



STRATEGY FOR DEVELOPING NATIONAL ACTION PLAN FOR REDUCING GHG EMISSIONS FROM SHIPPING IN COMPLIANCE WITH IMO REGULATIONS



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Chapter 1

Introduction and Contextual Overview

1.1 Overview of GHG Emissions From The Global Shipping Industry

Global shipping is crucial to international trade, accounting for approximately 80–90% of world trade volumes and being a significant contributor of greenhouse gas (GHG) emissions¹. Currently, shipping accounts for nearly 3% of anthropogenic CO₂ emissions across the globe and the emissions are still increasing in spite of increasing awareness and regulatory efforts². From 2016 to 2023, this sector's CO₂ emissions rose by about 12%, representing a compound annual growth rate of 1.4%, driven by increased shipping activity and LNG uptake³.

In response, the International Maritime Organization (IMO) has set ambitious targets to reduce GHG emissions by 20–30% by 2030 and net-zero by around 2050⁴. The IMO's 2025 regulatory package sets out mandatory fuel standards, a worldwide GHG charge scheme, and enforcement to propel the industry's transition to cleaner shipping fuels and technology⁵. Following on from this, the European Union is further integrating shipping emissions into its Emissions Trading System, supplementing global efforts to lower the sector's carbon footprint⁶. Concurrently, guidelines for onboard emission measurement under MEPC.402 (83), coming into effect in April 2025, allow shipping companies to opt out of default emission factors if they employ accurate direct measurement, potentially resulting in more efficient shipping⁷. Short-term decarbonization measures include slow steaming, route optimization, better hull coatings, and pilot fuels such as bio-LNG or ammonia⁸.

¹ "Recycling of Ships and the Hong Kong Convention," accessed June 24, 2025, <https://www.imo.org/en/MediaCentre/HotTopics/Pages/Recycling-of-ships-and-Hong-Kong-Convention.aspx>.

² Jie Jin et al., "Carbon Emission Reduction Strategy in Shipping Industry: A Joint Mechanism," *Advanced Engineering Informatics* 62 (October 1, 2024): 102728, <https://doi.org/10.1016/j.aei.2024.102728>.

³ Anastasia Kypriotaki, "ICCT: Global GHG Emissions from Shipping 2016–2023," SAFETY4SEA (blog), April 4, 2025, <https://safety4sea.com/icct-global-ghg-emissions-from-shipping-2016-2023/>.

⁴ "IMO's Work to Cut GHG Emissions from Ships," accessed June 24, 2025, <https://www.imo.org/en/MediaCentre/HotTopics/Pages/Cutting-GHG-emissions.aspx>.

⁵ "IMO Approves Net-Zero Regulations for Global Shipping," accessed June 24, 2025, <https://www.imo.org/en/MediaCentre/PressBriefings/pages/IMO-approves-netzero-regulations.aspx>.

⁶ "Reducing Emissions from the Shipping Sector - European Commission," accessed June 30, 2025, https://climate.ec.europa.eu/eu-action/transport-decarbonisation/reducing-emissions-shipping-sector_en.

⁷ "IMO Approves Net-Zero Regulations for Global Shipping."

⁸ Wanying Zhang et al., "Review of the State-of-the-Art of Alternative Marine Fuels: A Viable Approach to Zero-Carbon Shipping," *Cleaner Logistics and Supply Chain*, June 26, 2025, 100232, <https://doi.org/10.1016/j.clscn.2025.100232>.

1.2 Pakistan's Maritime Sector and Its Contribution to Emissions

The intensifying impacts of climate change are an urgent global concern, primarily driven by human-induced greenhouse gas (GHG) emissions from the burning of fossil fuels, including in the transport sector⁹. In the recent years, the shipping emissions are expected to increase significantly by 50 - 250% by 2050, threatening the achievement of global climate goals such as those enshrined in the Paris Agreement¹⁰. In response, the IMO has committed to reducing overall shipping GHG emissions by at least 50% and CO₂ emissions by 70% by 2050 compared to 2008 levels, which implies gigantic investments, technological advancements, and policy transformation particularly in developing regions of the world with rapidly expanding maritime industries¹¹.

Pakistan's shipping industry is pivotal to the economy of Pakistan, as around 95% of the import and export volume is handled by it¹². The newly launched National Maritime Policy 2025 emphasizes sustainable development, climate resilience, and compliance with international environmental marine legislation such as MARPOL 73/78 (Ministry of Maritime Affairs, 2025). Despite such efforts, Pakistan's shipping and port emissions are significant. Studies reveal that CO₂ contributes to more than 90% of port emissions at major ports such as Muhammad Bin Qasim Port, with the highest contribution from container vessels, followed by harbor crafts such as tugs and dredgers¹³. 2024 satellite data reveal rising CO₂ and other pollutant levels along the Pakistan coastline, while even after reducing, levels of particulate matter are above WHO recommendations¹⁴.

Currently, Pakistan lacks a comprehensive national GHG inventory encompassing all vessel types, including its extensive fishing fleet in the Arabian Sea, limiting accurate assessment of the maritime sector's environmental footprint and complicating policy development.

1.3 Importance of Aligning Pakistan's Shipping Industry with IMO Regulations

Up to mid-2025, Pakistan stepped up efforts to bring its shipping sector in line with IMO regulations under the National Maritime Policy (NMP) 2025, intended

9 Gibson Owthoro Ofremu et al., "Exploring the Relationship between Climate Change, Air Pollutants and Human Health: Impacts, Adaptation, and Mitigation Strategies," *Green Energy and Resources* 3, no. 2 (June 1, 2025): 100074, <https://doi.org/10.1016/j.gerr.2024.100074>.

10 "World Nations Agree to At Least Halve Shipping Emissions by 2050 | UNFCCC," accessed July 1, 2025, <https://unfccc.int/news/world-nations-agree-to-at-least-halve-shipping-emissions-by-2050>.

11 Magnus Hellström et al., "GHG Emission Reduction Measures and Alternative Fuels in Different Shipping Segments and Time Horizons – A Delphi Study," *Marine Policy* 160 (February 1, 2024): 105997, <https://doi.org/10.1016/j.marpol.2023.105997>.

12 Sahibzada M. Usman Ph.D, "Pakistan's Strategy for a Thriving Blue Economy," *Modern Diplomacy* (blog), March 19, 2024, <https://moderndiplomacy.eu/2024/03/19/pakistans-strategy-for-a-thriving-blue-economy/>.

13 Iftikhar Hussain et al., "Estimation of Shipping Emissions in Developing Country: A Case Study of Mohammad Bin Qasim Port, Pakistan," *International Journal of Environmental Research and Public Health* 19, no. 19 (January 2022): 11868, <https://doi.org/10.3390/ijerph191911868>.

14 Jolana Bosse, "Pakistan - Climate Performance Ranking 2025 | Climate Change Performance Index," November 20, 2024, <https://ccpi.org/country/pak/>.

to modernize the maritime industry while promoting environmental sustainability and adhering to international standards like MARPOL Annex VI and the Ballast Water Management Convention¹⁵.

The policy focuses on increasing Marine Protected Areas to 30% of Pakistan's Exclusive Economic Zone and enhancing marine pollution controls, such as digital tracking of pollution and enhancing offshore waste management¹⁶. Major ports of Karachi, Port Qasim, and Gwadar are being climate-resiliently modernized with investment in green infrastructure, digitalization, and operational reform to increase capacity and efficiency. Pakistan has undertaken mandatory IMO measures such as the Energy Efficiency Existing Ship Index (EEXI) and Carbon Intensity Indicator (CII) to minimize greenhouse gas emissions, aligned with IMO's net-zero vision for shipping by 2050¹⁷.

The government is also promoting alternative fuels, enhancing port emission controls, and investing Rs12 billion to revive the Gaddani Ship Recycling Yard¹⁸. Pakistan's merchant fleet is on the rise with plans for growing its share from 12% to 30% by 2047, in addition to establishing shipyards at Gwadar and Port Qasim to further shipbuilding and repair sectors¹⁹. The industry will earn Rs100 billion profit in FY2025, led by enhanced trade linkages and regional collaboration, such as transit trade with Central Asia²⁰. Organizations such as the forthcoming Pakistan International Maritime Expo and Conference (PIMEC 2025) seek to trigger investment and innovation, making Pakistan a regional maritime hub and taking its blue economy to the next level through sustainable development, maritime security, and global cooperation²¹.

1.4 Significance of addressing GHG emissions within the maritime sector

In recent years, shipping-related greenhouse gas emissions have gained prominence as a critical global climate issue.

In Pakistan, the coastal and port operations significantly contribute to local air pollution and public health concerns. A 2020 bottom-up study at Port Muhammad Bin Qasim showed that CO₂ accounts for 92% of total ship emissions, with container vessels responsible for 64% of those emissions during hoteling and maneuvering. Furthermore, IMO-aligned strategies such as

15 "PID," accessed July 7, 2025, https://pid.gov.pk/site/press_detail/27259.

16 "PID," accessed July 9, 2025, https://pid.gov.pk/site/press_detail/28195.

17 Monitoring Desk, "Pakistan Prioritizes Green Ports and Climate-Resilient Maritime Infrastructure in New Strategy," Profit by Pakistan Today (blog), June 12, 2025, <https://profit.pakistantoday.com.pk/2025/06/12/pakistan-prioritizes-green-ports-and-climate-resilient-maritime-infrastructure-in-new-strategy/>.

18 "Pakistan Approves \$42 Million to Transform Ship-Breaking Yard into 'Model Green Facility,'" Arab News, June 25, 2025, <https://arab.news/y5u4m>.

19 News, "Pakistan Aims to Boost Merchant Fleet to 30% by 2047."

20 "Pakistan, Russia Agree to Boost Trade Routes through Central Asia via Enhanced Road and Rail Links - Profit by Pakistan Today," accessed July 9, 2025, <https://profit.pakistantoday.com.pk/2025/07/03/pakistan-russia-agree-to-boost-trade-routes-through-central-asia-via-enhanced-road-and-rail-links/>.

