

# ***GREEN PORT STRATEGIES FOR SUSTAINABLE GROWTH AND DEVELOPMENT OF PORTS IN INDIA***

*Submitted for the partial fulfillment of the requirement for the degree of*

**MASTERS OF BUSINESS ADMINISTRATION**

In

**Port and Shipping Management**

Submitted By

**ANUGRAHA ANNA JOHN**

**Registration No.: 2005304008**



*Under the Guidance of*

**Dr. SREEJITH U**

(Associate Professor)

**SCHOOL OF MARITIME MANAGEMENT  
INDIAN MARITIME UNIVERSITY, KOCHI**

# DECLARATION

I, **ANUGRAHA ANNA JOHN** (**Registration No: 2005304008**) student of Maritime Management, INDIAN MARITIME UNIVERSITY, KOCHI, hereby declares that the project report titled, **“Green Port Strategies for sustainable growth and development of ports in India”** submitted in the partial fulfillment of the requirement for the degree of, **“Master of Business Administration in Port and Shipping Management”** is my original work carried under the guidance of my project guide. It has not formed the basis for the award of any degree/ diploma or associate ship of any University/ Institution. The information submitted is true and original to the best of my knowledge.

**Date:**

**Anugraha Anna  
John**

**Place:**

# CERTIFICATE



This is to clarify that, this Project report titled, “Green Port Strategies for sustainable growth and development of ports in India” submitted to School of Maritime management, Indian Maritime University, Kochi campus by Anugraha Anna John for the partial fulfillment of the requirements for the award of the degree of Master in Business Administration in Port and Shipping management is a bonafide record of work carried out by him under my guidance.

**Date:**

**Place:**

**(Dr. SREEJITH U)**

Associate Professor

## ACKNOWLEDGEMENT

I wish to express my sincere gratitude to the Management of the **School of Maritime Management, Indian Maritime University-Kochi**, who enhanced my knowledge in the field of Port and Shipping Management.

Despite my best efforts, this project would not have been feasible without the kind support and assistance of many individuals and organizations. I'd want to thank them all from the bottom of my heart.

My gratitude and appreciation to my institution for assisting me in establishing the project, as well as to those who have volunteered to assist me with their skills.

I wish to express my sincere gratitude and take immense pleasure in thanking my **Mentor and Project Guide Dr. SREEJITH U, School of Maritime Management** for moral support, able guidance and useful suggestions which helped me in completing this project work in time. My sincere gratitude to **Dr. YOGAMALA H.L., HOD MBA, School of Maritime Management** and other faculty members of SMM.

This opportunity is a significant step forward in my professional growth. I will make every effort to put my newly acquired skills and knowledge to the best possible use, and I will continue to work on improving them in order to achieve my professional goals, and I look forward to working with all of you in the future.

# TABLE OF CONTENTS

***Declaration*.....**

***Certificate***

***Acknowledgement***

## **Chapter 1**

**INTRODUCTION.....7**

## **Chapter 2**

**LITERATURE REVIEW.....10**

2.1 Environmental Issues in Port.....10

2.2 Green Port as a Concept.....12

2.3 Green Port Strategies.....15

## **Chapter 3**

**RESEARCH METHODOLOGY.....19**

3.1 Methodology Overview.....19

3.2 Case study Design.....19

## **Chapter 4**

**INDIA ON IMPLEMENTING GREEN PORTS.....20**

4.1 A short note about Indian Ports.....20

4.2 The Concept of Green India.....23

4.3 Green Policy (GPP).....27

## **Chapter 5**

### **THE GREEN PORT INITIATIVES ON FEW OF THE MAJOR**

<b>PORTS.....</b>	<b>31</b>
5.1 Haldia Port.....	31
5.2 New Mangalore Port.....	32
5.3 The port of Kolkata.....	35
5.4 JNPA.....	37
5.5 Paradip Port.....	38
5.6 Cochin Port.....	39
5.7 Mumbai Port.....	41
5.8 Chennai Port.....	42
5.9 Ennore Port (Kamarajar Port).....	43
5.10 V O Chidambaranar Port.....	44
5.11 Visakhapatnam Port.....	45

## **Chapter 6**

<b>COMPARISON AND FINDINGS.....</b>	<b>46</b>
-------------------------------------	-----------

## **Chapter 7**

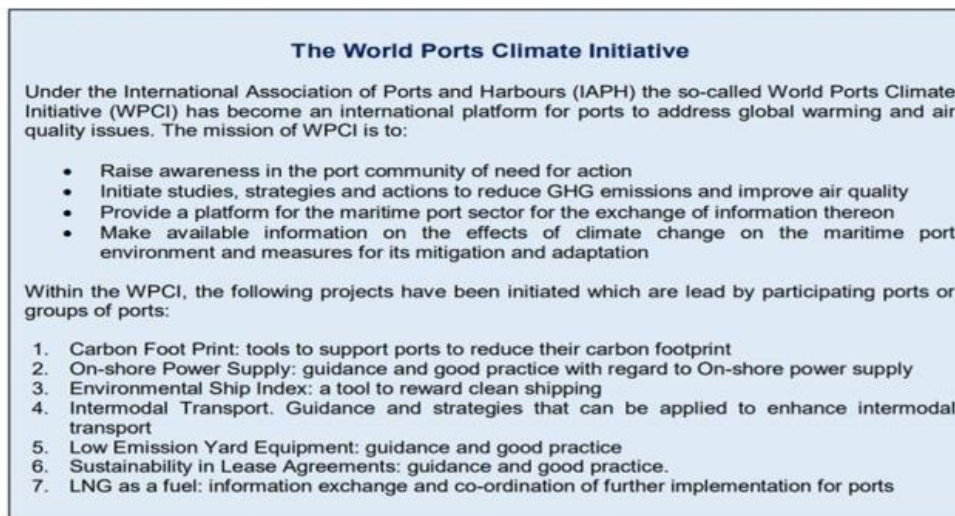
<b>CONCLUSION.....</b>	<b>49</b>
------------------------	-----------

<b>Bibliography.....</b>	<b>51</b>
--------------------------	-----------

# CHAPTER 1

## INTRODUCTION

Maritime transport is vital for the international trade and the transportation of bulk and raw material. Seaborne trade accounted for about 90% of the total volume of the global trade, which international shipping continues to expand and indeed became the backbone of the global economy (UNCTAD, 2019). In term of the global supply chain, the globalisation of the complex industrial production processes around the word also contributing to the increase of the importance of ports in international trade (Munim et al., 2018). According to (Gibbs, 2014). in order to cater to the wide range of interests, the functions of ports had expanded from time to time, which also has an adverse impact on climate change that caused by GHG pollution generated by the port.

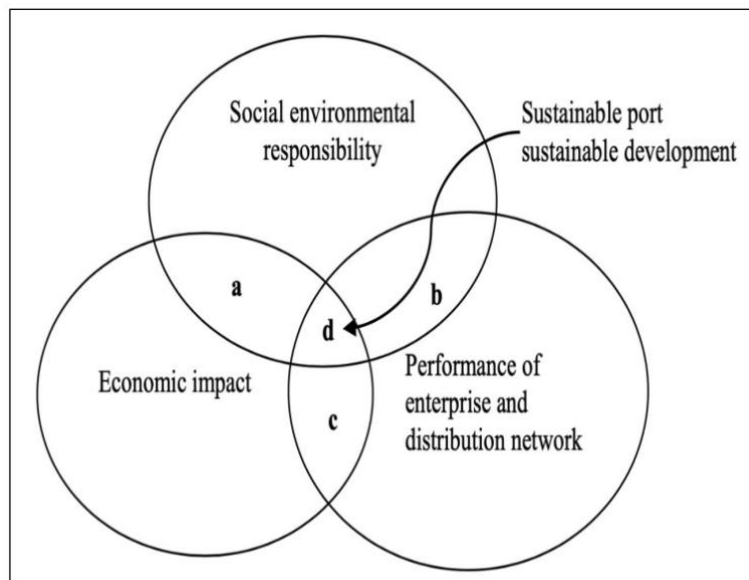


*Figure 1: The World Ports Climate Initiative (Source: IAPH)*

In 2015, the United Nation adopted the Sustainable Development Goals (SDGs) that represent a holistic and integrated approach in protecting the environment, improving community issues and even reaching the global economic (United Nations, n.d). As one of the vital centres of economic activity, the port sector can play a significant role to ensure port business strategies. including the governance of port itself, is in line with the global

sustainability standards. As shown in Figure 1 below, the International Association of Ports and Harbours (IAPH) has introduced the World Ports Climate Initiative (WPCI) to support this SDG missions.

