



CO₂ Emissions from International Shipping

How a Global National Allocation System Addresses the Problem

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Above: The Maersk Laguna pulls away from one of several international ports where it loads and unloads its cargo. The bunker fuel that powers maritime shipping vessels contributes to global CO₂ emissions. However, CO₂ emissions from international maritime shipping are excluded from national carbon budgets and domestic efforts to reduce greenhouse gases. Could a worldwide national allocation system be the answer?

A deep reduction in transport-related carbon dioxide (CO₂) emissions, including those from the maritime shipping sector, remains a challenge and a necessity. Parties to the United Nations Framework Convention on Climate Change (UNFCCC) are obligated to include CO₂ emissions from intracountry shipping in their national carbon budgets and to reduce domestic CO₂ emissions in line with national laws and international commitments. These commitments include those under the Paris Agreement. In contrast, CO₂ emissions from international shipping are not included in national carbon budgets and are, thus, not part of domestic efforts to reduce greenhouse gas emissions. The International Maritime Organization (IMO) estimates that international maritime transport was responsible for roughly 2 percent of global annual CO₂ emissions in the 2010s (1), a number that is roughly on par with all of Germany.

One way to further address CO₂ emissions from international shipping is to establish a global system of national allocation. Such an allocation system would mean that these emissions are added to national carbon budgets of total annual emissions, which would create stronger incentives for governments to take steps to reduce them. If included in national carbon budgets, the emissions would become part of a country's greenhouse gas reduction targets. Then, national governments could engage with domestically located actors in the international shipping industry to support emission reduction efforts, as well as set their own specific reduction targets for those actors. Governments also could increase funding for research and development of zero-carbon fuels, electric ships, or both. In addition, governments would have the option to expand mitigation in nonshipping sectors to meet national reduction targets, which would result in a greater overall reduction in global CO₂ emissions.

An open-access research article in *Environmental Research Letters* explored the option to establish an international system of national allocation CO₂ emissions from international shipping (2). This *TR News* article presents the main findings and conclusions of the journal article to stimulate further discussions on how to accelerate efforts to reduce and eventually phase out CO₂ emissions from the shipping sector. In short, the case for a national allocation scheme is outlined—based on the geographic location of ship owners, operated under the UNFCCC, and using the Paris Agreement’s system of nationally determined contributions for stimulating national-level actions by country parties, as well as by the European Union. The journal article includes the full analysis, and all data are available online as part of the supplementary material.

The analysis is based on a unique data set of ship movements combined with data on bunker fuel sales from the International Energy Agency as a bottom-up way to estimate annual CO₂ emissions. The different data were used to analyze how the carbon budgets of individual countries and the European Union would be affected if international shipping emissions were allocated to them, based on the national location of one of five of the following central shipping industry actors:

- Flag country,
- Ship owners,
- Ship managers,
- Ship operators, and
- Bunker fuel sellers.

Findings showed that the selection of a national allocation option can have widely varying implications for the national carbon budgets, particularly for some smaller countries.

The UNFCCC parties first raised the question of how to address CO₂ emissions from international shipping in the 1990s, but the parties delegated this issue to the IMO because of the organization’s central role in multilateral decision making on issues related to international shipping. However, it was not until 2016 that the IMO first adopted mandatory energy



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Registered in Monrovia, Liberia, the *MSC Chicago* heads into Georgia’s Savannah Harbor. Growth in international trade could see a marked increase in CO₂ emission levels, adding urgency to global emissions reduction efforts.

efficiency and fuel reporting measures. In 2018, the IMO agreed on an initial strategy for reducing greenhouse gas emissions from international shipping with the goal that emissions should peak as soon as possible and—by 2050—be reduced by at least 50 percent from 2008 levels, with the ultimate goal to phase them out completely. However, in its fourth greenhouse gas study (published in 2020), the IMO states that—if additional emissions reduction efforts are not taken—CO₂ emissions from international shipping may increase by up to 50 percent above 2018 levels by 2050 as a result of growth in international trade (1).