21 "Why PIMEC – PIMEC," accessed July 9, 2025, <https://pimec.gov.pk/about-maritime-expo-pimec/>.



the Energy Efficiency Existing Ship Index (EEXI), Carbon Intensity Indicator (CII), and shore power infrastructure can significantly reduce both GHG and co-pollutant emissions—mitigating negative health outcomes like respiratory and cardiovascular illnesses, which in Pakistan contribute to over 22,000 annual premature deaths due to ambient air pollution. Integrating these measures into Pakistan’s National Action Plan will not only support international compliance but also promote sustainable economic development, environmental protection, and societal well-being.

Chapter 2

International Regulatory Framework for Reducing GHG Emissions from Shipping and Status of Compliance in Pakistan

IMO - the International Maritime Organization - is the United Nations specialized agency with responsibility for the safety and security of shipping and the prevention of marine and atmospheric pollution by ships. This chapter will explore the IMO's international regulatory framework for reducing GHG emissions from shipping sector and Pakistan's status of compliance of these regulations.

2.1 IMO's Net-Zero Regulatory Framework

The International Maritime Organization (IMO) adopted a landmark Net-Zero Regulatory Framework aimed at aligning international shipping with the Paris Agreement's climate goals. These measures were approved during the 83rd session of the Marine Environment Protection Committee (MEPC 83) from 7–11 April 2023, and form part of the 2023 IMO GHG Strategy²². Core Elements of the Framework include;

2.1.1 Global GHG Fuel Standard (GFS)

- a. Introduces mandatory progressive reductions in greenhouse gas fuel intensity (GFI) on a well-to-wake basis, accounting for emissions across the entire fuel lifecycle—from production to onboard combustion.
- b. Affects all ships over 5,000 gross tonnage engaged in international voyages, responsible for ~85% of shipping CO₂ emissions.

2.1.2 Global Maritime Emissions Pricing Mechanism (Market-Based Measure - MBM)

- a. Ships that exceed GHG intensity thresholds must purchase compliance units (carbon credits).
- b. Ships using zero- or near-zero-emission fuels may generate surplus credits or benefit from financial redistribution schemes.

2.1.3 Implementation Timeline

- a. Formal adoption: October 2023
- b. Entry into force: 2025, under new Chapter 5 of MARPOL Annex VI
- c. Review mechanism embedded for 2030 and beyond.

22 <https://www.imo.org/en/mediacentre/pressbriefings/pages/imo-approves-netzero-regulations.aspx>

Once formally adopted (expected October 2025) and entering into force (likely 2027), the Net-Zero Regulatory Framework will be binding under Annex VI of the MARPOL Convention (International Convention for the Prevention of Pollution from Ships). This means that all signatory states (currently 108, covering ~97% of global shipping tonnage) will be legally obligated to implement and enforce these regulations for ships flying their flag or operating in their jurisdiction. Ships that fail to comply with the new GHG Fuel Standard or Emissions Pricing Mechanism can face detention, fines, or loss of access to international ports under Port State Control regimes.

2.2 The 2023 IMO Strategy on Reduction of GHG Emissions from Ships

In 2018, the International Maritime Organization (IMO) set forth an initial strategy to reduce ship-generated greenhouse gas (GHG) emissions. This strategy was updated as “IMO GHG Strategy 2023” by member states, committing to achieve net-zero GHG emissions by 2050 and establishing interim reduction goals of 20% (Striving for 30%) by 2030 and 70% (striving for 80%) by 2040, compared to 2008 levels, ultimately reaching Net Zero by 2050²³. This enhanced strategy, while not legally binding in itself, is supported by enforceable and legally binding measures such as the EEXI and the CII under the MARPOL treaty. Countries must ensure that their fleets comply with these standards as many member countries may deny port entry to non-compliant vessels.

2.3 MARPOL Annex VI

The International Convention for the Prevention of Pollution from Ships (MARPOL) is the main international convention covering the prevention of pollution of the marine environment by ships from operational or accidental causes.

The MARPOL Convention was adopted on 2 November 1973 at IMO. The Protocol of 1978 was adopted in response to a spate of tanker accidents in 1976-1977. As the 1973 MARPOL Convention had not yet entered into force, the 1978 MARPOL Protocol absorbed the parent Convention. The combined instrument entered into force on 2 October 1983. In 1997, a Protocol was adopted to amend the Convention, and a new Annex VI was added which entered into force on 19 May 2005. MARPOL consists of following six annexes.

- a. **Annex I - Regulations for the Prevention of Pollution by Oil** (entered into force 2 October 1983)
- b. **Annex II - Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk** (entered into force 2 October 1983, provisions took effect from 6 April 1987)

23 <https://www.imo.org/en/OurWork/Environment/Pages/2023-IMO-Strategy-on-Reduction-of-GHG-Emissions-from-Ships.aspx>

- c. Annex III - **Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form** (entered into force 1 July 1992)
- d. Annex IV - **Prevention of Pollution by Sewage from Ships** (entered into force 27 September 2003)
- e. Annex V - **Prevention of Pollution by Garbage from Ships** (entered into force 31 December 1988)
- f. Annex VI - **Prevention of Air Pollution from Ships** (entered into force 19 May 2005)

Under MARPOL Annex VI, the reduction of atmospheric emissions from ships and shipping operations is the main focus. The focus has predominantly fallen on emission control under the 2015 Paris Agreement which obligates its member states to reduce their emissions from all sectors to limit the global warming to either 1.5 °C or well below 2 °C by the end of this century.

The MARPOL Annex VI, which entered into force on 19 May 2005, deals with the prevention of air pollution from ships. Amendments were made to the MARPOL Annex VI on 1 November 2022, which made it mandatory for all ships to calculate their attained Energy Efficiency Existing Ship Index (EEXI) to measure their energy efficiency and to initiate the collection of data for the reporting of their annual operational carbon intensity indicator (CII) and CII rating.

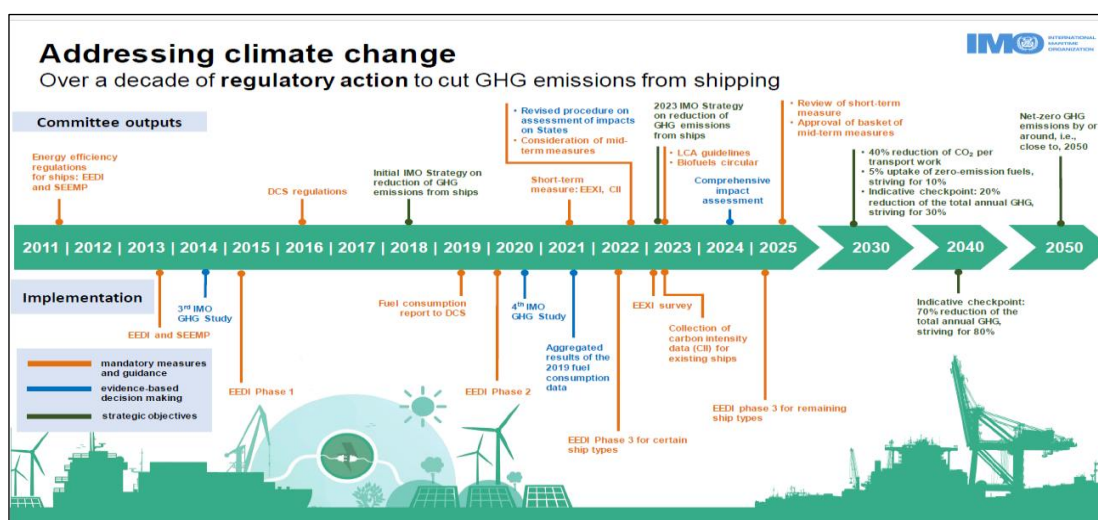


Figure 1: Timeline envisaged by IMO to reach Net Zero emissions from shipping, in line with Paris Agreement.

Source: <https://www.imo.org/en/MediaCentre/HotTopics/Pages/Cutting-GHG-emissions.aspx>

Table 1: An overview of Chapters included in MARPOL Annex VI

MARPOL Annex VI Chapters and Regulations	
Chapter 1 - General	Regulation 1 – Application Regulation 2 – Definitions Regulation 3 – Exceptions and Exemptions Regulation 4 – Equivalents
Chapter 2 - Survey, certification and means of control	Regulation 5 – Surveys Regulation 6 – Issue or endorsement of Certificates and Statements of Compliance related to fuel oil consumption reporting and operational carbon intensity rating Regulation 7 – Issue of a Certificate by another Party Regulation 8 – Form of Certificates and Statements of Compliance related to fuel oil consumption reporting and operational carbon intensity rating Regulation 9 – Duration and validity of Certificates and Statements of Compliance related to fuel oil consumption reporting and operational carbon intensity rating Regulation 10 – Port State control on operational requirements Regulation 11 – Detection of violations and enforcement
Chapter 3 – Requirements for control of emissions from ships	Regulation 12 – Ozone-depleting substances Regulation 13 – Nitrogen oxides (NO _x) Regulation 14 – Sulphur oxides (SO _x) and particulate matter Regulation 15 – Volatile organic compounds (VOCs) Regulation 16 – Shipboard incineration Regulation 17 – Reception facilities Regulation 18 – Fuel oil availability and quality
Chapter 4 – Regulations on the carbon intensity of international shipping	Regulation 19 – Application Regulation 20 – Goals Regulation 21 – Functional requirements Regulation 22 – Attained Energy Efficiency Design Index (attained EEDI) Regulation 23 – Attained Energy Efficiency Existing Ship Index (attained EEXI) Regulation 24 – Required EEDI Regulation 24 – Required EEXI Regulation 26 – Ship Energy Efficiency Management Plan (SEEMP) Regulation 27 – Collection and reporting of ship fuel oil consumption data Regulation 28 – Operational carbon intensity Regulation 29 – Promotion of technical cooperation and transfer of technology relating to the improvement of energy efficiency of ships
Chapter 5 - Verification of compliance with the provisions of this Annex	Regulation 30 – Application Regulation 31 – Verification of compliance

2.3.1 Short-term measures for reducing GHG emissions from ships under MARPOL Annex VI

i. Energy Efficiency Design Index (EEDI)

The EEDI is an important technical measure aiming at promoting the use of more energy efficient equipment and engines for the design of new ships in order to make them less polluting. The EEDI requires a minimum energy efficiency level per capacity mile (e.g. tonne mile) for different ship type and size segments. The EEDI provides a specific figure for an individual ship design, expressed in grams of carbon dioxide (CO₂) per ship's capacity-mile (the smaller the EEDI, the more energy efficient the ship design) and is calculated by a formula based on the technical design parameters for a given ship (MEPC.324(75)).

