

DGMA – IRS

Potential Collaboration

Presentation Note by
The Directorate General of Maritime
Administration



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Table of Contents

Potential Areas of Collaboration between DGMA and IRS.....	8
India's Maritime Vision	11
National Regulatory Framework.....	24
Imperative for Maritime Energy Transition	27
National Maritime Decarbonization Policy Framework.....	30
Maritime INDIA @ Net Zero.....	37
Alternative Fuels for Maritime	43
Alternative Fuel Transition : Challenges and Safety Considerations	56
National Green Hydrogen Mission – Green Hydrogen Hubs.....	61
India as a Net Green Energy Exporter & Bunkering Destination.....	64
Green Maritime Corridors.....	66
Study on Potential Demand and Pricing of Alternative Marine Fuels in India	67
Green Corridor Pre-Feasibility Study under the Indo-Danish Centre of Excellence.....	68
Nuclear Propulsion for Merchant Shipping	72
Strategic Rationale for Nuclear Marine Propulsion.....	73
Near-Zero Operational Emissions.....	73
Exceptional Energy Density	73
Long Endurance	74
Continuous High-Power Availability	74
Reduced Dependence on Bunkering Networks	75
Greater Predictability of Energy Costs	75
Nuclear Reactor Technology Options	77
Pressurised Water Reactors	77
Small Modular Reactors (SMR)	77
High-Temperature Gas-Cooled Reactors	79
Liquid Metal-Cooled Reactors.....	80
Molten Salt Reactors.....	81
India's Strength for Nuclear Marine Propulsion.....	82
Strategic Thorium Resource Base.....	86
Indian Defence Marine Nuclear Experience.....	92

India's Strategic Strength for Nuclear Marine Propulsion.....	95
Established Nuclear Programme.....	95
Advanced Fast-Reactor Development	95
Strategic Thorium Resource Base.....	95
Thorium Fuel-Cycle Research	95
Advanced Reactor Design Capability	95
National SMR Mission	96
Marine Nuclear Experience	96
Indigenous Manufacturing Base	96
Evolving Governance Framework	96
International Engagement	96
Priority Areas for Future Development.....	96
Small Modular Reactors (SMRs): Emerging Pathway for Maritime Applications	98
Evolution of Small Modular Reactors	99
Key Characteristics of SMRs.....	100
Compact and Modular Design	100
Factory-Based Manufacturing	100
Flexible Deployment.....	100
Enhanced Safety Features	100
Long Operating Cycles	101
Multi-Purpose Applications	101
Types of SMRs.....	101
Indian Context.....	102
Potential Maritime Applications of SMRs.....	102
Merchant Ship Propulsion.....	102
Floating Nuclear Power Plants.....	103
Port and Offshore Power Supply	103
Remote Coastal and Island Energy Systems.....	103
Desalination	103
Hydrogen, Ammonia and Synthetic Fuel Production	103
Integrated Maritime Energy Systems.....	103
Molten-Metal-Based Reactors (Liquid Metal-Cooled Reactors).....	104
Working Principle	105

Principal Types of Liquid Metal-Cooled Reactors	105
Sodium-Cooled Fast Reactors (SFR).....	105
Lead-Cooled Fast Reactors (LFR).....	105
Lead-Bismuth Eutectic Reactors (LBE)	106
Key Features	106
High Heat-Transfer Capability.....	106
High-Temperature, Low-Pressure Operation.....	106
High Power Density.....	106
Long Fuel Cycles	106
Efficient Fuel Utilisation.....	106
Indian Context.....	106
Potential Maritime Applications	107
Engineering Considerations for Marine Deployment.....	108
Floating Nuclear Power Platforms (Floating Nuclear Power Plants – FNPPs).....	110
Evolution of Floating Nuclear Power Plants	111
Basic Configuration and Working Principle	111
Key Characteristics and Advantages.....	111
Demonstrated Commercial Example – Akademik Lomonosov.....	113
Global Development Trends	114
Potential Applications	114
Challenges.....	115
Relevance for India	116
Nuclear Power Applications for Port Decarbonization.....	117
Nuclear Energy and Port Decarbonization	117
Contribution towards Scope 1 Emission Reduction	118
Contribution towards Scope 2 Emission Reduction	118
Contribution towards Scope 3 Emission Reduction	119
Integrated Maritime Energy Hubs.....	119
Relevance for India	120
Green Ports.....	121
Sustainable Indicators Framework for Indian Ports.....	128
GHG Emission Scopes.....	131
National Port Sustainability Council (NPSC) – Proposed.....	134

Harit Sagar – Green Port Guidelines	139
Green Tug Transition Program (GTTP).....	144
Integrated Vessel Traffic Management System (iVTMS).....	148
Just-in-Time Arrival and Digital Twin for Ports	151
Digital Twin Pilot – VOCPA Tuticorin	153
Shore-to-Ship Power (SPS) – Decarbonising Emissions at Berth	156
Swachh Sagar Portal	159
Just Transition in Maritime	161
Ship Recycling.....	164
ISO Standards for Ship Recycling	169
Ship Recycling Workforce Training Framework (proposed).....	170
Core Training Areas	171
Ship Recycling Credit Note	176
IMO Led Projects.....	183
Vizhinjam International Seaport – Strategic Role in India’s Transshipment and Maritime Network.....	187
Revocation of General Orders 1, 2 and 3 of 2018 – Analysis and Implications.....	190
Ship Building Sector	193
Scaling India’s Ship Building Capacity for Global Competitiveness.....	194
National Vision for Shipbuilding: From MIV 2030 to MAKV 2047	196
Strategic Importance of Shipbuilding	198
Four Pillar Approach for Strengthening India’s Shipbuilding Ecosystem.....	200
Pillar I: Shipbuilding Financial Assistance Scheme: Enhancing Competitiveness of Indian Shipyards.....	202
Accelerating the Transition towards Green Shipbuilding.....	206
Pillar II – Maritime Development Fund (MDF)	209
Pillar III – Shipbuilding Development Scheme (SBDS) - Building Capacity and Capability for Global Competitiveness.....	212
Cluster-Based Approach	214
Greenfield and Brownfield Expansion under the Shipbuilding Development Scheme (SBDS)	216
Pillar IV: Legal, Policy and Process Reforms.....	224
Indigenization of Shipbuilding Equipment and Components.....	226
Comprehensive Shipbuilding Portal	229

DGS–IRS Collaboration for Shipbuilding Transformation	232
India’s Seafaring Workforce: Expanding Global Leadership	236
Seafarer’s Wellness Initiatives	237
Social Security and Welfare for Seafarers	243
Seafarer Welfare Infrastructure – SWBAT	246
Zero Tolerance in Crewing	247
Maritime Training and Certification Lifecycle	251
Training Ecosystem.....	256
New MTI Module	259
Examination Reforms by C-DAC & NTA.....	261
Common Admission Portal	262
Transparency and Zero Tolerance for Fraud	266
Digital Initiatives in Training.....	267
International Ship and Port Facility Security (ISPS)	271
A. BoPS - Detailed function	272
B. Functional relationship with DG Shipping’s and transition to DGMA:	276
C. No role of BOPS in ISPS code compliance:	278
D: D.G Shipping’s existing role vis-à-vis safety and security on ports/vessels:	286
E. Legal amendments necessitated in light of the submission of clear demarcation of BoPS Role and functions	292
Indian Global Maritime Safety Platform	314
DGCOMM Centre	317
Long Range Identification and Tracking	319
Maritime Casualties Overview [2023- 2025]	321
Major Maritime Incidents	322
Navigational Safety at Ports Committee.....	324
International Ship and Port Security	325
DGS Initiatives for Maritime Safety and Casualty Response.....	327
Regulatory Compliance and Packaging Standards for Dangerous Goods (DG)	329
MoUs with International Group P&I Club	331
Anti Piracy Initiatives	333
Suraksha Sarvapratham.....	335
Coastal Shipping	339

Coastal State Workshops.....	342
Coastal Cargo Promotion Scheme	346
Inland Waterway Utilization	349
Digitalization in Maritime.....	352
Cyber Resilience in Maritime Governance.....	353
E-Samudra.....	357
License and Chartering Portal.....	360
4 Modules.....	361
24x7 Grievance Redressal Module	361
E- Navik - Crisis Response Management Module.....	365
Maritime Training Institutes (MTI) Module	367
Recruitment and Placement Services License (RPSL) Module.....	371
ERP for SWFS and SPFO	374
Maritime Knowledge Cluster.....	376
Maritime Single Window	378
Introduction of the IMO Shadow Portal	381
National Coastal Database Portal.....	382
Ship Recycling Portal	384
Humans as the Paramount Element in Maritime Industry	388
Formation of Bharat Maritime Insurance Pool	392

Potential Areas of Collaboration between DGMA and IRS

The Directorate General of Maritime Administration (DGMA) and the Indian Register of Shipping (IRS) may establish a structured technical partnership across the four strategic areas identified in the communication dated 15 July 2026. The collaboration may be progressed through dedicated Technical Working Groups, supported by defined deliverables, timelines, nominated technical officials and an agreed governance mechanism.

1. Nuclear Propulsion for Merchant Shipping



Potential Areas for DGMA–IRS Collaboration



IRS may support DGMA in developing a structured pathway for assessing nuclear applications in merchant shipping ports and coastal infrastructure, with initial focus on feasibility, safety, regulation and technical standards.

Technical Feasibility & Use-Case Assessment - Assess suitable vessel types and reactor options - Evaluate merchant propulsion, floating power and port applications - Examine integration with Indian shipyards and ports	Safety, Risk & Classification Framework - Develop safety requirements for marine and nuclear hazards - Undertake HAZID, HAZOP, FMEA and risk assessments - Frame classification rules and Approval-in-Principle pathways	Regulatory Roadmap - Map IMO, nuclear, liability and security requirements - Identify regulatory gaps and required amendments - Support in defining roles of flag, port, coastal and nuclear authorities
Port & Coastal Applications - Assess port electrification, shore power and floating nuclear platforms - Support hydrogen, ammonia, desalination and offshore power use cases - Map contribution to Scope 1, 2 and 3 emission reduction	Operational & Lifecycle Preparedness - Define crew, surveyor and port personnel competency requirements - Develop emergency response, security and safeguards arrangements - Address refuelling, waste management and decommissioning	Techno-Economic Assessment & Pilot Roadmap - Compare costs with conventional and alternative-fuel vessels - Identify suitable vessel, port or coastal pilot projects - Develop a phased pathway from feasibility to demonstration and deployment

22

IRS may support DGMA in developing a structured pathway for civilian nuclear maritime applications through:

- **Technical feasibility:** Suitable vessel types, reactor options, floating nuclear platforms and port applications
- **Safety and classification:** Marine–nuclear risk studies, safety requirements, classification rules and Approval-in-Principle
- **Regulatory roadmap:** IMO, nuclear safety, security, liability and jurisdictional requirements

- **Operational preparedness:** Crew competency, emergency response, safeguards, refuelling, waste management and decommissioning
- **Pilot pathway:** Techno-economic assessment and identification of suitable demonstration projects

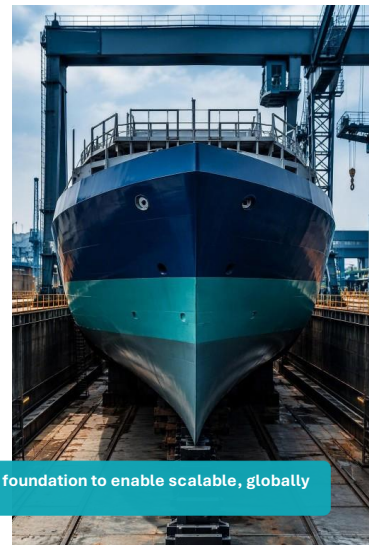
2. Technical Partnership for National Shipbuilding



DGS–IRS Collaboration for Shipbuilding Transformation



- **Digital ecosystem development:** IRS can support the development and operationalisation of a comprehensive national shipbuilding and ship recycling portal, enabling seamless workflows, technical integration and industry-wide transparency.
- **Knowledge repository:** IRS can contribute to establishing a national maritime knowledge repository by consolidating standards, design practices and regulatory guidance into a single authoritative technical reference for the sector.
- **Training & certification:** IRS can collaborate on human resource development through structured training, certification frameworks and capability -building programs for shipyards, designers and ancillary industries.
- **Indigenization & standardization:** IRS can support the standardization and indigenization of shipbuilding component manufacturers through technical validation, certification frameworks and alignment with class -compliant standards.
- **Design approval & capacity building:** IRS can provide technical design approvals, classification support and structured capacity-building initiatives to strengthen shipyard capabilities and accelerate India's shipbuilding ambitions.



DGS and IRS together can build a robust technical, institutional and capability -driven foundation to enable scalable, globally competitive shipbuilding in India.

34

IRS may support DGMA in strengthening the technical and institutional foundation of India's shipbuilding ecosystem through:

- **Digital ecosystem:** Development and operationalisation of the National Shipbuilding and Ship Recycling Portal
- **Knowledge repository:** Consolidation of standards, design practices, technical guidance and regulatory references
- **Training and certification:** Capacity building for shipyards, designers, surveyors and ancillary industries
- **Indigenisation and standardisation:** Technical validation and certification of domestically manufactured equipment and components
- **Design and classification support:** Technical approvals and capability development for green, specialised and advanced vessels

3. Ship Recycling and Hong Kong Convention Compliance



Potential Areas for DGMA–IRS Collaboration



IRS may support DGMA in developing a structured pathway for assessing nuclear applications in merchant shipping ports and coastal infrastructure, with initial focus on feasibility, safety, regulation and technical standards.

Ship Recycling Credit Note Implementation • Develop standardised technical verification protocols • Support scrutiny of recycling certificates and vessel particulars • Assist in resolving technical discrepancies and exceptional cases • Strengthen digital audit trails for issuance, transfer and redemption	Sustained HKC Compliance • Standardise survey, inspection and audit procedures • Support periodic monitoring of authorised recycling facilities • Develop guidance for IHM, final survey, SRP and Ready-for-Recycling certification • Facilitate corrective action and continual compliance improvement	Alignment with EU Ship Recycling Standards • Undertake HKC–EUSRR gap assessments • Assess yard readiness against applicable EU requirements • Support documentation, evidence and audit preparedness • Assist Indian yards in progressing towards European List recognition
Yard Standards and Technical Support • Develop harmonised technical and HSSE benchmarks • Support ISO-based management systems and audit readiness • Strengthen hazardous-material, waste and downstream traceability systems • Promote standardised operating and emergency procedures across yards	Workforce Training and Certification • Develop a national training curriculum and competency standards • Establish role-based certification for workers, supervisors and management • Accredite training centres, trainers and assessors • Enable refresher training and digitally traceable competency records	

46

IRS may provide technical support for strengthening India's ship-recycling framework through:

- **Ship Recycling Credit Note:** Standardised verification, scrutiny of recycling records and digital audit trails
- **Sustained HKC compliance:** Common survey, inspection and audit procedures with periodic yard monitoring
- **EU standards alignment:** HKC–EUSRR gap assessments, yard-readiness reviews and audit support
- **Yard standards:** Harmonised technical, HSSE, hazardous-material and downstream waste-management practices
- **Workforce development:** National training curricula, competency standards and role-based certification

4. Maritime Security and ISPS Framework

IRS may support DGMA and DGBoPS through:

- Standardisation of security procedures and reporting formats
- Clear delineation of institutional responsibilities
- Review of the Recognised Security Organisation framework
- Security audits, risk assessments and technical guidance
- Training and certification of ship and port security personnel

India's Maritime Vision



India's Vision for the Maritime Sector



MARITIME INDIA VISION 2030



Maritime India Vision (MIV) 2030

- Position India Globally in the Top 10 Shipbuilding, repair nations (from 30k GT to 500k + GT).
- Renewable Energy Share at Major Ports : >60%
- Promote Waste to Wealth through ship recycling. India from #2 to #1 ship recycling nation.
- Encourage green belt development (plantations) : Atleast 33% of port area
- Investment: INR 20,000+ Crores
- Employment Generation: 1,00,000+ additional jobs (direct and indirect)



Maritime Amrit Kaal Vision 2047

- Advanced phase targeting Top 5 global position in shipbuilding and maintaining 1 position in ship recycling
- Carbon neutral ports (green fuel, electrification, SPS). ≥ 60 % renewable-energy share, create hydrogen hubs, emission & resource monitoring toolkits for ports.
- Promote Alternate/ Green Fuels, Bunkering infrastructure, green framework for terminal operations, introduce incentives in port duties for low emission vessels .
- 300+ Strategic Initiatives across 11 key maritime areas
- Financial Assistance: 20-30% assistance for green vessels (including retrofitting)

5

Maritime India Vision 2030

Maritime India Vision 2030 is the Government of India's long-term strategic blueprint for the maritime sector for the decade up to 2030. It has been prepared by the Ministry of Ports, Shipping and Waterways as a coordinated roadmap to accelerate growth across ports, shipping and inland waterways. The document positions the maritime sector as a critical enabler of India's economic growth, trade competitiveness, logistics efficiency and employment generation.

The report makes it clear that India's maritime sector is not being treated merely as a transport function, but as a strategic economic multiplier. With a coastline of about 7,500 km, 12 Major Ports, 200+ Non-Major Ports and a large inland waterway network, the sector is central to trade and industrial development. The report notes that about 95% of India's trade by volume and 65% by value moves through maritime transport. This gives the maritime domain a foundational role in India's development trajectory.

MIV 2030 is therefore not just a sectoral plan. It is a national competitiveness document aimed at making India a stronger maritime nation by improving infrastructure, reducing logistics costs, raising productivity, modernising governance and building future-ready maritime capacity.

Nature and Approach of the Report

The document has been developed through a large consultative exercise involving 350+ stakeholders, 250+ brainstorming sessions, study of 100+ global benchmarks and best-in-class examples and analysis of 50+ laws and Acts, including State and environmental frameworks. This gives the report a strong institutional and policy basis.

The report is framed as a time-bound, implementation-oriented vision document rather than a purely conceptual one. It identifies 150+ initiatives across the maritime ecosystem and links them to policy reforms, infrastructure development, institutional strengthening and measurable performance outcomes.

The report adopts six guiding principles:

- Analyse present and future challenges before defining initiatives
- Use innovation and latest technology as core enablers
- Create time-bound action plans
- Benchmark against best-in-class international practices
- Focus on capability building and human resources
- Promote “waste to wealth” approaches

These principles are important because they show that the report is not confined to physical infrastructure. It also covers governance, innovation, sustainability and human capital.

Strategic Intent of MIV 2030

At its core, MIV 2030 seeks to move India from being a large maritime economy with untapped potential to becoming a globally competitive maritime power. The report tries to address multiple structural issues at once:

- inadequate world-scale port infrastructure in some locations
- high logistics costs relative to global benchmarks
- dependence on foreign transshipment hubs
- limited share in global shipbuilding and ship repair
- insufficient technological integration across the maritime value chain
- need for safer, greener and more efficient port operations
- need to expand India’s role as a seafaring nation

The report therefore combines hard infrastructure, soft infrastructure, policy reform, technology adoption, institutional change and skill development.

Structure of the Vision

The report is organised around 10 key themes, which together define the architecture of MIV 2030.

Theme 1: Develop Best-in-Class Port Infrastructure

This theme focuses on strengthening port capacity, expanding draft, modernising infrastructure and creating globally competitive port systems. The report recognises that India's cargo volumes are growing, vessel sizes are increasing and India needs deeper and more efficient ports to handle future trade demand. It highlights that only a limited share of Indian cargo transshipment is currently handled in Indian ports and that strengthening domestic transshipment capability is strategically necessary.

Theme 2: Drive End-to-End Logistics Efficiency and Cost Competitiveness

The report identifies India's logistics cost as higher than best-in-class benchmarks and links this to hinterland connectivity issues, evacuation delays and high unit costs. This theme therefore focuses on mechanisation, port connectivity, evacuation systems, port-led industrialisation and cost-effective logistics.

Theme 3: Enhance Logistics Efficiency through Technology and Innovation

MIV 2030 places strong emphasis on digital transformation. It mentions digitalisation of maritime stakeholder processes, National Logistics Portal (Marine), smart ports and system-driven performance monitoring. The objective is to improve ease of doing business and operational efficiency through technology.

Theme 4: Strengthen Policy and Institutional Framework

This theme addresses governance, legislation, institutional arrangements and financial resilience. The report recognises that infrastructure alone is insufficient unless backed by supportive legal, regulatory and policy systems.

Theme 5: Enhance Global Share in Shipbuilding, Repair and Recycling

This is highly relevant from the engineering and industrial standpoint. The report notes that India's share in global shipbuilding is still low, while ship repair is nascent. At the same time, India already has a strong position in ship recycling. MIV 2030 seeks to leverage domestic demand, create industrial ecosystems and promote "waste to wealth," especially through recycling and use of scrap in the steel sector.

Theme 6: Enhance Cargo and Passenger Movement through Inland Waterways

The report sees inland waterways as both economical and environmentally friendly. It proposes interventions for fairway development, terminal infrastructure, supportive regulatory policies and promotion of Ro-Ro and ferry movement.

Theme 7: Promote Ocean, Coastal and River Cruise Sector

MIV 2030 identifies cruise as a high-growth but underdeveloped segment in India. It proposes cruise terminals, themed circuits, island ecosystem development and cruise training infrastructure.

Theme 8: Enhance India's Global Stature and Maritime Cooperation

This theme expands the vision beyond domestic infrastructure to geopolitical and international maritime positioning. It aims to strengthen maritime cooperation, representation and connectivity with neighbouring and advanced maritime nations.

Theme 9: Lead the World in Safe, Sustainable and Green Maritime Sector

This is one of the most important themes from the current perspective. The report explicitly addresses renewable energy, emission reduction, water use efficiency, solid waste management and safety systems. It links Indian ports to sustainability obligations and global environmental expectations.

Theme 10: Become a Top Seafaring Nation with World-Class Education, Research and Training

The report recognises that India already contributes significantly to the global seafarer pool, but faces competition from other countries. It therefore stresses education, research, training, innovation and development of a stronger ecosystem for seafarers.

Key Targets and Performance Indicators

The report sets out measurable Key Performance Indicators (KPIs) to be achieved by 2030. These are important because they show that the document is meant to be implementation-focused.

Some of the major targets include:

- 3 Major Ports with more than 300 MTPA cargo handling capacity
- Increase the share of Indian cargo transshipment handled by Indian ports from 25% to more than 75%
- Increase the share of cargo handled at Major Ports by PPP/other operators from 51% to more than 85%
- Reduce average vessel turnaround time from 25 hours to under 20 hours
- Reduce average container dwell time from 55 hours to under 40 hours
- Increase average ship daily output from 16,500 gross tonnage to above 30,000
- Improve global ranking in shipbuilding and ship repair from 20+ to Top 10
- Raise India from 2nd to 1st position in ship recycling
- Increase annual cruise passengers from 4.68 lakh to over 15 lakh
- Raise India's share of global seafarers from 12% to above 20%
- Increase renewable energy share at Major Ports from less than 10% to more than 60%

These targets show that MIV 2030 is not limited to trade growth alone. It includes sustainability, seafaring, cruise, industrial capability and energy transition.

Investment and Economic Impact

The report envisions an overall investment of around ₹3,00,000–3,50,000 crore across ports, shipping and inland waterways. It estimates that this vision could unlock:

- ₹20,000+ crore of potential annual revenue for Indian ports
- 20,00,000+ additional jobs direct and indirect across the maritime sector

This is significant because it positions the maritime sector not just as a logistics enabler but as a major employment and investment platform.

Port Infrastructure and Traffic Planning Logic

The opening chapter on port infrastructure shows the level of analytical depth used in the report. It undertakes commodity-wise traffic forecasting using bottom-up origin-destination analysis, ministry policy inputs, industrial mapping and scenario planning. The report maps major producing and consuming sectors such as coal, steel, cement, fertilisers and refineries and uses this to project future port demand.

For example, for commodities such as POL, coal, iron ore, containers, cement, steel and fertilisers, the report develops high, base and low scenarios depending on demand trends, domestic production, policy changes and industrial expansion.

This analytical method is important because it means the infrastructure proposals are tied to demand forecasts, not generic expansion.

Green and Sustainable Maritime Dimension

One of the strongest aspects of the report is that it integrates sustainability and safety into the mainstream maritime development agenda rather than treating them as separate issues.

Under Theme 9, the report highlights the need to:

- increase use of renewable energy
- reduce air emissions
- optimise water use
- improve solid waste management
- implement zero-accident safety programmes
- create centralised monitoring systems
- align with international sustainability and safety practices

This makes MIV 2030 the early foundation for later developments in India's green maritime agenda, including green ports, renewable energy adoption in ports and broader decarbonisation strategies.

Seafaring, Education and Human Capital

Theme 10 is especially relevant for your FSM work. The report clearly identifies human capital as a strategic pillar. It notes that India contributes around 10–12% of world seafarers and aims to raise this to more than 20% by 2030.

The report's emphasis is not only on increasing numbers, but also on:

- world-class maritime education
- research and innovation
- stronger training ecosystems
- capability building
- support for seafarers as a professional class

This theme strongly supports the broader argument that maritime competitiveness will increasingly depend on quality of human capital, not only on port capacity or fleet size.

Strategic Significance of MIV 2030

From a strategic standpoint, MIV 2030 is important for five reasons.

First, it shifts maritime policy from fragmented development to integrated planning.

Instead of addressing ports, shipbuilding, logistics, waterways and seafarers separately, it presents a unified national maritime roadmap.

Second, it links maritime development to national economic competitiveness.

By focusing on logistics cost, turnaround time, transshipment, capacity and connectivity, it directly supports India's manufacturing, trade and export ambitions.

Third, it expands the maritime agenda beyond infrastructure.

The report includes sustainability, training, institutional reform, digitalisation and innovation.

Fourth, it lays the foundation for India's maritime leadership ambitions.

The report is not defensive. It aims for global positioning in shipbuilding, recycling, seafaring and port performance.

Fifth, it provides a policy bridge between growth and future readiness.

Themes such as green ports, digital systems, training and research show that the report was already anticipating the future transition of the sector.

Maritime AmritKaal Vision 2047

The **Maritime Amrit Kaal Vision 2047 (MAKV 2047)** is the Government of India's long-term strategic roadmap aimed at transforming India into a **leading global maritime power by the centenary year of independence in 2047**. The vision has been developed by the **Ministry of Ports, Shipping and Waterways (MoPSW)** through extensive stakeholder consultations involving government agencies, industry stakeholders, financial institutions and academic institutions.

India possesses a vast maritime geography, with **over 7,500 km of coastline, 12 major ports and more than 200 non-major ports**, making maritime infrastructure critical to the country's trade and economic growth. The maritime sector facilitates a major share of India's external trade and plays a crucial role in logistics, industrial development and global connectivity.

The MAKV 2047 builds upon earlier initiatives such as **Maritime India Vision 2030**, the **National Logistics Policy** and the **PM Gati Shakti National Master Plan** and aims to create a holistic maritime ecosystem encompassing ports, shipping, shipbuilding, coastal infrastructure, maritime services and human capital.

The vision document has been prepared through **more than 150 stakeholder consultations** and benchmarking of **over 50 international policies and best practices**, resulting in the identification of **more than 300 actionable initiatives** across the maritime sector.

Strategic Objective of MAKV 2047

The central objective of MAKV 2047 is to enable India to achieve **global maritime leadership** by strengthening infrastructure, improving logistics efficiency, promoting sustainable maritime operations and expanding India's global maritime presence.

The vision is aligned with the broader national development agenda and supports India's ambition of becoming a **\$30 trillion economy by 2047**. It also integrates the concept of the **Blue Economy**, which recognizes the oceans as a major driver of economic growth, employment generation and environmental sustainability.

The MAKV framework seeks to achieve this transformation through:

- expansion of port infrastructure
- development of shipping capacity
- promotion of coastal shipping and inland waterways
- development of shipbuilding and ship repair industries
- strengthening maritime education and research
- technological modernization and digitalisation

- environmental sustainability and decarbonisation

Guiding Principles of the Vision

The development of MAKV 2047 follows several guiding principles aimed at ensuring a practical and implementable roadmap.

First, the vision emphasizes **gap analysis of the current maritime ecosystem**, identifying areas requiring policy reforms, infrastructure upgrades and institutional strengthening.

Second, the framework draws extensively on **international best practices**, ensuring that India's maritime policies remain aligned with global standards in infrastructure, regulation and sustainability.

Third, the vision promotes **innovation and financing frameworks** to support the development of maritime infrastructure and industry.

Fourth, the document emphasizes **Atmanirbhar Bharat**, encouraging domestic manufacturing, shipbuilding capabilities and indigenous maritime technology development.

Finally, the roadmap includes **clearly defined timelines for the implementation of action points**, ensuring that the vision translates into measurable outcomes.

Major Strategic Themes

MAKV 2047 identifies **11 key themes** that collectively define India's maritime transformation roadmap.

Lead the World in Safe, Sustainable and Green Maritime Sector

One of the most important pillars of MAKV 2047 is the transition toward a **green and sustainable maritime ecosystem**.

The vision aligns India's maritime sector with global climate commitments and the **IMO greenhouse gas reduction strategy**. The government intends to reduce emissions from maritime operations through the adoption of cleaner fuels, renewable energy and energy-efficient technologies.

Several initiatives have been proposed to achieve this goal, including:

- development of **carbon-neutral ports**
- adoption of **alternative fuels such as LNG, hydrogen, ammonia and biofuels**
- introduction of **shore-to-ship power systems**
- expansion of **renewable energy use in ports**

- development of **green maritime shipping programs**

The vision proposes the establishment of a **Decarbonization Cell at the Directorate General of Shipping (DG Shipping)** to coordinate the implementation of maritime decarbonisation initiatives.

Promote Ocean, Coastal and River Cruise Sector

MAKV 2047 identifies maritime tourism as an important growth area for the Indian maritime economy.

Although the global cruise industry has been expanding rapidly, India's share in cruise tourism remains limited. The vision therefore proposes the development of:

- cruise terminals and marinas along the eastern and western coasts
- river cruise infrastructure along inland waterways
- improved regulatory frameworks for cruise operations
- simplified visa processes and fiscal incentives

These initiatives aim to significantly increase cruise passenger volumes and position India as a major cruise tourism destination.

Enhance Modal Share of Coastal Shipping and Inland Waterways

The vision recognizes that India has not fully utilized its **coastal shipping and inland waterway potential**, despite having extensive navigable waterways and a long coastline.

Compared to road and rail transport, water-based transportation offers several advantages:

- lower cost of cargo movement
- reduced emissions
- higher energy efficiency
- reduced congestion in land transport networks

To address this gap, MAKV 2047 proposes initiatives such as:

- development of coastal shipping corridors
- expansion of inland waterway infrastructure
- introduction of low-draft vessels
- improved multimodal connectivity
- reduction in port charges and logistics costs

The vision targets a significant increase in cargo movement through inland waterways, from **109 MMTPA currently to over 500 MMTPA by 2047.**

Promote Maritime Clusters

The development of **maritime industrial clusters** is another key theme of MAKV 2047.

These clusters aim to integrate port infrastructure with manufacturing, logistics, shipbuilding and maritime services, thereby creating regional maritime economic hubs.

The vision proposes maritime cluster development in locations such as:

- Deendayal Port Authority
- Visakhapatnam Port
- Syama Prasad Mookerjee Port (Haldia)
- Andaman and Nicobar Islands

Island development projects also include plans to develop specific islands for specialized maritime functions such as:

- ship repair hubs
- bunkering facilities
- maritime logistics services.

Promote Maritime Professional Services

A modern maritime economy requires a strong ecosystem of **professional services**, including finance, insurance, arbitration and maritime law.

MAKV 2047 proposes the creation of institutional frameworks that can support maritime investments and dispute resolution mechanisms.

Key initiatives include:

- establishment of a **Maritime Development Fund** for long-term financing
- development of **international maritime arbitration centres**
- strengthening maritime insurance services
- providing fiscal incentives for maritime investments

These initiatives aim to position India as a regional hub for maritime financial and professional services.

Become a Global Player in Shipbuilding, Repair and Recycling

India already holds a strong position in **ship recycling**, particularly through the Alang ship recycling cluster. However, the country's global share in **shipbuilding and ship repair remains relatively small**.

MAKV 2047 therefore proposes measures to strengthen the shipbuilding ecosystem through:

- extension of shipbuilding financial assistance schemes
- development of new shipyard infrastructure
- simplified customs procedures for vessel spares
- promotion of domestic shipbuilding under Atmanirbhar Bharat

The vision also proposes expanding ship recycling capacity and developing new recycling locations along the eastern coast of India.

Develop World-Class Maritime Education, Research and Training

Human capital development is recognized as a crucial element of maritime growth.

The vision highlights the need to create a **strong maritime knowledge ecosystem**, including:

- maritime research centres
- innovation incubators and accelerators
- international partnerships with leading maritime institutes
- maritime knowledge clusters
- centres of excellence in maritime logistics and technology

These initiatives aim to promote innovation, skill development and research capabilities in the maritime sector.

Strengthen India's Global Maritime Presence

MAKV 2047 emphasises the importance of international cooperation and global engagement in maritime governance.

Key initiatives include:

- establishment of a dedicated **IMO coordination cell**
- strengthening India's representation in international maritime institutions
- development of maritime partnerships with regional organizations such as **BIMSTEC and IORA**

- promotion of international maritime diplomacy

These initiatives aim to enhance India's influence in global maritime policy-making.

Develop World-Class Next Generation Ports

The vision proposes a major expansion of port capacity and efficiency.

India's current port capacity is estimated at **around 2,500 million tonnes**, while the MAKV 2047 roadmap targets an increase to **over 10,000 million tonnes by 2047**.

Key initiatives include:

- development of deep-draft ports (18–23 meters)
- creation of port clusters with capacities exceeding **300 MTPA**
- development of transshipment hubs
- construction of new major ports
- increased private sector participation in port development

Enhance Efficiency Through Technology and Innovation

Digital transformation is a major focus area in MAKV 2047.

Technological initiatives proposed include:

- implementation of **Just-in-Time arrival systems**
- development of **digital twins for ports**
- adoption of **AI-based berth allocation systems**
- drone-based inventory management
- automated cargo handling equipment
- establishment of digital innovation centres for maritime technology

These measures aim to improve operational efficiency and reduce logistics costs.

Enhance India's Shipping Tonnage

India's share in global shipping tonnage remains relatively small compared to other major maritime nations.

To strengthen India's merchant fleet, MAKV 2047 proposes policy reforms such as:

- fiscal incentives for Indian shipping companies
- infrastructure status for the shipping industry
- financing support through alternative investment mechanisms

- regulatory simplification for ship registration and operations

These reforms aim to increase India's share in the global shipping fleet and strengthen domestic shipping capacity.

Strategic Aspirations for 2047

The vision outlines several ambitious targets to be achieved by 2047, including:

- development of **14 carbon-neutral major ports**
- establishment of **hydrogen and ammonia bunkering hubs**
- development of **three transshipment hubs**
- increase in inland waterway cargo movement to **more than 500 MMTPA**
- development of **13 deep-draft ports**
- establishment of **smart ports with Just-in-Time operations**
- expansion of India's global ranking in shipbuilding to the **Top 5**.

National Regulatory Framework

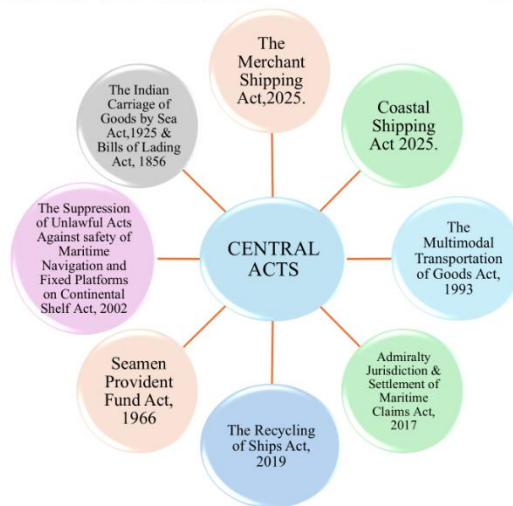


National Regulatory Framework

Legislative Frameworks driving Maritime Ecosystem



New Maritime Legislative Reforms - 2025



Directorate General of Shipping $\xrightarrow{\text{Transitioning to}}$ Directorate General of Maritime Administration 4

India's maritime sector is supported by a **comprehensive and evolving legislative framework**, which forms the backbone of:

- Safe and efficient shipping operations
- Regulatory oversight and compliance
- Trade facilitation and logistics efficiency
- Environmental protection and sustainability

A strong legal ecosystem is critical for:

- **Ease of doing business in maritime sector**
- **Alignment with international conventions (IMO, ILO, UNCLOS etc.)**
- **Enhancing global competitiveness of Indian shipping**

Evolution of India's Maritime Legislative Framework

India's maritime laws have evolved in response to:

- Technological advancements in shipping and port operations
- Growing complexity of global supply chains

- Environmental and sustainability obligations
- Need for digitisation and modern trade practices

The transition from legacy laws to **modern, forward-looking legislations (2025 reforms)** reflects:

- Regulatory modernization
- Institutional strengthening
- Integration with global maritime ecosystem

Key Legislative Instruments – 2025 Reforms

The **five new Acts (2025)** represent a major overhaul of India's maritime legal framework:

Merchant Shipping Act, 2025

- Principal legislation governing Indian shipping
- Expands definition of vessels and ownership norms
- Aligns with international safety and operational standards
- Strengthens regulatory oversight of vessels

Indian Ports Act, 2025

- Replaces the Indian Ports Act, 1908
- Introduces modern governance framework for ports
- Mandates:
 - Environmental safeguards
 - Tariff transparency
 - Disaster preparedness

Coastal Shipping Act, 2025

- Promotes coastal and inland water transport
- Enhances modal shift from road/rail to waterways
- Supports cost-effective and sustainable logistics

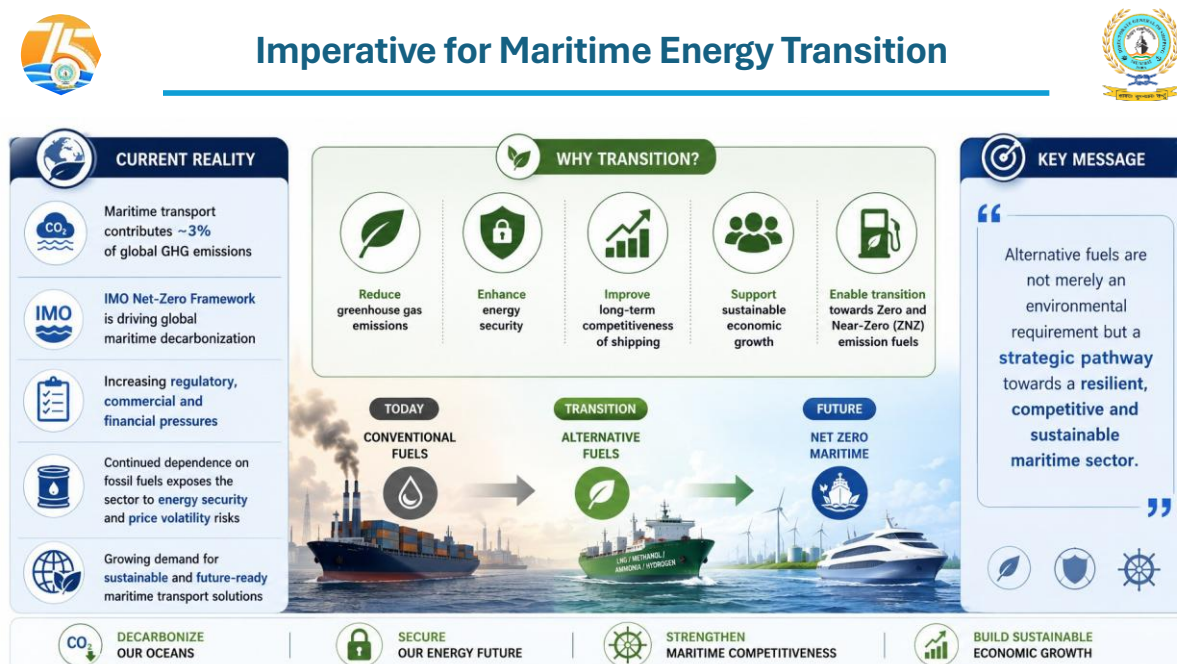
Bills of Lading Act, 2025

- Modernises trade documentation framework
- Enables electronic bills of lading
- Improves:
 - Transparency
 - Traceability
 - Trade security

Carriage of Goods by Sea Act, 2025

- Updates liability and carriage provisions
- Aligns with international conventions
- Ensures uniform and predictable trade practices

Imperative for Maritime Energy Transition



Maritime transport is central to global trade, supply chains and economic development. At the same time, the sector is increasingly required to address greenhouse gas emissions, improve energy efficiency and prepare for a future in which low and zero-emission operations become commercially and operationally necessary. Maritime energy transition, therefore, is not merely an environmental agenda. It is a strategic requirement for ensuring the long-term resilience, competitiveness and sustainability of the maritime ecosystem.

Shipping has traditionally depended on conventional fossil fuels such as heavy fuel oil, marine gas oil and diesel. While these fuels have supported the growth of global trade, continued dependence creates exposure to volatile fuel prices, supply disruptions, import dependence and future compliance risks. It also places the sector under increasing pressure to reduce its greenhouse gas footprint and align with evolving international expectations on cleaner shipping.

The global maritime sector is moving towards decarbonisation through a combination of regulatory measures, market expectations, technological innovation and financial signals. The 2023 IMO GHG Strategy seeks net-zero GHG emissions from international shipping by or around 2050 and includes interim ambitions for 2030 and 2040. It also envisages increasing uptake of zero and near-zero GHG emission technologies, fuels and energy sources. Discussions on the proposed IMO Net-Zero Framework are continuing, including on a global fuel standard and a GHG-pricing mechanism.

This evolving international environment is likely to influence vessel design, fuel selection, ship operations, chartering decisions, access to finance, port infrastructure and future trade competitiveness. Shipping companies that are unable to adapt may face higher operating costs, reduced market access and greater exposure to regulatory and commercial risks. Conversely, early preparedness can create opportunities for greener fleets, efficient ports, domestic manufacturing, fuel production and new maritime services.

The transition is necessary for five broad reasons.

First, it is essential to reduce greenhouse gas emissions from shipping and associated maritime activities. This includes not only emissions from onboard fuel use but also lifecycle emissions associated with fuel production, transportation, storage and use. A lifecycle approach is important to ensure that emissions are genuinely reduced rather than shifted from ships to other parts of the energy system.

Second, maritime energy transition can strengthen energy security. Diversifying fuel options through sustainable biofuels, green methanol, green ammonia, hydrogen, battery-electric systems and other cleaner technologies can reduce dependence on conventional imported fuels. This is particularly relevant for India, where maritime growth, energy security and domestic green-energy capability must progress together.

Third, the transition is necessary to safeguard the long-term competitiveness of Indian shipping. Future competitiveness will increasingly depend on the ability of vessels and ports to meet efficiency standards, access cleaner fuels, comply with carbon-related requirements and respond to changing expectations from cargo owners, charterers, financiers and international supply chains.

Fourth, the transition can support sustainable economic growth. Development of green-fuel ecosystems, bunkering infrastructure, renewable-energy integration, shipbuilding capability, retrofitting capacity, port electrification, digital systems and specialised skills can generate new economic activity and strengthen domestic maritime capability. It can also create opportunities for Indian ports and coastal regions to emerge as green-fuel production, storage, bunkering and maritime-service hubs.

Fifth, maritime energy transition is necessary to enable a progressive shift towards zero and near-zero emission fuels and technologies. The transition will not follow one uniform pathway. Different vessel segments, routes, operating profiles and port conditions will require different solutions. Energy-efficiency measures, operational optimisation, hull and propulsion improvements, wind-assist technologies, shore power, batteries, hybrid systems and multiple alternative fuels will need to be adopted in a phased and practical manner.

The pathway for transition can broadly be understood in three stages. In the immediate term, the focus should be on improving energy efficiency, optimising operations, reducing fuel consumption and preparing vessels and ports for future requirements. In the medium term, greater deployment of alternative fuels, retrofits, green bunkering facilities, shore power and digital optimisation systems will be required. In the long term, the objective is to create a net-

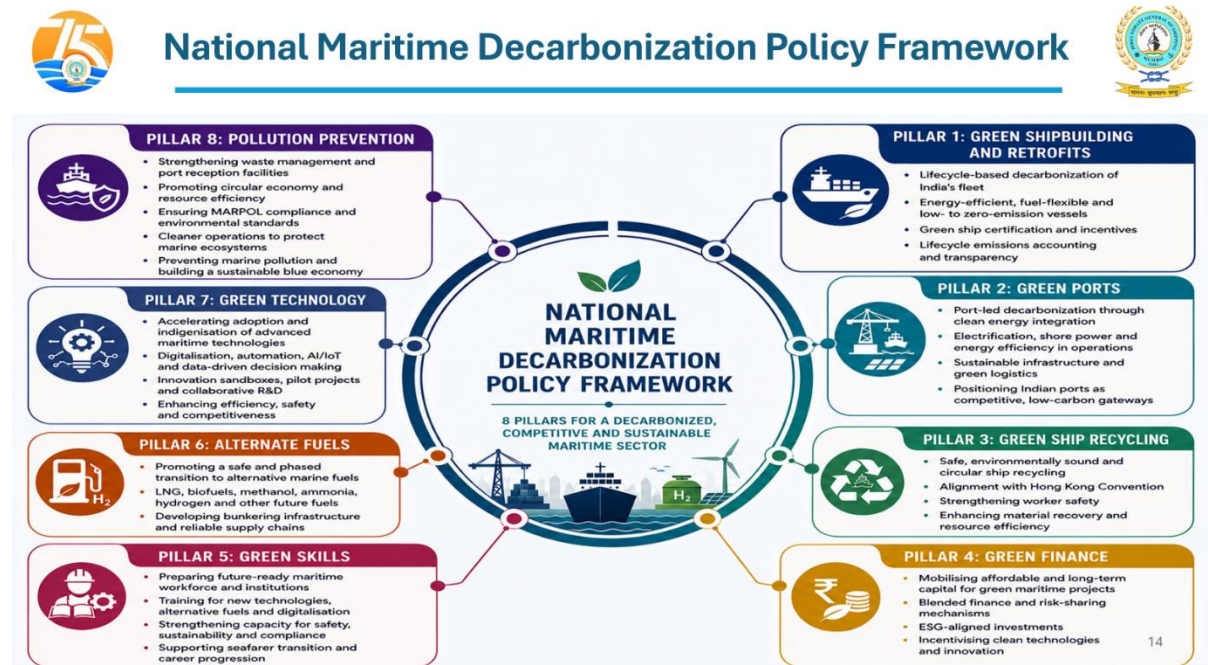
zero maritime ecosystem supported by cleaner fuels, efficient ships, green ports, reliable infrastructure, skilled personnel and appropriate safety and regulatory frameworks.

Alternative fuels are an important component of this journey, but they are not a standalone solution. Their successful adoption will depend on availability, affordability, safety, lifecycle emissions, storage and bunkering arrangements, vessel compatibility, engine technology, crew training and international standards. The transition must therefore be supported by coordinated action across shipping, ports, shipbuilding, energy, finance, technology, skill development and regulation.

For India, maritime energy transition presents an opportunity to align climate responsibility with national priorities of energy security, Atmanirbhar Bharat, industrial development, port-led growth and Viksit Bharat. It provides a pathway to develop a resilient and future-ready maritime sector that can support trade growth while progressively reducing environmental impact.

The central message is that maritime energy transition should be viewed not as a compliance burden but as a strategic opportunity. A well-planned transition can help decarbonise maritime operations, strengthen energy resilience, improve competitiveness, support innovation and create sustainable economic growth across the maritime value chain.

National Maritime Decarbonization Policy Framework



The National Maritime Decarbonization Policy Framework (NMDP) is envisaged as India's umbrella transition framework to systematically decarbonise and green the entire maritime ecosystem. It provides a unified national approach covering ships, ports, marine fuels, shipbuilding and ship repair, ship recycling, green finance, human capital development and digital governance systems, across both coastal and inland waterways.

The NGSP is designed not merely as an environmental policy, but as a strategic transformation instrument that aligns India's maritime growth ambitions with national climate commitments, international regulatory developments and long-term economic competitiveness. It seeks to embed sustainability as a core operational and investment principle across maritime planning, regulation and implementation, rather than treating decarbonisation as a parallel or incremental activity.

Policy Evolution and Development Process

The formulation of the NMDP has followed a phased, consultative and evidence-led approach.

- An initial Consultative Document on the National Green Shipping Policy was developed by Lloyd's Register. This consultative document laid out the preliminary

policy landscape, identified gaps in India's green maritime ecosystem and proposed a broad set of policy actions across technology, fuels, ports, finance and regulation. The document was formally released during the Green Shipping Conclave, marking the commencement of structured stakeholder engagement on the proposed policy.

- Building upon this consultative foundation, the draft National Green Shipping Policy was subsequently prepared by TERI – National Centre of Excellence for Green Ports and Shipping (NCoEGPS). This stage involved extensive stakeholder consultations and focused sectoral discussions, covering key maritime verticals including shipping, ports, shipbuilding, ship recycling, green fuels, finance and skill development. Inputs from central ministries, regulators, port authorities, shipowners, shipyards, technology providers, financial institutions, academia and international partners were systematically incorporated to strengthen policy coherence, practicality and implementability.

This two-stage process ensured that the NMDP evolved from a conceptual and gap-identification exercise into a robust, nationally owned draft policy, grounded in stakeholder consensus and aligned with India's developmental and institutional realities.

Role of NMDP as a Convergence Policy

Importantly, the NMDP is not a standalone scheme or isolated programme. It functions as a convergence and integration policy, bringing together multiple existing national visions, guidelines and sectoral initiatives under a single, coherent framework. These include Maritime India Vision 2030, Maritime Amrit Kaal Vision 2047, the Harit Sagar Guidelines and the Green Tug Transition Programme.

By consolidating these initiatives, the NMDP addresses the current fragmentation in India's green maritime landscape, where policies, schemes and pilot projects exist but lack a common definitional basis, emissions baseline, monitoring architecture and implementation sequencing. The policy therefore serves as the principal national reference framework for defining what constitutes "green" in the maritime context, establishing measurable targets, standardised monitoring and reporting mechanisms and enabling coordinated action across ministries, regulators, ports, shipping companies, shipyards and financial institutions.

At a strategic level, the NMDP positions India to pursue a phased, realistic and nationally aligned maritime decarbonisation pathway, balancing developmental priorities with environmental responsibility, while providing a credible basis for engagement with evolving global maritime decarbonisation frameworks.

Why NMDP Is Imperative Now

The need for a National Maritime Decarbonization Policy Framework (NMDP) has become immediate and unavoidable due to the convergence of global regulatory pressures, domestic policy gaps and India's rapidly expanding maritime footprint. While India has launched several forward-looking green maritime initiatives over the past decade, these efforts remain fragmented, scheme-driven and unevenly implemented, limiting their cumulative impact.

Escalating Global Regulatory and Market Pressures

International shipping is entering a decisive phase of decarbonisation. The International Maritime Organization (IMO), through its Revised GHG Strategy (2023), has committed to achieving net-zero greenhouse gas emissions from international shipping by or around 2050, with interim targets for 2030 and 2040. These developments are being reinforced by emerging market-based measures, fuel standards and emissions reporting requirements across major trading blocs.

In the absence of a comprehensive national framework, Indian shipping, ports and maritime service providers risk:

- Regulatory misalignment with global standards
- Higher compliance costs and trade frictions
- Reduced competitiveness of Indian-flag vessels and ports

The NGSP is therefore required to provide policy certainty, regulatory preparedness and strategic alignment, enabling Indian maritime stakeholders to anticipate and adapt to evolving international obligations in a coordinated manner.

Fragmentation of Domestic Green Maritime Initiatives

India has already initiated several important green maritime measures, including the Harit Sagar Guidelines, the Green Tug Transition Programme, ship recycling reforms and pilot green fuel projects at select ports. However, these initiatives currently operate as standalone interventions, without a common framework for:

- Defining what constitutes a “green ship”, “green port” or “green fuel”
- Establishing national emissions baselines across ships, ports and inland waterways
- Standardising Monitoring, Reporting and Verification (MRV) systems
- Sequencing short-term, medium-term and long-term decarbonisation actions

This fragmentation constrains scale-up and dilutes accountability. The policy is imperative to unify these disparate efforts into a single national transition architecture, ensuring coherence across policies, programmes and investments.

Scale and Growth of India’s Maritime Sector

India’s maritime sector underpins nearly 95% of the country’s trade by volume and continues to expand rapidly, supported by major investments in ports, inland waterways, coastal shipping and shipbuilding. With new mega ports, industrial clusters and logistics corridors under development, the carbon footprint of maritime activities is set to increase sharply if sustainability is not embedded at the planning stage.

Without a guiding national policy:

- Infrastructure investments risk locking in carbon-intensive pathways
- Retrofitting costs will rise over time

- Opportunities for early adoption of clean technologies may be missed

The policy is therefore critical to mainstream decarbonisation at the design, procurement and investment stages, rather than treating it as a post-facto corrective measure.

Alignment with India's National Climate Commitments

India's climate commitments under the Panchamrit framework and the Long-Term Low Emission Development Strategy (LT-LEDS) set a national net-zero target for 2070. However, the maritime sector requires a sector-specific transition pathway to translate these economy-wide goals into actionable measures for ships, ports and fuels.

The policy bridges this gap by:

- Translating national climate commitments into maritime-specific targets
- Aligning domestic timelines with global maritime decarbonisation trajectories
- Providing a calibrated and development-sensitive transition pathway

In doing so, it ensures that India's maritime decarbonisation efforts are credible, measurable and nationally appropriate.

Enabling Green Finance and Investment Readiness

The transition to green shipping will require significant capital mobilisation for new vessels, retrofits, alternative fuel infrastructure, renewable energy integration and digital systems. Global climate finance, sustainability-linked lending and green bonds are increasingly tied to clear policy signals, measurable outcomes and robust governance frameworks.

In the absence of a national policy:

- Investors face uncertainty and higher perceived risks
- Access to international green finance remains constrained
- Domestic financial institutions lack clear guidance on eligibility and metrics

The NMDP is imperative to establish the policy and institutional foundations for green maritime finance, de-risking investments and enabling access to domestic and international capital.

Strategic Opportunity for Global Leadership

Finally, the timing of the NMDP presents a strategic opportunity. India is simultaneously:

- Expanding its maritime and port infrastructure
- Scaling renewable energy capacity
- Emerging as a leader in ship recycling and green fuel potential

By acting now, India can move from being a policy follower to a rule-shaper in global green shipping, positioning itself as a credible hub for green vessels, green fuels and sustainable maritime services.

In essence, the NMDP is imperative now because delay would increase transition costs, fragment action and weaken India's strategic positioning, whereas timely adoption enables a coordinated, cost-effective and globally aligned green maritime transition.

NMDP Objectives and Pillar Architecture

Core Objectives of the National Maritime Decarbonization Policy Framework

The National Maritime Decarbonization Policy Framework (NMDP) articulates a set of clear, interlinked objectives aimed at guiding India's maritime sector through a phased, measurable and inclusive green transition. These objectives serve as the operational foundation for all actions undertaken under the policy.

The key objectives of the NMDP are to:

Decarbonise India's maritime sector in a structured and time-bound manner

The NMDP seeks to progressively reduce greenhouse gas emissions across ships, ports, fuels and associated maritime activities, while aligning domestic action with India's national climate commitments and evolving international maritime decarbonisation frameworks.

Establish a common national definition and standards for "green" maritime activities

A core objective of the policy is to define, standardise and operationalise what constitutes a *green ship*, *green port* and *green fuel*, using measurable, auditable and lifecycle-based criteria. This is intended to remove ambiguity and enable consistency across regulation, procurement, certification and financing.

Create a robust governance, monitoring and reporting framework

The NMDP aims to institutionalise national emissions baselines, Monitoring Reporting and Verification (MRV) systems and performance assessment mechanisms, ensuring transparency, accountability and data-driven decision-making across the maritime ecosystem.

Enable investment and de-risk the green maritime transition

Recognising the scale of capital required, the policy seeks to unlock domestic and international green finance by providing policy certainty, standardised metrics and institutional mechanisms that reduce risk for investors, shipowners, ports and technology providers.

Promote technology adoption, innovation and indigenisation

The NMDP encourages the adoption of clean and energy-efficient maritime technologies while supporting domestic manufacturing, research and innovation in areas such as alternative fuels, propulsion systems, digital solutions and emissions reduction technologies.

Ensure a just, inclusive and capacity-driven transition

The policy explicitly integrates human capital development, green skilling and inclusion of

MSMEs, informal operators and coastal communities, ensuring that the benefits of the green transition are equitably distributed.

Pillar Architecture of the NMDP

To operationalise these objectives, the NMDP is structured around a multi-pillar architecture, with each pillar addressing a critical dimension of the maritime ecosystem. The pillars are designed to function interdependently, enabling coordinated implementation rather than isolated interventions.

The NMDP pillar framework comprises:

1. Green Shipbuilding and Retrofits

This pillar focuses on decarbonisation of vessels across coastal, inland and international shipping segments, including shipbuilding and ship repair. It addresses green ship standards, retrofitting, new builds, emissions monitoring, certification and financial incentives for cleaner vessels.

2. Green Ports

The Green Ports pillar targets reduction of emissions and environmental impacts at ports and terminals through renewable energy integration, energy efficiency, electrification, shore-to-ship power, waste management, digital monitoring and green port certification mechanisms.

3. Green Ship Recycling

The Green Ship Recycling pillar aims to strengthen environmentally sound and safe ship recycling practices, aligned with international conventions and domestic regulations, while promoting circularity, transparency and occupational safety.

4. Green Finance

This pillar focuses on mobilising and de-risking capital for green maritime investments through dedicated funds, sustainability-linked finance instruments, incentives, subsidies and blended finance mechanisms aligned with measurable performance outcomes.

5. Green Skills

This pillar addresses the workforce dimension of the transition by strengthening green skilling, certification, training and institutional capacity across seafarers, port workers, shipyard personnel, regulators and allied maritime professionals.

6. Alternate Fuels

This pillar supports the transition from conventional marine fuels to low- and zero-carbon alternatives such as biofuels, LNG, green hydrogen, ammonia and methanol. It covers fuel standards, lifecycle emissions assessment, bunkering infrastructure, green corridors and fuel transition pathways.

7. Green Technology

The Green Technology pillar promotes adoption and indigenisation of clean maritime technologies, including propulsion systems, energy storage, emissions reduction solutions and digital tools. It also emphasises research, development and international technology collaboration.

8. Pollution Prevention

Preventing Marine Pollution and building sustainable blue economy. Strengthening waste management and port reception facilities, Ensuring MARPOL Compliance and environmental standards. Cleaner operations to protect marine ecosystem.

Relevance of the Pillar Architecture for Implementation

The pillar-based structure allows the NMDP to be **translated into actionable programmes, timelines and responsibilities**, while enabling coordination across ministries, regulators, ports, shipping companies, shipyards, financial institutions and technology providers. It also facilitates **tracking, monitoring and course correction** by clearly mapping actions, stakeholders and outcomes to specific thematic pillars.

Maritime INDIA @ Net Zero

NGSP Multi-Ministerial Action Planning and Governance Workshop



Maritime INDIA @ Net Zero

14 – 15 January 2026, India Habitat Centre (Hybrid)



Maritime INDIA @ Net Zero was jointly organised by the Directorate General of Shipping (DGS) and NCoEGPS at TERI as a **high-level multi-ministerial action plan and governance workshop** to translate the National Green Shipping Policy (NGSP) vision into **phased, implementation-ready national pathways** aligned with India's climate commitments.

Way Forward

- **Conduct focused stakeholder webinars** to validate priority actions and implementation sequencing
- **Undertake inter-ministerial consultations** to finalise roles, timelines and coordination mechanism
- **Final submission of consolidated roadmap and action matrix to NITI Aayog** for strategic guidance and national rollout



9

India's maritime sector underpins national economic growth, with nearly 95% of India's trade by volume carried through maritime transport. At the same time, international shipping is entering a decisive transition phase driven by the International Maritime Organization's (IMO) revised 2023 GHG Strategy, which commits global shipping to net-zero greenhouse gas emissions by or around 2050, supported by enforceable interim measures based on lifecycle (well-to-wake) emissions.

In parallel, India has articulated its own long-term climate pathway, including a net-zero target by 2070, requiring calibrated alignment between domestic development priorities and evolving international regulatory regimes such as EEXI, CII and forthcoming GHG Fuel Intensity (GFI) standards.

Against this backdrop, the National Maritime Decarbonization Policy Framework (NGSP) has been developed as India's unifying national framework for maritime decarbonisation, integrating ships, ports, fuels, shipbuilding, ship recycling, finance, skilling and governance into a single transition architecture.

To move NGSP from policy articulation to implementation readiness, the Maritime INDIA @ Net Zero Workshop was convened as a high-level, multi-ministerial and multi-stakeholder platform focused on execution planning, coordination and governance alignment.

Workshop Overview

The Maritime INDIA @ Net Zero – NGSP Multi-Ministerial Action Plan and Governance Workshop was held on 14–15 January 2026 at India Habitat Centre, New Delhi, in hybrid mode. The workshop was organised by the Directorate General of Shipping (DGS), Ministry of Ports, Shipping and Waterways (MoPSW), in collaboration with the National Centre of Excellence for Green Ports and Shipping (NCoEGPS), TERI, which has been designated by MoPSW as the national technical and knowledge partner for India’s green maritime transition.

The workshop brought together senior officials from central ministries, maritime administrations, ports, industry, financial institutions, international organisations and knowledge partners.

A key milestone during the workshop was the release of the knowledge document “Advanced Green Fuels for Maritime Applications – Roadmap for India”, prepared by Dr Piyali Das (NCoEGPS–TERI), providing a structured, lifecycle-based foundation for alternative fuel transition planning in India’s maritime sector .

Objectives

The workshop was explicitly designed to go beyond awareness-building and instead focus on implementation-oriented action planning. The core objectives were to:

- Translate NGSP into phased national action plans with short-, medium- and long-term priorities
- Deliberate transition pathways across green ships, green ports, green fuels, ship recycling and enabling pillars
- Assess regulatory, safety and institutional readiness for emerging technologies and alternate fuels
- Examine finance, market instruments and de-risking mechanisms for maritime sustainability investments
- Strengthen governance, coordination, monitoring and review mechanisms for NGSP implementation
- Position India within global maritime decarbonisation initiatives and international cooperation frameworks

Strategic Significance

The Maritime INDIA @ Net Zero Workshop marked a clear turning point in India’s approach to green shipping. It moved the conversation away from isolated and fragmented green initiatives towards a shared, nationally coordinated pathway for maritime decarbonisation. By bringing all key stakeholders to the same table, the workshop helped create a common understanding of priorities, sequencing and responsibilities.

Importantly, the workshop reinforced the National Maritime Decarbonization Policy Framework (NGSP) as the central reference framework for both domestic action and international engagement. It positioned the maritime sector not just as a compliance-driven industry, but as an active contributor to India's long-term climate goals, energy security and economic growth.

In doing so, Maritime INDIA @ Net Zero laid the groundwork for a more structured, collaborative and implementation-focused green transition—one that aligns India's maritime ambitions with global developments while remaining grounded in national realities.

Inaugural Session

The inaugural session set the strategic tone for the two-day deliberations.

- Shri R. R. Rashmi, Distinguished Fellow, TERI, situated NGSP within the global climate and energy transition, emphasising the importance of realistic timelines, lifecycle-based decision-making and system-level thinking.
- Shri Shyam Jagannathan, IAS, Director General of Shipping, outlined NGSP's alignment with emerging IMO regulations on emissions, fuel intensity and safety and highlighted the need for credible national governance and MRV systems.
- Shri Rajesh Kumar Sinha, IAS, Special Secretary, MoPSW, underscored the necessity of clear institutional ownership, inter-ministerial coordination and phased execution mechanisms to translate policy intent into measurable outcomes.

Session-Wise Key Themes

Session 1: National Green Shipping Policy – Framework and Governance

This session presented NGSP as a comprehensive national transition framework, not a standalone scheme. Discussions focused on:

- NGSP's pillar architecture and lifecycle-based approach
- Establishment of a national maritime emissions baseline (2021)
- Development of an integrated Monitoring, Reporting and Verification (MRV) framework
- Proposal of the National Green Shipping Coordination Cell (NGSCC) as the nodal governance mechanism
- Introduction of a Rolling National Green Maritime Implementation Plan (NGMIP) to convert policy into time-bound action

Stakeholders emphasised the need for statutory strength, escalation powers and decision-linked MRV systems.

Session 2: Green Ship Recycling and Circular Economy

This session focused on strengthening India's ship recycling ecosystem under NGSP, particularly in light of the Hong Kong International Convention entering into force.

Key themes included:

- Safe and environmentally sound recycling practices
- Circular economy linkages and green steel value chains
- Worker safety, skilling and welfare
- Digitalisation, compliance monitoring and transparency systems

Ship recycling was positioned as a strategic decarbonisation and resource-efficiency lever, not merely an end-of-life activity.

Session 3: Green Fuels and Alternate Energy Pathways

This session examined India's fuel transition through a technology-neutral, lifecycle-based portfolio approach.

Deliberations covered:

- Definition of green fuels under NGSP (biofuels, green hydrogen, green ammonia, green methanol, renewable LNG etc.)
- Phase-wise transition targets (short, medium and long term)
- Safety standards, fuel handling and infrastructure readiness
- Integration with port bunkering systems and MRV frameworks

The session reinforced that fuel transition must be safe, phased and system-integrated, avoiding premature fuel lock-in.

Session 4: Green Ports and Port-Led Decarbonisation

Ports were identified as critical system anchors for maritime decarbonisation.

Discussions focused on:

- Renewable energy integration and energy efficiency
- Shore-to-Ship Power (OPS) and port electrification
- Port-level emissions accounting and benchmarking
- Integration of ports with green fuel hubs and logistics clusters

The session highlighted that port readiness will directly determine the pace and credibility of shipping decarbonisation.

Session 5: Green Ships and Green Technology Transition

This session addressed vessel-side decarbonisation across coastal, inland and ocean-going fleets.

Key focus areas included:

- Technology transition pathways for newbuilds and retrofits
- Fuel-flexible and hybrid vessel configurations
- Readiness of Indian shipyards and technology ecosystems
- Alignment of standards, certification and safety regimes

Green shipping was positioned as a technology-enabled and finance-dependent transition, requiring coordinated policy signals.

Session 6: Green Finance and Market Instruments

This session examined finance as a core enabler of NGSP implementation.

Discussions covered:

- Limitations of conventional maritime finance
- Need for de-risking instruments for first-of-a-kind projects
- Role of blended finance, guarantees, green bonds and incentives
- Alignment with global ESG and climate finance frameworks

Participants emphasised that without credible finance mechanisms, green maritime investments will not scale.

Session 7: Training and Capacity Building

The workshop deliberately reframed the originally envisaged pollution-prevention focus into a dedicated session on training and capacity building, recognising that environmental outcomes depend fundamentally on human and institutional capability.

The session addressed:

- Skill gaps arising from new fuels, technologies and safety regimes
- Capacity requirements for regulators, surveyors, ports and crews
- Alignment of maritime education and training with NGSP needs
- Long-term development of India as a green maritime skills hub

Session 8: International Collaboration and Global Best Practices

This session situated NGSP within global maritime decarbonisation initiatives, including:

- IMO GreenVoyage2050
- Green shipping corridors
- Bilateral and multilateral cooperation frameworks

India's potential leadership role in the Indian Ocean region was highlighted, alongside the importance of coordination, capacity building and technology transfer.

Key Outcomes of Maritime INDIA @ Net Zero Workshop

The Maritime INDIA @ Net Zero Workshop resulted in a shared, cross-stakeholder understanding that India's maritime decarbonisation journey must be coordinated, phased and institutionally anchored, rather than driven through isolated initiatives.

A key outcome was the collective endorsement of the National Green Shipping Policy (NGSP) as the single, unifying framework for India's green maritime transition, cutting across ships, ports, fuels, ship recycling, finance, skilling and governance. Stakeholders broadly converged on the need to avoid fragmented pilots and instead pursue system-level implementation aligned to NGSP pillars.