For the green port management perspective, the success of the green port concept depends on several factors. In term of sustainable development, all the strategies aligned shall put into consideration of all factors, especially economic and environmental objectives. According to (Jiuh-Bing Sheu et. al., 2013), factors of Green Port in sustainable development can be divided into three dimensions; (i) economic, (ii) environmental, and (iii) social.



*Figure 2: The Concept of Sustainable Port (Source: Jiuh-Bing Sheu et. al., 2013)*

Referring to Figure 2 above, we can see that how sustainable port development can be seen as a combination of three dimensions, which will need the systematic approaches or strategies in order to balance all of them. Many ports from developed countries, for example, from Europe and America have also embraced the idea of green ports in their port development strategies. However, for the developing countries, still few researches or related academic literature have focused on it. Most of

these developing countries were putting more emphasis on their economic development rather than environmental protection.

For this research, the gaps from both developed and developing countries in term of the implementation of a green port concept will be the main motivation, by focusing more on the strategic approach. For Malaysia case, there is still a little study related to green port implementation. The objective of this paper is to identify the current level of India's green port management, by comparing India's green port management with other developed countries' situation. This paper also aims to study India's green port management from a policy perspective.

By doing the comprehensive literature review and conceptual development, this paper aims to formulate the strategies or practical application of green port concepts in Indian ports. which will emphasise to fulfilling both economic and environmental aspect for sustainable growth and development of the ports. The objectives are (1) to understand the current development of Indian ports from the perspective of green port concept; (2) to analyse the gap between Indian ports and other successful green ports, and (3) to provide the practical strategies of the green port concept in India.

# CHAPTER 2

## Literature Review

### 2.1 Environmental issues in ports

The volume of global commerce, or seaborne trade, is predicted to grow each year, implying that transportation through the port would grow as well. Using air pollution as an example, large emissions of diesel exhaust, particulate matter, and nitrogen oxides may be found near ports, resulting in asthma, respiratory illness, cardiovascular disease, lung cancer, and premature death in neighbouring areas. According to the OECD (2017), pollution may be split into three categories in the context of a green port: (i) port activities, (ii) ship emissions, and (iii) hinterland traffic. These three categories will serve as the foundation for the analyses' framework in this study.

The actions of ports have had a significant negative influence on the environment. Pollution from ships or other industrial activity in port locations might pollute the air, water, soil, trash, and noise. Various diesel-powered gear, including as straddle carriers, terminal tractors, and reach lifters, were employed in port operations. Not only did these diesel-powered engines spew numerous pollutants, but they also produced noise, which is another sort of pollution. According to (Han, 2010), noise pollution from different diesel engines in ports can cause hypertension, cardiovascular illness, and mental stress, particularly in workers who are exposed to the environment for extended periods of time. Ports that handled a huge volume of items such as timber, fertiliser, and aggregates, on the other hand, contributed to air pollution, This was caused by dust drifting due to dry and windy circumstances This form of pollution can have a negative impact on employees' health, as well as the health of nearby communities and residents. Other environmental

problems related to the port's operations include ballast water control in port water. Ballast water, as we all know, is critical for a ship's safe operation, as it offers stability and manoeuvrability throughout voyages and loading and unloading activities. The treatment of this ballast water, however, may have an impact on the coastal ecology by importing exotic species or pathogens carried by ships (IMO, 2016). In addition, the port expansion program such as dredging and reclaiming has also added environmental issues to the port area, in which the wetlands, coral reefs and marine ecosystems are vulnerable.

Growing shipping activities in port areas have had detrimental impacts on the environment, air quality and human health. The port areas are the most noticeable of pollutant receptors generated by ships. According to (ICCT, 2007), approximately 80% of the world fleet is either operating in port areas (55% of the time) or near a coast (25% of the time). Ships only spend around 20% of the time far from land. It is estimated that approximately 70 per cent of ship emissions are within 400 km of land. Ship emissions may threaten the air quality while berthing or manoeuvring and in coastal communities as they move along the coast. Because of the manoeuvring, bunkering and hoteling phases, air pollution from ships can be very high in port areas. Whenever ships at berth, the majority of ships deliver their services by auxiliary diesel engines. According to (Whall et. al., 2002), in-port NO<sub>x</sub> and SO<sub>2</sub> emissions account for 5-6 per cent of the total ship produced during all navigation phases. Generally, particulate matter generated by ship emissions is the main source of air pollution. Besides of this, the large emissions intensities that generated by ships were not only becoming the burden of both regional and global environment but has affected human health as well. Over 30 human epidemiological studies have found that air emission increases cancer risk, and kids who live near major traffic centres are more likely to suffer from impaired lung capacity, wheezing and bronchitis. As a whole, diesel emissions have been described as

"genotoxic carcinogenic" by the International Association of Cancer Research, IARC (Benbrahim-Tallaa et. al., 2012).

A port is a transport node that can accommodate many kinds of transport. According to (Rodrigue et al., 2006), road transport dominates the whole hinterland transit in most ports, resulting in substantial truck mobility in port cities. According to an OECD research, trucks contribute the most significant quantity of air pollution emission components in road freight transportation. The volume of goods transported by road from port to hinterland is increased from time to time, resulting in increasing congestion and pollution from transportation. Aside from ships and some cargo handling equipment, land transportation such as trucks or trains also produce noise that may damage surrounding residential areas. This situation becomes more worse for ports that are open 24 hours a day. Ports and other stakeholders must create innovative solutions, including methods to analyse the hinterland transportation system, in order to preserve sustainable transportation. At the same time, port communities are progressively implementing a plan or policy to reduce the negative consequences of maritime transportation.

## **2.2 Green port as a concept**

There are numerous studies on port development that are particularly relevant to the concept of the green port. In recent years, the green port idea has had a considerable impact on port development. Any modern port should be adapted to green and intelligent development models, with an emphasis on environmental and technological issues. The 'greenness' of any port is determined by its characteristics, according to (Karim et al., 2007). Both green and smart ports must be interconnected as one systematic concept that was designed based on a systematic governance framework for the creation of an intelligent or smart port. Their research also emphasised how green development may be a major notion of a

smart port, with technological innovation as one of the primary elements. The creation of green concepts has emerged as a response to the pollution created by port construction and operation. In their research, (Pavlic et al., 2014) stated that in order to achieve sustainable port development, both economic and environmental objectives must be integrated. The Organization for Economic Cooperation and Development (OECD) has released a new Green Growth Sustainable Development Strategy that aims to encourage economic growth while also protecting natural resources and environmental services.

Despite rising global and regional port pollution control legislation and increased public discussions, port communities are no longer able to avoid environmental issues. As a complement to national and local laws, Port has a position to support the development and compliance of conventions, meaning that green ports often need strengthened political structure, allocation of official duties or decentralization of governance (Ke Du, 2019). Green port management will indeed incorporate the wider issue of ecosystem conservation by port sustainability plans and legislation on environmental planning (Schipper et. al., 2017). Other issues relating to socio-economic and planning must also be addressed in order to obtain a thorough understanding of green ports (Dooms et. al. 2015).

As a result, special regulations and solutions must be developed and implemented to ensure a smooth transition from traditional or ecologically unfavourable ports to sustainable and climate-friendly ports.

Organizational behaviour toward green port rules is very important and must be monitored, particularly in environmental management (Chang et. al, 2012). The risks and possibilities faced by industrialised and emerging countries, on the other hand, differ due to differences in economic and political conditions and circumstances. The World Association for Waterborne Transport Infrastructure (PIANC, 2014) had also highlighted four main elements of the green port, which are:

- long-term vision over tolerable footprint on nature and environment.
- transparent stakeholder engagement and their full involvement in process and growth.
- a conceptual shift of thinking, that sustainability as an economic driver rather than as a legal obligation, and
- active information sharing, and cooperation between other stakeholders and ports, and steady growth in innovation and technology.

Since the early 1990s, the term "green port" and its basic notion have been utilised. As a result, this concept has come to apply to ports that are proactive in reducing their negative environmental externalities. The green port concept is viewed as a new model for balancing port operations with environmental and social considerations while maintaining economic growth (PLANC/IAPH, 2018). The majority of studies on green ports idea have been conducted on European and North American ports, according to (Davarzani et al. 2016). Water quality, dredging, and noise were the key environmental challenges faced by European and North American ports in the early century, with the emphasis on how crucial it was for port management to use present legislation as a foundation for the application of new regulations of green strategies.