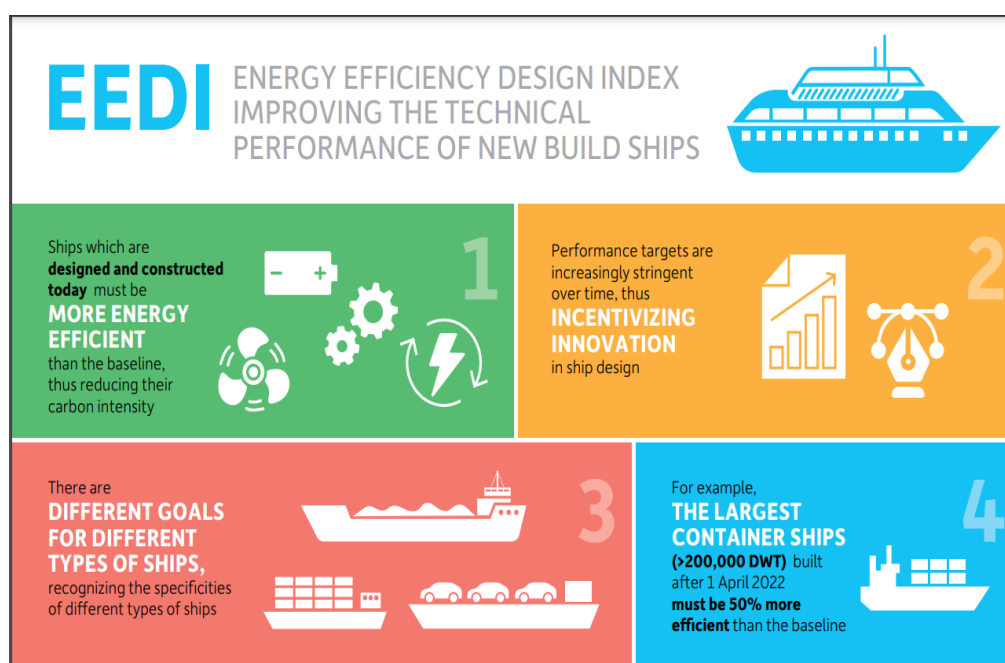


Figure 2. EEDI overview.

Source: https://www.wcdn.imo.org/localresources/en/MediaCentre/HotTopics/Documents/EEXI%20and%20CII%20Sheets/Infographic%2004_EEDI.pdf

ii. Energy Efficiency Existing Ship Index (EEXI)

A ship's attained EEXI indicates its energy efficiency compared to a baseline. The attained EEXI will then be compared to a required Energy Efficiency Existing Ship Index based on an applicable reduction factor expressed as a percentage relative to the Energy Efficiency Design Index (EEDI) baseline. It must be calculated for ships of 400 gross tonnage and above, in accordance with the different values set for ship types and size categories. The calculated attained EEXI value for each individual ship must be below the required EEXI, to ensure the ship meets a minimum energy efficiency standard.

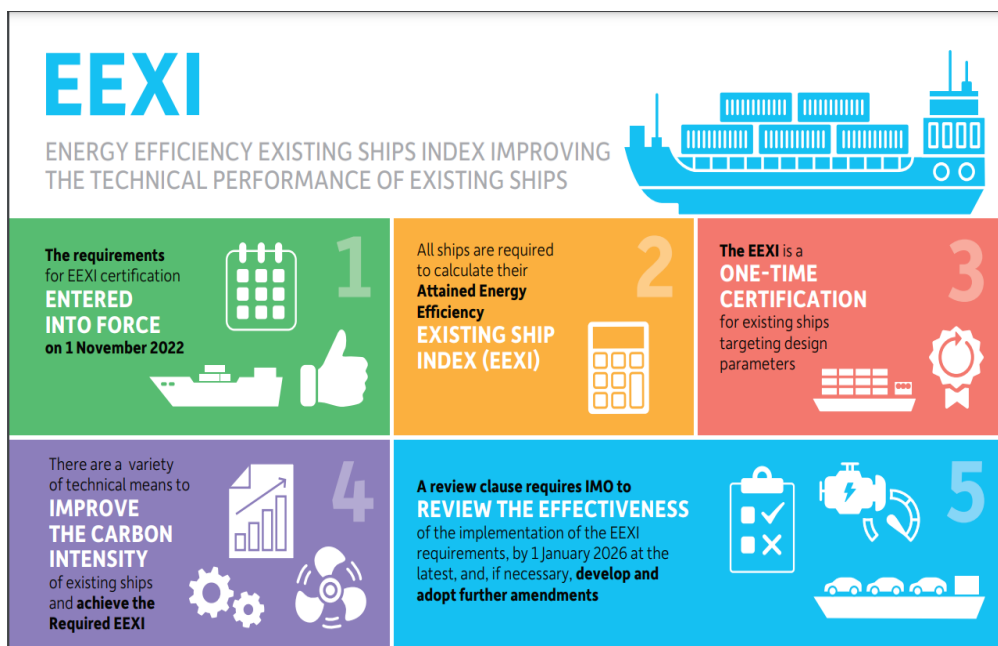


Figure 3. EEXI overview.

Source: https://wwwcdn.imo.org/localresources/en/MediaCentre/HotTopics/Documents/EEXI%20and%20CII%20Sheets/Infographic%2002_EEXI.pdf

iii. Ship Energy Efficiency Management Plan (SEEMP)

Both new and existing ships are required to keep on board a ship-specific Ship Energy Efficiency Management Plan (SEEMP). The SEEMP establishes a mechanism to improve energy efficiency using operational measures.

The SEEMP for ships of 5,000 gross tonnage and above shall include a description of the methodology that will be used to collect the data required by regulation 27.1 of MARPOL Annex VI and the processes that will be used to report the data. On or before 1 January 2023, it shall also include a description of the methodology that will be used to calculate the ship's attained annual operational carbon intensity indicator (CII), and the required annual operational CII, required by regulation 28 of MARPOL Annex VI.

iv. Carbon Intensity Index (CII)

This regulation applies to every ship of 5,000 gross tonnage and above and requires that each ship calculate the attained annual operational carbon intensity indicator (CII), after the end of calendar year 2023 and after the end of each following calendar year. The regulation also establishes the method of determining the required annual operational CII, and operational carbon intensity rating (A to E), taking into account the guidelines developed by the IMO2.

Where a ship is found not to have achieved the required operational carbon intensity rating then it is required to develop a plan of corrective

action within the ship's SEEMP, subject to verification, to achieve the required annual operational CII.

From 1 January 2023 it became mandatory for all ships to calculate their attained Energy Efficiency Existing Ship Index (EEXI) to measure their energy efficiency and to initiate the collection of data for the reporting of their annual operational carbon intensity indicator (CII) and CII rating.

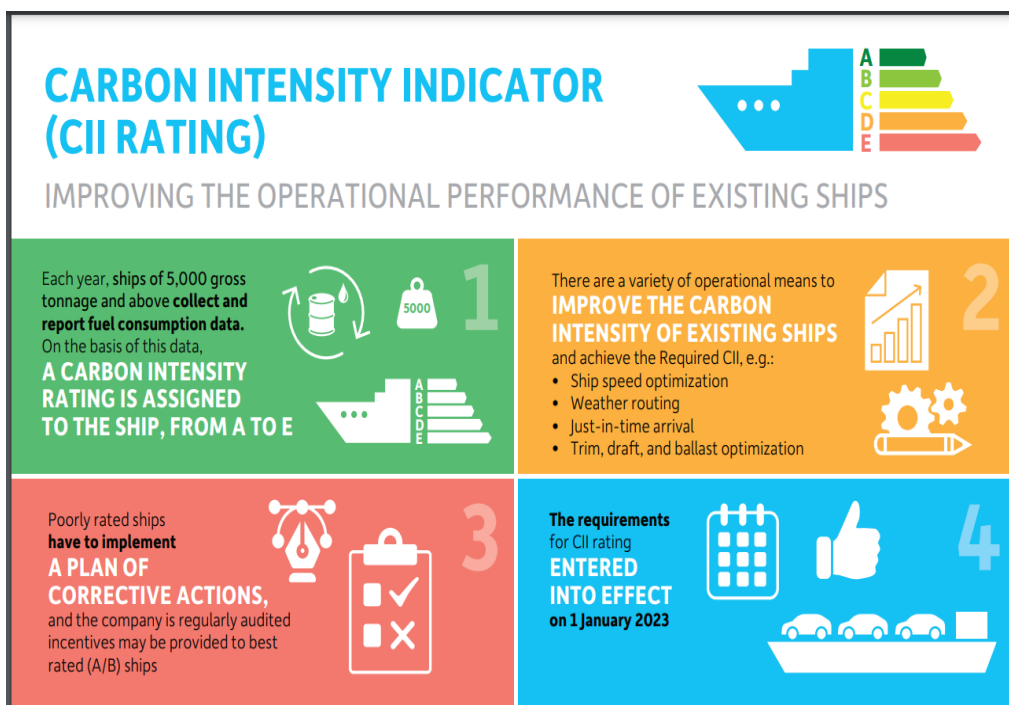


Figure 4. Overview of CII.

