Green Ports- Implementation Roadmap (Short Term)

Executive Summary

Green Port Implementation Framework for phase 1 (0-6 months)

The Green Port Implementation Framework establishes a structured pathway to transition ports toward environmentally sustainable operations through **performance assessment, classification, and incentive-linked support mechanisms**. The framework is designed to operationalize the national green port vision by translating sustainability objectives into measurable outcomes and actionable transition strategies.

At its core, the framework defines a Green Port as one that demonstrably reduces its environmental footprint across key operational domains, including carbon emissions, energy consumption, equipment operations, pollution management, waste handling, and ecosystem stewardship. Greenness is determined not only by infrastructure adoption but by verified environmental performance outcomes, particularly carbon intensity reduction and overall environmental impact relative to port activity levels.

To enable objective performance evaluation, the framework adopts a data-driven assessment approach aligned with the ***Green Port Performance Index (GPPI)*** developed by the Ministry of Ports, Shipping and Waterways. The GPPI serves as the national measurement and benchmarking mechanism, providing standardized environmental performance scores based on established sustainability indicators. Building upon this measurement foundation, the implementation framework operationalizes assessment outcomes through tier-based classification and performance-linked transition support.

Ports will be categorized into **three sustainability tiers** ***Green Leaders, Transitioning Ports, and Early-Stage Ports*** reflecting varying levels of environmental maturity and infrastructure readiness. This classification structure enables benchmarking, incentivization, and targeted policy support, creating a progressive pathway for sustainability advancement across the port ecosystem.

To drive transition, the framework incorporates a structured incentive linkage mechanism that connects environmental performance tiers to fiscal and non-fiscal benefits. These include access to **green finance, infrastructure funding support, concessional capital, technical assistance, and national recognition programs**. By aligning financial support with verified sustainability outcomes, the framework establishes a performance-driven transition model.

Operationalization of the framework will be supported through structured **data collection and reporting architecture**. In the short term, standardized reporting templates will be deployed to enable baseline environmental performance assessment. Over time, this will evolve into an integrated digital reporting platform facilitating real-time monitoring, benchmarking, and policy decision support.

The immediate implementation phase (0–6 months) focuses on establishing the institutional and methodological foundation required to activate the framework. Key actions include **notification of the Green Port system**, **finalization of tier classification** thresholds, development of **self-assessment toolkits**, rollout of **reporting templates**, **baseline data collection**, **provisional tier assignment**, and **preparation of incentive and digital platform blueprints**.

Completion of this phase will create the governance, measurement, and reporting backbone necessary to drive long-term sustainability transformation across ports. By integrating assessment, classification, incentivization, and monitoring into a unified system, the Green Port Implementation Framework provides a scalable and performance-driven roadmap for advancing

environmentally responsible port development.

International Definitions of a Green Port

To establish conceptual alignment with global sustainability frameworks, it is important to examine how the term "Green Port" has been defined across international organizations and maritime institutions. While terminology and scope may vary, most global definitions converge on the integration of environmental protection, emissions reduction, sustainable energy transition, and pollution control within port infrastructure and operations.
The following internationally recognized definitions provide the conceptual foundation for formulating a contextualized Green Port definition for this framework.

ESPO definition
"A Green Port is one that integrates environmental considerations into all port development and operational activities, aiming to reduce environmental impacts such as air emissions, water pollution, waste, and habitat degradation while maintaining economic performance."

World Bank definition
"Green Ports are ports that pursue environmental sustainability through energy efficiency, emissions reduction, renewable energy adoption, sustainable logistics, and pollution control across port and vessel interface operations."
UNCTAD definition
"Environmentally sustainable or 'green' ports are those that adopt policies and technologies to reduce greenhouse gas emissions, improve energy performance, manage waste, and mitigate environmental impacts arising from port activities."

Drawing from international sustainability frameworks, a Green Port may be defined as:

A port that systematically minimizes the environmental footprint of its infrastructure and operations through decarbonization of energy systems, electrification of cargo handling equipment, adoption of shore power, pollution prevention, sustainable waste and water management, and protection of coastal and marine ecosystems, supported by transparent environmental monitoring and reporting systems.