The green port plan is essentially a solution for the port to address environmental concerns that arose from the three sections outlined in the previous section from a management standpoint. Ports that use alternative energies or clean fuels for port operations have received the "green port" moniker.

Due to differences in political structure and port history, port management is a dynamic process that differs between ports and

countries. However, little research has been done on these characteristics, which could influence the port's decision to embrace the green port idea, due to both political structure and port history. This orientation could involve tool choices, as well as any innovations or ambitions they may have. Because green port research has mostly focused on European and North American ports, many pioneering ports in Europe, such as Bremen (Bremerhaven), Rotterdam, and Antwerp, have been designated as green ports. These ports, notably Singapore and Shanghai, have taken steps to demonstrate their environmental interests and obligations, and have begun to include the notion of sustainability, according to (Lam and Notteboom, 2014).

For my research, I classified it into three parts; (i) ship emissions, (ii) port activities, and (iii) hinterland transport, which is based on (OECD, 2017), regarding on the emissions of GHGs and pollutants which cause environmental problems in the port adopted in the project. Previously, some of the researchers have also conducted similar research in some other countries. Since the factors or variables that influenced the implementation of green port concept might differ between countries.

## **2.3 Green port strategies**

Green port strategies practised by some world-classed ports around the world were analysed and set as the benchmark to assess Indian ports. All of the information was derived from several resources, including ports' official website, annual reports and related studies. Referring to OECD, the green port strategies were divided into three main categories; ship activities, port activities, and hinterland transport.

### **2.3.1 Shipping emission**

Air pollutants, water pollution, noise, and oil waste are all environmental repercussions of shipping traffic. Shipping activities generate more than

18% of an air pollution, according to (Schrooten et al., 2009). Concerns about the impact of ships on the environment are developing in tandem with the growth of marine traffic. CO2 emissions from shipping activities contribute significantly to global warming, but NOx, SOx, PM, and VOC emissions largely impair human health in port towns. According to (UNCTAD, 2017), shipping activities emit roughly 1 billion tonnes of CO2 each year. Based on anticipated economic growth and energy development, shipping emissions could rise by 50 to 250 percent by 2050.

Various nations and towns across the world have implemented incentive schemes in the port area to encourage ships to use cleaner marine fuels or to reduce air pollution while calling at ports. For instance, the Environmental Ship Index (ESI), which was created in 2010, is one of the incentive schemes implemented by ports to promote improved air quality as a result of shipping activities, particularly in the port region. Major ports including Le Havre, Bremen, Hamburg, Antwerp, Amsterdam, and Rotterdam have already successfully enlisted in this scheme. Along with the IMO's existing emission criteria, the ESI offers a reduction in port fees or tonnage costs for vessels with below average SOX, NOX, and/or CO2 emissions. Other than this, the Energy Efficiency Design Index (EEDI) and the Ship Energy Efficiency Management Plan (SEEMP) has also initiated to address NOx emissions by ships.

**Table 1:** Participating Ports in ESI by Region (Source: ESI, 2020)

<b>EUROPE</b>	<b>ASIA</b>	<b>LATIN AMERICA</b>	<b>USA &amp; CANADA</b>	<b>MIDDLE EAST</b>	<b>OCEANIA</b>
<b>35</b>	<b>4</b>	<b>1</b>	<b>4</b>	<b>2</b>	<b>1</b>
For example; Rotterdam, Hamburg, Antwerp	Busan, Ulsan, Tokyo, Yokohama	Panama Canal	Los Angeles, New York & New Jersey, Vancouver, Prince Rupert	Ashdod in Israel, Sohar in Oman	Nelson in New Zealand

Additionally, other pollution control methods include slow steaming while on approach or in ports. A 20 per cent reduction in speed will reduce fuel consumption by around 40 per cent and CO<sub>2</sub> by about 7 per cent (Cullinane, 2013). However, according to (Cariou, 2011), this option is only attractive if the bunker rates per tonne are relatively high. Besides this, emissions from ships in port can be minimised by providing onshore power supply (OPS). Emissions from ship's engines that run at berth are a significantly contribute emissions in ports. If shore power is to be used for all ports in Europe, an estimated 2,94 billion euros in health costs could be avoided in 2020 as well as a possible reduction in 800.000 tons of carbon emissions.

Pollution from port operations contributes less to overall emissions that can be addressed with particular ways, although only a few ports currently quantify their emissions. Adopting ways for managing electricity demand and producing renewable energy locally is one of the strategies that ports might use. Wind turbines, solar panels, and thermal plants are examples of renewable energy. Ports, on the other hand, should examine additional measures such as trash management and recycling facilities, sewage, spills, and ballast water management, as well as reducing the amount of noise, vibration, and dust produced by the ports. Many initiatives are being implemented to reduce pollution caused by port operations, such as the use of LNG-powered trucks. Some ports, such as the Port of Rotterdam, have pushed port-based businesses to track their carbon footprints and continue to promote the use of sustainable energy to reduce CO<sub>2</sub> emissions.

When ports try to implement green regulations at their ports, they face numerous problems and issues. The problems could stem from the cost of implementation, a lack of infrastructure, prohibitively expensive installation costs, and various institutional and governance issues. A

important part of governance is the effective recognition and introduction of ecologically friendly operations.

### **2.3.2 Inland transport system**

There has been very little research into the environmental performance of the inland transportation system (to and from ports). However, several externalities have resulted from this region. particularly pollution and traffic congestion As we all know, port inland transport emissions are mostly attributable to port operations, thus if they are to be improved, coordination between port and inland actors is necessary. However, it was argued that greening inland transportation is at least part of the port's obligation with this approach.

In terms of hinterland transportation plans, (Gonzales-Aregall et al., 2018) discovered that 76 of the 365 world ports were adopting some type of green port strategy for the hinterland in their research. In the same study, they discovered that the most important green hinterland goal for these ports was to reduce air pollution, which was often accomplished by constant monitoring programmes. Apart from that, dealing with congestion in the hinterland transportation system has been a top priority for most of these ports, which requires more infrastructure investment. Enhanced technology was the most popular way to reduce land congestion, while infrastructure investment was the most effective way to promote modal shift (Gonzales-Aregall et. al., 2018).

# **CHAPTER 3**

## **RESEARCH METHODOLOGY**

### **3.1 Methodology overview**

For this research, all data were collected through research and websites and questionnaires, including referring to the relevant policy and respective strategy documents. According to (Corbin J., 2008), surveys, the most common approach used by researchers when involving data collection in some intermodal transport and green port management study. Another qualitative approach which was used in this research for data collection is questionnaire. The questionnaires are conducted by sending it via email and collected back once they finish. On the other hand, by considering the output of this study is theory building, this study is also based on an extensive literature review (academic journals, books, publications etc.) and also based on comparing two case studies.

### **3.2 Case study design**

The types of case study styles that commonly used were of two forms; single or multiple - case studies. For this research, two case studies are chosen as a case study design. With this design, data will be analysed based on each situation, which may be different due to several factors, unlike when choosing only a single case study. In addition, having multiple-case studies enable researcher in getting two or more significant sources of information, rather than a single case design. The central focus for this study is the green port tool and concept in the perspective of Indian ports. The 'how' and 'why' questions should be answered in different circumstances throughout the interview. By doing so, it would allow case study analysis in a better direction to collect information to examine the gap between Indian ports and other developed-country ports.

## **CHAPTER 4**

### **India on implementing Green Ports**

Green port efforts have been implemented by the government in major ports to improve their environmental performance. Acquisition of equipment for monitoring environmental pollution, dust suppression systems, sewage/ waste water treatment plants, garbage disposal systems for ports and ships, developing shore reception facilities for wastes from ships, setting up projects for energy generation from renewable energy sources, providing shore power to ships at berths, and creating Oil Spill Response (Tier-1) capability are among the green port initiatives.

