

# Greenhouse Gas Emissions from Shipping

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Recent years have seen growing interest among governments, practitioners and researchers towards measures and initiatives aimed to increase the environmental performance of international shipping. Main drivers of this "green revolution" are identifiable in the need to meet internationally agreed emissions targets but also in financial issues and external pressures due to increasing awareness on climate change and environmental preservation. In April 2018, the International Maritime Organization (IMO) agreed on the Initial IMO Strategy to reduce greenhouse gas (GHG) emissions in the shipping sector. The Strategy includes a target to *"reduce the total annual GHG emissions by at least 50 per cent by 2050 from 2008 levels whilst pursuing efforts towards phasing them out"*. Being able to meet the ambitious decarbonization IMO's targets is one of the major challenges the maritime industry has to face in decades. This contribution lists the most popular GHG emission reduction measures the shipping industry can adopt to try to cope with the new IMO's GHG requirements.

Keywords: maritime emissions ; decarbonisation measures ; green shipping ; IMO Strategy ; GHG

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## 1. Methods

Achieving the sustainability targets defined by the IMO is not straightforward and depends on the widespread adoption of low-carbon technologies and measures. The available emission reduction options can be classified into:

- Technological measures: Switch to alternative fuel options (LNG, ammonia, renewable energies, etc.), Ship design (EEDI, hull optimization, economies of scale, kites);
- Operational measures (fleet-related): Speed management, Route planning and Voyage optimization;
- Management measures and Decision Support Models: Network design, Fleet deployment, Berth allocation, Scheduling optimization and Vessels routing;
- Market-based Measures (MBMs): Tax, Incentives and Green Shipping Practices.

Each measure or action poses both risks and opportunities, and it seems almost impossible to anticipate which solutions will prove most valid. Furthermore, some important disputes or disagreements exist in both the scientific and business communities related to shipping's decarbonization. Main controversies seem to concern the actual effectiveness or reduction potential of various emission reduction options, the way they are conceived and applied, their economic impact, etc. Particularly, the main disputes seem to be concentrated around the following four popular measures: speed reduction, EEDI, MBMs, and LNG as a marine fuel.

## 2. Discussion

This contribution discusses only the application of MBMs for reducing shipping emissions. For an extensive discussion of the pros and cons of all the listed mitigation options and of the existing controversies relating to their adoption please refer to [\[1\]](#).

Recently, the interest in market-based measures (MBMs) has become strong. Generally speaking, MBMs can act in two main ways:

- By discouraging the use of high-carbon fuels;
- By encouraging the adoption of low-carbon practices through incentive mechanisms.

The former can be pursued through the application of emissions price-control or quantity-control approaches. Price-control approaches concern bunker levy schemes, such as the carbon tax or the GHG Fund.

Ship-owners and operators pay a fixed levy based on their fuel consumption, and part of this money can be used to finance future projects for CO<sub>2</sub> reduction. Although these types of approaches have a theoretical efficiency in both economic and environmental terms, they also have the potential risk to cause the shift from maritime to higher-carbon transport modes and the risk of carbon leakage <sup>[2]</sup>.

Furthermore, this type of tax can be easily bypassed by taking fuel onboard from countries where it is not applied <sup>[3]</sup>.

Emissions quantity-control approaches, such as cap-and-trade programs or emission trading schemes (ETS), issue a limited number of annual allowances that allow companies to emit a certain amount of CO<sub>2</sub>. Once the total cap on emissions is set, companies can trade their unused allowances or can be taxed if they produce higher emissions than their permits allow. Although the emission reduction effect of ETS in the short-term is generally taken for granted, some scholars have demonstrated that this is not always true. The implementation of ETS can even increase CO<sub>2</sub> emissions depending on other factors, such as charter rate and bunker price <sup>[4]</sup>.

At the IMO level, the discussion on the possible adoption of MBMs started in 2010 when an IMO Expert Group was tasked to evaluate 11 MBM proposals submitted by various Member States and organizations. In 2013, after three years of work, the MEPC decided to suspend the work of the Group with nothing done. One of the main obstacles to the progress of the discussion was reported to be the objection raised by developing countries about the compatibility of MBMs with the "Common But Differentiated Responsibilities" (CBDR) principle. Another issue of political disagreement was the way of using the funds raised by the MBM <sup>[5]</sup>.

No MBM has been applied on an international level so far, and it seems unlikely it will happen shortly <sup>[6]</sup>. However, in the framework of the IMO's Strategy, the implementation of MBMs seem to be expected in the long-term <sup>[7]</sup>.

As for incentive mechanisms, they can take several forms: Favorable tax systems, low-interest loans for environmentally friendly interventions, the provision of subsidies, etc. Ports have also recently started implementing initiatives aimed at reducing the amount of maritime in-port emissions from ships and following a more environmentally caring path <sup>[8][9]</sup>. Port initiatives can include discounts to port fees for ships fulfilling certain environmental criteria or the promotion of effective voluntary programs to improve air quality surrounding port areas.

Several shipping firms have begun to respond to environmental concerns by voluntarily embracing green shipping practices (GSPs) to make their operations "greener". Examples of such practices include counting the carbon footprint of shipping routes and using alternative transportation equipment to reduce environmental damage in performing shipping activities.

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