Green and Efficient Ports

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3-5 December 2025

पत्तन, पोत परिवहन
एवं जलमार्ग मंत्रालय
MINISTRY OF
PORTS, SHIPPING
AND WATERWAYS

सत्यमेव जयते

जनेप प्राधिकरण
JNPA

INDIA'S LARGEST CONTAINER PORT

Enabling ONSHORE POWER SUPPLY

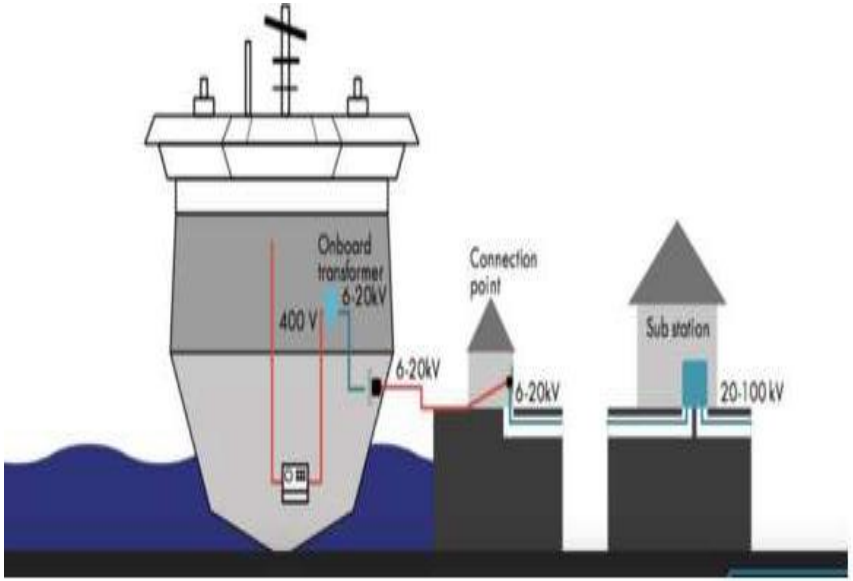
- India's first large scale "green investment" in Shore power Infrastructure

JNPA - India's first port to develop Shore Power Infrastructure at scale

INDIA'S LARGEST CONTAINER PORT

JNPA is one of the pioneering adopters of shore power technology in emerging markets, a first-of-its-kind initiative for Exim vessels at any major Indian port at this scale. Shore power allows vessels docked at port to connect to the local electricity grid, shutting down their diesel auxiliary engines, thereby reducing greenhouse gas emissions and cutting local air pollutants such as nitrogen oxides and particulate matter.

Illustrative diagram of typical Shore Power Supply



7 TERMINALS

DELIVERED OVER 2 PHASES OF PLAN IMPLEMENTATION

$70M

2025 ESTIMATE TO PROVIDE SHORE POWER, INFRASTRUCTURE

9,838 LESS CO_2T

THROUGH IMPLEMENTATION BY FY 2030 OVER NO IMPROVEMENT SCENARIO

80% LESS NO_X, SO_2

THROUGH IMPLEMENTATION BY FY 2030 OVER NO IMPROVEMENT SCENARIO

(Air Pollution for Mumbai Metropolitan Region)

VALUE CREATION

- ✓ DECARBONIZATION
- ✓ ESTABLISH A SCALABLE MODEL FOR REPLICATION ACROSS INDIAN PORTS, SOUTH ASIA

Why Innovation ? Sustainability is core to JNPA strategy

- The implementation of this technology at a major port like JNPA thus marks a **pivotal shift from policy commitment to early commercialization,** with potential for replication across India's major ports.
- The **port's prominent role**, handling over half of India's containerized trade among major ports, reinforces its visibility and establishes environmental and operational precedents nationwide.
- From **a market perspective**, if Indian ports adopt shore power infrastructure, they could position themselves as preferred nodes in Europe-linked trade routes, where shore power use for vessels at berth is mandatory. This is supported by growing willingness from international carriers to utilize shore power—supported by their commitments to ZEV 2040, IMO regulations, and other pledges.
- **Alignment with Government of India (GoI) regulatory frameworks**: India has adopted an ambitious agenda to align with IMO's Net Zero framework to phase out GHG emissions in the sector by 2070. Among other policy actions development of shore power facilities (also known as "cold ironing" or "onshore power supply" – OPS) in major ports to mitigate emissions and air pollution from ships docked at the ports is incorporated in Green Port Policy and Harit Sagar guidelines,