Greenness is determined not only by the presence of green infrastructure but by measurable environmental outcomes particularly reduced carbon intensity and overall environmental impact relative to port throughput and operational activities

Short term phase (0-6 months)

The short-term focus under the Green Ports pillar is the notification and operationalisation of the GPPI-linked tier classification framework, the national green port reporting architecture, and the port-level carbon accounting methodology. The phase will also focus on defining minimum environmental infrastructure and monitoring requirements to guide ports toward baseline Green Port compliance

Key activities in this phase include

- Defining what constitutes a Green Port,
- Finalizing performance indicators,
- Developing self-assessment and reporting templates,
- Initiating baseline data collection, and
- Designing the scoring and tier assignment methodology.

The **end goal of the Green Port implementation framework is to drive ports toward environmentally sustainable operations by linking measurable environmental performance to structured assessment, classification, and incentive mechanisms**.

Action 1: Green Port Assessment & Classification

Assessment under the Green Port framework will be outcome-oriented and performance-based, ensuring that sustainability is measured through verifiable indicators such as emissions intensity, energy transition, pollution control, and ecosystem management outcomes.

In this context, the **Green Port Performance Index (GPPI)** will serve as the foundational measurement and benchmarking framework for evaluating environmental performance across ports. The implementation framework will leverage GPPI performance outputs as the basis for classification, benchmarking, and transition planning, without duplicating existing indicator and calculation methodologies.

This approach ensures alignment with national sustainability indices while enabling structured classification, policy targeting, and performance-linked transition support across the port sector

1.1 Tier Classification Framework for Green Ports

Tier Structure Design
Ports will be classified into three performance tiers based on their composite GPPI scores and overall sustainability performance:

Tier 1 — Green Leader Ports
- Tier 1 will represent ports demonstrating advanced environmental performance and leadership in green transition.
- These ports are expected to show strong outcomes across emissions reduction, energy transition, pollution control, and ecosystem management parameters as reflected in their GPPI performance scores.
- Tier 1 ports will serve as national benchmarks for green port development and may qualify for priority incentives, international recognition, and advanced transition funding mechanisms.

Tier 2 — Transitioning Green Ports
- Tier 2 will include ports that are actively progressing toward green transition but have not yet achieved full environmental performance maturity.
- These ports demonstrate measurable sustainability improvements but may still be undergoing infrastructure upgrades, energy transition initiatives, and pollution control system deployment.
- Tier 2 ports will be supported through targeted transition funding, technical assistance, and capacity-building programs to accelerate their movement toward Tier 1 classification.

Tier 3 — Conventional / Early-Stage Ports
- Tier 3 will represent ports at early stages of environmental transition, with limited adoption of green infrastructure and sustainability systems.
- The focus for Tier 3 ports will be foundational transition support, including infrastructure modernization, technical capacity building, and access to basic sustainability funding mechanism

Green Tier	Compliance Criteria	Key Parameters
Tier 1 — Green Leader Ports	Ports demonstrating advanced environmental performance aligned with GPPI indicators across climate change, environmental health, and ecosystem vitality pillars	- Scope 1 & 2 emissions intensity significantly below national port average - Renewable energy share ≥50% of total electricity consumption - ≥70% electrification of cargo handling equipment - Shore power operational across major berths - Real-time air, water, and noise monitoring systems deployed - 100% sewage treated on site - ≥75% dredged material beneficially reused - ≥20% port green cover - Integrated environmental monitoring and reporting systems
Tier 2 — Transitioning Green Ports	Ports demonstrating moderate environmental performance with ongoing sustainability transition initiatives aligned to GPPI indicators	- 15–40% emissions reduction vs baseline - Renewable energy share between 20–50% - 30–70% electrification of cargo handling equipment - Shore power pilots operational at select berths - Continuous monitoring in high-impact zones - Functional sewage and wastewater treatment systems - 10–20% green cover - Partial dredged material reuse programmes - Environmental data reporting systems established
Tier 3 — Early-Stage / Conventional Ports	Ports at foundational stages of environmental transition with limited sustainability infrastructure and monitoring systems	- Fossil fuel dominant energy consumption - <30% cargo handling electrification - No operational shore power infrastructure - Periodic/manual environmental monitoring - Basic sewage and wastewater treatment systems - <10% green cover - Conventional dredge disposal practices - Limited environmental data reporting systems

(Threshold scores for each tier will be finalized through technical consultation and may be periodically revised to reflect evolving sustainability standards and sectoral progress.)