#### **4.1 A short note about Indian Ports**

India has a shore line of around 7516.6 kilometres, making it one of the world's largest peninsulas. The Indian mainland's coastline length is 5422.6 kilometres, whereas all of the islands' combined coastal length is 2094 kilometres. The state of Gujarat has the longest coastline, while Goa has the shortest. India has the 18th longest total coastline length of any country in the world. With the Arabian Sea on the west and the Bay of Bengal on the east, India's coastline line spans nine states and four union territories. Gujarat, Maharashtra, Goa, Karnataka, and Kerala are the western coastal states, whereas Tamil Nadu, Andhra Pradesh, Orissa, and West Bengal are the eastern coastline states. Daman & Diu, Puducherry, the Lakshadweep Islands, and the Andaman & Nicobar Islands are the four union territories.

Positive traffic increase has been recorded at 9 of the 12 main ports. With a 16.5 percent increase in cargo handling, Cochin port led the way. Paradip, Kolkata, JNPT, Mangalore, Visakhapatnam, Kamarajar, Chennai,

and Kandla are among the other ports that have seen excellent growth. Among the main ports, Kandla Port (Deendayal Port) handled the most cargo with 110.10 million tonnes.

The Major Ports in India are public service ports with private elements within, such as the BOT operators active in these ports. From the Business Plans of the 12 Major Ports there is a clear intention to shift towards the landlord port management model. Obviously, switching to a different port management model, such as a landlord model, would be a significant undertaking that would take several years to complete. The economic and societal consequences would be enormous.

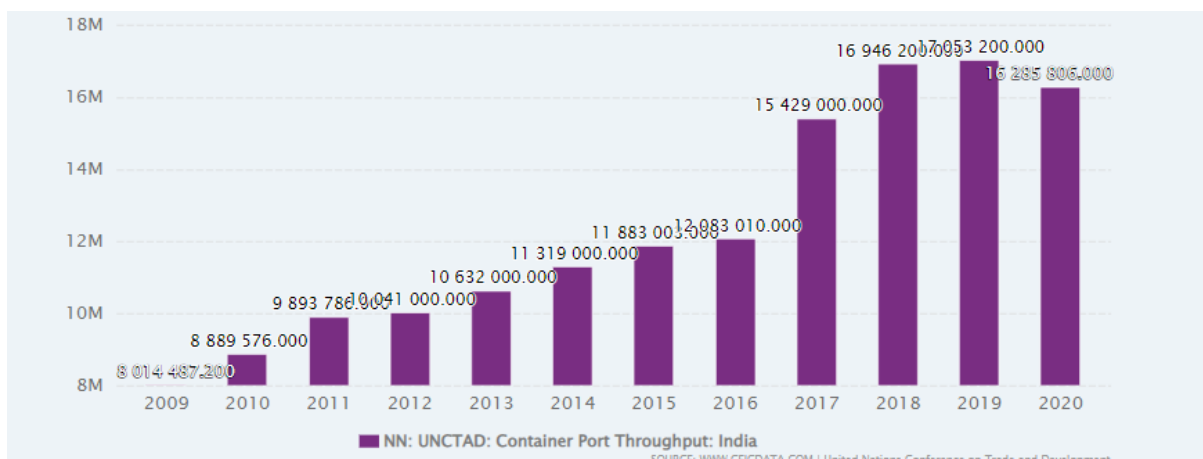
<b>S. No</b>	<b>NAME OF THE PORT</b>	<b>COAST</b>	<b>STATE</b>
<b>1</b>	Deendayal Port	Western Coast	Gujarat
<b>2</b>	Mumbai	Western Coast	Maharashtra
<b>3</b>	JNPT	Western Coast	Maharashtra
<b>4</b>	Mormugao	Western Coast	Goa
<b>5</b>	New Mangalore	Western Coast	Karnataka
<b>6</b>	Cochin	Western Coast	Kerala
<b>7</b>	V.O. Chidambaram Port	Eastern Coast	Tamil Nadu
<b>8</b>	Paradip	Eastern Coast	Odisha
<b>9</b>	Vishakhapatnam	Eastern Coast	Andhra Pradesh
<b>10</b>	Chennai	Eastern Coast	Tamil Nadu
<b>11</b>	Kamarajar (Ennore)	Eastern Coast	Tamil Nadu
<b>12</b>	Kolkata Port	Eastern Coast	West Bengal

### **MAJOR PORTS IN INDIA**

Almost majority of India's overseas trade is handled through its sea ports. In addition, major ports in India handle 57 percent of all trade. Due to insufficient capacity and lengthier turnaround time — the time it takes to

unload and reload freight — India's major ports have lost up to 20% of their total cargo to minor ports since the turn of the century. The fact that the number of lesser ports has constantly increased over the last half-century hasn't helped matters.

The total cargo handling capacity of Indian ports is about 2400 mn tonnes per annum (MTPA). Ports in India handle approximately 95% (by volume) and 68% (by value) of India's external trade. Total traffic handled at Major Ports in 2020-21 was 672.68 Mn Tonnes. The cargo handling capacity during 2020-21 at Major Ports was 1560.61 MTPA and for Non-Major Ports, it was 1002.24 MTPA. The total Capacity of all the Indian Ports as on 31-3-2021 was 2562.85 MTPA. The capacity of India's major ports was 1,561 million tonnes per annum (MTPA) in FY21. All major Indian ports handled 650.52 million tonnes (MT) of cargo traffic in FY22 (through February) 2022. Gujarat's Mundra Port Mundra just surpassed Mumbai's Jawaharlal Nehru Port as India's busiest container port, with 5.7 million TEU (twenty-foot equivalent unit) of cargo handled in 2020-21 versus 4.7



million TEU for the latter.

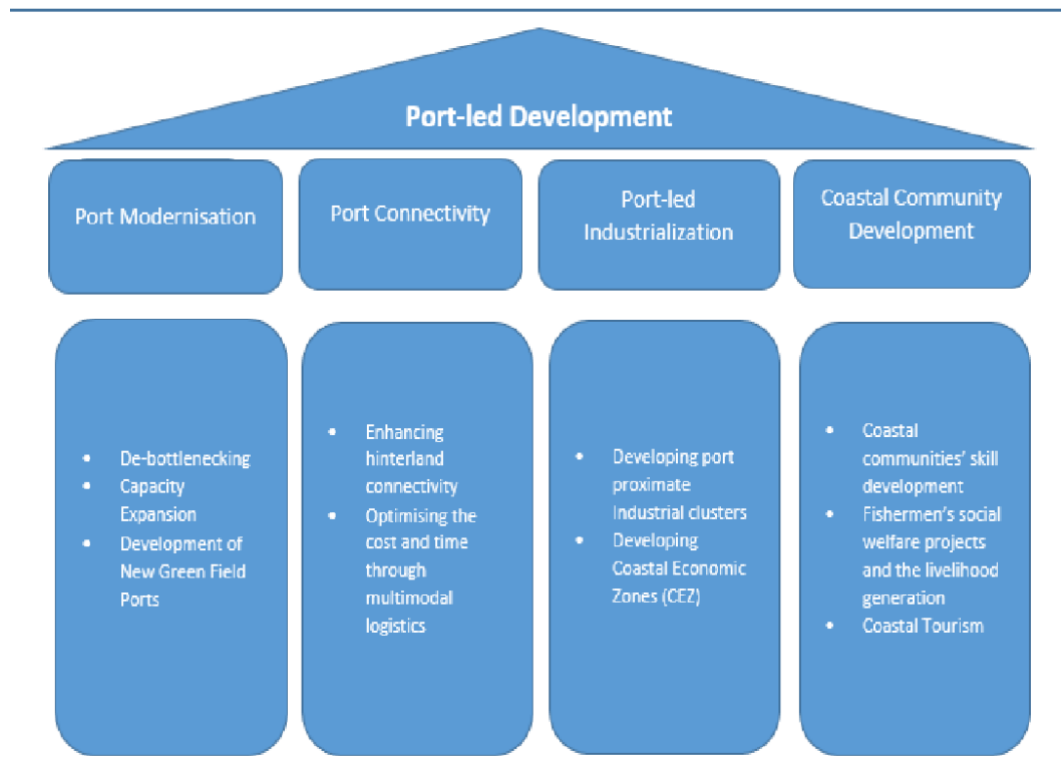
*India's Container Port Throughput from 2008 to 2020*

Surface transportation, such as road and rail, is the backbone of India's hinterland connectivity, with domestic waterways (coastal shipping and

inland waterways) playing a minor part. Only crude oil, refined petroleum products, and natural gas are transported by pipelines. Because India's cargo-generating centres are primarily in the hinterland rather than the coastal region, good port connectivity is even more critical. The long lead time raises logistics costs and limits the time frame in which the cargo may be delivered.