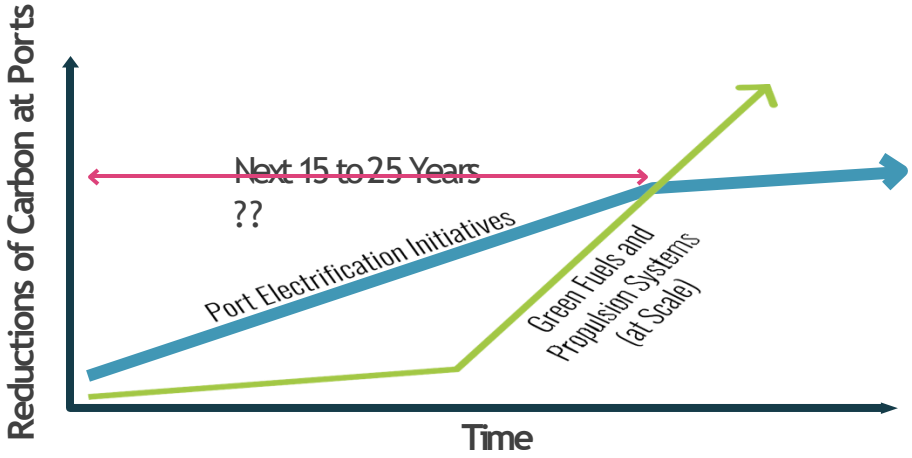
Studies estimate that **~ 7% of total shipping emissions occur in or near ports** during maneuvering and berthing phases.

In Indian container ports, average berth time can exceed **2 days per vessel**, more than double the global average of 1.05 day. Prolonged idling results in significant emissions from auxiliary engines, negatively impacting GHG emissions, port-area air quality, and public health.

Innovation = Long Term Payoffs ?

The IMO estimates total shipping emitted **1,056 million tons of CO2 in 2018**, accounting for about 2.89% of the total global anthropogenic (human activity-related) CO2 emissions for that year (International Maritime Organization, 2021). As shipping continues to expand, IMO business-as-usual scenarios suggest emissions could represent 90-130% of 2008 emissions by 2050. **Shore power systems are a proven way to reduce in-port and near-port emissions of air pollution, benefiting air quality for communities located near or adjacent to the port, many of which are non-attainment areas for criteria air pollutants (USEPA, 2022; USEPA, 2017).**

THE PUSH FOR RESULTS TODAY



While shore-to-ship electrical connections are established in some advanced economies, no Indian port has successfully commercialized OPS for container vessels at scale until now. <u>Globally only 3% of Ports have enabled shore power supply systems</u>

Implementing Shore Power : Key Challenges, Potential Risks

SYSTEM COSTS

$6-$15M PER BERTH OGV SHORE POWER SYSTEM COSTS, EXCLUDING UTILITY UPGRADES

Moffatt & Nichol Estimate, 2024

OCEAN GOING VESSEL READINESS

< 20% OF OGV CONTAINER VESSELS EQUIPPED WITH SHORE POWER CONNECTION / SYSTEMS

Shore power investments face potential **under-utilization** in early years due to **delayed vessel readiness** and regulatory adoption.

IMO adoption of Net Zero Framework has recently been delayed by a year, potentially compromising international shipping line commitment until these timelines are reinforced.

UTILITY SUPPLY AND RELATIVE COSTS

"The **relative cost of using shore power instead of a vessel's onboard fuel sources** is more attractive when fuel costs are greater than electricity costs."