Action 2: Data capture and Digital System operationalization

Following notification of the GPPI tier framework and finalisation of classification methodology, the next phase will focus on activating port sustainability classification through structured **data capture** while simultaneously establishing the national digital reporting and monitoring system

Implementation

Action	Coverage	Output Generated
2.1 Standardised environmental reporting templates issued to all ports	A structured reporting template is circulated covering emissions, energy consumption, equipment inventory, renewable energy usage, water consumption, waste generation, sewage treatment, dredge management, environmental monitoring systems, and GPPI indicator data fields	Uniform sustainability reporting format across all ports
2.2 Indicator-aligned Excel reporting formats circulated for baseline submission	Pre-formatted Excel workbooks are issued with indicator-wise sheets, unit standardisation, emission calculation fields, auto-sum formulae, and validation cells aligned to GPPI data requirements	Structured, comparable baseline environmental datasets
2.3 Data submission protocols and timelines notified	• Template format to be used • Submission deadline • Reporting period covered • Nodal officer designation • Department responsible (environment / operations / engineering) • Mode of submission (email / portal / upload link) • Evidence documentation requirements • Non-compliance escalation protocol	Formalised reporting compliance mandate
2.4 Ports submit baseline environmental performance data	Ports populate reporting templates with latest operational data including fuel consumption, electricity usage, cargo throughput, monitoring records, and environmental compliance reports (past 3 years)	Port-wise sustainability performance datasets
2.5 Evidence documentation uploaded	Ports submit supporting records such as fuel invoices, electricity bills, monitoring logs, STP reports, dredge disposal records, and environmental compliance certificates	Verifiable environmental performance evidence repository
2.6 Dataset validation and completeness review conducted	Submitted templates reviewed for completeness, unit consistency, missing data gaps, and indicator coverage	Cleaned and validated national dataset
2.7 GPPI performance datasets compiled	Indicator data aggregated into a structured national sustainability database aligned to GPPI scoring requirements	National GPPI-ready dataset
2.8 Provisional sustainability classification conducted	Ports mapped against tier thresholds using submitted performance data	Initial tier positioning of ports

2.9 Technical review and classification confirmation	Provisional classifications reviewed by technical agency prior to notification	Verified baseline tier classification

2.1 Suggestive standardized environmental reporting templates issued to all ports

Reporting Module	Data Field	Unit / Format	Reporting Frequency
Port Profile & Operations	Port name	Text	Annual
	Port category (Major / Non-major / Private)	Classification	Annual
	Annual cargo throughput	Tonnes / TEUs	Annual
	Number of vessel calls	Number	Annual
	Terminal types	Text	Annual
Energy Consumption	Total electricity consumption	kWh	Monthly
	Grid electricity consumption	kWh	Monthly
	Renewable energy generation	kWh	Monthly
	Renewable energy procurement	kWh	Monthly
	DG set fuel consumption	Litres	Monthly
	Shore power electricity supplied	kWh	Monthly
Fuel Consumption — Equipment & Fleet	Diesel consumption — CHE	Litres	Monthly
	Diesel consumption — harbour craft	Litres	Monthly
	Fuel consumption — port vehicles	Litres	Monthly
	Alternative fuel usage	Litres / kg	Monthly
Equipment Inventory	Total CHE fleet	Number	Annual
	Electric CHE units	Number	Annual
	Diesel CHE units	Number	Annual
	Hybrid equipment units	Number	Annual
Shore Power Infrastructure	Total berths	Number	Annual
	OPS-enabled berths	Number	Annual
	Vessel OPS connections	Number	Quarterly
	Electricity supplied via OPS	kWh	Quarterly

Water Management	Freshwater consumption	m^3	Monthly
	Recycled water consumption	m^3	Monthly
	Total water demand	m^3	Monthly
	Water recycling capacity	m^3/day	Annual
Waste Management	Solid waste generated	Tonnes	Monthly
	Hazardous waste generated	Tonnes	Monthly
	Waste disposal method	Text	Annual
Sewage Management	Sewage generated	m^3	Monthly
	Sewage treated on-site	%	Monthly
	STP capacity	m^3/day	Annual
Dredging & Ecosystem	Total dredged material	Tonnes	Annual
	Dredged material reused	%	Annual
	Disposal method	Text	Annual
	Green cover area	%	Annual
Environmental Monitoring Systems	Air monitoring stations	Number	Annual
	Marine water monitoring systems	Number	Annual
	Noise monitoring systems	Number	Annual
	OCEMS installations	Number	Annual
Environmental Compliance	CPCB/SPCB compliance status	Yes / No	Annual
	Environmental audit reports	Submitted / Not	Annual
	Pollution incidents reported	Number	Annual