Since about more than 90% of India's trade by volume is conducted via the country's maritime route, there is a continuous need to develop India's ports and trade related infrastructure to accelerate growth in the manufacturing industry and to assist the 'Make in India' initiative.

As per the studies conducted under the Sagarmala Programme, it is expected that by 2025, cargo traffic at Indian ports will be approximately 2500 MMTPA while the current cargo handling capacity of Indian ports is only 1500 MMTPA. A roadmap has been prepared for increasing the Indian port capacity to 3300+ MMTPA by 2025 to cater to the growing traffic. This includes port operational efficiency improvement, capacity expansion of existing ports and new port development.



## Sustainable port development in India

### 4.2 The concept of green India

'Green Port' concepts in the port business can be a complete effort to address environmental challenges from a port operation by incorporating all parts outlined in the green port concept. To become the port of the future, India's ports must undergo a well-planned and coordinated transformation, excelling in operational efficiency, environmental preservation, green economic growth, and societal endeavours. This transformation concept can begin with regulatory compliance, then vigorous action on all environmental issues, optimization on a proactive strategy to accomplish sustainable goals, and finally transformation into a fully Green Port.

**Green Growth in India** is a concept that goes beyond climate mitigation and adaptation to achieve socially inclusive and environmentally sustainable economic growth. **Green growth was recognised by the Ministry of Environment, Forestry, and Climate Change** in its vision, which prioritised 'poor eradication' alongside green growth. Green growth, according to the Indian Finance Commission, entails "rethinking growth plans in terms of their impact(s) on environmental sustainability and the environmental resources available to poor and vulnerable communities." The Finance Commission and the Ministry of Environment, Forests, and Climate Change have both stated that inclusion is critical to India's green growth.



**Ministry of Environment,  
Forest and Climate Change**  
Government of India



Environmental management and conversation are implemented through including environmental issues into development plans, as well as all necessary decision-making systems. The fundamentals of sustainable development, which include economic growth, social progress, and environmental preservation, were also crucial in the policy formation.

All environmental aspects must be integrated into all stages of development, including programme planning, under the integrated development planning and execution model. These environmental obligations should be included in all port economic planning programmes, including master plans, framework plans, and internal plans, according to port management. Environmental concerns should be incorporated into and enforced by a systematic evaluation process, taking into account social, economic, and health repercussions, in order to build any green port policies in any respective ports.

NPE also stressed the need of industries developing policies that lead to operations in terms of emissions prevention and environmental degradation control with fewer environmental consequences. An integrated strategy to pollution control and prevention can take numerous forms, including the adoption of best feasible techniques for pollution reduction or source control for all main pollutants to air, land, and water. This plan also urged businesses to take steps to design and execute environmental management systems (EMS), including collaborating with other universities and research institutes to boost research and development of environmentally friendly technologies.



Green activities in ports are also being pushed as a sunrise segment in MIS 2016 as part of the aforesaid drive to ensure ecologically benign operations and sustainable port development. By 2020, 135 MW of solar power projects will be installed across eight major ports, and 50 MW of wind energy projects will be installed across three major ports. The shipping ministry has also launched an incentive programme to encourage the use of green energy at key ports, promising to cover up to half of the entire cost of waste water treatment projects and biodiesel promotion.

Incentives such as reduced port taxes for environmentally friendly ships, as offered by other ports around the world such as Rotterdam and Hamburg, will go a long way to promote green ports in India. San Diego, Singapore, Gothenburg, Vancouver, and Hong Kong are just a few of the ports that have implemented comparable green programmes.

Green ports are critical to India's maritime sector's development. To ensure the long-term development of the Indian marine industry, this notion must migrate from the margins to the centre of port operations and be integrated into the planning process.

## 4.3 Green Port Policy (GPP)

### Introduction

**Safe, Sustainable, and Green Marine Industry'** has been designated as a focus area in the **Maritime India Vision (MIV) 2030** to be a world leader in the maritime sector. MIV 2030 aims to improve port operations sustainability, which can be accomplished through an effective management system. While continuing with operational tasks, the system must concentrate on the process's safety, health, and environmental elements. Indian ports have launched a number of programmes to minimise, mitigate, and control pollution, including solar and wind energy adoption, the Swachh Bharat Abhiyan, and the Swachh Sagar portal for trash management, among others. However, there are currently no guiding principles or policy framework in place to guide the implementation of initiatives/interventions aimed at becoming more sustainable. This gap is filled by the Green Port Policy.

Owing to rising temperatures, **Green House Gas (GHG)** emissions and disruption of the natural ecosystem, "Climate change" has emerged as an existential threat to the planet. As a result, countries across the globe have adopted an international agreement at **United Nations Framework Convention on Climate Change (UNFCC) Conference of the Parties (COP) 21 in 2015**, to act against climate change. India has played a prominent role in the climate change negotiations. Under the agreement, countries publicly announced their voluntary actions against climate change, known as "**Intended Nationally Determined Contributions (INDCs)**".

### The Context

India has emerged as a leader in climate change and has declared its ambitious INDC targets. Some of these targets are as follows:

1. Reduce emissions intensity per unit GDP by 33-35% below 2005 levels by 2030;
2. Create additional carbon sink of 2.5-3.0 billion tonnes of carbon dioxide through additional tree cover;
3. Increase share of non-fossil fuel-based power generation capacity to 40% by 2030. Ports constitute a critical infrastructure sector and are responsible for around 95% external trade (by volume).

Ports also are a source of air and water pollution, and GHGs.

Globally, targets have been set for the Shipping sector as well. These are as follows:

- International Maritime Organization (IMO) has set a target of 40% CO2 reduction from shipping sector by 2030.
- 'CEOs of 11 major global ports participated in World Ports Climate Action Program (WPCAP) and pledged a series of 5 agreements to reduce carbon emissions in their ports.'

India has lofty climate targets that will necessitate measures across important industrial and infrastructural sectors, and the port sector's initiative against climate change will be the "Green Ports Policy."

### **The need for the policy**

**The Green Ports Policy (GPP) aims to build on the MIV 2030 goals** by providing information on various implementation models and incentive frameworks. The goal of this strategy is to **encourage stakeholders (port operators and port authorities) to develop steps that will lessen the sector's influence on climate change.** This policy paper has been written to address the Indian Ports' sustainability and environmental issues. This policy is an integral part of the Indian government's overall sustainability strategy. For port operators and port

authorities, the Green Ports Policy document captures the target areas, measure results, implementation plan, cost recovery mechanism, capacity building, and monitoring mechanism.

The proposed objective outcomes will assist India in meeting both the INDC and the IMO 2030 targets. The goals set out in this policy paper are consistent with the MIV 2030 document, which also includes a list of goals that ports should strive for in order to ensure sustainable infrastructure and operations. This policy document will enable the ports to meet the MIV 2030 document's environmental goal.

This Green Port Policy is applicable to both major and non-major ports in India.

### **Primary targets**

The following focus areas and targeted outcomes have been identified for Indian ports to attain the 'green' port status:

S. No.	Focused Areas	Measured Outcomes
1	Green House Gas (GHG) emissions	<ul style="list-style-type: none"> <li>Calculate the baseline level for GHG emissions (Scope 1, and 2) as of 2021.</li> </ul>