"Many ports still do not have the appropriate infrastructure to connect vessels to shore power – upgraded connections to the electrical grid are often required"

EPA Shore Power Technology Assessment at U.S. Ports, 2022

UTILITY FUEL MIX

Challenges to sustainability achievement as the reliance on India's currently **carbon intensive grid** continues, but these risks are likely to ease as grid decarbonization continues.

Based on conservative estimates, JNPA is likely to use most of the electricity from Indian grid with an emission factor of 515.9 gCO2/KWh, that is 14% less carbon intensive than the fuel oil currently used by vessels at the berth (598.50 gCO2/KWh), thereby avoiding ~ 10,000 tCO2e P.A. by 2030.

Developing VADHAVAN PORT

- India's first greenfield Offshore Port by JNPA

Vadhavan Port – Brief Overview

India's planned deep-water, offshore port located in Maharashtra, designed to be a major global maritime hub that will **double India's container handling capacity**. It is being built entirely **on reclaimed land offshore**, making it a key part of India's maritime infrastructure development and strategically positioned to boost trade, particularly within the India-Middle East-Europe Economic Corridor (IMEC).

Key features of Vadhvan Port

- **Offshore and deep-water design:** The port is being constructed in the sea, eliminating the need for local rehabilitation and resettlement, and will have a draft of over 18 meters to accommodate large ships.
- **Capacity:** It is designed to handle approximately 23.2 million TEUs (twenty-foot equivalent units) by 2040, doubling India's current container capacity.
- **Infrastructure:** It will feature nine container terminals, liquid cargo berths, Ro-Ro facilities, and multi-purpose terminals.
- **Connectivity:** It will have excellent road and rail connectivity to industrial hubs in northern India, including proximity to the Delhi Mumbai freight corridor and the Delhi Mumbai expressway.
- **Strategic importance:** The port is strategically located to become a gateway for international trade and play a crucial role in initiatives like the IMEC, enhancing India's position as a global maritime hub.

Background - JNPT's need for a new "offshore" port

- **Decongest existing ports:** JNPA is nearing its capacity utilization and Vadhavan Port will relieve this pressure.
- **Handle growing cargo demand:** India's container traffic is soaring, and the new port is designed to handle the expected surge, potentially doubling the country's container capacity.
- **Accommodate larger ships:** Vadhavan will have a deep draft, allowing it to handle the increasingly large container vessels that are now common in global trade.
- **Boost international trade:** Vadhavan port is strategically located to become a major gateway for international trade, enhancing India's position in global shipping routes and connecting it to corridors like the International North-South Transport Corridor (INSTC) and India-Middle East-Europe Economic Corridor (IMEEC).
- **Drive economic growth:** The project is expected to create thousands of jobs and foster industrial and economic development in Maharashtra and the surrounding region.
- **Enhance logistics and efficiency:** Port's modern facilities and integration with other infrastructure, like the Delhi-Mumbai Freight Corridor, aim to reduce transit times and costs for cargo moving throughout the country.
- **Trans-shipment Focus** - GoI is keen to turn the port into a major Asian container hub.

The new port is expected to boost India's maritime trade, improve global competitiveness, accommodate larger vessels, and stimulate regional economic growth.

Why Offshore Ports work – International Experience

Economics improve viability of offshore ports

- **Offshore ports are designed to address inefficiencies** (improve economics) from port congestion, labor issues, ballast water treatment system requirements, fuel & air emission requirements, slower handling and turnaround times, and an inability to accommodate the largest (and most efficient) ships. The international shipping fleet is transitioning to larger vessels that are more economical to operate and decrease the cost per shipped container.
- **Hub-and-spoke distribution system of offshore ports** couples the most efficient way to move goods across the ocean (ultra-large containerships) with the most efficient way to move goods domestically (shortsea shipping). By trans-loading cargo from larger ships to smaller coastal carriers, freight can be sorted for regional markets on offshore port and move via a commercial waterway system. Optimization of freight movement given that 375% more freight can be moved by waterway compared to truck for a given amount of fuel.
- **Decreased costs for shipped goods -** If utilized, a system of offshore ports may garnish more competitive rates, possibly lowering shipping costs by $300 per TEU. With a projected 20MTEU of imports, can result in $6B/year in revenue generation, enough to pay for capitalization of the platforms and their operations over their useful life.
- **Downstream economic impacts -** domestic job growth, decreased highway maintenance due to less long-haul truck traffic, decreased traffic congestion add to the economic benefits of offshore ports.