The workshop generated session-wise technical and policy inputs across all NGSP domains, highlighting:

- the critical role of fuel transition and bunkering readiness as long-term decarbonisation levers
- the centrality of ports as system enablers for energy transition, electrification and fuel deployment
- the importance of ship recycling and circular economy linkages as a comparative strength for India
- the recognition that green finance and de-risking mechanisms are prerequisites for scaling investments
- the acknowledgement that capacity building and institutional readiness are foundational to safe and effective implementation

Stakeholders also identified common cross-cutting challenges, including:

- absence of harmonised emissions baselines and MRV systems
- safety and regulatory preparedness for alternate fuels
- high upfront capital costs and limited access to concessional finance
- skills gaps across ships, ports and regulatory institutions

Overall, the workshop marked a shift from policy intent to execution thinking, with emphasis on sequencing, prioritisation and accountability.

Way Forward

Building on the deliberations and stakeholder inputs, the following next steps have been identified to operationalise outcomes from the workshop:

1. Consolidation	of	Workshop	Outputs
Session-wise recommendations and inputs will be distilled into a structured NGSP Action-Point Matrix, aligned to policy pillars and categorised into short-term, medium-term and long-term actions, with indicative ownership and dependencies.			

2. **Stakeholder Validation and Refinement**
Following consolidation, focused thematic webinars and consultations will be conducted to validate proposed actions, refine sequencing and strengthen alignment among concerned ministries, regulators, ports and industry stakeholders.
3. **Inter-Ministerial Convergence**
The consolidated action matrix will be taken up for inter-ministerial consultation, to clarify roles, responsibilities and coordination mechanisms across shipping, ports, energy, environment, finance and skilling domains.
4. **Policy-Level Review and Strategic Alignment**
The refined and implementation-ready NGSP action framework will be presented to NITI Aayog for policy-level review, strategic alignment with national climate and energy pathways and guidance on national rollout.
5. **Governance and Execution Mechanism**
Parallel to the above, governance and execution arrangements under NGSP will be strengthened, including mechanisms for coordination, monitoring and periodic review. TERI-NCoEGPS, as the designated National Centre of Excellence for Green Ports and Shipping, will support technical facilitation, knowledge development and stakeholder coordination as required.
6. **Initiation of Priority Pilot Actions**
Based on readiness and impact potential, priority pilot actions across fuels, ports, ships, finance and capacity building will be identified for early implementation, to generate learning, build confidence and inform scale-up.

Alternative Fuels for Maritime

Global Transition Imperative in Maritime Fuels



Alternative Fuels in Maritime



The global maritime sector is undergoing a structural and irreversible transition driven by the convergence of tightening international climate regulations, rapid technological evolution and shifting fuel economics. Shipping, which has traditionally relied on energy-dense fossil fuels, is now subject to explicit decarbonisation pathways that fundamentally alter how vessels are designed, operated and fuelled.

A critical inflection point in this transition is the adoption of the IMO Net-Zero Framework by the International Maritime Organization, which operationalises global decarbonisation objectives through binding regulatory instruments. Central to this framework is the introduction of mandatory Greenhouse Gas Fuel Intensity (GFI) requirements, assessed on a well-to-wake lifecycle basis, covering emissions from fuel production, transport and onboard use. This marks a decisive shift away from earlier, predominantly efficiency-based measures toward a fuel-centric regulatory regime.

Under this emerging framework, fuel choice becomes the primary determinant of regulatory compliance. Unlike earlier phases of maritime environmental regulation, where incremental efficiency improvements could offset emissions growth, the new regime directly links compliance status, financial exposure and operational flexibility to the carbon intensity of the fuel used. As a result, vessels relying on conventional fossil marine fuels are increasingly exposed to:

- escalating compliance costs
- reduced commercial attractiveness
- long-term asset obsolescence

Consequently, conventional marine fuels such as heavy fuel oil and marine diesel oil are expected to be progressively displaced over the coming decades by low-carbon and zero-carbon alternatives, including biofuels and hydrogen-derived fuels. In this context, fuel transition has emerged as the single most critical decarbonisation lever for shipping, outweighing incremental gains from hull design, operational optimisation or energy efficiency measures alone.

This global transition imperative establishes the foundational context for national and sectoral strategies on alternate fuels for maritime applications, requiring countries to align domestic fuel pathways with evolving international regulatory trajectories while managing economic, safety and technological constraints.

Indian Maritime Context and Rationale for a Multi-Fuel Pathway

India's maritime ecosystem is characterised by significant heterogeneity across vessel types, operational profiles, trade routes and fleet age. The national fleet spans inland waterway vessels, coastal and short-sea shipping, offshore support vessels and deep-sea ocean-going vessels (OGVs), each operating under distinct technical, economic and regulatory constraints. This diversity inherently limits the feasibility of a uniform fuel transition pathway.

The Future Fuel Strategy prepared by the Indian Register of Shipping (IRS) and the Advanced Green Fuels Road Map for Maritime Applications led by Dr Piyali Das under TERI–NCoEGPS both converge on the assessment that a single-fuel transition pathway is neither technically viable nor economically optimal for India. Instead, fuel choices must be tailored to vessel size, engine configuration, operating range, voyage duration and refuelling frequency.

The analyses highlight that short-sea, coastal and inland vessels operate under markedly different conditions compared to deep-sea OGVs. These segments typically involve shorter voyage lengths, frequent port calls and smaller engine capacities, which allow for earlier adoption of certain alternate fuels and technologies. In contrast, OGVs face stringent energy density requirements, long endurance needs and limited refuelling opportunities, constraining near-term fuel choices and pushing zero-carbon fuel adoption further into the medium and long term.

Further, the existing fleet composition presents a critical constraint. A substantial proportion of India's operational fleet comprises vessels that were not designed for zero-carbon fuels, making immediate large-scale conversion economically prohibitive. Both IRS and TERI assessments therefore emphasise the necessity of transitional fuel solutions—such as blend fuels and drop-in alternatives—to enable near-term regulatory compliance while avoiding premature asset stranding.

In this context, India's maritime fuel transition is framed as a phased, portfolio-based approach, rather than a linear or single-fuel shift. This approach balances:

- near-term compliance requirements under evolving international regulations

- medium-term technology maturation and infrastructure development and
- long-term decarbonisation objectives aligned with zero-carbon fuels

Such a pathway allows India to manage regulatory risk, control transition costs and progressively align its maritime sector with global decarbonisation trajectories, while remaining responsive to domestic operational realities.

Transitional Fuels and Near-Term Compliance Options

Fossil-Liquefied Natural Gas (LNG)

Fossil-based LNG is recognised in the NMDP and associated consultative material as a **transitional marine fuel**, offering limited greenhouse gas intensity benefits relative to conventional marine fuels but not constituting a net-zero solution in the long term.

The policy framing reflects international regulatory developments under the IMO, particularly the shift toward well-to-wake greenhouse gas accounting, under which the climate benefits of fossil LNG are constrained by **upstream methane emissions and lifecycle impacts**. As a result, LNG is positioned within NMDP as an **intermediate compliance pathway**, whose long-term acceptability depends on a transition toward bio-LNG or synthetic LNG rather than continued reliance on fossil LNG.

From a lifecycle perspective, fossil LNG can exhibit lower greenhouse gas fuel intensity than heavy fuel oil under specific conditions, particularly when used in high-pressure dual-fuel engines with minimal methane slip and low upstream leakage. Well-to-wake assessments typically place fossil LNG between approximately **65 and 100 gCO₂eq/MJ**, compared to **90–94 gCO₂eq/MJ for HFO**, with outcomes highly sensitive to engine technology and methane slip rates.

While this differential enables near-term compliance gains, it remains insufficient to meet post-2040 and net-zero trajectories without carbon-neutral sourcing or offset mechanisms. This technical limitation underpins NMDP’s **explicit avoidance of LNG as an end-state fuel**.

Fuel	Approx. GFI (gCO ₂ eq/MJ)
HFO	~90-94
LNG	~65-100
Bio-methanol	~9-17
Green ammonia	~3-12

National future fuel assessments referenced in the NMDP documentation further reinforce LNG’s transitional status. For Indian shipping, LNG demand is projected to decline over time, reflecting tightening international regulations and the increasing role of hydrogen-derived fuels. While LNG retains relevance in the near term due to existing engine technology, operational familiarity and partial infrastructure availability, the policy framework anticipates that continued use of LNG beyond the medium term will require a shift toward bio-LNG or synthetic LNG to remain compliant with international

decarbonisation pathways.

Key Policy Signals on LNG:

- Fossil-LNG is acknowledged as a **lower-carbon alternative to conventional marine fuels**, but not a zero- carbon fuel.
- Its role is explicitly framed as **transitional, supporting early emissions reduction** while alternative fuels mature.
- LNG's long-term compatibility with IMO net-zero targets is conditional on **green or bio-based sourcing**.
- Methane slip and **upstream emissions** limit LNG's effectiveness under well-to-wake GHG accounting.
- Policy emphasis **shifts progressively away from fossil LNG** toward methanol, hydrogen and ammonia pathways.
- Ports and shipowners are cautioned against **long-term lock-in risks** associated with LNG-specific infrastructure and assets.

Biofuels

Biofuels are recognised in the NDMP as **critical near-term and transitional solutions** for reducing greenhouse gas emissions from shipping, particularly during the early phases of fuel transition. Their policy relevance stems from their **compatibility with existing vessel engines** and fuel handling systems, enabling emissions reduction **without requiring immediate fleet replacement** or large- scale retrofitting. Within the NDMP framework, biofuels are positioned as an enabling pathway that supports early compliance with evolving IMO greenhouse gas fuel intensity requirements while longer-term zero-carbon fuels mature.

From a lifecycle emissions perspective, biofuels demonstrate **substantially lower well-to-wake greenhouse gas intensity** compared to conventional marine fuels. Assessments referenced in the consultative process indicate that **biodiesel and bio-methanol achieve GFI values in the range of approximately 10-30 gCO₂eq/MJ**, depending on feedstock and production pathway, compared to **~90-95 gCO₂eq/MJ for heavy fuel oil**. This differential allows biofuels to deliver meaningful emissions reductions within existing technical constraints, reinforcing their role as an early-stage compliance option under GFI-based regulatory regimes.

For India, biofuels are particularly relevant in the near to medium term due to **domestic feedstock availability, alignment with waste-to-energy and circular economy objectives and comparatively lower infrastructure complexity**. While biofuels alone are not sufficient to achieve net-zero emissions by mid- century, the policy framework recognises their role in **reducing cumulative emissions, building operational experience and mitigating transition risks** during the early phases of decarbonisation.

Below table summarises the compatibility and infrastructure requirements for biofuels:

Parameter	Biofuels
Engine compatibility	Compatible with existing ICEs (subject to OEM limits)
Vessel modification	Not required for low-percentage blends
Fuel storage	Existing liquid fuel tanks usable
Bunkering systems	Existing liquid bunkering infrastructure
Safety classification	Comparable to conventional liquid fuels
Port readiness requirement	Low incremental change

Key Policy Signals on Bio-fuels:

Biofuels such as biodiesel and renewable diesel as well as e-FT diesel are treated as **transition fuels** and are not considered long-term zero-carbon fuels.

Reported well-to-wake greenhouse gas fuel intensity values for biofuels range from **approximately 9 to 17 gCO₂/MJ**, depending on the feedstock and production method.

Biofuels are mainly considered for **blended or drop-in use**, rather than as sole propulsion fuels.

Long-term decarbonisation will require a move to e-hydrogen, with biofuels playing a supporting role during the transition period.

The use of biofuels requires **clear sustainability criteria and lifecycle emissions accounting** to ensure that greenhouse gas reductions are credible.

Green Ammonia

Ammonia is identified as a long-term zero-carbon fuel option for maritime transport, particularly in the context of achieving deep decarbonisation consistent with international net-zero trajectories. The policy framework treats ammonia as a fuel that will require **significant lead time for technology maturation, safety standardisation and infrastructure development** and therefore positions it primarily in the medium to long term. Only ammonia produced using **renewable electricity and green hydrogen pathways** is considered compatible with long-term decarbonisation objectives. Fossil-derived ammonia does not provide meaningful lifecycle greenhouse gas reductions and is therefore not aligned with net-zero pathways.

From an energy and fuel characteristics perspective, ammonia exhibits a substantially lower energy density than conventional marine fuels. On a mass basis, the lower calorific value of ammonia is approximately **18.6–18.9 MJ/kg**, compared to **~41–44 MJ/kg for HFO and MGO**, implying a requirement of roughly **2.2–2.3 times more fuel by mass** to deliver equivalent energy. More critically for ship design, liquid ammonia has a volumetric energy density of only **~12–13 MJ/L**, versus **~35–40 MJ/L for HFO/MGO**, resulting in

a need for approximately **three times the onboard fuel storage volume**. This significant volumetric penalty has direct implications for vessel layout, tank integration and cargo capacity, reinforcing ammonia's positioning as a medium- to long-term fuel option requiring purpose-built vessels and dedicated infrastructure.

This has direct implications for ship design, cargo capacity and retrofitting feasibility, making ammonia more suitable for **newbuild vessels** rather than retrofits in most cases. The document also notes that ammonia combustion presents challenges related to **ignition, flame speed and NO_x formation**, which are currently being addressed through engine development, dual-fuel concepts and after-treatment systems.

Currently, ammonia is considered at a **lower technology readiness level compared to LNG and methanol**, with commercial-scale marine engines still under development and early demonstration. As a result, ammonia is treated as a **medium- to long-term fuel option**, with near-term activity expected to focus on **pilots, test vessels and controlled deployment** rather than widespread adoption. The document emphasises that regulatory frameworks, classification rules and international safety standards for ammonia as a marine fuel are still evolving.

Combustion of ammonia can result in **nitrous oxide (N₂O)** emissions, a potent greenhouse gas with a high **global warming potential**, which may materially affect lifecycle greenhouse gas intensity. This risk applies irrespective of whether ammonia is fossil-derived or produced via renewable hydrogen pathways. **Effective mitigation** of N₂O emissions through engine design, combustion control and exhaust after-treatment remains unproven at commercial marine scale, reinforcing the need for **extensive testing and validation** before ammonia can be considered fully aligned with net-zero objectives.

Key Policy Signals on Ammonia:

- The **energy density of ammonia is significantly lower than conventional marine fuels**, resulting in substantially higher onboard fuel storage volume requirements to achieve equivalent range, with direct implications for ship layout and payload capacity.
- Marine engine technology capable of operating on ammonia is **still under development**, with current designs addressing challenges related to **high ignition temperature, low flame speed and combustion stability**.
- Combustion of ammonia leads to **elevated nitrogen oxide (NO_x) emissions**, necessitating the use of advanced combustion control strategies and exhaust after-treatment systems to comply with emission limits.
- Retrofitting existing vessels for ammonia use is assessed as **technically complex and economically challenging**, due to fuel storage requirements, material compatibility and safety system integration, making ammonia more suitable for **newbuild vessels**.
- Ammonia is **toxic and corrosive**, requiring dedicated containment systems, continuous leak detection, ventilation, emergency shutdown mechanisms and

enhanced crew training to manage operational and safety risks.

- While ammonia is widely handled in industrial applications, **marine fuel use introduces additional risks** related to confined spaces, vessel motion and port interface operations, requiring marine-specific safety standards and procedures.
- **Bunkering and port infrastructure for ammonia as a marine fuel are currently limited**, with requirements for specialised storage tanks, transfer systems, safety exclusion zones and emergency response arrangements.
- Regulatory frameworks, classification rules and international standards for ammonia as a marine fuel are **still evolving**, indicating the need for pilot projects and phased deployment prior to large-scale adoption.

Green Methanol

Methanol is considered under the NGSP as a **transition fuel that can be deployed at scale earlier than hydrogen and ammonia**, while still contributing to greenhouse gas reduction when sourced from e-pathways. Its relevance lies in the availability of commercial marine engine technology, simpler storage and handling requirements and compatibility with existing liquid fuel logistics. The policy does not treat methanol as a final zero-carbon fuel, but as an intermediate option that supports phased decarbonisation and reduces transition risk.

The GHG performance of methanol is **directly determined by its production pathway**. Fossil-based methanol does not provide material well-to-wake greenhouse gas reductions and is therefore not aligned with long-term decarbonisation objectives under the NGSP. In contrast, **bio-methanol and green methanol** demonstrate substantially lower lifecycle emissions, with reported greenhouse gas fuel intensity values in the range of **approximately 5-25 gCO₂eq/MJ**, depending on feedstock and production route, compared to **91-95 gCO₂eq/MJ for heavy fuel oil**. Accordingly, only bio-based and renewable methanol pathways are considered relevant for emissions reduction under GFI-based regulatory frameworks.

From an operational and infrastructure perspective, methanol is handled as a liquid fuel at ambient temperature and pressure, eliminating the need for cryogenic storage or high-pressure systems. This enables the use of storage tanks and bunkering arrangements broadly similar to those employed for conventional liquid marine fuels, subject to additional safety provisions related to toxicity and flammability. From an energy standpoint, the lower calorific value of methanol is approximately **19.9–20 MJ/kg**, compared to **~41–44 MJ/kg for HFO and MGO**, meaning methanol contains **around 50–55% less energy per unit mass**. This lower mass-based energy content, combined with methanol's lower density, results in a volumetric energy density of only **~15–16 MJ/L**, versus **~35–40 MJ/L for HFO/MGO**. Consequently, vessels operating on methanol require substantially higher onboard fuel volumes to achieve equivalent range, leading to increased tank space requirements and potential impacts on vessel layout, payload capacity and retrofit feasibility.

Green Hydrogen as a Marine Fuel

Hydrogen is considered in alternative fuels studies as a **zero-carbon fuel option**, either for direct use onboard vessels or as a **primary energy carrier for hydrogen-derived fuels**. It produces no carbon dioxide at the point of use. Its relevance to maritime decarbonisation is therefore linked to its ability to achieve **very low well-to-wake greenhouse gas emissions**, provided that hydrogen is produced from electrolysis of water using renewable electricity (or nuclear based electricity). Renewable hydrogen and RFNBO (Renewable Fuels of Non-Biological Origin) compliant e-methanol and e-ammonia represent the long-term net-zero pathway. Bio-based methanol and ammonia may play a limited transitional role where sustainable biomass is available, but face scalability constraints.

Hydrogen can be stored onboard vessels either as **compressed gas** or as **liquid hydrogen**. Compressed hydrogen is typically stored at pressures of **350–700 bar**, while liquid hydrogen requires storage at **–253°C**. Both storage options impose significant design and operational constraints compared to conventional marine fuels. Hydrogen has a **high gravimetric energy density (approximately 120–142 MJ/kg)**, but a **very low volumetric energy density**, resulting in large fuel storage volumes and reduced vessel range for a given tank size. To deliver the same energy as conventional fuel oil, **compressed hydrogen at 700 bar requires approximately five to six times the storage volume**, while **liquid hydrogen requires approximately four to five times the storage volume**. These volume penalties directly affect vessel layout, cargo capacity and retrofit feasibility, making hydrogen more suitable for **newbuild vessels or short-range applications**.

Hydrogen propulsion can be achieved using **internal combustion engines adapted for hydrogen or fuel cell systems**. Marine hydrogen internal combustion engines remain under development, while fuel cell systems have reached early commercial deployment for **inland waterways and short-sea vessels**. The studies note that hydrogen combustion and handling introduce additional safety considerations due to its **wide flammability range** (approximately 4–75 %by volume in air) and **low ignition energy**, requiring stringent containment, ventilation and detection systems.

Port and bunkering infrastructure for hydrogen is assessed as **limited at present**. Dedicated storage, transfer systems, safety exclusion zones and emergency response arrangements are required. As a result, hydrogen deployment is expected to follow a **pilot-led and phased approach**, aligned with the development of standards, crew training and port readiness.

Additionally, India is stepping up its green energy transition with the development of a Hydrogen Hub under the National Green Hydrogen Mission, which aims to produce and export around 5 million tonnes of green hydrogen over the next five to six years. The initiative is a key part of India's long-term strategy to achieve net-zero carbon emissions by 2070. On January 28th, 2026 Deendayal Port Authority, Kandla, has signed an agreement with energies company, for the design, supply, installation, testing and

commissioning of 5 MW Green Hydrogen Plant at Deendayal Port, Kandla.¹

Key Signals on Hydrogen

- Hydrogen is recognised as a **clean fuel aligned with long-term decarbonisation goals**
- The policy treats hydrogen as part of a **phased transition**, with early focus on pilots, demonstrations and standards development.
- Hydrogen deployment is explicitly linked to **national green hydrogen production and renewable energy availability**.
- Port and bunkering infrastructure for hydrogen are to be developed **progressively**, alongside safety and regulatory frameworks.

Battery Electric Energy

Battery electric propulsion is considered P as a **near-term decarbonisation solution for specific vessel segments**, particularly those operating on **short, fixed routes with predictable duty cycles**. The policy recognises that battery electric systems eliminate direct fuel combustion onboard and therefore produce **zero emissions at the point of use**, while overall emissions performance depends on the carbon intensity of grid electricity used for charging.

The NGSP positions battery electric energy as **segment-specific rather than fleet-wide**, due to limitations related to energy density, vessel range, charging time and grid interface requirements. As a result, battery electric propulsion is primarily associated with **inland waterways vessels, ferries, harbour craft, tugs and short-sea coastal operations**, where daily return-to-base operations enable controlled charging.

Battery systems are addressed within the broader framework of **electrification of maritime operations**, alongside shore power and port-side electrification. The policy links battery adoption to port readiness, grid capacity and renewable electricity integration, rather than treating it as a standalone fuel pathway.

National Green Hydrogen Mission – Enabling Ecosystem

India's long-term maritime fuel transition is underpinned by the National Green Hydrogen Mission, launched in 2023.

- India targets 5 MMT of green hydrogen production annually by 2030
- Green hydrogen is defined using a lifecycle emissions threshold of ≤ 2 kg CO₂e per kg H₂

- Deendayal Port Authority, V.O. Chidambaranar Port Authority and Paradip Port Authority have been designated as Green Hydrogen Hubs
- Port-based pilot projects have been commissioned to support early adoption

These initiatives establish the upstream production, certification and infrastructure base required for hydrogen-derived maritime fuels.

Alignment with the National Maritime Decarbonization Policy Framework

The National Maritime Decarbonization Policy Framework integrates the above technical assessments into a national policy framework by:

- Recognising blend fuels as near-term compliance solutions
- Positioning methanol and ammonia as long-term decarbonisation fuels
- Linking fuel transition with port infrastructure, safety regulation, finance and skill development

NMDP thus functions as the policy convergence layer, translating evidence-based fuel roadmaps into coordinated national action.

Alternative Fuels Properties Comparison

Parameter	E-LNG	Methanol	Ammonia	Hydrogen
Physical properties for storage	Liquid at -162°C	Liquid (up to 65°C)	Liquid at -33°C	Compressed gas at > 250 bar or liquid at -253°C
Fuel tank size for same energy content as MDO	1.8 times	2.5 times	3 times	5–7 times
Flammability limits in air (%V/V)	5%–15% (Methane)	6%–36.5%	15%–28%	4%–75%
Ignition temperature ($^{\circ}\text{C}$)	595	464	630	560
Flashpoint ($^{\circ}\text{C}$)	-188	12	132	—
Density of liquid phase (kg/m^3)	450	790	696	71
LCV (MJ/kg)	50	19.9	18.6	120
Energy density (MJ/L)	21.2	15.7	12.7	8.5



Alternative Fuels Comparison



Hydrogen

Pros

- High gravimetric energy density
- Very pure hydrogen
- Only emits water

Cons

- Highly flammable
- Cryogenic temperature
- Complex storage necessary
- Difficult to handle
- No IMO rules available

E-Ammonia

Pros

- Carbon free
- Experience as cargo or refrigerant
- Higher energy density than hydrogen
- Since Dec 2024 IMO guidelines

Cons

- Toxic
- Not commercially available yet
- Highly trained personal needed
- High cost

E-Methanol

Pros

- Liquid at room temperature
- Easy to handle
- Mature technology
- Rules exist
- Higher energy density than hydrogen

Cons

- Toxic
- Highly flammable
- Still contains carbon
- High cost

E-LNG

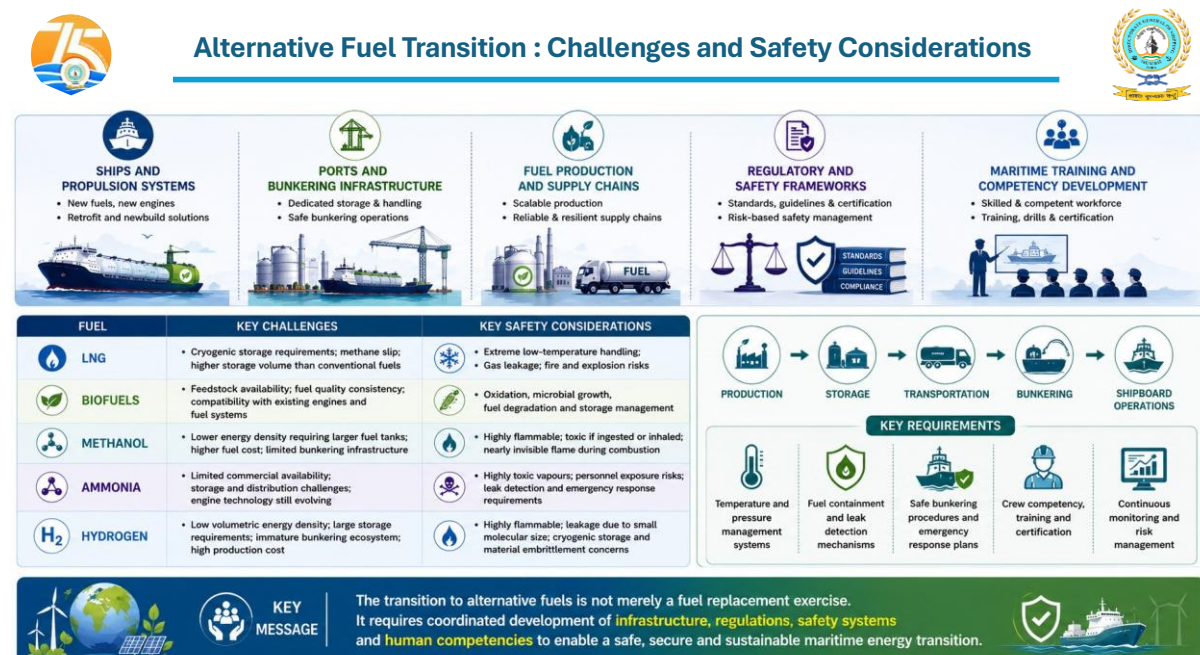
Pros

- Mature technology
- Rules exist
- Higher energy density than hydrogen

Cons

- Not commercially available yet (fuel production)
- Cryogenic temperature
- Complex storage necessary
- High cost
- Risk of methane leakage / slip

Alternative Fuel Transition : Challenges and Safety Considerations



The transition towards alternative fuels is a critical component of maritime decarbonisation. However, it is not a simple substitution of conventional marine fuels with cleaner alternatives. It requires coordinated development across ships, ports, fuel production, storage, transportation, bunkering systems, regulations, safety procedures and human capability.

The maritime sector is exploring multiple fuel pathways, including LNG, sustainable biofuels, methanol, ammonia and hydrogen. Each fuel offers different emissions-reduction potential, technical characteristics, infrastructure requirements and safety implications. Therefore, a one-size-fits-all approach is not suitable. Fuel choices will depend on vessel type, route, operational profile, fuel availability, port readiness, technology maturity and lifecycle emissions performance.

The transition must be supported by a safe, reliable and resilient fuel ecosystem from production to shipboard use.

Ships and Propulsion Systems

Alternative fuels require changes in vessel design, propulsion systems, fuel storage arrangements and onboard operating procedures. Depending on the selected fuel, ships may require new engines, dual-fuel engines, dedicated fuel tanks, fuel-conditioning systems, ventilation arrangements, gas detection systems and fire protection measures.

For existing vessels, retrofit feasibility will depend on available space, tank configuration, engine compatibility, cost, remaining vessel life and operational requirements. For newbuild

vessels, early design-stage decisions are important because fuel choice affects hull arrangement, cargo capacity, safety systems, machinery layout and future flexibility.

The transition should therefore encourage both retrofit solutions for the existing fleet and future-ready designs for new vessels.

Ports and Bunkering Infrastructure

Ports will play a central role in enabling alternative fuel adoption. Safe bunkering requires dedicated infrastructure for fuel receipt, storage, handling, transfer and emergency response. The infrastructure requirements vary significantly between fuels.

Ports may need to develop:

- Dedicated storage and handling facilities
- Fuel transfer systems and bunkering vessels
- Segregated safety zones
- Leak detection and monitoring systems
- Firefighting and emergency-response capability
- Trained personnel and operating procedures
- Coordination arrangements with terminal operators, fuel suppliers, shipowners and local authorities

Port readiness must be developed in a phased manner. Not every port may need to handle every fuel initially. Ports may be identified based on trade patterns, vessel traffic, industrial clusters, renewable-energy availability, proximity to fuel-production centres and potential bunkering demand.

Fuel Production and Supply Chains

The availability of alternative fuels at scale remains a major challenge. Green fuels need reliable production capacity, stable quality, competitive pricing and resilient supply chains. The transition cannot succeed if vessels are designed for cleaner fuels but the required fuel is unavailable, inconsistent in quality or commercially unviable.

Fuel production and supply-chain planning must address:

- Availability of feedstock or renewable-energy sources
- Production capacity and scalability
- Fuel certification and traceability
- Quality assurance and compatibility
- Storage and distribution arrangements
- Last-mile delivery to ports

- Long-term offtake arrangements
- Cost competitiveness and financial viability

A coordinated approach is required between the maritime sector, energy sector, ports, fuel producers, technology providers and financial institutions.

Regulatory and Safety Frameworks

Alternative fuels introduce new risks that require updated regulations, standards, guidelines and certification systems. Safety management must be risk-based and fuel-specific.

The regulatory framework should cover vessel design, fuel storage, handling, bunkering operations, emergency response, crew competence, port procedures, fuel quality, incident reporting and inspection requirements. It should also ensure alignment with international conventions, class requirements and evolving IMO instruments.

Clear procedures are necessary for:

- Fuel transfer and bunkering operations
- Ship-to-ship and shore-to-ship interfaces
- Hazard identification and risk assessment
- Emergency shutdown arrangements
- Leak detection and containment
- Firefighting and evacuation
- Incident reporting and investigation
- Inspection, audit and certification

A robust regulatory framework will provide confidence to shipowners, ports, fuel suppliers, financiers and insurers.

Maritime Training and Competency Development

Human capability is central to safe alternative fuel adoption. Seafarers, port personnel, bunker operators, surveyors, emergency responders and other maritime stakeholders will require specialised knowledge and practical training.

Training must cover the properties of each fuel, operational procedures, hazard recognition, personal protective equipment, emergency response, fuel containment, firefighting, leak management and communication during incidents.

Competency requirements should include:

- Fuel-specific familiarisation training
- Simulator-based and practical exercises

- Bunkering drills and emergency-response drills
- Certification of shipboard and shore-side personnel
- Refresher training and periodic assessment
- Training for surveyors, inspectors and port authorities
- Joint exercises involving ships, ports and emergency services

The development of a skilled and competent workforce is essential to ensure that safety standards keep pace with technological transition.

Fuel-Specific Challenges and Safety Considerations

LNG

LNG is relatively mature compared to several other alternative fuels and can provide emission benefits over conventional marine fuels. However, it requires cryogenic storage at extremely low temperatures and has a larger storage-volume requirement than conventional fuels.

Key challenges include methane slip, cryogenic storage requirements, higher tank volume, bunker availability and investment requirements.

Key safety concerns include low-temperature exposure, gas leakage, fire and explosion risks, ventilation requirements, containment systems and emergency shutdown arrangements.

Biofuels

Biofuels can offer a practical near-term pathway, particularly where they are compatible with existing engines and bunkering systems. Their sustainability depends on feedstock source, production method, lifecycle emissions and quality consistency.

Key challenges include feedstock availability, fuel-quality consistency, scalability, cost, storage stability and compatibility with existing engines.

Key safety concerns include oxidation, microbial growth, fuel degradation, contamination and storage-management issues. Proper fuel testing, segregation and monitoring are important.

Methanol

Methanol is increasingly being considered as a marine fuel because it can be stored in liquid form at ambient conditions and may be easier to handle than some gaseous fuels. However, it has lower energy density than conventional fuels, requiring larger storage capacity.

Key challenges include lower energy density, increased fuel-tank requirements, fuel cost, bunkering infrastructure and supply availability.

Key safety concerns include flammability, toxicity if ingested or inhaled, invisible or low-visibility flames and the need for suitable fire detection, containment and personal-protection measures.

Ammonia

Ammonia has potential as a zero-carbon fuel at the point of use when produced from renewable energy. However, it remains at an early stage of maritime application and poses significant toxicity concerns.

Key challenges include limited commercial availability, storage and distribution requirements, engine-technology development, bunkering readiness and uncertainty regarding wider deployment.

Key safety concerns include highly toxic vapours, personnel-exposure risks, leak detection, ventilation, protective equipment, emergency response and evacuation procedures. Safety systems for ammonia will need particularly strong attention.

Hydrogen

Hydrogen has strong long-term potential, particularly for selected vessel segments and applications. However, it has low volumetric energy density and requires substantial storage space. It may be stored as compressed gas, liquid hydrogen or converted into derivative fuels.

Key challenges include storage-volume requirements, high production cost, limited bunkering ecosystem, technology maturity and distribution constraints.

Key safety concerns include high flammability, low ignition energy, leakage through small openings, cryogenic hazards for liquid hydrogen, material embrittlement and the need for robust gas-detection systems.

End-to-End Safety Chain

Safety must be addressed throughout the entire value chain:

Production → Storage → Transportation → Bunkering → Shipboard Operations

At every stage, the system must ensure safe containment, controlled transfer, leak prevention, emergency preparedness and trained personnel. Any weakness in one part of the chain can affect the overall reliability and safety of maritime fuel transition.

The key operational requirements include:

- Temperature and pressure management systems
- Fuel containment and leak-detection mechanisms
- Safe bunkering procedures and emergency-response plans
- Fuel-specific training, drills and certification
- Continuous monitoring, inspection and risk management

National Green Hydrogen Mission – Green Hydrogen Hubs



National Green Hydrogen Mission – Green Hydrogen Hubs



The National Green Hydrogen Mission (NGHM) aims to position India as a **global hub for green hydrogen production, utilisation and export**, with a target of **5 MMT annual production by 2030**, supporting decarbonisation and energy transition.

Deendayal Port Authority (Kandla) – Western Hub	Paradip Port Authority – Eastern Hub	V.O. Chidambaranar Port (Tuticorin) – Southern Hub
• 1 MW green hydrogen plant commissioned (electrolyser-based)  • 3,400 acres land allocated for Green Hydrogen / Ammonia projects • 3.5 MMTPA jetty compatible for Green Ammonia handling • Port Readiness Level 6 (7) for green fuel / methanol bunkering  • Advancing methanol bunkering ecosystem and alternative fuel transition  • Western gateway for green fuel production + bunkering + export corridors	• ₹797 crore Green Hydrogen / Ammonia jetty approved  • 4.0 MTPA handling capacity for green energy cargo • Development includes jetty, storage, pipelines and handling systems • Implemented under PPP / BOT  • Designed to connect eastern hydrogen clusters to global markets • Anchor hub for bulk handling, storage and export logistics 	• 10 Nm³/hr Green Hydrogen pilot plant commissioned (Apr 2025) at cost of INR 3.87 Crore  • Pilot supports port operations (lighting, EV charging) • 205.72 acres land allocated for GH2 / Ammonia projects  • Developing Green Methanol Bunkering Facility (2 × 750 m³) • Emerging as green fuel + digital + renewable integrated port  • Southern hub for pilot deployment, innovation and green bunkering

The National Green Hydrogen Mission is a flagship initiative of the Government of India aimed at establishing a comprehensive ecosystem for **production, utilisation and export of green hydrogen and its derivatives**. The Mission is a critical pillar in India's transition towards a **low-carbon, energy-secure and self-reliant economy**, aligned with the national target of **Net Zero by 2070**.

The Mission recognises green hydrogen as a **strategic energy carrier**, capable of decarbonising hard-to-abate sectors such as refining, fertilisers, steel, shipping and heavy mobility, while also reducing dependence on imported fossil fuels.

Key Objectives

- Position India as a **global hub for green hydrogen production, utilisation and export**
- Achieve **at least 5 Million Metric Tonnes (MMT) annual production by 2030**, with potential scaling to 10 MMT
- Enable **deep decarbonisation across industrial and transport sectors**
- Promote **domestic manufacturing of electrolyzers and related technologies**
- Facilitate **development of export infrastructure and global trade linkages**

Strategic Approach

The Mission adopts an **integrated and phased approach**, combining:

- Demand creation (domestic + export markets)
- Supply-side incentives (electrolyser manufacturing and hydrogen production)
- Infrastructure development (ports, pipelines, storage, refuelling)
- Regulatory and policy framework
- R&D, skilling and international collaboration

A key element of this strategy is the development of **Green Hydrogen Hubs**, based on a **cluster model**, to enable economies of scale and reduce logistical challenges.

Green Hydrogen Hubs – Port-led Development Model

Given the challenges in long-distance hydrogen transport, the Mission promotes **cluster-based hydrogen hubs**, particularly around ports, where production, storage, handling and export infrastructure can be co-located.

In the maritime sector, **three major ports have been identified as Green Hydrogen Hubs**:

- **Deendayal Port Authority (Kandla)** – Western Hub
- **Paradip Port Authority** – Eastern Hub
- **V.O. Chidambaranar Port Authority (Tuticorin)** – Southern Hub

These hubs are designed to act as **anchors for green fuel production, bunkering, storage and export**, supporting India's emergence as a global green energy supplier.

Deendayal Port Authority (Kandla) – Western Hub

Deendayal Port is being developed as a **front-runner green fuel hub** on the western coast, with strong focus on production and bunkering ecosystem.

Key Developments:

- **1 MW electrolyser-based green hydrogen plant commissioned**
- **~3,400 acres of land allocated** for hydrogen and ammonia projects
- **3.5 MMTPA jetty infrastructure** compatible with green ammonia handling
- **Achieved Port Readiness Level (PRL) 6 (progressing to 7)** for methanol/green fuel bunkering

- Active development of **methanol bunkering ecosystem and alternative fuel infrastructure**

Strategic Role:

- Western gateway for **green fuel production, bunkering and export corridors**
- Key node for **global green shipping routes and trade linkages**
- Early mover in **fuel transition and port readiness for alternative fuels**

Paradip Port Authority – Eastern Hub

Paradip Port is being positioned as a **large-scale green energy logistics and export hub** on the eastern coast.

Key Developments:

- **₹797 crore Green Hydrogen / Green Ammonia jetty project approved**
- Planned **4.0 MTPA cargo handling capacity** for green energy fuels
- Development includes **jetty, storage systems, pipelines and handling infrastructure**
- Project being implemented under **PPP/BOT model**

Strategic Role:

- Anchor hub for **bulk handling, storage and export logistics**
- Designed to connect **eastern hydrogen clusters to global markets**
- Critical node for **scaling export-oriented hydrogen economy**

V.O. Chidambaranar Port Authority (Tuticorin) – Southern Hub

VOC Port is emerging as a **pilot-driven innovation hub** for green hydrogen and derivative fuels in southern India.

Key Developments:

- **10 Nm³/hr green hydrogen pilot plant commissioned (Apr 2025)** at cost of ₹3.87 crore
- Pilot supports **port operations including lighting and EV charging**
- **~205 acres of land allocated** for hydrogen and ammonia projects
- Development of **Green Methanol Bunkering Facility (2 × 750 m³)**
- Integration of **renewables, digital systems and green fuel infrastructure**

Strategic Role:

- Southern hub for **pilot deployment, innovation and technology validation**
- Emerging centre for **green fuel bunkering and integrated port operations**
- Supports development of **green shipping corridors (Kandla–Tuticorin linkage)**

Strategic Significance of Port-based Hydrogen Hubs

The development of these hubs has multi-dimensional impact:

Decarbonisation of Maritime Sector

- Enables adoption of **green ammonia, methanol and hydrogen-based fuels**
- Supports IMO-aligned **net-zero transition in shipping**

Export Competitiveness

- Ports act as **gateways for global hydrogen trade**
- Strengthens India's role in **emerging green fuel supply chains**

Industrial and Energy Integration

- Co-location of **production, storage and consumption ecosystems**
- Enables **economies of scale and cost reduction**

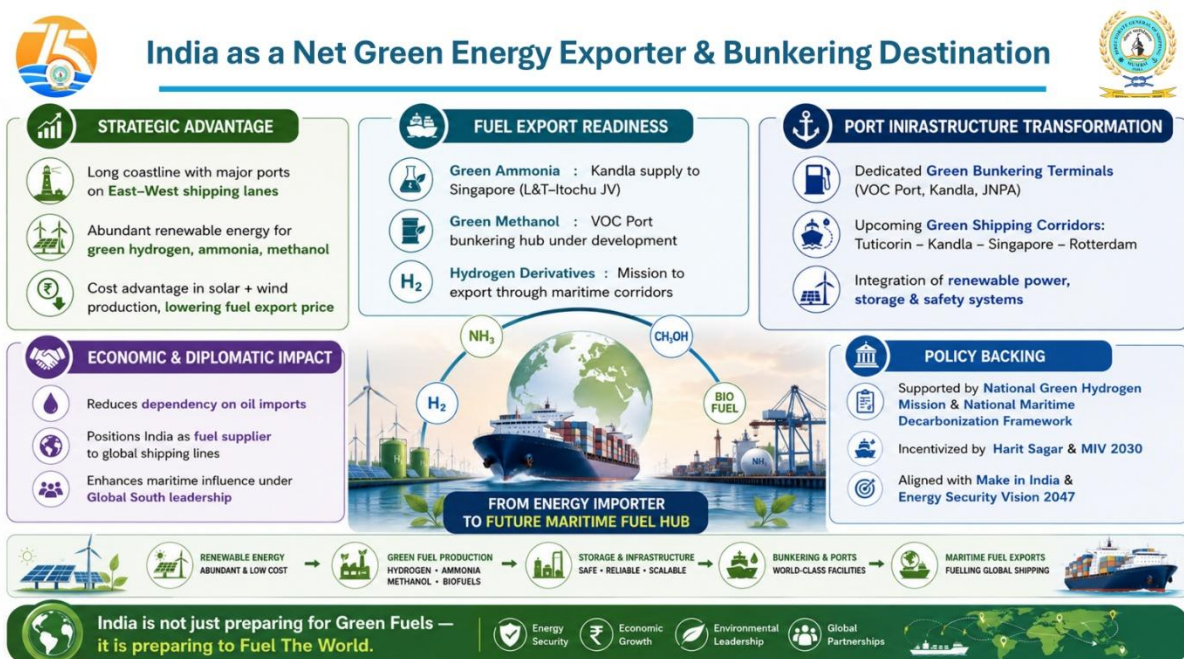
Investment and Economic Growth

- Attracts **large-scale investments in clean energy infrastructure**
- Creates employment across **energy, logistics and maritime sectors**

Alignment with National Vision

- Supports **Aatmanirbhar Bharat and energy independence**
- Integral to **Maritime INDIA @ Net Zero and NMDP framework**

India as a Net Green Energy Exporter & Bunkering Destination



India's positioning as a net green energy exporter and global bunkering destination should be viewed as a long-term strategic vision, rather than a reflection of current energy balances. Historically, India has been a net energy-importing and energy-deficit nation, with high dependence on imported fossil fuels to meet domestic and industrial demand, including for the maritime sector.

The emerging global transition towards low-carbon and zero-carbon fuels presents India with a structural opportunity to reverse this trajectory over the coming decades. By leveraging its renewable energy potential, coastline advantages and expanding port infrastructure, India aims to progressively transition from an energy-deficit economy to a net energy-surplus nation, capable of supplying green energy and green fuels not only for domestic consumption but also for international markets.

In the maritime context, this vision translates into India evolving from a fuel-import dependent shipping ecosystem to a producer, exporter and bunkering hub for green maritime fuels, including hydrogen-derived fuels such as green ammonia and green methanol. This shift is envisioned to occur in a phased manner, aligned with the maturation of fuel technologies, scaling of renewable energy capacity and development of safe port-based bunkering infrastructure.

Achieving net energy surplus status is therefore not an immediate outcome but a strategic end-state, underpinned by long-term national initiatives on renewable energy expansion, green hydrogen production, port modernisation and maritime decarbonisation. As these elements converge, India's maritime sector is expected to move from being a passive energy consumer to an active contributor to global green energy supply chains.

This future-oriented vision underpins India's policy approach to green shipping and bunkering and frames the country's ambition to play a system-level role in the global maritime energy transition, while strengthening long-term energy security and economic resilience.

Green Maritime Corridors

Green Maritime Corridors have emerged internationally as a pragmatic and implementation-oriented mechanism to advance maritime decarbonisation in a structured manner. Rather than attempting immediate sector-wide transformation, green corridors focus on specific routes, vessel segments and port pairs where coordinated action across the value chain can be demonstrated under real operating conditions.

The corridor approach enables regulators, ports, shipowners, fuel producers and technology providers to collectively address the key barriers to adoption of alternative marine fuels, including fuel availability, pricing, safety, operational reliability and regulatory readiness. By concentrating effort on defined corridors, early investments can be de-risked and lessons generated for wider replication.

In the Indian context, green maritime corridors form the core implementation pillar of the Green Voyage approach, translating long-term policy ambition on green shipping into route-based, evidence-driven and commercially grounded interventions.

Study on Potential Demand and Pricing of Alternative Marine Fuels in India



IMO – DNV Study on Potential Demand and Pricing of Alternative Fuels



Strong Alternative Fuel Demand Potential

- Alternative marine fuel demand projected to reach **42–65 PJ by 2035**
- Demand could increase to **113–293 PJ by 2047**
- Growth expected to be driven by increasing adoption of low and zero-carbon fuels in shipping

India's Strategic Bunkering Opportunity

- India's location along major East-West trade routes provides strong potential as a regional bunkering hub
- Opportunity is driven by vessels already calling at Indian ports rather than passing traffic alone
- Container vessels identified as the most promising early adopters of alternative fuels

Fuel Transition Pathway

- Biofuels and methanol expected to lead early adoption
- Ammonia expected to play a larger role in the long term as infrastructure, supply chains and safety frameworks mature
- Methanol identified as the most suitable starting fuel for initial bunkering deployment

Potential Bunkering Hubs

- Mundra, JNPA, Chennai and Tuticorin identified as key demand centres
- Supported by nearby production and hydrogen hub locations including Deendayal (Kandla) and Tuticorin
- Hub-and-spoke bunkering model recommended for efficient fuel supply

Phased Development Roadmap

- **2026–2030:** Establish pilot bunkering ecosystem
- **2030–2035:** Scale proven bunkering clusters
- **2035–2047:** Position India as a regional alternative fuel bunkering hub integrated with international Green Shipping Corridors

11

One of the foundational analytical inputs supporting India's Green Voyage strategy is the Study on Potential Demand and Pricing of Alternative Marine Fuels in India, undertaken under the aegis of the International Maritime Organization, in partnership with the Directorate General of Shipping and the Ministry of Ports Shipping and Waterways, with technical support from DNV.

The study evaluates India's prospects of developing into a regional bunkering hub for alternative marine fuels, examining demand drivers, pricing dynamics, operational constraints and competitive positioning. A central and policy-critical conclusion of the study is that:

India's strongest and most realistic bunkering opportunity lies with container vessels already calling at Indian ports for cargo operations or transshipment, rather than with vessels merely passing by along international shipping lanes.

This finding has important strategic implications. The study demonstrates that proximity to shipping lanes alone does not generate bunkering demand. Global shipping lines rarely deviate from established routes unless the bunkering proposition offers clear advantages in delivered fuel cost, operational reliability and turnaround efficiency. As a result, bunkering strategies premised on deviation-based demand are inherently weak.

Instead, the study underscores that cargo-linked demand, particularly from containerised liner services with regular port calls, provides a stable and predictable foundation for early

alternative fuel uptake. Transshipment hubs, where vessels already berth for cargo consolidation, offer especially strong potential, as bunkering can be integrated without additional operational disruption.

Key insights from the study include:

- Container vessels represent the most viable early adopters due to frequency of port calls and fleet standardisation
- Early demand for alternative fuels is likely to be led by biofuels, given cost and compatibility, with e-methanol and e-ammonia scaling over time
- Bunkering hub development should be selective and concentrated, rather than dispersed across multiple ports
- Policy certainty, targeted incentives and infrastructure readiness are decisive factors for market uptake

The study thus provides a market-grounded demand lens for India's green corridor planning.

Green Corridor Pre-Feasibility Study under the Indo-Danish Centre of Excellence



India Green Corridors Pre-Feasibility Study

By Mærsk Mc-Kinney Møller Center for Zero Carbon Shipping



Key Outcomes

- Assessed 14 Indian ports across inland, coastal and international shipping segments
- Screened **230+ potential routes** and identified a **first suite of 40 Green Shipping Corridors**
- Corridor portfolio includes:
 - 8 Inland Waterway Corridors
 - 8 Coastal & Domestic Corridors
 - 8 Deep-Sea International Corridors
 - 8 Strategic Opportunity Corridors
 - 8 Emerging Corridors
- E-ammonia identified as the most credible scalable fuel pathway for early corridor deployment
- VOC, Kandla, Paradip and Mundra identified as leading corridor anchor ports
- Gujarat and Odisha emerged as key green fuel production hubs supporting future corridor development

Consortium Incubation Workshop conducted on May 28, 2026 at New Delhi

12

The India Green Corridors Pre-Feasibility Study represents an important early initiative under the India–Denmark Green Strategic Partnership to support India's transition towards a safe, sustainable and future-ready maritime sector.

The broader cooperation is anchored in the Green Strategic Partnership between India and Denmark, established in 2020, which provides a framework for deepening bilateral collaboration on green growth, renewable energy, sustainable development and climate action.

Maritime cooperation and green shipping have emerged as key areas within this partnership, reflecting the shared objective of accelerating low-carbon transition in the maritime sector.

In June 2025, during the meeting between the Hon'ble Minister of Ports, Shipping and Waterways, Government of India and the Danish Minister of Industry, Business and Financial Affairs in Copenhagen, both sides reiterated their commitment to maritime cooperation under the India–Denmark framework. The discussions built upon the bilateral Memorandum of Understanding on maritime affairs signed in 2024 and highlighted the need to establish an Indo-Danish Centre of Excellence for Green Shipping in India.

The Centre of Excellence is envisaged as a platform to improve the quality and efficiency of maritime activities while supporting India's green transition. Its work is aligned with the Maritime Amrit Kaal Vision 2047 and India's aspiration to emerge as a global hub for safe, sustainable and green maritime operations. Development of Green Shipping Corridors was identified as one of the priority areas through which the Centre of Excellence could contribute to practical and measurable outcomes.

Accordingly, the India Green Corridors Pre-Feasibility Study was initiated as one of the first substantive technical deliverables under this collaboration. The study was undertaken between September 2025 and May 2026 by the Mærsk Mc-Kinney Møller Center for Zero Carbon Shipping, with support from Implement Consulting Group. It was carried out in collaboration with the Ministry of Ports, Shipping and Waterways, Directorate General of Shipping, Indian Ports Association, Danish Energy Agency and Danish Maritime Authority. The project was supported through Danish funding arrangements involving the Danish Maritime Authority, Danish Energy Agency and Ministry of Foreign Affairs of Denmark.

The study moves beyond broad policy intent and seeks to establish an evidence-based basis for identifying corridors that can support early deployment of lower and zero-emission maritime solutions. It assesses green corridors not merely as routes connecting two ports, but as integrated ecosystems involving vessels, fuel supply, renewable-energy availability, port infrastructure, bunkering systems, cargo demand, regulations, safety arrangements and stakeholder commitments.

The assessment was undertaken through a structured methodology developed by the Mærsk Mc-Kinney Møller Center for Zero Carbon Shipping. The methodology covered workstreams relating to alternative fuels, port and bunkering readiness, vessels and cargo, trade routes, regulatory frameworks, just and equitable transition considerations and corridor selection. The Indian institutions supported the process through data provision, port inputs, regulatory perspectives and stakeholder engagement, while the technical analysis and modelling were undertaken by the study consortium.

Key Outcomes

- **14 Indian ports were assessed** across inland waterways, coastal shipping and international trade segments.

- **More than 230 potential routes were screened** to identify a practical portfolio of corridor candidates.
- **A first suite of 40 Green Shipping Corridors** was identified for further prioritisation and maturity.
- The identified corridor portfolio includes:
 - **8 Inland Waterway Corridors**
 - **8 Coastal and Domestic Corridors**
 - **8 Deep-Sea International Corridors**
 - **8 Strategic Opportunity Corridors**
 - **8 Emerging Corridors**
- **E-ammonia was identified as the most credible scalable fuel pathway for early corridor deployment**, especially for larger vessels and long-distance bulk, tanker and energy-related trades.
- **V.O. Chidambaranar Port, Kandla, Paradip and Mundra were identified as leading corridor anchor ports**, based on alternative-fuel readiness, likely fuel availability, strategic location, trade patterns and associated industrial ecosystems.
- **Gujarat and Odisha emerged as key potential green-fuel production hubs** that could support future corridor development, particularly in relation to green hydrogen and green ammonia pathways.
- **A Consortium Incubation Workshop was conducted on 28 May 2026 in New Delhi** to discuss the findings, identify priority stakeholders and facilitate the next stage of corridor maturation.

The categorisation of corridors reflects different levels of readiness. Inland and coastal corridors can provide a practical pathway for early pilots involving harbour craft, tugs, ferries, barges and selected coastal vessels, where distances are shorter, operations are more predictable and fuel or charging arrangements can be managed more easily. These segments may be suitable for electrification, hybridisation, biofuels and other near-term lower-emission solutions.

Deep-sea corridors are more complex and are intended to support larger vessel categories such as tankers, bulk carriers, container vessels and general cargo vessels. These corridors will require greater convergence between fuel production, international partner-port readiness, commercial offtake, vessel availability, bunkering systems, safety standards and regulatory alignment. For such segments, scalable fuels such as e-ammonia and e-methanol are likely to be more relevant than battery-electric solutions.

The study also highlights that fuel transition cannot be approached through a uniform pathway. The suitability of fuels will depend on vessel type, voyage length, cargo profile, fuel

availability, storage requirement, engine technology, port infrastructure and safety considerations. While e-ammonia appears to be a strong pathway for early scalable deployment, biofuels, electrification and hybrid systems may remain important for shorter-range and operationally controlled applications.

The identification of Kandla, Mundra, Paradip and V.O. Chidambaranar Port as anchor ports is significant because it indicates that early corridor development may be concentrated around a limited number of regional clusters rather than being distributed evenly across the country. These clusters can combine port infrastructure, renewable-energy potential, industrial demand, green-fuel projects, bunkering potential and shipping activity to create viable early ecosystems.

The study further underlines that port readiness alone will not be sufficient for successful corridor implementation. Green corridors will require coordinated commitments from shipping companies, cargo owners, fuel producers, ports, terminal operators, technology providers, financial institutions, regulators and training institutions. The next phase must therefore focus on detailed feasibility studies, commercial structuring, fuel supply arrangements, vessel deployment plans, safety and regulatory requirements, financing models and stakeholder commitments.

Overall, the India Green Corridors Pre-Feasibility Study provides a structured foundation for India to move from high-level green-shipping ambition towards practical, phased and evidence-led implementation. It supports the larger objective of building a resilient maritime ecosystem that strengthens energy security, develops green industrial capability, improves maritime competitiveness and enables progressive decarbonisation of domestic and international shipping.

Nuclear Propulsion for Merchant Shipping



Nuclear Propulsion for Merchant Shipping



Maritime decarbonization requires propulsion solutions that can reduce emissions without compromising the range, speed, cargo capacity and reliability required for global trade.

Strategic Rationale

Near-zero operational emissions

No combustion of conventional marine fuels, resulting in near-zero tank-to-wake greenhouse gas emissions.

Exceptional energy density

A small quantity of nuclear fuel can provide very large amounts of energy, reducing onboard fuel-storage requirements.

Long endurance and limited refuelling

Extended reactor fuel cycles can support prolonged deep-sea operations with fewer refuelling interruptions.

Reliable high-power output

Continuous power for propulsion and energy-intensive onboard systems, particularly for large vessels.

Reduced dependence on bunkering networks

Less reliance on frequent bunkering and uncertain global supply chains for low- and zero-carbon fuels.

Emergence of compact reactor technologies

SMRs and advanced reactor concepts offer compact designs, modular construction and enhanced passive safety features.

16

International shipping requires propulsion systems capable of delivering high power continuously over long distances while maintaining vessel speed, cargo capacity and operational reliability. At the same time, the sector is under increasing pressure to reduce greenhouse gas emissions and transition away from conventional marine fuels.

Most current decarbonisation pathways rely on energy-efficiency measures and alternative fuels such as methanol, ammonia, hydrogen, biofuels and synthetic fuels. However, these options may involve lower energy density, additional storage requirements, uncertain global availability, higher production costs and the need for extensive new bunkering infrastructure. Nuclear propulsion is therefore being reconsidered as a potential long-term option, particularly for large, energy-intensive and deep-sea vessels.

Nuclear marine propulsion is not a new technology. It has been successfully applied for several decades in naval vessels and icebreakers, while a limited number of civilian demonstration and merchant vessels have also been developed. The technology is therefore proven in marine operation, although its use in international commercial shipping remains constrained by high capital costs, specialised infrastructure, regulatory gaps, port-access concerns and public acceptance.

Principle of Nuclear Marine Propulsion

A nuclear-powered vessel uses heat generated through controlled nuclear fission rather than combustion of marine fuel.

In a conventional marine nuclear propulsion arrangement:

1. The reactor generates heat through nuclear fission.
2. A primary coolant removes heat from the reactor core.
3. The heat is transferred to a secondary system, which produces steam or drives another power-conversion cycle.
4. The steam operates a turbine.
5. The turbine may:
 - directly drive the propeller shaft through gearing, or
 - drive an electrical generator that supplies propulsion motors and onboard systems.
6. The steam is condensed, recirculated and reused.

Pressurised Water Reactors have historically been the dominant technology in naval propulsion because of their established reliability, compact configuration and operational experience. However, their high-pressure systems, weight and complexity have encouraged examination of alternative technologies such as SMRs, high-temperature gas-cooled reactors, molten salt reactors and liquid metal-cooled reactors for future civilian applications.

Strategic Rationale for Nuclear Marine Propulsion

Near-Zero Operational Emissions

Nuclear propulsion does not require combustion of conventional marine fuels. It can therefore achieve near-zero tank-to-wake emissions of carbon dioxide, sulphur oxides and particulate matter, while also substantially reducing nitrogen oxide emissions associated with combustion.

Lifecycle emissions are not entirely zero because uranium mining, enrichment, fuel fabrication, ship construction, reactor servicing and decommissioning consume energy. Nevertheless, nuclear power generally offers significantly lower lifecycle greenhouse gas emissions than fossil-fuel-based propulsion.

This makes nuclear propulsion relevant to the long-term decarbonisation of vessels for which energy-efficiency improvements alone may be insufficient.

Exceptional Energy Density

Nuclear fuel contains vastly more energy per unit mass than conventional marine fuel. A relatively small quantity of nuclear fuel can support several years of operation, depending on reactor and fuel design.

This can reduce the requirement for:

- large fuel tanks
- frequent bunkering
- fuel-transfer systems
- combustion-air intakes
- exhaust systems
- associated fuel-treatment machinery

The released space and weight may be used for cargo, additional safety systems or other operational requirements. However, part of this benefit is offset by the weight and space required for the reactor compartment, containment, shielding and auxiliary safety systems.

Long Endurance

Long reactor fuel cycles could allow vessels to operate for years without conventional refuelling. This may be particularly beneficial for:

- long-distance container shipping
- bulk carriers on fixed deep-sea routes
- specialised cargo vessels
- Arctic or remote-area operations
- vessels requiring prolonged operation away from bunkering hubs

Nuclear icebreakers have demonstrated the operational value of long endurance in remote and demanding environments where conventional refuelling logistics are difficult.

Continuous High-Power Availability

Large merchant vessels require dependable propulsion power over sustained periods. Nuclear reactors can provide continuous baseload power for:

- main propulsion
- cargo-handling systems
- refrigeration
- hotel loads
- pumps and compressors
- desalination
- onboard electrical systems

This characteristic may make nuclear propulsion more relevant to large container ships, bulk carriers, tankers, gas carriers, cruise ships and specialised vessels than to smaller ships with lower and more variable energy demand.

Reduced Dependence on Bunkering Networks

Alternative marine fuels will require substantial investment in production, storage, transportation and bunkering facilities across major global trade routes.

A nuclear-powered vessel would still require specialised refuelling and servicing facilities, but these interventions would occur far less frequently than conventional bunkering. The technology could therefore reduce dependence on:

- global marine-fuel supply chains
- fuel availability at intermediate ports
- price fluctuations
- compatibility of fuel specifications across regions
- repeated fuel-transfer operations

Greater Predictability of Energy Costs

Nuclear-powered vessels would have high initial capital and infrastructure costs, but the nuclear fuel component generally represents a smaller share of total lifecycle cost than fuel expenditure for conventional vessels.

Long fuel cycles could reduce exposure to:

- oil-price volatility
- carbon pricing
- future fuel mandates
- supply constraints for hydrogen-derived fuels
- regional variation in alternative-fuel prices

However, potential fuel-cost stability must be assessed together with the costs of nuclear specialists, maintenance, licensing, insurance, security, waste management and decommissioning.

Historical Civilian Experience

Several civilian nuclear-powered vessels were developed during the twentieth century to demonstrate the feasibility of commercial nuclear propulsion.

NS Savannah

The United States developed the first nuclear powered vessel , *NS Savannah* as a demonstration cargo-passenger vessel. It successfully demonstrated nuclear propulsion but was commercially constrained by high operating costs, specialised shore-support requirements and limited cargo capacity.

Otto Hahn

Germany's *Otto Hahn* was developed as a nuclear-powered research and cargo vessel. It operated successfully from a technical standpoint but faced high operating costs and restrictions on access to certain ports.

Mutsu

Japan's *Mutsu* was developed as an experimental nuclear-powered cargo vessel and training platform. The programme faced technical, political and public-acceptance challenges, including concerns following a radiation-leak incident.

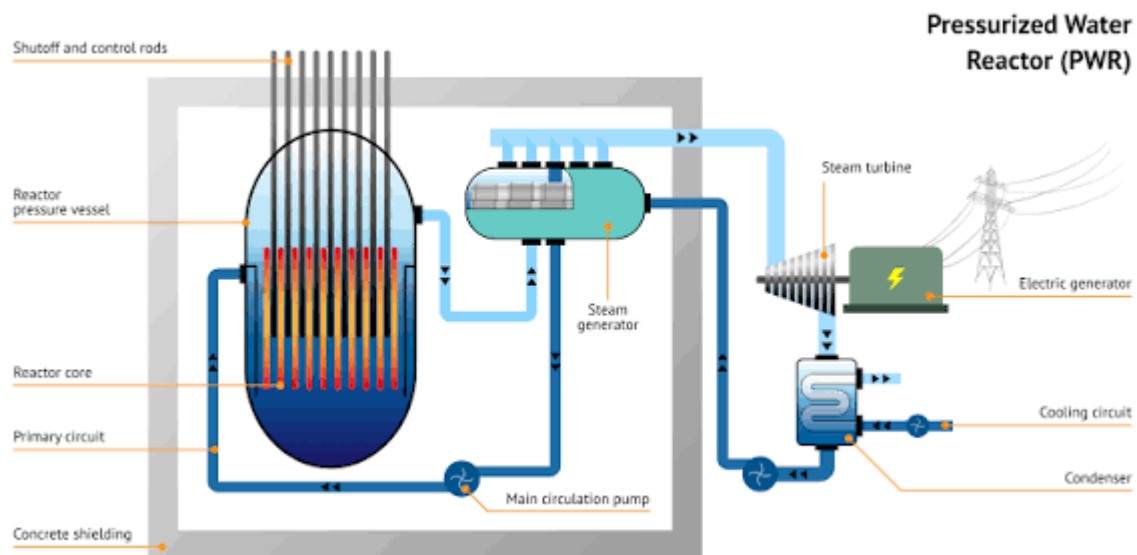
Sevmorput

The Russian *Sevmorput*, a nuclear-powered lighter-aboard-ship and icebreaking cargo vessel, is the most prominent example of a nuclear-powered merchant vessel achieving sustained operational service. Its experience indicates that nuclear propulsion can be viable in specialised routes where endurance and icebreaking capability justify the additional cost and institutional requirements.

The historical experience demonstrates that the fundamental technology is workable. The principal limitations were not limited to reactor performance; they included economics, route restrictions, port acceptance, regulation and the absence of a sufficiently large fleet over which common infrastructure costs could be distributed.

Nuclear Reactor Technology Options

Pressurised Water Reactors

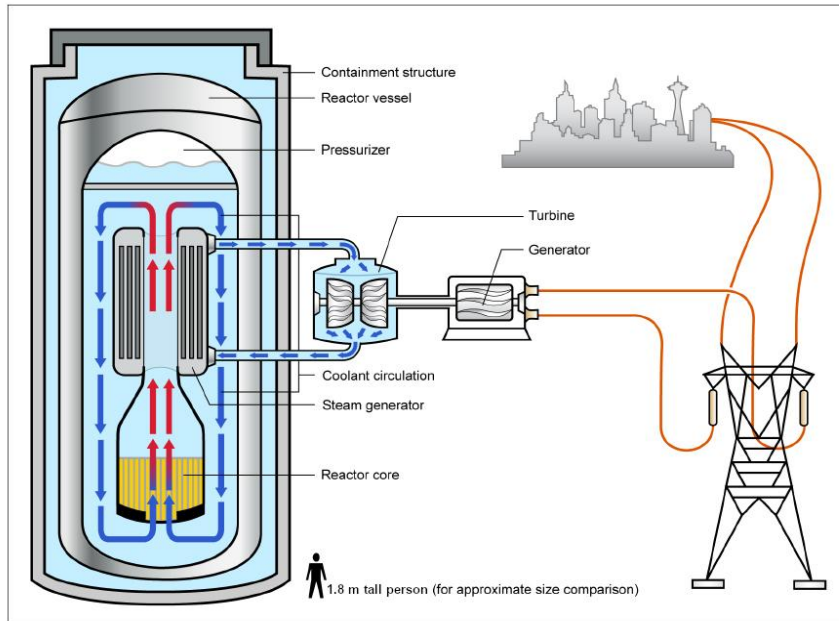


PWRs have the most extensive marine operating history. Their advantages include technological maturity, established safety experience and a well-understood power-conversion system.