Source: https://wwwcdn.imo.org/localresources/en/MediaCentre/HotTopics/Documents/EEXI%20and%20CII%20Sheets/Infographic%2003_CII.pdf

2.3.2 How do the Ratings Work?

Based on a ship's CII, its carbon intensity is rated A, B, C, D or E (where A is the best). The rating indicates a major superior, minor superior, moderate, minor inferior, or inferior performance level. The performance level is recorded in a "Statement of Compliance" to be further elaborated in the ship's Ship Energy Efficiency Management Plan (SEEMP).

A ship rated D for three consecutive years, or E for one year, has to submit a corrective action plan to show how the required index of C or above will be achieved.

A ship run on a low-carbon fuel can clearly get a higher rating than one running on fossil fuel, but there are many things a ship can do to improve its rating, through measures such as:

- hull cleaning to reduce drag;
- speed and routing optimization;
- installation of low energy light bulbs; and

- d. installation of solar/wind auxiliary power for accommodation services.

2.3.3 Mid-term measures for GHG reduction

A set of proposed binding “mid-term measures” for GHG reduction are currently being considered by Member States, with a view to adoption in late 2025, which include a technical element, i.e., a global marine fuel standard regulating the phased reduction of a marine fuel's GHG intensity; and an economic element, i.e., a maritime GHG emissions pricing mechanism under the IMO Net Zero Framework.

2.4 Existing national legislation and policies related to emissions and climate change in Pakistan

The table 2 provides an overview of existing legislations related to emissions reduction and climate change in Pakistan. The regulations have a major gap in ignoring shipping sector as a major transport sector and almost all policies and frameworks miss commitments related to this crucial growing sector of national economy.

Table 2: Existing national legislation and gaps related to emissions reduction in the shipping sector of Pakistan

Policy/Framework	Focus	Gaps
National Climate Change Policy (NCCP) 2012 (Revised 2021)	- Sets Pakistan's overall climate vision. - Emphasizes GHG reduction, renewable energy, energy efficiency, and transport emissions control. - Calls for integration of international obligations (UNFCCC, Paris Agreement) into national planning.	Commitments on overall GHG reduction, but <i>no shipping-specific targets</i> .
Framework for Implementation of Climate Change Policy (2014–2030)	Provides an implementation roadmap with sectoral priorities, including transport and energy efficiency.	Emissions from Maritime transport are missing.
Pakistan Environmental Protection Act, 1997 and National Environmental Quality Standards (NEQS)	- Framework for regulating emissions and Empowers Pakistan Environmental Protection Agency (Pak-EPA) to regulate emissions, set standards, and monitor compliance. - Includes authority to address air pollution, industrial discharges, and maritime-related environmental concerns. - NEQS set emission limits for industries and vehicles.	Provides emission control powers, but <i>standards for shipping GHGs not defined</i> .

Policy/Framework	Focus	Gaps
Nationally Determined Contributions (NDCs) under Paris Agreement	- Pakistan submitted its Updated NDC (2021). - Pledges a 50% reduction in projected emissions by 2030, conditional on international support. - Identifies transport, energy, and industrial emissions as priority sectors.	Maritime/shipping is indirectly covered under transport and energy efficiency measures
Maritime & Shipping Legislation		
Pakistan Merchant Shipping Ordinance, 2001	- Regulates shipping operations in line with IMO conventions. - Provides the legal framework for implementing MARPOL (International Convention for the Prevention of Pollution from Ships) but MARPOL Annex VI has not been ratified	Ministry of Maritime Affairs is developing a Shipping Policy, referred to as the Pakistan Shipping Policy 2024, intended to succeed the outdated Merchant Marine Policy of 2001.
National Maritime Policy 2025	Key focus areas include marine pollution control, IMO Compliance, Renewable energy, port development, coastal tourism, expansion of the blue economy, and enhancing maritime security	GHG Emission reduction targets and alignment with national climate goals is missing.

Chapter 3

Guidelines for Development of National Action Plan for Reducing Greenhouse Gas Emissions from the Shipping Sector

IMO encourages member states to develop and submit voluntary National Action Plans (NAP) to address GHG emissions from ships, outlining respective policies and actions. The development of NAP serves to mobilize a broad range of national stakeholders to get involved in ship emissions reduction efforts, including those that may not necessarily be covered by IMO conventions. NAP of a country can propose strategies for reducing GHG emissions from both domestic and international shipping practices and help to meet its climate commitments like Nationally Determined Contributions (NDCs)²⁴.

IMO, under the GreenVoyage2050 Project, has published a guideline for the preparation of NAP for countries who wish to work on reducing GHG emissions from their shipping sector titled “National Action Plan to address GHG emissions from ships: From decision to implementation”. The GreenVoyage2050 Project was launched in 2019 as a joint initiative of the IMO and the Government of Norway. It builds on earlier IMO-Norway cooperation (the GloMEEP Project) and supports the implementation of MARPOL Annex VI and the IMO Initial, and now Revised 2023 GHG Strategy. Its main goal is to assist countries in transitioning to low- and zero-carbon shipping through capacity-building, technical cooperation, and policy development.

3.1 Steps Involved in Preparing a National Action Plan (NAP)

The steps involved in preparation of a NAP, as outlined in the “National Action Plan to address GHG emissions from ships: From decision to implementation” are depicted in Figure 5.

3.1.1 Determining The Need For A NAP

The first step is to evaluate the need for a NAP based on the following questions.

- a. What is the role of maritime transport in the national economic policy? How much of the country's economy and national economic development including trade is dependent on shipping and the services that support it?
- b. Is there an understanding of the proportion of emissions domestic maritime transport contributes to national emissions?
- c. What is the potential role of maritime transport in national energy transition? Can maritime transport be part of national energy transition policy? Can the country contribute to the decarbonization of international shipping?

²⁴ IMO-Norway GreenVoyage2050 Project, 2022: National Action Plan to address GHG emissions from ships - From decision to implementation.

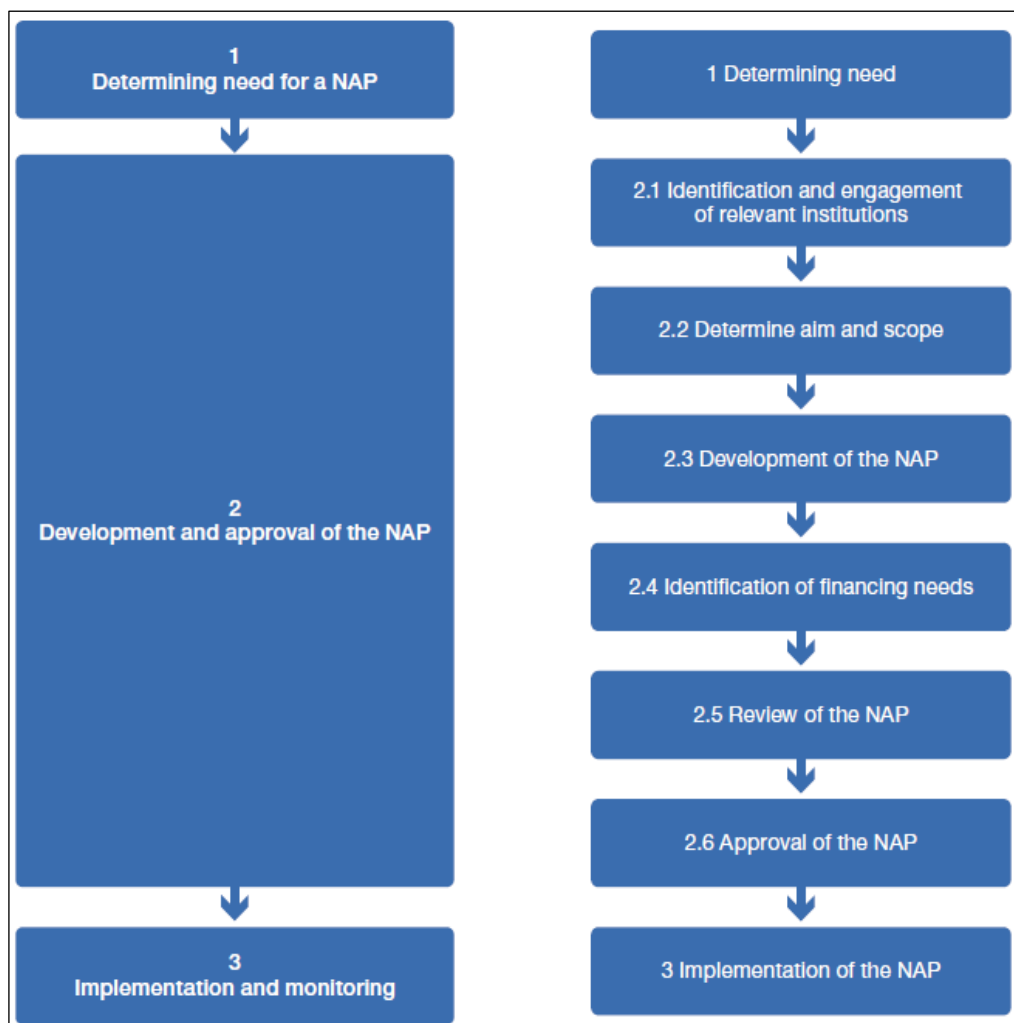


Figure 5: Steps involved in development of NAP for addressing GHG emissions from Ships (Source: IMO-Norway GreenVoyage2050 Project, 2022: National Action Plan to address GHG emissions from ships - From decision to implementation.)

Pakistan's context

Maritime transport plays a vital role in Pakistan's economy, as nearly 95% of its trade by volume moves through sea routes. Pakistan's maritime transport sector plays a pivotal role in the country's national economic policy, serving as the backbone of trade and a key driver of sustainable growth²⁵. The National Maritime Policy 2025 adopted by the government speaks of upgrading port facilities, increasing capacity, and improving operational effectiveness in key ports such as Karachi, Port Qasim, and Gwadar²⁶.