Ecological, Social Upsides

- Overcome numerous challenges to continued port expansion shoreward side, such as the ecological impact of dredging and limits to reclamation in terms of international sea boundaries.
- Given that container ports are less labour-intensive than break-bulk ports, proximity to a large workforce is not essential, thus making an offshore location a possibility to consider in future.
- Effective strategy for reducing air pollution, alongside other benefits such as traffic reduction, is shifting some or all of the port activity to offshore ports.

Successful examples of offshore ports - Yangshan (Shanghai), Khalifa (Abu Dhabi)

Challenges in designing Vadhavan's Offshore Port Structure

The shift of the Vadhavan Port from an **onshore to an offshore site** was a strategic decision to mitigate significant challenges, including local opposition and environmental concerns, thereby improving project viability.

Issues

- **Land reclamation** problem and engineering challenges to build the port in deep water by cutting hills on land to source the sand/material needed for reclamation, adding to both environmental and financial costs
- **Land Acquisition**
- **Quelling Local Opposition:** Protests from local fishing and farming communities due to fears of displacement and substantial harm to their livelihoods and the environment.
- **Project viability, inefficiencies**

Mitigation

- **Sourcing alternative Reclamation Material**: The offshore plan uses material from marine borrow pits off the Daman coast, which is more cost-effective and reduces the onshore environmental impact.
- Port was **relocated to 4-6 kms inside the sea from the earlier onshore site** to address concerns over the ecologically fragile area, environmental damage, pollution and social concerns in Dahanu taluka.
- Offshore development also required **minimal land acquisition** for the main port operations (1,473 hectares of reclaimed offshore land), concentrating land acquisition efforts on the necessary road and rail connectivity (571 hectares).
- **Improved Operational Efficiencies** in offshore site to optimize the port layout for futuristic requirements, leveraging a natural deep draft of up to 20 meters, which allows it to accommodate ultra-large container vessels (>24,000 TEUs) without requiring extensive capital dredging for navigation channel.

Annexures

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INDIA'S LARGEST CONTAINER PORT

- JNPA was commissioned in 1989 – 36 years
- 7.30 million TEUs in FY 2024-25
- 23rd Globally in Container Port Performance Index 2020-24
- Ranked 28th in Top 100 Container Ports of the World
- 50% of container in Major ports handled in JNPA
- 21% of the country's Customs revenue is from JNPA
- 5 Container Terminals, 2 Liquid and 2 General Cargo
- Deep Water Draft of 15.5 M
- Ships of 18,000 TEUs capacity

Our Partners

INDIA'S LARGEST CONTAINER PORT

Container Terminals (10.2 MTEUs)

DP WORLD

Two Terminals
(Apr 1999/Jul 2006)
2 MTEUs

Lifting Global Trade
APM TERMINALS

One Terminal (Mar 2006)
1.8 MTEUs

PSA The World's Port of Call

Two Terminals
(Feb 2018/Oct 2025)
4.8 MTEUs

J M BAXI THE PORT SPECIALIST PORTS & LOGISTICS
CMA CGM

One Terminal (Feb 2023)
1.6 M TEUs

Bulk Terminals (18.5 MMTPA)