Challenges include:

- high system pressure
- large and heavy reactor components
- extensive shielding
- complex maintenance requirements
- limited commercial suitability at lower power ratings

Small Modular Reactors (SMR)



Source: GAO, based on Department of Energy documentation. | GAO-15-652

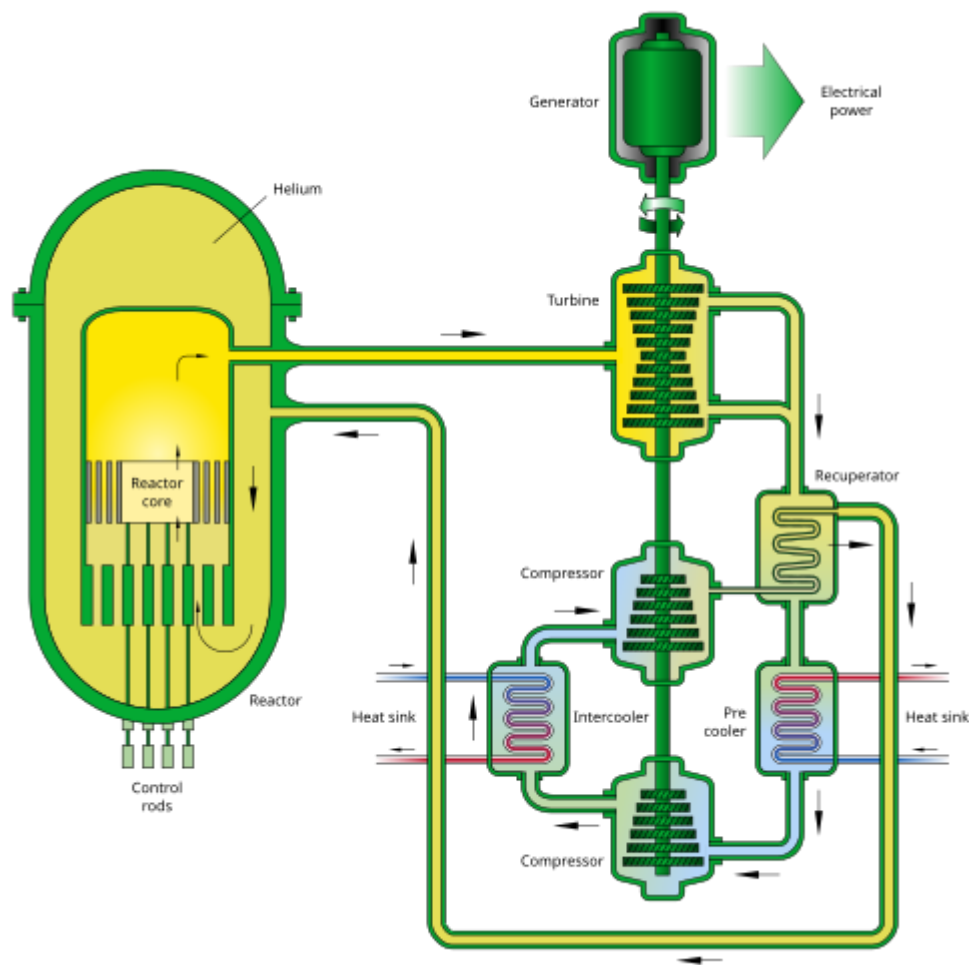
SMRs are advanced reactors generally designed to generate up to 300 MWe per module. Their compact size, modular construction and factory-manufacturing potential make them particularly relevant to future maritime applications.

Potential advantages include:

- smaller footprint
- standardised modules
- passive safety features
- longer fuel cycles
- flexible power ratings
- replacement or servicing of complete modules at specialised facilities

Water-cooled SMRs are likely to be more suitable for nearer-term consideration because they build upon established reactor technology. More advanced SMR concepts may become relevant over the longer term. The IAEA recognises transportable SMRs, including nuclear-propelled ships and floating nuclear power units, as potential sources of reliable energy for international shipping and net-zero objectives.

High-Temperature Gas-Cooled Reactors



HTGRs use gas, generally helium, as coolant and can operate at higher temperatures. They may offer improved thermal efficiency and passive safety characteristics.

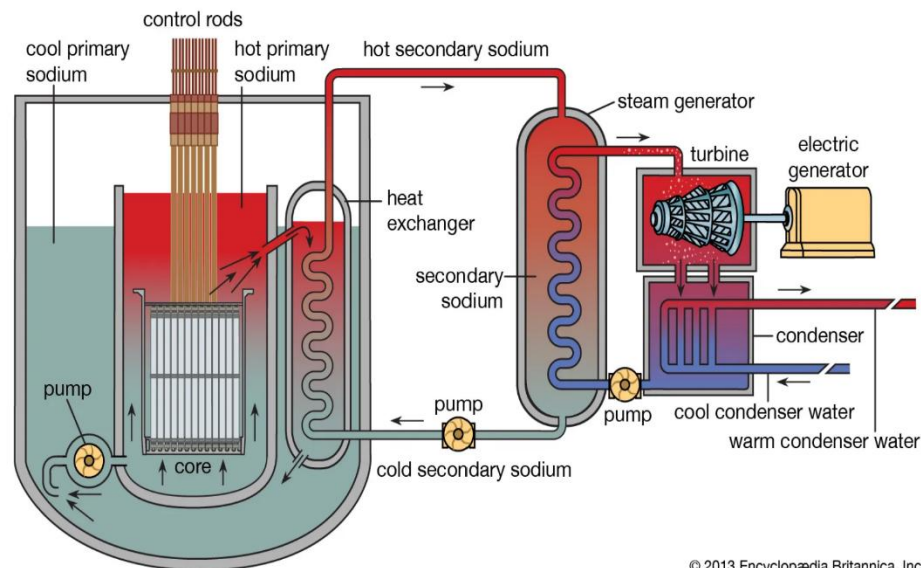
Their application may support:

- electric propulsion
- high-efficiency power generation
- hydrogen production
- process heat

However, maritime integration, fuel handling, safeguards and technology maturity require further assessment.

Liquid Metal-Cooled Reactors

Sodium-cooled liquid-metal reactor



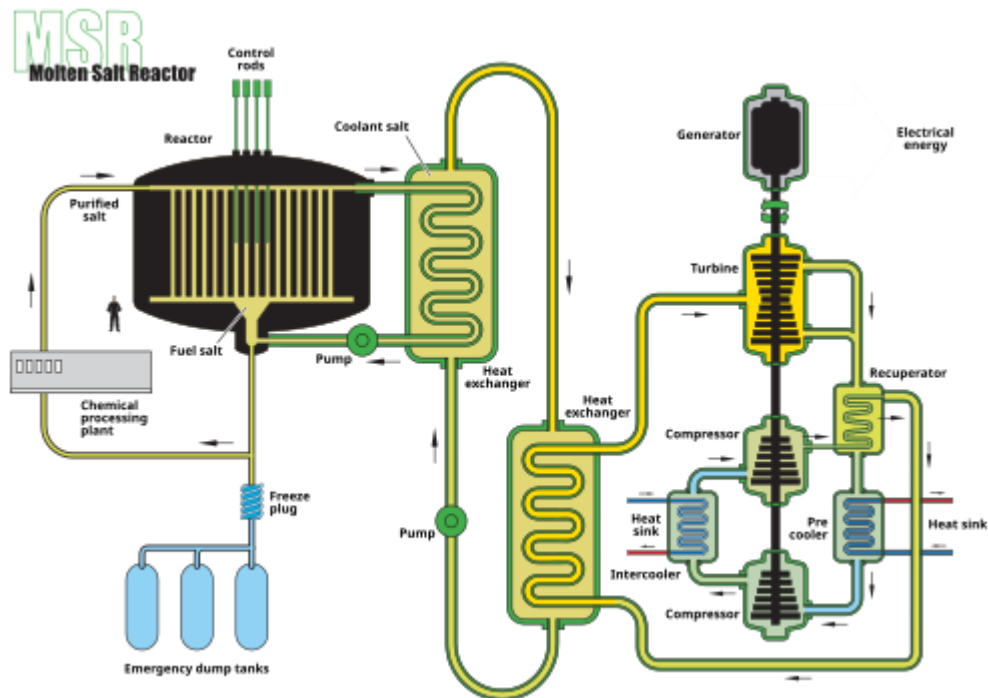
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Sodium, lead or lead-bismuth may be used as reactor coolants. These technologies can provide:

- high heat-transfer performance
- high power density
- high-temperature operation
- low-pressure cooling systems
- potential for long fuel cycles

Challenges include sodium reactivity, corrosion, coolant freezing, radioactive activation products, inspection difficulty and, in the case of lead systems, considerable weight.

Molten Salt Reactors



Molten salt reactor concepts can use molten salt as coolant or as a medium containing the nuclear fuel. Potential advantages include high-temperature and low-pressure operation, passive safety characteristics and compact arrangements.

However, commercial maturity, materials performance, corrosion management, fuel processing and licensing remain unresolved for maritime use.

India's Strength for Nuclear Marine Propulsion



India's Strength for Nuclear Marine Propulsion



Mature Nuclear Ecosystem

- 24 operating reactors across 7 locations
- 8.78 GW installed nuclear capacity
- Indigenous capability across reactor design, fuel fabrication, operation, reprocessing, recycling, waste management and radiation safety
- 500 MWe Prototype Fast Breeder Reactor at Kalpakkam attained first criticality in April 2026
- National ambition of 100 GW nuclear capacity by 2047

Strategic Thorium Advantage

- 11.93 million tonnes of monazite resources, containing about 1.07 million tonnes of thorium
- Thorium forms the third stage of India's long-term nuclear programme through conversion to uranium-233
- Capabilities developed across extraction, fuel fabrication, irradiation, reprocessing and recycling
- Advanced thorium-based concepts include AHWR and AHWR-LEU (developed by BARC)

Advanced Reactor Capability

- ₹20,000 crore Nuclear Energy Mission for SMR design, development and deployment
- At least five indigenous SMRs targeted by 2033
- Key initiatives :
 - 200 MWe Bharat Small Modular Reactor
 - 55 MWe SMR
 - High-temperature gas-cooled reactor for hydrogen production

Defence Marine Nuclear Experience

- Indigenous experience in integrating and operating compact nuclear propulsion systems on Naval vessels
- Technical knowledge in shielding, thermal management, reactor integration, trained manpower and operation under dynamic sea conditions
- Provides an important base for future civilian assessment, subject to separate safety, liability and regulatory frameworks

Sources: PIB, A New Chapter in India's Nuclear Journey, 2026; PIB, SHANTI Bill, 2025; PIB, Thorium Reserves in Country, 2014; BARC, Thorium Fuel Cycle.

17

India possesses a significant technical, institutional and resource base for examining the future application of nuclear energy in the maritime sector. This foundation arises from the country's established civil nuclear programme, indigenous fast breeder reactor capability, long-standing thorium fuel-cycle research, emerging Small Modular Reactor programme and limited publicly documented experience with nuclear-powered naval platforms.

This provides a credible base for undertaking technical studies, reactor-technology assessment, vessel-integration research and development of an appropriate safety and regulatory framework for civilian maritime use.

India's strengths may be examined under four broad areas:

1. Established nuclear energy and fuel-cycle capability
2. Strategic thorium resources and thorium-technology development
3. Emerging advanced reactor and SMR programme
4. Existing experience with nuclear-powered naval platforms

Established Nuclear Energy Programme

India has developed a substantial domestic nuclear energy programme over several decades. PIB factsheet records an installed nuclear power capacity of **8.78 GW**. During 2024–25,

nuclear power plants generated **56,681 million units of electricity**, accounting for approximately **3.1% of India's total electricity generation**. The installed capacity is projected to increase to **22.38 GW by 2031–32**.

The importance of this established programme for a possible marine nuclear initiative lies not merely in installed generating capacity, but in the broader capabilities developed through the nuclear fuel cycle and reactor programme.

Indian capability in areas including:

- design and development of nuclear reactors
- fabrication of nuclear fuels
- operation of nuclear power systems
- reprocessing of spent nuclear fuel
- recycling of recovered fissile material
- development of fast breeder reactor technology
- management of radioactive materials and nuclear waste
- research into thorium utilisation

India's nuclear programme follows a **closed nuclear fuel-cycle approach**, under which fissile materials recovered from spent fuel are reprocessed and reused in subsequent stages of the programme.

For a future nuclear marine programme, such experience would be relevant to the development of:

- long-life reactor fuel
- reactor servicing and refuelling arrangements
- spent-fuel management
- radiation protection
- specialised maintenance systems
- end-of-life and decommissioning arrangements

These possible maritime applications are analytical areas for future assessment.

India's Three-Stage Nuclear Power Programme

India's nuclear power programme was formulated to address the country's relatively limited uranium resources and substantial thorium resources. The programme is structured in three

interconnected stages and is based on progressive utilisation and multiplication of domestic fissile resources.

Stage One: Pressurised Heavy Water Reactors

In the first stage, natural uranium is used as fuel in Pressurised Heavy Water Reactors. During operation, plutonium is produced in the spent fuel. This plutonium is recovered through reprocessing and becomes an important fuel input for the second stage.

Stage Two: Fast Breeder Reactors

The second stage uses plutonium recovered from the first-stage reactors as fuel in fast breeder reactors. These reactors are designed to produce more fissile material than they consume.

The **500 MWe Prototype Fast Breeder Reactor at Kalpakkam** attained first criticality on **6 April 2026**. The reactor was indigenously designed and constructed, and its technology was developed by the Indira Gandhi Centre for Atomic Research. The achievement marks India's entry into the second stage of its three-stage nuclear programme.

The PFBR uses uranium-plutonium mixed oxide fuel. Its core is surrounded by a uranium-238 blanket, in which fast neutrons convert uranium-238 into fissile plutonium-239. The reactor is also designed to provide a future pathway for conversion of thorium-232 into uranium-233. The spent fuel is intended to be reprocessed and recycled as part of the closed fuel cycle.

Once fully operational, India would become the second country after Russia to operate a commercial fast breeder reactor.

Stage Three: Thorium-Based Reactors

The third stage is intended to use uranium-233 produced from thorium-232. This stage seeks to enable large-scale utilisation of India's thorium resources and provide a long-term domestic energy resource.

Relevance to Marine Applications

The existing three-stage programme is designed primarily for land-based nuclear energy development.

However, the programme has created research capability in:

- fast-neutron systems
- advanced nuclear fuels
- fuel reprocessing and recycling
- high-temperature coolant systems
- reactor materials

- long-term thorium utilisation

These competencies may support future research into compact or marine-specific reactor technologies, subject to dedicated design, safety and regulatory assessment.

Fast Breeder Reactor Capability

The PFBR milestone is relevant because it demonstrates India's ability to undertake indigenous research, engineering, construction and commissioning of an advanced reactor system.

The PFBR programme establishes experience in:

- fast-reactor physics
- uranium-plutonium mixed oxide fuel
- breeding of fissile material
- reprocessing and recycling
- closed fuel-cycle management
- advanced reactor materials
- high-temperature heat-transfer systems

The reactor is a land-based, 500 MWe sodium-cooled fast breeder reactor.

Liquid-metal-cooled reactors are among the advanced reactor concepts being studied internationally for future maritime use. The IAEA's categorisation of SMR technology lines includes liquid-metal-cooled fast reactors, alongside water-cooled reactors, molten salt reactors and high-temperature gas-cooled reactors.

Maritime use would require separate work on:

- reactor miniaturisation
- vessel motion and vibration
- shielding and weight
- collision and grounding protection
- coolant behaviour in a marine environment
- maintenance at sea
- port entry and emergency response

The EMSA study states that detailed reactor-to-vessel integration studies and vessel-specific risk assessments would be required before individual marine applications could be evaluated.

Strategic Thorium Resource Base

India has a substantial identified thorium-bearing mineral resource.

The Atomic Minerals Directorate for Exploration and Research had established **11.93 million tonnes of in-situ monazite resources** as of September 2014. These resources were estimated to contain approximately **1.07 million tonnes of thorium**.

The state-wise monazite resources include:

State	Monazite resources
Andhra Pradesh	3.72 million tonnes
Tamil Nadu	2.46 million tonnes
Odisha	2.41 million tonnes
Kerala	1.90 million tonnes
West Bengal	1.22 million tonnes
Jharkhand	0.22 million tonnes
Total	11.93 million tonnes

Thorium is a fertile material and cannot be used directly as fissile nuclear fuel. It must first be converted into uranium-233 through irradiation in a reactor. The PIB release specifically states that sustainable utilisation of thorium depends on progression through the second stage of fast breeder reactors and that thorium is not a short-term solution to immediate power requirements.

Accordingly, India's thorium resources should be described as a **long-term strategic advantage**, not as a readily available fuel for present-day merchant vessels.

Thorium Fuel-Cycle Capability

BARC states that work on thorium has been undertaken from the beginning of India's nuclear programme. Research and development have covered:

- mining and extraction
- production of nuclear-grade thorium
- fuel fabrication
- irradiation in research and power reactors
- evaluation of fuel properties and irradiation behaviour
- post-irradiation examination
- reprocessing

- recovery of uranium-233
- recycling of recovered material

BARC records that several tonnes of nuclear-grade thoria powder have been produced and that thoria-based fuel has been fabricated at BARC and the Nuclear Fuel Complex. Thorium-based fuel has been irradiated in research reactors, PHWRs and the Fast Breeder Test Reactor.

- thoria fuel rods irradiated in CIRUS were reprocessed at BARC
- recovered uranium-233 was fabricated as fuel for the KAMINI reactor
- thoria blanket assemblies irradiated in FBTR were reprocessed at IGCAR
- recovered uranium-233 was used for experimental irradiation of a PFBR-type fuel assembly in FBTR

These activities demonstrate experience across several parts of the thorium fuel cycle.

Relevance to Nuclear Marine Propulsion

Some advanced reactor concepts considered internationally for long-term maritime application may use thorium-bearing fuels or uranium-233. This is particularly discussed in relation to certain molten salt and advanced reactor systems.

India's thorium capability could therefore support future research on:

- long-life nuclear fuels
- advanced reactor fuels
- closed-cycle fuel management
- thorium-based molten salt concepts
- uranium-233 utilisation

Advanced Heavy Water Reactor Development

BARC has designed the **Advanced Heavy Water Reactor** and the **AHWR-LEU** to support development of technologies required for thorium utilisation.

Advanced Heavy Water Reactor

The BARC describes the AHWR as:

- a 300 MWe reactor
- a vertical pressure-tube design
- boiling light-water cooled
- heavy-water moderated

- intended as a technology-demonstration reactor for thorium utilisation
- designed to use thorium-plutonium and thorium–uranium-233 mixed oxide fuels

A co-located fuel-cycle facility is planned to support fuel fabrication, reprocessing and waste management.

AHWR-LEU

The AHWR-LEU is also described as a 300 MWe vertical pressure-tube reactor using thorium and low-enriched uranium mixed oxide fuel. It is based on a once-through fuel cycle, with provisions for long-term storage, monitoring and retrieval of spent fuel.

Relevance to Marine Applications

The AHWR and AHWR-LEU are land-based reactor concepts. Its importance to the present assessment lies in demonstrating India’s ability to develop advanced reactor designs around:

- thorium fuel
- passive and advanced safety approaches
- fuel-cycle integration
- uranium-233 utilisation
- long-term spent-fuel management

Nuclear Energy Mission and Emerging SMR Programme

India’s Nuclear Energy Mission, announced under the Union Budget 2025–26, marks a major step towards the development and deployment of advanced nuclear technologies. As per the PIB material, a budgetary provision of **₹20,000 crore** has been made for research, design, development and deployment of Small Modular Reactors, with a target of making at least **five indigenously designed SMRs operational by 2033**.

The indigenous reactor initiatives being taken forward include:

- **220 MWe Bharat Small Modular Reactor — BSMR-200**
- **55 MWe Small Modular Reactor — SMR-55**
- **High-Temperature Gas-Cooled Reactor of up to 5 MWth** for hydrogen generation

In-principle approval has been received for all three reactor programmes. The lead units of BSMR-200 and SMR-55 are proposed to be established at the Tarapur Atomic Power Station site, while the High-Temperature Gas-Cooled Reactor is proposed at BARC Vizag.

India has also developed important enabling technologies indigenously, including advanced reactor-vessel alloy, forging technology for reactor pressure vessels and control-rod drive

mechanisms. A majority of the required equipment is stated to be within the manufacturing capability of Indian industry, with technological support from BARC.

Relevance of SMRs to Maritime Applications

The IAEA describes SMRs as advanced reactors typically producing up to **300 MWe per module**, with an emphasis on compact design, modular construction and factory-based manufacturing. Transportable SMRs may be deployed as floating nuclear power units or adapted for nuclear-propelled ships.

The key characteristics relevant to maritime use include:

- compact reactor architecture
- modular and standardised construction
- factory fabrication and controlled quality assurance
- smaller physical footprint
- flexible power ratings
- potential for longer operating cycles
- incorporation of inherent and passive safety features
- suitability for integration with electric propulsion and onboard power systems

The IAEA notes that most established marine-reactor concepts are based on pressurised water reactor technology. Water-cooled SMRs are generally regarded as suitable for nearer-term development, while advanced concepts such as molten salt reactors and high-temperature gas-cooled reactors are being explored for longer-term applications.

India's indigenous SMR programme can therefore strengthen the national knowledge, manufacturing and regulatory base required for future assessment of marine propulsion and floating nuclear power systems. The transition from a land-based design to a maritime application would involve specialised engineering for vessel motion, vibration, collision protection, marine corrosion, compact shielding, variable shipboard power demand and servicing at designated facilities.

High-Temperature Reactor and Hydrogen Development

As per PIB, BARC is developing a **High-Temperature Gas-Cooled Reactor of up to 5 MWth** for hydrogen generation.

High-temperature gas-cooled reactors operate at higher outlet temperatures than conventional water-cooled reactors. The IAEA identifies these systems as particularly suitable for cogeneration and industrial process-heat applications.

Their relevance to the maritime sector may arise through two complementary pathways.

Marine Power and Propulsion

Over the longer term, high-temperature reactor concepts may be assessed for:

- marine-based electricity generation
- integrated electric propulsion
- floating nuclear power platforms
- offshore and coastal energy systems

Production of Low-Carbon Maritime Fuels

Nuclear-generated heat and electricity may also support the production of:

- hydrogen
- ammonia
- synthetic fuels
- other low-carbon energy carriers

Such fuels can be supplied to conventionally powered vessels and can support the development of low-carbon bunkering ecosystems at ports.

The indigenous HTGCR programme therefore has significance not only for advanced reactor development, but also for the wider maritime energy transition through its potential contribution to clean-fuel production and port-based industrial applications.

Nuclear Legal and Regulatory Development

The **Sustainable Harnessing and Advancement of Nuclear Energy for Transforming India framework** represents an important step towards modernising India's nuclear governance architecture.

the framework seeks to:

- consolidate and modernise the legal provisions governing nuclear energy
- enable limited private participation under regulatory oversight
- provide for licensing and safety authorisation
- grant statutory recognition to the Atomic Energy Regulatory Board
- strengthen nuclear safety, security and safeguards
- establish provisions relating to liability and compensation
- improve emergency preparedness and institutional coordination
- support India's objective of achieving **100 GW of nuclear capacity by 2047**

Sensitive activities such as specified enrichment, spent-fuel reprocessing, recycling and high-level radioactive-waste management continue to remain under the control of the Central Government or its wholly owned institutions.

Relevance to Marine Nuclear Development

A modern and enabling nuclear framework can support:

- research and development of advanced reactors
- participation of specialised industries and equipment manufacturers
- indigenous manufacturing of nuclear-grade components
- development of new business and deployment models
- strengthening of regulatory and safety institutions
- collaboration among government, research organisations and industry

For marine applications, this nuclear framework would need to be complemented by maritime-specific provisions covering:

- design and construction of nuclear-powered vessels
- classification and statutory certification
- Flag State oversight
- Port-entry and port-acceptance procedures
- crew competency and certification
- nuclear safety and security at sea
- emergency preparedness
- civil liability and insurance
- refuelling and servicing
- radioactive-waste management
- decommissioning and end-of-life arrangements

The development of such a framework would require coordinated participation by the Department of Atomic Energy, AERB, DGMA, classification societies, shipyards, ports, security agencies and other relevant institutions.

Indian Defence Marine Nuclear Experience

India's experience with nuclear-powered naval platforms provides an important marine dimension to its wider nuclear capability. India currently operates **three indigenously built Arihant-class nuclear-powered ballistic missile submarines—INS Arihant, INS Arighaat and INS Aridhaman**. Developed under the Advanced Technology Vessel (ATV) programme, these submarines constitute the sea-based leg of India's strategic deterrence while demonstrating the country's indigenous capability in nuclear propulsion, submarine design, marine systems integration and advanced naval engineering.

Indian Nuclear-Powered Vessels

INS Arihant is India's first indigenously developed nuclear-powered ballistic missile submarine. *Its development marked India's entry into the select group of countries possessing the capability to design and build nuclear-powered submarines*. The vessel was launched in 2009 and subsequently inducted into service. Official Ministry of Defence material identifies Arihant as an indigenously built nuclear-propelled strategic submarine.

INS Arighaat, the second Arihant-class submarine, was commissioned into the Indian Navy on **29 August 2024 at Visakhapatnam**. As per the Ministry of Defence, its construction involved advanced design and manufacturing technologies, special materials, complex engineering and highly skilled workmanship. Its systems and equipment were conceptualised, designed, manufactured and integrated through the combined efforts of Indian scientists, industry and naval personnel. The technological advancements incorporated in INS Arighaat make it more advanced than INS Arihant.

These submarines were developed under India's Advanced Technology Vessel programme and represent the convergence of nuclear science, naval architecture, marine engineering, specialised materials and indigenous manufacturing.

INS Aridhaman, the third Arihant-class nuclear-powered ballistic missile submarine, was commissioned into the Indian Navy in **April 2026**, further strengthening India's indigenous nuclear-powered submarine fleet and sea-based strategic deterrence. Developed under the Advanced Technology Vessel (ATV) programme, INS Aridhaman represents the continued evolution of India's indigenous submarine-building capability and reflects the growing maturity of the country's expertise in nuclear propulsion, complex marine engineering, advanced manufacturing and systems integration. Together with INS Arihant and INS Arighaat, it reinforces India's experience in operating nuclear-powered vessels in demanding maritime environments and provides an important technological foundation for future advancements in marine nuclear engineering

Significance of the Arihant-Class Programme

The Arihant-class programme demonstrates India's capability to integrate nuclear propulsion within a complex marine platform. A nuclear-powered submarine requires the reactor and its associated systems to operate reliably within a compact vessel while being exposed to vessel motion, vibration, pressure variations and prolonged submerged operations.

The programme has contributed to national experience in areas such as:

- integration of a nuclear reactor with a marine platform
- compact machinery and power-system arrangements
- operation of nuclear systems within confined spaces
- radiation protection and shielding
- heat removal and power conversion at sea
- operation under rolling, pitching and vibration
- use of specialised materials and complex engineering systems
- indigenous design, manufacturing and systems integration
- specialised personnel training and operating procedures
- security of the reactor and nuclear material
- maintenance and emergency preparedness in a marine environment

Nuclear propulsion enables such vessels to remain submerged for extended periods without the frequent refuelling requirements associated with conventional propulsion. This provides high endurance and sustained availability for long-duration marine operations.

Relevance to Civilian Nuclear Propulsion

Civilian merchant vessels would operate under different commercial, regulatory and international conditions. However, the technological and institutional experience developed through the Arihant-class programme provides a valuable national reference for examining civilian nuclear applications.

This experience can support future work relating to:

- assessment of reactor technologies suitable for merchant vessels
- integration of compact reactors with ship propulsion and electrical systems
- marine safety and risk assessment
- shielding, structural protection and heat-removal arrangements
- development of nuclear-marine training and competency frameworks
- specialised shipbuilding, maintenance and servicing requirements
- coordination between nuclear, maritime, defence and industrial institutions

A civilian programme would build upon this broader marine experience while developing dedicated arrangements for:

- civilian design approval and classification

- flag-State certification and regulatory oversight
- international port access and port acceptance
- internationally recognised nuclear safety and safeguards
- commercial insurance and liability
- civilian crew competency and certification
- commercial repair, servicing and refuelling
- compatibility with cargo and passenger operations

India's nuclear-powered submarine programme therefore constitutes an important component of the country's overall foundation for undertaking structured research, technology assessment and eventual development of nuclear propulsion for civilian maritime applications.

International Cooperation

India has established a broad framework of international engagement in the peaceful use of nuclear energy. India has entered into intergovernmental agreements on civil nuclear cooperation with **18 countries**.

This cooperation provides opportunities for knowledge exchange and collaboration in areas such as:

- advanced reactor technologies
- Small Modular Reactors
- nuclear safety and regulation
- nuclear-grade materials and equipment
- fuel-cycle arrangements
- safeguards and security
- radioactive-waste management
- floating nuclear power platforms
- research, training and capacity building

International cooperation assumes particular importance for nuclear-powered merchant shipping because commercial vessels operate across national jurisdictions and rely on recognition by flag States, port States and coastal States.

Future maritime cooperation may therefore involve:

- engagement with the IAEA and IMO

- harmonisation of nuclear and maritime safety requirements
- common principles for classification and certification
- port-entry and emergency-response arrangements
- crew competency and training standards
- liability and insurance mechanisms
- international recognition of vessel and reactor approvals

India's established civil nuclear partnerships and active participation in international maritime institutions provide a suitable platform for initiating such dialogue.

India's Strategic Strength for Nuclear Marine Propulsion

India's strength for examining nuclear marine propulsion arises from the convergence of several established national capabilities.

Established Nuclear Programme

India has an operational nuclear power programme with an installed capacity of **8.78 GW**, supported by experience in reactor operation, fuel fabrication, reprocessing, recycling and radioactive-waste management.

Advanced Fast-Reactor Development

The **500 MWe Prototype Fast Breeder Reactor at Kalpakkam** attained first criticality in April 2026. This milestone demonstrates indigenous capability in advanced reactor research, engineering, construction and the closed nuclear fuel cycle.

Strategic Thorium Resource Base

India has **11.93 million tonnes of identified monazite resources**, containing approximately **1.07 million tonnes of thorium**, as per the official estimate of September 2014.

Thorium Fuel-Cycle Research

India has undertaken work across extraction, fuel fabrication, irradiation, reprocessing, uranium-233 recovery and recycling of thorium-based materials.

Advanced Reactor Design Capability

BARC has developed advanced thorium-oriented reactor concepts, including the AHWR and AHWR-LEU, and is leading the development of indigenous SMRs and high-temperature reactor systems.

National SMR Mission

The allocation of **₹20,000 crore** for SMR research and deployment, together with the target of at least five indigenous SMRs by 2033, creates a strong policy and technology base for compact reactor development.

Marine Nuclear Experience

India's experience with nuclear-powered naval platforms provides an existing marine reference for the operation and integration of nuclear systems at sea.

Indigenous Manufacturing Base

Important nuclear materials, reactor-vessel technologies and control systems have been developed indigenously. Indian industry is expected to participate in manufacturing a majority of equipment required for the indigenous SMR programme.

Evolving Governance Framework

India's modernising nuclear legal and regulatory framework is intended to support advanced technology development, wider industrial participation and stronger regulatory oversight.

International Engagement

Civil nuclear cooperation with 18 countries provides a platform for technical partnerships, research collaboration, regulatory dialogue and development of internationally acceptable systems.

Taken together, these capabilities provide India with a credible foundation for studying nuclear propulsion for merchant vessels, floating nuclear power platforms and nuclear-supported port and coastal energy applications.

Priority Areas for Future Development

Building on India's existing strengths, a structured programme for nuclear marine applications may focus on the following priority areas:

Marine Reactor Technology

- selection of suitable reactor technology
- compact and modular reactor design
- long-life civilian nuclear fuel
- passive safety and containment
- marine-qualified materials and equipment

Vessel Design and Integration

- reactor location and shielding
- stability and structural protection
- electric propulsion architecture
- collision and grounding protection
- cooling and emergency power systems

Safety and Risk Assessment

- marine hazard identification
- nuclear safety analysis
- fire, flooding and loss-of-cooling scenarios
- radiation-protection arrangements
- security and safeguards by design

Classification and Regulation

- dedicated classification rules
- statutory certification requirements
- flag-State and port-State procedures
- port-entry and port-acceptance frameworks
- civil liability and insurance arrangements

Infrastructure

- specialised construction and servicing facilities
- refuelling arrangements
- spent-fuel and radioactive-waste management
- emergency-response infrastructure
- decommissioning facilities

Human Resources

- civilian nuclear-marine competency standards
- training and certification of reactor operators
- specialised training for marine engineers and deck officers
- training of surveyors, port personnel and emergency responders

Demonstration and Deployment

- technology-readiness assessment
- identification of suitable vessel or floating-platform applications
- preliminary design and Approval in Principle
- controlled pilot or demonstration project
- phased movement towards commercial application

The EMSA study identifies radiation safety, marine accidents, external threats, regulation, licensing, design requirements, capable shipyards and safeguards as central considerations for future marine nuclear applications. These areas provide a useful framework for structuring India's research and regulatory roadmap.

Small Modular Reactors (SMRs): Emerging Pathway for Maritime Applications



Small Modular Reactors (SMRs): Emerging Pathway for Maritime Applications



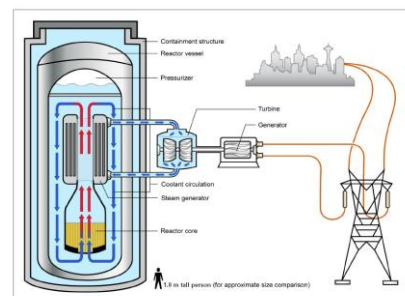
SMRs are advanced nuclear reactors of up to 300 MWe per module, designed for compact, modular and factory-based deployment.

Key Features

- **Compact and modular design**
Suitable for space-constrained marine and offshore applications.
- **Factory fabrication and standardization**
Modules can be manufactured under controlled conditions and transported for installation.
- **Enhanced safety characteristics**
Many designs incorporate inherent and passive safety systems.
- **Flexible power applications**
Can support propulsion, onboard electricity, process heat, desalination and fuel production.
- **Long fuel cycles**
Extended operation between refuelling may support deep-sea and long-endurance applications.
- **Multiple technology pathways**
Water-cooled SMRs are considered more suitable for near-term deployment, while MSRs and HTGRs are longer-term options.

India Context

- **₹20,000 crore Nuclear Energy Mission** for SMR research, development and deployment
- Indigenous programmes:
 - **220 MWe BSMR-200**
 - **55 MWe SMR-55**
 - **Up to 5 MWth HTGCR** for hydrogen production
 - **In-principle approval** received
- Lead units proposed at **Tarapur** and **BARC Vizag**
- Key reactor materials and control systems developed indigenously
- Majority of equipment can be manufactured by Indian industry with BARC support
- Supports India's target of **100 GW nuclear capacity by 2047**

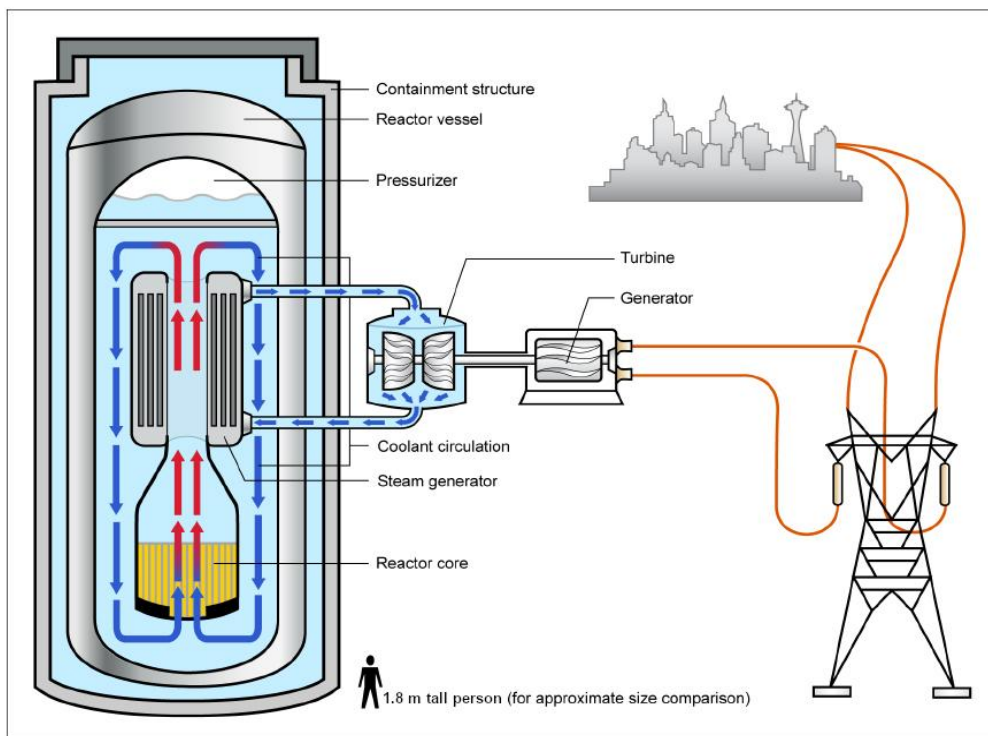


Source: GAO, based on Department of Energy documentation. | GAO-15-452

Potential Maritime Applications

- Merchant vessel propulsion
- Floating nuclear power plants
- Port and offshore power supply
- Remote coastal energy systems
- Desalination
- Hydrogen, ammonia and synthetic fuel production

Sources: IAEA, Overview of SMR Designs for Maritime-based Nuclear Power Plants; IAEA, Small Modular Reactors; EMSA, Potential Use of Nuclear Power for Shipping; PIB, SHANTI Bill, 2025



Source: GAO, based on Department of Energy documentation. | GAO-15-652

Small Modular Reactors (SMRs) represent one of the most significant developments in advanced nuclear technology and are increasingly being viewed as a practical pathway for expanding the use of nuclear energy beyond conventional grid-based electricity generation. As per the International Atomic Energy Agency (IAEA), SMRs are advanced nuclear reactors with an electrical output of **up to 300 MWe per module**, designed using modular construction principles and factory-based manufacturing techniques. Unlike conventional gigawatt-scale nuclear power plants, SMRs can be deployed individually or as multi-module plants depending on the required power output.

The growing interest in SMRs is driven by their ability to provide reliable, low-carbon and flexible power generation while reducing construction timelines, improving affordability and incorporating advanced safety features. Their compact size and modular configuration also make them suitable for applications beyond conventional electricity generation, including industrial process heat, hydrogen production, district heating, desalination, floating nuclear power plants and, potentially, maritime propulsion.

Evolution of Small Modular Reactors

Although the term **Small Modular Reactor** has gained prominence only during the past decade, the underlying concept is not new. Nuclear reactors designed for submarines, aircraft carriers and icebreakers have demonstrated for several decades that compact nuclear reactors

can safely operate in confined spaces while providing high power output and long operating endurance.

Modern SMRs build upon this experience by integrating advances in reactor design, digital instrumentation, passive safety systems, modular construction techniques and advanced materials. Instead of constructing large nuclear power plants entirely at site, SMRs are designed so that major components or complete reactor modules can be manufactured under factory-controlled conditions, transported to the installation site and assembled with significantly reduced construction time and complexity.

Worldwide, more than **80 SMR designs and concepts** are currently under development, representing a broad range of reactor technologies and applications. These include light-water reactors, heavy-water reactors, high-temperature gas-cooled reactors, liquid-metal fast reactors, molten salt reactors and microreactors.

Key Characteristics of SMRs

SMRs combine several engineering characteristics that distinguish them from conventional large nuclear reactors.

Compact and Modular Design

SMRs occupy a significantly smaller physical footprint than conventional reactors, enabling deployment where land availability or space constraints limit construction of large nuclear power plants. Their compact dimensions also make them attractive for offshore installations, floating nuclear power platforms and future marine propulsion systems.

Factory-Based Manufacturing

One of the defining characteristics of SMRs is modular construction. Major reactor components can be manufactured, tested and quality-assured in dedicated factories before being transported to the installation site. This approach is expected to improve manufacturing consistency, reduce construction risks and shorten project schedules.

Flexible Deployment

SMRs may be deployed as single modules or multiple modules operating together. Capacity can therefore be increased progressively as demand grows without constructing an entirely new power plant.

Enhanced Safety Features

Many SMR designs incorporate **passive safety systems**, relying on natural circulation, gravity, convection and stored energy instead of active pumps or external power supplies. These features simplify emergency cooling arrangements and improve overall plant resilience. It should be noted that passive safety is a feature of many modern reactor designs and is not exclusive to SMRs.

Long Operating Cycles

Many SMR concepts are designed for extended fuel cycles, allowing operation for several years before refuelling. This characteristic is particularly attractive for remote installations and marine applications where frequent refuelling may be operationally difficult.

Multi-Purpose Applications

Beyond electricity generation, SMRs can simultaneously provide:

- industrial process heat
- hydrogen production
- ammonia and synthetic fuel production
- desalination
- district heating
- offshore energy supply
- electric propulsion systems

This flexibility significantly broadens the potential role of SMRs within future low-carbon energy systems.

Types of SMRs

SMRs are **not a single reactor technology** but rather a family of reactor designs characterised by their size and modularity. Different SMRs employ different reactor technologies depending on their intended application.

The principal reactor families include:

- Pressurised Water Reactors (PWR)
- Boiling Water Reactors (BWR)
- Pressurised Heavy Water Reactors (PHWR)
- High-Temperature Gas-Cooled Reactors (HTGR)
- Liquid Metal Fast Reactors (LMFR)
- Molten Salt Reactors (MSR)

Among these, **light-water SMRs based on Pressurised Water Reactor technology are considered the most mature and are expected to see the earliest commercial deployment.** Advanced Generation-IV concepts such as molten salt reactors and high-temperature gas-cooled reactors are expected to mature over a longer timeframe.

Indian Context

India has identified nuclear energy as a key component of its long-term clean energy and energy security strategy. As part of the **Nuclear Energy Mission** announced under the Union Budget 2025–26, the Government has provided **₹20,000 crore** for the research, development and deployment of Small Modular Reactors (SMRs), with a target of making at least **five indigenously designed SMRs operational by 2033**. The programme aims to accelerate indigenous reactor technology, strengthen domestic manufacturing capability and support the country's objective of achieving **100 GW of nuclear power capacity by 2047**.

India's indigenous SMR programme presently comprises three major initiatives:

- **220 MWe Bharat Small Modular Reactor (BSMR-200)**
- **55 MWe Small Modular Reactor (SMR-55)**
- **High-Temperature Gas-Cooled Reactor (HTGR) of up to 5 MWth** for hydrogen production

In-principle approval has been accorded for all three reactor programmes. The lead units of BSMR-200 and SMR-55 are proposed to be established at **Tarapur Atomic Power Station**, while the HTGR demonstration unit is proposed at **BARC, Visakhapatnam**.

An important feature of the programme is the emphasis on **indigenous technology development**. BARC has developed key reactor technologies, including advanced reactor-vessel materials, forging technologies and control systems. The PIB further states that a majority of the equipment required for these reactors can be manufactured by Indian industry with technological support from BARC, creating opportunities for expansion of the domestic nuclear manufacturing ecosystem.

The SMR programme complements India's broader three-stage nuclear power programme, ongoing fast breeder reactor development, thorium fuel-cycle research and the national objective of expanding clean, reliable and dispatchable energy sources. Although the current programme is primarily intended for land-based deployment, the technologies and industrial capabilities developed through these initiatives provide a strong foundation for examining future maritime applications of compact nuclear reactors.

Potential Maritime Applications of SMRs

The compact size, modular construction and flexible operating characteristics of Small Modular Reactors make them suitable for a wide range of maritime and offshore applications. International studies by the IAEA and EMSA recognise SMRs as one of the most promising reactor technologies for extending the use of nuclear energy into the maritime domain.

Merchant Ship Propulsion

SMRs are being actively evaluated as potential propulsion systems for future merchant vessels. Their high energy density and long fuel cycles could enable ships to operate for extended

periods without refuelling, while significantly reducing greenhouse gas emissions and dependence on conventional marine fuels. They are particularly attractive for vessels operating on long international routes where endurance and cargo capacity are important considerations.

Floating Nuclear Power Plants

Floating Nuclear Power Plants (FNPPs) employ compact SMRs mounted on floating platforms or barges to provide reliable electricity and heat to coastal regions, islands, offshore facilities and industrial clusters. The IAEA identifies FNPPs as an emerging application capable of supplying clean baseload power while avoiding many of the site constraints associated with land-based nuclear power plants.

Port and Offshore Power Supply

SMRs can provide continuous low-carbon electricity to ports, shipyards, offshore platforms and coastal industrial zones. Such installations can support shore power (cold ironing), electrified cargo handling equipment, port operations and future green-fuel production while reducing dependence on fossil-fuel-based grid electricity.

Remote Coastal and Island Energy Systems

Many coastal communities and island territories rely on imported fossil fuels for electricity generation. SMRs offer a potential long-term solution by supplying stable baseload power with minimal fuel logistics and reduced greenhouse gas emissions. Their modular design also enables deployment where conventional large nuclear power plants may not be feasible.

Desalination

SMRs can simultaneously generate electricity and process heat, making them suitable for large-scale seawater desalination. Nuclear-powered desalination can support freshwater requirements of ports, island territories, offshore installations and water-stressed coastal regions.

Hydrogen, Ammonia and Synthetic Fuel Production

SMRs can provide both electricity and high-temperature process heat required for production of hydrogen and hydrogen-derived fuels such as ammonia and synthetic fuels. These fuels are expected to play an important role in the decarbonisation of international shipping. Nuclear-assisted fuel production can therefore complement the development of future green maritime fuel hubs.

Integrated Maritime Energy Systems

Beyond individual applications, SMRs offer the possibility of developing integrated maritime energy ecosystems in which a single reactor installation simultaneously supplies electricity for ports, shore power for ships, desalination facilities, hydrogen production plants and nearby coastal industries. Such integrated systems could enhance energy security, improve infrastructure resilience and support the transition towards low-carbon maritime operations.

Molten-Metal-Based Reactors (Liquid Metal-Cooled Reactors)



Molten-Metal-Based Reactors (Liquid Metal Cooled)



Molten-metal-based reactors (liquid metal cooled) use liquid metals such as **sodium, lead or lead-bismuth** as coolants. Most are fast-spectrum reactors and are being explored for compact, high-power and long-endurance applications.

Key Features

- **High heat-transfer capability**
Enables efficient cooling and compact reactor design.
- **High-temperature, low-pressure operation**
Improves thermal efficiency and avoids very high-pressure coolant systems.
- **High power density**
Suitable for space- and weight-constrained marine applications.
- **Extended fuel cycles**
Potential for extended operation between refuelling.
- **Efficient fuel utilization**
Fast reactors can use uranium resources more efficiently and support breeder configurations.

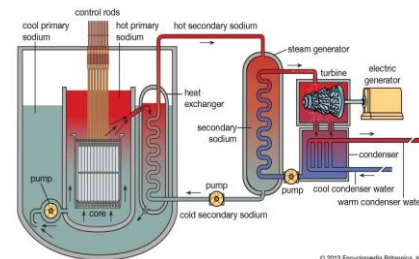
Principal Types

- Sodium-Cooled Fast Reactor (SFR)
- Lead-Cooled Fast Reactor (LFR)
- Lead-Bismuth Eutectic-Cooled Reactor

India Context

- India has strong experience in **sodium-cooled fast reactor technology**
- Key assets include the **Fast Breeder Test Reactor (FBTR)** and **500 MWe Prototype Fast Breeder Reactor (PFBR)** at Kalpakkam
- **PFBR attained first criticality in April 2026**, marking entry into Stage 2 of India's three-stage nuclear programme
- Provides a strong base in **fast-reactor design, coolant management, materials and closed fuel-cycle technology**
- Any maritime use would still require separate work on **miniaturisation, shielding, vessel integration, safety and licensing**

Sodium-cooled liquid-metal reactor



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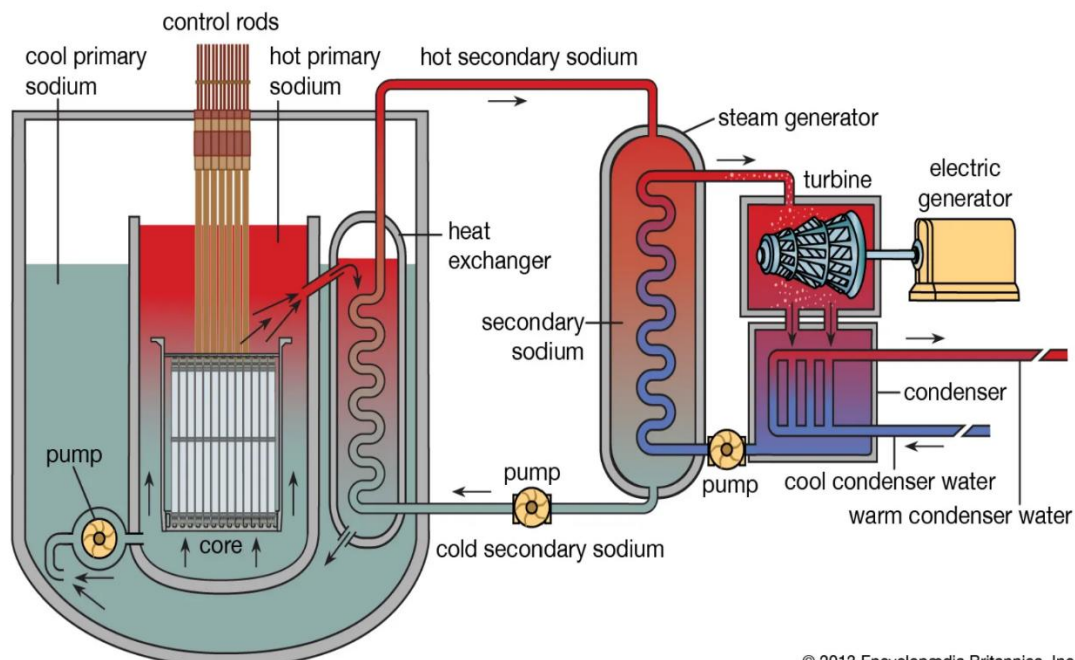
Potential Maritime Applications

- Nuclear propulsion for specialised long-endurance merchant vessels
- Power for floating nuclear platforms
- Offshore and remote marine energy systems
- Port and coastal low-carbon power applications

Sources: EMSA, *Potential Use of Nuclear Power for Shipping*, 2024; PIB, *A New Chapter in India's Nuclear Journey*, 2026; Britannica Encyclopædia.

19

Sodium-cooled liquid-metal reactor



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Molten-metal-based reactors, more commonly referred to as **Liquid Metal-Cooled Reactors (LMRs)**, are nuclear reactors in which a liquid metal is used as the primary coolant instead of

water. The most commonly used liquid metals include **sodium, lead and lead-bismuth eutectic**, although other metals have also been investigated. Most liquid-metal-cooled reactors operate with a **fast neutron spectrum** and are therefore classified as **Liquid Metal Fast Reactors (LMFRs)**. These reactors have attracted considerable international interest because of their ability to operate at high temperatures while maintaining relatively low system pressure, making them suitable for compact, high-power and long-endurance applications.

Liquid-metal-cooled reactors have been developed primarily for fast breeder reactor programmes and have also been employed in certain nuclear-powered submarines and experimental naval propulsion systems. Their high power density, excellent heat-transfer characteristics and long fuel cycles make them one of the advanced reactor technologies being evaluated for future marine nuclear applications.

Working Principle

Unlike conventional pressurised water reactors, which use water as both coolant and moderator, liquid-metal reactors circulate molten metal through the reactor core to remove the heat generated during nuclear fission.

The heated liquid metal transfers thermal energy through intermediate heat exchangers to a secondary circuit, where steam is generated to drive turbines for electricity generation or marine propulsion. Because liquid metals possess very high boiling points, the primary coolant remains in the liquid phase even at temperatures significantly higher than those encountered in water-cooled reactors. This enables reactor operation at **near-atmospheric pressure**, thereby reducing the need for heavily pressurised coolant systems.

Most liquid-metal reactors are designed as **fast-spectrum reactors**, where neutrons are not slowed by a moderator. This allows efficient utilisation of nuclear fuel and supports breeder reactor configurations capable of generating additional fissile material from fertile isotopes such as uranium-238 or thorium-derived fuel cycles.

Principal Types of Liquid Metal-Cooled Reactors

Liquid-metal reactors are generally classified according to the coolant employed.

Sodium-Cooled Fast Reactors (SFR)

Sodium is the most mature and widely deployed liquid-metal coolant. It possesses excellent thermal conductivity, low neutron absorption and favourable heat-transfer characteristics. Sodium-cooled fast reactors have been extensively developed in several countries and form the basis of many existing fast breeder reactor programmes.

Lead-Cooled Fast Reactors (LFR)

Lead offers high boiling temperature, excellent radiation shielding characteristics and chemical stability with water and air. These properties make lead-cooled reactors attractive for future

advanced reactor concepts, although their higher density introduces additional engineering considerations for pumps, structures and materials.

Lead-Bismuth Eutectic Reactors (LBE)

Lead-bismuth eutectic has a lower melting point than pure lead while retaining many of its thermal characteristics. It has been used in certain naval propulsion applications and is being studied for advanced reactor systems requiring compact configurations and extended operating life. Material compatibility and corrosion control remain important areas of research.

Key Features

Liquid-metal-cooled reactors possess several engineering characteristics that distinguish them from conventional water-cooled reactors.

High Heat-Transfer Capability

Liquid metals exhibit significantly higher thermal conductivity than water, enabling rapid removal of heat from the reactor core and supporting compact reactor configurations.

High-Temperature, Low-Pressure Operation

The high boiling points of sodium, lead and lead-bismuth permit reactor operation at elevated temperatures while maintaining relatively low operating pressure. This improves thermal efficiency and reduces the complexity associated with highly pressurised coolant systems.

High Power Density

Efficient heat removal allows greater power generation within a relatively small reactor volume, an important consideration where space and weight are constrained, such as onboard ships and submarines.

Long Fuel Cycles

Fast reactors are capable of operating for extended periods between refuelling, making them suitable for applications requiring long operational endurance.

Efficient Fuel Utilisation

Fast neutron reactors make more effective use of available nuclear fuel and can support breeder configurations that generate additional fissile material, thereby improving long-term fuel utilisation.

Indian Context

India has developed substantial expertise in **sodium-cooled fast reactor technology** through the implementation of the second stage of its three-stage nuclear power programme.

The country's principal facilities include:

- **Fast Breeder Test Reactor (FBTR), Kalpakkam**
- **500 MWe Prototype Fast Breeder Reactor (PFBR), Kalpakkam**

The Prototype Fast Breeder Reactor attained **first criticality in April 2026**, marking an important milestone in India's fast-reactor programme and the transition towards Stage II of the national nuclear strategy. As highlighted in the PIB factsheet, the PFBR strengthens India's indigenous capability in reactor engineering, sodium coolant technology, advanced materials, fuel-cycle management and fast-reactor operation.

The experience gained through FBTR and PFBR contributes to national capability in:

- sodium coolant technology
- fast-reactor physics
- reactor design and systems engineering
- high-temperature materials
- heat-transfer systems
- closed nuclear fuel cycle
- reactor operation and maintenance
- advanced nuclear manufacturing

Although these facilities are land-based power reactors, the technological knowledge generated through India's fast-reactor programme provides an important foundation for evaluating compact liquid-metal reactor concepts for future maritime applications.

Potential Maritime Applications

Liquid-metal-cooled reactors are considered one of the advanced reactor technologies with potential relevance for future maritime applications, particularly where compact size, high power density and extended operating endurance are important requirements.

Potential applications include:

Nuclear Propulsion for Long-Endurance Merchant Vessels

Compact fast reactors could support propulsion of specialised merchant vessels operating on long international routes with minimal refuelling requirements.

Floating Nuclear Power Platforms

Liquid-metal reactors may be employed in floating nuclear power stations supplying electricity and heat to ports, islands, offshore installations and remote coastal regions.

Offshore Energy Systems

Compact reactors may provide continuous low-carbon electricity for offshore industrial facilities, offshore energy hubs and remote marine infrastructure.

Port and Coastal Energy Supply

High-temperature reactor systems could support reliable electricity generation, industrial process heat, desalination and future hydrogen production for maritime decarbonisation.

Engineering Considerations for Marine Deployment

While liquid-metal reactors possess several characteristics favourable for marine applications, adapting them for civilian merchant vessels would require specialised engineering beyond existing land-based reactor technology.

Key areas include:

- reactor miniaturisation
- compact biological shielding
- shipboard integration
- vibration and motion tolerance
- corrosion management in marine environments
- coolant chemistry control
- passive safety systems
- emergency cooling arrangements
- classification and certification
- nuclear safety and licensing for civilian maritime operations

These considerations represent engineering development areas rather than fundamental technological barriers and would form part of the design process for any future marine liquid-metal reactor.

Liquid-metal-cooled reactors represent one of the most advanced reactor technologies currently under development for high-performance nuclear applications. Their ability to combine **high power density, efficient heat transfer, high-temperature operation and extended fuel cycles** makes them attractive candidates for future marine propulsion, floating nuclear power platforms and offshore energy systems.

India's experience with sodium-cooled fast reactors through the **FBTR** and **PFBR** has established important indigenous capabilities in fast-reactor technology, coolant management, advanced materials and closed fuel-cycle engineering. While dedicated marine reactor development would require further engineering and regulatory work, these capabilities provide a strong technological foundation for evaluating liquid-metal-based reactors as part of future civilian maritime nuclear applications.

Floating Nuclear Power Platforms (Floating Nuclear Power Plants – FNPPs)



Floating Nuclear Power Platforms



Floating Nuclear Power Plants (FNPPs) are nuclear power units installed on barges, ships or offshore platforms to generate electricity, heat and other energy products for coastal and offshore users. Unlike nuclear -propelled vessels, their primary purpose is power generation rather than propulsion.

Key Features and Advantages

- Floating and relocatable configuration
- Compact reactor systems
- Reduced land and site-preparation requirements
- Reliable, continuous low-carbon power
- Multi-purpose energy supply
- Access to marine cooling
- Centralised servicing and lifecycle management

Demonstrated Example: Akademik Lomonosov

- Russian non-self-propelled floating nuclear power platform at **Pevek**;
- Entered commercial operation in **2020**
- Equipped with **two modified KLT-40S pressurised water reactors**
- Generates approximately **70 MW electrical power** or **300 MW thermal power**
- Supplies electricity to the regional grid and heat to the town of Pevek



Potential Applications

- Reliable power for islands and remote coastal communities
- Low-carbon electricity for ports, shipyards and maritime industrial clusters
- Energy supply for offshore installations and mining operations
- Seawater desalination and freshwater production
- Hydrogen, ammonia and synthetic marine -fuel production
- Temporary or emergency power supply

Relevance for India

- Clean power for island territories and remote coastal regions
- Low-carbon energy for major ports and maritime industrial zones ; Energy supply for offshore infrastructure
- Power and heat for green hydrogen and green ammonia production
- Desalination for coastal communities and industries
- Potential integration with India's SMR, nuclear and shipbuilding programmes

Sources: IAEA, Deployment of Floating Nuclear Power Plants: Benefits and Challenges; IAEA, Overview of SMR Designs for Maritime-based Nuclear Power Plants; Akademik Lomonosov Wiki.

20

Floating Nuclear Power Plants (FNPPs) are nuclear power generation facilities installed on floating structures such as barges, ships or offshore platforms. Unlike nuclear-powered ships, where the reactor is intended primarily for propulsion, the principal purpose of an FNPP is to generate electricity, heat and other energy products for shore-based or offshore users. Electricity is transmitted to the onshore grid through subsea cables, while thermal energy may be utilised for district heating, industrial processes or seawater desalination.

The concept combines proven marine engineering with mature nuclear reactor technology to provide reliable, low-carbon energy in locations where construction of conventional land-based nuclear power plants is technically difficult, economically unviable or environmentally constrained. Floating deployment also enables reactors to be manufactured in shipyards, transported to the operating site by sea, and relocated or decommissioned when required.

Interest in FNPPs has increased significantly in recent years due to global decarbonisation efforts, growing electricity demand in coastal regions, expansion of offshore industries and advances in Small Modular Reactor (SMR) technologies. The IAEA recognises transportable and floating SMRs as a potential solution for reliable clean energy while supporting net-zero emission objectives.

Evolution of Floating Nuclear Power Plants

The concept of floating nuclear power generation is not new. Early work dates back to the 1960s when the United States developed the **MH-1A Sturgis**, a floating nuclear power station built on a converted Liberty Ship. Although technically successful, widespread commercial deployment did not materialise due to economic factors and the availability of inexpensive fossil fuels.

Interest revived during the past decade owing to advances in modular reactor technologies and increasing emphasis on low-carbon energy systems. At present, **Russia remains the only country operating a commercial floating nuclear power plant**, while several countries and technology developers are investigating next-generation floating SMRs.

Basic Configuration and Working Principle

An FNPP generally consists of a compact nuclear reactor installed on a specially designed floating platform. The reactor produces heat through nuclear fission, which is converted into electricity using conventional steam turbine technology.

The floating unit is permanently moored or berthed at a coastal location and connected to shore through electrical transmission cables and thermal distribution systems. Depending on the design, the plant may simultaneously provide:

- Electricity
- Industrial process heat
- District heating
- Seawater desalination
- Hydrogen production
- Ammonia production
- Steam for industrial applications

Unlike merchant vessels, these platforms normally remain stationary throughout their operational life, requiring only periodic towing for maintenance, refuelling or decommissioning.

Key Characteristics and Advantages

Floating nuclear power plants combine several advantages of modular nuclear reactors with those of marine engineering.

Modular and Factory-Based Construction

Most floating plants are designed to be constructed in shipyards under controlled manufacturing conditions before being transported to their deployment site. This approach reduces on-site civil construction, improves quality control and shortens project schedules.

Minimal Land Requirement

Since the reactor is installed offshore or alongside existing port infrastructure, extensive land acquisition, excavation and large-scale site preparation are avoided. This is particularly beneficial for densely populated coastal regions.

Relocatable Infrastructure

Unlike conventional nuclear plants, floating units can be relocated to another site if regional electricity demand changes or after completion of a project's operational life.

Continuous Low-Carbon Power

FNPPs provide uninterrupted baseload electricity independent of weather conditions, complementing renewable energy sources such as wind and solar.

Marine Cooling

The surrounding seawater offers an abundant heat sink for condenser cooling, improving thermal efficiency and supporting both active and passive heat removal systems.

Centralised Maintenance

Major maintenance activities, reactor refuelling and eventual decommissioning may be undertaken at specialised shipyards rather than at every deployment site, reducing operational complexity.

Demonstrated Commercial Example – Akademik Lomonosov



The world's first commercial floating nuclear power plant is **Akademik Lomonosov**, developed by Russia's state nuclear corporation Rosatom.

It is a **non-self-propelled floating power barge** permanently stationed at **Pevek**, in Russia's Chukotka region. Commercial operation commenced in **May 2020**, making it the first operational floating nuclear power plant supplying electricity and district heating to a civilian population.

Key characteristics include:

- Two modified **KLT-40S pressurised water reactors**, derived from Russian nuclear icebreaker technology.
- Approximately **70 MWe electrical output** (35 MWe per reactor) and about **300 MW thermal output**.
- Supplies electricity to the regional grid while simultaneously providing heat to the town of Pevek.
- Intended to replace ageing coal-fired and land-based nuclear generation in the region.
- Demonstrates the technical feasibility of long-term commercial operation of floating nuclear power infrastructure under Arctic conditions.

The project has established a practical reference for future FNPP development, although subsequent designs are expected to employ newer reactor technologies with higher power output and enhanced passive safety features.

Global Development Trends

The IAEA notes that increasing interest in floating nuclear platforms is being driven by the transition towards net-zero energy systems and the maturation of SMR technologies.

Several advanced concepts are under development internationally, including:

- Floating SMRs based on pressurised water reactors.
- High-temperature gas-cooled reactors.
- Molten salt reactors.
- Advanced liquid-metal-cooled reactors.
- Multi-module floating energy platforms capable of producing electricity, hydrogen, desalinated water and industrial heat simultaneously.

Several private developers are also evaluating floating nuclear systems for supplying energy to offshore industries, mining operations, isolated islands and maritime industrial clusters.

Potential Applications

Floating nuclear power platforms can support a wide range of civilian maritime and coastal applications.

Reliable Power for Islands and Remote Coastal Communities

Many islands and remote coastal settlements depend on expensive diesel-based generation. FNPPs can provide continuous low-carbon electricity without requiring extensive transmission infrastructure.

Port Electrification

Major commercial ports require significant electrical power for container handling equipment, cold ironing (shore power), warehouses and logistics operations. Floating nuclear plants could supply dependable low-carbon electricity while reducing dependence on fossil-fuel-based grids.

Offshore Energy Infrastructure

Oil and gas platforms, offshore wind integration hubs, subsea processing facilities and future offshore industrial clusters require reliable power supplies that are often difficult to provide using conventional generation.

Green Hydrogen and Green Ammonia Production

Continuous nuclear electricity and high-temperature process heat can improve utilisation rates of electrolyzers, supporting large-scale production of hydrogen, ammonia and synthetic maritime fuels.

Seawater Desalination

Floating nuclear plants can simultaneously produce electricity and desalinated water, offering an integrated solution for water-scarce coastal regions.

Emergency or Temporary Power Supply

FNPPs can be deployed following natural disasters or during infrastructure shortages to restore electricity and essential services without constructing permanent generation facilities.

Challenges

Despite their advantages, floating nuclear power plants present several technical, regulatory and societal challenges.

Regulatory Framework

Existing international nuclear regulations were largely developed for land-based reactors. Deployment of floating reactors requires harmonisation between nuclear safety regulations, maritime law, port regulations and flag-state responsibilities.

Nuclear Security

Protection against sabotage, piracy, terrorism and cyber threats assumes greater importance for offshore nuclear installations.

Environmental Protection

Although floating plants minimise land impacts, careful assessment is required regarding marine ecology, thermal discharge, emergency planning and spent fuel management.

Public Acceptance

As with all nuclear technologies, successful deployment depends upon public confidence, transparent regulation and demonstrable safety performance.

Insurance and Liability

International conventions governing nuclear liability and marine operations require further evolution to accommodate floating nuclear infrastructure.

Port Infrastructure

Suitable mooring systems, electrical transmission facilities, emergency response capability and long-term servicing infrastructure are essential prerequisites for deployment.

Relevance for India

Although India has not announced a floating nuclear power plant programme, several ongoing national initiatives provide an enabling technological foundation.

India is expanding its nuclear sector through the **Nuclear Energy Mission**, with a target of achieving **100 GW of nuclear capacity by 2047**, including the development of indigenous Small Modular Reactors. Simultaneously, the country possesses extensive experience in nuclear engineering, marine engineering and shipbuilding, creating opportunities to evaluate floating nuclear technologies in the future.

Potential long-term applications in the Indian context include:

- Reliable electricity for island territories such as Andaman & Nicobar and Lakshadweep.
- Low-carbon power supply for major ports and maritime industrial clusters.
- Offshore energy support for future offshore infrastructure.
- Dedicated electricity and process heat for green hydrogen and green ammonia production.
- Large-scale desalination for water-stressed coastal cities and industrial zones.
- Integration with India's future SMR programme, advanced nuclear technologies and indigenous shipbuilding capabilities.

Any future deployment would require development of a dedicated regulatory framework, maritime nuclear safety standards, specialised port infrastructure and comprehensive emergency preparedness arrangements.

Nuclear Power Applications for Port Decarbonization



Nuclear Power Application for Port Decarbonization



Floating nuclear power platforms or coastal SMRs could provide reliable low-carbon electricity and process heat to ports, vessels and surrounding industrial ecosystems, thereby Supporting Scope 1, Scope 2 and Scope 3 Emission Reduction

Potential Nuclear Contribution

Scope 1 - Direct emissions from port-controlled operations

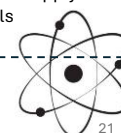
- Electrification of cranes and material-handling systems
- Replacement of diesel generators
- Electrification of port vehicles and support equipment
- Charging infrastructure for electric harbour craft
- Clean power and heat for port buildings and workshops

Scope 2 - Indirect emissions from purchased electricity

- Continuous low-carbon electricity for:
 - terminal operations
 - warehouses and cold storage
 - shipyards and repair facilities
 - lighting and digital infrastructure
 - onshore shore power systems
- Reduced dependence on carbon-intensive grid electricity.

Scope 3 - Wider value-chain emissions

- Production of low-carbon hydrogen, ammonia and synthetic fuels
- Electrification of privately operated terminals
- Clean power for rail and logistics systems
- Low-carbon energy for port-based industrial clusters
- Charging or power supply for electric coastal vessels



21

Ports are rapidly evolving from conventional cargo-handling facilities into integrated energy, logistics and industrial hubs. In addition to supporting shipping operations, modern ports supply electricity to terminals, warehouses, cold-storage facilities, shipyards, industrial clusters and transport infrastructure. They are also expected to become production and bunkering centres for future low-carbon fuels such as hydrogen, ammonia and synthetic fuels.

Meeting these growing energy demands while simultaneously reducing greenhouse gas emissions presents a significant challenge. Although renewable energy sources such as solar and wind are expected to play an important role, their intermittent nature necessitates complementary sources of reliable, dispatchable and low-carbon electricity. In this context, international organisations have identified **Small Modular Reactors (SMRs)** and **Floating Nuclear Power Plants (FNPPs)** as potential options for providing continuous clean electricity and process heat to ports and surrounding industrial ecosystems.

Unlike conventional large nuclear power plants that primarily supply national electricity grids, coastal SMRs or floating nuclear platforms could be deployed closer to major ports, enabling direct supply of electricity, heat and other energy products to maritime infrastructure while supporting long-term decarbonisation objectives.