These plans are designed to realize the sector's full capacity, with the ports currently operating at merely around 50% of their capacity, and

25 Inayat Kalim and Areeja Syed, "Maritime Economy and Gwadar Port: A Growth Catalyst," Policy Perspectives 17, no. 1 (2020): 73–82, <https://doi.org/10.13169/polipers.17.1.0073>.

26 Kalbe Ali, "Maritime Minister for Expanding Pakistan's Port Capacities," DAWN.COM, 06:11:14+05:00, <https://www.dawn.com/news/1895184>.

doubling the trade volume of the nation from approximately \$90 billion to \$180 billion over the next four years²⁷. The government also aims to raise the share of the national merchant fleet from 12% to 30% by 2047 to decrease foreign shipping dependence and lower freight charges, which stand at \$6–8 billion per year²⁸.

These initiatives represent an integrated strategy for the use of maritime transport as a driver of economic growth, regional integration, and employment generation in order to establish Pakistan as an emerging hub of global maritime trade corridors.

Pakistan currently lacks a comprehensive monitoring, reporting, and verification (MRV) system for greenhouse gas (GHG) emissions from maritime transport. National GHG inventories primarily focus on land-based transport, with shipping-related emissions largely excluded. Pakistan's shipping sector includes 12 commercial vessels owned by the national flag carrier i.e., PNSC. Pakistan Maritime Security Agency (PMSA) has a total of 34 vessels used for patrolling and monitoring at sea; Karachi Port Trust (KPT) manages the operations of the Karachi port through several harbour crafts which include dredgers, tugs, barges, floating cranes, and ferry boats. Several harbour crafts are used by Port Qasim Authority (PQA) to manage and facilitate the operations at Port Qasim including tugs, pilot boats, and small boats. In addition, there are a total number of 21,899 ships currently operational in the Sindh Province and of Pakistan which includes fishing vessels, skiff boats, passenger boats, water and fuel carrying boats, and pleasure boats., and a total number of 6,837 ships in Balochistan²⁹, with no record of their fuel consumption and emissions. The emissions from the shipping sector are expected to grow exponentially, with the renewed interest in developing the maritime sector of Pakistan.

Maritime transport can play a pivotal role in Pakistan's energy transition by adopting cleaner fuels, improving vessel energy efficiency, and developing green ports powered by renewables. The International Maritime Organization's MARPOL Annex VI and 2023 GHG Strategy provide the regulatory pathway for achieving net-zero emissions from shipping by 2050 (IMO, 2023). Pakistan, though not yet a party to Annex VI, can integrate maritime decarbonization into its National Energy Policy (2021–2030) and Nationally Determined Contributions by developing a National Action Plan (NAP) aligned with the IMO–Norway GreenVoyage2050 Programme.

27 "Pakistan's Maritime Sector Major Contributor of Economic Growth: Qaiser," February 28, 2025, <https://www.app.com.pk/national/pakistans-maritime-sector-major-contributor-of-economic-growth-qaiser/>.

28 Dr Sahibzada Muhammad Usman, "Pakistan's Maritime Vision: Transforming Gwadar Into A Global Trade Hub – OpEd," Eurasia Review (blog), March 7, 2025, <https://www.eurasiareview.com/07032025-pakistans-maritime-vision-transforming-gwadar-into-a-global-trade-hub-oped/>.

29 Semab, B., Muhammad Javed I., K., Amir, S., & Tariq, M. A. U. R. (2023). Development of greenhouse gas emissions baseline and identification of carbon offset cost for maritime vessels of a developing country. *Frontiers in Environmental Science*, 10, Article 1076585. <https://doi.org/10.3389/fenvs.2022.1076585>

3.1.2 Identification and engagement of relevant stakeholders

The following questions need to be addressed for the identification and engagement of relevant stakeholders.

- a. Which Ministry/Government Department/Agency has responsibility for maritime transport?
- b. Which Ministry/Government Department/Agency has responsibility for policy on national GHG emissions?
- c. Do these bodies already collaborate on maritime policy?
- d. Who will be responsible for the development of the NAP to address GHG emissions from ships? Who should lead the process? Who should be involved/participate?
- e. Who will be responsible for implementation of measures developed as part of the NAP?

Pakistan's Context

In Pakistan, Ministry of Climate Change and Environmental Coordination (MoCC&EC) is the focal ministry dealing with GHG emissions under the UNFCCC and makes policies regarding the reduction of GHG emissions³⁰. However, the shipping sector is looked after by the Ministry of Maritime Affairs with a dedicated Directorate General of Ports and Shipping. The two ministries need to collaborate and decide on a possible course of action to develop a NAP on shipping emissions reduction, which is a glaring gap in the process at the moment.

In order to structure the process of developing and implementing the NAP in consultation and cooperation with the relevant agencies and stakeholders, the following actions are recommended by IMO:

- a. Identify **Lead Body**
- b. Establish **National Task Force**
- c. Designate **National Focal Point**

3.1.3 Determining the Aim and Scope of the NAP

This step would involve the following aspects:

National Character of Maritime Transport

Several issues will need to be considered when identifying the national character of the maritime transport sector for the country. These issues are, in no particular order, as follows:

30 https://unfccc.int/sites/default/files/2025-09/Pakistan_NDC3.0_24%20Sep.pdf

- a. Shipping fleet composition;
- b. Fuel consumption and fleet emissions and possible emissions scenarios;
- c. Existing legislation and policies related to emissions and climate change;
- d. Key maritime sectors and stakeholders.

What Role Could Ports Play?

Ports are increasingly an important part of the efforts by maritime transport to decarbonize and need to be considered as part of any NAP to reduce GHG emissions from ships. This has been acknowledged by the IMO in resolution MEPC.323(74) that invites Member States to encourage cooperation between port and shipping sectors to contribute to reducing GHG emissions from ships.

Several issues will need to be considered when identifying what role ports could play as part of the potential for addressing GHG emissions from ships. These issues are, in no particular order, as follows:

- a. Existing and planned ports; and
- b. Existing bunkering facilities and expansion plans.

Pakistan's Context

Pakistan's merchant fleet is relatively small, dominated by the Pakistan National Shipping Corporation (PNSC) and a large, unregulated fishing fleet of over 28,000 vessels, with limited data on fuel use and emissions.

Ports can play a pivotal role in this transition. Major ports like Karachi, Port Qasim, and Gwadar could adopt green port initiatives; introducing onshore power supply (cold ironing), energy-efficient cargo handling, and clean fuel bunkering. Developing port-level emissions inventories, expanding LNG and future low-carbon fuel facilities, and fostering public-private partnerships can position Pakistan to align its maritime sector with IMO's decarbonization objectives while enhancing competitiveness and sustainability.

3.1.4 Development of National Actions

The actions under the NAP are the core elements. These include;

- a. Identifying objectives and actions
- b. Identifying and creating linkages with other national and international strategies
- c. Allocating responsibilities
- d. Setting timeframes for implementation



Figure 6: Models of different countries for identifying actions under the NAP

3.1.5 Identification of Financing Needs

Increasingly the key barrier to supporting climate action is finance. Countries need to identify sources of finance/ capital that will enable them to take the necessary action to both adapt to and mitigate climate change and so support efforts to achieve their nationally determined contribution (NDC) under the 2015 Paris Agreement. Whilst multinational funding streams for climate action are available and likely to grow, access to those funds requires insight and understanding to be developed and the lead times to identify and obtain such funds can be significant.

Pakistan's Context

Pakistan can mobilize funds for its National Action Plan on reducing GHG emissions from shipping through a mix of international and domestic sources. Key opportunities include IMO's GreenVoyage2050 Programme for technical support, and climate finance mechanisms such as the Green Climate Fund (GCF) and Global Environment Facility (GEF) for project funding. Development partners like the World Bank, ADB, and IsDB can support green port and energy efficiency initiatives, while bilateral cooperation with countries such as Norway, Japan, and the EU can provide technology and capacity-building.

3.1.6 Reviewing and Approving the NAP

Once the draft NAP is at a reasonably advanced stage, it should be reviewed in terms of whether it is 'fit for purpose'. This means that it is clear about the aim to be achieved and how to achieve it. To do this effectively, the NAP must support the direction and vision of the government's overall policy and it must be easily understandable and accessible to the people who will need to work with it and implement it.

Once the NAP has been reviewed by all relevant parties and is considered 'fit for purpose', the document will require formal endorsement and approval/adoption at the highest appropriate political and administrative level, in line with national government protocols.

Pakistan's Context

In Pakistan's context, since the country has not yet ratified MARPOL Annex VI and lacks dedicated legislation on maritime emissions, the review and endorsement phase of the NAP will need to focus on ensuring policy alignment and institutional readiness rather than legal enforcement at the outset. The draft NAP should be framed as a foundational policy instrument; a roadmap that demonstrates Pakistan's intent to move toward compliance with IMO regulations and international climate commitments under the Paris Agreement and national NDCs.

Formal adoption could be pursued through Cabinet or inter-ministerial endorsement led by the Ministry of Maritime Affairs and Ministry of Climate Change, positioning the NAP as a precursor to future ratification of MARPOL Annex VI and the development of domestic legislation for maritime emissions control. This approach would signal Pakistan's readiness to comply with IMO standards while building the institutional and technical capacity needed for full legal implementation later.

3.1.7 Implementation and Monitoring

The development and implementation of the NAP is an iterative process rather than a one-off activity and should be monitored, evaluated and revised on a regular basis to ensure the relevance of the NAP in the face of changing national and international circumstances. It is also important to monitor if desired results are achieved or plan is on course towards the aim of the NAP.

Key questions to be addressed during the Monitoring and evaluation phase are mentioned here.

Monitoring

- a. How will the implementation progress of the NAP be monitored?
- b. At what intervals will this occur?
- c. What criteria/performance indicators will be used to assess the implementation of the NAP?
- d. Who will be responsible for monitoring progress and evaluating effectiveness?

Evaluation

- a. Which actions have been successfully implemented?
- b. Which have not? If not, how could they be improved?
- c. Have other challenges been identified? (e.g. information gaps, lack of engagement)
- d. How can these challenges be addressed?