इंडियनऑयल IndianOil
Bharat Petroleum

One Oil Terminal (Feb 2002)
7.2 MMTPA

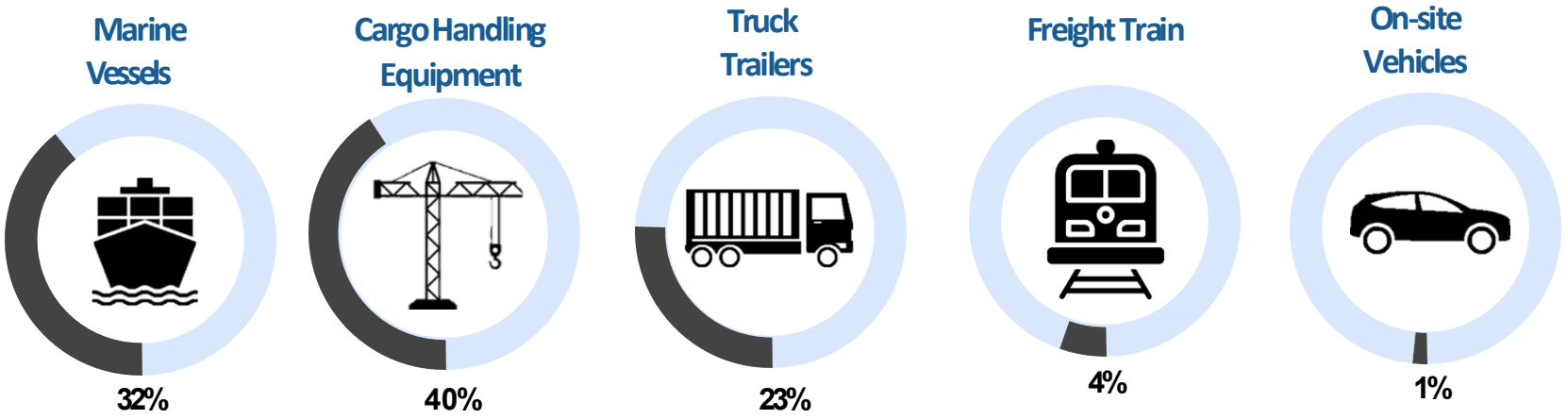
JSW

One Oil Terminal (Nov 2024)
4.5 MMTPA

J M BAXI THE PORT SPECIALIST PORTS & LOGISTICS

One Bulk Terminal
(May 2023) 6.8 MMTPA

Emissions From Various Port Activities



Various Port-Related Sources which Contribute to Total NO2 Emissions from a Port

JNPA's Initiatives to Control Pollution from Marine Vessels

Shore Power Supply

- **Shore power supply to tugs and port crafts** - Available
- **Shore Power for vessels – In process at an estimated cost of Rs.600 Crores for all terminals**

Reduction in TAT

THE WORLD BANK

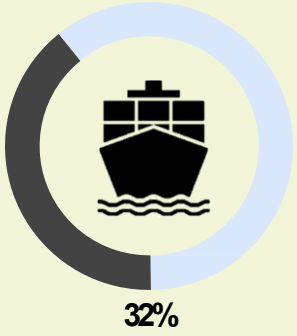
S&P Global

- **#1 Globally in TAT in 2022**
- **#23 Globally in CPPI 2020-2024**
- **#10 in Top 20 Global** Ports that improved performance in 2020-2024

Electric Ferry

- **Electric Ferry Boat**
- Part of Harit Sagar Initiative, aiming for net-zero emissions by 2047 set by the Ministry
- Faster Commute

JNPA's Initiatives to Control Pollution from Marine Vessels



Green Tug Transition Program (GTTP)

- **Present Fleet - 10** Conventional hired tugs.
- **Ministry Mandate - Minimum 2 Green Tugs** as per Green Tug Transition Program (GTTP).
- **Status -** 2 hired Electric Tugs with 60 Ton Bollard Pull will join by October 2027
- **Future Plan -** The conventional 10 tugs to be replaced with fully green tugs upon completion of their existing contract period (prior 2036) in a phased manner.