Nuclear Energy and Port Decarbonization

Nuclear power offers several characteristics that make it attractive for future port energy systems.

- Continuous 24×7 low-carbon electricity independent of weather conditions.
- High energy density requiring comparatively small land footprint.
- Capability to simultaneously produce electricity, steam and industrial process heat.
- Reliable power for energy-intensive port operations.
- Integration with hydrogen, ammonia and synthetic fuel production.
- Long operating cycles with high availability.

These characteristics allow nuclear energy to complement renewable energy sources while supporting reliable operation of ports, shipyards and maritime industrial clusters.

Contribution towards Scope 1 Emission Reduction

Scope 1 emissions arise directly from sources owned or controlled by the port authority or terminal operator.

Nuclear-generated electricity can contribute to reducing these emissions by enabling electrification of equipment traditionally powered by diesel or other fossil fuels.

Potential applications include:

- Electrification of quay cranes, rubber-tyred gantry cranes and material-handling equipment.
- Replacement of diesel generators used for backup and auxiliary power.
- Electrification of port vehicles, trucks, buses and operational support equipment.
- Charging infrastructure for electric harbour craft, tugs and pilot boats.
- Clean electricity and heat for port administration buildings, maintenance workshops and engineering facilities.
- Electrified cargo-handling systems and automated terminal equipment.

The availability of continuous nuclear-generated electricity enables these systems to operate reliably without dependence on fossil-fuel-based generation.

Contribution towards Scope 2 Emission Reduction

Scope 2 emissions arise from purchased electricity consumed by ports and associated facilities.

A dedicated coastal SMR or floating nuclear power platform could provide continuous low-carbon electricity directly to port infrastructure, thereby reducing dependence on carbon-intensive grid electricity.

Potential beneficiaries include:

- Container and bulk cargo terminals.
- Warehouses and cold-storage facilities.
- Shipbuilding and ship repair yards.
- Lighting systems and digital infrastructure.
- Shore power (Cold Ironing) systems supplying electricity to ships alongside.
- Port administration complexes and logistics facilities.

Reliable nuclear electricity can also improve resilience of critical port infrastructure by providing stable baseload power throughout the year.

Contribution towards Scope 3 Emission Reduction

Scope 3 emissions encompass indirect emissions across the wider maritime value chain, including shipping, logistics and industrial activities associated with the port.

Nuclear energy can support reduction of these emissions through:

- Production of low-carbon hydrogen.
- Production of green ammonia and synthetic maritime fuels.
- Electrification of privately operated terminals.
- Clean electricity for rail freight and inland logistics systems.
- Low-carbon energy supply to port-based industrial clusters.
- Charging or power supply for electric coastal vessels and future battery-electric shipping.
- Supply of industrial process heat for manufacturing activities within the port ecosystem.

By supporting production of alternative marine fuels and decarbonisation of associated industries, nuclear energy contributes beyond the physical boundaries of the port itself.

Integrated Maritime Energy Hubs

One of the emerging concepts internationally is the development of **Integrated Maritime Energy Hubs**, where ports function simultaneously as logistics centres, clean-energy producers and industrial clusters.

Within such a framework, a coastal SMR or floating nuclear platform could provide:

- Continuous electricity for port operations.
- Shore power for berthed vessels.

- Process heat for industries.
- Hydrogen production through electrolysis.
- Ammonia and synthetic fuel production.
- Desalinated water for industrial and municipal use.
- Electricity for surrounding industrial parks and coastal communities.

Such integrated systems improve overall energy efficiency while supporting maritime decarbonisation and regional economic development.

Relevance for India

India is undertaking large-scale modernisation of its ports under initiatives such as the **Harit Sagar Green Port Guidelines**, expansion of shore power infrastructure, green hydrogen development, maritime decarbonisation and establishment of green maritime industrial clusters.

As India's nuclear programme expands through indigenous SMRs and the **Nuclear Energy Mission**, compact coastal nuclear energy systems could, in the long term, complement renewable energy by supplying reliable low-carbon electricity to major ports, shipyards and maritime industrial regions.

Potential long-term applications include:

- Decarbonisation of major commercial ports.
- Reliable power for shipbuilding and ship-repair facilities.
- Green hydrogen and green ammonia production.
- Electrification of future shore-power systems.
- Power supply to coastal industrial corridors.
- Desalination facilities supporting water security in coastal regions.

Any future implementation would require comprehensive techno-economic studies, environmental assessment, regulatory approvals and integration with national nuclear and maritime policies.

Green Ports





Green Ports

Driving Sustainable Maritime Growth

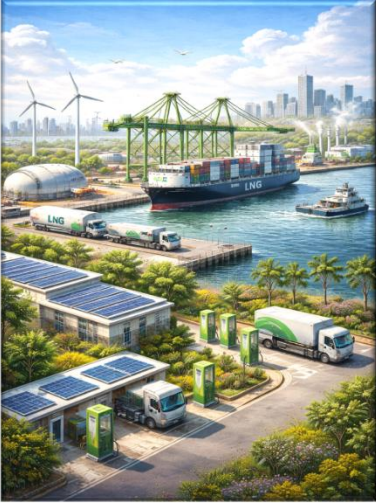


Concept of Green Ports

- Ports designed & operated with minimal environmental impact.
- Integration of clean energy, efficiency, and circular economy practices.

Key Initiatives in India

- Harit Sagar Guidelines (2023): National framework for green port development.
- Proposed National Port Sustainability Council (NPSC): Metrics for emissions, energy, waste, and community impact.
- Onshore Power Supply (OPS): Cut ship emissions at berth by connecting to shore electricity.
- Waste & Plastics Management: Port reception facilities for MARPOL Annex V compliance.



India's ports form an essential backbone of the national economy and the maritime transport system, underpinning about 95 per cent of the country's trade by volume and almost 68 per cent by value. Backed by a coastline covering more than 7,500 kilometres, the country's port system includes **12 major ports in addition to over 200 non-major ports**, enabling international trade and coastal shipping while supporting inland waterways transport and port-based industrialisation.

Ports are not only gateways for freights, but they are also important logistics and industry hubs that integrate sea transport with rail, road and inland waterways and therefore are at the core of supply chain efficiency and competitive advantage. Port operations are becoming increasingly energy-intensive as India's trade volumes increase and the port infrastructure increases its capability while it makes room for large ships and throughput. Cargo handling, vessel berthing, port craft operations, building services and auxiliary infrastructure all contribute to greenhouse gas emissions, local air pollution, noise and pressure on coastal and marine ecosystems. The impacts are mostly concentrated in and around port regions, which are typically situated neighbouring major urban centres and ecologically sensitive coastal areas

In consequence, **improving the environmental performance of ports** has risen from being a peripheral concern into central necessity for sustainable maritime growth and social acceptance and long-term operational resilience. National climate commitments set out in India, including its goal of becoming **net zero emissions by 2070** and its interim goals based on the Paris Agreement provide an opportunity to implement sector-level strategies that link macro-level targets with real-world action by the sector. With their long use lifetimes of assets, high energy consumption and prominent position in maritime logistics, ports constitute one of the most viable interfaces for promoting sustainable environmental reductions within the maritime industry.

Therefore, responding to emissions and environmental impacts at ports not only **helps national targets for climate** but also contributes to **improved air quality, resource management efficiency and the resilience of the local coastline's infrastructure**.

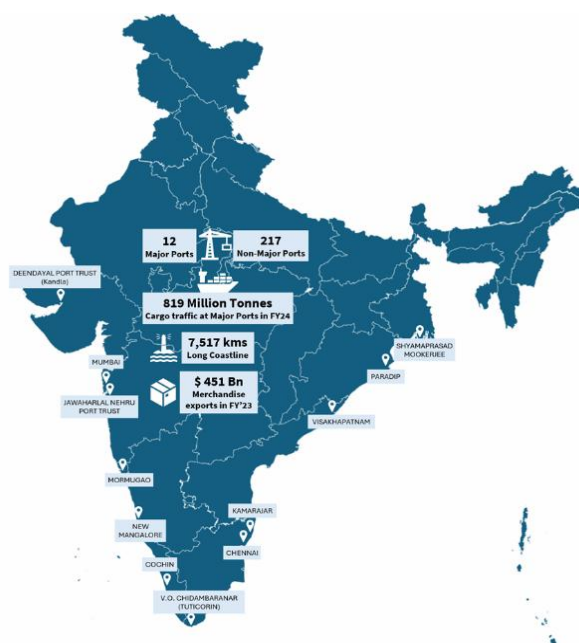


Figure 1 Ports of India

GREEN PORTS IN INDIA

Green ports occupy a crucial facilitating position in India's green shipping and maritime decarbonisation trajectory. Ports therefore can impact emissions outcomes along multiple pathways across maritime value chains, as a set of fixed infrastructure nodes that interact face to face with vessels, fuels, energy systems and logistics infrastructure, directly from the port to ships, fuel sector with the fuel system to logistics network. Because of this, green ports are not just concerned with their own operational footprint, but they also provide the conditions for **cleaner shipping and sustainable maritime operations**.

By Indian policy framework green ports would aim to make the practice of environmentally sustainable operations systematic, infrastructural and governing. Common key areas include emissions reduction of port-controlled assets through electrification and energy optimisation, renewable generation of energy as part of port power solutions, shore-to-ship power systems to minimise ship emissions on board ships and environmental monitoring and management systems.

Simultaneously, ports are also believed to play a pivotal role in facilitating the switch to **alternative and low carbon fuels**, *providing storage, handling and bunkering infrastructure* and holding all these facilities to a high standard of safety and environmental sustainability. Ports also grow to be even more critical determinants of shipping emissions performance. Port infrastructure and services including effective berth allocation, reduced hold-up times, arrival through ports just-in-time system and shore power directly impact vessel fuel consumption and adherence to global indicators like the Carbon Intensity Indicator (CII). Green ports in this space serve as **systemic enablers** that help ship operators fulfil regulatory requirements and operating efficiency requirements while also helping with broader decarbonisation results.

The National Maritime Decarbonization Policy Framework recognises green ports as an essential component of India's maritime transition, supported by complementary instruments such as the **Harit Sagar Green Port Guidelines** (which gives guidance on implementation) and the **Green Port Performance Index (GPPI)**, which provides a systematic framework for measurement and benchmarking of environmental performance.

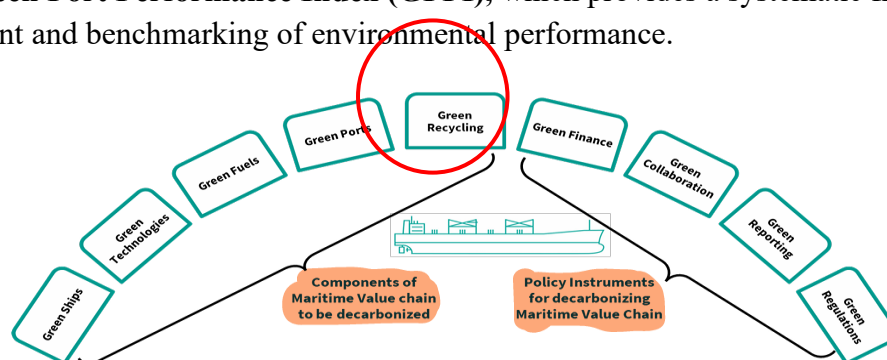


Figure 2 Core areas of NGSP

Together, these instruments create a coherent architecture that connects policy objectives to the **phased implementation and performance-based governance**. By implementing green port practice on an incremental basis with an emphasis on readiness to go green and pilot schemes to widespread and institutionalised application of this approach, Indian ports may become the anchors of port-led decarbonisation.

While the green ports have the capacity to act as systemic enablers of cleaner shipping and maritime decarbonization, translating this role into practice is constrained by a set of regulatory, infrastructure, technological, financial and coordination challenges. Understanding these constraints is essential for designing phased, targeted interventions that unlock effective and scalable implementation.

The following highlights the key barriers that must be addressed to enable green ports to deliver sustained environmental and operational outcomes



KEY PILLARS OF GREEN PORT

Energy and Emissions

Energy consumption and reduction of emissions is the foundation of Green Port building because ports, located in dense hotspots for electricity, fuel use and GHG, the main sources of power/fuel usage along with GHG emission are highly concentrated ports. Emissions are generated by ships at berth, cargo handling apparatus, vehicles and auxiliary power facilities and ports are important places for intervention to promote decarbonisation.

Green Ports focus on renewable energy uptake and electrification of port equipment, shore power installation and energy-saving measures to mitigate both direct and indirect CO2 emissions. These interventions are consistent with national climate targets and are also associated with enduring cost efficiencies and operational sustainability

Water and Waste Management

Successful water and waste management is a basic component of Green Ports, addressing effluents, ballast water, stormwater runoff and solid and hazardous waste left after port and shipping operations. Dysregulation of these streams may have the potential to damage marine ecosystems and erode the confidence of port communities, in the ports and marine pollution and pollution remediation by the port community.

Waste in Green Ports is governed along integrated water stewardship principles and circular waste management mechanisms promoting the reduction, reuse, recycling and safe disposal. Such practices promote environmental protection and enhance regulatory compliance and operational efficiency.

Biodiversity and Ecosystem Protection

Ports are frequently situated in natural coastal zones, where human activities and construction can disrupt habitats, fisheries and natural coastal systems. Loss and degradation of biodiversity, which is not only environmentally vulnerable but also leads to potential future operational and regulatory risk for ports

Green Ports includes biodiversity into planning and management and habitat restoration-oriented nature-based environmental solutions-based environment monitoring. This framework integrates port development with long-term challenges for environmental resilience and climate adaptation.

Digitalisation and Operational Efficiency

Digitalisation is a major enabler of Green Ports which helps them to monitor port operations in real time with performance optimization supported by data-driven decision making. Digital tools help ports monitor energy consumption, emissions, shipments flow, environmental impact more efficiently. It increases transparency and the efficiency of production thereby fulfilling the environmental sustainability and competitive goals, strengthening the connection of the two.

Stakeholder Engagement and Governance

Development of Green Port is supported by robust governance mechanisms and the proactive participation of stakeholders, port authorities, terminal operators, shipping lines, regulators, communities and financiers. Good stakeholder participation will facilitate objectives alignment, transparency and shared ownership over sustainability results. Strong governance also enables ports to align sustainability with strategic planning, investment decision-making and performance management thereby enhancing the likelihood of sustainability beyond projects or leadership cycles

KEY FOCUS AREA FOR IMPLEMENTATION

The Green Port Guidelines of the **Harit Sagar** target the sustainable development of the port ecosystem where national Green Port performance standards have been defined. These priorities center around **minimising the emissions** associated with port activity by electrifying plant equipment and vehicles, increasing the use of renewable energy, shore-to-ship power supply to reduce vessel emissions at berth and transitioning port crafts to cleaner propulsion systems aligned with national energy targets. Collectively, these interventions aim to reduce the carbon intensity of port activities, while promoting energy efficiency, operational reliability and environmental performance.

Aside from driving emissions reduction, the Guidelines focus very much on **resource and environmental efficiency** improving water and wastewater management, waste handling and recycling, protection of marine and coastal ecosystems and green cover among port areas to create biodiversity and to operate as natural carbon sink mechanisms. The main focus areas include an emphasis on energy-efficient buildings, digital optimisation of port operations, promotion of coastal shipping as a low carbon transport mode and good management of the environment with clear performance indicators, audits and incentive structures

Collectively, these focus areas provide a comprehensive and flexible framework for ports to adopt best practices, resilient designs and continuous performance improvement in line with national and global sustainability objectives.

The solutions and opportunity areas contained in this table are drawn upon and aligned with the possible solutions and Key opportunities outlined in the NGSP consultative framework

Solutions	Key Opportunities
Green Corridors	- Requires coordinated efforts among governments, industry bodies and international partners. - India can leverage its bilateral and multilateral relationships to formalize Green Corridors
Just-In-Time Arrival and Port Efficiency	- Standardization of digital solutions and harmonization of port systems will enable seamless operations - Optimizing port design and berthing schedules can reduce congestion and emissions - Digitalization of port operations and intelligent scheduling can improve turnaround times - Linking port efficiency with CII compliance can drive sustainable practices. - National strategy for JIT implementation can ensure uniformity across ports
Shore Power (Cold Ironing)	- Variations in power tariffs and tax structures across states pose challenges - India's lower shore power costs compared to Western markets offer an opportunity - A centralized policy, similar to the EV Charging Policy, can standardize shore power infrastructure - PPPs can support the integration of solar energy and carbon sinks into port infrastructure.
Greener Dredgers & Harbour Crafts	- Current efficiency regulations (e.g., EEXI) do not apply to dredgers and harbour crafts - Gaps in maintenance and energy efficiency training need to be addressed. - Hybrid diesel-electric dredgers can serve as a transitional solution. - Phasing out inefficient harbour crafts through regulatory mandates can support energy transition.

Bunkering Hubs for Alternative Fuels	• India can emerge as a major bunkering hub for alternative fuels like hydrogen and ammonia • Demand-supply assessment and regional baseline planning are required. • Financial mechanisms such as concessional finance and partial credit guarantees can de-risk investments. • Collaboration across the fuel value chain is crucial for infrastructure development

Table Solution and Key opportunities in green ports

INTERNATIONAL GREEN PORT BENCHMARKS

International experience shows that early-stage green port programmes succeed when they combine (i) phased delivery, (ii) credible benchmarking and (iii) targeted incentives that reduce first-mover risk. LR's NGSP consultative work already points to the value of aligning national approaches with recognised green port benchmarking schemes (e.g., Eco Ports in Europe and Green Marine in North America), using tiered criteria, periodic verification and public reporting to create transparency and a "race to the top".

A consistent lesson is that incentives and tariff design matter as much as technology. Early OPS/electrification roll-out is often constrained by power pricing, taxes and grid readiness; therefore, national-level measures that harmonise the OPS policy approach and enable PPP delivery models can accelerate adoption and standardisation, while avoiding fragmented port-by-port approaches.

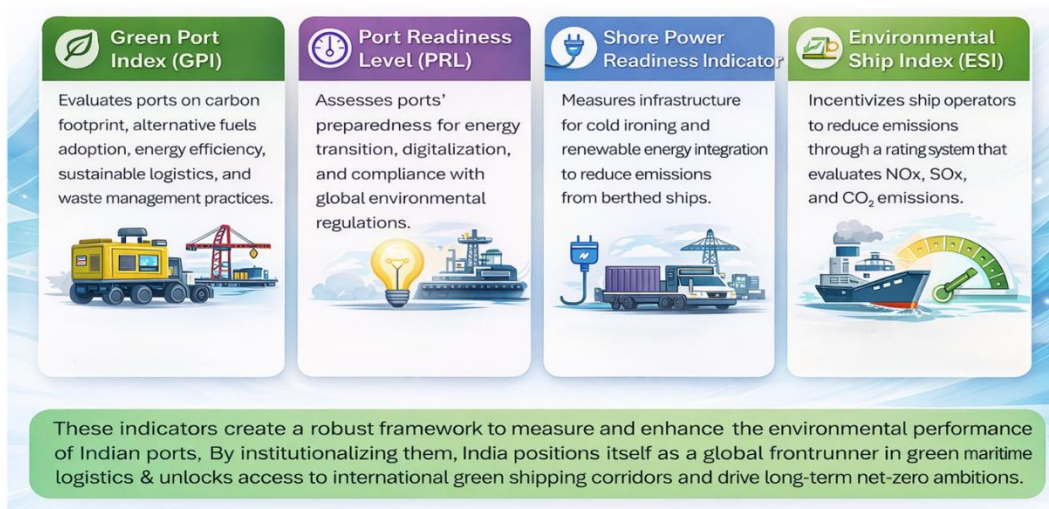
Green corridors are another proven accelerator because they concentrate demand, investment and collaboration across the value chain. Recent regional studies (e.g., UN ESCAP) highlight that corridors face barriers such as limited awareness and infrastructure and stress that digitalisation enables decarbonisation through data-sharing, optimisation and port call synchronisation. In practical terms, tools that support Just-in-Time arrival and port call optimisation, together with IoT/AI-enabled monitoring and "digital twin" approaches, can unlock material efficiency gains and support scalable MRV.

Implication for India: adopt a staged "pilot → scale" pathway anchored in national enablers (standards, tariffs, finance, MRV) while using GPPI/certification to verify progress; the NGSP consultative milestones already envisage early designation of initial green ports with OPS and subsequent corridor scale-up."

Sustainable Indicators Framework for Indian Ports



Sustainable Indicators for Indian Ports



19

As part of India's broader transition towards sustainable maritime development, a structured framework of measurable sustainability indicators is being institutionalized for Indian ports. The objective is not merely to adopt isolated environmental measures, but to establish a coherent system through which port performance can be evaluated, benchmarked and progressively improved.

The proposed framework rests on four interlinked indicators:

1. Green Port Index (GPI)

The Green Port Index serves as a comprehensive evaluation tool to assess the overall environmental performance of ports. It measures parameters such as:

- Carbon footprint and greenhouse gas emissions
- Adoption of alternative fuels
- Energy efficiency measures
- Sustainable logistics practices
- Waste management systems

The intent of GPI is to move beyond project-based interventions and bring sustainability into routine port operations. By quantifying environmental performance across multiple dimensions, ports can identify specific gaps and prioritize targeted improvements. Over time, the index will enable benchmarking across ports and support evidence-based decision-making.

2. Port Readiness Level (PRL)

The Port Readiness Level indicator evaluates the preparedness of ports for the ongoing energy transition and digital transformation.

PRL examines:

- Infrastructure readiness for alternative fuels
- Compliance alignment with evolving international environmental regulations
- Digital systems supporting operational efficiency
- Integration of sustainability into planning and governance

As global shipping moves toward low-carbon fuels and stricter environmental standards, ports must adapt accordingly. PRL provides a structured method to assess whether ports are capable of supporting next-generation vessels and future regulatory requirements. This indicator ensures that ports are not reactive, but forward-prepared.

3. Shore Power Readiness Indicator

Shore power, or cold ironing, is increasingly recognized as a critical intervention to reduce emissions from ships at berth. The Shore Power Readiness Indicator evaluates:

- Availability of onshore power supply infrastructure
- Capacity to integrate renewable energy sources
- Grid stability and connection systems
- Operational protocols for ship–shore interface

Emissions from berthed vessels contribute significantly to local air pollution. By measuring infrastructure readiness and operational capability, this indicator supports phased implementation of shore-to-ship power systems across Indian ports. It also aligns with international decarbonization pathways and improves air quality in port cities.

4. Environmental Ship Index (ESI)

The Environmental Ship Index focuses on incentivizing ship operators to reduce emissions. It evaluates vessels based on emissions performance, including:

- Nitrogen oxides (NO_x)
- Sulphur oxides (SO_x)
- Carbon dioxide (CO₂)

Ports may integrate ESI-based incentives such as differential port dues or priority berthing for higher-rated vessels. This creates a market-based mechanism encouraging cleaner ship operations and aligns port policy with vessel-level environmental performance.

Integrated Impact of the Framework

Individually, each indicator addresses a specific dimension of port sustainability. Collectively, they create a robust governance framework that integrates infrastructure, operations, compliance and incentives.

Institutionalizing these indicators will:

- Enable measurable tracking of environmental performance across Indian ports
- Support structured transition toward low-carbon port operations
- Strengthen India's credibility in global green maritime logistics
- Facilitate participation in international green shipping corridors
- Contribute to long-term net-zero objectives

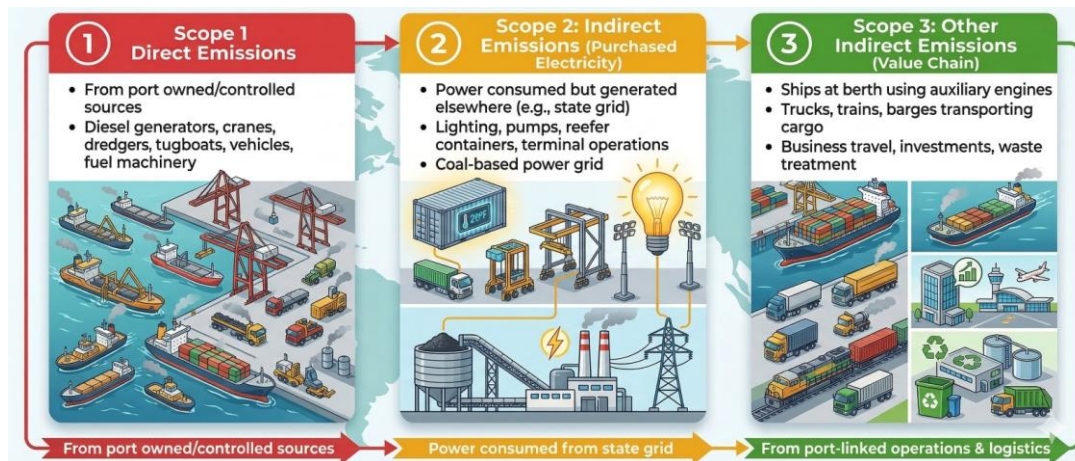
Rather than relying solely on regulatory mandates, this framework introduces performance measurement and benchmarking into port governance. Over time, it will support standardization of sustainability practices across both major and non-major ports.

By embedding these indicators within policy and operational systems, India positions its ports not only as trade gateways, but as active enablers of the global maritime energy transition.

GHG Emission Scopes



GHG Emission Scope at Ports



19

Effective decarbonisation of the port sector requires a **clear understanding of emission sources across the port ecosystem**. Ports are complex, multi-actor environments where emissions arise not only from port-owned assets but also from energy consumption and broader logistics activities.

To enable **standardised measurement, reporting and mitigation**, port emissions are classified into **three internationally recognised scopes - Scope 1, Scope 2 and Scope 3**, aligned with global frameworks such as the GHG Protocol.

This classification allows ports to transition from **fragmented emission management to a holistic, system-wide decarbonisation approach**.

Scope 1 – Direct Emissions

Scope 1 emissions refer to **direct greenhouse gas emissions from sources owned or controlled by the port authority or terminal operators**.

Key Sources

- Diesel generators
- Cargo handling equipment (cranes, RTGs, forklifts)
- Dredgers and tugboats
- Port-owned vehicles
- Fuel-based machinery within port premises

Characteristics

- Fully under **operational control of port authorities**
- Most straightforward to **measure, monitor and regulate**
- Typically dependent on fossil fuel consumption

Strategic Importance

- Represents the **starting point for decarbonisation interventions**
- Offers **immediate emission reduction opportunities**

Scope 2 – Indirect Emissions (Electricity Consumption)

Scope 2 emissions arise from **electricity purchased and consumed by port operations but generated externally**, typically from the grid.

Key Sources

- Terminal lighting systems
- Pumping operations
- Reefer container power supply
- Administrative and operational buildings
- Electrified equipment and terminal infrastructure

Characteristics

- Emissions are **indirect but energy-linked**
- Strongly influenced by **grid emission intensity**
- High contribution in regions with **coal-dominated power generation**

Strategic Importance

- Increasing relevance due to **electrification of port operations**
- Critical lever for decarbonisation through **clean energy transition**

Scope 3 – Other Indirect Emissions (Value Chain Emissions)

Scope 3 emissions encompass **all other indirect emissions occurring across the port value chain**, outside direct ownership or control of the port.

Key Sources

- Ships at berth using auxiliary engines

- Cargo transport via trucks, rail and barges
- Hinterland logistics operations
- Waste treatment and disposal
- Business travel and associated activities
- Upstream and downstream supply chain emissions

Characteristics

- **Largest and most complex emission category**
- Occurs beyond the physical boundary of the port
- Requires **multi-stakeholder coordination**

Strategic Importance

- Represents the **dominant share of total port-related emissions**
- Central to achieving **deep decarbonisation outcomes**

Integrated Understanding of Port Emissions

The three scopes together provide a **comprehensive view of emissions across the port ecosystem**:

- Scope 1 → Operational emissions within direct control
- Scope 2 → Energy-linked emissions influenced by power systems
- Scope 3 → Value chain emissions requiring collaborative action

This integrated classification enables:

- End-to-end emissions mapping
- Prioritisation of mitigation strategies
- Alignment with international reporting standards

National Port Sustainability Council (NPSC) – Proposed



National Port Sustainability Council (NPSC)

Proposed Framework



Institutional Framework for Port Sustainability in India

- The **National Port Sustainability Council (NPSC)** is a proposed institutional mechanism under the **Ministry of Ports, Shipping and Waterways (MoPSW)** to provide a structured approach for advancing sustainability across Indian ports.
- The Council will serve as the **national platform for coordinating environmental performance monitoring, sustainability benchmarking and energy transition initiatives across major and non-major ports.**

Key Functions of NPSC

- **Standardization of Sustainability Indicators** across Indian ports
- **Monitoring and Reporting of Port Emissions** including GHG inventory development
- **Benchmarking Environmental Performance** through sustainability indexing frameworks
- **Supporting Energy Transition Initiatives** such as shore power and alternative fuels
- **Alignment with Global Green Port Frameworks** and international sustainability standards

41

India's port sector is entering a phase where sustainability can no longer be treated as a peripheral issue. With more than 200 ports, including 12 major ports and with increasing pressure from global decarbonisation rules, ESG-linked trade expectations and the need for climate-resilient infrastructure, Indian ports require a more structured and measurable approach to sustainability. The concept note therefore proposes the creation of a **National Port Sustainability Council (NPSC)** as a central institutional mechanism to guide, monitor and standardise sustainability efforts across both major and non-major ports.

The note is built around the idea that sustainability at ports must be assessed through a defined set of indicators rather than through isolated projects. For this reason, it brings together frameworks such as **Green Port Indexing (GPI)**, **Green Port Readiness Level / Port Readiness Level (GPRL/PRL)**, **Smart Port Shore Power Index (SPSPI)**, **Environmental Ship Indexing (ESI)** and an institutionalised **GHG emissions inventory**.

Need for a National Institutional Mechanism

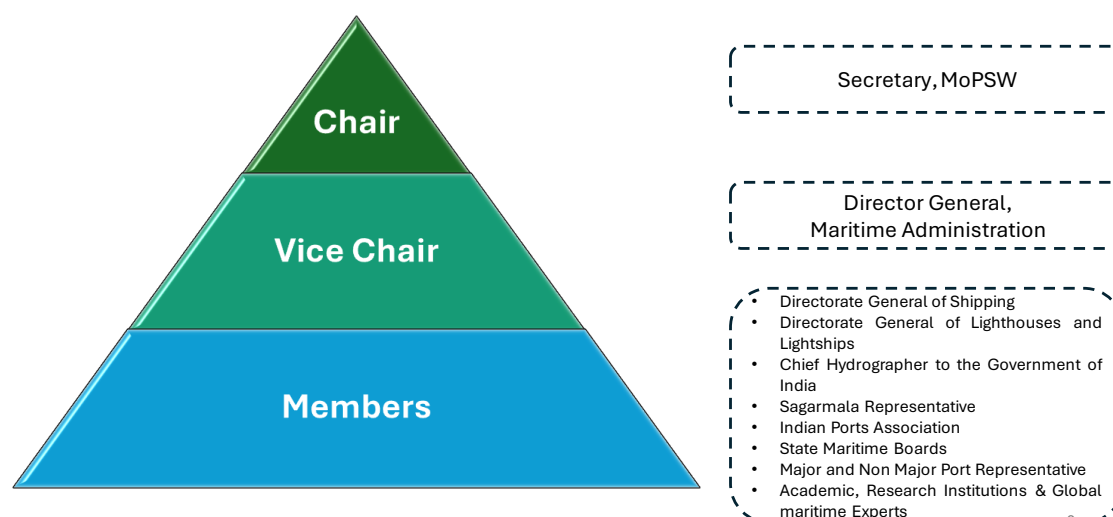
The central argument of the concept note is that India presently has policy intent, individual initiatives and broad sustainability ambitions, but does not yet have a unified national framework that can consistently assess readiness, compare port performance and link sustainability with compliance, investment and global competitiveness. The proposed NPSC is therefore conceived as an apex regulatory and advisory body under the Ministry of Ports, Shipping and Waterways to bring coherence to these efforts.

The note also places this proposal in the context of the expected transition from DG Shipping to the **Directorate General of Maritime Administration (DGMA)** under the forthcoming Merchant Shipping Bill / Maritime Services Bill framework. In the concept note, DGMA is visualised as a broader authority with responsibilities extending beyond vessel and seafarer regulation into port sustainability, alternative fuel readiness, digital governance and environmental compliance.

In practical terms, the NPSC is meant to provide national direction on issues such as emissions monitoring, electrification, alternative fuel readiness, digital port systems, green financing signals and harmonisation with global standards such as the IMO Revised GHG Strategy, EU Fit-for-55 and Maritime Vision 2030.

National Port Sustainability Council – Proposed Role

The NPSC is presented not as a symbolic committee but as a working governance structure that would monitor, evaluate and facilitate the implementation of sustainability and readiness frameworks across Indian ports. Its proposed role includes standard setting, benchmarking, compliance oversight, coordination with central and state-level bodies and support for digital platforms needed for real-time monitoring.



The proposed governing structure is chaired by the Secretary, MoPSW, with the DGMA as Vice-Chairperson. The membership is broad-based and includes the Chief Hydrographer, DGLL, DG Shipping representative, Sagarmala representative, Indian Ports Association, State Maritime Boards, port authorities, private port operators, academic institutions and global maritime experts. This reflects the note’s view that port sustainability cannot be managed only through a single regulator and requires operational, technical and policy coordination.

The concept note further proposes specialised technical committees within the NPSC dealing with port safety and navigation, GHG emissions and energy transition, digitalisation and smart ports, sustainable infrastructure and policy and compliance. This is useful because it breaks down sustainability from a broad concept into operational workstreams.

Integration of Navigational Safety and Sustainability

A major point in the note is that sustainability and safety should not be treated as separate verticals. The document therefore links the modernization of the **Navigational Safety at Ports Committee (NSPC)** with the creation of the NPSC. The NPSC, constituted in 1997, has traditionally focused on navigational safety, emergency preparedness, environmental protection and compliance with conventions such as SOLAS, MARPOL and the ISPS Code.

The note argues that port safety today must evolve to include digital systems, emissions considerations, shore power, alternative fuels and climate-related resilience. For that reason, it recommends strategic integration of the NSPC within the broader NPSC framework so that safety, readiness and sustainability are assessed together. The reasons given include holistic port governance, regulatory synergy, better use of resources, stronger crisis preparedness and improvement in India's global competitiveness.

This is one of the stronger ideas in the note because it avoids creating parallel structures for safety on one side and green transition on the other. Instead, it suggests a single institutional architecture where navigation, environment, infrastructure and digital systems are viewed together.

Sustainable Indicators for Indian Ports

The note makes it clear that sustainability must be measurable. It therefore proposes a set of indicators that can be used to assess ports on environmental performance, infrastructure preparedness and operational transition. It specifically highlights GPI, PRL, SPSPI and ESI as the core tools through which Indian ports can be benchmarked and guided.

The need for such indicators is linked to several factors. First, international regulations such as IMO's carbon-related measures and the EU's Fit-for-55 package are creating real commercial pressure on ports and supply chains. Second, India's own port modernisation ambitions under Maritime Vision 2030 require ports to become low-emission and digitally integrated hubs. Third, participation in future green shipping corridors will require ports to demonstrate readiness in a structured and internationally understandable form.

The note also refers to the need for an institutionalised mechanism for port emissions assessment so that green initiatives can actually be tracked and verified rather than only announced. This includes the use of real-time digital emissions monitoring systems and formal carbon accounting tools.

Green Port Indexing (GPI)

The Green Port Index is described as a framework to evaluate the environmental performance of ports in a structured way. The document identifies the main objectives of GPI as benchmarking sustainability performance, encouraging best practices, informing policy, supporting stakeholder engagement and attracting investment into eco-friendly infrastructure.

For India, the GPI framework is linked with national environmental regulation as well as Harit Sagar-type environmental indicators. The note groups assessment into management indices, operational indices and condition indices. It also lists pollution-related parameters covering air, water, noise, effluent and waste-related metrics.

The note proposes a multi-tier institutional structure for GPI implementation. At the national level, MoPSW would provide the policy framework. The NPSC would standardise criteria and ensure regulatory alignment. The Indian Ports Association would act as an executing authority, including through annual reporting, digital emissions platforms and pilot implementation at selected ports such as JNPT, Chennai and Visakhapatnam.

The key assessment parameters proposed for Indian ports under GPI include carbon footprint and GHG emissions, renewable energy and electrification, sustainable cargo handling and logistics, waste management and marine pollution control and digitalisation / smart port initiatives.

Green Port Readiness Level (GPRL / PRL)

The note draws on the IAPH's Port Readiness Level approach to assess how prepared ports are for the energy transition, digitalisation and future regulatory requirements. The readiness assessment is built across dimensions such as alternative fuel readiness, shore power integration, digital and smart port systems, regulatory compliance and net-zero infrastructure transition.

The readiness levels range from basic recognition of sustainability needs at lower levels to global sustainability leadership at the highest level, where ports are fully digitalised and effectively carbon-neutral. The note also mentions global examples such as Rotterdam, Singapore, Los Angeles and Hamburg as leading references.

For Indian application, the note proposes a National Port Readiness Framework supported by MoPSW, with the NPSC acting as the regulatory body and IPA as the executing authority. It recommends annual readiness reports, digital dashboards and pilot implementation at ports such as JNPT, Chennai and Deendayal. Assessment dimensions for India include decarbonisation and alternative fuels, digitalisation and smart readiness, regulatory compliance, net-zero infrastructure readiness and sustainable cargo and logistics efficiency.

Smart Port Shore Power Index (SPSPI)

The concept note gives separate importance to shore power through the proposed Smart Port Shore Power Index. This is significant because emissions from berthed ships are increasingly becoming a major focus in global port decarbonisation. The SPSPI is intended to assess port readiness for shore-to-ship power, renewable energy integration, smart grid preparedness, regulatory compliance and economic viability.

The note goes a step further by proposing a certification framework for ships that use shore power at Indian ports. Under this proposal, calibrated metering, auditable data systems, grid-based emission factor calculations and digital access to certificates would allow vessels to demonstrate verified emission reductions. The note also suggests that such certification could support reduced port charges and potential carbon credit eligibility.

Institutionally, the SPSPI framework again follows a multi-tier model: MoPSW for national policy, NPSC for regulatory standards and IPA for dashboards, rankings and capacity building. Pilot ports suggested include JNPT, Chennai and Deendayal.

Environmental Ship Indexing (ESI)

The note includes the Environmental Ship Index as a way to align ship-side environmental performance with port-side incentives. It describes ESI as a voluntary global system developed by IAPH that scores ships on emissions performance, fuel efficiency, shore power compatibility and alternative fuel adoption.

The relevance for India lies in using ESI to support greener shipping practices at Indian ports by linking incentives such as reduced port dues or priority treatment to better-performing vessels. The note also sees ESI as complementary to mandatory IMO measures such as CII, EEXI and SEEMP, thereby allowing ports to use one framework for incentive design while remaining aligned with international regulatory systems.

This is an important idea because it shifts the role of ports from passive infrastructure providers to active participants in shaping cleaner fleet behaviour.

GHG Emissions Inventory

One of the strongest and most practical portions of the note is its emphasis on creating a formal GHG emissions inventory for Indian ports. The document argues that without a structured inventory of energy users and emission sources, it is not possible to understand the baseline, identify hotspots or build cost-effective reduction strategies.

The note recommends a centralised institutional mechanism for emissions monitoring, reporting and mitigation. Suggested elements include emission inventories, air quality monitoring systems, use of emission factors, carbon accounting software, eco-efficiency indicators, ISO 14001-based environmental management systems and third-party audits. It also refers to international best practices such as AI-based monitoring and real-time reporting using IoT and blockchain.

The value of this part of the note is that it moves from a broad sustainability narrative to the actual systems needed for measurement, reporting and verification.

Harit Sagar – Green Port Guidelines



Harit Sagar – Green Port Guidelines



Vision

To reduce carbon intensity and develop an environment-friendly ecosystem at Major Ports through green technologies, optimization of port procedures and decarbonization benchmarks aligned with India's Panchamrit commitments.

Core Principles

- Sustainability in Port Development & Operations
- Adoption of carbon-neutral & environment-friendly technologies
- Working with Nature approach
- Maximizing use of Clean / Green energy in Port operation
- Eliminate-Reduce-Control (ERC) for emissions
- 5R Concept (Refuse, Reduce, Reuse, Repurpose, Recycle)
- monitoring, based on Environmental Performance Indicators

Sr. No.	Environment Performance Indicator (EPI)	Target by 2030	Target by 2047
1	% share of Renewable Energy consumption	>60%	>90%
2	% Port equipment / vehicles electrified	>50%	>90%
3	% Area under green belt	>20%	>33%
4	% Reduction in CO ₂ emission per ton of cargo (Base Year 2023)	>30%	>70%
5	% GHG emission reduction in all coastal / EXIM vessels	>10%	>50%
6	% Reduction in fresh-water consumption per ton of cargo (Base Year 2023)	>20%	—
7	% Recycle and reuse of consumed water	>100%	—
8	% Reduction in energy consumption per ton of cargo (Baseline Year 2023)	>20%	—
9	One LNG bunkering station	By year 2030	—
10	Green Hydrogen / Ammonia bunkers and refueling facilities	By year 2035	—
11	Adequate number of EV charging stations	By year 2025	—

The “**Harit Sagar**” **Green Port Guidelines**, issued by the Ministry of Ports, Shipping and Waterways in May 2023, provide the broad framework for Major Ports in India to reduce carbon intensity and move towards environmentally sustainable port development and operations. The guidelines were circulated through an Office Memorandum dated 11 May 2023 for further action by all Major Ports.

The document has been positioned as a practical guidance framework for ports to prepare action plans, adopt green technologies, reduce wastage and monitor measurable outcomes over defined timelines. It is also linked to the broader national context of **COP-26 commitments**, **Panchamrit targets**, **Maritime India Vision 2030** and India’s long-term objective of reaching **net zero by 2070**. The introductory section of the guidelines clearly states that ports are expected to contribute to de-carbonisation by reducing carbon emissions per ton of cargo handled and by promoting a sustainable ecosystem around port operations.

Vision of the Guidelines

The central vision of the document is to reduce carbon intensity and develop an environment-friendly ecosystem at Major Ports through participation of all stakeholders, including terminal operators, logistics service providers, partner government agencies and shipping lines. The broader intent is to position Major Ports not just as cargo gateways, but as sustainable hubs of economic growth and development. This is to be achieved through optimization of procedures, adoption of green technologies, reduction of wastages and measurable decarbonisation benchmarks. The vision statement is set out explicitly in the guideline document and is also highlighted visually on the vision page.

Policy Context and Importance

The guidelines derive importance from three connected policy drivers.

First, the maritime sector has a major role in national trade. The guidelines note that the sector accounts for **95 percent of trade by volume and 65 percent by value**, which means that any sustainability transition in ports has a large impact on the economy as a whole. Second, India's climate commitments require a reduction in emission intensity and increased use of non-fossil energy sources by 2030. Third, ports are recognized as critical points where energy use, vessel interface, cargo handling, water use, waste generation and local environmental impacts converge.

The document therefore treats ports as a major lever for achieving environmental goals, rather than only as operational infrastructure. It also makes it clear that the purpose is not limited to carbon accounting alone; the framework covers air, water, waste, noise, ecology, resource efficiency and reporting.

Principles Underlying Harit Sagar

The guidelines are based on a set of broad principles that shape the rest of the document. These include ensuring environmental, economic and social sustainability in port development, adopting environmentally compatible designs, promoting clean and green energy, minimizing carbon and other harmful emissions through the **Eliminate, Reduce and Control (ERC)** approach, minimizing waste through the **5R concept**, conducting appropriate environmental impact assessments and strengthening continuous monitoring and reporting. The document also emphasizes the concept of **“Working with Nature”**, linking port development with ecosystem sensitivity rather than only engineering expansion.

This is important because the guidelines are not drafted as a narrow engineering manual. They are framed as a management and governance instrument that asks ports to integrate sustainability into planning, operation, maintenance and reporting.

Applicability

The guidelines are explicitly applicable to **all Major Ports of India**. At the same time, the message from the Secretary in the front portion of the document indicates that the framework could also be recommended to State Governments and State Maritime Boards for adoption in ports other than Major Ports. This shows that while the legal applicability is limited to Major Ports at present, the document is intended to serve as a broader model for the wider port sector.

Focus Areas for Implementation

The main strength of the Harit Sagar document is that it converts the sustainability agenda into concrete implementation areas.

Green Cover

Ports are required to increase green area cover in order to capture fugitive emissions, attenuate noise and support biodiversity. The target is to increase green belt area to **more than 20 percent**

by 2030 and 33 percent by 2047 of port area. The document links this not only to visual greening but also to soil moisture retention, erosion control, groundwater recharge and carbon sink creation.

Electrification of Port Equipment and Vehicles

Ports are asked to move progressively towards electrification of vehicles and equipment, targeting **more than 50 percent electrification by 2030 and more than 90 percent by 2047**. Existing diesel-powered equipment is to be retrofitted or converted in a phased manner and future procurement is expected to favour electric systems or compatibility with greener fuels such as methanol, ethanol, ammonia, hydrogen fuel cell and CNG.

Port Crafts

The guidelines extend beyond landside equipment and also cover port crafts such as tugs, pilot boats, mooring boats and survey boats. Ports are expected to prepare action plans for retrofitting these with cleaner propulsion technologies and for creating infrastructure under the National Green Hydrogen Mission. The document specifically states that **green ammonia bunkers and refuelling facilities are to be established at all Major Ports by 2035**.

Renewable Energy

Renewable energy is one of the most explicit targets in the guidelines. Ports are expected to ensure that the share of renewable energy exceeds **60 percent by 2030 and 90 percent by 2047**. The guidelines also provide for **at least one LNG bunkering station by 2030** and adequate EV charging stations in port campuses or nearby areas by 2025. In addition, select ports are expected to support offshore wind energy development. The document specifically mentions V.O. Chidambaranar Port as a pilot port for offshore wind-linked activity.

Shore to Ship Power Supply

All ports are required to develop infrastructure for shore power in a phased manner, beginning with port crafts, then extending to Coast Guard / Navy / small coastal vessels and finally to EXIM vessels. The phased timelines given are **2023, 2024 and 2025** respectively. This is significant because it shows that the guidelines were not only aspirational but provided a sequence for implementation.

Resource Utilisation

The guidelines address water efficiency in a fairly detailed way. Ports are required to increase treatment capacity, use treated water, reduce fresh water consumption per ton of cargo by **more than 20 percent by 2030** and achieve **100 percent recycle and reuse of consumed water**. The document also encourages installation of STPs, rainwater harvesting, desalination plants and even utilisation of condensed water from LNG terminal chilling plants.

Energy-Efficient Equipment and Green Buildings

Ports are directed to use energy-efficient equipment and materials such as LED smart lighting and highly rated appliances, reduce energy consumption per ton of cargo by **more than 20**

percent by 2030 and adopt green building concepts for all new buildings. The document also encourages use of digital systems such as Sagar Setu, NLP-Marine, EBS and RFID to improve efficiency and thereby reduce carbon footprint.

Promotion of Coastal Shipping

The guidelines recognise coastal shipping as a cost-effective and energy-efficient alternative mode of transport and ask ports to facilitate it through infrastructure and viable mechanisms. This reflects an important systems-level view: decarbonisation is not only about what happens inside the port boundary, but also about improving cargo movement choices.

Effluent, Marine Ecosystem and Waste Management

The document includes explicit directions regarding effluent discharge, monitoring of waste from ships under MARPOL, prohibition of wastewater and bilge discharge into port waters, declaration of waste by ships, protection of mangroves and shore ecosystems, oil spill preparedness under NOS-DCP, ballast water management and shore reception facilities. These provisions show that the guidelines treat sustainability as wider than only carbon reduction.

Environmental Management and Incentives

Each port is expected to have approved Environment Management Guidelines, an Environment Management Plan and a dedicated Environment Cell. Independent annual environmental audits are required and the audit reports are to be uploaded on the port website before **30 April every year**. The guidelines also encourage ports to earn carbon credits and introduce green incentives for ships, private craft operators, concessionaires, truck operators and other port users adopting cleaner fuels or shore power-compatible systems. They further direct ports to incorporate green and sustainability aspects into DPRs and PPP projects.

Methodology for Implementation and Compliance

The Harit Sagar document is notable because it does not stop at listing areas of intervention. It also prescribes a method for implementation.

All ports are required to prepare an action plan within **two months** of launch of the guidelines, in reference to the listed Environment Performance Indicators. Ports are expected to establish real-time **Continuous Ambient Air Quality Monitoring Stations (CAAQMS)**, **Continuous Marine Water Quality Monitoring Stations (CMWQMS)** and **Online Continuous Effluent Monitoring Systems (OCEMS)**, all linked to digital dashboards and to the MoPSW server / portal / Sagarmanthan dashboard for real-time monitoring and feedback. Different timelines are prescribed depending on the type of port operations.

The guidelines further provide that until these real-time systems are installed, regular reports should be prepared by independent environment auditors and uploaded annually on port websites. In addition, all ports are required to undertake a **baseline study using FY 2022–23 as the base year** within three months, including GHG emissions, carbon footprint and annual emissions of pollutants from all relevant port-related sources such as vessels, harbour crafts, cargo handling equipment and trucks.

This makes the document more implementation-oriented than many broad policy guidelines, because it links targets with baseline data and monitoring architecture.

Environmental Performance Indicators and Targets

The annexures are one of the most useful parts of the document because they convert broad sustainability language into measurable parameters.

Legal Compliance Framework

Annexure-A lists applicable laws relating to air, noise, DG set noise, water, hazardous waste, e-waste, solid waste, biomedical waste, plastic waste, battery waste, construction and demolition waste and environmental clearance. This makes clear that Harit Sagar is not a standalone framework outside the legal system, but is intended to operate in conjunction with existing environmental law and regulatory rules.

Environmental Performance Indicators

Annexure-B lists indicators for air, water, noise and effluent. These include parameters such as SO₂, NO₂, PM₁₀, PM_{2.5}, ozone, lead, ammonia, benzene, arsenic, mercury, dissolved oxygen, BOD, COD, turbidity, salinity, noise levels and effluent discharge parameters. Annexure-C provides a reporting format for waste management across hazardous waste, e-waste, solid waste, plastic waste, battery waste, construction and demolition waste and biomedical waste.

Sustainability Targets

Annexure-D sets out specific sustainability targets. These include:

- Renewable energy share at ports: **more than 60 percent by 2030 and more than 90 percent by 2047**
- Electrified port equipment / vehicles: **more than 50 percent by 2030 and more than 90 percent by 2047**
- Area under green belt: **more than 20 percent by 2030 and more than 33 percent by 2047**
- Reduction in CO₂ emission per ton of cargo: **more than 30 percent by 2030 and more than 70 percent by 2047**
- Reduction in GHG emissions in coastal / EXIM vessels: **more than 10 percent by 2030 and more than 50 percent by 2047**
- Reduction in fresh water consumption per ton of cargo: **more than 20 percent by 2030**
- Recycle and reuse of consumed water: **more than 100 percent by 2030**
- Reduction in energy consumption per ton of cargo: **more than 20 percent by 2030**
- One LNG bunkering station: **by 2030**
- Green hydrogen / ammonia bunkering and refuelling facilities: **by 2035**

- Adequate number of EV charging stations: **by 2025.**

These annexed targets are perhaps the most important operational takeaway from the document because they provide benchmarks that ports can actually monitor and report.

Reporting, Review and Recognition

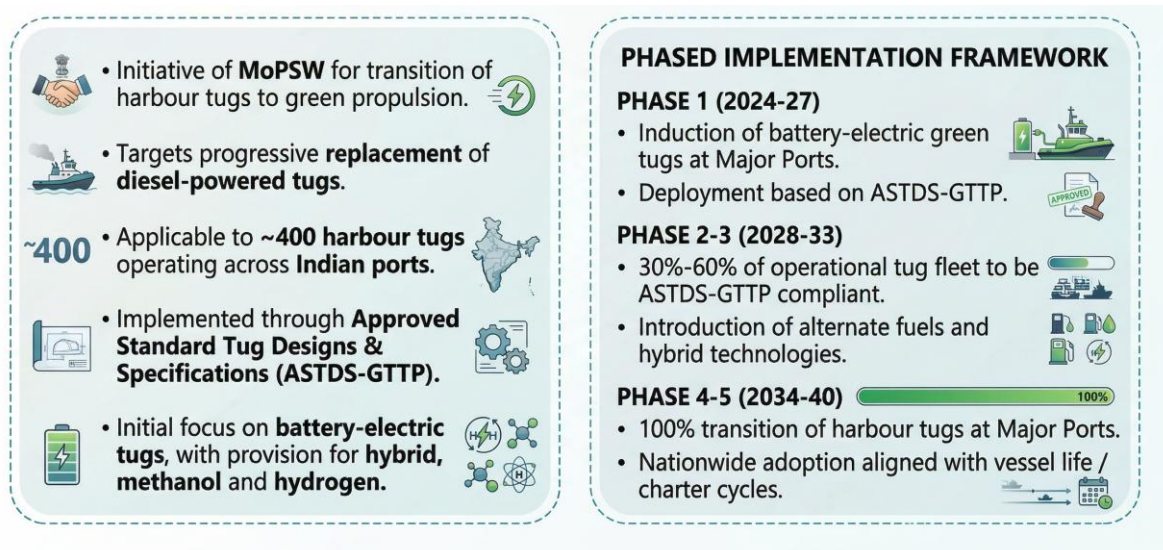
The guidelines also stress reporting and communication. Ports are encouraged to adopt the **Green Reporting Initiative (GRI)** as a global standard for communicating accountability with regard to impacts on environment, economy and people. The Ministry also reserves the power to interpret, clarify and relax provisions in public interest and may amend the guidelines from time to time.

An important provision is that the Ministry will recognize and award the **best three green performing ports of the year** based on evaluation criteria. This gives the guidelines a performance-based character rather than merely a compliance-based one.

Green Tug Transition Program (GTTP)



Green Tug Transition Program (GTTP)



Harbour tugs play a critical role in port operations, particularly in berthing, unberthing and ship-assist functions. However, these vessels are typically powered by diesel engines and operate continuously within port limits, making them a concentrated source of greenhouse gas (GHG) emissions as well as local air pollutants such as NO_x, SO_x and particulate matter.

With increasing emphasis on maritime decarbonisation under national and global commitments, port-based emissions have emerged as a priority area for intervention. In this

context, the Government of India has introduced the **Green Tug Transition Program (GTTP)** as a focused initiative to transition harbour tug fleets towards cleaner and low-emission alternatives.

The program forms part of the broader sustainability agenda under maritime sector reforms and aligns with national frameworks such as Maritime India Vision 2030 and Maritime Amrit Kaal Vision 2047.

The GTTP is designed to facilitate the phased replacement of conventional diesel-powered harbour tugs with environmentally sustainable alternatives using zero-emission or low-emission technologies.

The program envisages a structured transition pathway, supported by standardized design specifications, phased implementation and institutional oversight.

As per the official launch, Phase 1 of the program will be implemented from **October 2024 to December 2027**, with an estimated investment of approximately **INR 1000 crore** for development and deployment of green tugs .

Implementation Framework

Phase 1 (2024–2027)

The initial phase focuses on early adoption and demonstration across select major ports. The following four ports have been identified:

- Jawaharlal Nehru Port Authority (JNPA)
- Deendayal Port Authority (DPA)
- Paradip Port Authority
- V.O. Chidambaranar Port Authority

Each port is expected to procure or charter a minimum of two green tugs, based on standardized designs developed by the **Standing Specification Committee (SSC)** .

The first set of tugs will primarily be **battery-electric**, with provision for adoption of other emerging propulsion technologies such as hybrid systems, methanol and green hydrogen as technology maturity improves.

Technology Approach

The GTTP adopts a **technology-neutral but future-ready approach**, enabling ports to adopt suitable propulsion systems based on operational requirements and infrastructure readiness.

Key technology pathways include:

- Battery-electric propulsion for short-duration harbour operations
- Hybrid propulsion combining battery and fuel-based systems

- Alternative fuels such as methanol and green hydrogen
- Provision for retrofitting and modular upgrades as technologies evolve

This approach ensures flexibility while maintaining alignment with long-term decarbonisation objectives.

Standardization and Compliance

A key feature of the GTTP is the development of **Approved Standard Tug Designs and Specifications (ASTDS)** to ensure:

- Uniformity in design and performance benchmarks
- Safety and operational reliability
- Ease of procurement and scalability
- Alignment with environmental performance standards

Further, it has been envisaged that:

- By **2033**, all new tugs built for Indian ports will be required to comply with GTTP standards
- By **2040**, all tugs operating in major ports are targeted to transition to green alternatives

Strategic Alignment

The GTTP is closely aligned with national maritime and climate objectives:

Maritime India Vision 2030 (MIV 2030)

- Target of **30% reduction in carbon emissions per ton of cargo**
- Increased adoption of renewable energy across ports

Maritime Amrit Kaal Vision 2047

- Long-term decarbonisation of port operations
- Reduction in emissions from port-owned vessels

The transition of harbour tugs represents a **high-impact, low-complexity intervention**, as these vessels operate within controlled port environments and are well-suited for electrification and alternative fuels.

Industrial and Economic Impact

The GTTP is also positioned as an industrial development initiative:

- All tugs under the program are to be constructed in Indian shipyards under the **Make in India** initiative
- Expected to generate demand in shipbuilding, design and marine engineering sectors
- Creation of employment across manufacturing and ancillary industries
- Development of domestic capabilities in green vessel technologies

Environmental Significance

The transition to green tugs is expected to deliver measurable environmental benefits:

- Reduction in direct (Scope 1) emissions from port-owned vessels
- Improvement in air quality in port cities
- Contribution towards national GHG reduction commitments
- Demonstration effect for wider adoption of green technologies in maritime sector

Given the high utilisation rates of harbour tugs, even limited fleet replacement can result in **disproportionately high emission reductions**.

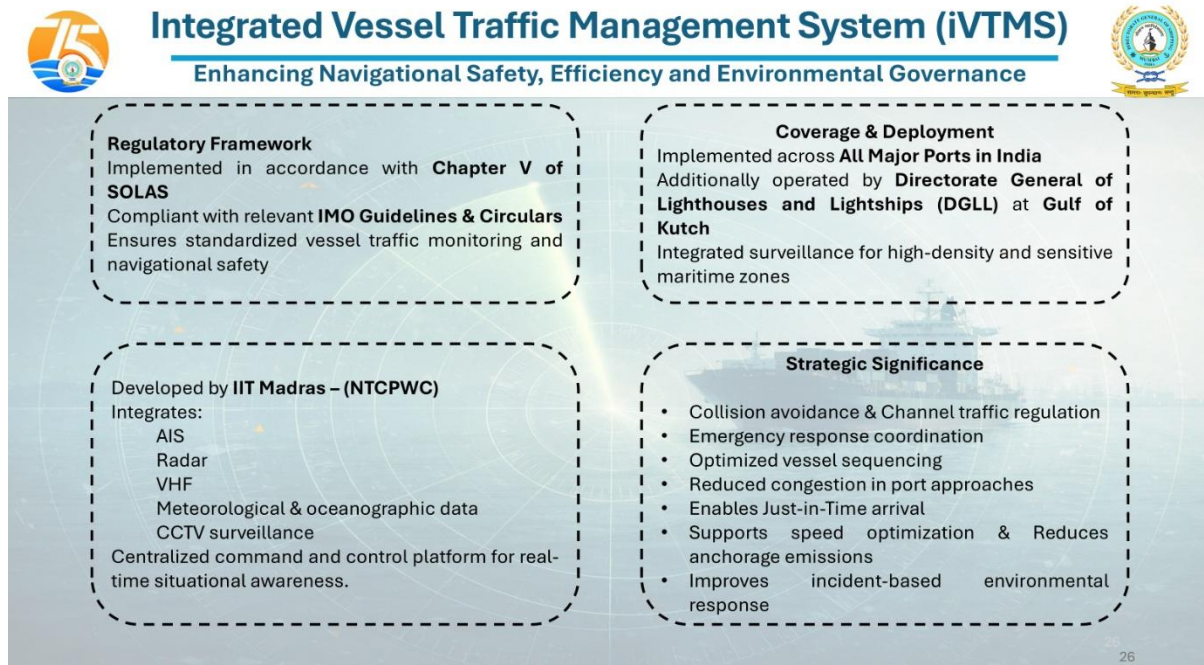
Key Challenges and Considerations

While the program is well structured, certain implementation challenges need to be addressed:

- High upfront capital cost of green technologies
- Charging or fuel infrastructure readiness at ports
- Technology maturity, particularly for hydrogen-based systems
- Operational reliability and lifecycle performance
- Need for capacity building among port operators and crew

Addressing these will be critical for scaling beyond the initial phase.

Integrated Vessel Traffic Management System (iVTMS)



The Integrated Vessel Traffic Management System (iVTMS) has been implemented in accordance with Chapter V of the International Convention for the Safety of Life at Sea (SOLAS), which deals with safety of navigation. The system aligns with relevant IMO guidelines and circulars governing vessel traffic services and navigational safety standards.

The primary objective of iVTMS is to ensure standardized vessel traffic monitoring in high-density maritime areas, port approaches and sensitive coastal zones. By institutionalising real-time surveillance and control mechanisms, the system strengthens India's compliance posture under international maritime safety obligations.

The regulatory basis of iVTMS ensures that its deployment is not discretionary or project-based, but anchored within an established global maritime safety framework.

Coverage and Deployment

iVTMS has been implemented across all Major Ports in India, creating a uniform navigational safety architecture across the country's principal maritime gateways.

In addition, the Directorate General of Lighthouses and Lightships (DGLL) operates iVTMS in the Gulf of Kutch region, one of India's most sensitive and high-density maritime corridors. This region handles significant volumes of crude oil traffic and large tankers, requiring enhanced surveillance and traffic coordination.

The system therefore provides integrated monitoring in both port-specific and broader coastal maritime zones. This layered deployment enhances oversight in congested approaches, narrow channels and environmentally sensitive areas.

System Architecture and Technical Integration

iVTMS is a centrally integrated command-and-control platform developed by IIT Madras through the National Technology Centre for Ports, Waterways and Coasts (NTCPWC).

The system integrates multiple real-time data sources, including:

- Automatic Identification System (AIS)
- Radar surveillance
- VHF communication channels
- Meteorological and oceanographic inputs
- CCTV-based visual monitoring

These inputs are consolidated into a unified operational dashboard, enabling maritime authorities to maintain real-time situational awareness.

The integration of navigational, meteorological and communication systems into a single interface significantly reduces response time during abnormal situations and improves traffic sequencing efficiency.

Operational Significance

The operational value of iVTMS extends beyond passive vessel tracking.

It enables:

- Collision avoidance through proactive traffic regulation
- Structured channel traffic management in constrained waterways
- Coordinated emergency response in case of mechanical failure, grounding or collision
- Optimised vessel sequencing to reduce waiting time
- Congestion management in port approaches

By providing predictive and real-time visibility of vessel movements, iVTMS reduces uncertainty in navigation and enhances overall maritime safety.

Environmental Governance Dimension

While iVTMS is primarily a navigational safety system, its environmental implications are equally significant.

First, optimized vessel sequencing reduces unnecessary anchorage time. Prolonged anchorage leads to continuous operation of auxiliary engines, resulting in avoidable emissions. By enabling Just-in-Time (JIT) arrival practices, iVTMS contributes indirectly to emission reduction.

Second, traffic regulation supports speed optimization. Controlled speed adjustments during approach reduce fuel consumption and associated GHG emissions.

Third, in the event of maritime incidents such as oil spills or collisions, real-time surveillance supports rapid response coordination, thereby limiting environmental damage.

In this manner, iVTMS serves as both a safety and environmental governance tool.

Strategic Importance for India

India's maritime traffic density is increasing, with rising cargo volumes, crude imports and containerized trade. As port capacity expands, navigational complexity correspondingly increases.

iVTMS provides the digital backbone required to manage this complexity. It enhances India's credibility as a safe maritime destination and aligns with global best practices in vessel traffic services.

Furthermore, integration of iVTMS with future digital initiatives such as digital twins, Just-in-Time arrival systems and port community platforms can create a seamless operational ecosystem.

In the long term, iVTMS strengthens three core pillars:

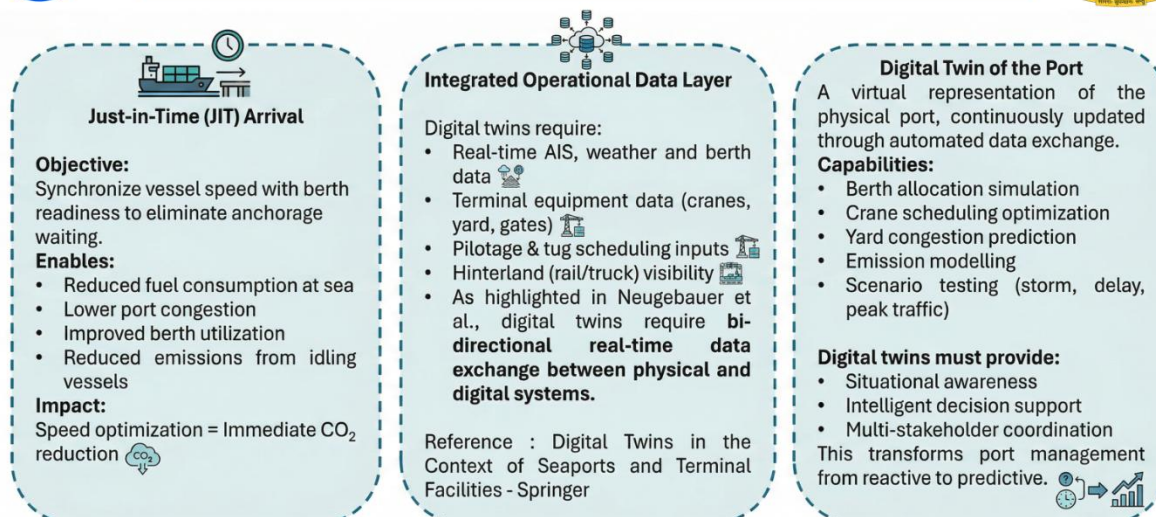
- Navigational Safety
- Operational Efficiency
- Environmental Responsiveness

It therefore represents a foundational infrastructure element in India's broader maritime modernization strategy.

Just-in-Time Arrival and Digital Twin for Ports



Just-in-Time & Digital Twin for Ports



Just-in-Time (JIT) Vessel Arrival – Eliminating Anchorage Inefficiencies

One of the persistent inefficiencies in port operations globally is excessive anchorage waiting. Vessels often arrive at port approaches ahead of berth availability and remain at anchor with auxiliary engines running, leading to avoidable fuel consumption, congestion and emissions.

The Just-in-Time (JIT) arrival framework seeks to address this structural inefficiency by synchronizing vessel speed with real-time berth readiness.

Objective

The core objective of JIT is to align vessel arrival with confirmed berth availability so that ships can reduce speed during voyage and avoid idle waiting at anchorage.

Operational Principle

Instead of vessels rushing to port and waiting, dynamic scheduling information is shared in advance. Based on real-time berth status, crane availability, pilotage inputs and channel conditions, vessels adjust speed to arrive precisely when required.

Benefits

- Reduced fuel consumption at sea through speed optimization
- Lower congestion in port approaches
- Improved berth utilization
- Elimination or reduction of emissions from idling vessels at anchorage

Speed optimization has an immediate impact on carbon dioxide emissions. Even modest reductions in sailing speed can produce measurable emission savings due to the non-linear relationship between speed and fuel consumption.

JIT is therefore not merely an operational improvement — it is a decarbonization intervention embedded in voyage planning.

Digital Twin Architecture for Ports

JIT cannot function effectively without an integrated digital data environment. This is where the Digital Twin concept becomes foundational.

A Digital Twin of a port is a dynamic virtual representation of the physical port ecosystem, continuously updated through automated real-time data exchange.

Integrated Operational Data Layer

For a Digital Twin to function effectively, it must integrate multiple real-time inputs:

- AIS vessel tracking data
- Weather and oceanographic conditions
- Berth occupancy status
- Terminal equipment data including cranes and yard operations
- Pilotage and tug scheduling inputs
- Hinterland connectivity visibility (rail and truck flows)

The system must enable bi-directional real-time data exchange between physical infrastructure and digital platforms. It is not merely a visualization tool but a decision-support architecture.

