby emitting not only GHGs, but also ‘black carbon’ into the atmosphere.
 - Black carbon is a short-lived climate pollutant. While it has a lifetime of only days to weeks after release into the atmosphere, it has a warming impact that is 460 to 1,500 times stronger than CO₂ per unit of mass.
 - It accounts for about 20% of CO₂-equivalent emissions from ships.
 - It can have significant direct and indirect impacts on the climate, glacial regions, agriculture and human health.⁷
 - It is of particular concern in the Arctic (e.g. when emitted from the cruise ships), where it gets deposited on snow and ice, accelerating its melting.
 - Fuel oil is also infamous for its **high sulphur content**.⁸
 - HFO contains 35,000ppm sulphur, and is thereby of the order of 3,500 times more polluting than road diesel.
 - HFO is burnt by most cruise ships, for example. Few of these ships have diesel particulate filters or selective catalytic converters to clean exhaust gases – technologies that are standard for road vehicles, including trucks.
 - Just 15 of the largest ships emit more health-damaging sulphur dioxide and nitrous oxide than all the world’s cars.⁹
 - As of 1 January 2020, however, sulphur content in ships’ fuel oil has been limited to a maximum 0.5%, vs the current limit of 3.5%.¹⁰
 - The International Maritime organisation (IMO) estimates that this new requirement will cut sulphur oxide emissions from ships by some 77%. (See below for more on the IMO).

Policy: monitoring and regulating GHG emissions

- **International shipping, like aviation, was omitted from both the 1997 Kyoto protocol and 2015 Paris Agreement.**¹¹
- **International shipping is regulated by the IMO** – a specialised agency of the United Nations, which is also responsible for cutting emissions in the sector. (The International Civil Aviation Organisation (ICAO) is the equivalent for the aviation sector).
 - [For aviation, a global emissions reduction deal was agreed in 2016, based on an offsetting approach; leaving international shipping as the only sector not covered by a global deal until 2018.]
- **Higher energy efficiency standards**
 - 2011: The IMO’s Energy Efficiency Design Index (EEDI), approved in July 2011, was the first globally-binding design standard aimed at abating climate change from shipping.
 - The index, which entered into force in 2013, requires new ships to be more energy efficient, with standards that will be made progressively more stringent. The ultimate aim is for new ships to be some 30% more efficient.
 - There has been widespread criticism, however, that the standards are too weak to drive improvements. (e.g. EEDI applies only to new ships, and so cannot meaningfully reduce GHGs from the shipping sector in the near term.)
 - There is evidence that ship design efficiency tends to fluctuate more according to economic cycles and fuel prices.

- **CO₂ emissions monitoring in the European Economic Area (EEA).** From 1 January 2018, large ships (over 5,000 gross tonnage) loading or unloading cargo or passengers at ports in the EEA are to monitor and report their related CO₂ emissions and other relevant information.¹²
- Following the adoption of the above regulation in the EU, The IMO established an IMO Data Collection System. **Global data collection started on 1 January 2019.**¹³
 - The system requires large-ship owners to report information on their ships' fuel consumption to the flag States of those ships. The flag States then report aggregated data to the IMO, which produces an annual summary report to the IMO Marine Environment Protection Committee.
 - Given how recent the global shipping GHG emissions monitoring requirements are, it is perhaps not surprising that global regulation on the shipping sector's GHG emissions is lagging.
- **In April 2018, the IMO adopted its first-ever strategy to reduce the sector's GHG emissions.**
 - It pledged to reduce total annual GHG emissions from shipping by at least 50% by 2050 (compared with 2008 levels) and to pursue efforts to phase them out as soon as possible.¹⁴
 - However, short-, mid-, and long-term emission reduction measures, as well as research and innovation, necessary to achieve the objectives under the strategy, remain to be developed and agreed.
 - The regulation, however, does not include black carbon or methane emissions.
 - A few additional initiatives were approved in May 2019, but nothing ground-breaking was agreed upon. The strategy is to be reviewed in 2023.¹⁵
 - The consensus appears to be that the above measures are insufficient and not detailed enough to set the maritime sector on a pathway compatible with the temperature goals of the Paris Agreement.
 - The EU has called for a plan to reduce emissions by at least 70%, which would have been in line with the 2°C Paris target.¹⁶
- **In November 2020, the IMO approved rules to improve vessels' carbon efficiency with the aim of reducing the sectors' GHG emissions.**¹⁷
 - The measures have, however, been widely criticised for not being anywhere near sufficient to deliver the required emissions reductions. It has been suggested that if fully enforced, they would cut carbon dioxide and fuel use by 1% from 'Business as Usual' in 2030. Under the agreed policy, shipping emissions would still grow by about 15% over the next ten years.¹⁸
 - To achieve the IMO's targeted 50% reduction in emissions by 2050, most of world's fleet needs to switch to zero-emission fuels, but these do not exist at the commercial scale needed.
 - The Global Maritime Forum estimates that the transition would cost more than \$1 trillion.¹⁹ It would take strong regulatory or price incentives to drive such investment.
- **The shipping industry is also not part of the EU carbon trading market (ETS).**
 - The EU is looking to include the sector in the EU carbon market – which regulates emissions from the power sector, industry, and airlines – by 2023 if the IMO has been judged to have made insufficient progress.²⁰
 - Latest reports suggest that the EU will propose next year that shipping be brought under its emissions trading scheme.
- **The IMF is an advocate for a universal carbon tax.**
 - The IMF recently estimated that a shipping carbon tax of US\$75 per tonne of CO₂ in 2030, and \$150 in 2040, would reduce maritime CO₂ emissions by nearly 15% by 2030 and 25% by 2040.
 - It would raise revenues of about \$75 billion in 2030, and \$150 billion in 2040, while increasing shipping costs by a mere 0.075% of global GDP in 2030.²¹
- **Subsidies.** The EU gives an estimated >€24bn per year in subsidies to the maritime sector in the form of fossil fuel tax exemptions under the European Energy Tax Directive (ETD) and national tax legislation.²²