2.2 Excel reporting workbook (can be refined later with stakeholder consultation)

Sheet	Data Captured	Key Fields Included	Output Generated
Port Profile	Port baseline operational data	Port name, port category, cargo throughput, vessel calls, terminal types	Standardised port operational baseline
Energy Consumption	Electricity and fuel energy usage	Grid electricity, renewable generation, renewable procurement, DG fuel use	Energy consumption dataset
Fuel Consumption	Equipment and fleet fuel use	CHE diesel use, harbour craft fuel, port vehicle fuel	Fuel consumption inventory

Equipment Inventory	Cargo handling equipment fleet profile	Total CHE units, electric CHE, diesel CHE, hybrid units	Electrification baseline dataset
Shore Power	OPS infrastructure and utilisation	Total berths, OPS-enabled berths, vessel connections, OPS electricity supplied	Shore power performance dataset
Water Management	Water consumption and recycling data	Freshwater use, recycled water use, total water demand	Water sustainability dataset
Waste Management	Waste generation and disposal	Solid waste, hazardous waste, disposal method	Waste performance dataset
Sewage Management	Sewage treatment performance	Sewage generated, sewage treated, STP capacity	Wastewater treatment dataset
Dredging & Reuse	Dredged material handling	Total dredged quantity, reused quantity, disposal method	Ecosystem impact dataset
Environmental Monitoring	Monitoring infrastructure deployment	Air monitors, water monitors, noise monitors, OCEMS units	Monitoring infrastructure dataset
Compliance Reporting	Environmental regulatory compliance	CPCB/SPCB compliance status, audit reports, incidents	Compliance performance dataset

Digitalization of the reports

In the first six months, we will issue standard reporting templates and collect the last 3 **years of environmental data from ports, aligned to the GPPI framework**. This helps us build a clean baseline dataset and assess ports under Action 1.

Parallelly, we will prepare a digitalisation blueprint identifying key reporting modules aligned to GPPI but the actual digital platform development and operationalisation will begin in Phase 2.

In Phase 1, the focus is on collecting validated data and assigning tiers. In Phase 2, we move toward automation and full digital integration.

Action 3: Reporting and MRV Framework Institutionalization

Following baseline data submission and provisional sustainability classification, the next phase will focus on institutionalizing environmental reporting across ports through structured submission cycles, monitoring protocols, and verification mechanisms. This will establish the governance and procedural backbone required to ensure data credibility, comparability, and continuity of sustainability performance tracking.

Implementation Action	Execution Activity	Operational Protocols / Submission Definitions	Output Generated

Sustainability reporting frequency framework notified	Indicator-wise sustainability reporting periodicity defined and formally issued to ports through official notification.	**Monthly:** Energy consumption, fuel use, water use, waste generation submitted within 10 days of month-end. **Quarterly:** Environmental monitoring & compliance data submitted within 15 days of quarter-end. **Annual:** GPPI dataset submitted within 60 days of financial year closure.	Notified national sustainability reporting calendar with defined submission timelines and compliance requirements.
Mandatory reporting compliance mandate issued	Sustainability data submission made compulsory through regulatory notification applicable to all ports.	Reporting applicability defined for major, non-major, and private ports. Non-submission flagged after **30 days;** Escalation to regulatory authority after **60 days.**	Institutionalised sustainability reporting compliance mandate.
Port nodal officers designated	Ports instructed to nominate sustainability reporting focal points responsible for data submission and coordination.	Each port to designate Environment, Operations, and Engineering reporting representatives; Officer details submitted within 30 days of notification.	Defined reporting accountability and coordination structure.
Monitoring protocol guidance issued	Standard operating guidance circulated on tracking sustainability indicators across operational areas.	Monitoring coverage defined for energy meters, fuel logs, water meters, waste logs, emission monitoring stations, and sewage treatment systems.	Standardised sustainability monitoring methodology across ports.

