Chapter 6
Greening Maritime Transport Processes

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ABSTRACT

The process of transporting goods by sea is a key activity to facilitate global trade, and this contributes to significant environmental challenges related to emissions and pollution. In this chapter, the authors investigate the greening of maritime transport, regulatory frameworks, the application of technologies, and the adoption of designated practices. It examines the main global actions taken by the International Maritime Organization (IMO), the European Union (EU), and selected national governments to cut emissions. The chapter also discusses the obstacles and pathways to sustainable maritime transport, emphasizing cooperation, government actions, and rising consumer awareness that can encourage greener practices.

1. INTRODUCTION

International trade is the basis of maritime transportation, carrying approximately 90% of global goods emanating from one continent to another (Akram, 2020; Verschuur et al., 2022). This is due to it being efficient, cheap, and able to carry huge quantities, making it vital for the continuation of global trade, but the position at the heart of global economic growth comes with high environmental costs. The industry is one of the world's biggest air and water polluters, greenhouse gas emitters, and stressors to marine biodiversity (Georgian et al., 2022). As a result of the rising public awareness of climate change and other environmental challenges today, there is a growing concern about environmental externalities in society (Lindsey &

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Santos, 2022). For this reason, the maritime industry faces a double-edged challenge. It remains operational, plays a key role in worldwide trade, and should press down on its environmental imprint.

Maritime transport comprises a suite of environmental challenges. Ships burn a significant amount of dirty heavy fuel oil, releasing masses of sulfur oxides (SOx), nitrogen oxides (NOx), and carbon dioxide (CO2) (Yu, 2024). Soils emit numerous reactive gases, which subsequently transform into minerals and atmospheric compounds (Randazzo et al., 2024). The most well-known emissions are carbon dioxide and nitrous oxide, as well as ammonia and methane. Maritime operations may also cause oil spills, ballast water discharge, raids of different pollutants, and pollution in the oceans, all of which have a significant impact on sea life and ecosystems. With such impacts in mind, it is inevitable that the maritime industry needs to move cleaner and greener. Greening maritime transport includes emissions reduction as well as waste reduction, and is committed to protecting the marine environment through progressive and innovative sustainable practices and technologies (Zhang et al., 2019).

The drive for greener maritime transport is strong, and it is an international, regional, and national regulatory force. The International Maritime Organization (IMO), a traditional lawmaker, regulates ships to prevent pollution of the ocean. The MARPOL Convention specifically regulates ship exhaust emissions of SOx and NOx and intentionally introduces ozone-depleting substances (Van Roy et al., 2024). The International Maritime Organization introduced the IMO 2020 Sulfur Cap, also known as IMO 2020 (Song et al., 2022), a regulation that sharply reduces sulfur levels in marine fuels from 3.5% to 0.5%, marking the largest air pollution reduction the maritime industry has ever experienced.

Regional initiatives also have an important role to play in the promotion of environmental practices in the maritime sector, in addition to international regulations. For example, the European Union (EU) has introduced the Regulation on Monitoring, Reporting, and Verification (MRV), and ships are required, inter alia, to monitor and report their CO2 emissions (Deane et al., 2019). The EU's Green Deal wants to boost a more sustainable and innovative maritime transport sector by fostering the roll-out of zero-emission alternative fuels and the use of energy-efficient technologies (Panoutsou et al., 2021). Individual countries like China and the United States have set up emission control areas (ECAs) as part of more general national initiatives, imposing stricter emissions targets within defined sea areas (Chen et al., 2018). This pushes the industry to implement cleaner technologies and methods more broadly.

With various technological advances available, the maritime industry is being swept over by a veritable boom in technology to reduce its environmental footprint. One of the major developments is in the field of alternative fuels, especially diesel. As alternatives to traditional marine fuels, liquefied natural gas (LNG), biofuels,