All these steps need to be carefully integrated in the NAP for reducing GHG emissions in Pakistan and require a multi-sectoral and multi-departmental coordination at national and provincial levels.

Chapter 4

Recommendations and Way Forward

Development of a NAP for reducing GHG emissions from Shipping Sector remains a crucial step for sustainable development in the maritime sector of Pakistan, however it remains largely ignored. There are various technical, financial and legislative hurdles in the process.

4.1 Barriers to the development and implementation of a NAP

Barriers in Pakistan include:

- a. **Weak Regulation:** Pakistan has not ratified MARPOL Annex VI and lacks emission-related maritime laws; regulatory authority is fragmented among MoMA, DG P&S, and EPAs.
- b. **Poor Coordination:** Multiple ministries with overlapping roles create delays and lack shared goals; a national coordination committee is needed.
- c. **Low Stakeholder Engagement:** Private sector and port operators have little incentive or awareness to adopt emission-reduction measures.
- d. **Unclear Responsibilities:** No defined roles or accountability mechanisms for agencies during implementation.
- e. **Data Gaps:** Absence of baseline data and MRV systems for fleet fuel use and emissions, especially in the fishing sector.
- f. **Limited Finance:** No dedicated budget; reliance on donor funding and lack of fiscal incentives for green investment.
- g. **Technology Barriers:** High cost and low availability of cleaner fuels and retrofitting technologies.
- h. **Capacity Gaps:** Shortage of trained technical personnel in maritime and environmental agencies.
- i. **Competing Priorities:** Economic and trade goals often overshadow environmental actions.
- j. **Private Sector Constraints:** Smaller shipowners face financial challenges in adopting new technologies or meeting future emission standards.

4.2 Stakeholders and their Roles

The table summarizes the key stakeholders that can be made part of the process of developing NAP and their main roles.

Institution / Stakeholder	Key Role	Proposed Actions
Ministry of Maritime Affairs (MoMA)	Lead coordination and policy oversight	Oversee NAP development and implementation; align with national maritime and Blue Economy strategies; coordinate inter-agency actions.
Ministry of Climate Change and Environmental Coordination (MoCC&EC)	National climate policy and finance	Integrate maritime emissions into NDCs; facilitate access to GCF/GEF funds; ensure policy coherence with national climate commitments.
DG Ports & Shipping	Maritime regulation and compliance	Update regulatory framework to include emission standards; maintain ship registry data for MRV system; support MARPOL Annex VI preparation.
Karachi Port Trust (KPT) – DG Operations	Port-level emission reduction	Implement green port initiatives (shore power, renewable energy, waste management); collect and report emission data.
Pakistan Navy (PN)	Military vessel operations and expertise	Distinguish military vs. commercial emissions; adopt efficiency measures; support emission monitoring and technology sharing.
Gwadar Port Authority	New port development and management	Integrate low-carbon design; develop bunkering for alternative fuels; build MRV capability at Gwadar.
Port Qasim Authority (PQA)	Port operations and logistics	Develop emission inventories; improve energy efficiency and fuel handling; pilot green cargo-handling equipment.
Pakistan Maritime Security Agency (PMSA)	Enforcement and surveillance	Support compliance with maritime environmental standards; assist in vessel

Institution / Stakeholder	Key Role	Proposed Actions
		tracking and emission reporting.
Mercantile Marine Department (MMD)	Certification and inspection	Integrate emission compliance into ship surveys and certification; contribute data to MRV system.
Fisheries Department	Regulation of fishing vessels	Record fuel use and emissions of fishing fleet; promote cleaner engines and awareness among boat owners.
Environmental Protection Agencies (EPAs)	Environmental standards and monitoring	Incorporate maritime emissions into NEQS; review environmental clearances for ports and shipyards.
National Institute of Oceanography (NIO)	Scientific research and data	Conduct studies on marine pollution and carbon cycles; support baseline emission assessments.
Karachi Shipyard & Engineering Works (KSEW)	Shipbuilding and retrofitting	Promote energy-efficient ship design and retrofits; develop local R&D for clean propulsion technologies.
Fishing Boat Owners & Local Harbour Authorities	Implementation and awareness	Participate in pilot programs for fuel efficiency; support data collection and waste management.
Karachi University / Academia	Research and capacity building	Conduct studies on maritime GHG reduction and alternative fuels; train technical staff.
Industries (Oil, Energy, Ship Repair, etc.)	Technology and infrastructure	Invest in cleaner fuels, energy-efficient equipment, and green port infrastructure; collaborate through PPPs.
Pakistan Coast Guard	Law enforcement and coastal monitoring	Support enforcement of maritime environmental regulations; monitor illegal fuel practices and pollution incidents.

4.3 Short to Long term Actions

4.3.1 Short-Term (0–2 Years): Foundation and Readiness

- a. Conduct national baseline assessment of maritime emissions.

- b. Establish an MRV system for fuel use and emissions tracking.
- c. Form an inter-ministerial coordination committee.
- d. Align NAP with NDCs, Blue Economy, and Climate Policy.
- e. Build capacity and awareness among maritime stakeholders.
- f. Engage with IMO GreenVoyage2050, GCF, and ADB for technical and financial support.

4.3.2 Medium-Term (3–5 Years): Implementation and Efficiency

- a. Draft and adopt national maritime emission regulations; prepare for MARPOL Annex VI ratification.
- b. Introduce energy efficiency measures for ships (EEXI/CII).
- c. Launch green port initiatives — shore power, clean equipment, waste management.
- d. Pilot alternative fuels (LNG, biofuels) and conduct energy audits.
- e. Develop port-level emissions inventories and integrate renewables in port operations.
- f. Create incentives for low-carbon ships and technologies.

4.3.3 Long-Term (5–10+ Years): Transition and Integration

- a. Ratify and implement MARPOL Annex VI and related IMO GHG measures.
- b. Promote zero- or near-zero emission fuels (green hydrogen, ammonia, methanol).
- c. Develop green bunkering infrastructure and regional green shipping corridors.
- d. Integrate maritime GHG targets into national climate reporting.
- e. Foster R&D and innovation in green ship technology.
- f. Expand public–private investment in sustainable port and ship modernization.

4.4 NIMA's Efforts for Emissions Reduction in the Shipping Sector and Advocacy for Ratification of MARPOL Annex VI

- a. NIMA conducted a webinar titled “IMO's Net-Zero Framework under MARPOL Annex VI: Pakistan's Commitment and Way Forward” on 30 April 2025. During the seminar, Secretary, Ministry of Climate Change and Environmental Coordination, Ms. Aisha Humera Chaudhry expressed the ministry's support in including the GHG emissions in the Nationally Determined Contributions (NDCs) with the support of Global Climate-Change Impact Studies Centre (GCISC). The Post Event Report is attached as Annex A.
- b. Proposal titled Inclusion of maritime sector in the Nationally Determined Contributions (NDCs) submitted to MoCC&EC and MoMA. Proposal attaches as Annex B.

c. NIMA applied for **“Call for Expression of Interest-IMO GreenVoyage2050 Support for the Development of National Action Plans to Reduce GHG Emissions from Ships”** in August 2024. After thorough evaluation of the applications, Pakistan was not selected because of lack of patronage of the application by relevant ministry. **For the purpose of information, India and Bangladesh were selected by IMO for technical assistance of the same year.** MoCC&EC in liaison with MoMA can be the relevant ministry to submit this application in the next call with the support of NIMA.

d. NIMA conducted a side-event at COP29 at Pakistan Pavilion on 19 Nov 2024 titled **“Pakistan’s Transition to Green Shipping (including green ship recycling) - Opportunities and Challenges”**. The focus of the panel discussion was to showcase Pakistan’s commitments to Green Shipping technologies in its shipping sector and environment friendly practices in the Ship Recycling Industry.

e. NIMA conducted a seminar on **“IMO’s Obligations of Reducing Harmful Emissions at Sea – Pakistan’s Perspective and Challenges”** in **Jan 24**, where representative from IMO reaffirmed IMO’s help and assistance to Pakistan in the process of ratification of MARPOL Annex VI.

4.5 Conclusion

The maritime sector in Pakistan plays a critical role in trade, employment, and the national economy, yet its greenhouse gas (GHG) emissions remain largely unaccounted for in the country’s climate commitments. With increasing maritime activity and over 90% of trade volume transported by sea, the sector’s emissions - estimated at nearly 2.5 million tonnes of CO₂e annually - must be addressed through targeted mitigation strategies. Aligning with international obligations like the IMO’s GHG Strategy and MARPOL Annex VI, and incorporating maritime emissions into Pakistan’s Nationally Determined Contributions (NDCs), is essential. Doing so will not only help meet global climate goals but also position Pakistan’s shipping industry for sustainable growth and international compliance. The report aims to serve as a guiding document in the preparation of Nation Action Plan for reducing GHG emissions from Shipping, an integral part of maritime sector.

**POST EVENT REPORT- NIMA WEBINAR “IMO’S NET-ZERO FRAMEWORK
UNDER MARPOL ANNEX VI: PAKISTAN’S COMMITMENT AND WAY FORWARD”**

INTRODUCTION

1. National Institute of Maritime Affairs (NIMA) held a joint consultative webinar on “IMO’s Net-Zero Framework under MARPOL Annex VI: Pakistan’s Commitment and Way Forward” on 30 April 2025.
2. The webinar was conducted in the wake of International Maritime Organization’s (IMO) recently adopted, legally binding **“Net-Zero Regulatory Framework” under MARPOL Annex VI**, in order to accelerate climate action and align global shipping with global climate goals.
3. In this background, NIMA brought together key stakeholders from ports and shipping sector as well as the Ministries of Climate Change and Maritime Affairs to explore and understand the challenges and opportunities the new developments bring for Pakistan. The discussions assessed institutional readiness for MARPOL Annex VI, explore opportunities for green financing and technology transfer, evaluated how Pakistan can engage in the IMO’s emerging carbon markets and explored options for the integration of shipping emissions into national GHG inventories and future Nationally Determined Contributions (NDCs) of Pakistan.