Capabilities of a Port Digital Twin

When fully functional, a Digital Twin can enable:

- Simulation of berth allocation scenarios
- Crane and yard scheduling optimization
- Congestion prediction in yard and gate operations
- Emission modelling under different traffic scenarios
- Scenario testing for weather disruptions, peak traffic or operational delays

This shifts port management from reactive intervention to predictive planning.

Governance Implication

A well-designed Digital Twin supports:

- Situational awareness
- Intelligent decision support
- Multi-stakeholder coordination across port authority, terminal operators, pilots and shipping lines

It creates a unified operational picture, reducing information asymmetry between stakeholders.

Digital Twin Pilot – VOCPA Tuticorin



Digital Twin at VOCPA Tuticorin

Prestigious Digital Twin System commissioned in record 6 months

Cost: ₹24.62 Crore

Executed by: IPRCL

Inaugurated by Hon'ble Minister of MoPSW Shri Sarbananda Sonowal (23 Feb 2026)



Salient Features

Complete 3D Port Visualization

The entire port ecosystem is displayed in real-time 3D on a holographic table, enabling intuitive and immersive operational oversight.

Integrated CCTV Surveillance (~400 Cameras)

Nearly 400 CCTV cameras are mapped to their exact physical locations, allowing centralized and location-specific monitoring of port activities.

VTMS Integration – Real-Time Vessel Intelligence

The Vessel Traffic Management System is fully integrated. With a single click on a vessel image, movement details and cargo information are instantly accessible.

Integrated Weather Monitoring

Live weather systems are embedded into the platform, enabling proactive monitoring of rainfall, cyclones and other atmospheric disturbances.



28

The Digital Twin initiative at VO Chidambaranar Port Authority (VOCPA), Tuticorin represents India's first structured implementation of this next-generation port management architecture.

The project was executed in record time and commissioned within six months at an approximate cost of ₹24.62 crore. It was executed by IPRCL and inaugurated by the Hon'ble Minister of Ports, Shipping and Waterways on 23 February 2026.



Key Features of the VOCPA Digital Twin

1. Complete 3D Port Visualization

The entire port ecosystem is rendered in real-time 3D format through an interactive visualization platform. This enables immersive and intuitive operational monitoring across berths, yards and channel approaches.

This visualization capability is not cosmetic; it enhances comprehension of spatial relationships between vessel movements, equipment positions and yard occupancy.

2. Integrated CCTV Surveillance (~400 Cameras)

Nearly 400 CCTV cameras across the port are mapped to their exact physical coordinates within the digital environment. This allows location-specific monitoring and centralised oversight of activities.

Operators can transition from a macro port view to micro-level surveillance instantly.

3. VTMS Integration – Real-Time Vessel Intelligence

The Vessel Traffic Management System is fully integrated with the digital twin. Vessel movement details, cargo status and navigational information are accessible through a single operational interface.

This integration strengthens navigational oversight and supports synchronized berth planning.

4. Integrated Weather Monitoring

Live weather systems are embedded within the platform, enabling proactive monitoring of rainfall, cyclonic activity and atmospheric disturbances.

This capability supports early-warning based decision-making and improves resilience against extreme weather events.

Strategic Significance of the VOCPA Pilot

The VOCPA Digital Twin is not an isolated technology demonstration. It establishes a proof-of-concept for:

- JIT-enabled berth synchronization
- Data-driven emission reduction
- Predictive congestion management
- Integrated maritime safety and environmental governance

By linking vessel traffic intelligence, equipment data and weather inputs into a unified platform, the pilot demonstrates how digital infrastructure can directly support operational efficiency and decarbonisation objectives.

The next logical step would involve scaling such platforms across major ports, integrating them with JIT frameworks and aligning them with Green Port Index parameters.

Shore-to-Ship Power (SPS) – Decarbonising Emissions at Berth



Shore to Ship



What is Shore Power?

Electricity supplied from the shore to berthed ships, allowing engines to be switched off and eliminating fuel combustion while docked.

Why It Matters

- Cuts CO₂, NO_x, SO_x and Particulate Matter emissions in port zones
- Improves Air Quality and ESG scores for Indian ports
- Supports compliance with IMO CII, GHG & Green Port Index

Implementation Status in Indian Ports

- **Kamarajar Port** - 500 kW, 400V, 50-60 Hz in Coal Berth 1 & 2
- **VO Chidambaranar Port** - 305 kW, 400V 60Hz in VOC Berth 2 & 3
- **Jawaharlal Nehru Port Authority** - SPS used for Tugs. SPS for all terminals planned (45MVA; INR 600 crore expected)
- **Paradip Port** - Newly commissioned. Delivered full load power to MV APJ Indrani at CB1 Berth.



Possible Financing Options

Blended finance → govt + MDBs + private capital.

Green/blue bonds → specifically earmarked for OPS infra.

PPP models → private players co-invest in OPS roll-out.

Shore-to-Ship Power (SPS), also referred to as cold ironing or Onshore Power Supply (OPS), involves supplying electricity from the shore grid to a vessel while it is berthed at port. During this period, the ship's auxiliary engines and diesel generators are switched off, thereby eliminating onboard fuel combustion for hoteling loads.

Under conventional operations, even when ships are stationary at berth, auxiliary engines continue to run to support lighting, ventilation, refrigeration, cargo operations and other onboard systems. These engines consume marine fuel and emit carbon dioxide (CO₂), nitrogen oxides (NO_x), sulphur oxides (SO_x) and particulate matter (PM), contributing to localized air pollution within port areas.

SPS replaces this combustion-based generation with shore-based electricity, significantly reducing emissions at berth.

Environmental and Regulatory Significance

The introduction of SPS directly addresses one of the most visible sources of port-area emissions — emissions from berthed vessels.

Its environmental impact includes:

- Reduction in CO₂ emissions during hoteling period
- Elimination of NO_x and SO_x emissions at berth
- Significant reduction in particulate matter in port zones

- Improvement in ambient air quality in port-adjacent urban areas

From a regulatory standpoint, SPS contributes to:

- Compliance alignment with IMO's Carbon Intensity Indicator (CII) framework
- Support to GHG reduction commitments
- Strengthening of Green Port Index parameters
- Enhancement of ESG metrics for Indian ports

As global shipping transitions toward decarbonisation, ports that provide SPS infrastructure become more attractive to environmentally compliant ship operators.

Strategic Importance for Indian Ports

For India, SPS has three distinct strategic implications:

First, it improves local air quality. Many Indian ports are located near dense urban populations. Reduction of emissions at berth has direct public health benefits.

Second, it strengthens India's positioning in green shipping corridors. Several international green corridor initiatives now incorporate shore power as a baseline infrastructure requirement.

Third, it enhances competitiveness. As shipping lines increasingly report Scope 1 and Scope 3 emissions, availability of SPS allows vessel operators to reduce emissions during port calls, improving their sustainability performance.

SPS therefore shifts ports from being passive infrastructure providers to active contributors in maritime decarbonisation.

Implementation Status in Indian Ports

- **Kamarajar Port** has implemented 500 kW, 400V, 50–60 Hz SPS systems at Coal Berths 1 and 2.
- **VO Chidambaranar Port** has installed 305 kW, 400V, 60 Hz systems at VOC Berths 2 and 3.
- **Jawaharlal Nehru Port Authority (JNPA)** has deployed SPS for tug operations and has planned full-scale deployment across all terminals with an estimated 45 MVA capacity and projected investment of approximately INR 600 crore.
- **Paradip Port** has recently commissioned SPS facilities and delivered full load power to vessels at CB1 berth.

These early deployments indicate proof-of-concept and operational viability. However, large-scale adoption across cargo terminals will require capacity augmentation, grid integration and financial structuring.

Technical and Infrastructure Considerations

Implementation of SPS requires careful technical planning:

- Grid capacity and substation upgrades
- Frequency compatibility (50/60 Hz considerations)
- High-voltage connection systems for large container and cruise vessels
- Cable management systems and automated connection interfaces
- Safety interlocks and harmonised standards for ship–shore interface

Vessels must also be SPS-ready, meaning onboard electrical systems must be configured for shore connection. Therefore, adoption requires coordination between ports, ship operators and classification societies.

Financial Structuring and Investment Models

SPS infrastructure involves significant capital expenditure, especially for high-capacity berths. To scale deployment, diversified financing models may be required.

Possible approaches include:

- **Blended finance models**, combining government support, multilateral development banks and private investment.
- **Green or blue bonds**, specifically earmarked for shore power and decarbonisation infrastructure.
- **Public–Private Partnership (PPP) models**, where terminal operators co-invest in SPS infrastructure.

Given the long asset life and public-good environmental benefits, concessional finance mechanisms may improve viability.

Challenges and Way Forward

While SPS offers clear environmental benefits, certain practical challenges remain:

- High upfront capital costs
- Tariff competitiveness versus onboard fuel generation
- Standardisation across vessel categories
- Grid stability and renewable energy integration

To address these challenges, a phased expansion approach may be adopted:

1. Prioritisation of high-traffic container and cruise terminals.
2. Integration with renewable energy sources to maximize decarbonisation benefit.

3. Development of uniform national technical standards.
4. Incentivization mechanisms for vessels that utilise SPS.

Long-term viability will depend on coordinated policy support, tariff rationalisation and integration within broader port decarbonisation strategies.

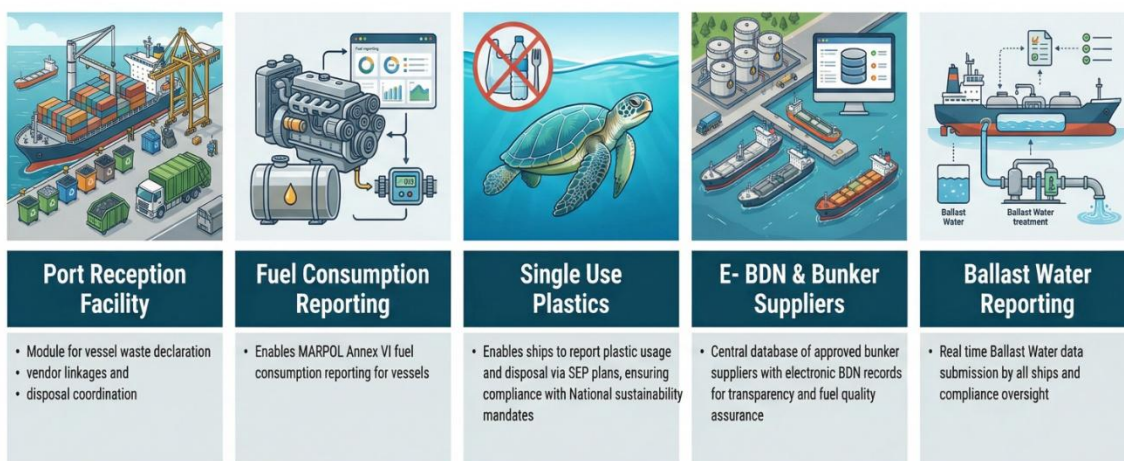
Swachh Sagar Portal



Swachh Sagar Portal



*India's digital platform for clean seas and maritime decarbonization.
Developed and Managed by IRS on behalf of DGS.*



The Swachh Sagar Portal is India's unified digital platform for maritime environmental compliance, developed to support clean seas, transparent reporting and decarbonisation efforts. It consolidates all pollution control and sustainability mandates under a single national system, enabling ships, ports and regulatory authorities to operate within a structured, real-time governance framework. Each module within the portal addresses a specific environmental obligation under MARPOL and IMO conventions, ensuring data integrity, traceability and enforcement consistency.

Port Reception Facility (PRF) Module

The Port Reception Facility module establishes a structured digital system for vessels to declare ship-generated waste prior to port arrival. It links ships with authorised waste collection vendors and enables real-time approval, tracking and disposal coordination, reducing delays and eliminating informal handling. By digitally recording every waste transaction, it ensures full transparency under MARPOL Annex V and prevents sea dumping. This module supports

State Maritime Boards, Port Authorities and Pollution Control Boards in monitoring compliance, while creating auditable records for IMO and port State control inspections.

Fuel Consumption Reporting

This module captures fuel consumption data for all vessels required to report under DGS regulations, including those below the IMO's global Data Collection System threshold of 5,000 GT. It enables national compliance with MARPOL Annex VI carbon intensity and energy efficiency requirements. All operational fuel data, type, quantity, voyage consumption, is digitally lodged, enabling India to build a national emissions database. This data will support policy development for future MBM mechanisms and ensure readiness for IMO's Net-Zero Framework implementation.

Single Use Plastics (SUP) Module

The Single Use Plastics module operationalises DGS Order No. 05 of 2019 by mandating ships to submit a Ship Execution Plan (SEP) identifying plastic items onboard, their phase-out measures and disposal methods. It enables tracking of plastic usage, recycling and substitution with sustainable alternatives. By capturing ship-level data, this module enforces India's national ban on certain plastic categories and contributes to IMO's Action Plan on Marine Litter. It shifts plastic control from advisory to mandatory digital reporting, enhancing accountability.

e-BDN & Bunker Supplier Information System

This module creates a national registry of licensed bunker suppliers and mandates issuance of electronic Bunker Delivery Notes (e-BDN) for every fuel transaction. Each e-BDN is time-stamped, digitally signed and serialised, preventing manipulation or use of unregistered suppliers. It improves traceability of marine fuels and helps detect off-spec or adulterated bunkers. By integrating supplier verification and fuel documentation, the portal strengthens maritime fuel governance and directly supports enforcement of fuel quality standards under MARPOL Annex VI.

Ballast Water Reporting Module (BWM Convention Alignment)

The Ballast Water module requires all ships, Indian and Foreign Flagged, to electronically report ballast operations upon every arrival and departure. It captures data on ballast uptake, exchange, treatment and discharge, enabling continuous monitoring in line with IMO's experience-building phase. This allows authorities to assess invasive species risk, treatment plant functionality and compliance behaviour. By linking with GISIS reporting, it elevates India's oversight role under the Ballast Water Management Convention and prepares ports for future biological discharge standards.

Together, these five modules establish India's first end-to-end maritime environmental registry, shifting compliance from manual declarations to auditable, technology-driven oversight. By integrating reporting on waste, fuel, plastics, bunkers and ballast water, the portal strengthens India's role in global maritime regulation and positions the country to lead international

initiatives on green shipping corridors, blue economy and marine pollution control. Swachh Sagar is not just a compliance tool, but a strategic instrument for India's transition to a cleaner, future-ready maritime ecosystem.

Just Transition in Maritime

Putting People at the Core of Decarbonisation



The global maritime sector is undergoing a structural transformation driven by decarbonisation commitments, alternative fuel adoption and digitalisation. However, decarbonisation is not merely a technological or fuel transition — it represents a workforce transition.

For maritime economies such as India, this dimension assumes critical importance. With approximately 3.23 lakh Indian seafarers as of 2025 — accounting for nearly 12% of the global maritime workforce — India plays a pivotal role in shaping the human dimension of maritime transition.

A green transition that does not account for employment continuity, skills upgrading and safety risks would create structural imbalances. Therefore, the principle of a Just Transition seeks to ensure that environmental progress does not come at the cost of workforce vulnerability.

Workforce Implications of Fuel Transition

The shift toward alternative marine fuels such as green ammonia, hydrogen, methanol and other low-flashpoint fuels introduces new technical and operational complexities.

These fuels:

- Present distinct toxicity and flammability risks
- Require modified onboard storage and handling systems
- Demand new emergency response protocols
- Necessitate revised competency standards

This implies that decarbonisation will require new competencies across engineering, deck operations, safety management and port handling systems.

A structured upskilling strategy is therefore essential to ensure that the maritime workforce transitions alongside technological change.

Skills and Training Ecosystem

A Just Transition framework must prioritize large-scale capacity building.

Key areas include:

- Structured upskilling for handling green fuels
- Modernization of STCW-aligned training modules
- Investment in simulator-based training for ammonia, hydrogen and hybrid propulsion systems
- Upgradation of maritime training infrastructure

India's maritime training institutions must progressively integrate green fuel modules into curricula. This is not a short-term training exercise but a phased institutional transformation.

The emphasis must be on competency-based certification aligned with emerging IMO standards and future regulatory frameworks.

Safety and Standards

Alternative fuels introduce unfamiliar safety risks. For example:

- Ammonia exposure risks
- Hydrogen storage complexities
- Low flashpoint fuel handling hazards

A Just Transition requires a safety-first approach.

This includes:

- Strengthening onboard safety protocols
- Revising emergency preparedness standards
- Aligning operational practices with evolving IMO IGF Code provisions
- Ensuring compliance with the Maritime Labour Convention (MLC 2006) and international labour norms

Safety cannot be compromised in pursuit of decarbonisation targets. Technological adoption must be matched by risk mitigation frameworks.

Equity and Inclusion

The maritime workforce is globally distributed, with developing nations supplying a significant share of seafarers. Without coordinated support, the transition to green fuels risks widening global skills gaps.

A Just Transition approach must therefore:

- Avoid marginalization of seafarers from developing maritime nations
- Promote equal access to new training pathways
- Encourage gender inclusion and diversity within maritime professions
- Support global knowledge-sharing mechanisms

India, as a leading supplier of maritime manpower, has both an opportunity and responsibility to advocate for inclusive transition pathways.

Policy Direction for India

India's maritime decarbonisation roadmap must embed workforce considerations within broader sustainability initiatives.

Key policy directions may include:

1. Integration of green fuel competencies within national maritime training frameworks.
2. Structured collaboration between DGS, training institutes and industry stakeholders.
3. Development of standardized certification pathways for alternative fuel operations.
4. Incorporation of Just Transition principles within National Maritime Decarbonization Policy Framework frameworks.

The objective should be to ensure that environmental ambition is matched with human resilience.

Ship Recycling



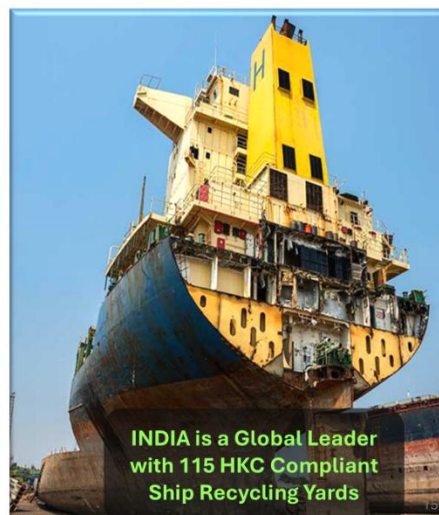
Ship Recycling



- Process of dismantling end-of-life ships to recover **steel and other valuable materials**.
- India is a **global leader**, with Alang–Sosiya in Gujarat being the **world's largest ship recycling cluster**.
- Governed internationally by the **Hong Kong Convention (HKC)**, which entered into force on **26 June 2025**.
- Integral to the **circular economy**, reducing the demand for virgin raw materials. 97-98% Materials recoverable

India's Role & Importance

- Handles **30% - 35% of global ship recycling tonnage** annually. (~500 vessels annually)
- Provides **20 - 25% of India's ferrous scrap requirement**, reducing dependence on imports.
- India is the **only country with 100+ HKC Compliant Recycling Yards**. Supplies input material for the **Green Steel ecosystem**, boosting India's low-carbon transition.
- Generates **direct employment for 15000+ workers** and **indirect livelihood opportunities** for thousands more in logistics, scrap processing, and allied services.
- Strengthens India's position in **global maritime sustainability**.



Ship Recycling – India's Global Leadership



- Recycling governed internationally by the **Hong Kong Convention (HKC)**
- Integral to the **circular economy**, reducing the demand for virgin raw materials (97-98% Materials recoverable)

India is a leading hub with world's largest ship recycling cluster

35.4%

India leads Global Ship Recycling with a 35.4% share in 2025

115

HKC Compliant Yards present in India

20-25%

India's ferrous scrap requirement met, reducing import dependence

15k+

Direct employees & indirect livelihood opportunities for thousands



36

Ship recycling forms the terminal stage of a vessel's operational life and has historically been treated as a downstream industrial activity. However, in the present regulatory and sustainability environment, it has evolved into a strategically important maritime segment with implications for industrial policy, environmental governance and international compliance.

Ships typically operate for 25 to 30 years. At the end of this lifecycle, dismantling must be carried out in a manner that ensures safe handling of hazardous materials, recovery of recyclable components and minimal environmental impact. A modern ocean-going vessel contains large quantities of high-grade steel along with non-ferrous metals, machinery, electrical systems and reusable equipment. When dismantled under controlled conditions, a significant proportion of this material re-enters the industrial supply chain.

The global regulatory framework governing this activity changed materially with the entry into force of the Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships on 26 June 2025 .

Post-HKC, ship recycling is no longer a loosely regulated industrial activity; it is now a structured compliance-based system requiring lifecycle documentation, certification and facility authorisation.

India has aligned its domestic legal framework accordingly through the Recycling of Ships Act, 2019 and related Rules, positioning itself as an early mover in the post-HKC regime.

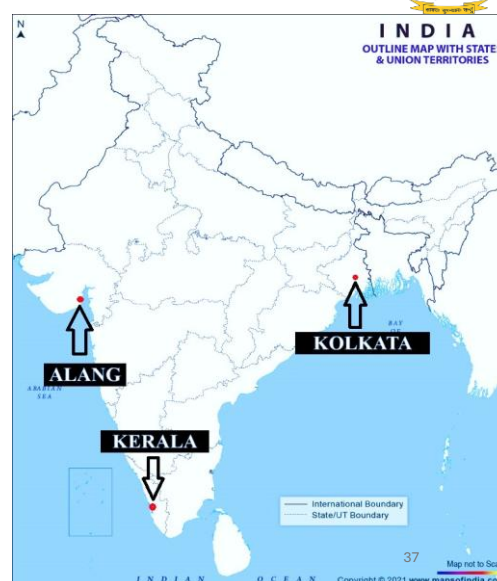


Ship Recycling Statistics in India



Yard	Total Number of Plots	Operational Plots	HKC Compliant yards
Alang, Bhavnagar (Gujarat)	150	128	115
Steel Industries Limited (Kerala)	1	1	0
Amar Iron Udyog, Kolkata (West Bengal)	1	1	0

Timeline	No of Vessels	Total LDT
March 1983 – March 2026	8956	71328850.09
FY 2025 - 2026	119	1087447.01



India's Leadership

India today occupies a central position in global ship recycling. The Alang–Sosiya ship recycling cluster in Bhavnagar, Gujarat is the largest such cluster in the world .

Current status of the Alang cluster:

- 150 total plots
- 128 operational plots
- 115 HKC compliant yards

The fact that 115 yards are HKC compliant is significant. It reflects not only infrastructure upgradation but a conscious regulatory transition over the past decade. No other recycling nation currently has over 100 HKC compliant facilities concentrated in a single cluster .

In volume terms, India handles approximately 30–35% of global ship recycling tonnage annually

At the national level, the sector supplies around 20–25% of India’s ferrous scrap requirement. Given India’s steel production expansion targets, this contribution is strategically relevant.

The sector provides direct employment to more than 15,000 workers and sustains a broader ecosystem involving logistics operators, re-rolling mills, scrap traders and ancillary service providers .

India’s leadership is therefore based on scale, regulatory alignment and economic integration.

Strategic Importance

Ship recycling intersects with India’s priorities in steel production, maritime manufacturing and sustainability commitments.

First, it strengthens domestic scrap availability. Scrap-based steel production is less energy intensive compared to primary steelmaking and reduces dependence on iron ore extraction and coal usage. In the context of decarbonisation and resource efficiency, this is important.

Second, it supports maritime industrial integration. The introduction of the Ship Recycling Credit Note under SBFA 2.0 has created a policy linkage between dismantling and new shipbuilding . This ensures that economic value generated from recycling remains within the domestic maritime ecosystem.

Third, post-HKC, shipowners assess recycling destinations on compliance credentials. India’s compliance depth strengthens its credibility and reduces the risk of business diversion to alternative jurisdictions.

Hong Kong Convention (HKC)



Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships



Inventory of Hazardous Materials

All **in-service ships** to comply with:

- Flying the flag of a state party to the Convention, or
- Calling at a port in a country that is a party to the Convention.

When?

- **New builds:** From **26 June 2025**.
- **Existing ships:** By 26 June 2030, however, we strongly recommend the **next harmonised survey** after 26 June 2025.

What is required?

- A **valid Inventory of Hazardous Materials (IHM)**.
- An **International IHM Certificate**, valid for **5 years**, issued by the **RO or flag State**.



Final Survey

All **in service ships going for recycling** to comply if:

- flying the flag of a state party to the Convention, or
- being recycled in a country party to the convention.

When?

- Any **ship going for recycling** on or after **26 June 2025**

What is required?

- **IHM part I** and valid **certification**
- **IHM parts II & III**
- a **ship specific recycling plan** from an authorised recycling facility
- An **international ready for recycling certificate**. Valid for **3 months**. Issued by **RO or flag State**.



Ship Recycling Facility Certification

All **recycling facilities** operating in countries party to the convention.

When?

SRF certification need certification from **26 June 2025**.

What is required?

- **Ship Recycling Facility Plan**
- Produce **ship specific recycling plans**
- Access to appropriate **medical and waste treatment facilities**
- Be **authorised** by their competent authority
- Hold a valid **Document of Authorisation for Ship Recycling (DASR)**.

38

The Hong Kong Convention establishes binding obligations for both ships and recycling facilities.

For ships:

- New ships are required to comply from 26 June 2025.
- Existing ships must comply by 26 June 2030 .

Ships proceeding for recycling after 26 June 2025 must carry:

- A valid Inventory of Hazardous Materials (IHM).
- Updated IHM Parts II and III.
- A ship-specific Recycling Plan.
- An International Ready for Recycling Certificate (valid for three months) .

For recycling facilities:

- An approved Ship Recycling Facility Plan is mandatory.
- Authorisation by the competent authority is required.
- A valid Document of Authorisation for Ship Recycling (DASR) must be held .

India's Recycling of Ships Act, 2019 operationalises these requirements domestically, ensuring harmonisation between international obligations and national enforcement.

Compliance and Risk

In the current regime, compliance gaps carry both regulatory and commercial consequences.

Improper handling of hazardous materials such as asbestos, PCBs, oils or sludge can result in environmental contamination and worker safety incidents. Documentation deficiencies in IHM or recycling plans can undermine international confidence.

Reputational risk is particularly relevant in the post-HKC environment, where shipowners and flag administrations are expected to exercise due diligence in selecting recycling destinations.

India's approach has therefore emphasised:

- Yard infrastructure upgradation.
- Adoption of internationally recognised management systems.
- Structured inspection and oversight.
- Progressive digitalisation of compliance processes.

The objective is to institutionalise compliance rather than rely solely on periodic enforcement.

Inventory of Hazardous Materials (IHM)

The IHM framework is central to safe and environmentally sound recycling.

The IHM consists of three parts:

- Part I – Hazardous materials present in ship structure and equipment.
- Part II – Operational wastes.
- Part III – Stores.

Ships must maintain a valid IHM certificate, generally with a five-year validity . Prior to recycling, Parts II and III must be completed and verified.

The IHM enables:

- Identification of hazardous substances.
- Planning of removal and segregation.
- Safe disposal pathways.
- Worker safety during dismantling.

In practical terms, effective IHM governance reduces uncertainty at the yard stage and supports structured dismantling.

ISO Standards for Ship Recycling



ISO Compliance



Strengthening India's Global Credibility

Enforcing ISO management systems ensures ship recycling operations at Alang are **system-driven, auditable and internationally benchmarked**, complementing HKC compliance and supporting EUSRR recognition.

Key ISO Standards for Ship Recycling Yards

ISO 9001 – Quality Management: Streamlined processes, documentation and continual improvement.

ISO 14001 – Environmental Management: Pollution control, waste handling and eco-monitoring.

ISO 30000 – Ship Recycling Management: Integrates HKC principles for safe and compliant recycling.

ISO 45001 – Occupational Health & Safety: Worker safety, risk control and preventive culture.

Impact of Enforcement

- Builds **credibility and transparency** in global markets.
- Enhances **environmental, health and safety performance**.
- Improves **audit readiness** for IMO and EU inspections.
- Positions **Alang as a benchmark for responsible recycling**.



31



A significant number of Indian recycling facilities operate under ISO-based management systems, including:

- ISO 9001 – Quality Management.
- ISO 14001 – Environmental Management.
- ISO 30000 – Ship Recycling Management.
- ISO 45001 – Occupational Health and Safety.

These systems formalise documentation control, environmental monitoring, safety audits and corrective action mechanisms. ISO certification strengthens process discipline and enhances international credibility.

Ferrous Scrap Development Fund (FSDF)

The Ferrous Scrap Development Fund supports systemic improvements in the recycling ecosystem

The Fund is utilised for:

- Yard infrastructure improvements.
- Effluent treatment and hazardous waste management systems.
- Worker housing and welfare facilities.
- Skill development and training initiatives.
- Research and consultancy inputs.

The objective is to ensure that compliance and safety improvements are capital-backed and sustainable.

Ship Recycling Workforce Training Framework (proposed)



Training, Certification & Competency Framework for Ship Recycling Workforce

A standardised national framework is required to ensure that ship recycling personnel possess the knowledge, practical skills and safety competencies necessary for HKC-compliant, environmentally sound and incident-free operations.



Core Training Areas

General Safety and Safe Working Practices

- PPE use and maintenance
- General and job-specific hazard awareness
- Injury, incident and near-miss reporting
- Safe work procedures and worker responsibilities

High-Risk Ship Recycling Operations

- Gas cutting and hot-work safety
- Safe-for-entry and safe-for-hot-work procedures
- Confined-space entry
- Working aloft and fall protection
- Lifting, rigging, crane and winch operations
- Cylinder and cutting-equipment safety

Environmental Protection and Waste Management

- Waste segregation and hazardous-waste control
- Pollution prevention and spill containment
- Conservation and good housekeeping
- Downstream waste disposal and traceability
- Environmental monitoring and regulatory compliance

Hazardous Materials Management

- Identification and communication of hazardous materials
- Asbestos-containing materials, batteries, oils, chemicals and toxic residues
- Isolation, removal, handling, transportation, storage and disposal
- Inventory of Hazardous Materials awareness

Emergency Preparedness and Response

- Fire prevention and firefighting
- First aid and rescue
- Oil and hazardous-material spill response
- Emergency evacuation
- Use of firefighting equipment and breathing apparatus
- Roles and responsibilities during crisis

Occupational Health and Worker Welfare

- Exposure prevention and occupational health risks
- Health surveillance and medical response
- Hygiene, sanitation and welfare provisions
- Worker rights, grievance redressal and safety communication

Proposed Competency Categories

Foundation Safety Competency

Mandatory induction, PPE, hazard awareness, safe work practices and incident reporting for all workers

Trade-Specific Competency

Practical certification for cutters, riggers, crane operators, hazardous-material handlers and other specialised personnel

Supervisory Competency

Job hazard analysis, permit-to-work controls, worksite supervision, emergency coordination and compliance monitoring

Management & Compliance Competency

HKC implementation, HSSE governance, audits, incident investigation, documentation and continual improvement

40

The transition towards environmentally sound and internationally compliant ship recycling requires a skilled workforce possessing the technical knowledge, practical skills and safety competencies necessary for handling complex recycling operations. The entry into force of the **Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships (HKC)** has further strengthened the need for a structured competency-based approach to workforce development across all ship recycling facilities.

Ship recycling involves a wide range of high-risk activities including gas cutting, heavy lifting, confined-space entry, hazardous-material handling, work at height and waste management. These activities require personnel to possess clearly defined competencies supported by systematic training, periodic assessment and continuous skill upgradation.

A standardised national training and certification framework would help establish uniform competency standards across Indian ship recycling facilities, improve occupational safety, strengthen environmental compliance and support sustained implementation of the Hong Kong Convention.

Objectives of the Competency Framework

The proposed framework should aim to:

- Develop a skilled and safety-conscious ship recycling workforce.
- Establish uniform national competency standards across recycling facilities.
- Improve compliance with the Hong Kong Convention and applicable national regulations.
- Reduce occupational accidents, injuries and environmental incidents.
- Promote continual professional development through refresher training and periodic certification.
- Enhance confidence among international ship owners and regulatory authorities regarding the competence of the Indian ship recycling workforce.

Core Training Areas

A comprehensive competency framework should include structured training across the following core areas.

General Safety and Safe Working Practices

This forms the foundation for all personnel entering ship recycling facilities.

Training should cover:

- Personal Protective Equipment (PPE) selection, use and maintenance.
- General hazard awareness and job-specific risk identification.
- Safe work procedures and worker responsibilities.
- Incident, injury and near-miss reporting.

- Permit-to-work systems.
- Toolbox talks and behavioural safety practices.

High-Risk Ship Recycling Operations

Specialised technical training should be provided for personnel engaged in hazardous operational activities.

Training areas include:

- Gas cutting and hot-work safety.
- Safe-for-entry and safe-for-hot-work procedures.
- Confined-space entry.
- Lifting, rigging and crane operations.
- Working at height and fall protection.
- Cylinder handling and cutting-equipment safety.
- Heavy structural dismantling techniques.

Hazardous Materials Management

Workers should be trained in the identification, handling and safe disposal of hazardous materials commonly encountered during ship recycling.

Training should include:

- Inventory of Hazardous Materials (IHM) awareness.
- Identification and communication of hazardous substances.
- Safe handling of asbestos-containing materials, oils, chemicals, batteries and toxic residues.
- Isolation, removal, storage, transportation and disposal procedures.
- Spill prevention and contamination control.

Emergency Preparedness and Response

Emergency response capability is essential for minimising the consequences of accidents.

Training should include:

- Fire prevention and firefighting.
- First aid and rescue.
- Oil and hazardous-material spill response.

- Emergency evacuation procedures.
- Use of firefighting equipment and breathing apparatus.
- Roles and responsibilities during emergency situations.

Environmental Protection and Waste Management

Personnel should understand the environmental responsibilities associated with ship recycling.

Training should cover:

- Waste segregation.
- Hazardous-waste management.
- Pollution prevention.
- Spill containment.
- Good housekeeping practices.
- Downstream waste disposal and traceability.
- Environmental monitoring and regulatory compliance.

Occupational Health and Worker Welfare

The competency framework should also address worker health, welfare and occupational hygiene.

Training should include:

- Prevention of occupational illnesses.
- Health surveillance and medical response.
- Hygiene and sanitation practices.
- Worker welfare provisions.
- Safety communication.
- Worker rights and grievance redressal mechanisms.

Competency Categories

A tiered competency framework may be adopted to reflect the different responsibilities within a ship recycling facility.

Foundation Safety Competency

Applicable to all personnel before deployment.

The competency should include:

- Mandatory induction.
- PPE usage.
- Hazard awareness.
- Safe working practices.
- Incident reporting.
- Basic emergency response.

Trade-Specific Competency

Applicable to personnel performing specialised operational tasks.

Examples include:

- Gas cutters.
- Riggers.
- Crane operators.
- Heavy-equipment operators.
- Hazardous-material handlers.
- Waste-management personnel.

Certification should combine classroom instruction with practical assessment.

Supervisory Competency

Supervisors should receive additional training covering:

- Job Hazard Analysis.
- Permit-to-work systems.
- Worksite supervision.
- Safety leadership.
- Emergency coordination.
- Regulatory compliance monitoring.
- Incident investigation.

Management and Compliance Competency

Management personnel should possess competencies relating to:

- Hong Kong Convention implementation.
- HSSE management systems.
- Internal audits.
- Documentation and record management.
- Continual improvement.
- Regulatory liaison.
- Contractor management.

Certification Framework

A national certification framework may include:

- Standardised competency standards for each job category.
- Accredited training centres.
- Qualified trainers and assessors.
- Practical and theoretical assessments.
- Digital competency records.
- Defined validity periods for certificates.
- Periodic refresher training and re-certification.

Digital certification records may also improve traceability and facilitate verification by regulatory authorities, employers and international stakeholders.

Institutional Framework

Implementation of a national competency framework would require coordinated participation by:

- Directorate General of Maritime Administration (DGMA)
- Gujarat Maritime Board (GMB)
- Indian Register of Shipping (IRS)
- Ship Recycling Facilities (SRFs)
- Training institutions
- Industry associations
- Occupational health and safety experts
- Environmental agencies

Such collaboration would support uniform implementation of competency standards across the ship recycling sector.

Benefits

Implementation of a structured national training and certification framework can contribute to:

- Improved worker safety and reduced accident rates.
- Enhanced compliance with the Hong Kong Convention.
- Better environmental protection and hazardous-material management.
- Uniform operational practices across ship recycling facilities.
- Improved emergency preparedness.
- Increased international confidence in India's ship recycling industry.
- Development of a professionally trained and globally competitive workforce.
- Strengthening India's position as a leading destination for safe and environmentally sound ship recycling.

Ship Recycling Credit Note



Ship Recycling Credit Note



- Introduced under **Ship Building Financial Assistance Scheme 2.0 (SBFA 2.0)**
- Incentivizes ship owners to **recycle in India** and **build new ships in Indian shipyards**

Allocation of : ₹ 4,001 crore
(under SBFA)

How It Works

- When a vessel is recycled in a certified Indian yard, the ship owner receives a **Credit Note for 40% of scrap value**.
- The Credit Note remains valid until the owner builds a new vessel/ ship in an Indian shipyard
- Redeemed as **financial assistance/ subsidy** under SBFA 2.0

Expected Benefits

- Encourages **safe and HKC compliant ship recycling** in India
- Provides **direct business boost for Indian shipyards**
- Attracts **new players** to India's ship recycling and shipbuilding ecosystem
- Strengthens India's **circular economy** : recycling feeds into new shipbuilding
- Positions India as a leader in **Green and Sustainable Maritime Growth**



34



Ship Recycling Credit Note

Global First



₹ 4,001 Cr allocated under the SBFAS with 10-year validity from 24th September 2025 to 31st March 2036



43

The **Ship Recycling Credit Note (SRCN)** is a strategic financial incentive mechanism introduced under the **Shipbuilding Financial Assistance Scheme (SBFAS) 2.0** to promote a **circular maritime economy in India**.

It aims to **link ship recycling with shipbuilding**, incentivising ship owners to:

- Recycle vessels in India (HKC-compliant yards)
- Reinvest in new shipbuilding within Indian shipyards

This initiative strengthens India's position as a **global hub for sustainable ship recycling and domestic shipbuilding**.

Policy Objective

The SRCN mechanism is designed to:

- Promote **safe and environmentally sound ship recycling** in India
- Encourage **domestic shipbuilding demand**
- Create a **closed-loop maritime ecosystem (Recycle → Build → Operate)**
- Support India's commitments under the **Hong Kong Convention (HKC)**
- Enhance **circular economy linkages (steel reuse and resource efficiency)**

Key Features of the Scheme

Credit Value

- Ship owner receives a **Credit Note equivalent to 40% of Fair Scrap Value (FSV)**

- FSV determined based on notified **price per LDT (quarterly basis)**

Validity

- Credit Note valid for **3 years from date of scrapping completion**

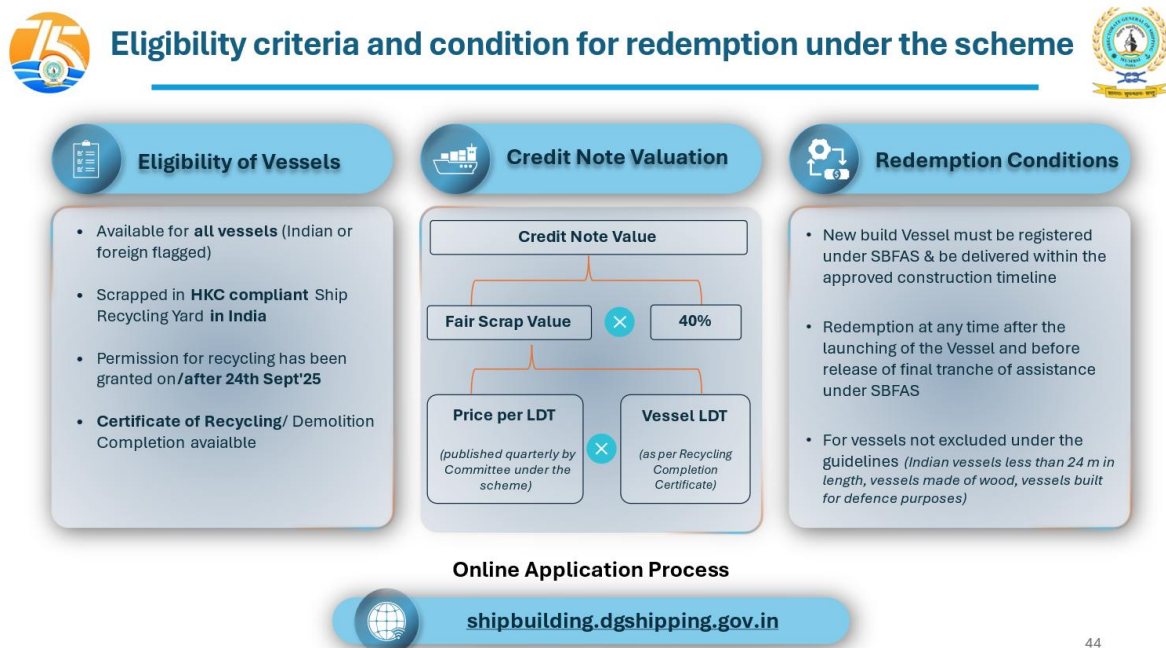
Redemption Limit

- Redeemable amount is the **lower of**:
 - Credit Note value
 - **5% of Fair Price of new vessel**

Mode of Benefit

- Redeemed as **financial assistance/subsidy**
- Paid directly to **Indian shipyard constructing the vessel**

Eligibility Criteria



Vessel Eligibility

- Indian or foreign-flagged vessels
- Must be scrapped in **India**
- Recycling yard must be:
 - **HKC-compliant**
 - Certified by recognised organisations / State Maritime Boards

Regulatory Conditions

- Permission for recycling issued **on or after 24 September 2025**
- Mandatory:
 - Certificate of Recycling / Demolition Completion
 - Approval from State Maritime Board / State Government

Operational Mechanism

Step 1: Recycling

- Vessel scrapped in certified Indian recycling yard

Step 2: Application

- Ship owner applies via **designated online portal**
- Submission within **3 months of scrapping completion**

Step 3: Verification

- Competent Authority verifies:
 - Vessel details
 - Scrapping proof
 - Compliance documentation

Step 4: Credit Note Issuance

- Digital SRCN issued with:
 - Unique serial number
 - Credit value
 - Validity period
 - Vessel details

Step 5: Redemption

- Used for:
 - New vessel construction in Indian shipyard
- Redemption allowed:
 - After vessel launch
 - Before final subsidy tranche is released

Flexibility & Market Features

Transferability

- SRCN can be:
 - **Sold or transferred** to another entity
- Executed through:
 - Online portal
 - Legally documented transfer agreement
- Pricing:
 - **Market-driven**

Stacking Mechanism

- Multiple SRCNs can be combined
- Applicable to:
 - Single vessel
 - Series shipbuilding orders
- Subject to:
 - **5% cap on vessel value**

Partial Utilisation

- Unused balance remains valid within original timeline

Risk & Compliance Safeguards

- Mandatory:
 - Digital tracking via portal
 - Documentation verification
- Security:
 - Redemption backed by **security instruments**
- In case of:
 - Cancellation → refund with **9% interest**
 - Non-utilisation → expiry after 3 years
- Ensures:
 - Transparency

- Accountability
- Financial discipline

Financial Outlay

- Allocated under SBFAS: **₹ 4,001 crore**

This allocation supports both:

- Shipbuilding incentives
- Ship recycling-linked credit mechanism

Strategic Impact

For Ship Recycling Sector

- Boosts demand for **HKC-compliant recycling yards (Alang ecosystem)**
- Encourages **formalisation and compliance**

For Shipbuilding Sector

- Generates **direct order pipeline**
- Improves utilisation of Indian shipyards

For Maritime Economy

- Strengthens **circular economy (steel reuse → shipbuilding)**
- Reduces dependency on imports
- Enhances domestic value creation

For Global Positioning

- Positions India as:
 - **Leader in sustainable ship recycling**
 - Emerging hub for **green shipbuilding ecosystem**

Key Challenges

- Awareness among global ship owners
- Price competitiveness vs international yards
- Efficient digital implementation and tracking
- Alignment with financing and leasing ecosystem

Green Steel

- “Green Steel” is defined by its CO₂ emission intensity — less than 2.2 tonnes CO₂ emission per tonne of finished steel (tfs).
- Greenness is expressed as a percentage reduction below the threshold of 2.2 tonnes CO₂ emission per tonne of finished steel
- The certification done via NISST (National Institute of Secondary Steel Technology) under the Bureau of Energy Efficiency (BEE) Measurement, Reporting and Verification (MRV) methodology.

Star Rating System

- Five-Star: < 1.6 tCO₂e/tfs ★★★★★
- Four-Star: 1.6 – 2.0 tCO₂e/tfs ★★★★
- Three-Star: 2.0 – 2.2 tCO₂e/tfs ★★★
- > 2.2 tCO₂e/tfs → Not eligible for green rating
(Threshold reviewed every 3 years)



Green Steel is defined as steel with emission intensity below 2.2 tonnes of CO₂ per tonne of finished steel

Scrap-based steel production significantly reduces resource consumption. For every tonne of scrap steel used:

- 1,370 kg of iron ore is conserved.
- 780 kg of coal is saved.
- 270 kg of limestone is saved

Ship recycling therefore directly contributes to resource conservation and emissions reduction objectives.

Circular Economy Linkage

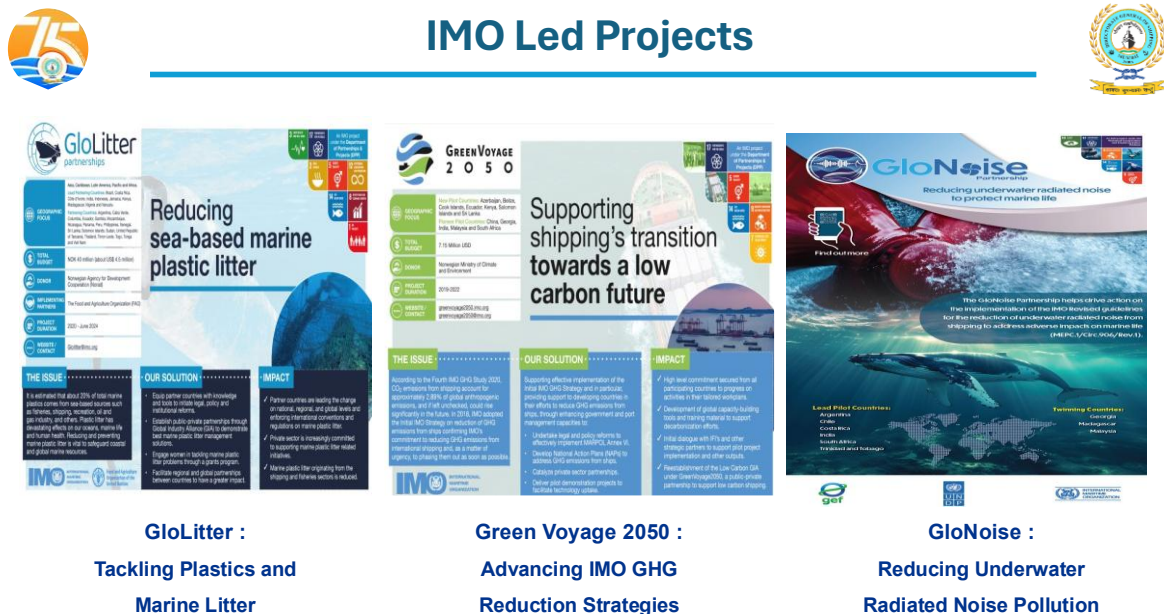
India’s ship recycling model now reflects a structured circular framework:

- Ships are dismantled in HKC-compliant yards.
- Scrap is channelled into domestic steel production.
- The Credit Note incentivises new vessel construction in India.
- Fleet renewal supports technological modernisation.
- FSDF reinvests in safety and infrastructure.

- Digital governance improves transparency and oversight.

The emphasis going forward will be on maintaining documentation integrity, strengthening digital systems and ensuring that worker safety and environmental safeguards remain embedded in operations.

IMO Led Projects



The International Maritime Organization (IMO), in collaboration with global partners, is leading several flagship initiatives aimed at addressing key environmental challenges in the maritime sector. These initiatives are designed to support developing countries through **capacity building, policy support, technology adoption and implementation frameworks**, ensuring a coordinated global response to sustainability challenges.

Among these, **GloLitter Partnerships, GreenVoyage2050 and GloNoise Partnership** represent critical interventions addressing marine pollution, greenhouse gas emissions and underwater noise respectively.

GloLitter Partnerships - Tackling Marine Plastic Litter

The **GloLitter Partnerships Project** is a global initiative focused on the prevention and reduction of marine plastic litter originating from sea-based sources, particularly from shipping and fisheries sectors.

The project is jointly implemented by the **International Maritime Organization (IMO)** and the **Food and Agriculture Organization (FAO)** and primarily supports developing countries, including Small Island Developing States (SIDS) and Least Developed Countries (LDCs), in strengthening their regulatory and institutional frameworks.

The initiative operates under the broader **OceanLitter Programme**, which serves as a platform for coordinated action against marine litter.

The GloLitter project has a wide global footprint, with **30 participating countries across five regions**, including both Lead Partner Countries and Partner Countries, enabling cross-regional knowledge exchange and implementation of best practices.

Key areas of intervention include:

- Development of National Action Plans (NAPs) for marine litter management
- Strengthening legal, policy and institutional frameworks
- Enhancing Port State Control (PSC) capacity for enforcement of MARPOL Annex V
- Promoting public-private partnerships for waste management solutions
- Supporting capacity building and training programmes

The project has achieved significant progress, with multiple countries, including India, developing **National Action Plans (NAPs)** and strengthening enforcement and compliance mechanisms.

Building on the GloLitter framework, the **RegLitter Project** has been launched as a regional initiative focused on Asia, aimed at advancing implementation at both national and regional levels.

RegLitter includes **seven participating countries** — India, Indonesia, Philippines, Sri Lanka, Thailand, Timor-Leste and Viet Nam — and focuses on strengthening regional cooperation, policy alignment and institutional capacity for tackling marine plastic litter.

A key milestone under RegLitter was the **Regional Task Force (RTF) Workshop held in Kochi, India, from 8–12 December 2025**, where participating countries collaborated to:

- Review progress on national and regional actions
- Share best practices and national experiences
- Strengthen cooperation on research and policy frameworks
- Build capacity for implementation of MARPOL Annex V and related instruments

The workshop also included targeted training programmes, including **Port State Control (PSC) training on ship-generated waste management**, enhancing enforcement capabilities at the operational level.

Overall, GloLitter, along with RegLitter, plays a crucial role in addressing plastic pollution at source, promoting regional cooperation and contributing to cleaner oceans and sustainable maritime operations.

GreenVoyage2050 - Advancing Maritime Decarbonisation

GreenVoyage2050 is IMO's flagship programme supporting developing countries in reducing **greenhouse gas (GHG) emissions from shipping**, aligned with the **IMO 2023 GHG Strategy**.

The programme is being implemented in two phases:

- **Phase 1 (2019–2023):** Focused on developing **policy frameworks, regulatory readiness and pilot project identification**
- **Phase 2 (2024–2030):** Focused on **scaling implementation**, including pilot projects, technology demonstrations and financing mechanisms

The initiative provides comprehensive support to partner countries across multiple areas:

- Development of **national policies and regulatory frameworks**
- Identification and execution of **pilot projects and green corridor initiatives**
- Promotion of **energy efficiency technologies and alternative fuels**
- Facilitation of **access to finance for green maritime technologies**

GreenVoyage2050 acts as a central pillar in IMO's broader GHG reduction efforts, ensuring that developing countries are able to actively participate in the transition towards **low and zero carbon shipping**.

The programme is supported by multiple donor countries including Norway, Denmark, Finland, France, Germany and the Netherlands, highlighting strong international commitment towards maritime decarbonisation.

GloNoise Partnership - Addressing Underwater Radiated Noise

The **GloNoise Partnership** focuses on mitigating the impacts of **underwater radiated noise (URN)** from shipping on marine ecosystems.

Led by IMO in collaboration with **UNDP and GEF**, the project supports the implementation of the **IMO Revised Guidelines for the Reduction of Underwater Noise (MEPC.1/Circ.906/Rev.1)**.

The initiative includes:

- **Nine beneficiary countries**, comprising:
 - **Six Lead Pilot Countries:** Argentina, Chile, Costa Rica, India, South Africa and Trinidad and Tobago
 - **Three Twinning Partner Countries:** Georgia, Madagascar and Malaysia

Key focus areas include:

- **Capacity building and technical training**
- Development of **data and evidence for policy formulation**
- Creation of tools such as the **URN Toolkit (RAINDROP)**
- Support for **national-level implementation of IMO guidelines**

The project aims to reduce underwater noise and its ecological impacts, particularly on marine species that rely on sound for communication, navigation and survival.

India, as a **Lead Pilot Country**, is actively contributing to global efforts through workshops, stakeholder engagement and capacity building initiatives, reinforcing its role in sustainable maritime governance.

Vizhinjam International Seaport – Strategic Role in India’s Transshipment and Maritime Network

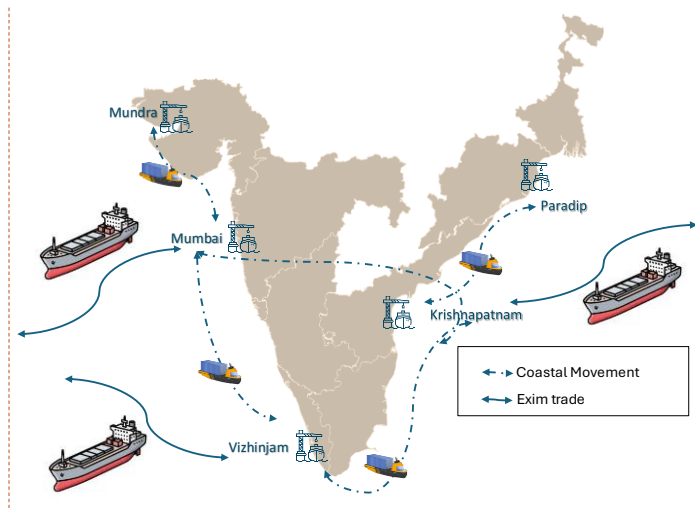


Vizhinjam Port



Vizhinjam Port Highlights

- India's first deep-water container transshipment port, designed to handle ultra-large container vessels naturally.
- Transshipment capacity of 1 million TEUs per annum in Phase-1, scalable to ~5 million TEUs in a phased manner.
- Over 285 ships have docked so far, including some of the world's most fuel-efficient vessels.
- Bigger mother vessels calling deepwater ports like Vizhinjam, Mundra etc. doing only EXIM trade do not require Licence.
- Smaller feeder vessels used for Coastal movements of transshipment & Empty containers requires Licence.
- Long term time charter for a duration of 2 years can be issued for undertaking multiple voyages calling multiple ports.



23

Vizhinjam International Seaport represents a transformational development in India’s maritime infrastructure, marking a strategic shift towards establishing the country as a global transshipment hub. Located at the southern tip of the Indian peninsula in Thiruvananthapuram, the port has been conceptualised as India’s first dedicated deep-water container transshipment port, designed to handle ultra-large container vessels and capture a significant share of global container traffic currently routed through foreign ports.

Strategic Location and Global Connectivity Advantage

One of the most defining features of Vizhinjam Port is its proximity to the international east–west shipping corridor, which connects Europe, the Persian Gulf, Southeast Asia and the Far East. Situated approximately 10 nautical miles from this high-density maritime trade route, the port offers a significant locational advantage by enabling minimal deviation for mainline vessels.

This geographic positioning is critical in the context of global shipping economics, where route efficiency, turnaround time and fuel optimisation are key determinants. Unlike several existing Indian ports, Vizhinjam allows large mother vessels to call directly without requiring substantial diversion, thereby enhancing its attractiveness as a primary transshipment hub.

Natural Depth and Capability to Handle Ultra-Large Vessels

Vizhinjam possesses a natural draft of approximately 24 metres, which significantly reduces the need for capital-intensive and maintenance-heavy dredging operations. This natural depth

enables the port to handle Ultra Large Container Ships (ULCS), including vessels exceeding 24,000 TEU capacity.

The infrastructure has already demonstrated its capability through the handling of some of the world's largest container vessels. The port's breakwater, extending to depths of up to 28 metres, further strengthens its ability to support safe and efficient operations in all weather conditions. This deep-water capability positions Vizhinjam alongside leading global transshipment hubs such as Colombo, Singapore and Jebel Ali.

Capacity Development and Phased Expansion

The development of Vizhinjam Port has been structured in a phased manner to align capacity expansion with demand growth. The first phase provides a transshipment capacity of approximately 1 million TEUs annually, with scalability provisions to expand capacity to around 5 million TEUs in subsequent phases.

The project has involved significant capital investment, with Phase I estimated at approximately ₹8,800 crore, and further expansion phases projected to require investments exceeding ₹20,000 crore. This phased approach ensures both financial viability and operational optimisation as traffic volumes increase over time.

Technological Advancement and Automation

Vizhinjam is India's first automated port, integrating advanced cargo handling systems, digital monitoring frameworks and high-capacity ship-to-shore cranes. The deployment of Super Post-Panamax cranes with extended outreach enables efficient handling of large container vessels, while automation enhances operational efficiency, reduces turnaround time and improves safety.

This technological positioning is important in the context of next-generation port operations, where digitalisation, automation and data-driven systems are becoming essential for competitiveness.

Integration with Domestic Port Network and Transshipment Model

The operational model of Vizhinjam is closely linked to a hub-and-spoke transshipment framework. Large mother vessels are expected to call at Vizhinjam, handling international EXIM cargo without regulatory constraints such as cabotage licensing for direct calls.

Subsequently, smaller feeder vessels facilitate coastal movement of containers to and from other Indian ports such as Mumbai, Mundra, Krishnapatnam and Paradip. These feeder operations, particularly for coastal and empty container repositioning, are subject to licensing requirements, ensuring regulatory oversight within domestic shipping operations.

The introduction of long-term time charter provisions, potentially extending up to two years, provides operational flexibility for shipping lines undertaking multi-port coastal movements. This enables efficient network planning and strengthens integration between transshipment hubs and regional ports.

Reduction of Transshipment Dependence on Foreign Ports

A major strategic objective of Vizhinjam Port is to reduce India's dependence on foreign transshipment hubs such as Colombo, Singapore and Dubai. Currently, a significant proportion of India's container traffic is transshipped through these international ports, leading to higher logistics costs, longer transit times and loss of economic value.

Vizhinjam is expected to capture up to 50 percent of India's transshipment traffic in the long term, thereby retaining cargo within the domestic ecosystem and enhancing India's position in global maritime trade.

Infrastructure Ecosystem and Future Development

The port development includes supporting infrastructure such as breakwater systems, container terminals, and planned rail connectivity, including the construction of a major rail tunnel to integrate the port with the hinterland logistics network. Additionally, provisions for cruise terminals and multi-purpose cargo handling indicate the port's evolution into a comprehensive maritime hub.

The port follows a landlord model, with ownership vested in the Government of Kerala and operations managed by a private concessionaire under a long-term agreement. This structure allows for efficient management, investment flexibility and operational expertise.

Strategic Significance for India's Maritime Sector

Vizhinjam Port is not merely an infrastructure project but a strategic intervention in India's maritime positioning. Its development aligns with broader national objectives under Maritime India Vision 2030 and Maritime Amrit Kaal Vision 2047, particularly in enhancing port efficiency, reducing logistics costs and strengthening global competitiveness.

The port also supports India's long-term decarbonisation and efficiency goals by enabling larger vessels, reducing voyage fragmentation and optimising shipping routes. In doing so, it contributes to both economic and environmental objectives within the maritime sector.

Revocation of General Orders 1, 2 and 3 of 2018 – Analysis and Implications

The proposal for revocation of General Orders 1, 2 and 3 of 2018 represents a significant policy recalibration aimed at strengthening India's shipping ecosystem while maintaining operational efficiency in coastal and transshipment trade. The issue is fundamentally linked to the balance between trade facilitation and protection of national maritime capacity, particularly in the container shipping segment where India's presence remains limited despite the scale of its trade.

Background and Policy Intent

The General Orders issued in 2018 were introduced as facilitative measures to improve the efficiency of maritime logistics and reduce dependence on foreign transshipment hubs. The key objectives included enhancing direct connectivity for India's EXIM cargo, lowering freight costs through increased competition, and promoting coastal movement of commodities including agricultural produce, fisheries-related cargo and fertilisers.

These measures were designed in the context of improving ease of doing business and enabling greater participation of vessels in coastal trade. However, over time, the operational outcomes of the policy diverged from its intended objectives, particularly in terms of strengthening domestic shipping capacity.

Emerging Concerns under the 2018 Regime

Subsequent developments in the sector have highlighted several structural issues arising from the implementation of the 2018 framework.

A key concern has been the decline in Indian-flagged container tonnage. Despite growth in container traffic at Indian ports, the share of cargo carried by Indian vessels has not increased correspondingly. Instead, foreign-flag vessels have captured a significant portion of this traffic, leading to a weakening of the domestic shipping base. At present, the Indian container fleet remains limited in scale, both in terms of vessel count and carrying capacity, which restricts its ability to compete effectively.

The relaxation of licensing requirements effectively diluted the Right of First Refusal mechanism, which had earlier provided Indian operators with a commercial safeguard. This resulted in a shift in cargo preference towards foreign vessels, reducing cargo availability for Indian operators and affecting their competitiveness in coastal and EXIM-linked trades.

Another major concern has been the lack of anticipated reduction in freight rates. While increased competition was expected to lower logistics costs, the actual trend has not reflected this outcome, indicating that the benefits of liberalisation have not fully translated to end users.

Operational challenges have also emerged for Indian coastal operators. Imbalance in cargo flows has led to situations where vessels operate with cargo in one direction but return without

cargo, resulting in inefficient utilisation and increased operational costs. This has adversely affected voyage economics and reduced the viability of coastal shipping operations.

The policy environment has also influenced investment behaviour. Reduced cargo assurance and increased competition from foreign vessels have discouraged Indian shipowners from investing in new vessels. Instead, there has been a greater reliance on short-term chartering arrangements, limiting long-term capacity building in the sector.

In addition, increased reliance on foreign-flag vessels has led to higher outflow of freight payments, resulting in greater foreign exchange expenditure and reduced retention of value within the domestic maritime economy. The cumulative effect of these factors has been a gradual erosion of India's shipping capacity in the container segment.

Rationale for Revocation

The revocation of the General Orders is therefore proposed as a corrective measure to address the unintended consequences of the earlier framework and restore a more balanced competitive environment.

A central element of this recalibration is the reactivation of the Right of First Refusal mechanism. By requiring foreign entities to obtain licences for engaging foreign vessels in coastal trade, Indian shipping companies are provided with an opportunity to participate on equal commercial terms and match competitive rates. This is expected to improve cargo access for Indian operators and strengthen their position in the market.

At the same time, the revised framework continues to allow flexibility for Indian entities to charter vessels without licensing requirements for specified coastal operations. This ensures that trade facilitation is not adversely affected and that operational continuity is maintained.

Expected Benefits and Outcomes

The revocation is expected to generate multiple positive outcomes for the Indian maritime sector.

Firstly, it is likely to improve utilisation of Indian vessels by enabling better access to cargo, including opportunities for carrying transshipment and empty containers on return journeys. This would reduce inefficiencies associated with unidirectional cargo movement and improve overall voyage economics.

Secondly, the policy is expected to support growth in Indian tonnage. With improved cargo visibility and a more stable commercial environment, Indian shipowners are likely to be incentivised to invest in fleet expansion. This would contribute to strengthening national shipping capacity over the medium to long term.

Thirdly, increased deployment of Indian-owned or Indian-chartered vessels would generate employment opportunities for Indian seafarers and support associated shore-based activities. This has broader implications for skill development and capacity building within the maritime sector.

Fourthly, a higher share of cargo carried by Indian vessels would result in greater retention of freight earnings within the country, thereby reducing foreign exchange outflows and strengthening the maritime economy.

Ease of Doing Business and Regulatory Framework

To ensure that the revised regime does not create procedural bottlenecks, a digital licensing and chartering system has been implemented. This platform enables transparent, time-bound processing of applications, with the capability to grant licences within a short turnaround time.

The regulatory distinction between different categories of operations is also clearly maintained. While foreign entities engaging foreign vessels in coastal trade are required to obtain licences, Indian entities retain the flexibility to charter vessels without licensing requirements for permitted activities. This ensures that the policy framework balances regulatory oversight with operational efficiency.

Impact on Transshipment Operations and Vizhinjam Port

The revocation does not affect the core operations of international EXIM trade, particularly in relation to large mother vessels calling at Indian ports. Foreign vessels engaged in international shipping and carrying transshipment cargo or empty containers as part of EXIM trade continue to operate without any additional licensing requirements.

This is particularly relevant for major transshipment hubs such as Vizhinjam Port. The port's operational model is based on the hub-and-spoke system, where large mother vessels handle international cargo and feeder vessels facilitate coastal distribution. The calling of ultra-large container vessels at Vizhinjam remains unaffected under the revised framework.

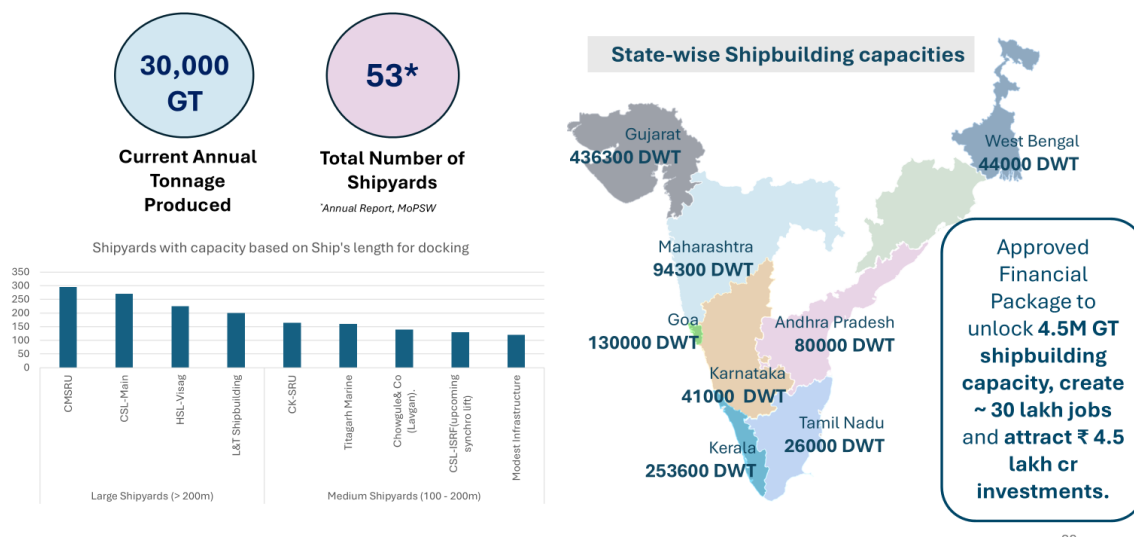
In the feeder segment, vessels chartered by Indian entities for coastal movement of transshipment cargo or empty containers continue to operate without licensing constraints. The licensing requirement applies only in specific cases where foreign entities directly deploy foreign-flag vessels for coastal operations. Given that such instances are relatively limited and supported by a streamlined digital licensing process, the overall impact on transshipment logistics is expected to be minimal.

Thus, the revocation preserves the operational integrity of India's transshipment strategy while introducing a more structured and equitable framework for coastal shipping participation.

Ship Building Sector



Shipbuilding Scenario in India



38

Shipbuilding is a strategic pillar of India's maritime and industrial ecosystem, with far-reaching implications for economic growth, national security and self-reliance. As a mother industry for heavy engineering, shipbuilding drives demand across steel, machinery, electricals, design and advanced manufacturing, creating strong industrial linkages. It is a major generator of direct and indirect employment, supporting a wide spectrum of skilled and semi-skilled jobs.

From a strategic perspective, shipbuilding enables the creation of critical maritime assets required for trade, energy security, defence and coastal connectivity. With India's growing dependence on energy imports and rising seaborne trade, strengthening domestic shipbuilding capacity is essential to reduce reliance on foreign-built vessels, curb foreign exchange outflow and enhance control over national tonnage. Recognising these imperatives, shipbuilding forms a core focus area under the Shipbuilding Pillar, aimed at building resilient, competitive and globally integrated shipbuilding capabilities in India.