Example of Refinitiv satellite technology which monitors all global shipping movements in real-time and can be applied to CO2 emission monitoring. In this case, monitoring a vessel GRACE 1 breaking international sanctions transporting crude oil from Iran.



Emissions reduction: Market-based measures

- There are a number of other untapped, cost-effective, and timely measures that could be implemented
- **Many technical and operational measures**, such as slow steaming, weather routing, contra-rotating propellers, and propulsion efficiency devices, can deliver more fuel savings than the investment required.²³
 - A recent OECD report looks at some of the pathways that the industry might take to decarbonise.

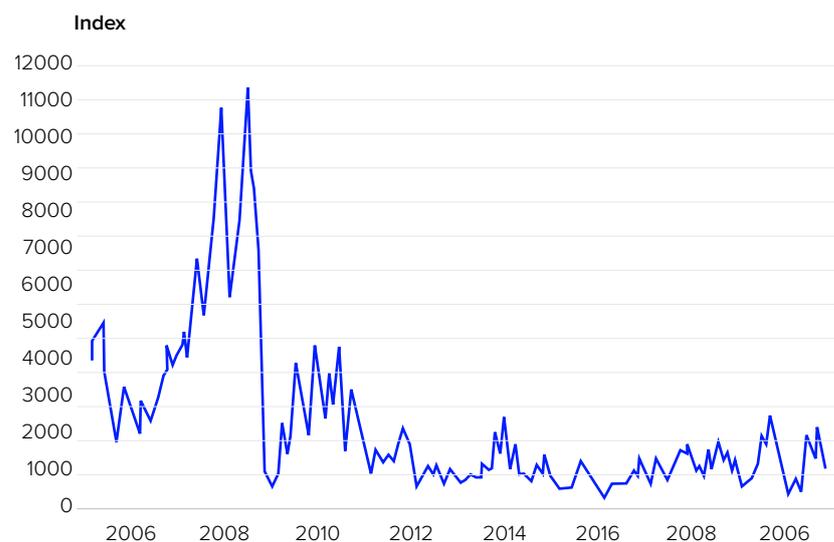
“Maximum deployment of currently-known technologies could make it possible to reach almost complete decarbonisation of maritime shipping by 2035,” the report says.