PARTICIPANTS AND SPEAKERS

4. As mentioned earlier, the Secretary, Ministry of Climate Change and Environmental Coordination (MOCC&EC) graced the event as Chief Guest. Vice Admiral (Retd) Ahmed Saeed HI(M), President NIMA, gave the opening remarks. Ms. Saba Zeenat, Research Associate NIMA moderated the session. The other eminent speakers included;
 - a. Dr. Fasiha Safdar, Research Associate, NIMA
 - b. Dr. Irfan Yousuf, Energy and Carbon Credits Consultant
 - c. Mr. Muhammad Shafique, Representative of Pakistan to IMO
 - d. Cdr (Retd) Farooq Ali, DGM (QHSE), Karachi Shipyard and Engineering Works (KS&EW)
 - e. Ms. Aafia Sarosh, Energy and Environment Expert

PROCEEDINGS/ DELIBERATION BY SPEAKERS

1. President NIMA, Vice Admiral Ahmed Saeed HI(M) (Retd) welcomed the esteemed guest on the webinar. He set the stage by stating that while global shipping emits nearly 3% of total GHGs, Pakistan’s GHG emissions are not accounted for and domestic fleets, such as fishing vessels, remain outside any emissions framework.

2. He apprised the audience that the International Maritime Organization (IMO) has introduced a Net-Zero Framework under MARPOL Annex VI. This includes strict fuel standards, carbon pricing from 2027, and mandatory efficiency measures signaling a shift that Pakistan must prepare for. Pakistan has yet to ratify MARPOL Annex VI and lacks key tools like maritime emission standards, fuel data, and a national GHG inventory. Without these, it risks being excluded from global shipping routes and facing trade barriers.
3. With a small national fleet and over \$10 billion spent on seaborne freight annually, Pakistan is economically vulnerable. Future green sanctions could further disrupt trade and supply chains. To address this gap, NIMA is working on guidelines to develop a National Action Plan for reducing maritime emissions. The plan will identify policy gaps, stakeholder roles, and pathways to comply with IMO regulations. The admiral concluded by saying that this effort requires joint collaboration across ministries, port authorities, industry, and academia.
4. Dr. Fasiha Safdar presented the introduction and technical aspects of the newly approved IMO Net Zero Strategy at Marine Environment Protection Committee (MEPC-83) in April 2025. This framework introduces two key mechanisms: a Global GHG Fuel Standard (GFS) to reduce fuel lifecycle emissions, and a Market-Based Mechanism (MBM) that will place a carbon price on maritime emissions by 2027. These measures, to be enforced under Annex VI of the MARPOL Convention, will reshape global trade and shipping dynamics.
5. Dr. Safdar stressed as the global shipping industry prepares for legally binding emissions regulations by 2050, countries like Pakistan face both opportunities and challenges. She highlighted that although Pakistan's only national shipping entity, PNSC, uses Tier II engines and VLSFO (Very Low Sulfur Fuel Oil), and is actively implementing MARPOL Annex VI protocols including SEEMP, EEXI, and carbon offset strategies, Pakistan is still not prepared to ratify MARPOL Annex VI. She emphasized developing a cohesive National Action Plan involving all stakeholders, legislative support, and international cooperation to meet IMO obligations and benefit from global green shipping initiatives. She also highlighted the need to introduce National Quality Standards from the shipping sector, including the domestic shipping vessels like fishing vessels, and inclusion of the emissions from this sector into NDCs.
6. Dr. Irfan Yousuf provided detailed insights into how Pakistan can align its regulatory regime with international frameworks, particularly through the Nationally Determined Contributions (NDCs) process. The UNDP is currently working on Pakistan's updated NDCs to set conditional and unconditional emission reduction targets by 2027, in which the maritime sector can be identified as a potential area for integration. These efforts will help position the NDCs as financeable documents capable of attracting international climate funds.
7. Dr. Yousaf highlighted that the introduction of carbon pricing in the shipping sector by 2027 will reshape global maritime trade. Pakistan must prepare for this shift by developing regulatory capacity, promoting carbon market participation, and leveraging standards like VERRA and Gold Standard.

8. Pakistan's geographic and strategic maritime location provides an opportunity to lead in green shipping initiatives. Pakistan National Shipping Corporation is already implementing emission reporting measures, which should be further expanded. To mitigate financial burdens from carbon pricing, Pakistan must tap into green financing, develop Monitoring, Reporting and Verification (MRV) systems, adopt energy-efficient technologies, and promote clean fuels like ammonia and hydrogen. These actions should be incorporated into the NDC and aligned with Article 6 of the Paris Agreement to enable carbon trading and revenue generation. He concluded by advocating for a fair and inclusive global decarbonization process, emphasizing that maritime sustainability is key to maintaining a balanced and resilient global trade system that benefits all nations, including Pakistan.

9. Mr. Muhammad Shafique, Pakistan's representative to IMO, shed light on Pakistan and like-minded countries' stance on the Net Zero Framework in the IMO. He stated that Pakistan believes in the principle of CBDR i.e., Common but Differentiated Responsibility, by virtue of which the developed countries, which have historically polluted the world, should pay more as carbon tax. However, the IMO has put a flat levy or carbon tax on all countries which is unfair according to Pakistan.

10. Pakistan and like-minded countries are headed by Saudia Arabia and it was agreed in the last MEPC that the IMO carbon pricing mechanism would not be under World Bank, rather a separate mechanism under IMO's arrangements. Besides that, the carbon levy collected from developed states usually goes to Small Island Developing States (SIDS) and Least Developed Countries (LDCs) which are more developed in shipping technology than countries like Pakistan. Due to our efforts in IMO, it has been agreed that the benefits of carbon levy would go to Developing Countries too along with SIDS and LDCs. However, this is nor set in stone and would be confirmed in the upcoming special session of IMO in October 2025.

11. In the IMO's proposed carbon pricing mechanism, the Z factor refers to a reduction multiplier or adjustment coefficient that reflects a ship's compliance level with GHG intensity standards or use of low-emission fuels. The Z factor adjusts the carbon levy based on how GHG-efficient a ship is. A ship using greener fuels or more efficient technologies would have a lower Z factor, and therefore pay less in carbon charges. Conversely, a ship that is less efficient or uses conventional high-emission fuels would have a higher Z factor, paying more under the pricing scheme. In this scenario, Pakistan, which has older ships would have to pay the largest carbon levy. Pakistan will fight this case again in IMO. Mr. Shafique stressed on the need for an impact assessment study which would quantify the impacts of such levy on Pakistan's food security as well as fuel security. Since Pakistan's energy needs are met by imports, these taxes would negatively impact Pakistan's economy as well as the common people. He stressed on the role of coordinated efforts from thinktanks, relevant ministries and all stakeholders in assessing the impacts of such levies on Pakistan.

12. Cdr (Retd) Farooq Ali, DGM (QHSE) KS&EW, talked about the efforts of KS&EW in conforming to IMO's regulations and suggestions to improve the EEDI of existing ships under IMO's Net Zero Framework. He emphasized the technical advancements in ship design and the strategic need for coordinated national efforts to meet IMO's Net-Zero goals.

13. Cdr. Farooq (Retd) apprised the audience about the ship design considerations to improve EEDI including hybrid propulsion systems, which combine traditional engines with alternative power sources to optimize fuel use and minimize emissions, propeller design, where new materials and efficient structures can significantly improve vessel performance and energy-saving devices, such as flatteners or specialized fins, which help reduce fuel consumption and support overall energy efficiency in shipping operations. He called for active participation from all maritime sectors, including shipyards, to meet international standards and regulatory requirements. While individual entities like shipyards are making efforts, He stressed that a coordinated national approach is crucial and advocated for collaboration among all relevant stakeholders to formulate and implement a National Action Plan that ensures sustainable and compliant maritime practices.

14. Ms. Aafia Sarosh, an Environmental and Energy Expert, shed light on opportunities for renewable energy in the shipping sector of Pakistan. She highlighted Pakistan contributes little to global emissions but faces severe climate impacts like floods and rising temperatures. To protect its interests, it must develop its own climate data systems instead of relying on international sources, which may not align with national priorities.

15. She highlighted that Pakistan contributes minimally to global greenhouse gas emissions but faces some of the most severe climate-related consequences, including devastating floods, rising temperatures, and declining agricultural productivity. This disparity highlights the urgent need for Pakistan to assert its climate rights through self-reliance in data and policymaking.

16. At the same time, global regulatory shifts like the IMO's 2025 Net Zero Framework present both challenges and opportunities. If Pakistan fails to ratify MARPOL Annex VI, its shipping industry risks exclusion from major ports and faces increased export costs due to carbon pricing. However, by investing in renewable energy—solar, wind, and green hydrogen—Pakistan can not only decarbonize its maritime sector but also position itself as a competitive player in future low-carbon trade networks. With abundant solar radiation in its deserts and vast wind potential along its coast, the country is uniquely positioned to develop a sustainable green shipping hub, particularly in collaboration with initiatives like China's Belt and Road through Gwadar.

17. Secretary, Ministry of Climate Change and Environmental Coordination, Ms. Aisha Humera Chaudhry articulated her admiration on NIMA efforts for collecting stakeholders for reducing GHG emissions from the shipping sector. She expressed the ministry's support in including the GHG emissions in the Nationally Determined Contributions (NDCs) with the support of Global Climate-Change Impact Studies Centre (GCISC). She highlighted the disparity between

emissions of the developed and developing countries and stated that almost 80% of the emissions come from the top 10 polluting countries of the world. However, it is important for us to conduct research and development of alternate fuels and build our capacity in this regard. She stressed the importance of international collaboration to ensure Pakistan is included in the cutting-edge technologies developing in the sector.