Scaling India's Ship Building Capacity for Global Competitiveness

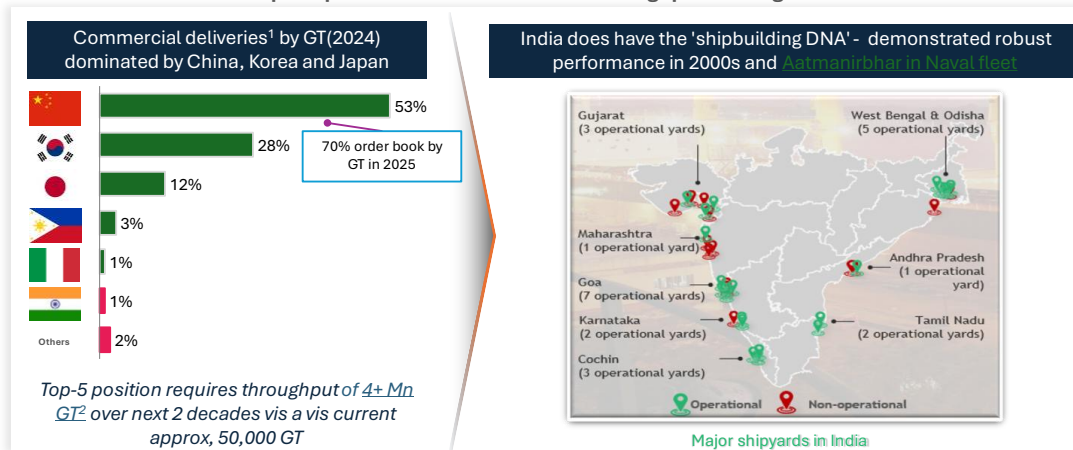


Scaling India's Shipbuilding Capacity for Global Competitiveness



India| 20+ shipyards in India contribute to about 1% of tonnage; India poised well to exploit the shipbuilding super cycle

India secured Top10 spot in 2000s with 300k+ Tn throughput- strong skillsets exist



1. Source: Clarkson's Database, Secondary research
2. Calculated tonnage basis projected SB market growth and current GT throughput of Top -5 nations

19

India's shipbuilding sector is positioned at a critical inflection point, where global demand dynamics, domestic capabilities, and strategic policy direction are converging to create a significant opportunity for expansion. While India currently operates more than 20 shipyards, its contribution to global shipbuilding tonnage remains modest at approximately 1 percent. This is in contrast to its demonstrated capabilities and historical performance, indicating a clear gap between potential and realised output.

Global Shipbuilding Landscape and India's Position

The global shipbuilding industry continues to be heavily concentrated, with China, South Korea and Japan collectively dominating commercial ship deliveries. As of 2024, China accounts for more than half of global gross tonnage deliveries, followed by South Korea and Japan with substantial shares. In comparison, India's share remains limited despite having an established industrial base and a geographically advantageous coastline.

A key indicator of future industry direction is the forward order book, with nearly 70 percent of global shipbuilding orders projected for 2025 already concentrated within the leading shipbuilding nations. This highlights the scale of competitiveness required to enter and sustain a meaningful position in the global market.

India's current throughput is estimated at approximately 50,000 gross tonnage annually. However, to achieve a Top-5 global ranking over the next two decades, the country would need

to scale its production capacity to more than 4 million gross tonnage. This represents not only a quantitative expansion challenge but also a qualitative transformation in terms of technology, efficiency, and industrial ecosystem maturity.

Historical Performance and Existing Capabilities

India's shipbuilding sector has previously demonstrated strong performance, particularly during the early 2000s when throughput levels exceeded 300,000 gross tonnage, enabling the country to secure a position among the top ten global shipbuilding nations. This historical precedent is important as it establishes that the country possesses inherent industrial and technical capabilities required for large-scale shipbuilding.

In addition to commercial shipbuilding, India has successfully developed indigenous capabilities in naval ship construction under the Aatmanirbhar Bharat framework. The performance of domestic shipyards in delivering complex naval platforms reflects the existence of strong engineering expertise, skilled workforce availability and project execution capabilities. These strengths form the foundation of what can be described as India's inherent "shipbuilding DNA."

Geographic Distribution and Infrastructure Base

India's shipbuilding infrastructure is distributed across multiple coastal states, with operational shipyards located in Gujarat, Maharashtra, Goa, Karnataka, Kerala, Tamil Nadu, Andhra Pradesh and along the eastern seaboard in West Bengal and Odisha. This geographically distributed base provides strategic advantages in terms of regional industrial development, access to ports, and proximity to shipping routes.

However, the current distribution also reflects varying levels of capacity utilisation, technological capability, and operational efficiency. While certain clusters such as Gujarat and the western coast have relatively higher activity levels, there remains significant untapped potential across other regions. Strengthening these clusters into integrated shipbuilding ecosystems will be essential for scaling output.

Emerging Opportunity: Global Shipbuilding Supercycle

The global shipbuilding industry is entering a potential supercycle driven by multiple structural factors. These include fleet renewal requirements, transition towards low- and zero-carbon vessels, tightening environmental regulations under the International Maritime Organization framework, and increasing demand for specialised vessels such as LNG carriers, offshore support vessels, and green fuel-ready ships.

For India, this presents a strategic window of opportunity to expand its share in global shipbuilding. The transition to alternative fuels such as hydrogen, ammonia and methanol will require new vessel designs and retrofitting capabilities, areas where late entrants can compete effectively by adopting next-generation technologies rather than legacy systems.

Key Challenges in Scaling Shipbuilding Capacity

Despite the opportunity, several structural challenges need to be addressed for India to scale its shipbuilding capacity effectively:

- Limited global market share and weak integration into international shipbuilding supply chains
- Capacity constraints and relatively low throughput compared to leading nations
- Need for significant capital investment in infrastructure, dry docks and automation
- Gaps in advanced ship design, modular construction techniques and digital shipbuilding capabilities
- Cost competitiveness challenges due to financing, input costs and economies of scale

Strategic Imperative and Way Forward

Scaling India's shipbuilding capacity is not merely an industrial objective but a strategic economic and geopolitical priority. A strong domestic shipbuilding sector supports:

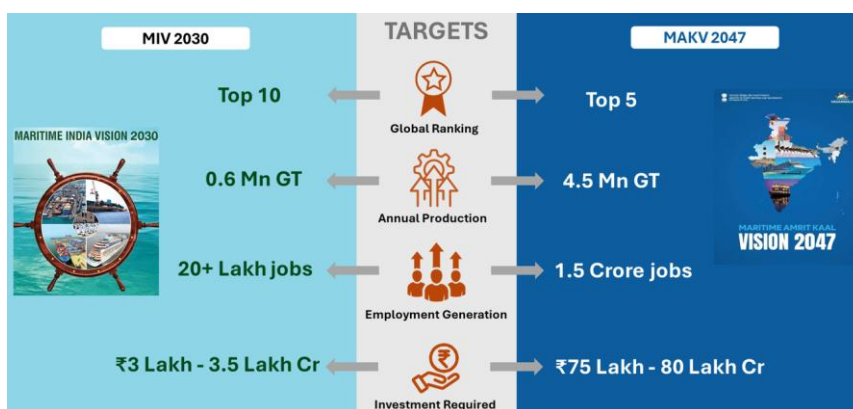
- Reduction in dependence on foreign shipyards
- Strengthening of maritime trade resilience
- Employment generation across manufacturing and allied sectors
- Integration with the broader maritime decarbonisation agenda

To achieve global competitiveness, India must adopt a multi-pronged approach focused on:

- Expanding shipyard capacity and modernising infrastructure
- Developing integrated maritime industrial clusters
- Enhancing access to finance and policy support mechanisms
- Promoting technology adoption, digitalisation and innovation in shipbuilding processes
- Strengthening linkages between shipbuilding, ship repair, and ship recycling ecosystems

National Vision for Shipbuilding: From MIV 2030 to MAKV 2047

India's national vision for shipbuilding is anchored in a long-term, phased transformation of the sector, aligned with the objectives of **Maritime India Vision (MIV) 2030** and **Maritime Amrit Kaal Vision (MAKV) 2047**. This vision recognises shipbuilding as a strategic industry critical to economic growth, industrial deepening, employment generation and maritime self-reliance. The approach envisages a calibrated scale-up of capacity, capability and global competitiveness over the next two decades.



Under **MIV 2030**, India aims to emerge among the **top 10 shipbuilding nations globally**, with an annual shipbuilding production capacity of approximately **0.6 million gross tonnage (GT)**. This phase focuses on laying strong foundations through targeted policy support, development of shipbuilding and ship repair clusters, modernisation of existing shipyards and creation of a robust domestic supply chain for key inputs such as steel, marine equipment and design services. A significant emphasis is placed on skill development, technology adoption and improving ease of doing business to attract both domestic and global players. By 2030, the sector is expected to generate **over 20 lakh direct and indirect jobs**, reflecting its high employment multiplier across manufacturing, logistics and ancillary industries. The estimated investment requirement during this phase is in the range of **₹3 lakh to ₹3.5 lakh crore**, largely driven by infrastructure creation, technology upgradation and capacity expansion.

Building on these foundations, **MAKV 2047** presents a bold and aspirational roadmap aligned with India's centenary of independence. The vision targets positioning India among the **top 5 global shipbuilding nations**, with a quantum leap in annual production capacity to about **4.5 million GT**. This phase envisages India becoming a global hub for construction of large, technologically advanced vessels, including container ships, tankers, gas carriers, cruise vessels and specialised ships. The sector is expected to support employment generation of nearly **1.5 crore jobs**, reflecting the maturation of domestic manufacturing ecosystems, advanced engineering capabilities and export-oriented growth. Achieving this scale will require substantial investments estimated at **₹75 lakh to ₹80 lakh crore**, driven by mega shipbuilding clusters, advanced dry docks, automation, green ship technologies and integrated industrial townships around shipbuilding hubs.

Together, MIV 2030 and MAKV 2047 articulate a clear, outcome-oriented national vision that transitions India from a modest shipbuilding presence to a globally competitive maritime manufacturing powerhouse. This vision underscores the strategic importance of coordinated policy action, Centre–State collaboration, private sector participation and sustained investment to unlock India's full shipbuilding potential.

Strategic Importance of Shipbuilding



Why Shipbuilding is a Strategic Priority



- Maritime carries 95% of India's trade by volume and 70% by value, making fleet and yard capacity a strategic economic issue.
- India currently ranks 16th in shipbuilding with annual production of 0.06 Mn GT, against the MAKV 2047 ambition of 4.5 Mn GT.
- Only 7% of Indian-owned ships are built in India, while a large forex outgo continues for foreign shipping services.
- India already has 60+ shipyards, 8 major shipyards, extensive coastline, ports and waterways — the opportunity is scale, integration and competitiveness.
- The government response is a **structured four-pillar** push combining incentives, finance, capacity creation and reforms.



24

Shipbuilding is fundamentally linked to India's economic growth, trade competitiveness and maritime security. The maritime sector facilitates approximately 95 percent of India's trade by volume and nearly 70 percent by value, making the availability of vessels and shipbuilding capacity a matter of strategic national importance. As India's economy continues to expand and trade volumes increase, the demand for vessels across commercial shipping, coastal shipping, inland waterways and offshore sectors is expected to grow substantially.

Despite being one of the world's largest maritime nations, India's current participation in global shipbuilding remains limited. The country presently ranks around 16th globally in shipbuilding, with an annual production capacity of approximately 0.06 million gross tonnage (GT). In contrast, Maritime Amrit Kaal Vision 2047 envisages increasing annual shipbuilding production to approximately 4.5 million GT and positioning India among the top five shipbuilding nations globally. This significant gap between current capability and future ambition highlights the scale of transformation required within the sector.

Another important consideration is India's continued dependence on foreign-built vessels. At present, only a small proportion of Indian-owned ships are constructed domestically, resulting in substantial foreign exchange outflows through vessel acquisition, chartering and shipping services. Strengthening domestic shipbuilding capabilities can help reduce this dependence, retain economic value within the country and contribute towards greater maritime self-reliance.

India, however, possesses several inherent strengths that provide a strong foundation for growth. The country has an extensive coastline of over 11,000 kilometres, a large network of major and non-major ports, growing inland waterway infrastructure and an established shipbuilding base comprising major public and private shipyards. India also possesses significant engineering talent, a large industrial workforce and demonstrated expertise in the construction of complex naval platforms, indicating the existence of strong underlying technical capabilities.

The challenge therefore is not the absence of capability, but the need to scale production, modernise infrastructure, strengthen domestic supply chains and improve global competitiveness. To address these challenges, the Government has adopted a structured and integrated policy framework centred on four key pillars—financial assistance, maritime financing, capacity development and legal reforms. Together, these interventions aim to create the conditions necessary for sustained growth of the shipbuilding sector and to position India as a major global hub for shipbuilding and maritime manufacturing.

The strategic rationale for strengthening shipbuilding extends beyond economics. A strong domestic shipbuilding sector contributes to national security, supports energy and trade resilience, generates large-scale employment, strengthens ancillary industries and enhances India's ability to participate meaningfully in the emerging global transition towards green and technologically advanced vessels. As the global shipbuilding industry enters a new growth cycle driven by fleet renewal, decarbonisation and evolving trade patterns, India has a unique opportunity to leverage its existing strengths and emerge as a globally competitive shipbuilding nation.

Four Pillar Approach for Strengthening India's Shipbuilding Ecosystem



The Four-Pillar Approach to Boost Shipbuilding



Cabinet approves ₹ 69,725 crore Package to Revitalize India's Shipbuilding and Maritime Sector



Shipbuilding Financial Assistance scheme

Allocation: ₹24,736 crore

Demand support through direct assistance, green vessel incentives and ship recycling credit note



Maritime Development Fund

Allocation: ₹25,000 crore

Enable Long-term capital through equity-style investment and interest incentivisation



Shipbuilding Development Scheme (SbDS)

Allocation: ₹19,989 crore

Cluster creation, yard expansion, capability centres and risk coverage



Legal, Policy and Process Reforms

Structural enablers
RoFR, financing reforms, infrastructure status, age norms and domestic demand visibility

Data Source : PIB Press Release 24 SEP 2025 3:08PM

25

The Government of India has adopted a comprehensive and integrated policy framework to transform the country's shipbuilding sector into a globally competitive maritime manufacturing ecosystem. Recognising that shipbuilding is a capital-intensive, long-gestation industry with strong interlinkages across manufacturing, logistics, trade and national security, the Government has moved beyond isolated interventions and developed a structured Four-Pillar Approach aimed at addressing the sector's financial, institutional, infrastructural and regulatory challenges in a coordinated manner.

This framework, supported by an overall allocation of approximately ₹69,725 crore, represents one of the most significant policy interventions undertaken in the maritime sector. The approach has been designed to simultaneously stimulate demand, improve access to finance, expand production capacity and create an enabling business environment. Together, these pillars seek to address both immediate competitiveness concerns and long-term structural constraints that have historically limited the growth of Indian shipbuilding.

The first pillar, the **Shipbuilding Financial Assistance Scheme (SBFAS)**, focuses on stimulating demand and improving the cost competitiveness of Indian shipyards. Through direct financial assistance, incentives for green vessels and the Ship Recycling Credit Note mechanism, the scheme seeks to bridge the cost disadvantage faced by Indian yards vis-à-vis major global shipbuilding nations. By reducing effective construction costs and incentivising domestic orders, the scheme provides immediate support to shipyards and creates a pipeline of vessel construction activity.

The second pillar, the **Maritime Development Fund (MDF)**, addresses one of the most significant barriers to growth in the shipbuilding industry—access to affordable long-term capital. The MDF introduces dedicated financing mechanisms to support investments in shipbuilding, ship repair, maritime infrastructure and related industries. By improving the availability of patient capital and reducing financing costs, this pillar seeks to attract private investment and facilitate large-scale infrastructure creation.

The third pillar, the **Shipbuilding Development Scheme (SBDS)**, focuses on capacity and capability development. While financial assistance helps generate demand, India must simultaneously develop the physical infrastructure and technological capabilities required to fulfil future orders. SBDS therefore supports greenfield shipbuilding clusters, brownfield expansion of existing shipyards, technology centres, common infrastructure and risk mitigation mechanisms. This pillar is intended to create the industrial backbone necessary for long-term growth.

The fourth pillar comprises **Legal, Policy and Process Reforms**, which aim to create a supportive regulatory environment for maritime investments. These reforms include Right of First Refusal provisions, demand aggregation initiatives, financing reforms, infrastructure status benefits and various measures to improve ease of doing business. The objective is to create a predictable policy environment that supports investment decisions and enhances the competitiveness of Indian shipyards.

What makes this framework particularly significant is the manner in which the four pillars reinforce one another. Financial assistance creates demand; financing mechanisms enable investment; development schemes create capacity; and regulatory reforms improve overall competitiveness. Together, they form a holistic architecture designed to move India from a relatively modest participant in global shipbuilding to a major maritime manufacturing nation.

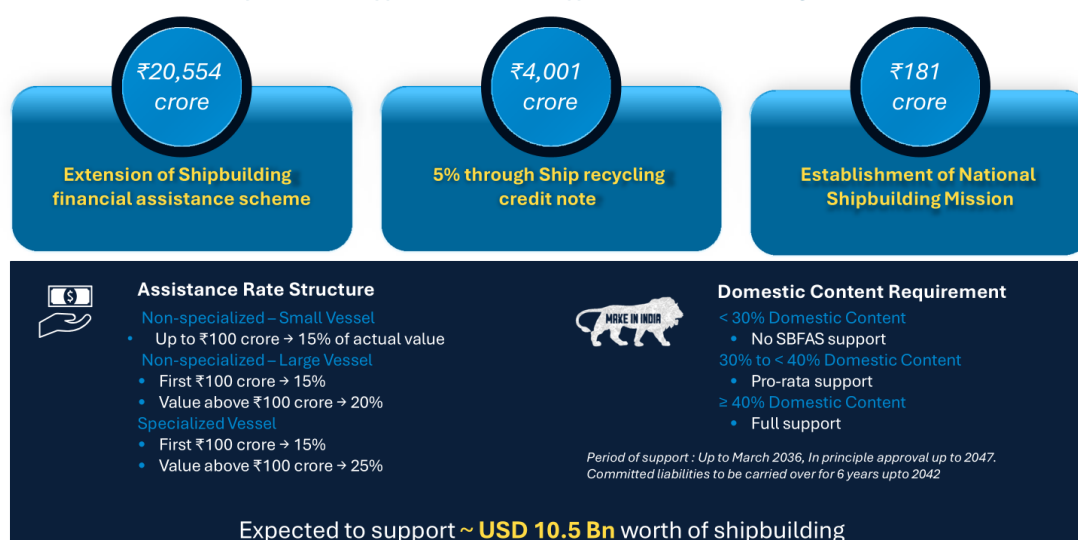
The Four-Pillar Approach is therefore not merely a collection of schemes but a coordinated national strategy aligned with the objectives of Maritime India Vision 2030 and Maritime Amrit Kaal Vision 2047. Its success will determine India's ability to increase domestic vessel construction, generate employment, strengthen industrial capabilities and establish itself as a globally recognised shipbuilding hub.

Pillar I: Shipbuilding Financial Assistance Scheme: Enhancing Competitiveness of Indian Shipyards



Pillar 1: Shipbuilding Financial Assistance Scheme (SBFAS)

Cost competitiveness support linked to vessel type, domestic content and green transition



The Shipbuilding Financial Assistance Scheme (SBFAS) constitutes the cornerstone of India's shipbuilding support architecture and serves as the primary demand-side intervention under the Four-Pillar Framework. With a total allocation of **₹24,736 crore**, the scheme has been designed to address one of the most persistent challenges faced by Indian shipyards—the cost disadvantage relative to global competitors such as China, South Korea and Japan.

Historically, Indian shipyards have struggled to compete internationally due to higher financing costs, fragmented supply chains, lower economies of scale and relatively higher production costs. These factors have limited the ability of Indian yards to secure large commercial orders despite possessing substantial engineering capability and technical expertise. The SBFAS directly addresses these challenges by providing financial assistance linked to vessel construction, thereby reducing the effective cost of shipbuilding within India.

The scheme comprises three key components. The first and largest component is the extension of the Shipbuilding Financial Assistance Scheme itself, supported by an allocation of **₹20,554 crore**. This component provides direct financial support to vessel construction projects undertaken at Indian shipyards. Assistance levels are structured according to vessel type and value, ensuring greater support for technologically advanced and specialised vessels that require higher capital investment and engineering complexity.

The second component is the **Ship Recycling Credit Note mechanism**, supported by an allocation of **₹4,001 crore**. This innovative provision links ship recycling activity with new

shipbuilding demand and creates a circular economy framework within the maritime sector. By connecting end-of-life vessel recycling with fresh vessel construction, the scheme promotes both sustainable recycling and domestic shipbuilding activity.

The third component is the establishment of the **National Shipbuilding Mission**, supported by an allocation of **₹181 crore**. The Mission is intended to provide institutional coordination, monitor implementation and align policy initiatives across stakeholders involved in the shipbuilding ecosystem.

A key feature of the SBFAS is its differentiated assistance structure. Smaller non-specialised vessels receive financial assistance at the rate of 15 percent of actual contract value. Larger vessels receive 15 percent support for the first ₹100 crore of contract value and 20 percent for the value exceeding ₹100 crore. Specialised vessels, which typically involve higher technological complexity, receive assistance of up to 25 percent on contract value exceeding ₹100 crore.

Another important feature is the Domestic Content Requirement framework, which promotes indigenous manufacturing and local value addition. Projects with less than 30 percent domestic content are not eligible for support, while projects achieving 40 percent or more domestic content receive full assistance. This provision creates strong incentives for the development of domestic supplier ecosystems and supports the broader objective of Atmanirbhar Bharat.

Overall, the SBFAS is expected to support approximately **USD 10.5 billion worth of shipbuilding activity**, significantly enhancing the order books of Indian shipyards while strengthening domestic manufacturing and employment generation.

Ship Recycling Credit Note: Linking Recycling to Renewal

The Ship Recycling Credit Note (SRCN) mechanism represents one of the most innovative policy interventions introduced under the Shipbuilding Financial Assistance Scheme. Designed to create a direct linkage between ship recycling and shipbuilding, the mechanism seeks to establish a circular maritime economy in which the retirement of old vessels contributes directly to the construction of new vessels within India.

India is already one of the world's leading ship recycling destinations, with Alang and other recycling facilities possessing significant capacity and expertise. However, until recently, ship recycling and shipbuilding operated as largely independent segments of the maritime industry. The SRCN bridges this gap by creating an incentive structure that rewards responsible recycling while simultaneously generating demand for new vessel construction.

Under the mechanism, shipowners who recycle vessels at Indian recycling yards become eligible to receive a credit note equivalent to **40 percent of the vessel's fair scrap value**. This credit note can subsequently be used to offset the cost of constructing a new vessel at an Indian shipyard. The mechanism effectively converts recycling activity into a financial incentive for fresh shipbuilding investment.



The structure provides several important benefits. First, it encourages shipowners to recycle vessels within India rather than at overseas facilities. Second, it creates a direct incentive for ordering replacement vessels from Indian shipyards. Third, it strengthens domestic maritime value chains by linking two important maritime sectors through a common incentive framework.

An important feature of the SRCN is that the benefit available for new vessel construction is capped at approximately **5 percent of the contract value of the new vessel**, ensuring that assistance remains targeted while still providing meaningful financial support. The credit note remains valid for three years, providing flexibility to shipowners in planning future investments.

Beyond its immediate financial benefits, the SRCN has significant strategic implications for India's maritime development objectives. The mechanism creates a continuous cycle of fleet renewal, whereby ageing vessels are responsibly recycled and replaced by newer, more efficient vessels constructed within India. This supports modernization of the national fleet while simultaneously generating demand for domestic shipyards.

The SRCN also aligns with emerging environmental and sustainability objectives. Global shipping is undergoing a transition towards cleaner, more energy-efficient vessels in response to evolving environmental regulations and decarbonisation targets. By encouraging replacement of older vessels with modern designs, the mechanism supports India's broader maritime sustainability agenda.

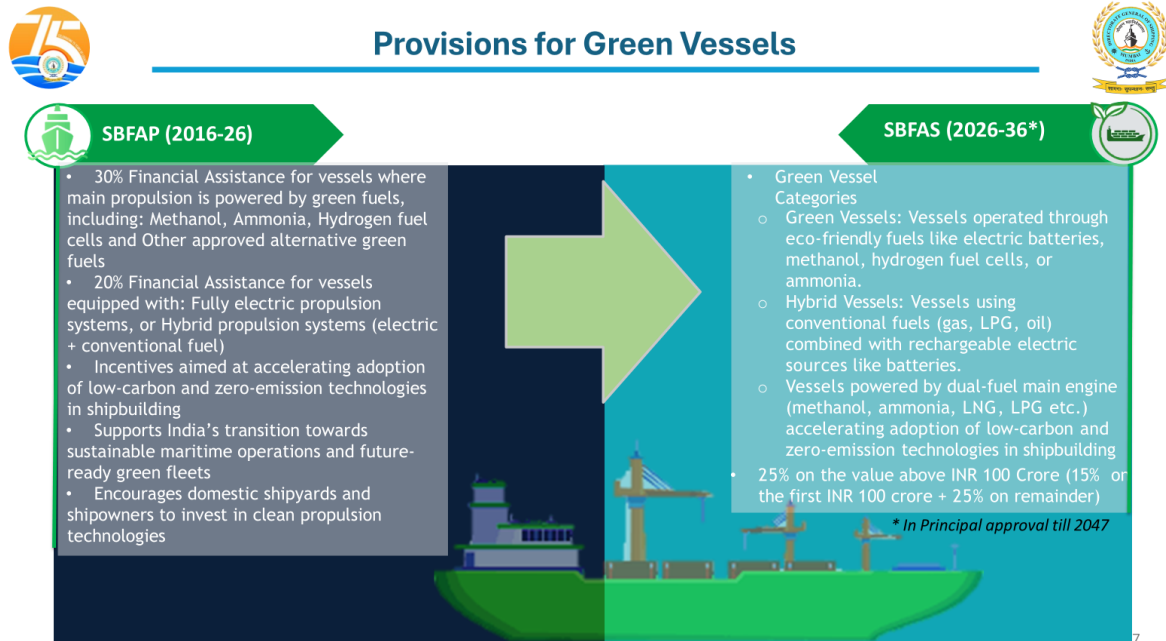
From an industrial perspective, the policy creates additional order visibility for Indian shipyards. Demand visibility is particularly important in shipbuilding because shipyards require long planning horizons, substantial capital investments and continuous order pipelines

to remain competitive. By linking recycling activity with future construction orders, the SRCN contributes to creating a more predictable market environment.

The mechanism also complements other components of the Four-Pillar Framework. Financial assistance under SBFAS improves competitiveness; SBDS creates capacity; MDF improves financing access; and the SRCN strengthens demand generation through fleet renewal. Together, these measures establish a comprehensive ecosystem for shipbuilding growth.

In the long term, the SRCN is expected to strengthen India's position across both shipbuilding and ship recycling segments, enhance domestic value retention, support sustainable maritime practices and contribute towards the broader objective of establishing India as a globally competitive maritime nation. It is therefore not merely an incentive mechanism but a strategic instrument for integrating shipbuilding, ship recycling and maritime sustainability into a unified national development framework.

Accelerating the Transition towards Green Shipbuilding



The maritime industry is undergoing one of the most significant technological transformations in its history. Driven by the International Maritime Organization's decarbonisation agenda, increasingly stringent environmental regulations and global commitments towards achieving net-zero emissions, the future of shipping will be defined by the adoption of cleaner fuels, alternative propulsion systems and energy-efficient vessel designs. Recognising this transition, the Government of India has incorporated dedicated provisions for green vessels within the Shipbuilding Financial Assistance Scheme (SBFAS), thereby positioning sustainability as a central element of India's shipbuilding strategy.

Historically, shipbuilding incentives worldwide focused primarily on enhancing competitiveness and increasing production capacity. However, the emerging global maritime landscape demands that competitiveness be aligned with environmental sustainability. The green vessel provisions under SBFAS seek to ensure that India does not merely expand its shipbuilding capacity but develops capabilities in future-ready vessel technologies that will dominate international markets over the coming decades.

Under the earlier Shipbuilding Financial Assistance Policy (2016–2026), special incentives were introduced for vessels powered by alternative green fuels. Vessels using methanol, ammonia, hydrogen fuel cells and other approved green fuels were eligible for enhanced financial assistance of up to 30 percent. Similarly, vessels employing fully electric propulsion systems or hybrid propulsion configurations received assistance of up to 20 percent. These provisions represented one of the earliest attempts to align India's shipbuilding incentives with emerging global sustainability requirements.

The revised SBFAS framework further strengthens this approach by introducing structured categories of green vessels. Green vessels are defined as ships operating on environmentally sustainable energy sources such as batteries, methanol, hydrogen fuel cells or ammonia. Hybrid vessels combine conventional fuels with rechargeable electric propulsion systems, providing a transitional pathway towards full decarbonisation. In addition, vessels equipped with dual-fuel engines capable of operating on fuels such as methanol, ammonia, LNG or LPG are also recognised within the incentive framework.

A particularly important feature of the revised scheme is the enhanced assistance available for specialised green vessels. By providing higher support rates for technologically advanced vessels, the Government seeks to encourage shipowners and shipyards to invest in clean propulsion technologies despite their higher upfront costs. This approach reduces commercial risk and helps establish a domestic market for green ship construction.

Beyond financial assistance, these provisions create a broader ecosystem effect. Increased demand for green vessels stimulates innovation in ship design, encourages investment in fuel infrastructure and creates opportunities for indigenous development of associated technologies. It also enables Indian shipyards to gain experience in constructing advanced vessels, thereby improving their competitiveness in export markets where environmental performance is becoming an increasingly important procurement criterion.

The green vessel provisions are therefore not merely environmental incentives but strategic industrial policy instruments. They support India's transition towards sustainable maritime operations while simultaneously building technological capabilities that will be essential for long-term competitiveness in global shipbuilding.

Strategic Significance for India's Maritime Future

The introduction of green vessel incentives aligns closely with broader national objectives relating to energy transition, industrial development and climate action. India's maritime sector will inevitably be affected by global regulatory developments, including carbon pricing mechanisms, emissions reporting requirements and fuel transition mandates. Developing domestic capability in green shipbuilding today will help ensure that Indian shipyards remain relevant and competitive in this evolving environment.

Green shipbuilding also presents an opportunity for technological leapfrogging. Unlike traditional shipbuilding leaders whose infrastructure is often built around legacy technologies, India can develop new facilities and capabilities specifically designed for future fuels and advanced vessel technologies. This creates the possibility of entering high-value market segments where technological sophistication is often more important than scale alone.

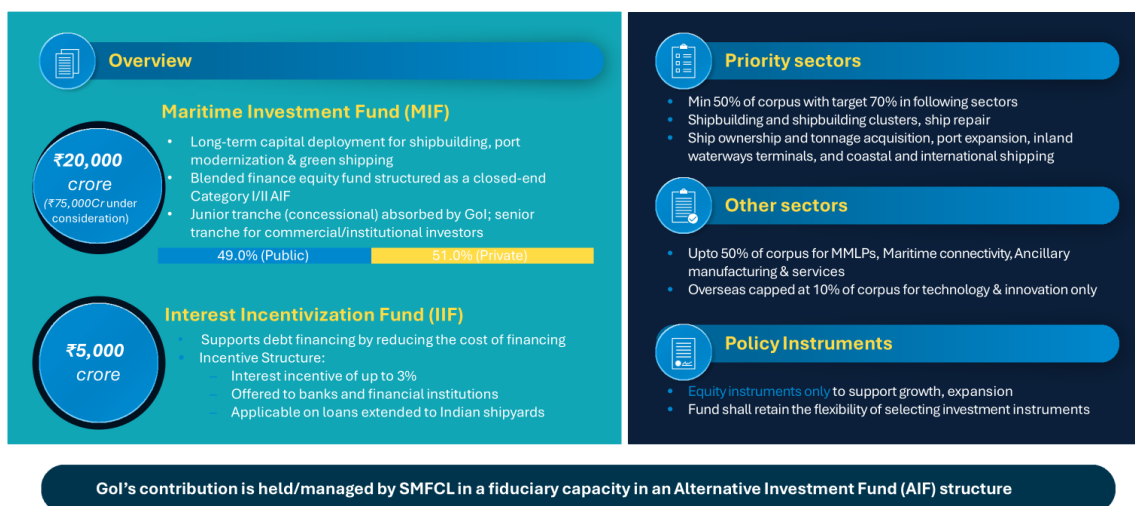
Furthermore, the development of green vessels contributes to the creation of new industrial ecosystems involving fuel producers, equipment manufacturers, research institutions and certification agencies. This broadens the economic impact of shipbuilding and supports the emergence of a more integrated maritime manufacturing base.

In the long term, these provisions will play a critical role in positioning India as a leading producer of sustainable maritime assets, supporting both domestic fleet modernisation and export-oriented growth.

Pillar II – Maritime Development Fund (MDF)



Pillars 2: Maritime Development Fund



28

One of the most significant constraints facing India's shipbuilding industry has historically been limited access to affordable, long-term capital. Shipbuilding projects are characterised by high capital intensity, long construction cycles and significant financing requirements. Unlike many competing nations where dedicated maritime financing institutions support the industry, Indian shipyards have often relied on conventional commercial lending, resulting in higher borrowing costs and reduced competitiveness.

The Maritime Development Fund (MDF) has been conceived as a transformational financing instrument designed to address these structural challenges. With a total allocation of **₹25,000 crore**, the MDF seeks to catalyse investment across shipbuilding, ship repair, maritime infrastructure and associated industries by providing access to patient capital and innovative financing mechanisms.

The MDF consists of two primary components: the Maritime Investment Fund (MIF) and the Interest Incentivisation Fund (IIF). Together, these mechanisms are intended to create a robust financing ecosystem capable of supporting large-scale maritime investments over the coming decades.

Maritime Investment Fund (MIF)

The Maritime Investment Fund represents the largest component of the MDF, with an allocation of **₹20,000 crore**, and a potential future expansion to approximately ₹75,000 crore under consideration. The MIF has been structured as a blended-finance investment vehicle designed to attract both public and private capital.

Unlike conventional subsidy schemes, the MIF operates primarily through equity-style investments. This approach allows the fund to participate directly in growth and expansion

opportunities while sharing risk with private investors. The fund is structured as a Category I/II Alternative Investment Fund (AIF), providing flexibility in investment deployment and enabling participation from institutional investors.

The blended finance structure is particularly important because it combines concessional public funding with commercial investment capital. Government participation helps reduce investment risk while simultaneously attracting private-sector participation. This model has been successfully used internationally to support infrastructure development and industrial expansion.

Priority sectors under the MIF include shipbuilding, ship repair, maritime clusters, vessel ownership, inland waterway infrastructure, port development and maritime connectivity projects. By supporting investments across the maritime value chain, the fund seeks to create integrated ecosystem development rather than isolated industrial growth.

Interest Incentivisation Fund (IIF)

The second component of the MDF is the Interest Incentivisation Fund, supported by an allocation of **₹5,000 crore**. While the MIF focuses on equity participation, the IIF addresses the cost of debt financing.

Shipbuilding projects frequently require large volumes of borrowed capital. High interest rates significantly increase project costs and can make Indian shipyards less competitive relative to international counterparts operating in lower-cost financing environments. The IIF directly addresses this issue by providing interest incentives of up to 3 percent on eligible loans extended by banks and financial institutions.

This intervention effectively reduces borrowing costs for shipyards, making expansion projects, technology upgrades and infrastructure investments more financially viable. By improving project economics, the IIF encourages both new investments and modernisation of existing facilities.

Strategic Importance of the MDF

The significance of the Maritime Development Fund extends beyond its financial allocation. The fund represents a shift in policy thinking from direct subsidy-based support towards the creation of long-term financial institutions capable of sustaining industry growth.

The MDF is expected to support investments in shipbuilding infrastructure, green shipping technologies, maritime industrial clusters, vessel acquisition and advanced manufacturing capabilities. By reducing financing barriers, the fund creates conditions necessary for large-scale capacity creation and technological modernisation.

The fund is also expected to support investments in emerging sectors such as alternative fuel infrastructure, digital shipbuilding technologies, automation and advanced marine equipment manufacturing. These investments will be critical in ensuring that India's shipbuilding sector remains aligned with future industry requirements.

Furthermore, the MDF contributes to broader economic objectives by mobilising private capital, strengthening financial market participation in maritime investments and creating long-term funding pathways for infrastructure development.

Long-Term Economic Impact

The establishment of the Maritime Development Fund has implications extending well beyond shipbuilding. Improved access to capital will support employment generation, industrial expansion, technology adoption and regional development. Maritime clusters supported through MDF investments are expected to create substantial economic multiplier effects through supplier networks, logistics activities and ancillary manufacturing.

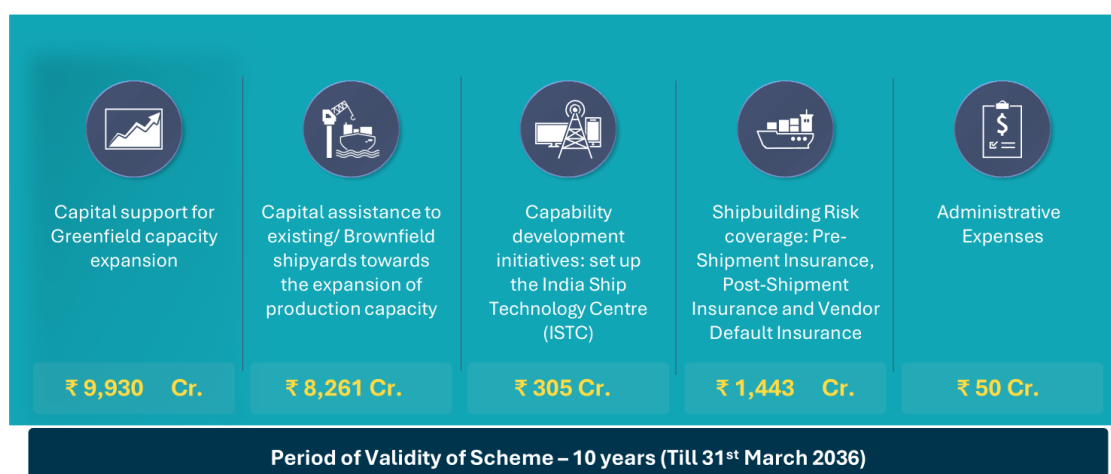
The fund also strengthens India's ability to compete globally by ensuring that financing availability does not become a limiting factor in industrial growth. In this respect, the MDF functions as both a development instrument and a strategic competitiveness tool.

Ultimately, the Maritime Development Fund provides the financial foundation upon which India's broader maritime ambitions can be realised. Without adequate financing mechanisms, capacity expansion and technological advancement would remain constrained. The MDF therefore serves as the critical financial backbone of India's shipbuilding transformation strategy.

Pillar III – Shipbuilding Development Scheme (SBDS) - Building Capacity and Capability for Global Competitiveness



Pillars 3: Shipbuilding Development Scheme



29

While financial incentives and access to capital are essential for stimulating demand and investment, they must be accompanied by corresponding expansion of physical infrastructure and technical capability. The Shipbuilding Development Scheme (SBDS) addresses this requirement by focusing on capacity creation, technological advancement and risk mitigation within India's shipbuilding ecosystem.

With a total allocation of **₹19,989 crore**, SBDS represents the principal supply-side intervention under the Four-Pillar Framework. The scheme seeks to create the infrastructure, institutional capability and industrial ecosystem necessary to support large-scale growth in shipbuilding activity.

A major component of SBDS is support for **greenfield shipbuilding capacity expansion**, with an allocation of ₹9,930 crore. This component aims to facilitate the creation of new shipbuilding facilities and maritime industrial clusters capable of competing at international scale. Greenfield development is particularly important because it allows the creation of modern facilities incorporating advanced technologies, efficient layouts and future-ready infrastructure.

Complementing this is support for **brownfield expansion**, supported by an allocation of ₹8,261 crore. Brownfield investments enable existing shipyards to modernise infrastructure, increase production capacity and adopt new technologies. This approach allows India to leverage existing industrial assets while simultaneously improving competitiveness.

A third major component is the establishment of the **India Ship Technology Centre (ISTC)**, supported by ₹305 crore. The ISTC is envisioned as a national centre of excellence for ship design, engineering, research and technology development. The centre will support innovation, standardisation and capability enhancement across the industry.

The scheme also includes **Shipbuilding Risk Coverage**, supported by ₹1,443 crore. This mechanism provides insurance coverage for pre-shipment, post-shipment and vendor default risks. Risk mitigation is particularly important in shipbuilding because projects often involve large contract values and long delivery periods.

Technology Development and Industrial Modernisation

One of the central objectives of SBDS is to enable technological upgrading across Indian shipyards. Global shipbuilding competitiveness increasingly depends on digitalisation, automation, modular construction techniques and advanced engineering processes. Indian shipyards must adopt these technologies to compete effectively with international counterparts.

The scheme therefore supports investments in advanced fabrication facilities, automation systems, digital shipbuilding technologies and modern production methodologies. Such investments will improve productivity, reduce construction timelines and enhance quality assurance.

The ISTC is expected to play a pivotal role in supporting these efforts by serving as a national platform for research, design and technology development. The centre will facilitate collaboration between industry, academia and government institutions while supporting indigenous innovation.

Strategic Role in Maritime Industrial Development

Beyond individual shipyards, SBDS contributes to broader industrial development objectives. Investments supported under the scheme will strengthen supplier ecosystems, create opportunities for MSMEs and encourage localisation of marine equipment manufacturing.

The scheme also promotes integration between shipbuilding, ship repair and ship recycling activities, creating a more cohesive maritime industrial ecosystem. This integrated approach is expected to improve resource utilisation, strengthen domestic value chains and support sustainable growth.

Ultimately, SBDS represents the industrial development pillar of India's shipbuilding strategy. By creating physical infrastructure, strengthening technological capability and reducing operational risks, the scheme provides the foundation necessary for long-term industry expansion.

Cluster-Based Approach



Cluster Based Approach Critical To Unlock Scale Economies



A cluster-based approach makes an attractive proposition for both the shipyards as well as the ancillaries as it will allow for efficient utilization of common assets and connectivity infrastructure



30

The cluster-based approach represents one of the most important strategic interventions within India's shipbuilding development framework. Rather than promoting isolated shipyards operating independently, the cluster model seeks to create integrated maritime industrial ecosystems where shipyards, suppliers, infrastructure providers and service organisations operate in close proximity and benefit from shared resources.

This approach is based on international experience, particularly from successful shipbuilding nations such as South Korea, where integrated clusters have enabled extraordinary gains in productivity, efficiency and competitiveness.

A maritime cluster typically consists of an anchor shipyard supported by a network of Tier 1, Tier 2 and Tier 3 suppliers, common infrastructure facilities, logistics systems, testing centres, training institutions and supporting social infrastructure. The objective is to create a self-sustaining ecosystem capable of supporting large-scale shipbuilding activity.

One of the primary advantages of clustering is efficient utilisation of high-cost maritime infrastructure. Facilities such as breakwaters, dredged channels, heavy-lift cranes, testing centres and dry docks require substantial investment and are often underutilised when developed for standalone projects. Shared utilisation significantly improves economic viability.

Scale Economies and Ecosystem Development

Clusters also facilitate development of strong supplier ecosystems. The proximity of equipment manufacturers, fabrication facilities and service providers reduces logistics costs, shortens lead times and improves coordination throughout the production process.

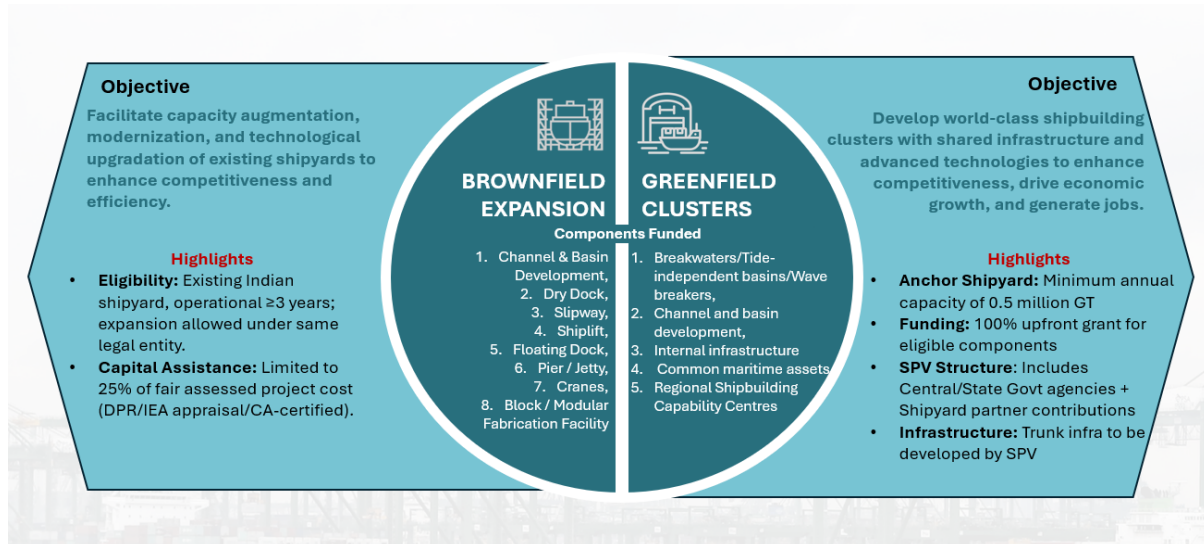
Another important advantage is the concentration of skilled manpower. Training centres, design facilities and technical institutions can serve multiple stakeholders simultaneously, creating a larger pool of specialised talent and supporting continuous skill development.

The cluster model also enables phased expansion. As demand grows, additional shipyards, suppliers and facilities can be incorporated into the cluster without requiring entirely new support infrastructure. This flexibility allows capacity growth to occur more efficiently and at lower cost.

From a governance perspective, clusters encourage collaboration between central and state governments, private investors and industry stakeholders. Shared planning and coordinated implementation improve infrastructure delivery and enhance investment attractiveness.

Ultimately, the cluster-based approach is critical for achieving the scale required under Maritime India Vision 2030 and Maritime Amrit Kaal Vision 2047. By combining infrastructure, industry, skills and innovation within integrated ecosystems, maritime clusters provide the most effective pathway for transforming India into a globally competitive shipbuilding nation.

Greenfield and Brownfield Expansion under the Shipbuilding Development Scheme (SBDS)



Introduction: Creating the Infrastructure Backbone for India's Shipbuilding Growth

The Shipbuilding Development Scheme (SBDS) has been designed as the principal capacity-building instrument under India's broader shipbuilding strategy. While financial assistance under the Shipbuilding Financial Assistance Scheme (SBFAS) seeks to stimulate demand and the Maritime Development Fund (MDF) addresses financing constraints, SBDS focuses on the creation and expansion of physical infrastructure required to support long-term growth of the shipbuilding sector.

A central feature of SBDS is its dual-track approach to capacity creation through **Greenfield Shipbuilding Clusters** and **Brownfield Shipyard Expansion**. This framework recognises that India must simultaneously create new world-class shipbuilding ecosystems while modernising and expanding existing shipyard infrastructure. The combination of these two approaches ensures balanced development across the sector and allows India to rapidly increase capacity while building a foundation for long-term global competitiveness.

The scheme is aligned with the objectives of Maritime India Vision 2030 and Maritime Amrit Kaal Vision 2047, which envisage India emerging as one of the world's leading shipbuilding nations. Achieving these ambitions requires large-scale infrastructure creation, development of integrated industrial ecosystems, adoption of advanced technologies and substantial investments in both new and existing shipbuilding facilities.

Part I: Greenfield Shipbuilding Clusters

Rationale for Greenfield Development

Greenfield shipbuilding clusters represent the most transformative element of the Shipbuilding Development Scheme. Unlike conventional shipyard projects, greenfield clusters are envisioned as integrated maritime industrial ecosystems combining shipbuilding facilities, ancillary industries, logistics infrastructure, common maritime assets, testing facilities, design centres and social infrastructure within a single development framework.

The rationale behind this approach is based on global experience. Major shipbuilding nations such as South Korea, China and Japan have achieved competitiveness not through isolated shipyards but through integrated clusters that allow economies of scale, efficient infrastructure utilisation and close coordination between shipyards and suppliers.

India's future shipbuilding growth cannot be supported solely through incremental expansion of existing facilities. To achieve the scale required under MAKV 2047, entirely new shipbuilding ecosystems capable of handling large commercial vessels and specialised ships must be established.

Greenfield clusters therefore serve as long-term strategic assets designed to anchor industrial development, attract private investment and create globally competitive shipbuilding hubs.

Eligible Infrastructure under Greenfield Development

A unique feature of the Greenfield component is the provision of **100% upfront grant support** for eligible common infrastructure. This significantly reduces investment barriers and improves project viability.

The scheme identifies five major categories of eligible infrastructure:

1. Breakwaters and Tide-Independent Basins

Development of breakwaters, wave breakers and tide-independent basins forms the foundation of maritime infrastructure. These facilities provide safe operating conditions, improve navigability and ensure year-round shipyard operations regardless of weather and tidal variations.

2. Channel and Basin Development

Support is available for capital dredging, land reclamation, area grading and development of turning basins. These investments create navigational access for large vessels and establish the marine infrastructure necessary for commercial shipbuilding operations.

3. Regional Shipbuilding Capability Development Centres

The scheme supports creation of regional centres focused on:

- Ship design and engineering
- Skill development

- Research and development
- Green shipbuilding technologies
- Testing and certification facilities

These centres are intended to create a continuous pipeline of skilled manpower and technological innovation.

4. Common Maritime Assets

Shared maritime assets improve operational efficiency and reduce duplication of investment.

Eligible assets include:

- Barges
- Heavy lift vessels
- Floating cranes
- Pontoons
- Tugs
- Auxiliary marine support craft

These assets must be registered under the Special Purpose Vehicle (SPV) and utilised collectively by cluster participants.

5. Internal Infrastructure and Utilities

This includes:

- Site preparation
- Internal roads
- Rail connectivity
- Power distribution
- Water supply
- Drainage systems
- Communication infrastructure
- Firefighting systems
- Waste treatment facilities

Together these elements create a fully functional industrial ecosystem rather than merely a shipyard facility.

Social Infrastructure and Worker Ecosystem

Recognising that shipbuilding is labour-intensive, the scheme also supports development of social infrastructure.

Eligible facilities include:

- Worker accommodation
- Welfare facilities
- Medical centres
- Parks and recreational facilities
- Training institutions
- Civic infrastructure

This approach reflects international best practices where industrial clusters are planned as integrated economic zones capable of supporting large workforces.

Eligibility Criteria for Greenfield Shipbuilding Clusters

The Greenfield framework incorporates detailed eligibility requirements to ensure viability and scale.

Cluster Capacity Requirements

Each cluster must have:

- Capacity of approximately 1.2 million GT per annum
- Minimum waterfront of approximately 2 kilometres
- Around 1,000 acres for shipyard operations
- Around 1,000 acres for ancillary industries

These requirements ensure sufficient scale to attract major shipbuilding investments.

Anchor Shipyard Requirements

Each cluster must include at least one anchor shipyard with:

- Design capacity of at least 0.5 million GT annually
- Commitment to achieve capacity targets within ten years
- Binding undertaking preventing diversion of assets for non-shipbuilding purposes

Anchor shipyards serve as demand generators and technology leaders for the cluster ecosystem.

SPV Structure

Development is undertaken through a Special Purpose Vehicle (SPV) involving:

- Central Government entity

- State Government entity
- Private sector participation

The SPV operates as the cluster developer, manages common infrastructure and ensures long-term governance.

The scheme also provides flexibility for Central Government entities willing to independently establish shipbuilding clusters.

Strategic Importance of Greenfield Clusters

Greenfield clusters are expected to:

- Create large-scale shipbuilding capacity
- Support localisation of marine equipment manufacturing
- Generate substantial employment
- Attract global shipbuilding investments
- Promote technology transfer
- Strengthen export competitiveness
- Accelerate maritime industrialisation

For coastal states, these clusters represent transformational economic opportunities capable of creating new industrial growth centres and supporting port-led development.

Part II: Brownfield Expansion of Existing Shipyards

Rationale for Brownfield Expansion

While greenfield clusters focus on future capacity creation, brownfield expansion aims to unlock the potential of existing shipyards.

India already possesses several public and private shipyards with established infrastructure, skilled manpower and operational experience. However, many of these facilities require modernisation, technology upgrades and capacity expansion to remain competitive.

Brownfield support therefore seeks to:

- Improve productivity
- Increase throughput

- Modernise infrastructure
- Introduce advanced technologies
- Enable construction of larger and more complex vessels

This approach provides a faster pathway to capacity enhancement than creating entirely new facilities.

Capital Assistance Framework

Under the Brownfield component, eligible shipyards can receive capital assistance of up to **25% of the fair assessed project cost**.

The assistance is intended to support investments that directly improve shipbuilding capability.

Projects must be based on:

- Detailed Project Reports (DPRs)
- Independent Evaluation Agency (IEA) assessments
- Chartered Accountant certified costs

The scheme limits assistance to a maximum of **₹1,500 crore per shipyard**, ensuring broad-based utilisation of available resources.

Eligibility Requirements

To qualify for support, shipyards must:

- Be operational for at least three years
- Operate under the same legal entity undertaking expansion
- Submit statutory and environmental clearances
- Complete projects within six years of approval

In addition, shipyards must possess at least three of the following five qualifying assets:

- Waterfront
- Dry berthing facilities
- Wet berthing facilities
- Fabrication facilities
- Material handling facilities

These criteria ensure that support is directed towards established shipbuilding facilities with demonstrated operational capability.

Eligible Categories for Brownfield Expansion

The scheme identifies ten categories of eligible investments.

Core Infrastructure

1. Channel and Basin Development
2. Dry Docks
3. Slipways
4. Shiplifts
5. Floating Docks

These facilities directly increase vessel handling and construction capacity.

Production Facilities

1. Piers and Jetties
2. Heavy Cranes
3. Block and Modular Fabrication Facilities

These investments improve productivity, material movement and modular construction capability.

Technology Upgradation

1. Automation and Digitalisation Systems

Support is available for:

- Process automation
- Digital manufacturing
- Smart yard systems
- Sensors and control systems
- Software platforms

This aligns Indian shipyards with global Industry 4.0 practices.

Flexible Category

1. Any Other Strategic Infrastructure

Additional facilities may be considered on a case-by-case basis subject to approval.

Strategic Importance of Brownfield Modernisation

Brownfield expansion offers several advantages:

- Faster implementation compared to greenfield projects

- Utilisation of existing industrial assets
- Lower execution risk
- Immediate productivity improvements
- Retention of skilled workforce
- Reduced capital requirements

By modernising existing facilities, India can rapidly increase shipbuilding throughput while simultaneously developing new greenfield capacity.

Integrated Impact of Greenfield and Brownfield Development

Together, the Greenfield and Brownfield components create a comprehensive capacity-building framework.

Greenfield clusters establish the future industrial architecture required for large-scale growth, while brownfield projects unlock the potential of existing infrastructure and accelerate near-term capacity enhancement.

The combined approach supports:

- Capacity expansion
- Technology adoption
- Employment generation
- Supplier ecosystem development
- Regional industrial growth
- Global competitiveness

Most importantly, it creates the physical infrastructure foundation necessary to support India's ambition of becoming a Top-5 global shipbuilding nation under Maritime Amrit Kaal Vision 2047.

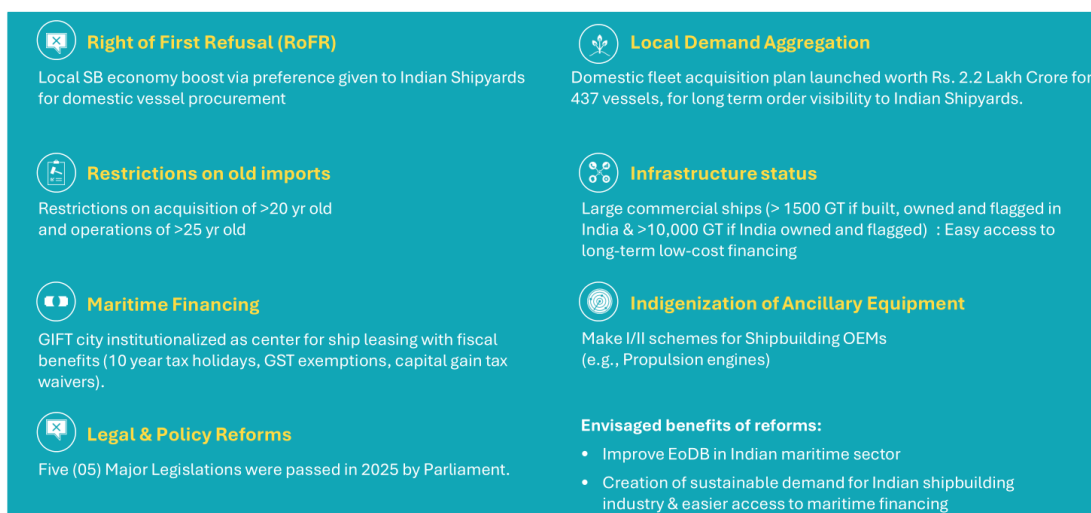
The Greenfield–Brownfield strategy therefore represents one of the most significant infrastructure development initiatives undertaken in India's maritime sector and forms the cornerstone of the country's long-term shipbuilding transformation agenda.

Pillar IV: Legal, Policy and Process Reforms



Pillar 4: Legal, Policy And Process Reforms

Structural changes to improve ease of doing business and create sustained order visibility



31

Creating the Enabling Environment for Shipbuilding Growth

While financial assistance, access to capital and infrastructure development are essential for shipbuilding expansion, their effectiveness depends significantly on the regulatory and policy environment within which the industry operates. Recognising this, the Government of India has introduced a comprehensive set of legal, policy and process reforms as the fourth pillar of its shipbuilding strategy. These reforms are intended to address long-standing structural barriers, improve ease of doing business, create sustained demand visibility and enhance the competitiveness of Indian shipyards.

Historically, Indian shipbuilding has faced challenges arising from fragmented regulatory processes, limited financing access, demand uncertainty and competitive disadvantages relative to global shipbuilding nations. The reforms under Pillar IV seek to systematically address these issues by creating a more predictable, transparent and investor-friendly ecosystem.

A key intervention under this pillar is the introduction of the **Right of First Refusal (RoFR)** framework. The RoFR provides Indian shipyards with a preferential opportunity to match bids in domestic vessel procurement programmes. This measure aims to strengthen domestic order books and ensure that a greater proportion of vessel construction demand generated within India is serviced by Indian shipyards. By creating a more stable domestic market, RoFR improves investment confidence and encourages capacity expansion.

Another important reform relates to restrictions on the acquisition and operation of ageing vessels. The policy restricts acquisition of vessels older than 20 years and operation of vessels

older than 25 years. These age norms are intended to improve fleet quality, promote vessel modernisation and generate replacement demand for new vessels. The resulting demand visibility is expected to benefit domestic shipyards while simultaneously improving safety and environmental performance.

Maritime Financing and Demand Aggregation

A significant structural challenge in the maritime sector has been limited access to globally competitive financing. To address this issue, the Government has strengthened the role of **GIFT City** as a centre for maritime financing, ship leasing and financial services. Fiscal incentives including tax holidays, GST exemptions and capital gains tax benefits have been introduced to attract maritime investments and reduce financing costs.

The development of a robust maritime financing ecosystem is expected to support vessel acquisition, fleet expansion and infrastructure investments while improving the overall attractiveness of the Indian maritime sector. The reforms also complement the Maritime Development Fund by creating additional channels for long-term capital mobilisation.

Another transformative intervention is the **Local Demand Aggregation Programme**, under which a domestic fleet acquisition plan worth approximately ₹2.2 lakh crore has been announced. This programme covers around 437 vessels and is intended to provide long-term order visibility to Indian shipyards. Demand aggregation addresses one of the most significant constraints faced by shipbuilders—the absence of predictable order pipelines. By consolidating future vessel requirements and communicating them to the industry, the Government enables shipyards to undertake long-term investment planning.

The reforms also provide **Infrastructure Status** benefits for eligible vessels. Large commercial ships built, owned and flagged in India gain access to long-term financing on more favourable terms. This improves project economics and enhances the competitiveness of domestic shipbuilding projects.

Long-Term Impact of the Reform Agenda

The legal and policy reforms are designed to function as structural enablers supporting the other three pillars of the shipbuilding strategy. Financial assistance becomes more effective when supported by stable demand; financing mechanisms perform better within an investor-friendly environment; and infrastructure development generates greater returns when supported by clear policy direction.

Collectively, these reforms are expected to improve ease of doing business, attract private investment, strengthen domestic demand, improve financing access and create a more competitive shipbuilding ecosystem. The reforms also support broader objectives such as maritime self-reliance, industrial growth and integration into global maritime value chains.

Ultimately, Pillar IV provides the governance framework necessary for the successful implementation of India's shipbuilding transformation agenda and serves as the institutional foundation upon which long-term sectoral growth will be built.

Indigenization of Shipbuilding Equipment and Components



Indigenization Of Shipbuilding Equipment And Components

From financial assistance to a deeper domestic manufacturing ecosystem



- DGS is actively supporting indigenization by providing technical inputs, prioritization frameworks and policy alignment to promote domestic manufacturing of shipbuilding equipment and components across the value chain..
- DGS is facilitating engagement with shipyards and industry stakeholders to identify critical equipment gaps and enable structured development of local supplier capabilities in line with national shipbuilding priorities.
- IRS can collaborate with DGS to establish standardized technical specifications and certification frameworks for indigenous manufacturers, ensuring quality, reliability and alignment with global class requirements.
- IRS can support evaluation, approval and classification of indigenized components, enabling faster acceptance and integration into shipbuilding projects while enhancing credibility of domestic products.
- DGS and IRS can jointly drive capacity-building initiatives for MSMEs and component manufacturers through technical guidance, certification readiness and ecosystem integration to accelerate self-reliance in shipbuilding.



Building a Domestic Maritime Manufacturing Ecosystem

A globally competitive shipbuilding industry cannot be sustained solely through the existence of shipyards. Long-term competitiveness depends equally on the strength of the domestic supplier ecosystem, including manufacturers of marine equipment, propulsion systems, electrical systems, navigation equipment, steel structures and specialised ship components. Recognising this reality, indigenization of shipbuilding equipment and components has emerged as a strategic priority within India's shipbuilding development agenda.

Currently, a substantial proportion of high-value shipbuilding equipment continues to be imported. While Indian shipyards possess significant construction capability, dependence on imported marine equipment increases project costs, extends procurement timelines and creates exposure to external supply chain disruptions. Indigenization seeks to address these vulnerabilities by promoting domestic manufacturing capabilities across the maritime value chain.

The Government's shipbuilding strategy incorporates multiple measures to encourage localisation. The Domestic Content Requirement under SBFAS directly incentivises use of indigenous equipment and components. Similarly, cluster-based development under SBDS

aims to create supplier ecosystems around shipyards, enabling closer integration between manufacturers and vessel builders.

The objective is not merely import substitution but the creation of a technologically capable and globally competitive marine manufacturing sector capable of serving both domestic and export markets.

Role of DGS in Promoting Indigenization

The Directorate General of Maritime Administration plays an important facilitative role in advancing indigenization initiatives. DGS engages with shipyards, equipment manufacturers, industry associations and policymakers to identify critical equipment categories where domestic capability development is required.

These engagements support development of prioritisation frameworks that identify strategic equipment categories with high import dependence and strong localisation potential. Areas such as propulsion systems, marine machinery, deck equipment, electrical systems and specialised vessel components are increasingly being examined for domestic manufacturing opportunities.

DGS also supports policy alignment and ecosystem development by ensuring that shipbuilding schemes, cluster initiatives and supplier development programmes reinforce localisation objectives. Through stakeholder consultations, the Directorate helps identify regulatory barriers and opportunities for accelerating domestic capability creation.

The broader objective is to establish an integrated maritime manufacturing ecosystem where shipyards and equipment manufacturers evolve together, creating greater domestic value addition and strengthening industrial resilience.

Potential Role of IRS and Future Outlook

The Indian Register of Shipping can play a critical role in accelerating indigenization by providing technical validation, certification and classification support. One of the major challenges faced by indigenous manufacturers is demonstrating compliance with international standards and achieving acceptance among shipyards and vessel owners.

IRS can support development of standardised technical specifications, certification frameworks and approval processes for indigenous marine equipment. Such frameworks improve confidence among buyers and facilitate integration of locally manufactured products into shipbuilding projects.

Another important area of collaboration is component testing and classification. IRS involvement can help ensure that indigenous products meet global performance and safety standards, thereby enhancing their competitiveness in both domestic and international markets.

Capacity-building initiatives involving DGS and IRS can further support MSMEs and component manufacturers through training, technical guidance and certification readiness programmes. Such interventions are particularly important because many potential suppliers

possess manufacturing capability but require support in navigating maritime certification and classification requirements.

In the long term, successful indigenization will reduce import dependence, strengthen supply chain resilience, increase domestic value addition and create new manufacturing opportunities. It will also contribute significantly to India's broader objectives under Atmanirbhar Bharat while supporting the emergence of a globally competitive maritime industrial ecosystem.

Comprehensive Shipbuilding Portal

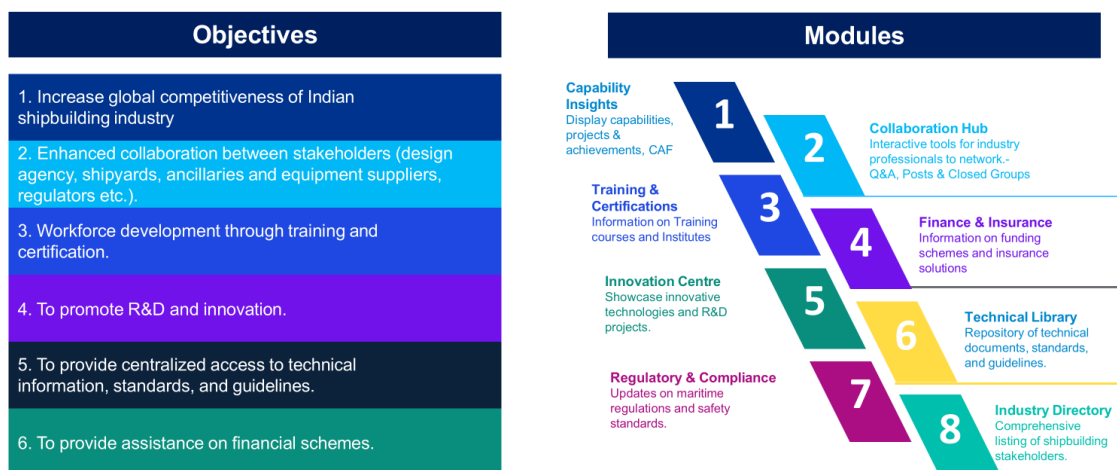


The Comprehensive Shipbuilding Portal



Vision

Establish a state-of-the-art portal as a central hub for information, collaboration, and innovation in Indian shipbuilding and repair industry



33

Digital Backbone of India's Shipbuilding Ecosystem

As India seeks to transform its shipbuilding sector into a globally competitive maritime manufacturing industry, the need for a modern digital ecosystem has become increasingly important. The Comprehensive Shipbuilding Portal has been conceived as a national digital platform designed to serve as the central hub for information, collaboration, innovation and stakeholder engagement across the shipbuilding and ship repair sectors.

The portal represents a shift from fragmented information systems towards a unified digital ecosystem connecting shipyards, equipment manufacturers, designers, regulators, financial institutions, researchers, training organisations and policymakers. By creating a single digital interface for the industry, the portal seeks to improve transparency, reduce information asymmetry and strengthen ecosystem integration.

The portal aligns closely with broader government objectives relating to digital governance, ease of doing business and industrial modernisation. It is intended not only as an information repository but also as an active platform for collaboration, capability development and industry growth.

Vision and Objectives

The vision of the Comprehensive Shipbuilding Portal is to establish a state-of-the-art digital platform that supports the long-term development of India's shipbuilding and ship repair industry.