Evidence documentation framework established	Documentation requirements issued to support sustainability data submissions.	Ports required to submit electricity bills, fuel purchase records, monitoring logs, STP reports, waste manifests, and environmental compliance certificates.	Structured environmental evidence documentation repository.
Third-party verification mechanism defined	Independent technical agencies identified and notified for sustainability data validation.	Verification coverage includes dataset screening, evidence review, anomaly detection, and site audit triggers for high-variance reporting.	Institutionalised third-party sustainability verification framework.
Data review and audit workflow operationalised	National-level data validation and audit review process activated.	Multi-stage review includes completeness screening, indicator validation, evidence cross-check, and technical audit escalation for discrepancies.	Structured sustainability data validation and audit mechanism.
Reporting escalation protocol notified	Non-compliance handling and reporting delay escalation procedures formally issued.	1st reminder at 15 days delay; escalation notice at 30 days; regulatory reporting at 60 days non-submission.	Enforceable sustainability reporting compliance enforcement system.

Action 4: Incentive Linkage

Following sustainability tier classification and institutionalized reporting, the implementation framework will operationalize **performance-linked financial access** by mapping port sustainability tiers to existing green maritime funding and transition finance mechanisms anchored under the National Green Shipping Policy (NGSP) and allied maritime financing structures

4.1 Tier linked green finance eligibility framework

Tier	Finance Access Level	Funding Nature	Investment Focus
Tier 1 — Green Leader Ports	Priority premium finance access	Bonds, ESG debt, climate finance	Innovation & scale decarbonisation
Tier 2 — Transitioning Ports	Transition infrastructure finance	Loans + blended finance	Electrification & infra conversion
Tier 3 — Early-Stage Ports	Foundational sustainability support	Grants + concessional finance	Compliance & monitoring infra

4.2 NGSP Anchored funding instruments

Funding Instrument	Financial Envelope	Eligible Green Port Investments
Maritime Development Fund (MDF)	₹70,000 crore	Shore power, electrification, RE, MRV systems
Sagarmala Finance Corporation Ltd. (SMFCL)	₹5,000 crore initial capitalisation	Green port infra, ESG projects, clean fuels
Maritime Green Transition Investment Need	₹1.5 – 2 lakh crore sector requirements	Ports, fuels, decarbonisation infra
Mandatory Green CAPEX Allocation	10% of port CAPEX by FY2027	Electrification, OPS, RE, monitoring
MRV & Monitoring Funding Windows	Scheme-based allocations	Sensors, digital reporting, emissions tracking

4.3 Tier wise finance access mapping

Tier	Primary Funds Accessible	Financing Mode
Tier 1	MDF + Green Bonds + ESG Loans + Climate Finance	Market + blended finance
Tier 2	MDF + SMFCL Loans + VGF + ESG Debt	Infra transition finance
Tier 3	Grants + SMFCL Soft Loans + MRV Funds	Compliance finance

4.4 Performance linked disbursement triggers

Performance Parameter	Funding Linkage
Tier Classification Status	Determines eligibility window
Tier Mobility Improvement	Access to higher funding ceilings
Emissions Intensity Reduction	ESG loan interest rebates
Renewable Energy Share	Grant / blended finance eligibility
Reporting Compliance	Continued disbursement approval

4.5 Tier-Linked Incentive Structure

Tier 1 — Green Leader Ports

Ports classified under Tier 1 will be eligible for advanced incentive mechanisms designed to reward sustainability leadership and encourage continued innovation.

Indicative support measures may include:

- Priority access to green infrastructure grants
- Preferential green financing and concessional loans
- Eligibility for climate finance and carbon market instruments
- National recognition and sustainability awards
- Facilitation of international green port certifications

Tier 2 — Transitioning Green Ports

Tier 2 ports will be supported through structured transition assistance aimed at accelerating their progression toward Tier 1 performance levels.

Indicative support measures may include:

- Capital subsidies for equipment electrification
- Renewable energy deployment support
- Shore power infrastructure funding
- Technical assistance and advisory support
- Capacity-building and training programmes

Tier 3 — Conventional / Early-Stage Ports

Ports in Tier 3 will receive foundational support focused on enabling baseline environmental compliance and infrastructure readiness.

Indicative support measures may include:

- Basic environmental infrastructure grants
- Pollution control system funding
- Monitoring and reporting system support
- Technical guidance for sustainability planning
- Compliance-linked financial assistance