S. No.	Focused Areas	Measured Outcomes																		
		<ul style="list-style-type: none"> <li>Reduce the Scope 1, Scope 2 emissions by 20% by 2025 below from 2021 levels, and 40% by 2030 below from 2021 levels.</li> <li>Port authorities shall ensure that minimum 60% supplied power are sourced from renewable sources by 2025. Port authorities shall strive to provide 100% green power by 2030.</li> </ul>																		
2	Pollution control	<ul style="list-style-type: none"> <li>Reduce the pollution levels over their 2021 levels</li> </ul> <table border="1"> <thead> <tr> <th>Pollutants</th> <th>Targets to be achieved by 2025</th> <th>Targets to be achieved by 2030</th> </tr> </thead> <tbody> <tr> <td>NOx</td> <td>25%</td> <td>50%</td> </tr> <tr> <td>Non-methane volatile organic compounds</td> <td>15%</td> <td>30%</td> </tr> <tr> <td>PM<sub>10</sub></td> <td>25%</td> <td>50%</td> </tr> <tr> <td>PM<sub>2.5</sub></td> <td>25%</td> <td>50%</td> </tr> <tr> <td>Black Carbon</td> <td>40%</td> <td>80%</td> </tr> </tbody> </table> <ul style="list-style-type: none"> <li>WHO Air quality guideline values for PM<sub>2.5</sub> is 5 µg/m<sup>3</sup>, for PM<sub>10</sub> is 15 µg/m<sup>3</sup>, NO<sub>2</sub> is 10 µg/m<sup>3</sup> and for SO<sub>2</sub> is 40 µg/m<sup>3</sup>. These targets may be considered as absolute target values for every ports.</li> </ul>	Pollutants	Targets to be achieved by 2025	Targets to be achieved by 2030	NOx	25%	50%	Non-methane volatile organic compounds	15%	30%	PM <sub>10</sub>	25%	50%	PM <sub>2.5</sub>	25%	50%	Black Carbon	40%	80%
Pollutants	Targets to be achieved by 2025	Targets to be achieved by 2030																		
NOx	25%	50%																		
Non-methane volatile organic compounds	15%	30%																		
PM <sub>10</sub>	25%	50%																		
PM <sub>2.5</sub>	25%	50%																		
Black Carbon	40%	80%																		
3	Biodiversity (if applicable)	<ul style="list-style-type: none"> <li>Port operators to achieve 'Zero bio-diversity loss' by 2025</li> <li>Port operators to achieve Zero waste, Zero Waste to Landfill, Zero Incineration, Zero Unauthorized Disposal, Zero Effluent Discharge by 2030</li> <li>50% Reduction by 2025 and 100% by 2030 in Water Pollution by shipping companies or any related third party</li> </ul>																		
4	Resource utilization	<ul style="list-style-type: none"> <li>Port operators to recycle and reuse 50% of their water consumption by 2025</li> <li>Port operators to create provisions for rainwater harvesting within the port premises by 2025</li> <li>Port Operators to implement Sewage Treatment Plant within the port</li> <li>Port operators to ensure at least 20% reduction in water consumption from its 2021 values by 2025.</li> </ul>																		
5	Productivity driven by automation	<ul style="list-style-type: none"> <li>Port operators and authority will identify options and implement solutions to enhance levels of automation in select port activities that will enhance productivity and help achieve outcomes 1-4.</li> </ul>																		

## **CHAPTER 5**

### **5.0 The Green Port initiatives on few of the major ports**

#### **5.1 HALDIA PORT**

The Haldia Dock Complex was created at the confluence of the Haldi River and the Hooghly River. As the port's partner, the Kolkata Port Trust was established. As a result, it is not a port. It's a government-run dock complex.



**HALDIA DOCK COMPLEX**

#### **Haldia on becoming as India's first Green port**

Union minister of road transport, highways and shipping Nitin Gadkari said the government is working on bio-diesel consumption regulations as he opened the bio-diesel dispensing facility at Haldia Dock Complex on Wednesday. "New standards will be in place in a couple of months," he stated. With this plant, Haldia Port will become the country's first green port, using bio-diesel to power its railway engines, lorries, and other vehicles. Emami Agrotech will supply the required biodiesel to the port, with a production capacity of 1.2 million tonnes.



**Haldia port as the cleanest port in India**

## **5.2 Mangalore Port**

New Mangalore Port is a tiny all-weather port located in Panambur, Mangalore, Karnataka, India, and is the deepest inner harbour on the west coast. It is Karnataka's only significant port and India's seventh largest port. The New Mangalore Port Trust manages it (NMPT).



New Mangalore Port, nestled between the turquoise waters of the Arabian Sea and the green towering Western Ghats, has seen exponential expansion in terms of trade and commerce throughout the last five decades of its service without compromising vital and critical environmental features. "MARITIME INDIA VISION 2030," an ambitious initiative of the Ministry of Ports, Shipping & Waterways aimed at

reforming the Indian maritime, has emphasised Green Port Initiatives, under which it seeks to construct green sustainable ports with a goal of increasing renewable energy to over 60% by 2030. As a result, New Mangalore Port has successfully adopted a number of initiatives aimed at improving environmental performance.

The Port has created a green belt around its vicinity and has earmarked 33% of its land area exclusively for greenery. For the last 5 years 1 lakh saplings were planted and the process is still going on.

**The Port has developed Sewage Treatment Plant** with a capacity of 1.20 MLD inside the Port area. This STP is enabled to receive domestic sewage of township and inside the Port as well. The treated water is used for watering the green belt and also for water sprinkling in operational areas.

The Port has installed **Slop Reception facility** for the vessels visiting to the Port and ensures hazardous wastes are disposed through authorized recyclers only. The Port has also developed an Oil Spill Response plan to monitor and control oil spills. Oil pollution drills are conducted regularly in compliance with NOSDCP and NMP is the first port to record the approval of its OSCP in 2017 by ICG complying with Tier-I OSR facility. To meet the water requirement, the Port has envisaged comprehensive plan to harvest the rain water. In this direction, 3 large water bodies have been created inside the Port area, in the catchment areas covering 64,217 Sq.Mtrs. with a capacity of 1,10,340 CUM of water. Due to creation of water bodies, the water levels in the nearby village wells also got recharged. Port is now self sufficient in its water requirement.

**The Port has installed 5.2 MW solar plant** in addition to roof top solar panels at the top of buildings and storage sheds at a total expenditure of Rs. 33.75 crores. The Port has generated total solar energy of 34.95 million KWH up to December 2021 & has achieved the coveted credit of

meeting 100% of its power requirement from the solar panels. Due to this nearly 29,709 tonnes of carbon foot print has been reduced (up to December 2021) and helped in saving approximately Rs. 23 crores in electricity bills for the port in 5 years.

**The Port has also switched over to LED lighting** which are more environment –friendly coupled with power saving. Over the years the port has mechanised almost 90% of its operations so as to mitigate dust pollution in the operational areas as per the Green Port initiatives under MIV 2030. Handling of coal, IOP, cement, etc are now fully mechanized. The port is also not lagging behind in usage of e-vehicles. All the port vehicles will be changed to electrical vehicles in phases. Two electric buses will be hired for transportation in operational areas inside the harbor in view of adopting multi-clean fueled vehicles.

As part of the future plans the Port **will be constructing an exclusive in-house facility to manage solid waste generated in the residential area & Port premises.** The plastic waste generated in the Port will be segregated & disposed through an authorized recycler as per Central Pollution Control Board guidelines. In view of reusing the materials generated through Dredging in Port waters the work feasibility study has been entrusted to NTCPWC, IIT (Chennai). The Port is also actively pursuing in coordination with Karnataka State Authorities to have an LNG import facility at the Port with a prospective operator i.e. LNG ALLIANCE which has shown interest in providing the facility.



**MANGALORE PORT TRUST**

### **5.3 THE PORT OF KOLKATA**

**The Port of Kolkata or Kolkata Port, officially known as Syama Prasad Mookerjee Port Trust (previously Kolkata Port Trust),** is India's only riverine major port, located 203 kilometres (126 miles) from the sea in Kolkata, West Bengal. It was built by the British East India Company and is India's oldest working port. Kolkata is a saltwater port with no salinity variations. The port includes two separate dock systems: the Kolkata Docks in Kolkata and the Haldia Dock Complex near Haldia, which has a deep water dock.



### **The port of Kolkata**

The Green Port programme has envisioned 143 initiatives for the Kolkata Port, with 68 of them relating to the green maritime industry. These include a thorough examination of the current situation in Haldia and the Kolkata Dock Systems (KDS), as well as recommendations for improving air quality, energy efficiency, and trash management, among other things.

The port has also made shore power supply to vessels available in 13 berths and for river cruise vessels, at the Indenture Memorial Jetty operational. Moreover, at the Liquid Natural Gas terminal, concession was given to H-Energy for LNG at Kukrahati, which will enable LNG bunkering in future while a water harvesting system has been implemented at various offices/ complexes of the Kolkata Dock System (KDS). A 160 kW roof-top solar panel was installed in KDS and a one MW solar power plant was commissioned at Haldia Dock Complex(HDC).

While wind barrier installations are planned in HDC, a rigorous GIS analysis on green belt area development is presently underway. The port

authorities stated that IoT sensors have been installed in tugs to monitor vessel movement and fuel use in order to reduce fuel consumption. On Nayachar Island, a mangrove forest was created. On a 19-acre tract of land in Dhobiatalao, KDS, an urban forest is being constructed.