The portal has six primary objectives.

First, it seeks to improve the global competitiveness of Indian shipbuilding by increasing visibility of domestic capabilities and facilitating engagement with potential customers and investors.

Second, it aims to strengthen collaboration among stakeholders including shipyards, design firms, equipment suppliers, regulators and research institutions.

Third, the portal supports workforce development through access to training programmes, certification pathways and skill development resources.

Fourth, it promotes research, development and innovation by showcasing emerging technologies and facilitating interaction between industry and academia.

Fifth, it provides centralised access to technical information, standards, regulations and best practices.

Finally, it supports access to financial schemes and industry support mechanisms, improving awareness and utilisation of government initiatives.

Together, these objectives position the portal as a strategic enabler of ecosystem development rather than merely an informational website.

Core Functional Modules

The portal incorporates multiple specialised modules designed to address different aspects of the shipbuilding ecosystem.

Capability Insights

This module serves as a digital showcase of India's shipbuilding capability. It provides information on shipyard capacities, completed projects, ongoing developments and industry achievements. Enhanced visibility of capabilities is critical for attracting investors and customers, particularly from international markets.

Collaboration Hub

The Collaboration Hub provides interactive tools enabling stakeholders to network, exchange ideas and collaborate on projects. Features such as discussion forums, thematic groups and professional networking tools support knowledge sharing and industry engagement.

Training and Certifications

This module provides information on maritime training institutions, certification programmes and skill development opportunities. Given the labour-intensive nature of shipbuilding, workforce development is a critical component of industry growth.

Innovation Centre

The Innovation Centre showcases emerging technologies, research projects and innovative solutions relevant to shipbuilding and maritime manufacturing. The module is intended to foster innovation and support adoption of advanced technologies.

Finance and Insurance

This module provides information on financing schemes, insurance products and investment opportunities available to industry stakeholders. Improved awareness of financial support mechanisms can facilitate greater participation in government initiatives.

Technical Library

The Technical Library functions as a central repository of standards, guidelines, regulations and technical documentation. It ensures that stakeholders have access to reliable and up-to-date technical information.

Regulatory and Compliance Module

This module provides updates on regulations, safety standards and compliance requirements. By improving access to regulatory information, the portal supports greater transparency and compliance across the sector.

Industry Directory

The Industry Directory serves as a comprehensive database of shipbuilding stakeholders including shipyards, suppliers, consultants, service providers and institutions. This improves connectivity across the ecosystem and facilitates business development.

Strategic Significance and Long-Term Impact

The Comprehensive Shipbuilding Portal is expected to play a transformative role in strengthening India's maritime industrial ecosystem. By bringing together information, stakeholders and services within a single digital platform, it addresses several structural challenges that have historically limited sectoral coordination.

The portal supports transparency by providing centralised access to information. It enhances collaboration by connecting stakeholders who would otherwise operate independently. It strengthens capability development through training and knowledge-sharing resources. It promotes innovation by facilitating interaction between industry and research institutions.

Most importantly, the portal provides a foundation for data-driven policy formulation and ecosystem management. Over time, it can evolve into a national digital backbone supporting shipbuilding, ship repair, ship recycling and maritime manufacturing activities.

As India pursues its ambition of becoming a major global shipbuilding nation, the Comprehensive Shipbuilding Portal will serve as a critical enabler, supporting competitiveness, collaboration and continuous capability enhancement across the maritime sector.

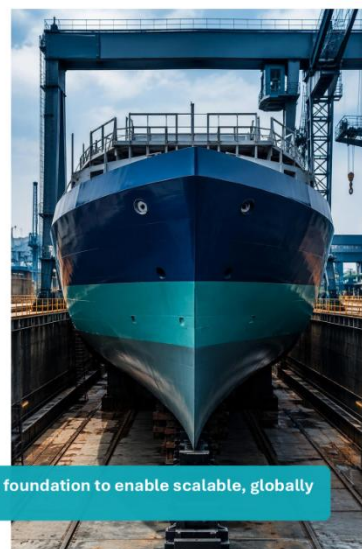
DGS–IRS Collaboration for Shipbuilding Transformation



DGS–IRS Collaboration for Shipbuilding Transformation



- **Digital ecosystem development:** IRS can support the development and operationalisation of a comprehensive national shipbuilding and ship recycling portal, enabling seamless workflows, technical integration and industry-wide transparency.
- **Knowledge repository:** IRS can contribute to establishing a national maritime knowledge repository by consolidating standards, design practices and regulatory guidance into a single authoritative technical reference for the sector.
- **Training & certification:** IRS can collaborate on human resource development through structured training, certification frameworks and capability-building programs for shipyards, designers and ancillary industries.
- **Indigenization & standardization:** IRS can support the standardization and indigenization of shipbuilding component manufacturers through technical validation, certification frameworks and alignment with class-compliant standards.
- **Design approval & capacity building:** IRS can provide technical design approvals, classification support and structured capacity-building initiatives to strengthen shipyard capabilities and accelerate India's shipbuilding ambitions.



DGS and IRS together can build a robust technical, institutional and capability-driven foundation to enable scalable, globally competitive shipbuilding in India.

34

Building the Institutional Foundation for India's Shipbuilding Ambition

India's shipbuilding transformation agenda represents one of the most ambitious maritime industrial development programmes undertaken in recent decades. Through the combined implementation of the Shipbuilding Financial Assistance Scheme (SBFAS), Maritime Development Fund (MDF), Shipbuilding Development Scheme (SBDS), legal and policy reforms, indigenization initiatives and the Comprehensive Shipbuilding Portal, the Government has established a comprehensive framework to reposition India as a major global shipbuilding nation.

However, the successful implementation of this vision requires more than financial incentives and infrastructure investments. It requires the creation of strong technical institutions, robust standards, credible certification systems, effective knowledge-sharing mechanisms and a highly skilled workforce capable of supporting a rapidly expanding shipbuilding ecosystem. In this context, collaboration between the Directorate General of Maritime Administration (DGMA) and the Indian Register of Shipping (IRS) assumes strategic importance.

As India seeks to move from a modest global shipbuilding presence towards becoming one of the world's leading shipbuilding nations, the role of technical institutions will become increasingly critical. International experience demonstrates that successful shipbuilding nations are supported by strong classification societies, well-established standards, integrated knowledge ecosystems and extensive industry-academia linkages. IRS, as India's premier

classification society, possesses technical expertise, certification capability and international engagement that can significantly strengthen the implementation of the national shipbuilding vision.

The proposed collaboration framework between DGS and IRS is therefore not limited to a specific project or initiative; rather, it represents an opportunity to build the technical and institutional architecture necessary to support long-term sectoral growth.

Strengthening the Technical Ecosystem through Collaboration

One of the most significant opportunities for collaboration lies in the development of a comprehensive digital and knowledge ecosystem for the shipbuilding sector. The proposed Comprehensive Shipbuilding and Ship Recycling Portal is intended to function as the digital backbone of India's maritime manufacturing ecosystem. While DGS provides policy leadership and implementation oversight, IRS can contribute significantly through technical content, standards integration, classification guidance and validation frameworks.

The portal can evolve into a national platform where shipyards, equipment manufacturers, designers, regulators, investors and maritime professionals access a common repository of information. IRS can support the development of technical libraries, classification requirements, design guidelines and industry best practices, thereby ensuring that the portal serves not merely as an information platform but as a credible technical resource for the industry.

Closely linked to this is the establishment of a National Maritime Knowledge Repository. The shipbuilding sector currently relies on information distributed across multiple institutions and organisations, often creating inefficiencies and duplication of effort. A centralised repository jointly supported by DGS and IRS can consolidate technical standards, design practices, regulatory guidance, classification requirements and industry reference materials into a single authoritative knowledge base.

Such an initiative would support consistency in design and construction practices, facilitate faster project execution and improve overall industry capability. It would also help create institutional memory and ensure that technical knowledge developed through individual projects is retained and disseminated across the broader maritime ecosystem.

Supporting Human Resource Development and Industrial Capability

The growth targets envisaged under Maritime India Vision 2030 and Maritime Amrit Kaal Vision 2047 will require a substantial increase in technical manpower across shipyards, design organisations, classification bodies and ancillary industries. Workforce development therefore represents a critical success factor for India's shipbuilding ambitions.

DGS and IRS can collaborate extensively in the areas of training, certification and capacity building. Structured programmes can be developed for shipyard personnel, marine engineers, naval architects, surveyors, designers and equipment manufacturers. Such programmes would not only improve technical competency but also ensure alignment with international standards and best practices.

The development of certification frameworks is particularly important as Indian shipyards increasingly target construction of technologically advanced vessels, including green vessels, specialised offshore vessels and export-oriented commercial ships. Certification programmes jointly supported by DGS and IRS can improve workforce readiness and create a stronger pipeline of skilled professionals for the industry.

Capacity building should also extend beyond shipyards to include MSMEs and indigenous equipment manufacturers. Many domestic suppliers possess strong manufacturing capabilities but require support in understanding maritime standards, classification requirements and quality assurance systems. Joint initiatives can help bridge this gap and accelerate integration of local manufacturers into the shipbuilding value chain.

Such interventions are aligned with broader indigenization objectives and contribute directly to strengthening India's maritime manufacturing ecosystem.

Advancing Indigenization and Technical Standardization

A major focus area for future collaboration is the standardization and indigenization of shipbuilding equipment and components. As India seeks to reduce dependence on imported marine equipment, the development of robust technical standards and certification frameworks becomes increasingly important.

DGS has already initiated efforts to identify critical equipment categories, promote local manufacturing and support supplier ecosystem development. IRS can significantly enhance these efforts by providing technical validation, classification support and certification services for indigenous products.

The establishment of standardised technical specifications will improve confidence among shipyards and vessel owners while facilitating broader acceptance of domestic products. IRS involvement can also support testing, approval and classification of indigenous equipment, enabling manufacturers to demonstrate compliance with internationally recognised standards.

This collaboration is particularly relevant for strategic equipment categories such as propulsion systems, deck machinery, electrical systems, automation solutions and specialised marine components. Over time, the development of a robust domestic supplier ecosystem can significantly increase local value addition, reduce project costs and improve supply chain resilience.

In addition to supporting domestic demand, a strong certification framework can enhance export potential for Indian marine equipment manufacturers and contribute to the emergence of India as a competitive global maritime manufacturing hub.

Design Approval, Classification Support and Future Readiness

As India's shipbuilding sector evolves towards construction of larger, more sophisticated and technologically advanced vessels, the importance of design approval and classification support will continue to increase. Future growth is expected to be driven not only by conventional

vessels but also by green ships, dual-fuel vessels, specialised offshore assets and technologically advanced commercial ships.

IRS can play a pivotal role in supporting this transition by providing design review, technical approval, classification services and guidance on emerging technologies. Early engagement between shipyards and classification societies can significantly reduce project risks, improve compliance and enhance confidence among shipowners and investors.

The collaboration can also extend to future-focused areas such as green shipbuilding, alternative fuel technologies, decarbonisation strategies and digital shipbuilding systems. As international regulations evolve, Indian shipyards will increasingly require support in understanding and implementing new technical requirements. Joint initiatives between DGS and IRS can help ensure that Indian industry remains aligned with global developments and is well positioned to compete in future markets.

Such collaboration will be particularly important as India seeks to leverage the global transition towards low-carbon shipping and capture emerging opportunities in green vessel construction.

Concluding Perspective

India today stands at a pivotal moment in the evolution of its maritime sector. The policy framework established under the Four-Pillar Approach provides a strong foundation for growth, while initiatives relating to financing, infrastructure development, indigenization and digitalisation create the enabling conditions required for large-scale expansion.

The next phase of growth will depend increasingly on institutional capability, technical excellence and ecosystem coordination. In this context, collaboration between DGS and IRS offers a unique opportunity to combine policy leadership with technical expertise, creating a partnership capable of supporting the long-term transformation of the shipbuilding sector.

By working together in the areas of digital ecosystem development, knowledge management, training and certification, indigenization, standardization, design approval and capacity building, DGS and IRS can help establish the technical and institutional backbone required to support India's emergence as a globally competitive shipbuilding nation.

Ultimately, this collaboration has the potential to move beyond individual initiatives and contribute to the creation of a resilient, technology-driven and internationally recognised maritime industrial ecosystem—one that supports the national aspirations articulated under Maritime India Vision 2030 and Maritime Amrit Kaal Vision 2047, while positioning India as a leading force in global shipbuilding.

India's Seafaring Workforce: Expanding Global Leadership



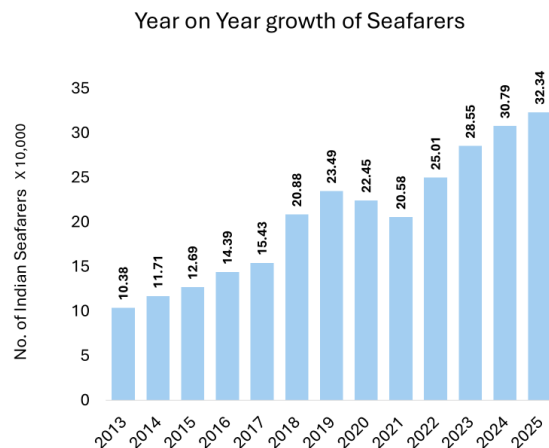
India's Seafaring Scenario



- **India among top 5 maritime nations** in seafarer supply
- **Contributes ~ 12%** of the global seafarer workforce
- **MIV 2030 target:** Increase India's share to **20%** by 2030

Current share of women seafarers in India: **< 0.5%**

- **MIV 2030 target:** Raise women participation to **2-3%** by 2030
- **Growth achieved:** **339%** rise since 2021



67

India is currently positioned among the **top five maritime nations** in terms of supplying seafarers to the global shipping workforce. The country contributes nearly **12%** of the world's seafarers and under the **Maritime India Vision (MIV) 2030**, the target is to further increase this share to **20%** by 2030.

Four key pillars to enhance India's share is outlined in Exhibit 10.5 of MIV 2030. It acts as a comprehensive national approach to increasing India's global share of seafarers through **four strategic pillars**. Each pillar targets a critical component of seafarer development ranging from improving training quality to expanding career opportunities and strengthening welfare frameworks.

1. Enhancement of Quality of Maritime Training

This pillar aims to ensure that India produces high-calibre seafarers by introducing standardized entrance tests, redesigning maritime curricula with digital and e-learning components, upgrading faculty development systems and providing specialized training (including cruise hospitality).

2. Improved On-Board Training Opportunities and Placements

India seeks to expand shipboard experience opportunities by increasing Indian tonnage and mainline calls, mandating training berths on foreign vessels, forming bilateral agreements with major ship-owning nations and boosting overall training capacity for cadets and ratings.

3. Promotion of Careers at Sea

Focused on attracting and retaining talent, this pillar reinvigorates the image of seafaring through marketing campaigns, success stories and digital media. It also emphasizes expanding training academies in key seafarer-producing regions and providing scholarships and benefits especially for women thereby encouraging wider participation.

4. Seafarer Welfare and Attractive Alternative Career Opportunities

To enhance retention and post-sea career mobility, this pillar prioritizes professional development courses, seafarer welfare facilities, mental health support and defined alternative career pathways. It promotes flexible learning options, counselling and upskilling to support seafarers both during and after their time at sea.

Initiative 10.15 from MIV 2030 focuses on increasing women's participation in India's seafaring workforce, where women currently represent only **0.5%** of active on-board seafarers. The low representation is attributed to limited awareness of career opportunities, lack of incentives from shipping companies and prevailing cultural barriers. To address these challenges, the initiative proposes an **awareness campaign** to highlight success stories of women seafarers and promote available opportunities. Additionally, it recommends strengthened **onboard gender sensitization** and launching an **onboarding buddy programme** to support women entering the profession.

Further, the initiative underscores the importance of ensuring seafarers' **mental well-being**, noting the current lack of awareness and support structures in this area. To address this gap, it advocates for establishing **port welfare committees** to build a holistic ecosystem of care, support and well-being for all seafarers.

Over the past decade, India has witnessed **steady year-on-year growth** in the number of seafarers, as reflected in the bar chart. The seafarer pool has expanded significantly, showcasing India's increasing relevance in global maritime operations.

In terms of gender participation, the current share of women seafarers stands at **less than 0.5%**, but the growth trajectory is highly encouraging. MIV 2030 aims to raise this participation to **2–3%**. Notably, India has already achieved a **339% increase** in women seafarers over the last 5 years, as shown by the green chart.

Overall, the data highlights India's expanding maritime talent pool, strong global positioning and focused efforts toward enhancing both workforce size and gender inclusivity in the sector.

Seafarer's Wellness Initiatives



Gender Inclusivity for Seafarers



Sagar Mein Samman

- Introduced under DGS Order 18 of 2024 to promote gender-inclusive maritime workforce.
- Establishes policy-backed norms for women's safety, equal opportunity, and career advancement.
- Strengthens governance through industry-wide compliance standards and workplace reforms aligned with IMO and UN SDG-5.
- Implemented in collaboration with MUI, supporting a joint framework to empower and protect women seafarers.

Initiatives of DG Shipping to promote women seafarers : ₹1,00,000 are offered via the Maritime Training Trust



Registered women seafarers increased by **739% from 1,699 in 2015 to 14,255 in 2024** reflecting significant progress in gender inclusion and transformation within the Indian maritime sector.

Sagar Mein Samman enhance India's maritime regulatory framework by setting structured standards for inclusivity, and safety across the crewing ecosystem

23



Holistic Wellness For Seafarers



Sagar Mein Yog

- Introduced under DGS Order 19 of 2024, focusing on mental, physical, and emotional well-being of seafarers.
- Standardizes wellness practices across training institutes via MoU with NUSI.
- Helps reduce stress, fatigue, and medical emergencies enhancing safety compliance.
- Integrates structured wellness modules into Pre-Sea, At-Sea, and Post-Sea stages



[LMS Link](#)

Sagar Mein Yog enhance India's maritime regulatory framework by setting structured standards for wellness across the crewing ecosystem.

24

One of the most significant shifts taking place in India's maritime landscape today is the growing focus on empowering women across a field long viewed as male dominated. For many years, women have represented less than half a percent of the seafaring workforce and this imbalance has held back both individual potential and the overall strength of the maritime ecosystem. Recognizing this gap, India introduced **Sagar Mein Samman** as a landmark initiative designed to transform the maritime environment into one where every woman is treated with dignity, respect and equal opportunity. It was created to ensure that women can

enter the sector, progress through it and contribute meaningfully without encountering the systemic obstacles that have limited their representation in the past.

Sagar Mein Samman is built on the understanding that gender inclusion is not only a matter of fairness but also a pathway to a stronger and more resilient workforce. It draws inspiration from the Maritime India Vision 2030, which aims to increase women's participation to two to three percent by 2030. This initiative recognizes that real change requires more than policy statements, so it brings together training institutions, industry partners, maritime unions, academic bodies and administrators to create a unified environment where women can thrive. A key step in this journey was the introduction of the draft policy framework on the International Day for Women in Maritime, signaling India's commitment to move from intent to structured action.

Women in maritime today face challenges that go far beyond numbers. Many of them encounter discrimination in pay and promotions, restricted access to leadership roles and cultural biases that remain deep rooted across the global maritime community. Safety concerns, harassment, limited mentorship and a lack of role models create additional barriers. For those balancing family responsibilities or dealing with inadequate onboard facilities, the path becomes even more difficult. These challenges are well known and Sagar Mein Samman addresses them by building a comprehensive ecosystem of support that focuses on empowerment, inclusivity, safety and continuous skill development.

The programme promotes awareness campaigns that reach young women who may not previously have considered maritime careers. It creates scholarship pathways that help them overcome financial constraints. It encourages companies to adopt recruitment practices that are inclusive and transparent. It expands gender sensitization efforts across ships and training institutes to reshape workplace culture. And it introduces buddy programmes, counselling access and stronger welfare support at ports to ensure that women feel protected both during their time at sea and when they return home. Through these measures, the initiative creates a complete safety and support framework around women, giving them the confidence to remain in the profession and grow as leaders.

At the same time, the initiative has a strong focus on skill building. Women receive training that prepares them for the technical and leadership demands of the maritime world and mentorship channels help them navigate the challenges of early career progression. These elements do more than support individual growth. They help create role models whose success will inspire more young women to envision themselves in this industry. The story of India's maritime workforce over the past decade already includes remarkable progress, with the number of women seafarers growing many times over and this upward trend is exactly what Sagar Mein Samman is designed to accelerate.

Sagar Mein Yog is a structured wellness programme introduced under DGS Order 19 of 2024 to address the mental, physical and emotional challenges that seafarers routinely encounter due to prolonged isolation, irregular work schedules and high pressure working conditions. The initiative provides a comprehensive framework of wellness practices that are meant to be an integral part of both maritime training and daily life at sea, reflecting the Directorate General of Shipping's focus on developing a healthier and more resilient workforce. The programme is designed in partnership with the National Union of Seafarers of India and is supported by Trijog Know Your Mind, a collaboration that ensures the content is guided by professional psychological and behavioural expertise. Its foundation is built on ten core wellness pillars that cover emotional, economic, physical, occupational, social, environmental, climatic, intellectual, cultural and spiritual wellness, creating a holistic system that nurtures the mind, body and inner stability of seafarers throughout their maritime journey.

These wellness pillars are supported through practical tools, reflective practices, guided learning and experiential content that respond directly to the unique lifestyle and demands of seafaring. The initiative integrates its modules across Pre Sea, At Sea and Post Sea stages so that wellness becomes a continuous, structured support system rather than a limited training intervention. To operationalise this framework, a pilot Training of Trainers programme was conducted with participation from approximately fifty trainers, ensuring that implementation capacity is already in place for wider rollout. The approach emphasises stress management, physical fitness, emotional stability and mindful awareness, which together contribute to improved safety and wellbeing on board. The Directorate General of Shipping notes that yoga, mindfulness and wellness routines incorporated into daily schedules can significantly improve mental resilience and reduce fatigue, which makes these practices essential components of the programme's design.

Sagar Mein Yog further strengthens its reach through a dedicated digital learning management system that offers easy access to structured wellness modules, guided audiovisual practices and reflective material for seafarers whether they are onboard or ashore. This learning ecosystem allows seafarers to study at their own pace and maintain consistent engagement with the wellness curriculum. The LMS provides a comprehensive curriculum booklet that outlines learning outcomes, practical routines and suggested practices for all ten wellness pillars, ensuring standardisation across maritime training institutes and shipboard environments. The digital platform reflects the Ministry of Ports, Shipping and Waterways commitment to delivering accessible wellness education for the entire maritime community and supports the broader vision of modern, inclusive and welfare driven maritime governance.

In essence, the Sagar Mein Yog initiative institutionalises wellness by embedding holistic health practices into maritime training systems and shipboard operations. It is designed to cultivate resilience, emotional balance, physical readiness and sustained well being among Indian seafarers, creating a healthier workforce that is better equipped to manage the demands of life at sea. The programme combines structured educational content, digital accessibility and

a multi dimensional wellness philosophy to align seafarer welfare with modern global expectations and national maritime objectives.

Pranaam Seafarers Assistance and Facilitation Counter

Pranaam Seafarers Assistance and Facilitation Counter is an on-ground support system created to give Indian seafarers a smooth, stress-free airport experience at the most critical point of their journey. The counter, inaugurated on 21 January 2026 at Mumbai International Airport Terminal 2, is designed to function like a dedicated meet-and-assist service where crew can get help before they even approach check-in or immigration. The need for such a counter became clear as Mumbai's T2 handles a large volume of seafarers every day, especially those flying to the UK, and many were facing issues such as incomplete documents, last-minute visa problems, or even offloading. These challenges not only caused stress to the seafarers and their families but also created compliance risks, legal exposure, and operational delays for shipping companies.

The counter changes this entire experience by offering structured, professional, and 24×7 support. Staffed by trained Guest Relations Officers equipped with airport entry passes, uniforms, laptops, and access to DGS systems, Pranaam ensures every seafarer undergoes a complete document verification process before reaching the airline. The officers check all essential documents such as the passport, visa, CDC, employment contract, e-Migrate Form I, travel itinerary, and where applicable, UK-specific requirements like Immigration References. This verification is important because many operational challenges earlier were the result of mismatched data between the passport, CDC, company letter, and e-Migrate entries. With Pranaam, these inconsistencies are caught early so that seafarers do not face embarrassment or legal trouble at the immigration desk.

Once documents are verified, the counter issues a Pranaam Clearance Token. This token signals to airlines and airport authorities that the crew has been pre-cleared. After receiving this token, the crew proceeds to check-in where they are assisted, if required, by an escort who helps them navigate queues, luggage, and priority processing. They are then guided to security and immigration where Pranaam-cleared travelers often receive expedited movement. The entire flow is designed to reduce congestion, prevent last-minute confusion, and make sure only compliant sailors reach the boarding stage.

The creation of this counter also addresses a serious and growing concern. The UK visa-free entry privilege for Indian seafarers was being misused by individuals falsely posing as crew. This led to detentions and scrutiny of genuine seafarers at foreign ports. To prevent further reputational damage and to protect our real crew, the Directorate General of Shipping, working through DGMA-trained staff, introduced Pranaam as a checkpoint where legitimacy is verified and misuse is filtered out. This additional layer of assurance protects both the industry and the individual traveller.

While the counter itself is a facilitation desk, it operates under strict SOPs. Staff maintain digital and physical records of all checks, escalations, and decisions. Any discrepancy triggers

immediate escalation to DGCOMM, the 24×7 DGS control room, and if needed, onward to the DGS Crew Branch. These escalation protocols help ensure issues are addressed early and documented properly.

The benefits of the counter are immediate and clear:

- It prevents wrongful detentions and offloadings by ensuring every document aligns correctly
- It reduces last-minute delays at check-in and immigration
- It protects seafarers from fraudulent practices, especially relating to visa-free misuse
- It creates a consistent, predictable travel experience for crew and their families

The counter is supported through a strong ecosystem involving DG Shipping, SWFS, maritime unions such as NUSI and MUI, airport authorities, and the UK Home Office which co-funds the initiative due to the high volume of UK-bound Indian crew. This collaborative structure ensures that the counter has the resources, authorization, and manpower it needs, and that seafarers receive a seamless experience from the moment they enter the terminal until they complete immigration.

In essence, Pranaam acts as a trusted, visible, embassy-like support desk inside the airport that safeguards compliance, improves efficiency, and most importantly, upholds the dignity of every Indian seafarer who travels for work. It represents a major shift in how we support our maritime workforce, ensuring that welfare and protection begin not just at sea but from the very start of their journey.

Social Security and Welfare for Seafarers



Towards Stronger Social Security and Welfare for Seafarers



Seamen's Provident Fund Organisation

Long-Term Financial Security

- **SPFO** manages provident fund contributions made by both seafarers and employers, which are accumulated and paid out as benefits upon retirement, completion of service, or in cases of disability or death.
- Improves the **quality of life of seafarers** by providing financial security, social protection, and long-term stability throughout their working life and after retirement.
- **Vision:** To Provide for an institution of a Provident Fund to the Seamen as an old age retirement benefit to them and to their family members in the event of death.



Seafarer Welfare Fund Society (SWFS)

Welfare & Immediate Support

- The **SWFS** welfare schemes are designed to support seafarers and their families through initiatives focused on health, education, welfare infrastructure, and various financial assistance measures.
- **Welfare Schemes:** Schemes covering active seafarers, retired personnel, women seafarers, families of deceased seafarers, and children of seafarers. Also, schemes for providing financial
- **Infrastructure Projects under welfare initiatives:** SWBAT
- **Insurance Coverage** for seafarers by supporting insurance premium payments through a structured and equitable system.



69

Seamen's Provident Fund Organisation (SPFO)

The **Seamen's Provident Fund Organisation (SPFO)** is the statutory social-security body created under the **Seamen's Provident Fund Act, 1966 (Act 4 of 1966)**. The **Seamen's Provident Fund Scheme, 1966**, the first dedicated social-security scheme for Indian Merchant Navy seafarers was **introduced retrospectively with effect from 1 July 1964**. To administer the Scheme, the **Office of the Seamen's Provident Fund Commissioner** was established on **9 July 1966**.

Mandate & Benefits. SPFO manages **contributory provident-fund accounts** comprising employee and employer contributions; the accumulations are paid out **on retirement/superannuation, completion of service, permanent incapacity (disability), or death**, thereby ensuring old-age and family benefits. SPFO's operations also include account management, claims processing, compliance, investments as per Government guidelines, and grievance handling.

Governance. The Fund vests in and is administered by a **tripartite Board of Trustees** (Government, Employers, Employees), chaired **ex officio** by the **Director General of Shipping**; the SPFO Commissioner functions as CEO and Secretary to the Board. (Board constitution and role are set out in the Act/Scheme and MoPSW portal.)

In essence, SPFO is the **long-term financial-security pillar** for Indian seafarers, providing a dependable, contributory retirement corpus and family protection, complementing SWFS' immediate welfare coverage.

Seafarers' Welfare Fund Society (SWFS)

The **Seafarers' Welfare Fund Society (SWFS)** is an autonomous society under the administrative control of the **Ministry of Ports, Shipping & Waterways (MoPSW)**, established as a central organisation for the welfare of Indian seafarers and their families in **1964**. It is **registered under the Societies Registration Act, 1860 (16.11.1964)** and as a **Trust under the Bombay Public Trust Act, 1950 (09.04.1966)**.

Mandate & Scope. SWFS provides financial assistance, welfare schemes and social-security benefits covering active and retired seafarers, women seafarers, families of deceased seafarers, and children of seafarers. Its portfolio includes gratuity management for rating seafarers, survivor/invalidity/old-age/maternity benefits, education support and other targeted reliefs, and it also funds welfare infrastructure.

Governance & Objectives. As recorded in SWFS' governing documents and Government portals, the **Director General of Shipping** chairs the Society with a tripartite representation of Government, shipowners and seafarers' unions. Core objectives in the **Memorandum of Association** include:

Providing welfare facilities to seafarers and their families, including financial support for **education, health and emergencies**;

Managing the **Seafarers' Gratuity Fund** for rating seafarers (under INSA–Unions arrangements since 1983);

Administering **welfare contributions** collected from shipping/RPSL companies, and utilising funds for seafarer benefit programmes and welfare infrastructure at/around ports in India and, where applicable, abroad.

In sum, SWFS is India's primary **welfare & immediate-support** institution for the seafaring community, operating statutory-aligned schemes and facilities that complement the regulatory role of DG Shipping.

As we look at the various welfare measures being undertaken by the Directorate General of Shipping through the Seafarers' Welfare Fund Society, it is important to recognize that these schemes collectively aim to strengthen social security and provide timely support to Indian seafarers and their families. The Society, functioning under the administrative control of the Ministry of Ports, Shipping and Waterways, has been consistently expanding both the scope and the scale of benefits to ensure that seafarers are protected across different stages of their career as well as during unforeseen situations.

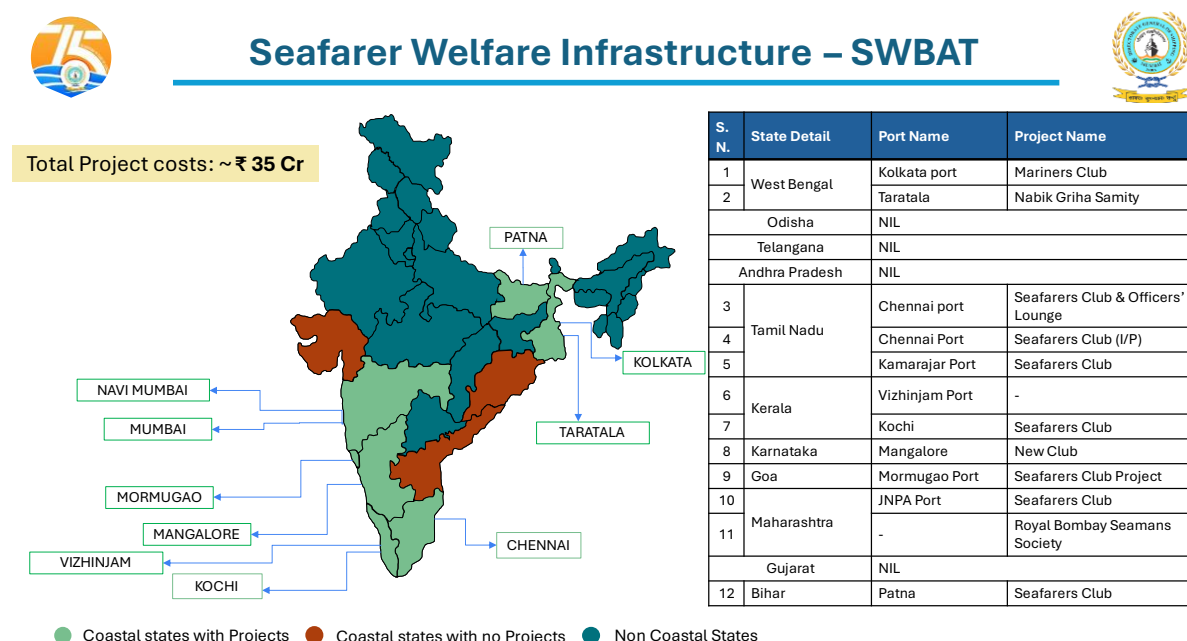
- The **Survivor's Benefit Scheme** provides financial assistance to the family or nominee of a deceased seafarer, where the benefit amount has been progressively enhanced to six lakh rupees for deaths occurring on or after January 1, 2026, with eligibility linked to death within thirty six months of the article period and the nominee registered for the last voyage.
- Complementing this is the **Death on Board Benefit Scheme**, which provides an ex gratia amount of two lakh rupees for any death or presumed death occurring on board for Indian CDC holders employed through Indian shipping companies or RPSL holders, with claims to be submitted within three months.

- For seafarers who face disability, the **Invalidity Benefit Scheme** offers up to six lakh rupees for permanent disability due to loss of limb, applicable within thirty six months of the article period and supported by certification from a DGS approved medical practitioner.
- For women seafarers, the **Maternity Benefit Scheme** provides financial support of fifty thousand rupees per delivery, up to a maximum of two deliveries, for those having sea service through an Indian Shipping Company or an RPSL within sixty months prior to delivery.
- Families of seafarers are also supported through the **Family Benefit Welfare Scheme**, under which children receive one lakh rupees on successful completion of a DGS approved pre sea training course along with CDC issuance, and fifty thousand rupees on completing a two year post graduate degree or diploma in a non maritime discipline.
- To support senior seafarers, the **Old Age Benefit Scheme** offers fifty thousand rupees upon attaining age sixty five for eligible individuals, with an additional one lakh rupees available once the seafarer attains the age of seventy five years on or after January 1, 2026, provided the required sea service and CDC cancellation conditions are met.
- In situations of abandonment or stranding, the **Ex Gratia Support Benefit Scheme** provides twenty thousand rupees per month for up to twelve months or until the date of abandonment, whichever comes earlier, with assistance beginning after two months of confirmed stranding.
- Encouraging educational excellence, the **Award to Meritorious Child of Seafarers** grants twenty five thousand rupees to children who secure the top position in a full time degree or postgraduate programme from an Indian university.
- The introduction of three new schemes further broadens the support framework, starting with the medical and term insurance premium assistance that reimburses up to fifty percent of premiums paid, subject to a maximum of five thousand rupees, for medical, critical illness and term insurance taken by Indian CDC holders.
- For **critical or terminal illnesses**, a dedicated medical support scheme provides a one time financial assistance of two lakh rupees based on certification from a government or recognised hospital.
- In addition, the **CoC Career Progression Scheme** encourages ratings to progress to officer roles by providing up to two lakh rupees to those who successfully obtain an Indian Certificate of Competency issued by the Directorate General of Shipping.
- There is also focused support for those affected by natural calamities through the **Disaster and Natural Calamity Assistance Scheme**, which provides a one time financial assistance of two lakh rupees for major damage or loss due to floods, cyclones, earthquakes, fire, landslides or other natural disasters, supported by certification from local authorities.

Taken together, these schemes reflect the government's commitment toward enhancing the welfare of seafarers, safeguarding their families, supporting their career progression and ensuring a robust social protection framework that responds to real challenges faced by the maritime community.

Continuing from the earlier overview of the various welfare schemes administered by the Seafarers' Welfare Fund Society, it is equally important to highlight how these schemes are translating into real impact through actual disbursement and beneficiary reach. The data reflects that when seafarers engage with the welfare framework and are aware of the support available, the schemes truly serve their purpose. During the period from **01.04.2024 to 16.03.2026**, we can see the extent to which different benefits have been accessed by the community. Altogether, **1,683** beneficiaries were supported across these schemes with a total disbursement of **₹ 16,85,37,169** during the stated period. This clearly demonstrates that when these welfare initiatives are accessed proactively, they deliver meaningful financial and social protection to the seafaring community.

Seafarer Welfare Infrastructure – SWBAT



70

SWBAT Projects

The national seafarer welfare programme is supported by a wide network of projects that have been identified across both coastal and non coastal states, with a total project investment of approximately thirty five crore rupees approved by the Committee. These projects represent the on ground implementation of the welfare inspection and infrastructure improvement mandate overseen through SWBAT, ensuring that each location strengthens the services available to seafarers in line with their needs and the guidelines already issued. The distribution of projects reflects the operational reality of Indian ports, where states with significant maritime activity have multiple facilities either newly developed, upgraded, or undergoing renovation,

while non coastal states have been included where seafarer footfall and examination activities justify welfare infrastructure.

West Bengal has two major welfare facilities at Kolkata Port and Taratala, both of which are functional but in need of substantial repair and modernization, and have therefore been approved for renovation and upgradation. Tamil Nadu has three identified projects, including the Seafarers Club and Officers Lounge at Chennai Port, the club outside port premises, and the facility within port premises that has recently reached its final stages of construction. Kerala has two ongoing welfare initiatives at Vizhinjam and Kochi, where one facility needs to be developed from scratch to address the absence of existing infrastructure and the other focuses on essential utilities such as an STP installation. Goa has a project at Mormugao Port where the existing officers club is in need of complete upgradation to meet current welfare requirements. Karnataka, Maharashtra, and Bihar each have one project, with Mangalore receiving a new club, the Royal Bombay Seamen's Society in Mumbai undergoing major renovation, and Patna being supported due to its role as an outreach centre and MMD office for inland seafarers.

The map visually represents the spread of these projects across the country, showing coastal states where development work is underway, coastal states that do not currently have active welfare projects, and the non coastal states where seafarer related infrastructure has still been identified as necessary. This nationwide footprint reflects the intention to create an inclusive and uniform welfare ecosystem that supports seafarers regardless of where they sign on, sign off, travel for examinations, or report for administrative procedures. The table on the slide captures the detailed list of states, ports, and the precise nature of each project, including facilities such as Mariners Club, Nabik Griha Samity, Seafarers Clubs both inside and outside port premises, new clubs, and heritage facilities being modernized. Together, the project list and the geographic representation demonstrate the practical outcomes of the inspection and evaluation framework under SWBAT, where every identified facility becomes part of a coordinated effort to improve seafarer welfare infrastructure across India and ensure that the national welfare goals are translated into tangible improvements on the ground.

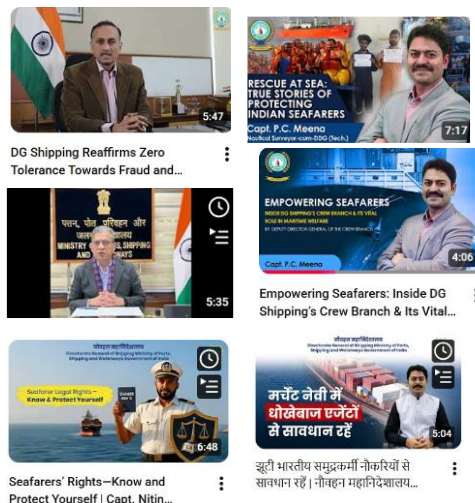
Zero Tolerance in Crewing



Zero Tolerance in Crewing



- DG Shipping follows a Zero Tolerance policy against fraud, cheating, and illegal recruitment of seafarers.
- A nationwide digital awareness campaign was launched through DG Shipping's social media platforms, publishing multiple videos on:
 - Fraudulent agents and fake job offers
 - Illegal payments to RPSL companies
 - Seafarers' rights
 - 24x7 Grievance redressal
- To strengthen outreach, DG Shipping conducted symposiums on seafarer recruitment and welfare.
 - Successfully held: Mumbai, Delhi
 - Planned next: Chennai, Kolkata
- The campaign combines digital engagement and onground awareness to protect seafarers and prevent exploitation.



49

Ensuring **fairness, transparency and ethical conduct in seafarer recruitment and crewing** is a core priority of India's maritime administration.

The **Directorate General of Shipping (DG Shipping)** has adopted a strict **Zero Tolerance policy** against:

- Fraudulent recruitment practices
- Cheating and misrepresentation
- Illegal placement and unauthorized intermediaries

This approach is aimed at safeguarding the **rights, welfare and professional integrity of Indian seafarers**, while strengthening trust in the regulatory framework governing maritime employment.

Core Objective

To establish a **transparent, accountable and exploitation-free crewing ecosystem** in India.

Key Policy Pillars

- Prevention of fraud and illegal recruitment
- Protection of seafarer rights and welfare
- Promotion of ethical and compliant crewing practices
- Strengthening regulatory oversight and enforcement

Key Challenges Addressed

The initiative directly targets persistent issues in the crewing ecosystem:

- Fraudulent agents and fake job offers
- Unauthorized payments to RPSL (Recruitment and Placement of Seafarers License) companies
- Lack of awareness among seafarers regarding rights and entitlements
- Limited access to grievance redressal mechanisms
- Risk of exploitation, especially among new entrants

Digital Awareness Campaign

Nationwide Outreach

DG Shipping has launched a **comprehensive digital awareness campaign** through its official platforms, including social media channels.

Key Focus Areas

The campaign disseminates targeted information on:

- Identification of **fraudulent agents and fake job offers**
- Risks associated with **illegal payments to RPSL companies**
- Awareness of **seafarers' statutory rights and entitlements**
- Availability of **24×7 grievance redressal mechanisms**

Content Strategy

- Use of **short informational videos and advisories**
- Simplified messaging for wider reach
- Multilingual communication for inclusivity

Outcome

- Enhances **awareness and vigilance among seafarers**
- Enables **informed decision-making**
- Reduces vulnerability to exploitation

On-Ground Outreach & Stakeholder Engagement

Symposia & Workshops

DG Shipping has complemented digital outreach with **physical engagement initiatives**, including:

- National-level symposia on **seafarer recruitment and welfare**
- Stakeholder consultations involving:
 - RPSL companies
 - Training institutes
 - Maritime professionals

Implementation Status

- Successfully conducted in: **Mumbai, Delhi, Kolkata**
- Planned expansion to: **Chennai**

Impact

- Strengthens **industry alignment with regulatory expectations**
- Facilitates **direct engagement with seafarer community**
- Promotes **compliance culture across stakeholders**

Grievance Redressal Mechanism

24×7 Support System

- Dedicated grievance channels available round-the-clock
- Accessible to all seafarers across India

Key Features

- Complaint registration and tracking
- Timely response and resolution
- Escalation mechanisms for serious violations

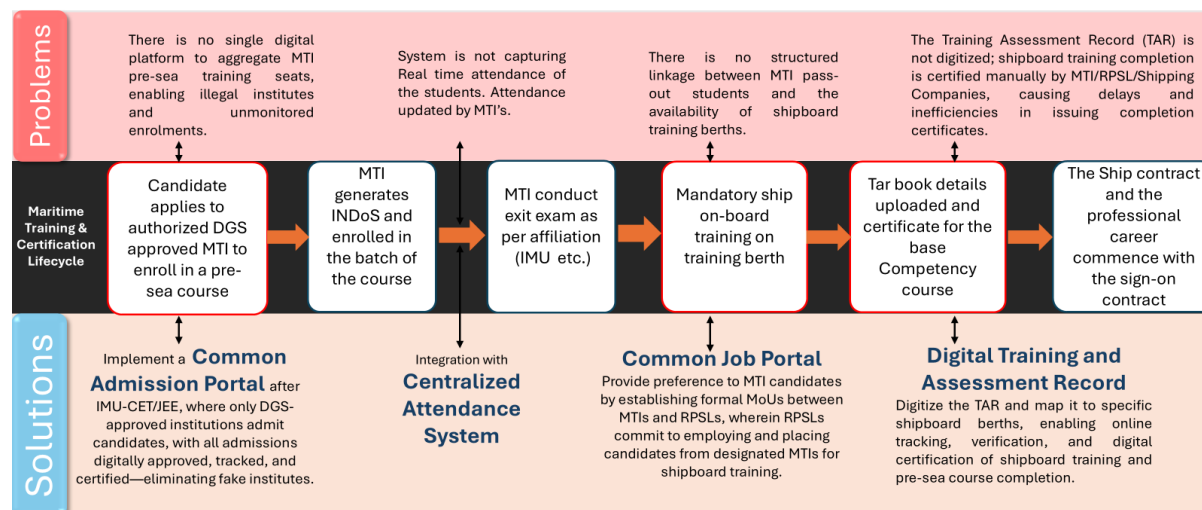
Strategic Role

- Acts as a **deterrent against malpractice**
- Builds **confidence among seafarers**
- Strengthens regulatory enforcement

Maritime Training and Certification Lifecycle



Maritime Training & Certification Lifecycle



28

The maritime training and certification ecosystem in India plays a critical role in sustaining the country's position as a leading supplier of global seafarers. However, the current system has evolved in a **fragmented and largely non-integrated manner**, with multiple stakeholders operating in silos — MTIs, RPSLs, shipping companies and regulatory bodies.

This has resulted in **limited visibility across the lifecycle of a candidate**, from admission to certification and has created operational gaps that impact both efficiency and regulatory oversight.

Key Systemic Issues

Admission-Level Gaps

At present, there is no unified mechanism to track or regulate **pre-sea training seat allocation across MTIs**. Admissions are handled independently by institutes, which creates scope for:

- Entry of non-compliant or unauthorized entities
- Lack of transparency in seat utilization
- Difficulty in monitoring intake capacity at a national level

This weakens the credibility of the training pipeline at the entry stage itself.

Absence of Real-Time Monitoring

Student attendance, which is a fundamental compliance requirement, is currently:

- Recorded manually
- Updated periodically by MTIs

There is no provision for **real-time validation or central visibility**, making it difficult for the regulator to ensure adherence to training norms.

Disconnect Between Training and Employment

One of the most critical gaps lies in the transition from **classroom training to shipboard training**.

Currently:

- There is no structured mechanism linking MTI graduates with **availability of training berths onboard vessels**
- Candidates are often left to navigate placement independently

This results in:

- Delays in securing onboard training
- Underutilization of trained manpower
- Increased dependence on informal channels

Manual and Fragmented TAR System

The Training Assessment Record (TAR), which is central to competency certification, continues to be:

- Maintained in physical/manual format
- Verified through multiple entities without a unified system

This leads to:

- Delays in certification issuance
- Lack of audit trail
- Inefficiencies in verification and validation

Need for Lifecycle-Based Reform

The above challenges are not isolated — they stem from the absence of a **connected lifecycle approach**.

What is required is a system where:

- Each stage of a candidate's journey is digitally linked
- Data flows seamlessly across stakeholders
- The regulator has end-to-end visibility

Proposed Digital Lifecycle Framework

A structured, technology-enabled lifecycle has been conceptualised to address these gaps.

Entry-Level Standardisation – Common Admission Portal

The introduction of a **Common Admission Portal** will act as the first control point in the system.

Key features:

- Admission restricted strictly to **DGS-approved MTIs**
- Centralised seat allocation and tracking
- Integration with entrance mechanisms (IMU-CET/JEE)

Impact:

Brings discipline at the entry stage and eliminates scope for unauthorized admissions.

Unified Candidate Identity – Digital INDoS Integration

Post admission, candidate data is captured through:

- Digital generation of **INDoS number**
- Batch-level enrollment managed centrally

Impact:

Creates a **single verified identity** for each candidate, enabling tracking across the lifecycle.

Compliance Monitoring – Centralized Attendance System

A real-time attendance system is proposed to:

- Capture attendance digitally at source
- Provide central visibility to regulators

Impact:

Shifts attendance from a declaratory system to a **verifiable compliance mechanism**.

Academic Integration – Exit Examination Layer

Exit examinations will continue under affiliating bodies such as IMU, but:

- Results and certification data will be digitally integrated

Impact:

Ensures continuity of data without disrupting existing academic structures.

Industry Linkage – Common Job Portal

To address the current disconnect, a **Common Job Portal** is proposed.

Key design principle:

- Formal linkage between **MTIs and RPSLs**

Through this:

- RPSLs can access verified candidate pools
- MTIs can align output with industry demand
- Candidates can access structured onboarding opportunities

Impact:

Transforms placement from an informal process to a **system-driven pipeline**.

Digitisation of TAR – Closing the Loop

The digitisation of the **Training Assessment Record (TAR)** is a critical reform element.

Proposed features:

- Digital TAR linked to candidate profile
- Mapping with specific shipboard training berths
- Online validation by shipping companies

Impact:

- Eliminates delays in certification
- Creates a complete audit trail
- Enables faster issuance of Certificates of Competency

End-to-End Lifecycle Integration

The proposed system ensures that the candidate journey is **fully traceable and connected**:

Admission → Enrollment → Attendance → Examination → Placement → Onboard Training → Certification

Each stage feeds into the next, removing discontinuities that currently exist.

Expected System-Level Improvements

Regulatory Control

- Real-time visibility for DGS
- Stronger compliance enforcement

Process Efficiency

- Reduced delays across stages
- Faster certification timelines

Transparency

- Elimination of informal and unverified channels
- Improved trust among stakeholders

Workforce Alignment

- Better matching of trained candidates with industry requirements

Strategic Relevance

The proposed lifecycle reform is aligned with:

- India's push towards **digital governance in maritime administration**
- Global expectations on **quality and traceability of seafarer certification**
- Long-term objective of maintaining India's position as a **trusted seafarer supply nation**

Way Forward

- Development of integrated digital platforms under a unified architecture
- Stakeholder onboarding (MTIs, RPSLs, shipping companies)
- Phased rollout with pilot implementation
- Continuous monitoring and system refinement

Training Ecosystem



Training Ecosystem



The Training Ecosystem Vision aims to establish a unified, cloud-based digital platform with its components supporting the objectives outlined in MIV-2030 and AKAM-2027, thereby strengthening maritime education and training.

Key Features

- Integration of 7 critical modules (e.g., Faculty Development, LMS, Web-Based Simulators) into one cohesive system.
- Real-time oversight and advanced technology for secure, transparent processes.

Current Status

- The RFP was published on 13th April. Multiple queries have been received from seven vendors in response to the RFP. Response for the queries received is being prepared.

Outcome of the Training Ecosystem RFP

- Selection of a Master System Integrator to deliver an integrated training ecosystem, improving maritime training, skilling, certification, and overall efficiency.



33

Maritime training in India is currently managed through a combination of institutional processes and regulatory oversight mechanisms, many of which operate independently. While the existing framework has supported scale, it has also led to **fragmentation across key stages such as training delivery, attendance monitoring, onboard training records and certification**.

As a result, there is **limited end-to-end visibility of a candidate's progression** and certain processes continue to rely on manual intervention and physical documentation. This creates challenges in ensuring consistency, transparency and timely decision-making.

With increasing emphasis on **digital traceability, quality assurance and alignment with international standards**, there is a clear need to move towards a more integrated and system-driven approach.

Concept of the Training Eco-System

The Training Eco-System has been conceptualized as a **unified, cloud-based digital platform** to bring together the key elements of maritime training, certification and professional development within a single framework.

The objective is not to replace individual components, but to **connect them through a common digital backbone**, enabling seamless flow of information across the entire training lifecycle — from admission to certification and employment linkage.

This approach shifts the focus from managing individual processes to **managing the ecosystem as a whole**.

Key Features of the Proposed System

Integrated Platform

The system integrates multiple functional areas including learning management, attendance tracking, training records, certification validation and industry engagement. This ensures that data is not isolated within individual modules but is available across the system.

Real-Time Monitoring and Oversight

Digital capture of attendance, training progress and assessment records enables **real-time visibility for the regulator**, reducing dependence on periodic reporting and improving overall oversight.

Digital Records and Traceability

The transition from paper-based documentation to digital records — particularly for Training Assessment Records (TAR) — ensures:

- Consistency of data
- Reduced processing time
- Availability of audit trails

Strengthened Industry Linkages

The inclusion of structured mechanisms such as a common job portal and engagement platforms helps bridge the gap between training institutions and industry requirements, ensuring better alignment of skills with onboard opportunities.

Functional Components

The Training Eco-System brings together the following key components within a single platform:

- **Learning Management System (LMS)** for course delivery and progress tracking
- **Centralized Attendance System** for real-time monitoring and compliance
- **Digital TAR Book** for onboard training documentation
- **Online Certificate Validation System** to enhance credibility and reduce fraud

- **Faculty Development Programme** to strengthen instructional quality
- **Web-Based Simulation Modules** aligned with modern shipboard technologies
- **Senior Seafarer Engagement Mechanism** to incorporate industry experience into training

Expected Outcomes

The implementation of the Training Eco-System is expected to result in:

- Improved **consistency and quality in training delivery**
- Enhanced **transparency in certification processes**
- Reduction in **manual intervention and associated delays**
- Availability of **reliable, real-time data for decision-making**
- Better **alignment between training output and industry requirements**

In addition, the system will help address long-standing issues related to **data gaps, duplication and lack of traceability**.

Strategic Importance

The Training Eco-System represents a broader shift towards **digitally enabled governance in maritime education and certification**.

It supports:

- Compliance with evolving international expectations
- Strengthening of regulatory confidence
- Improved global acceptance of Indian certification standards

More importantly, it enables a move from **process-based oversight to system-based governance**, which is critical for a sector of this scale.

Implementation Approach

Given the scope of the system, a **phased implementation approach** is considered appropriate:

- Initial rollout of core modules such as attendance, LMS and TAR
- Pilot implementation with selected institutions
- Gradual integration of certification and industry linkage components

- Scale-up based on operational feedback and system stability

New MTI Module

The Directorate General of Shipping (DGS) has, over the years, established a regulatory framework for Maritime Training Institutes (MTIs) covering approvals, inspections, faculty requirements and compliance monitoring. The existing MTI Module has been central to this framework and has supported the growth of maritime training capacity in the country.

However, with the increase in the number of institutes and the growing complexity of regulatory requirements, certain limitations have become evident. Key processes such as inspections, compliance tracking and record verification continue to depend on **periodic reporting and manual intervention**, resulting in gaps in real-time visibility.

There have also been instances of **non-compliance and inconsistencies in training delivery**, indicating the need for stronger monitoring mechanisms and a more integrated regulatory approach.

Need for a Revamped MTI Module

The existing system, while functional, is not fully equipped to support **real-time oversight and data-driven governance**. The absence of seamless integration between related systems — such as certification modules, TAR records and inspection frameworks — limits the ability to monitor the full lifecycle of training and certification.

In addition, increasing expectations from international stakeholders, particularly in relation to **STCW compliance and quality assurance**, require a system that can provide reliable, verifiable and readily accessible data.

A modernized MTI Module is therefore required to:

- Strengthen regulatory oversight
- Improve transparency in institutional functioning
- Ensure consistency in training standards across institutes

Concept of the New MTI Module

The New MTI Module is envisaged as a **central digital regulatory platform** that will serve as the backbone for overseeing Maritime Training Institutes in India.

The focus is on building a system that not only records information, but also **enables continuous monitoring, validation and decision-making**.

The module will bring together key regulatory functions — including approvals, inspections, faculty records and compliance tracking — within a **single, integrated digital environment**.

Key Features

Centralized Regulatory Control

All MTI-related activities, including approvals, renewals and inspections, will be managed through a unified platform, ensuring consistency and reducing dependency on fragmented processes.

Real-Time Monitoring and Compliance Tracking

The system will enable **real-time visibility of MTI operations**, including:

- Inspection status
- Compliance reports
- Faculty and infrastructure records

This reduces reliance on delayed submissions and enhances proactive oversight.

Integration with Related Modules

A key improvement in the new module is its integration with:

- **CIP (Continuous Improvement Programme)**
- **STCW Module**
- **Digital TAR Book**
- **Master Checklist Framework**

This ensures that regulatory oversight is not limited to isolated functions but extends across the entire training and certification ecosystem.

Strengthened Data Integrity

By digitizing records and standardizing data capture, the system will:

- Minimize discrepancies
- Enable easier verification

- Maintain a clear audit trail

Expected Outcomes

The implementation of the New MTI Module is expected to result in:

- **Improved compliance and regulatory control** through continuous monitoring
- **Enhanced transparency** in approvals, inspections and certification processes
- **Better training quality** through closer alignment with updated standards
- **Reduced scope for non-compliance and procedural gaps**
- **Improved global credibility** of Indian maritime training institutions

Strategic Significance

The New MTI Module is not merely a system upgrade, but a **structural improvement in the way maritime training is regulated**.

It enables a shift from:

periodic, document-based oversight to continuous, system-driven monitoring

This transition is essential to maintain alignment with global standards and to ensure that India continues to be a **reliable and high-quality source of trained seafarers**.

Examination Reforms by C-DAC & NTA

The examination reforms introduced by C-DAC and the National Testing Agency (NTA) mark a significant shift toward a fully digitized, transparent and secure assessment system for seafarers. These reforms cover the entire examination lifecycle—from user registration and eligibility verification to seat booking, conduct of examinations, evaluation, data storage and the management of question banks. By digitizing each stage, the system aims to eliminate procedural inconsistencies and enhance uniformity across all Mercantile Marine Departments (MMDs).

The revamped framework is designed to create a secure and reliable examination environment through biometric authentication, CCTV-based surveillance, online proctoring, encrypted question papers and digital scanning of answer scripts. This is supported by structured grievance-redressal and feedback mechanisms, ensuring accountability and responsiveness.

The system applies to both written and oral examinations conducted in hybrid or computer-based modes, thereby increasing flexibility while maintaining high integrity standards.

Collectively, these reforms have strengthened examination quality, improved operational efficiency and ensured a consistent candidate experience nationwide. By embedding digital safeguards and streamlining workflows, the new examination system significantly enhances transparency, reduces the scope for misconduct and supports the competency-based certification of Indian seafarers.

Common Admission Portal



Common Admission Portal



What is a Common Admission Portal ?	Stakeholder	Key Responsibilities
➤ A single, centralized digital platform for all students seeking admission to DG Shipping-approved Maritime Training Institutes (MTIs). ➤ Enables a uniform, transparent, and merit-based admission process for pre-sea maritime courses across India. ➤ Provides standardized eligibility checks, online applications, document verification, and merit ranking. ➤ Ensures admissions only to approved MTIs, courses, and sanctioned intake capacities, maintaining regulatory compliance. ➤ Offers real-time visibility to DG Shipping on admissions, seat allocation, and institute performance.	Students	Apply for courses, upload documents, track admission status
	Maritime Training Institutes (MTIs)	Verify applications, manage course intake & batches, approve admissions
	DG Shipping	Monitor institute-wise admissions, ensure compliance with approved intake capacity
	Portal Administrators	Manage system operations, control user access

31

Admissions to Maritime Training Institutes (MTIs) in India are currently carried out by individual institutes, each following its own process within the broader regulatory framework of DG Shipping. While guidelines exist, the absence of a **single unified system** has resulted in variations in admission practices across institutes.

This has led to concerns such as:

- Lack of uniformity in eligibility verification
- Limited transparency in seat allocation
- Inconsistent documentation and record-keeping
- Difficulty in monitoring adherence to approved intake capacities

In addition, there is currently **no centralized visibility for the regulator** on real-time admission status across institutes.

Need for a Common Admission Portal

Given the scale of maritime training in India and the importance of maintaining credibility in pre-sea education, there is a need to bring admissions under a **standardized and transparent framework**.

A centralized system would:

- Ensure that admissions are conducted strictly as per approved norms
- Reduce inconsistencies across institutes
- Provide visibility to DG Shipping for effective oversight
- Simplify the process for students

Concept of the Common Admission Portal

The Common Admission Portal is proposed as a **single, centralized digital platform** for all students seeking admission to DG Shipping-approved Maritime Training Institutes.

The portal is designed to handle the complete admission process in a structured manner, covering:

- Eligibility verification
- Application submission
- Document validation
- Merit-based ranking
- Seat allocation

The intent is to ensure that admissions are carried out in a **uniform, transparent and merit-driven manner across the country**.

Key Features of the Portal

Centralized Application System

Students will apply through a single platform instead of multiple institute-level applications, reducing duplication and improving accessibility.

Standardized Eligibility Checks

Eligibility criteria will be embedded within the system, ensuring that only candidates meeting prescribed requirements are allowed to proceed.

Online Document Verification

Digital submission and verification of documents will:

- Reduce manual errors
- Speed up the admission process
- Improve reliability of records

Merit-Based Ranking and Seat Allocation

Admissions will be based on clearly defined merit criteria, with automated seat allocation aligned to:

- Approved MTIs
- Recognized courses
- Sanctioned intake capacities

Real-Time Monitoring

The system will provide DG Shipping with **real-time visibility** on:

- Number of applicants
- Seat allocation status
- Institute-wise admissions

This enables better control and timely intervention where required.

Stakeholder Roles

The portal clearly defines responsibilities across stakeholders:

- **Students**
Apply for courses, upload documents, track admission status
- **Maritime Training Institutes (MTIs)**
Verify applications, manage course intake, approve admissions
- **DG Shipping**

Monitor admissions across institutes, ensure compliance with approved capacities

- **Portal Administrators**

Manage system operations, user access and platform integrity

Expected Outcomes

The Common Admission Portal is expected to bring the following improvements:

- **Uniformity in admission processes** across all MTIs
- **Enhanced transparency and fairness** in seat allocation
- **Reduction in discrepancies and manual errors**
- **Improved compliance with approved intake capacities**
- **Better data availability for regulatory oversight**

It will also make the process more streamlined for students by providing a **single point of access**.

Importance

The introduction of a Common Admission Portal is a key step towards **standardizing entry into the maritime training ecosystem**.

It supports:

- Strengthening of regulatory control
- Improved credibility of training institutions
- Alignment with digital governance initiatives

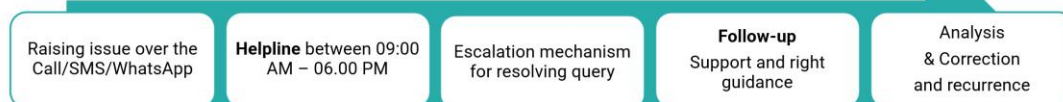
Most importantly, it ensures that the **quality of intake into maritime training remains consistent**, which directly impacts the overall standard of seafarers entering the system.

Transparency and Zero Tolerance for Fraud



Transparency and Zero Tolerance for Fraud

A Digital Transformation for Maritime Education



27th February 2026

34

1. Reporting Issue

Concerns or irregularities can be reported through established communication channels, including telephone, SMS and WhatsApp. This ensures accessibility and timely submission of complaints or queries.

2. Dedicated Helpline Support

A helpline operates during defined working hours (09:00 AM to 06:00 PM) to address inquiries, provide initial assistance and record details for further action.

3. Structured Escalation Mechanism

Unresolved issues follow a formal escalation path, ensuring that complex or critical matters are reviewed by the appropriate authority level for effective resolution.

4. Follow-Up and Guidance

Each case receives systematic follow-up to verify progress, offer necessary guidance and ensure that the individual receives accurate and timely support throughout the process.

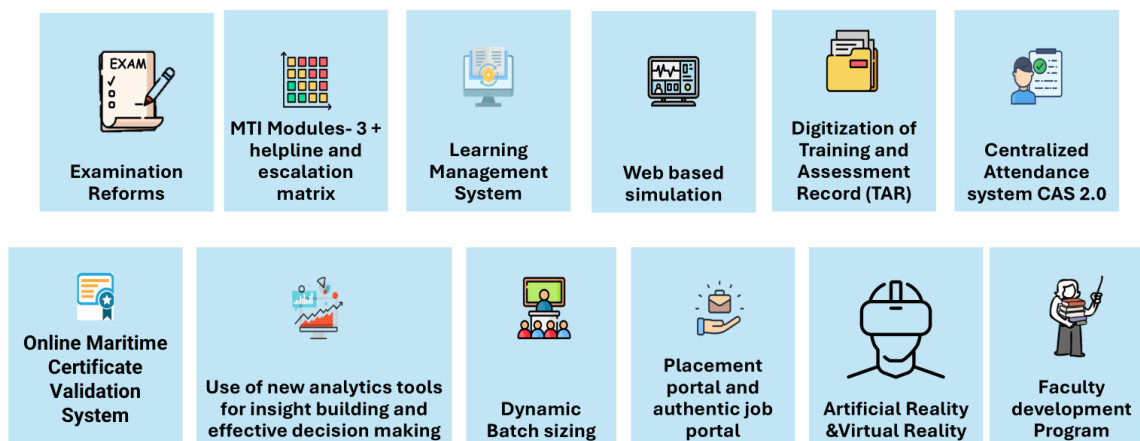
5. Analysis and Corrective Action

Reported issues undergo detailed analysis to identify root causes. Corrective and preventive measures are then implemented to avoid recurrence and strengthen overall operational integrity.

Digital Initiatives in Training



Digital Initiatives in Training



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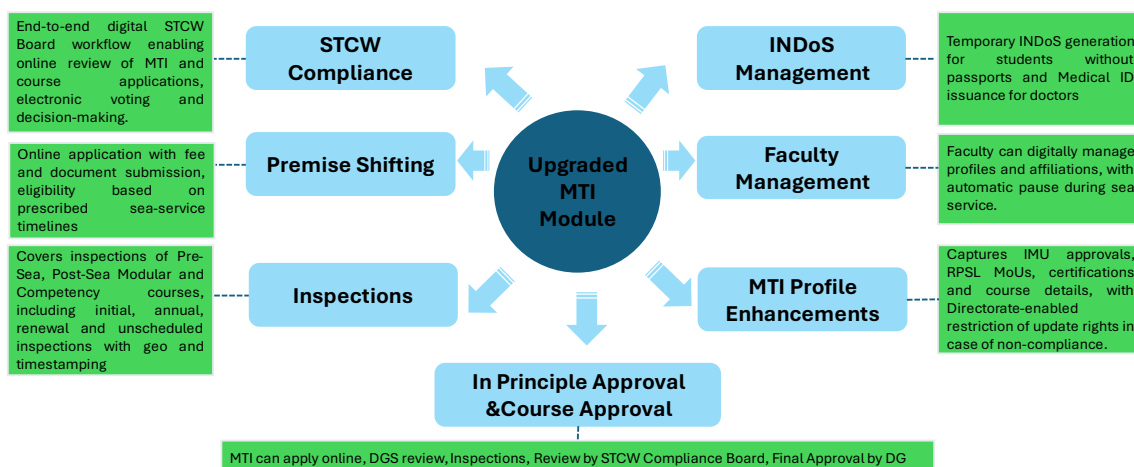
MTI Modules



Maritime Training Institute Module



Aims to enhance efficiency, compliance, and transparency in the **Maritime Training Institutes (MTI)** ecosystem through digital automation and seamless integration.



30

The MTI Module serves as DG Shipping's central digital system for regulating Maritime Training Institutes, overseeing approvals, inspections, faculty records, INDoS generation and compliance activities, but rising non-compliance and limited monitoring capacity have exposed the need for a modernized platform with stronger oversight and improved data integrity. A redesigned module would support STCW Board workflows, enhance inspection management

across all inspection types and integrate seamlessly with systems such as the LMS, faculty development programs, examination reforms, INDoS, RPSLs, grievance redressal mechanisms and CAS. It would also provide better tools for updating faculty information, uploading batch data, enabling dynamic batch sizing and capturing key institutional details such as approvals, MOUs, certifications and course structures, ultimately improving transparency, accountability and overall training quality across the maritime education ecosystem.

Dynamic Batch Sizing

Dynamic Batch Sizing is a data-driven method used to calculate the intake capacity for new pre-sea courses. It evaluates how many trainees joined shipboard training within the last 12 months and how quickly they transitioned after course completion. The method adds a 25% buffer to this verified placement-linked number to determine realistic intake capacity. If the number of students in an MTI who are getting shipboard training within 12 months decreases it negatively affects the intake capacity of the MTI for the next batch.

This ensures batch sizes are aligned with actual industry absorption, preventing oversupply and maintaining training quality.