JNPA's Initiatives to Control Pollution from Cargo Handling Operations

INDIA'S LARGEST CONTAINER PORT

Cargo Handling Equipment

40%

RENEWABLE ENERGY

- **Total Demand – 18 MW**
- **Total RE Capacity – 45.67 MWp**
- **Current Share of RE - ~50%**
- **Expected by 2030 = 60%**
- **CO_2 Saving/Yr**: . ~42677 Ton

Electrification of CHEs

- **Total CHEs – 261**
- **Hybrid/Elecrtic– 45%**
- **Diesel CHEs - ~55%**
- **Expected by 2030: 72%**
- **For new PPP Operators**:. 100% Hybrid/ Electric

Oil Spill Response

JNPA won the prestigious 2024 Blue Planet Award for **Sustainability Excellence in Tier 1 Facility Operations in Ports** in 2024.

JNPA's Sustainable Initiatives to Control Pollution from Vehicular Operations

Truck Trailers

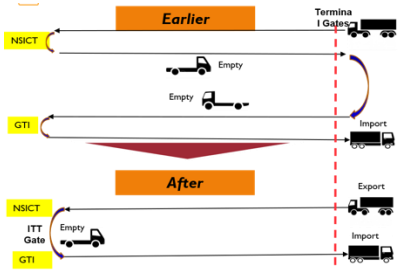
23%

On-site Vehicles

1%

Zero Emission Trucking

- 54 E-Trucks with 75 MT capacity
- Target – 550 by Dec. 2026
- Battery Swapping Station – 60 Batteries simultaneous charging



Inter-Terminal TT Movement

- Earlier Tractor-Trailers had to exit one terminal and then enter other.
- Now the TTs can move from one terminal to other
- Distance saved -7.5 Km/trip

Clean Fuel and E-Vehicles

Present Fleet –

- E-Cars – 10
- CNG Cars - 56
- Staff Buses – 22

Target –

- All Cars (66) as well as all 22 buses to be Electric by Dec. 2026

JNPA's Sustainable Initiatives to Control Pollution from Vehicular Operations

Truck
Trailers

23%

CENTRALISED PARKING PLAZA (CPP)

Area – 45 Ha
Smart Parking Slots -2,832 TTs
Reefer Points: 125
Parking for Reefer TTs - 250
Open Examination Yard –
Open Area - **2.5 Ha**
Shed Area **– 12,000 Sq Ft, 10,000 Sq Ft**
Buffer Yard – 2.99 Ha
Benefits to Exporter – Total savings of about **Rs.800 Cr plus per year** due to reduced waiting time, fuel savings and less fees.
Facilities for Drivers:
Canteen (subsidised rates),
Dormitory – 50 Beds
Free Health Check Up

JNPA's Initiatives to Control Pollution from Freight Train Operations

Freight Train

4%

Dedicated Freight Corridor

- Connecting – JNPA to Dadri
- Distance – 1,504 Km
- Present Rail Share – 15%
- Expected increase – 25-30%
- Travel Time Reduction – 70+ Hrs to 17 Hrs
- CO_2 Footprint Savings due to shift from road to rail

Electrification of Rail Tracks

- JNPA Serves – 54 ICDs
- Last Mile – 12 Km Diesel Engines used
- Electrification up to JNPA with Electronic Interlocking
- Engine Change time saved – 2 Hrs per train
- CO_2 Emissions Savings - 203 Tonnes/Year

JNPA's Sustainable Initiatives- Others

Unmanned Solar Boat

- **Purpose**: Collect floating trash
- **Capacity:** 500 Kg
- **Zero-Emission & Auto-Docking**
- **Real-Time Monitoring**

Energy Efficient Solutions

CO_2Saved Tons/Yr

- **LED Lamps- 644**
- **Smart Streel Lights- 5**
- **BLDC Fans - 79**
- **5 Star A/c - 265**

Green Cover

Present – 34% land under green cover

- **280.17 Ha –** Gardens, Parks
- **884.66 Ha -** Mangroves
- **Target – 40% Green Cover**