“This reduction would equal the annual emissions of approximately 185 coal-fired power plants.”²⁴

- **Slow-steaming.** A practice whereby the (operational) speed of the ship is reduced. This is often regarded **as the most cost-effective and immediate way to reduce CO₂ emissions.**
 - Main engine power demand is proportional to the cube of the speed.
 - Hence reducing a ship's speed by 10% can lead to as much as a 27% fall in a ship's emissions.
 - If all ships were to slow-steam, the total available cargo capacity on the market would effectively be reduced. If the additional emissions of building and operating these new ships were taken into account then reducing the fleet's speed by 10% would lead to an overall CO₂ savings of 19%.²⁵
 - Slow-steaming could be enforced globally using the Automatic Identification System (AIS), already mandatory on all large ships, which provides real-time information on ships' location, speed and direction.
- **More efficient engines**
 - The initial Virgin Voyages vessel, for example, that was due for delivery in 2020, would be the first of a fleet of three innovative ships designed and built with environmental responsibility in mind.
 - Each vessel's design incorporates the ABB's Azipod propulsion system, which reduces fuel consumption by up to 15% compared with traditional shaft-line propulsion systems.²⁶
 - Virgin Voyages plans also included partnering with Climeon, a Sweden-based company dedicated to converting ship engine heat to electricity, thereby decreasing overall fuel needs. They are among the first cruise ships to adopt this technology.²⁷
 - The COVID-19 pandemic is however likely to have set the cruise ship industry's ability to innovate and invest back.
- **Need for cleaner fuels**
 - Much hope is being placed on technological developments, with the emphasis on using greener fuels including ammonia, ethanol, and hydrogen – or even wind power.
 - Biofuels and Liquefied Natural Gas (LNG) have been proposed as alternative fuel sources. However LNG delivers, at best, only up to a 10% reduction of GHGs compared with (the replaced) diesel fuel.
 - One recent study goes even further to suggest that, due to previous underestimations of methane production when LNG is used, LNG use may actually be even worse than diesel for the climate.²⁸
 - The recent cap on sulphur content in ships' fuel oil, albeit well overdue, has been welcomed.
 - Zero-carbon shipping fuels however are not as yet available on the scale needed to drive decarbonisation, and the industry cites significant transition costs in changing from fossil fuels.²⁹
- **Research support**
 - Historically, global shipping has invested less than 1% of revenue in R&D, technology, and innovation: one of the lowest ratios of all major global industries. Global banking, for example, invests 12% of its revenue in new technologies.³⁰
 - In 2019, international shipping organisations, including the International Chamber of Shipping, proposed creating a \$5 billion fund to support the research and technology necessary to cut GHG emissions.³¹
 - Executives at some of the world's top shipping groups advocate a levy on carbon emissions on shipping in an effort to shape tightening rules on GHGs, while providing a means to fund development of cleaner fuel sources.³²
 - Compared with other transport sectors, international shipping appears to be falling short on climate action.
 - Whereas the aviation sector is already experimenting with alternative fuels, and is making significant progress in energy efficiency, the shipping sector seems to be only at the research/planning stage.

- **Ship finance.** There has however been a significant shift from the financing side – the so-called Poseidon Principles are a framework for assessing and disclosing the climate alignment of ship finance portfolios.³³
 - Major shipping banks will for the first time integrate climate considerations into their lending decisions, to incentivise maritime shipping’s decarbonisation.
- **International shipping, along with aviation, are among the most impacted sectors from the recent COVID-19 outbreak.**
 - The container shipping industry, a bellwether of international trade, has seen a collapse in volumes since early 2020.³⁴
 - China’s Shenzhen port, the fourth-largest in the world, reported an estimated 50-75% fall in business when the outbreak began.
 - Likewise, Yangshan port in Shanghai reported some 40-50% fall in trade.
 - The Baltic Dry Index, which measures the cost of shipping dry bulk commodities around the world, is often considered a harbinger for world trade (See Fig 4 below).
 - The index previously recorded sharp falls during the 2008 Global Financial Crisis as well as the 2015-2016 period of slowing global growth.
 - The index bottomed out in May and has started to tick higher since, with Chinese production and exports gradually starting to recover.

Figure 4: Baltic Dry Index



Source: Macrobond

- These developments wreaked havoc on equity markets, especially the dry bulk segment, which relies heavily on China’s huge imports of iron ore and coal, among other products.