Meanwhile, the Kolkata Port authorities hope to complete the following projects by 2030: a 20,000 square metre shed with a rooftop solar plant at KDS by December 2022. A portion of the Jellingham project land under the port at Shalukkhali will be used for solar power generation.

Investigate the possibility of deploying hybrid diesel/battery operated engines for tug boats and other small craft, harnessing tidal and wave energy for power generation, and collaborating with dredging partners to identify and build port-specific recycling and reuse strategies and roadmaps, among other initiatives.

#### **5.4 JAWAHARLAL NEHRU PORT TRUST**

Under the Maritime India Vision 2030, JNPT intends to use 60% of renewable energy, Adoption of Multi Fuel (CNG/Electric / LNG), Shore Power, LNG Bunkering, Energy Efficiency Smart Lightning, Green Belt Cover, Water Conservation/Sewage Treatment, Upcoming solar plants of 2.5MWp.

Jawaharlal Nehru port is committed to sustainable development, and the Port takes adequate measures to maintain ecological balance. The total land available with JNPT is around 3402 hectares out of this, 1147 hectares area (34%) of the Port is under green cover, including mangroves. The Port's ecosystem consists of rich and diversified flora and fauna. To address the Global climate change problem at the port level, the Port has taken the initiative to acquire "Green Port Status".



## **JAWAHARLAL NEHRU PORT TRUST**

### **5.5 PARADIP PORT**

Chairman Paradip Port Trust, Shri P L Haranadh, affirmed that the Port is in line to the Ministry's vision and is committed to reduce its carbon footprint. Shri Haranadh says that some roof top solar plants based on the RESCO concept have been constructed in Paradip, and that talks are underway with the Odisha State Government about providing roughly 50 acres of land for a 10 MW solar facility. To encourage the use of multi-clean fuels, Paradip Port is working with oil companies such as IOCL, BPCL, and GAIL to develop a framework for establishing an LNG depot at the port and converting existing dumpers to LNG engines. Around 30 kilometres of rail line have been electrified at Paradip Port, with the goal of electrifying the entire rail network by 2024. Diesel locomotives will also be phased out in the coming years.

Several dust management systems have already been carried out at PPT that includes net barriers around port premises, covered conveyor belts and pipelines from nearby industries, water sprinklers and dry fog dust

suppression system at berths, siding plots & MCHP. Use of mist cannons, road sweeping machines and truck tyre washing systems are few activities that have been carried out to mitigate dust on roads.

Under waste management, Paradip Port has already installed three Sewage Treatment Plants of total 6.5 MLD capacity, water from which is being used in mist cannons, water sprinkling systems and gardening. Around 50 acres of land have been provided to Paradip Municipality for solid waste management. Paradip Port has undertaken an agreement with Numaligarh Refinery Limited (NRL) for using about 2.3 million cubic meter of dredged material for land reclamation of its upcoming crude oil tank



terminal at Paradip.

## **PARADIP PORT**

### **5.6 COCHIN PORT TRUST**

Cochin Port Trust has taken up a slew of green initiatives under Maritime Vision 2030 that includes aiming for 100% solar electricity powered cranes in future, shore based power supply to all ships/vessels at all the berths in Willingdon Island, Vallarpadam ICTT, COT, NTB, STB & LNG terminal and utilise available vacant land/waterfront area for solar power generation under PPP or other suitable mechanism.

In the first phase, shore based power supply will be provided to Cruise ships visiting Cochin Port.

Cochin Port Trust plans to develop more roof-top solar power plants with a capacity of 350 kWp in the next two years, as well as grid-connected floating solar panels under the RESCO model. Consumers are also encouraged to install solar power plants on their properties by Cochin Port. Solar power plants with a capacity of 190kWp have already been installed by port users. In the year 2020, the Cochin Port Trust would generate 3.27 lakh units of power, saving Rs.22.50 lakhs. The Port has already implemented smart electrical metres and smart street lighting, which have resulted in lower electricity consumption.

Green Port initiatives already taken up by Cochin Port include, Bio gas plant using food waste and other biodegradable waste 75 to 90 Kg of Food Waste that can generate 3 to 4 Kg gas per day/plant and a Septage Treatment Plant within the Port area having a capacity of 100 cu.m/day Cochin Port has already installed mechanized cargo handling infrastructure for hazardous cargo like cement, chemicals, fertilizer etc.



**COCHIN PORT TRUST**

## **5.7 MUMBAI PORT TRUST**

As per a release, some of the major initiatives undertaken by Mumbai Port are as follows:

### **1. MW solar rooftop installation**

At Mumbai Port, 1 MW solar rooftop installation was completed in 2021 and 0.4 MW earlier, satisfying 48% of the port's energy needs through renewable energy. A policy for giving priority to CNG, LNG and electric vehicles for port entry is in the offing. Shore to ship power is being provided for port-owned vessels, vessels in dry dock and Coast Guard vessels. Shore to ship power facility will be provided in future to cruise vessels and also at the Oil Tanker Terminal. Smart lighting of port areas is operational and pilot studies for smart lighting in office areas is underway.

### **2. An Eco Park**

An Eco Park at Sewree for conservation of bio-diversity and mangroves is planned for development on PPP basis. Fish wet waste is being processed

in Sassoon Docks. A FSRU for LNG, to satisfy energy needs, will be developed off Karanja Island, for which LoA has been issued to SP Armada Clean Energy Ventures.

Discussions are on for bunkering facilities for LNG with BPCL, HPCL and IOCL. Besides, some discussions have also happened with HPCL and BPCL for hydrogen generation facilities. Some pilot projects are being designed with domestic and international support for having solar/electric/hybrid fuel ferries and supply vessels in Mumbai Harbour.



Image courtesy of Mumbai Port Trust

## **MUMBAI PORT TRUST**

### **5.8 CHENNAI PORT**

Chennai Port is the third largest container port of India. The port is the largest one in the Bay of Bengal.

Chennai port has taken green initiatives with a 500 kW solar energy project and a wind farm capable of generating 14.5 MW power. Chennai Port Trust in India's Tamil Nadu state intends to install wind turbines through a public-private partnership to cover part of its electricity demand. Chennai Port Trust in India's Tamil Nadu state intends to install wind turbines through a public-private partnership to cover part of its electricity demand. Chennai Port Trust has also taken steps to make the port a "Green Port" by meeting its major portion of its energy requirement through renewable energy. Since the Chennai Port has committed itself to generating 500 KW solar energy, out of which 100 KW (Phase-I) was awarded to Alectrona Energy Pvt. Ltd.



**CHENNAI PORT**

## **5.9 ENNORE PORT(KAMARAJAR PORT)**

Ennore Port was recently renamed as Kamarajar Port. It is located on the Coromandel Coast, about 24 km north of Chennai Port, Chennai, and is the 12th major port of India. The port was declared as a major port under the Indian Ports Act, 1908 in March 1999 and incorporated as Ennore Port

Ltd under the Companies Act, 1956 in October 1999. Kamarajar Port is the only corporatized major port and is registered as a company. This port is designed as Asia's energy port and seen as a satellite port to decongest and improve the environmental quality at the bustling Chennai Port.



**ENNORE (KAMARAJAR) PORT**

## **5.10 VO CHIDAMBARANAR PORT**

V.O. Chidambaranar Port Trust, Tuticorin has been the trendsetter in establishing Roof Top Type Solar Power Projects among the Major Ports. The port has already established 500 KW Rooftop Solar Power Plants at a cost of Rs. 4.78 crores through Power purchase agreement.

The Roof top solar Power plants have been established at various premises of the Port spanning a total area of 5530 Sq.m. with 1779 panels. The average monthly generation from the roof top Solar Power is about 5800 KWh units. The installation of Roof Top Type Solar Power Project have enabled the port management to reduce carbon foot prints to a tune of 476 Metric Tonnes per year.

In addition to the 500 KW rooftop solar power already installed at the Port, orders have been issued to Tamil Nadu Energy Development Agency (TEDA), Chennai for installing 140KW solar roof top power plant at various locations of Port establishments at a value of Rs.76 lakhs. The

above project would be commissioned by the first quarter of 2020 and the expected average power generation per year would be Two lakhs units.



## **VOC PORT**

### **5.11 VISHAKAPATNAM PORT**

The project “Mechanization of General Cargo Berth” at Vizag Port for coal handling is in itself an Environmental Management Programme. GCB is an eco-friendly facility.