Other Initiatives for Sustainable port management

Environmental monitoring

Environmental Monitoring is carried out through IIT Madras at JNPA

Rejuvenating Water Bodies

The project involves Bioengineering techniques for the rejuvenation of the water bodies

Real time parking management

Streamlining traffic movement using Real Time Parking Management system

Solid Waste Management

10 MT/Day Solid Waste Management Facility commissioned

Beach Cleaning Drive

JNPA has conducted multiple beach cleaning program at Uran Pirwadi beach

Carbon Footprint Saving

Total Energy Consumed (RE + Grid) in Million Units	85.44	82.25	92.50	100.47	104.84
(Container Handling in Million Teus)	(5.03)	(4.67)	(5.68)	(6.05)	(6.43)
Year	2019-20	2020-21	2021-22	2022-23	2023-24
Energy Consumed per Teu	16.99	17.61	16.28	16.61	16.30

84% of the total energy is consumed for operating Container Terminals.

- Saving in carbon foot print achieved – about 10,000 Tons / year
- Expected saving in carbon foot print due to ongoing green initiatives – about 10,600 Tons / year

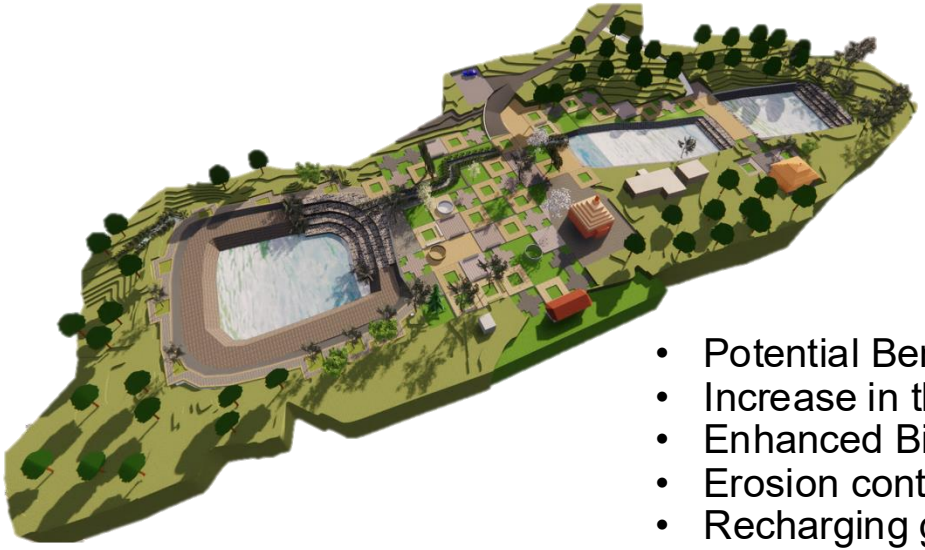
Preserving Flora and Fauna

- JNPA has appointed to Gujarat Institute of Desert Ecology for Migratory birds and their habitat study.

- A total of 112 bird species was recorded from 17 order and 45 families in the JNPA area & spans 10-kilometer radius.

Rejuvenation of Water Bodies

In order to encourage green projects in port area it is decided to preserve the water bodies located in JNPT area. The existing water bodies which are located at Sheva temple and Sheva foothill are filled with rain water and remain wetted for entire season. The rejuvenation of water bodies also included in Maritime India Vision 2030. The project involves Bioengineering techniques for the rejuvenation of the water bodies. Schedule Date of completion is 03.07.2023.



- Potential Benefits
- Increase in the Quality and Volume of Water in the lakes
- Enhanced Bio diversity
- Erosion control in the watershed area
- Recharging ground water table
- And improvement of the lake precinct to establish a connect between the Locals and Visitors.

Plantation by Miyawaki method in JNP SEZ

1,11,000+ tree planted in SEZ through this method

This method of afforestation was developed by the Japanese botanist and plant ecology expert Professor Akira Miyawaki, and draws inspiration from nature's ecosystems to create 100% organic, dense and diverse pioneer forests in as little as 20-30 years.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Thank You!