Useful sources

IMO: <http://www.imo.org/>

The International Council on Clean Transport: <https://theicct.org/>

Energy Transitions: <https://www.energy-transitions.org/unlocking-the-first-wave/>

The Poseidon Principles: <https://www.poseidonprinciples.org>

¹ Estimated for the period 2007-12. For more, see: https://theicct.org/sites/default/files/publications/Global-shipping-GHG-emissions-2013-2015_ICCT-Report_17102017_vF.pdf

² <https://ccacoalition.org/en/blog/black-carbon-and-maritime-shipping-long-road-regulating-short-lived-climate-pollutant>

³ <https://www.transportenvironment.org/what-we-do/shipping-and-environment/shipping-and-climate-change>

⁴ https://theicct.org/sites/default/files/publications/Global-shipping-GHG-emissions-2013-2015_ICCT-Report_17102017_vF.pdf

⁵ https://ec.europa.eu/clima/policies/transport/shipping_en

⁶ <https://www.ics-shipping.org/shipping-facts/shipping-and-world-trade>

⁷ Black carbon is a small, dark particle that is emitted when fuel burns incompletely. Black carbon strongly absorbs sunlight, directly heating the atmosphere. When it falls on snow and ice, it accelerates melt, revealing darker land or water beneath, including in remote regions of the world, such as the Arctic.

⁸ Sulphur is the main component of acid rain which can acidify waterways, cause deforestation and forest degradation.

⁹ <https://www.euractiv.com/section/shipping/opinion/europe-must-stand-firm-and-clean-up-shippings-giant-co2-emissions/>

¹⁰ <http://www.imo.org/en/MediaCentre/PressBriefings/Pages/03-1-March-carriage-ban-.aspx>

¹¹ The argument was that international shipping cannot be attributed to any particular national economy due to its global nature and complex operation.

¹² <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02015R0757-20161216&from=EN>

¹³ https://ec.europa.eu/clima/policies/transport/shipping_en

¹⁴ https://ec.europa.eu/clima/policies/transport/shipping_en

¹⁵ <https://unfccc.int/news/imo-accelerates-climate-action>

¹⁶ <https://www.undispatch.com/a-paris-agreement-for-the-shipping-industry/>

¹⁷ <https://www.carbonbrief.org/guest-post-the-perils-of-counter-intuitive-design-in-ipcc-graphics>

¹⁸ <https://www.forbes.com/sites/nishandegnarain/2020/10/24/global-shippings-un-climate-talks-fail-amid-threats-of-a-walkout/?sh=379dc6153897>

¹⁹ Ibid.

²⁰ <https://www.euractiv.com/section/shipping/opinion/time-to-steer-shipping-into-the-eu-carbon-market/>

²¹ <https://www.imf.org/en/Publications/WP/Issues/2018/09/11/Carbon-Taxation-for-International-Maritime-Fuels-Assessing-the-Options-46193>

²² This is estimated based on national tax rates applicable to road diesel – used by trucks – in EU member states. Each tonne of CO₂ emitted by fossil ships causes the same level of climate change as the CO₂ emitted by fossil trucks. https://www.transportenvironment.org/sites/te/files/publications/2019_09_EU_Shipping_24bn_fossil_tax_holiday.pdf

²³ https://ec.europa.eu/clima/policies/transport/shipping_en

²⁴ <https://www.itf-oecd.org/sites/default/files/docs/decarbonising-maritime-transport.pdf>

²⁵ <https://www.transportenvironment.org/what-we-do/shipping-and-environment/shipping-and-climate-change>

²⁶ <http://www.connectivity4ir.co.uk/article/155481/New-Virgin-Voyages-cruise-ship-fleet-powered-by-ABB-efficiency.aspx>

²⁷ <https://www.virginvoyages.com/sustainability>

²⁸ <https://www.stand.earth/latest/protect-arctic/clean-ship-fuel/report-Ing-marine-fuel-worse-business-usual-climate>

²⁹ https://www.bbc.co.uk/news/science-environment-54958363?utm_campaign=Carbon%20Brief%20Daily%20Briefing&utm_content=20201117&utm_medium=email&utm_source=Revue%20Daily

³⁰ <https://www.forbes.com/sites/nishandegnarain/2020/10/24/global-shippings-un-climate-talks-fail-amid-threats-of-a-walkout/?sh=379dc6153897>

³¹ https://en.wikipedia.org/wiki/Environmental_impact_of_shipping

³² <https://www.euractiv.com/section/shipping/news/carbon-levy-should-fund-cleaner-shipping-fuels-say-top-executives/>

³³ <https://www.poseidonprinciples.org>

³⁴ <https://www.ft.com/content/1071ae50-6394-11ea-b3f3-fe4680ea68b5>
Prepared for SMI by Refinitiv





Produced in association with



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