A well designed dust suppression system with atomized water sprinkler has been installed at GCB to eliminate dust. The accumulated sprinkled water is recycled using settlement tanks.

Further, consumption of renewal energy viz., solar power is under process.



**VISHAKAPATNAM PORT**

## **CHAPTER 6**

### **COMPARISON AND FINDINGS**

By comparing from the green port initiatives of the Indian major ports due to lack of secondary data, only a part of the information is being possessed to do this research and the following are the findings from the above research made.

Cochin Shipyard Ltd. is working on a number of projects to increase the share of green shipping, including hybrid electric ferries, autonomous zero-emission vessels, pilot projects on hydrogen fuel cell ferries, electric catamaran water taxis, hybrid electric ro-ro, hybrid LNG-electric inland cargo carrier, hybrid tugs, and more.

Primary data has been used to study the current scenario of Indian ports, environmental impact of Indian ports and effectiveness of measures taken by port officials to reduce the pollution at ports







Indian ports and maritime bodies need to focus on key environment, safety and health areas such as:

- Increasing Renewable Energy usage at ports
- Improving Air quality at ports
- Optimizing water usage and increasing green cover
- Improving solid waste management
- Dredging material recycling
- Zero accidents, injuries or health hazards at ports
- Centralized monitoring of KPIs and compliance to global standards

Major Ports currently have approx. ~118 M W generation capacity<sup>2</sup> through Solar PV, with both Rooftop PV and Floating PV gaining commercial acceptance at ports.

With economic factors driving the need for port operators to maximize revenues, it is necessary that ports optimize all available water, air, land and soil and

**Exhibit 9.2 | Comparison between off-shore and on-shore wind farms**

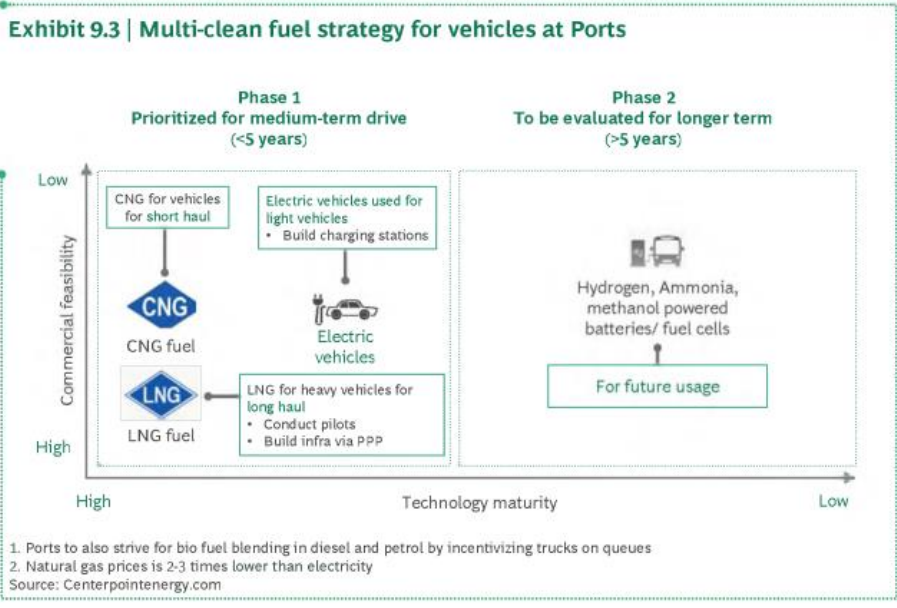
Key model parameters	Off Shore Wind farm	On-shore Wind farm
 Cost of construction & maintenance	High: due to installation away from shore	Low: due to installation in on/near ports (shallow water/ breakwaters, etc.)
 Energy collection by wind mill	High: due to no physical blockages	Med: due to presence of physical restrictions
 Efficiency or, voltage drop	High: due to larger cabling distance	Low: due to shorter cabling distance
 Noise pollution for ports	Low: wind mills are far out in the sea	High: wind mills are on the shore
<b>Global Examples</b>	 <b>Europe &amp; Scandinavian countries</b> <ul style="list-style-type: none"> <li>Scotland has installed 5 off-shore wind turbines</li> <li>14 European ports allocated 430 ha to off-shore wind related activities</li> </ul>	 <b>Rotterdam, Zeebrugge, Hamburg</b> <ul style="list-style-type: none"> <li>Successfully installed wind power plants for use of power in ports and also provide energy to nearby areas</li> </ul>
<b>Indian Ports</b>		<ul style="list-style-type: none"> <li>Wind farm operational at Deendayal (21 MW)</li> <li>Additional project at VoCPT, Kamarajar Port</li> </ul>

Source: Press Search

societal space to the best of their ability.

Air emissions from the land and sea based sources are one of the major source of pollution in the port areas due to terminal activities. During construction phase use of vehicles, equipment for land based activities, excavation, and transportation may result in combustion emissions. During the operational phase combustion emissions from vessels add to the land based activities like cargo handling, engines, broilers etc.

- to be greener
- These heavy vehicles will make up 15% of its truck fleet
- storage and rail terminal
- Offers incentives (monetary and queue prioritization) on clean fuel-LNG consumption
- for short-haul drayage routes



As a result, India's new "Green Port" project is a step toward more responsible maritime transportation. All of the country's state-owned ports now function on renewable energy, making it the first in the world. According to sources, solar and wind energy power ports at Kandla, Mumbai, Thoothukudi, Kochi, Chennai, Kolkata, Visakhapatnam, Paradip, Mormugao, and Mangaluru nearly two years after the project was first announced. Docked ships will be able to use the port's green energy to offset carbon emissions, which are typically 5x-10x higher than the port's emissions. The Green Port project involves obtaining equipment for monitoring environmental pollutants and dust suppression systems, as well as building up waste-water treatment plants, all with a goal of cleaner day-to-day operations.

Green Port brings us closer to the Sagar Mala logistics development project, a bigger overhaul aimed at boosting shipping's decreasing proportion of cargo flow. The country's cargo flow is handled by less than half of the country's new green ports, which are the major ports.

## CHAPTER 7

### CONCLUSION

Eight key interventions were identified to improve the Safety and sustainability at Indian ports and maritime bodies:

**Renewable Energy:** Make Indian Major Ports green & sustainable by increased usage of renewable energy (solar, wind and advanced energy solutions)

**Air Quality improvement:** Improving usage of clean fuels and other measures at ports  
Water usage optimization:

**Developing water treatment infrastructure and employing water conservation techniques across ports**  
**Improving Solid Waste management:** Improve waste segregation, recycling & re-use and promoting waste to wealth in alignment with Swachh Bharat Mission

**Dredging Material Recycling:** Employing sustainable dredging disposal mechanism to improve dredging material that is recycled and reused at ports.

**Zero Accident Safety Program:** Improving safety across key elements - risk audit, safe equipment handling, process re-engineering, and safety culture & training

**Occupational Health management:** Drive medical monitoring of workers and strengthen occupational health centres & services across ports.

**Centralized Monitoring:** Driving compliance to international standards, conduct robust target setting and ensure central monitoring of KPIs As part of Vision 2030, globally benchmarked targets have been defined to help India improve Safety and sustainability at Ports

By focusing on green port strategy in Indian ports, this study aims to discover the differences in green port management philosophy between developed and developing countries. A comparison between the major ports of India were made. From the analysis, it was found that these ports are very active in implementing green initiatives in port activities, which includes several strategies for mitigating noise, waste and dust, but not so effective in minimizing ship emissions and hinterland transport systems. These ports tend to focus on issues within their jurisdiction, as historically seen: ports in developed countries, first to take action within the port, but less likely to move against carriers and the intermodal transport. In India, the port authorities were mainly concerned with environment conservation and the management of waste and dredged materials to prevent marine pollution mostly only in the early stages. However, energy efficiencies issues gradually evolved from time to time and became a major issue that received less focus.

Like some other developing countries, India is moving forward gradually towards sustainable development. It revealed from interviews that with certain green port policies in effect (and others to be implemented), Indian ports were in the right path and can be regarded in their early stage' of being a fully green port.

## **BIBLIOGRAPHY**

### **Websites**

- [sagarmala.gov.in](http://sagarmala.gov.in) (green port initiatives)
- [iaeme.com](http://iaeme.com)
- [www.researchgate.net](http://www.researchgate.net) (green ports in theory and practice)
- [oceanconference.un.org](http://oceanconference.un.org)
- Google Scholar