As a first step, analysis of the journal article suggested that the UNFCCC and the Paris Agreement were better forums for discussions about a national allocation scheme for CO₂ emissions than was the IMO, based on comparing the objectives, principles for decision making, and geographical coverage of the two forums. The UNFCCC and the Paris Agreement have clear objectives of reducing CO₂ emissions, while the IMO has only a partial focus on reducing maritime pollution. Both the UNFCCC and the Paris Agreement recognize that parties can take on varying commitments (albeit in two

slightly different ways), whereas the IMO has a strong adherence to the equal treatment principle. In addition, the UNFCCC has a larger membership than the IMO (195 versus 174 member states, with the European Union also being a UNFCCC party but not an IMO member), which helps reduce the possibility of shipping actors getting a free ride by moving to countries outside a collective allocation and governance mechanism.

Under each of the five allocation options examined (based on the location of shipping industry actors), a clear majority of CO₂ emissions would be distributed to fewer countries. Between 69 percent and 75 percent of total CO₂ emissions would be allocated to the top 10 countries under each option, while between 88 percent and 90 percent of emissions would go to the top 20 countries. The individual countries in the top 10 and 20 vary across the five options, and national allocation would result in widely diverging percentage increases to the countries’ carbon budgets. The flag country option is the one allocation option that would most heavily affect the national carbon budgets of smaller countries, with the Marshall Islands seeing an increase of 51,203 percent, followed by Liberia

Five Allocation Options

Allocation Option	Description
Flag Country	The country where a ship is officially registered. A ship flies the flag of the country where it is registered.
Ship Owner	The owner is the asset owner, or the entity that ultimately benefits financially from the vessel's employment.
Ship Operator	The operator is the commercial decision maker concerning the employment of the vessel and, therefore, decides how and where that asset is employed.
Ship Manager	The manager is the entity responsible for the daily running of the vessel. Management may be subcontracted by a third party or undertaken as an internal function by the owner or operator.
Bunker Fuel Seller	Bunker fuel sellers are typically located near major ports.

Learn more at <https://www.iopscience.iop.org/article/10.1088/1748-9326/abec02>.

(8,143 percent), Tuvalu (2,450 percent), and Malta (2,061 percent). Under the bunker fuel sellers option, some countries—including Malta, Singapore, and Panama—would also see relatively large percentage increases to their carbon budgets at 281 percent, 232 percent, and 121 percent, respectively.

If CO₂ emissions were allocated according to the location of the ship operator and ship manager, then they would predominantly add to the carbon budgets of wealthier members of the Organisation for Economic Co-operation and Development (OECD). However, the Marshall Islands' carbon budget would increase by nearly 400 percent under either of these options. Both the ship operator (making decisions on operational issues, including a ship's routing) and the ship manager (having responsibility for the day-to-day running of a ship, including ship speeds and fuel oil purchases) make decisions that influence the amount of CO₂ emissions coming from

an individual ship. However, these decisions have less of an effect on the total amount of CO₂ emission reductions than the capital investment choices in engine upgrades and the purchase of new vessels in the future that can run on zero-carbon energy—determinations made by ship owners.

The analysis in the research article concluded that the influence of ship owners on modifications to existing ship engines and the purchase of future ships makes them the most effective industry actors for carrying out a transition to zero CO₂ emissions. Allocating emissions to countries—based on ship owners—also incorporates an equity dimension in that most CO₂ emissions would be allocated to the carbon budgets of OECD countries. As these emissions are incorporated into national carbon budgets, they would—for the first time—be part of national mitigation efforts and also increase the incentives for national governments to more actively engage with efforts

to reduce these emissions. Yet, under the owner option, the Marshall Islands' carbon budget would also increase by 610 percent. Addressing this situation, for example, could involve allocating the vast majority of the CO₂ emissions that would go to the Marshall Islands to other larger countries' carbon budgets using a collectively agreed-upon distribution formula.

Rather than relying on IMO processes to produce sufficient decarbonization outcomes, other options should be considered. These options include the possible creation of a national allocation scheme for CO₂ emissions from international shipping—based on the geographical location of the ship owners—to be operated under the UNFCCC and linked to the Paris Agreement's nationally determined contributions. However, this would depend on agreement among the world's countries to create such a scheme and governments instructing their respective national delegations to the UNFCCC and the IMO to take the necessary steps. Reaching such an agreement would likely be challenging. It requires political will, especially from countries that are leaders in international trade and shipping. When they finally commit to making the reduction of greenhouse gas emissions—from all sectors—a true priority, the answer to how to phase out CO₂ emissions from shipping will be much clearer.

REFERENCES

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