18. President NIMA in his closing remarks reiterated that Pakistan urgently needs a clear strategy for maritime decarbonization, as highlighted in today's discussions under the IMO's new regulatory framework. Developing a National Action Plan is not just for compliance, it's essential for building a climate-resilient and economically sustainable maritime sector. NIMA will continue this work by integrating today's insights into its ongoing study and engaging all key stakeholders.

PICTORIAL GLANCES



PROPOSAL

INCLUSION OF MARITIME SECTOR IN THE NATIONALLY DETERMINED CONTRIBUTIONS (NDCS)

1. Background

Every year, 10 billion tons of cargo is transported by sea, accounting for 2.9% of global greenhouse gas (GHG) emissions, including carbon dioxide (CO₂). This is because ships use enormous amounts of petroleum fuels, emitting nearly 1 billion tons of GHG annually³¹. Emissions from domestic shipping practices, including the fishing and military vessels, are beyond this estimate, which add to the GHG emissions.

Pakistan's shipping sector includes 12 commercial vessels owned by the national flag carrier i.e., PNSC. Pakistan Maritime Security Agency (PMSA) has a total of 34 vessels used for patrolling and monitoring at sea; Karachi Port Trust (KPT) manages the operations of the Karachi port through several harbour crafts which include dredgers, tugs, barges, floating cranes, and ferry boats. Several harbour crafts are used by Port Qasim Authority (PQA) to manage and facilitate the operations at Port Qasim including tugs, pilot boats, and small boats. In addition, there are a total number of 21,899 ships currently operational in the Sindh Province and of Pakistan which includes fishing vessels, skiff boats, passenger boats, water and fuel carrying boats, and pleasure boats., and a total number of 6,837 ships in Balochistan³², with no record of their fuel consumption and emissions. The emissions from the shipping sector are expected to grow exponentially, with the renewed interest in developing the maritime sector of Pakistan.

2. International Instruments and Obligations

The International Convention for the Prevention of Pollution from Ships (MARPOL) is IMO's key instrument addressing the prevention of pollution of the marine environment by ships. The MARPOL Annex VI, which entered into force on 19 May 2005, deals with the prevention of air pollution from ships. In July 2023, IMO Member States adopted the 2023 IMO Strategy on Reduction of GHG Emissions from Ships, aligning with the Paris Agreement goal of limiting global temperature rise to 1.5°C. Countries must ensure that their fleets comply with these standards as many member countries may deny port entry to non-compliant vessels. Pakistan has not ratified the MARPOL Annex VI yet, which deals with reducing emissions from the international shipping. It is important to mention here that there are two types of emissions from the shipping sector, owing to the transboundary nature of the sector;

31[https://aida-americas.org/en/blog/maritime-shipping-whats-being-done-reduce-emissions#:~:text=The%20International%20Maritime%20Organization%20\(IMO\)%20is%20the,for%20safe%2C%20efficient%2C%20and%20environmentally%20sound%20shipping](https://aida-americas.org/en/blog/maritime-shipping-whats-being-done-reduce-emissions#:~:text=The%20International%20Maritime%20Organization%20(IMO)%20is%20the,for%20safe%2C%20efficient%2C%20and%20environmentally%20sound%20shipping).

32 Semab, B., Muhammad Javed I., K., Amir, S., & Tariq, M.A.U.R. (2023). Development of greenhouse gas emissions baseline and identification of carbon offset cost for maritime vessels of a developing country. *Frontiers in Environmental Science*, 10, Article 1076585. <https://doi.org/10.3389/fenvs.2022.1076585>

- a. International maritime transport and emissions: In Pakistan, the 12 ships of PNSC, which carry oil and cargo to international waters, must report their emissions to IMO under MARPOL Annex VI.
- b. Domestic and Inland maritime transport and emissions: The countries must reduce their emissions from domestic maritime shipping activities under GHG strategy of IMO and should be reported in their NDCs.

According to the International Transport Forum & Organisation for Economic Co-operation and Development (ITF-OECD): “Governments should include clear goals for the deployment of low carbon transport solutions”.

The goals should cover all modes of transport, across both passenger and freight:

- a. Land transport
 - i. Road transport
 - ii. Walking and cycling
 - iii. Public transport
 - iv. Popular transport
 - v. Rail
- b. Water-based transport
 - i. Inland waterways
 - ii. International maritime transport
- c. Aviation
 - i. Domestic aviation
 - ii. International aviation

While international aviation and international shipping emissions are not within scope of the NDC emissions reductions targets, governments should still highlight the domestic actions that will be taken to reduce emissions from these modes. This applies especially where actions to support domestic travel support international efforts, e.g. scaling up Sustainable Aviation Fuels for both domestic and international aviation³³.

In this regard, IMO encourages member states to develop and submit voluntary National Action Plans (NAP) to address GHG emissions from ships, outlining

³³ International Transport Forum & Organisation for Economic Co-operation and Development (ITF-OECD). (2022). *Transport Nationally Determined Contributions (NDC): A guidebook*. Retrieved June 30, 2025, from <https://www.itf-oecd.org/sites/default/files/docs/transport-ndc-guide.pdf>

respective policies and actions. The development of NAP would mobilize a broad range of national stakeholders to get involved in ship emissions reduction efforts, including those that may not necessarily be covered by IMO conventions. NAP of a country can propose strategies for reducing GHG emissions from both domestic and international shipping practices and help to meet its climate commitments like Nationally Determined Contributions (NDCs).

3. Inclusion of Maritime Shipping Emissions in NDCs 3.0 of Pakistan

Pakistan's National Determined Contributions include key sectors of economy namely Agriculture, Energy, Transportation, Waste and pollution control, Disaster management, Water, Health, Forestry, Land-use change, Industry. While shipping, which is an important sector of Blue Economy and is projected to increase exponentially in the future, is not included in the NDCs of Pakistan.

According to the Ministry of Maritime Affairs of Pakistan, over 90% of Pakistan's trade by volume is carried out by sea and seaborne exports contribute substantially to Pakistan's GDP, other than supporting other sectors like fisheries, tourism etc. and creating employment opportunities. Reducing GHG emissions from shipping sector is an important aspect of mitigation strategies being pursued worldwide and needs to be taken up at national level in Pakistan.

According to a study carried out at National Institute of Maritime Affairs Islamabad in 2023³⁴, it was revealed that 2,468,789.21 tonnes of GHGs (CO₂e) are being emitted annually from the maritime vessels of Pakistan, which is 4.9% of the overall transport sector emissions of the country. Carbon offset cost of 37,031,838.14 US\$/annum and approximately 20,020 hectares of mature mangrove forest to remove 2,468,789.21 metric tonnes of CO₂e emissions from the atmosphere in a timeline of 1 year are required to become carbon neutral, from this sector alone.

It is imperative to update and develop a baseline for emissions from shipping sector, to meet our national climate commitments and fill this crucial gap in Pakistan's NDCs.

4. NIMA's Efforts for Emissions Reduction in the Shipping Sector and Advocacy for Ratification of MARPOL Annex VI

In view of the urgency posed by the obligations set by the United Nations (UN) and the IMO for member states, NIMA is conducting a comprehensive study on **“Strategy for Developing National Action Plan for Addressing GHG Emissions from Shipping in Compliance with IMO Recommendations”**, which can ultimately lead to policy level suggestions to the government of Pakistan for development of a NAP.

34 Semab, B., Muhammad Javed I., K., Amir, S., & Tariq, M. A. U. R. (2023). Development of greenhouse gas emissions baseline and identification of carbon offset cost for maritime vessels of a developing country. *Frontiers in Environmental Science*, 10, Article 1076585. <https://doi.org/10.3389/fenvs.2022.1076585>

NIMA conducted a webinar titled “IMO’s Net-Zero Framework under MARPOL Annex VI: Pakistan’s Commitment and Way Forward” on 30 April 2025. During the seminar, Secretary, Ministry of Climate Change and Environmental Coordination, Ms. Aisha Humera Chaudhry expressed the ministry’s support in including the GHG emissions in the Nationally Determined Contributions (NDCs) with the support of Global Climate-Change Impact Studies Centre (GCISC).

NIMA applied for **“Call for Expression of Interest-IMO GreenVoyage2050 Support for the Development of National Action Plans to Reduce GHG Emissions from Ships”** in August 2024. After thorough evaluation of the applications, Pakistan was not selected because of lack of patronage of the application by relevant ministry. **For the purpose of information, India and Bangladesh were selected by IMO for technical assistance of the same year.** MoCC&EC in liaison with MoMA can be the relevant ministry to submit this application in the next call with the support of NIMA.

NIMA conducted a side-event at COP29 at Pakistan Pavilion on 19 Nov 2024 titled **“Pakistan’s Transition to Green Shipping (including green ship recycling) - Opportunities and Challenges”**. The focus of the panel discussion was to showcase Pakistan’s commitments to Green Shipping technologies in its shipping sector and environment friendly practices in the Ship Recycling Industry.

NIMA conducted a seminar on **“IMO’s Obligations of Reducing Harmful Emissions at Sea – Pakistan’s Perspective and Challenges” in Jan 24**, where representative from IMO reaffirmed IMO’s help and assistance to Pakistan in the process of ratification of MARPOL Annex VI.

5. Conclusion

The maritime sector in Pakistan plays a critical role in trade, employment, and the national economy, yet its greenhouse gas (GHG) emissions remain largely unaccounted for in the country’s climate commitments. With increasing maritime activity and over 90% of trade volume transported by sea, the sector’s emissions - estimated at nearly 2.5 million tonnes of CO₂ annually - must be addressed through targeted mitigation strategies. Aligning with international obligations like the IMO’s GHG Strategy and MARPOL Annex VI, and incorporating maritime emissions into Pakistan’s Nationally Determined Contributions (NDCs), is essential. Doing so will not only help meet global climate goals but also position Pakistan’s shipping industry for sustainable growth and international compliance. NIMA, as a premier maritime thinktank is willing to collect all stakeholders for the cause and conduct an updates baseline study to gather the data on the basis of which the NDCs can be formulated for the sector. IMO and ILO have repeatedly committed their support for the cause and these international bodies can be engaged for technical advice on the subject.