Learning Management System

The LMS is a secure, DGS-compliant e-learning platform for standardized maritime training which ensures training integrity through real-time tracking, anti-cheating controls and assessment access only after full course completion.

Web-Based Simulator

A web-based simulator provides an immersive, interactive platform that replicates real-world maritime scenarios for effective learning and assessment.

Faculty Development Program (FDP)

A Faculty Development Program (FDP) is a structured initiative designed to upgrade teaching skills, subject expertise and professional competencies of faculty members through continuous learning and assessment.

Digital TARBook

The Training and Assessment Record (TAR) Book is a mandatory document that records and verifies a seafarer's structured onboard training and practical competencies.

Centralized Attendance System (CAS)

The Centralized Attendance System (CAS) uses facial biometrics to securely verify the presence of candidates, faculty and administrators across Maritime Training Institutes.

Placement portal and authentic job portal

A placement portal is a structured platform used by institutes or organizations to connect trainees with verified employment opportunities, an authentic job portal ensures legitimacy by

listing only genuine, vetted job openings, protecting candidates from misleading or fraudulent postings.

Examination Reforms

Examination Reforms aim to modernize and standardize the assessment framework for maritime training and certification. The initiative focuses on **digitization of examinations, automation of evaluation processes and strengthening of integrity controls** to eliminate malpractices.

It includes:

- Computer-based testing and centralized question banks
- Randomization of questions and answer sets
- Automated evaluation and result processing
- Enhanced security features such as audit trails and candidate verification

These reforms improve **credibility, transparency and efficiency** of the examination system while ensuring alignment with global standards.

Helpline and Escalation Matrix (MTI Modules – 3+ Support System)

A structured helpline and escalation matrix is designed to provide **multi-level support for stakeholders**, including students, faculty and institutes.

The system ensures:

- Timely resolution of queries and grievances
- Defined escalation pathways for unresolved issues
- Accountability through tracking and response timelines

This enhances **service delivery, responsiveness and user confidence** in the digital ecosystem.

Digitization of Training and Assessment Record (TAR)

Digitization of the Training and Assessment Record (TAR) enables **electronic recording, verification and tracking of onboard training and competencies** of seafarers.

Key features include:

- Real-time updates and validation by authorized personnel
- Secure digital storage and access
- Integration with certification and compliance systems

This eliminates manual errors, improves traceability and ensures **standardized competency tracking across the training lifecycle**.

Online Maritime Certificate Validation System

The Online Maritime Certificate Validation System provides a **centralized digital mechanism for verification of certificates issued to seafarers**.

It ensures:

- Instant validation of certificates by employers, authorities and international stakeholders
- Prevention of fraudulent or duplicate certifications
- Integration with national and global maritime databases

This strengthens **trust, authenticity and global recognition** of Indian maritime certifications.

Analytics Tools for Insight Building and Decision Making

Advanced analytics tools are being deployed to enable **data-driven decision-making across the maritime training ecosystem**.

These tools support:

- Performance monitoring of MTIs and training outcomes
- Identification of trends in enrolment, placement and compliance
- Predictive insights for capacity planning and policy formulation

This enhances **strategic planning, regulatory oversight and continuous improvement** in training quality.

Artificial Reality (AR) and Virtual Reality (VR)

AR and VR technologies are being introduced to provide **immersive and simulation-based training environments** for maritime education.

These technologies enable:

- Realistic replication of onboard operations and emergency scenarios
- Safe and controlled training for high-risk situations
- Enhanced engagement and experiential learning

This significantly improves **skill acquisition, preparedness and competency development** of trainees.

International Ship and Port Facility Security (ISPS)



History of International Ship and Port Facility Security (ISPS)



Origin of the ISPS Code:

The ISPS Code was internationally adopted after the 9/11 attacks, which highlighted the potential for merchant ships to be used as tools by terrorists.

Purpose and Implementation:

1. The ISPS Code was implemented to enhance the security of ships and port facilities globally
2. It came into force on July 1, 2004.

Scope of the ISPS Code:

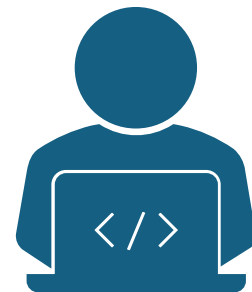
The code includes comprehensive security-related requirements for ships, ports, and governments.

Implementation in India:

In India, the ISPS Code is enforced through Part IX B of the Merchant Shipping Act, 1958, and Section 68D of the Indian Port Act, 1908.

Designated Authority:

The Director General Shipping (DGS) has been appointed as the Designated Authority for the implementation of the ISPS Code in India, as per the directive from the Ministry of Shipping dated July 4, 2003.



48



ISPS Code & India's Implementation



Origins of the ISPS Code

The ISPS Code was internationally adopted after the 9/11 terrorist attacks, which exposed the vulnerability of merchant ships being used as tools by terrorists. IMO convened a Diplomatic Conference in December 2002 and adopted the Code as an amendment to SOLAS.

Purpose & Implementation

The ISPS Code was implemented to enhance the security of ships and port facilities globally. It came into force on 1st July 2004. It lays down a standardized framework for security assessment, planning, and implementation.

Scope of the ISPS Code

The Code includes comprehensive security-related requirements for ships (>500 GT on international voyages), mobile offshore drilling units, and port facilities serving such ships. It applies to Contracting Governments, ship companies, and port facility operators.

Implementation in India

In India, the ISPS Code is enforced through Part IX-B of the Merchant Shipping Act, 1958 and Section 68D of the Indian Ports Act, 1908. India ratified SOLAS and has been implementing ISPS since July 2004.

Designated Authority

The Director General of Shipping (DGS) has been appointed as the Designated Authority for ISPS Code implementation in India vide Ministry of Shipping directive dated 4th July 2003. DGS approves PFSA's, PFSP's, issues PFSC's, and conducts periodic audits.

74

Port Facilities ISPS Compliant in India

ISPS Security Levels

Level 1 NORMAL	Minimum security measures at all times — routine operations.
Level 2 HEIGHTENED	Additional protective measures due to elevated security risk.
Level 3 EXCEPTIONAL	Further specific measures when a threat is probable or imminent.

49

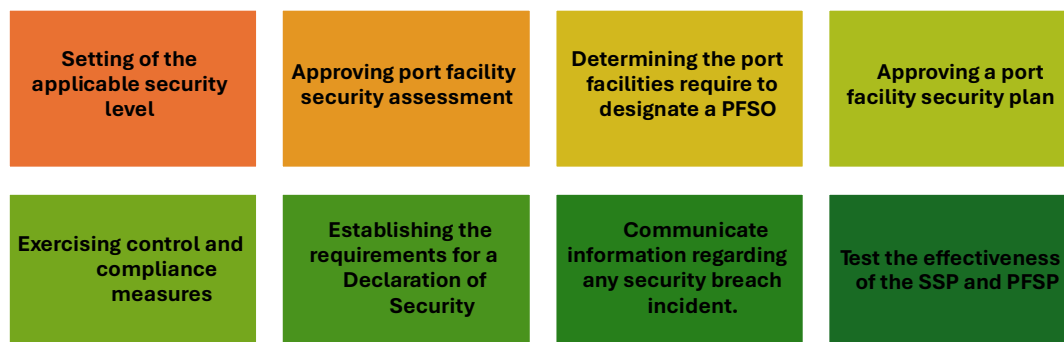
The ISPS Code was adopted internationally after hijacked aircrafts flew into the twin towers of the World Trade Center on 11th Sept 2001. After this incident there were concerns that merchant ships could also be used as a tool by terrorists. In view of the same, the International Ship and Port Security code (ISPS) was adopted internationally to strengthen security of ships and ports, which came in to force on 1st July 2004.

ISPS Code contains detailed security related requirements for Government, Port authorities and shipping companies to enhance security in ports and on ships. India is a Party to SOLAS Convention, which incorporates the international code for ship and port facility security (ISPS Code), which prescribe 'special measures to enhance maritime security'. Part-IXB of the Merchant Shipping Act, 1958 makes provisions on security of ships and port facilities in compliance with India's obligation under the SOLAS Convention.

The rules apply to Indian ships of all types, foreign flag ships when they call at any Indian port or offshore facility, and to Indian port facilities themselves.



ISPS - Responsibility of Administration



50

A. BoPS - Detailed function



Bureau of Port Security (BoPS)



- **Bureau of Port Security (BoPS)** has been constituted under **Section 13(1) of the Merchant Shipping Act, 2025**, vide [notification](#) dated **27.06.2026**.
- Draft Cabinet Note for creation of **DG / ADG posts (Level 15 / Level 14 IPS)** for operationalisation of BoPS was submitted on **18.06.2026**.
- Proposal for creation of **75 additional posts** for BoPS was submitted to **Department of Expenditure (DoE)** on **23.06.2026**. As advised by DOE the proposal will be resubmitted after cabinet approval of **DG / ADG posts**.
- [Organogram](#) of BoPS finalized after inter-ministerial consultations with MHA and other stakeholders.
- Draft Bureau of Port Security (BoPS) Rules and Ship & Port Facility Security (SPS) Rules have been prepared and submitted to MoPSW.

55

The Bureau of Port Security (BoPS) will function as an independent organization, responsible for overseeing port security facilities and conducting audits as per domestic security compliance codes and SOPs. Its role will be to ensure these regulations do not conflict with the ISPS Code or other international conventions. BoPS will establish a domestic regulatory framework for security and operational aspects of port facilities while maintaining alignment with global standards.

BoPS will set security standards for all categories of ports, including government-owned, private, and non-export-import (exim) ports. It will also define procedures for audits and compliance with security standards while ensuring adherence to international conventions. The organization will be responsible for collecting and monitoring security-related information regarding port facilities, ensuring its timely assessment and analysis.

Additionally, BoPS will enforce adequate and proportionate maritime security measures at ports and other maritime facilities in coordination with law enforcement agencies. It will develop SOPs to streamline security procedures while ensuring ease of business operations, minimizing disruptions to passengers, crew, cargo movement, and port management activities. BoPS will also establish security training guidelines for personnel working in ports and other relevant establishments, as mandated by the Central and State Governments.

Under the proposed Merchant Shipping (MS) Bill, the Bureau of Port Security (BOPS) is envisioned to play a key role in the security framework of ports and maritime operations. While BOPS may be responsible for developing security standards and frameworks based on evolving threats and vulnerabilities, it does not have the authority to directly board or inspect ships and their cargo. This restriction is in place to ensure that inspections are conducted in a streamlined manner by designated entities, preventing multiple inspections that could hinder business operations.

Responsibilities	Major Ports (Indian Port Act, 1908 & MS Act, 1958)	Non-Major ports (as per Indian Port Act, 1908)
Formulate SOP & minimum standards of security categorization of security infrastructure (as per local requirements & otherwise)	DG Shipping	DG Shipping
Port Facility Security Assessment (PFSA)	DG Shipping	DG Shipping
Preparation of Port Facility Security Plan (PFSP)	DG Shipping	DG Shipping
Approval of Port Facility Security Assessment and Port Facility Security Plan.	DG Shipping	DG Shipping
Conduct of Port Facility audit/certification	DG Shipping	DG Shipping
Ensuring ISPS Compliance	DG Shipping	DG Shipping
Ensuring Security Compliance other than ISPS Compliance	BoPS/Port Authority	BoPS/Port Authority

1. Policy and Training Division

This division shall perform the following functions:

- i. To decide the roles, responsibilities and jurisdiction of security agencies on the landward and waterfront of Ports/Shipyards and for security of Single Point Moorings/Offshore Installations and Terminals.

- ii. To lay down port security norms and promulgate Standard Operating Procedures (SOPs) in accordance with global security standards for categorization of all Ports, Ships and Shipyards etc.in a harmonious manner and to ensure uniform application of the same to all Ports for effective security outcomes.
- iii. To devise mechanisms to strengthen security of Ports, Ships and Shipyards including physical security through deployment of central forces or other security agencies and technological solutions.
- iv. To enumerate criteria for certification of a port with respect to its security as per set standards, which shall cover conveyance security (to prevent unauthorized access or tampering); stakeholder requirements and security procedures, container security (procedures for ensuring proper sealing and container integrity, physical access controls; procedural security; personnel security (background checks, etc.); physical security (fences, gates, cameras, alarms systems, etc.); Information technology security, as well as procedures to report any problems to port facility guarding Central/State security force, etc. other authorities. Also, to prepare list of equipment required for ports as per cargo volume and location including nearby warehouse/godown and inland container depot.
- v. To impart security training to all personnel of concerned agencies directly or indirectly related to ports/shipyard business.
- vi. To carry out trainee need analysis and prepare material for training and certification of such training courses.
- vii. To lay down training and operating standards for both Government and private security agencies and to verify compliance to ensure global security standards are achieved.
- viii. To suggest procedures/methodology for the recruitment, training, security vetting/certification, extension of certificate and management of all private security personnel and agencies deployed for security of private ports/terminals.

- ix. To have linkages with National Academy for Coastal Policing (NACP), Rastriya Raksha University (RRU), and such other establishments for preparation of training module, inter-alia for capacity building.
- x. To certify and audit training facilities engaged in offering certification for personnel engaged in Port Security functions.
- xi. To categorize/classify the port on the basis of certain parameters like cargo handled, area under port jurisdiction, etc.
- xii. Any other functions as may be assigned by the Ministry.

I. Functions which are not envisaged to be performed by the BOPS:

The **International Ship and Port Facility Security (ISPS) Code** is a key international framework that enhances the security of ships and port facilities, especially in light of the increasing threat of terrorism. While the **Bureau of Port Security (BPS)** could play an important role in port security whie, there are certain functions and responsibilities pertaining to Ships and ports it may not be able to **perform** in view of the requirements of SOLAS Convention and other convention for which Director General of Shipping is the custodian.

B. Functional relationship with DG Shipping's and transition to DGMA:



Provision of Merchant Shipping Act, 2025



- BoPS is a unique institutional framework created by India under the Merchant Shipping Act, 2025.
- ISPS Code, provides for a Designated Authority (DA) only for Port Facilities which gives the flexibility to the Administration as far as security of Port Facilities.

Provision of Merchant Shipping Act, 2025 regarding BoPS:

- The Merchant Shipping Act, 2025 under Section 13 mandates the constitution of a body for the security of vessels and port facilities.
- The Merchant Shipping Act, 2025 under Section 13(3) specifically requires that, while framing the rules, due consideration shall be given to the provisions of the International Ship and Port Facility Security (ISPS) Code under the Safety Convention.
- The Bureau of Port Security (BoPS) handles port facility security and vessel/port interfaces.

The Merchant Shipping Bill 2025 seeks to repeal and re-enact the Merchant Shipping Act, 1958. The Directorate General of Shipping headed by the Director-General of Shipping (proposed to be re-named as Director-General of Maritime Administration under clause 7 of the Bill) who will facilitate the implementation of the Bill, is already in existence.



Solas Chapter XI-B Special Measures for Maritime Security



- **SOLAS Chapter XI-2** and the **ISPS Code** form the basis of maritime security implementation in India.
- **Background of the ISPS Code:**

The ISPS Code was internationally adopted after the 9/11 terrorist attacks, which exposed the vulnerability of merchant ships being used as tools by terrorists. IMO convened a Diplomatic Conference in December 2002 and adopted the Code as an amendment to SOLAS.
- Under **Regulation 3, Contracting Governments / Administration** are responsible for **setting security levels** and ensuring communication to ships and port facilities.
- Under **Regulation 4, ships and companies** are required to comply with ISPS requirements, including **verification and certification**.
- **Till date Directorate General Maritime Administration functions both as the Administration** and Designated Authority for implementation of **ship and port security requirements** under SOLAS and ISPS Code with the support of Recognized Security organization Indian Register of Shipping.
- **74 EXIM port facilities** in India are presently **ISPS compliant**.
- Recently, Central Industrial Security Force (CISF) Technical Consultancy Wing has been authorized as a Recognized Security Organization (RSO) for port facilities only.

51

The augmented responsibilities of DG shipping after transitioning to DGMA are as follows:

- Renaming DG Shipping as DG Maritime Administration (DGMA), in line with international practices to oversee maritime affairs other than commercial aspects of Ports (Clause 7)
- Security of Port Facility under ISPS Code (and Chapter XI-2 of SOLAS Convention) will be overseen by DGMA
- Creation of Body which may be headed DGMA to carry out the regulatory and oversight functions in respect of security of vessels and port facilities (Clause 13)
- Supervision of DGMA over DG of Aids to Navigation to ensure over all safety of navigation in the sea
- Supervision of Ports with respect to discharge of obligations under International Conventions

C. No role of BOPS in ISPS code compliance:

BOPS shall be an independent subordinate body under Ministry

The Bureau of Port Security (BoPS) is envisioned as an independent subordinate body directly under the Ministry. It is designed to function autonomously in developing and enforcing domestic port security regulations and standards while maintaining a clear functional interface with the Directorate General of Shipping (DG Shipping) and its transition to the DG Maritime Administration (DGMA) for aspects related to international compliance.

BoPS's primary mandate is to ensure a robust domestic regulatory framework for port facility security, audit practices, and operational procedures without adversely affecting compliance with the ISPS Code and other international conventions.

India's extensive coastline and the increasing volume of domestic and international trade necessitate a proactive, coordinated approach to port security. While DG Shipping (transitioning to DGMA for certain functions) continues to handle international compliance issues, there is a growing recognition of the need for a dedicated domestic agency that can:

- Develop and enforce security standards specific to the operational realities of Indian ports.
- Conduct audits and monitor compliance based on domestic security codes and standard operating procedures (SOPs).
- Coordinate with various law enforcement and security agencies to address coastal, offshore, and port-related threats.

BoPS is conceived as part of a broader initiative to upgrade port infrastructure and security. It is intended to complement existing international regulatory frameworks most notably the International Ship and Port Facility Security (ISPS) Code by focusing on domestic needs. This dual approach ensures that while international compliance is maintained by DG Shipping/DGMA, BoPS can tailor regulatory measures to local conditions and operational exigencies at ports.

BoPS shall:

- **Establish a Domestic Regulatory Framework:**
Develop comprehensive security standards and procedures for all categories of ports

(government, private, Exim, or Non-Exim) without adversely affecting the ISPS Code and other international conventions.

- **Audit and Compliance:**
Formulate procedures for regular security audits and ensure that port security facilities adhere to the domestic security compliance code and approved SOPs.
- **Information Collection and Monitoring:**
Set up systems to collect, analyze, and monitor security-related information from port facilities to facilitate timely decision-making.
- **Security Measures Coordination:**
Ensure that appropriate, proportionate maritime security measures are implemented at ports, coordinating closely with law enforcement and other relevant agencies.
- **Operational Guidelines and Ease of Business:**
Prepare and disseminate SOPs for the effective implementation of security protocols that balance robust security with operational efficiency—minimizing disruptions to passengers, crew, and cargo movement.
- **Training and Capacity Building:**
Develop and enforce security training guidelines for the workforce in all ports and related establishments as notified by the Central or State Governments.
- **Inter-agency Coordination:**
Facilitate seamless coordination between various security and enforcement agencies (including coastal, offshore, customs, and intelligence agencies) to respond to threats efficiently.

Independent Establishment of BOPS

BoPS is to be set up as an autonomous body directly under Ministry. Its posts, recruitment, and establishment matters shall be entirely distinct from those of DG Shipping/DGMA. This separation ensures that:

- **Autonomy in Decision-Making:** BoPS can develop and enforce domestic security measures without institutional overlap or conflicts of interest.
- **Clear Functional Boundaries:** While DG Shipping (transitioning to DGMA) will retain responsibility for aspects related to international conventions (such as the ISPS Code), BoPS will manage the domestic regulatory framework and operational aspects of port security.

Functional Areas and Responsibilities:

1. Security Standards and Audit Procedures

- **Standards** **Development:**
BoPS will lay down security standards for all port categories, ensuring they are aligned with domestic priorities and operational requirements while not interfering with international norms
- **Audit** **Protocols:**
Develop and implement a schedule for regular security audits of port facilities. Audits will verify compliance with the domestic security compliance code and approved SOPs.

2. Information Collection and Monitoring

- **Data** **Systems:**
Establish an integrated data management system to collect, monitor, and analyze security-related information from port facilities.
- **Real-Time** **Monitoring:**
Leverage technology for real-time monitoring of port security, enabling swift action in case of anomalies or breaches.

3. Security Measures Implementation

- **Maritime** **Security:**
Oversee the implementation of adequate and proportionate security measures at ports, coordinating with law enforcement agencies.
- **Operational** **Readiness:**
Ensure that security procedures do not impede the smooth flow of port operations—maintaining the balance between safety and operational efficiency.

4. SOP and Training

- **SOP** **Development:**
In consultation with port authorities and stakeholders, BoPS will prepare detailed SOPs for the implementation of security procedures. These SOPs will be designed to ensure ease of doing business and minimal disruption to port operations.

- **Training**

Guidelines:

Formulate and enforce guidelines for training the port workforce, ensuring that all personnel are well-versed in the latest security protocols and practices.

5. Coordination with Enforcement Agencies

- **Inter-agency**

Linkages:

BoPS shall serve as the nodal point for coordinating with all relevant security and enforcement agencies—ensuring that port security measures are comprehensive and synchronized across all levels.

- **Crisis**

Response:

Establish protocols for rapid response and coordination during security incidents.

Relationship of BoPS with DG Shipping / DGMA

While DG Shipping (transitioning to DGMA for certain international functions) will continue to supervise aspects related to the ISPS Code and other international conventions, BoPS will focus solely on domestic regulatory and operational aspects. This division of roles is designed to:

- **Avoid**

Functional

Overlap:

Maintain clear lines of responsibility so that the domestic and international security frameworks operate in parallel without conflict.

- **Enhance**

Efficiency:

Ensure that the specialized expertise of each agency is deployed most effectively for their respective mandates

Legal and Regulatory Framework

BoPS's operations will be underpinned by a robust legal framework that:

- **Ensures**

Compliance

with

National

Legislation:

Operates in accordance with domestic maritime and port security laws.

- **Respects**

International

Norms:

Explicitly states that its procedures and protocols shall not impinge upon the ISPS Code

or other international conventions these remain under the purview of DG Shipping/DGMA.

- **Mandates** **Clear** **Accountability:**
Legal provisions should delineate the responsibilities, reporting requirements, and accountability mechanisms for BoPS.

Therefore, establishment of the Bureau of Port Security (BoPS) marks a strategic initiative to bolster domestic port security and operational efficiency in India. By operating as an independent subordinate body under the Ministry with a clear mandate, robust regulatory framework, and distinct operational boundaries from DG Shipping/DGMA, BoPS will:

- Enhance the security and resilience of India's port infrastructure.
- Ensure compliance with both domestic and international security standards.
- Foster a coordinated, technology-driven approach to maritime security.
- Support economic growth by ensuring that security measures facilitate rather than hinder port operations.
- Explicitly ensure that its procedures and protocols shall not impinge upon the ISPS Code or other international conventions, ISPS code shall remain under the purview of DG Shipping/DGMA.

Directorate General of Shipping (DGS) Responsibilities as per ISPS code

The Directorate General of Shipping (DGS) is the central regulatory authority for maritime safety and security in India. Under the ISPS Code, DGS has several key responsibilities, including:

- **Implementation and Enforcement of ISPS Code:** The DGS ensures the implementation of the ISPS Code within the Indian maritime domain, ensuring compliance by ships and port facilities.
- **Issuing Security Certificates:** The DGS is responsible for issuing International Ship Security Certificates (ISSC) to ships. These certificates verify that the ships comply with the security measures set out by the ISPS Code.
- **Approval of Ship Security Plans:** The DGS reviews and approves the ship security plans (SSPs) of vessels under the flag of India to ensure they align with the ISPS Code.

- **Monitoring and Auditing:** The Directorate monitors the security standards of vessels and port facilities, ensuring periodic audits, inspections, and compliance assessments are carried out.
- **Training and Awareness:** DGS plays a significant role in promoting maritime security awareness and providing necessary training to shipping companies, crew members, and other stakeholders involved in the maritime industry.
- **Incident Investigation:** The DGS is involved in investigating security incidents that may occur on ships, reporting the findings, and recommending corrective measures.

Requirement of ISPS Code as per SOLAS Regulations

Following is the basic requirement of the ISPS code as per SOLAS Regulation

The regulations pertain to the **International Ship and Port Facility Security (ISPS) Code**, and they lay out the application and responsibilities for both ships and port facilities, including the obligations of contracting governments. Here's a summary of key points from **Regulation 2: Application, Regulation 3: Obligations of Contracting Governments with respect to security, Regulation 7: Threats to ships, Regulation 9: Control and compliance measures, and Regulation 10: Requirements for port facilities:**

Regulation 2: Application

This regulation defines the scope of the ISPS Code's application:

1. **Ships Engaged on International Voyages:**
 - Passenger ships (including high-speed passenger craft).
 - Cargo ships (including high-speed craft) of 500 gross tonnage and above.
 - Mobile offshore drilling units.
2. **Port Facilities Serving International Ships:**
 - Port facilities that primarily serve ships engaged in international voyages are covered by the ISPS Code.
 - In the case of port facilities used primarily by non-international ships, contracting governments can decide the extent to which the ISPS Code applies.
3. **Exemptions:**
 - Warships, naval auxiliaries, and other government-owned ships used for non-commercial purposes are exempt from the provisions of this chapter.

Regulation 3: Obligations of Contracting Governments with respect to security

1. Setting and Updating Security Levels:

- Administrations must establish security levels and provide security level information to ships flying their flag.
- Security levels must be updated as circumstances change.

2. Provision of Security Information to Port Facilities:

- Contracting governments must ensure port facilities in their territory receive updated security level information.
- Ships entering ports or already in port must be provided with security information before and during their stay.

Regulation 7: Threats to Ships

1. Security Level Information for Ships:

- Contracting governments must provide security level information to ships operating in their territorial seas or those intending to enter.

2. Point of Contact for Ships:

- Governments must provide a point of contact through which ships can request assistance or report concerns related to security, including threats posed by other ships or unusual movements.

Regulation 9: Control and Compliance Measures

1. Control of Ships in Port:

- Ships in port are subject to control by authorized officers, who verify whether the ship has a valid International Ship Security Certificate (ISSC) or Interim ISSC.
- If there are clear grounds to believe that a ship is not compliant with the ISPS Code, officers may take control measures (e.g., inspection, detention, restriction of movement, or expulsion).

2. Ships Entering Port:

- Ships intending to enter a port may be required to provide information on their security status (e.g., current security level, prior port security level, special measures taken).

3. Avoiding Undue Detention/Delay:

- Efforts should be made to avoid undue detention or delay of ships. If a ship is detained or delayed unfairly, it is entitled to compensation for any loss or damage suffered.
- Emergency and humanitarian access to ships must not be hindered for security purposes.

Regulation 10: Requirements for Port Facilities

1. Compliance with ISPS Code:

- Port facilities must comply with the requirements of the ISPS Code, considering the guidance in Part B of the ISPS Code.

2. Port Facility Security Assessments and Plans:

- Contracting governments must ensure that port facility security assessments are carried out, reviewed, and approved.
- Port facility security plans must be developed, reviewed, approved, and implemented in accordance with the ISPS Code.

3. Measures for Different Security Levels:

- Contracting governments must designate and communicate measures to be addressed in port facility security plans for varying security levels, including when a Declaration of Security (DoS) is required.

Key Points to Consider:

- The ISPS Code places a significant responsibility on contracting governments to manage maritime and port security through defined security levels, regular updates, and compliance checks for ships and port facilities.
- Specific measures include controlling ships in port, ensuring correct certification, sharing security-related information, and implementing effective security assessments and plans for port facilities.
- Governments must ensure that the ISPS Code's requirements are met without causing undue disruption to ships or facilities, while also enabling flexibility for ships not primarily engaged in international voyages.

D: D.G Shipping's existing role vis-à-vis safety and security on ports/vessels:

Audits and Inspections Under the ISPS Code

The ISPS Code mandates regular audits and inspections of ships and port facilities to verify compliance with international security regulations. These assessments are crucial in maintaining security integrity and ensuring preparedness against potential threats. The responsibility for conducting these audits primarily lies with the Flag State, which ensures that vessels under its registry adhere to the ISPS Code.

Role of Flag State in ISPS Compliance

The Flag State holds primary responsibility for ensuring that its registered vessels comply with the ISPS Code. Given the need to harmonize inspections and avoid unnecessary redundancies, the Flag State may delegate the auditing process to Recognized Security Organizations (RSOs). These RSOs conduct ISPS audits in conjunction with other mandatory inspections, such as:

- **Safety Management Audits** (under the International Safety Management (ISM) Code)
- **Maritime Labour Convention (MLC) Audits** (ensuring crew welfare and working conditions)

This integrated approach helps facilitate ease of doing business by minimizing disruptions while maintaining compliance with multiple maritime regulatory frameworks.

Port State Control (PSC) and ISPS Inspections

Port State Control (PSC) inspections play a crucial role in verifying ISPS Code compliance when foreign vessels enter a port. The Director General (DG) of Shipping officials are authorized to carry out these inspections, ensuring that both Indian and foreign vessels adhere to security protocols. These inspections follow:

- **Risk-based inspection matrices**, evaluating vessels based on factors such as compliance history, ship type, and operational area.
- **International Maritime Organization (IMO) Procedures on Port State Control**, which provide standardized guidelines for conducting inspections.

The PSC inspections help in identifying and addressing security deficiencies while ensuring that only compliant ships operate within the port's jurisdiction.

Oversight of Security Arrangements in Ports

While BOPS may not have direct inspection authority over ships, it plays a vital role in overseeing security measures at port facilities. This includes:

- Implementing security frameworks tailored to specific threat assessments.
- Coordinating with Flag State authorities and RSOs to ensure effective ISPS compliance.
- Monitoring adherence to security measures without directly intervening in shipboard inspections.

Ensuring Compliance Without Hampering Trade

A key consideration in ISPS Code compliance is balancing security requirements with the need for seamless maritime trade. By centralizing inspections under Flag State authorities and RSOs, the framework avoids excessive disruptions while maintaining a robust security environment. This approach ensures that:

- Inspections are harmonized and non-redundant.
- Security is upheld without imposing unnecessary operational burdens on shipping companies.
- Compliance measures align with international best practices to facilitate global trade.

International Cooperation on ISPS Code Enforcement and Engagement with IMO:

The **International Ship and Port Facility Security (ISPS) Code** is a fundamental element of the global maritime security framework. It aims to safeguard ships, port facilities, and maritime assets from various security threats, including terrorism, piracy, and unauthorized access. While national governments are responsible for enforcing the ISPS Code within their jurisdictions, **international cooperation** plays a crucial role in ensuring its **effective and consistent implementation worldwide**.

A key aspect of international cooperation is engagement with the International Maritime Organization (IMO), which serves as the principal global authority overseeing maritime

security regulations. By collaborating with IMO and other international stakeholders, national maritime authorities can align their security measures with global standards, enhancing security preparedness, response capabilities, and resilience against emerging threats.

Importance of International Cooperation in ISPS Code Enforcement

Effective implementation of the ISPS Code depends on strong international partnerships to ensure seamless security measures across maritime borders. The key areas of cooperation include:

- **Cross-Border Coordination:** Strengthening bilateral and multilateral agreements with international partners facilitates the uniform application of security measures across different jurisdictions.
- **Standard Harmonization:** Aligning India's security protocols with internationally recognized best practices ensures consistency in maritime security implementation.
- **Joint Security Exercises:** Conducting drills and simulation exercises with global maritime security agencies enhances preparedness and tests the effectiveness of response mechanisms.
- **Information & Intelligence Sharing:** Collaborating with organizations such as the IMO, International Maritime Bureau (IMB), and regional security centers helps in proactive risk assessment and early threat mitigation.
- **Threat Mitigation Efforts:** Coordinated efforts with global partners help address terrorism, piracy, cyber threats, and other maritime security risks, ensuring safe and secure maritime operations.

Training and Certification:

- The **ISPS Code** requires that personnel involved in security (e.g., Ship Security Officers (SSOs), Port Facility Security Officers (PFSOs)) undergo specific training and certification. While the Bureau of Port Security could encourage and facilitate training, the **actual certification** of security personnel is typically handled by **flag state**, training providers approved by DG Shipping.

Issuance of Security Levels:

- Under the ISPS Code, ships and port facilities must adjust security measures according to different **security levels** (Level 1, Level 2, and Level 3). While the BoPS might assist in maintaining security measures at ports, the **actual issuance** of security levels and adjustments to those levels are typically the responsibility of the Flag States.

1. **Definition of Security Levels:**

The ISPS Code defines three security levels:

- **Security Level 1** (Normal): The level at which ships and port facilities operate under routine security conditions.
- **Security Level 2** (Heightened): Implemented when there is an increased risk of a security incident but no specific threat has been identified.
- **Security Level 3** (Imminent Threat): Enforced when a security incident is probable or ongoing.

2. **Authority for Issuance and Adjustment:**

- **Flag States' Role:** The responsibility for setting and adjusting security levels for ships lies primarily with the **Flag State**. The government of the country where the ship is registered dictates security measures in response to intelligence, threats, or international advisories.
- **Port State Control & Coastal States:** While Flag States regulate ships, **Port States and Coastal States** can enforce security measures within their jurisdiction. They can impose security levels for ships entering their waters or ports, ensuring compliance with ISPS requirements.
- **Designated Authority (DA):** Each country appoints a **Designated Authority** responsible for overseeing ISPS Code implementation at the national level, ensuring that security levels are enforced effectively at ports and port facilities.

3. **Implementation of Security Measures at Different Levels:**

- At **Level 1**, routine security measures are maintained, such as access control and surveillance.
- At **Level 2**, enhanced screening, increased patrols, and stricter access control are enforced.
- At **Level 3**, emergency procedures are activated, including ship inspections, restricted movements, and heightened security personnel presence.

- The BoPS would likely play a role in **implementing** security levels at the port level. But for ships the BoPS would not be the sole authority in issuing or altering the security level.

Security-Related Legislation and Enforcement:

While the Bureau of Port Security could advocate for stronger port security measures and work on developing security protocols, the **legislative and enforcement powers** related to the ISPS Code (such as imposing fines or penalties for non-compliance) are typically vested in Flag States .

The Bureau's role would more likely to frame policies, procedures, and guidance for improving security standards considering new forms of threats, intelligence inputs, cybersecurity threats etc. The BoPS is envisaged to work alongside other agencies to ensure the enforcement of policies related to port and ship security.

I. Safety and Security on ports/ vessels and transition to DGMA

The Directorate General of Shipping (D.G. Shipping) in India plays a crucial role in ensuring the safety and security of ports and vessels. Its responsibilities cover regulatory oversight, policy implementation, and compliance monitoring in alignment with international maritime conventions. Here's a breakdown of its existing role in this regard:

1. Safety Regulations on Vessels and Ports

- Enforces **International Maritime Organization (IMO) conventions** like SOLAS (Safety of Life at Sea), MARPOL (Marine Pollution Prevention), and STCW (Standards of Training, Certification, and Watchkeeping for Seafarers).
- Implements **Indian Merchant Shipping Act** provisions related to vessel safety, crew training, and pollution control.
- Conducts **port state control (PSC) inspections** to ensure foreign vessels comply with international safety standards.
- Ensures proper certification of vessels and crews to maintain high safety standards.

2. Vessel Requirements

- Communication & safety equipment: Mandatory for Indian vessels, with certified operators.
- Stability & load lines: Must carry approved stability data; load lines assigned by Chief Ship Surveyor (or authorized surveyor).
- Overloading prohibited: Vessels cannot submerge assigned load lines.

3. Passenger Vessels

- Certification: No passenger operations without valid certificates.
- Conditions: Central Government sets rules for passenger safety, amenities, cargo/livestock carriage, and medical facilities.
- Master's duty: Submit passenger manifests in prescribed format.

4. Security Oversight

- Implements the **International Ship and Port Facility Security (ISPS) Code** for Indian ports and ships to prevent security threats like piracy, terrorism, and unlawful activities.
- Coordinates with **Indian Coast Guard, Navy, and Port Authorities** to strengthen maritime security.
- Monitors and enforces **security clearance procedures** for vessels entering Indian territorial waters.

5. Accident Investigation and Emergency Response

- Investigates **maritime accidents, collisions, and safety violations** to prevent future occurrences.
- Ensures the establishment of **Search and Rescue (SAR) mechanisms** for distressed vessels.
- Works with agencies like the **Indian National Maritime Search and Rescue Board (INMARSARB)** for rescue operations.

6. Environmental Protection and Pollution Control

- Implements MARPOL regulations to prevent oil spills, hazardous waste discharge, and emissions from ships.
- Enforces **Ballast Water Management Rules** to prevent marine biodiversity threats.
- Ensures shipbreaking and hazardous material handling comply with safety and environmental standards.

7. Training and Certification of Seafarers

- Regulates maritime training institutes and ensures that seafarers receive proper safety training.
- Conducts examinations and certifications in compliance with international safety protocols.

8. Crisis Management & Compliance

- Collaborates with **Ministry of Ports, Shipping & Waterways** and other agencies to develop safety frameworks.
- Issues advisories and safety circulars based on evolving maritime risks.

9. Prohibitions & Penalties

- Misconduct onboard: Penalties for drunkenness, molestation, fare evasion, refusal to disembark, or carrying hazardous substances.
- Cargo/passenger violations: No carriage without valid certificates or exceeding certified limits.
- Unseaworthy vessels: Liability for owners/masters sending vessels to sea unseaworthy unless justified.

10. Safety Management & Audits

- Safety/Security Management Systems: Mandatory for vessels, companies, and port facilities.
- Audits: Central Government or authorized agencies to audit compliance.
- Security levels: Government may set varying security tiers for ports/vessels

The D.G. Shipping acts as the key regulatory body ensuring that maritime operations in India adhere to strict safety and security norms, thereby safeguarding human lives, the environment, and national interests. Let me know if you need more details on any specific aspect.

E. Legal amendments necessitated in light of the submission of clear demarcation of BoPS Role and functions:

Merchant Shipping Bill, 2024 – Section 13: Body for Security of Vessels and Port Facilities

The Merchant Shipping Bill, 2024 proposes the establishment of a body under Section 13, aimed at strengthening the security of port facilities and vessels. This body would enhance intelligence gathering, security coordination, and response mechanisms at ports.

Key Considerations Regarding BoPS and its Role in ISPS Code Implementation:

1. Ship Security Limitations:

- The ISPS Code addresses both ship and port facility security.
- Since the proposed Bureau of Port Security (BoPS) is focused solely on port security, it does not have the authority or capability to regulate ship security, making it unsuitable for fulfilling the role of the ISPS Code authority.

2. Lack of Authority to Issue ISSCs:

- Section 13 of the Bill does not grant the proposed body the power to issue International Ship Security Certificates (ISSCs), a crucial requirement under Regulation XI-2/6 of the ISPS Code.
- The Directorate General of Shipping (DG Shipping) retains exclusive jurisdiction over ship certification, meaning it remains the only viable authority to issue ISSCs and regulate ship security.

Proposed Amendment to the Merchant Shipping Bill, 2024 – Section 13

To ensure clarity and avoid overlap in responsibilities, the Merchant Shipping Bill, 2024 should be amended as follows:

Clarification of BoPS's Role:

- The amendment should explicitly state that BoPS is tasked with enhancing port security, specifically focusing on securing port facilities and improving coordination with security agencies such as the CISF, Coast Guard, and Customs.
- It should also clarify that BoPS is not responsible for regulating ships or overseeing compliance with ship security measures under the ISPS Code.

This demarcation of responsibilities will ensure that the roles of BoPS and DG Shipping are clearly defined, allowing each body to focus on their respective areas of expertise without overlap, while still maintaining compliance with international maritime security standards.

I. DG Shipping role as DG Maritime Administration

The Director General of Shipping (DG Shipping), in its capacity as the designated Maritime Administration of India, holds the exclusive mandate for ensuring compliance with all international conventions acceded to by India. This includes overseeing adherence to regulations and protocols established by the International Maritime Organization (IMO) and other relevant global bodies. The Bureau of Port Security (BoPS) shall have no jurisdiction over these matters

Furthermore, all international conventions relevant to maritime governance fall within the purview of DG Shipping, including those related to safety, security, environmental protection, and operational standards. In particular, compliance with the International Ship and Port Facility Security (ISPS) Code remains under the sole jurisdiction of DG Shipping. Given its core domain expertise and the extensive 75-year engagement of DG Shipping in international maritime conventions.

This reaffirmation underscores that DG Shipping, as the statutory authority, continues to be the primary entity responsible for India's obligations under international maritime conventions, ensuring alignment with global standards and safeguarding the nation's maritime interests.

II. Legal Amendments necessary in the notified Merchant Shipping (Ships and Port Facility security) Rules 2022 as mandated to be submitted

1. Strengthening Cyber security in Port Security

The 2022 Rules focus primarily on physical security, lacking explicit provisions for **cyber security threats**, which have become a major concern globally.

IMO Resolution MSC. 428(98) mandates cyber risk management as part of the **International Safety Management (ISM) Code**, but Indian rules need a specific **legal framework** for enforcement.

Suggested Inclusions:

- **Integration of Cyber security Measures:** Mandate the incorporation of cyber security protocols within the Ship Security Plan (SSP) and Port Facility Security Plan (PFSP).

- **Regular Cyber security Audits:** Implement periodic assessments to identify vulnerabilities and ensure compliance with established cyber security standards.
- **Incident Reporting Mechanism:** Establish a clear protocol for reporting cyber security incidents to relevant authorities promptly.

2. Enhanced Legal Clarity on Jurisdiction between Central & State Authorities

The **Merchant Shipping (Ships and Port Facility Security) Rules, 2022** do not clearly define **jurisdiction over minor ports**, leading to conflicts between the **state governments** and **central security agencies**.

Major ports are governed by the **Major Port Authorities Act, 2021**, while **minor ports** come under state governments, but security remains a national concern.

Suggested Inclusions:

- **Defined Roles and Responsibilities:** Clearly outline the specific duties of central and state authorities to prevent overlaps and ensure cohesive security management.
- **Coordination Mechanisms:** Establish formal channels for communication and collaboration between central and state entities to enhance operational efficiency.

ISPS code and Role of DG Shipping

The ISPS Code mandates a collaborative approach between contracting governments, ships, and port facilities, focusing on security assessment, level management, compliance, and communication to mitigate risks and maintain safe international shipping operations.

The Government has notified Director General of Shipping as the Designated Authority for the ISPS code. DG shipping is the custodian of the SOLAS convention for last 50 years.

The International Ship and Port Facility Security (ISPS) Code plays a crucial role in ensuring the safety and security of ships, port facilities, and maritime trade. Given the complexity of maritime security and the need for strict compliance with international regulations, it is essential that the responsibility for ISPS implementation remains under the Directorate General of Shipping (DG Shipping). DG Shipping is the most appropriate authority for this role due to its extensive operational expertise, domain knowledge, and alignment with global maritime security standards.

The DG Shipping serves as the primary regulatory body overseeing maritime affairs, including shipping safety, security, and environmental protection. One of its core functions is ensuring that Indian shipping operations comply with international conventions, standards, and regulatory frameworks, such as those established by the International Maritime Organization (IMO). Since the ISPS Code falls under the SOLAS (Safety of Life at Sea) Convention, which DG Shipping already enforces, it is logical that ISPS compliance remains within its jurisdiction.

Maritime security is unique and highly specialized, requiring a deep understanding of ship operations, port facility vulnerabilities, and international security threats such as piracy, smuggling, cyberattacks, and terrorism. Unlike general security or law enforcement agencies, DG Shipping has the technical knowledge and expertise to implement ISPS measures effectively.

III. Role of the Director General of Shipping (DG Shipping)

The DG Shipping is the central authority responsible for the administration of shipping regulations in India. The office operates under the Ministry of Ports, Shipping, and Waterways and is tasked with various functions, including policy implementation, regulatory compliance, maritime safety, and security at ports and on national waters.

The key responsibilities and functions of the DG Shipping are as follows: -

1. **Implementation of Shipping Policy and Legislation:** The DG Shipping plays a crucial role in formulating and enforcing national policies related to the maritime sector. These policies must align with international maritime conventions and regulations, particularly those set by the International Maritime Organization (IMO).

- **Legislative Authority:** The office ensures compliance with national shipping laws such as the Merchant Shipping Act, 1958, the Indian Ports Act, 1908, and the Pollution Control Act.
- **International Compliance:** It ensures that Indian maritime laws conform to international conventions such as the International Convention for the Safety of Life at Sea (SOLAS), International Convention on Standards of Training, Certification, and Watchkeeping for Seafarers (STCW), and International Convention for the Prevention of Pollution from Ships (MARPOL).

2. **International Convention for the Safety of Life at Sea (SOLAS) :**

The SOLAS Convention is one of the most significant and foundational instruments in global maritime law. It sets minimum safety standards for ships regarding their construction, equipment, and operation, including vital aspects of maritime security. SOLAS convention is under the mandate of DGS

- **Impact on Maritime Security:** The SOLAS Convention provides guidelines on the safety of life at sea, focusing on the protection of human life and preventing incidents such as sinking, fire, and collisions.
- **The International Ship and Port Facility Security (ISPS) Code,** which is a part of SOLAS, directly addresses maritime security. The ISPS Code lays down detailed security measures for ships and port facilities to prevent acts of terrorism, sabotage, piracy, and other unlawful acts. It includes requirements for the establishment of security plans, risk assessments, and designated security officers.
- **Security Enhancements:** SOLAS, through the ISPS Code, mandates the installation of security systems, such as surveillance cameras, ship security alert systems (SSAS), and the maintenance of security levels based on threat assessments.
- **Mandatory Security Plans:** Under SOLAS, ships must have a Ship Security Plan (SSP), and ports must have Port Facility Security Plans (PFSP) to guide responses to potential security threats.

3. Convention on the International Regulations for Preventing Collisions at Sea (COLREG): The COLREGs establish rules for preventing collisions at sea. While primarily aimed at maritime safety, COLREGs also contribute to maritime security by addressing situations that can lead to accidents or security vulnerabilities.

- **Impact on Maritime Security:**

By regulating the navigation of ships to prevent collisions and improve traffic management, COLREG helps avoid incidents that could create security risks, such as sabotage or hijacking.

Ensuring the safe and predictable movement of ships is critical for port and ship security, especially in high-traffic areas that could be targeted for terrorist attacks, piracy, or other unlawful acts.

COLREGs enhance situational awareness for ships and vessels, which is a key component of preventive security.

4. International Convention for the Prevention of Pollution from Ships (MARPOL)

The MARPOL Convention primarily addresses the environmental impact of shipping, specifically the prevention of marine pollution from oil, chemicals, and garbage. While its main focus is environmental protection, it also plays a significant role in maritime security.

- **Impact on Maritime Security:** Pollution incidents, especially oil spills or the illegal discharge of chemicals could undermine security in critical shipping lanes or port areas, creating long-term hazards to maritime infrastructure and the environment.

MARPOL regulations ensure that ships are equipped to prevent such incidents, which could be targeted by terrorists or criminals for sabotage, leading to both environmental damage and security risks.

By enforcing security measures on the disposal of waste, MARPOL indirectly supports overall maritime safety and security, ensuring ships do not become tools for carrying out illicit acts (e.g., transporting hazardous materials for illegal purposes).

5. International Convention on Standards of Training, Certification and Watch keeping for Seafarers (STCW)

The STCW Convention sets the minimum training standards for seafarers to ensure they are adequately trained to handle various safety and security situations on board.

Impact on Maritime Security:

- The STCW Code provides a framework for the training, certification, and watchkeeping of seafarers, ensuring that they are well-equipped to handle security-related situations, such as responding to piracy attacks or preventing unauthorized access to ships.
- The Convention includes provisions for specialized training in security awareness and anti-piracy measures, ensuring that crew members are prepared for emergency response scenarios.

- STCW also helps maintain crew competency in performing security duties required under the ISPS Code, including conducting security assessments, inspections, and implementing security measures during heightened threats.

6. Convention for the Suppression of Unlawful Acts against the Safety of Maritime Navigation (SUA Convention)

The SUA Convention is directly focused on protecting maritime navigation from unlawful acts, including terrorism, hijacking, and the transportation of weapons of mass destruction.

Impact on Maritime Security:

- The SUA Convention criminalizes acts such as hijacking, terrorism, and attacks on ships, thus providing a legal framework for the global suppression of maritime terrorism.
- The Convention was amended in 2005 to include new offenses, such as the use of ships for smuggling weapons of mass destruction or causing harm to people. This makes the SUA Convention an essential tool in counterterrorism and maritime security law enforcement.
- Through its provisions, the SUA Convention strengthens the ability of states to prosecute offenders and enhance cooperation between states in combating maritime-related crimes, which is a crucial component of overall maritime security.

7. Long-Range Identification and Tracking (LRIT) System

The LRIT System provides the ability to track ships in real-time, which is a critical element of maritime security.

Impact on Maritime Security:

The LRIT system allows authorities to monitor the location of ships worldwide, providing early warnings about suspicious or potentially dangerous ships, such as those operating without proper identification or involved in illicit activities.

Enhanced Surveillance: The ability to track ships at sea, especially in high-risk areas like the Gulf of Aden or the Strait of Malacca, allows authorities to quickly respond to security threats such as piracy or smuggling.

The system strengthens global maritime surveillance and enhances cooperation among states in maintaining the security of international shipping lanes.

8. International Maritime Dangerous Goods (IMDG) Code

The IMDG Code is a set of regulations that governs the safe transport of dangerous goods by sea. The Code's goal is to minimize risks to both the crew and the marine environment.

- **Impact on Maritime Security:**

The safe transportation of dangerous goods is essential for preventing incidents that could result in maritime disasters, which could be exploited for terrorist activities or illegal trade.

The IMDG Code ensures that dangerous goods are properly packaged, labelled, and stowed, preventing accidents or security breaches during transport.

It also ensures that dangerous materials, such as explosives, chemicals, and radioactive substances, are not used maliciously to create security threats or disrupt maritime operations.

9. Convention on Facilitation of International Maritime Traffic (FAL)

The term **FAL Convention** refers to the **Convention on Facilitation of International Maritime Traffic**, adopted by the International Maritime Organization (IMO) in 1965. Its primary purpose is to **streamline international maritime traffic** by minimizing unnecessary bureaucracy and ensuring standardized practices across ports and regulates the procedures for ships entering and leaving ports.

- **Impact on Maritime Security:**

- By establishing uniform protocols for port entry, departure, and cargo handling, the FAL Convention reduces inconsistencies and loopholes that could be exploited by bad actors, such as smugglers or terrorists.
- By standardizing documentation and processes, the convention helps reduce the risk of forged documents or false declarations being used to smuggle illegal goods or people.

- The FAL Convention complements other IMO instruments like the **International Ship and Port Facility Security (ISPS) Code**, which focuses on preventing security breaches in the maritime sector.

The IMO's conventions and codes play a significant role in enhancing maritime security by setting international standards for the safety and security of ships, crew, cargo, and port facilities. These conventions address a wide range of security-related issues, including preventing terrorism, combating piracy, ensuring safe navigation, and controlling the transport of dangerous goods. By establishing universal rules, the IMO helps maintain a secure, efficient, and reliable global shipping system that protects both maritime operations and the marine environment.

As global maritime security threats evolve, it is essential that IMO conventions and codes continue to adapt and strengthen to address emerging challenges in the maritime industry.

Role of DG Shipping in International Cooperation

The **Directorate General of Shipping (DG Shipping)** plays a pivotal role in India's maritime security and compliance with international regulations. Its responsibilities in the enforcement of the ISPS Code and global maritime security cooperation include:

- **Primary Maritime Authority:** DG Shipping is the principal regulatory body responsible for overseeing maritime security and ensuring compliance with international conventions, including the ISPS Code.
- **Engagement with IMO:** DG Shipping represents India in key IMO bodies such as the Maritime Safety Committee (MSC) and Facilitation Committee (FAL), contributing to discussions on international maritime security policies.
- **Security Policy Implementation:** It aligns India's national maritime security policies with international best practices to enhance overall security preparedness.
- **Capacity Building:** In collaboration with IMO, DG Shipping organizes training programs, workshops, and awareness initiatives to strengthen the implementation of ISPS Code provisions among stakeholders.
- **Intelligence Sharing:** DG Shipping actively participates in international security initiatives to exchange intelligence on piracy, armed robbery, and other maritime security threats. This helps in early threat detection and coordinated response strategies.

1. Maritime Security Requires a Specialized Approach

The ISPS Code was designed specifically for maritime security, which differs significantly from land-based security frameworks. Ships and port facilities face unique threats, including:

- **Piracy and Armed Attacks** – Attacks on ships and hijacking incidents require specialized countermeasures that maritime professionals understand.
- **Maritime Terrorism** – Ships and ports are high-risk targets for terrorist activities, requiring stringent access controls and cargo screening.
- **Smuggling and Illicit Trade** – The maritime sector is a major channel for drug trafficking, human trafficking, and contraband smuggling.
- **Cybersecurity Threats** – Increasing digitalization in shipping has exposed the industry to cyber risks that could compromise navigational systems and port operations.

Since DG Shipping already monitors these risks and collaborates with international bodies such as IMO, INTERPOL, and the International Maritime Bureau (IMB), it is better positioned to oversee ISPS compliance rather than transferring this responsibility to another agency with no maritime expertise.

2. Efficient Coordination with Stakeholders

Maritime security requires collaboration between multiple stakeholders, including:

- Shipowners and operators
- Port authorities
- Customs and immigration departments
- Coast Guard and navy
- International regulatory bodies

DG Shipping has well-established communication channels with these entities, ensuring that security threats are identified and addressed promptly. Keeping ISPS under DG Shipping eliminates bureaucratic inefficiencies and enhances real-time response capabilities for security incidents.

Additionally, since DG Shipping is responsible for issuing Ship Security Certificates (SSC) and conducting Port Facility Security Assessments (PFSA), it already possesses the required administrative and operational mechanisms to handle ISPS compliance without unnecessary duplication of efforts.

3. Ensuring Compliance and International Reputation

A failure in ISPS compliance can lead to **severe international repercussions**, such as:

- Increased security inspections and delays at foreign ports
- Loss of trading privileges under international shipping agreements
- Higher insurance costs for vessels due to security risks
- Blacklisting of ports and shipping companies, affecting global trade

DG Shipping's existing regulatory framework and maritime expertise ensure that India remains in full compliance with international security obligations, protecting the country's maritime industry from reputational and financial damage.

The ISPS Code is a highly specialized security framework tailored for the maritime sector, requiring an **in-depth understanding of ship and port operations, international regulations, and evolving security threats**. The DG Shipping is the only authority with the **necessary domain knowledge, operational experience, and international credibility** to manage ISPS implementation effectively.

By keeping ISPS under DG Shipping, India can ensure:

- ✓ **Stronger maritime security enforcement**
- ✓ **Seamless integration with existing maritime regulations**
- ✓ **Efficient coordination between industry stakeholders**
- ✓ **Full compliance with international security standards**
- ✓ **Protection of India's ports, ships, and global trade reputation**

Transferring ISPS responsibilities to another agency could lead to **administrative inefficiencies, security loopholes, and regulatory misalignment**, ultimately compromising

national maritime security. Therefore, **ISPS should remain under DG Shipping to maintain a robust, well-regulated, and internationally compliant maritime security framework.**

The division of responsibilities between the BOPS and ISPS is outlined below

Ship Certification:

Under the ISPS Code, audits and inspections are critical for ensuring compliance. It may be noted that the primary responsibility for security of vessels rests with Ship owners, Master, and crew onboard the vessels. Every ship is required to have Ship Security Plan (SSP) approved by the Flag State and Company shall ensure implementation of the SSP by Masters and officers on board ships. The security level for the vessels to be declared by the Flag States.

Every ship is required to undergo mandatory audit process as per the International Convention on Safety of Life at Sea (SOLAS Convention) and issued with the International Ship Security Certificate (ISSC) valid for five years subject to internal audits by the companies every year Initial Audit at the time of delivery, Intermediate audit between 2nd and 3rd year and renewal audit every five years. The statutory ISPS audits of the vessels are carried out by the Flag State or the Recognized Security Organization of the flag state at the specified intervals. During the audit implementation of ISPS code and SSP are verified. Upon successful completion of audit, the Flag State issues the ISSC certificate. The ISPS audits of the vessels are being carried out along-with several other Survey and audit requirements of the vessel which follows the Harmonized survey and certification regime mandated by the SOLAS Convention to avoid frequent inspections and audits of the vessel. In practice, the audits under ISPS are carried out along with audits of ISM Code and MLC Convention as per the audit cycle of the vessels.

The primary responsibility of security of vessels rests with the owners under the ISPS regime. Additionally, the Flag State has the full responsibility for implementation of ISPS code on their vessels to ensure compliance with SOLAS Convention. The ISPS code specifies the additional security measures to be taken by the vessels when the vessel and port are operating in different security levels. The cost involved in additional security measures for the vessels to be borne by the owners of the vessel.

The **approval and certification** of Ship Security Plans (SSPs) are typically managed by **Flag States** (countries where the ships are registered) or recognized security organizations, not Bureau of Port Security.

The Bureau would coordinate with the relevant maritime authorities, but it wouldn't independently approve or implement the security measures on ships as required under the ISPS Code.

Ship Security Plans (SSPs) Approval and Implementation:

Ship Certification Under ISPS Code:

The International Ship and Port Facility Security (ISPS) Code is a crucial regulatory framework that ensures maritime security. It was introduced by the International Maritime Organization (IMO) in response to growing security concerns, including piracy, terrorism, and other threats to international trade. The ISPS Code mandates specific audits, inspections, and responsibilities for ship owners, crew members, and flag states. Proper adherence to these regulations helps prevent security threats such as piracy, terrorism, and unauthorized access, ensuring the safety of vessels, crew members, and cargo.

1. Audits and Inspections

Audits and inspections are essential for ensuring compliance with the ISPS Code. These evaluations verify that ships meet security standards and implement necessary security measures.

- **Purpose of Audits:** Audits help in assessing vulnerabilities, ensuring the effectiveness of security measures, and verifying that security management systems function correctly.
- **Responsibility:** The responsibility for security primarily rests with the ship owners, Masters, and crew. Flag States and recognized security organizations also play a role in conducting inspections and verifying compliance.
- **Frequency of Inspections:** Regular audits ensure that security protocols are up to date and effective in safeguarding the vessel and its personnel. Inspections may be carried out by port state control authorities, flag states, or independent security organizations.

2. Ship Security Plan (SSP)

The Ship Security Plan (SSP) plays a vital role in maritime security. It must be approved by the Flag State before implementation. The key elements of the SSP include:

- **Approval by the Flag State:** Ensures the plan meets international security standards and is aligned with IMO regulations.
- **Implementation by Masters and Officers on Board:** The ship's officers are responsible for executing the plan effectively and ensuring crew compliance.

Declaration of security level

- **Security Levels Declared by Flag States:** The Flag State determines security levels based on risk assessments and potential threats. The levels include:
 - **Security Level 1:** Normal, where minimum security measures are maintained at all times.
 - **Security Level 2:** Increased threat, requiring enhanced security measures.
 - **Security Level 3:** Imminent threat, necessitating maximum security measures.
 - The Designated authority is responsible for establishing and implementing appropriate security levels for port facilities. These levels should align with national and international maritime security frameworks such as the International Ship and Port Facility Security (ISPS) Code. Authorities must also ensure security levels are updated based on risk assessments, intelligence reports, and situational changes.
 - A Declaration of Security (DoS) is a formal agreement between a port facility and a ship outlining their respective security responsibilities. Authorities must ensure that DoS requirements are enforced, particularly for high-risk operations, sensitive cargo handling, and vessels arriving from regions with heightened security threats.

Training and Drills: Crew members must undergo regular training and security drills to stay prepared for potential threats.

Mandatory Audits

To maintain ISPS Code compliance, ships must undergo periodic audits, which include:

1. **Initial Audit at Delivery:** Conducted when a vessel is first delivered to ensure compliance with ISPS requirements. This audit involves assessing ship documentation, verifying security procedures, and ensuring proper training of crew members.

2. **Intermediate Audit (2nd-3rd Year):** Performed within the second or third year to verify continued adherence to security protocols. It evaluates any modifications to the security plan and ensures the ship maintains adequate measures.
3. **Renewal Audit (Every Five Years):** A comprehensive assessment to renew certification and confirm sustained security measures. The renewal process includes reviewing previous audit findings, conducting physical inspections, and evaluating ship security records.

Issuance of International Ship Security Certificate (ISSC): Granted upon successful completion of audits, signifying compliance with ISPS regulations. Ships that fail to comply may face penalties, including detentions or restrictions on entry into international ports.

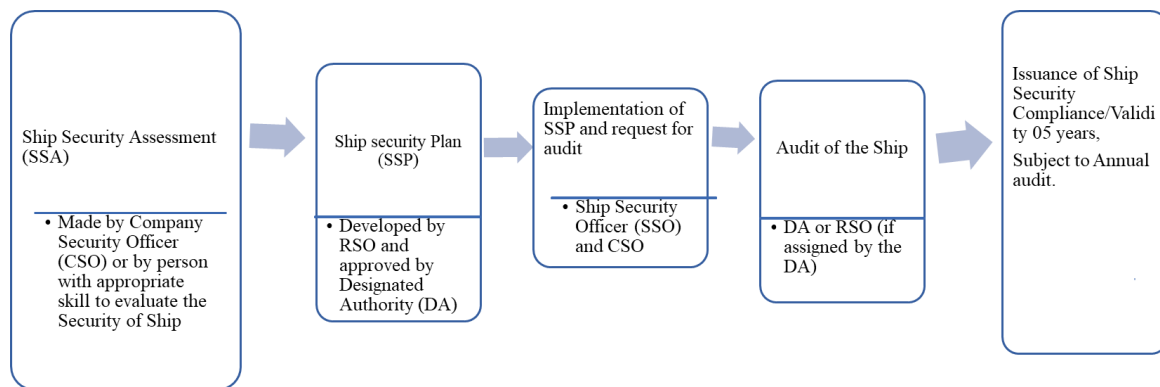
Flag State Responsibilities

Flag States play a critical role in enforcing ISPS Code regulations. Their key responsibilities include:

- **Full Responsibility for ISPS Code Implementation:** Ensuring all registered vessels adhere to security requirements, conducting periodic audits, and approving Ship Security Plans (SSP).
- **Additional Security Measures:** Implementing enhanced security measures during heightened security levels or threats. Flag States may issue directives requiring ships to increase surveillance, conduct additional drills, or restrict access to certain areas.
- **Cost Allocation:** While the Flag State oversees implementation, vessel owners bear the financial responsibility for security compliance. This includes costs associated with security training, maintenance of surveillance equipment, and hiring security personnel if necessary.

ISPS Compliance Process Flow Chart for Ship Security

The division of responsibilities between the BOPS and ISPS is outlined below



Port Security and Certification process:

Port Facility Security: (Regulation 14)

- Ports are busy place, spread over a large area and includes certain operational area which should have restricted access control.
- A port facility is required to act upon the security level set by the contracting Government within whose territory it is located.
- Above work of setting the security level is done by Designated Authority (DA) taking in to account of threat assessment. Threat assessment is to be analyzed by Designated Authority after taking input from security agency. As per section 4.3 setting of security level is to be done by designated authority only.

Port Facility Security Assessment (Regulation 15):

The port facility security assessment is an essential and integral part of the process of developing and updating the Port Facility Security Plan (PFSP). The Security assessment shall periodically be reviewed and updated. Designated Authority or RSO on behalf of DA Conducts detailed assessments of port facilities periodically and upon commissioning of new port facilities.

- The port facility security assessment shall be carried out by the contracting government.
- The person carrying the assessment shall have appropriate skill to evaluate the security of the port facility in accordance with this section, taking in to account the guidance given in part B

- Above work is to be done by DA. To comply with the above mandatory requirement, personnel familiar with the ISPS code will be required and who can conduct detailed assessments of port facilities periodically and upon commissioning of new port facilities.

Port Facility Security Plan (Regulation 16):

- A port facility security plan shall be developed and maintained, based on a port facility security assessment for each port facility. Port Facility Security Plan (PFSP) takes into account the threat perception, available resources access control, water front monitoring etc. PFSP is reviewed from time to time on the recommendation of Port Advisory Security Committee (PASC) to ensure compliance as per the required plan.
- The Port Facility Security Plan (PFSP) shall be approved by the contracting government which is designated authority.
- Such plan shall be developed taking in to account the guidance given in part B of this code.
- The person developing and approving the plan requires experience in maritime.

Audit and inspection of Port (Regulation 1.20)

The designated authority concerned may test the effectiveness of the PFSP.

The ISPS audit of port taking in to account the mandatory requirement of ISPS code part A and guidance given in part B of the code.

The person carrying out the ISPS audit of the port requires expertise in the Maritime domain and following expertise also ensures the effective execution of the proposed Merchant Shipping (Ships and Port Facility Security) Rules, 2024 and other executive orders issued from time to time by the Directorate General of Shipping. Conduct audits on the security rules, protocols, procedures, and guidelines for compliance evaluation.

the security rules, protocols, procedures, and guidelines for compliance

- Carries objective assessments of audit findings, identifies shortcomings and mandates rectification by the respective agencies or ports within stipulated time frames as per ISPS code.
- Verifies adherence to ISPS through regular and event-triggered inspections and audits.

Exclusive function of Designated Authority

DG shipping is notified as a designated authority. As per ISPS code section 4, following duties can only be performed by the designated authority:

- Setting of applicable security level
- Approving a port facility security assessment.
- Determining the port facility which will be required to designate a port facility security officer.
- Approving a port facility security plan
- Exercising control and compliance measures
- Establishing the requirement for a Declaration of Security.

Port Certification: Ensuring Security and Compliance

1. Initial Assessment and Security Plan

Port Facility Security Assessment (PFSA)

The first step in obtaining port certification involves conducting a **Port Facility Security Assessment (PFSA)**. This comprehensive assessment aims to identify potential security threats, vulnerabilities, and the likely consequences of a security breach. The assessment is crucial in understanding the specific risks associated with the port facility, including unauthorized access, smuggling, cyber threats, and terrorist activities.

Security assessments evaluate vulnerabilities, risks, and potential threats to a port facility. The designated authority must review and approve these assessments to ensure they comply with regulatory standards. This includes assessing threats from terrorism, smuggling, cyberattacks, and unauthorized access, and ensuring mitigation strategies are in place.

A detailed PFSA includes:

- Identifying critical assets and infrastructure within the port.
- Evaluating existing security measures and identifying gaps.
- Analysing past security incidents and trends.
- Assessing the effectiveness of security personnel and technology in place.

Port Facility Security Plan (PFSP)

Each port facility must have a security plan that outlines specific procedures for threat detection, prevention, and response. Authorities are responsible for reviewing, approving, and periodically updating these plans. The plans should cover aspects such as surveillance, restricted access measures, emergency protocols, and collaboration with law enforcement agencies.

Following the PFSA, a **Port Facility Security Plan (PFSP)** is developed to mitigate identified risks. This plan serves as a blueprint for security measures and emergency response strategies. The PFSP typically includes:

- Access control measures to prevent unauthorized entry.
- Surveillance and monitoring protocols, including CCTV and biometric systems.
- Procedures for handling security threats and incidents.
- Coordination with local and international maritime security agencies.

The PFSP must be continuously updated to adapt to emerging security challenges and technological advancements.

2.Designation of Personnel

To ensure the successful implementation of security measures, ports must designate key personnel responsible for maintaining security protocols.

Port Facility Security Officer (PFSO)

Appointing competent security officers is crucial to maintaining a high level of preparedness. Authorities must ensure that designated officers possess the necessary qualifications, undergo relevant training, and stay updated on evolving security threats. These officers play a key role in implementing security plans, coordinating responses, and conducting security drills.

A **Port Facility Security Officer (PFSO)** is appointed to oversee security operations. Their responsibilities include:

- Implementing and maintaining the PFSP.
- Conducting security drills and training programs for port staff.
- Liaising with the Ship Security Officer (SSO) and relevant authorities.

- Ensuring compliance with national and international security standards.

The PFSO plays a critical role in maintaining the integrity of the port's security framework and responding effectively to security breaches.

Implementation of Security Measures

Once the PFSP is established, ports must implement the prescribed security measures to meet certification requirements. These measures typically include:

Physical Security Infrastructure

- Erection of fences, gates, and barriers to restrict access.
- Installation of access control systems, such as biometric scanners and ID verification.
- Deployment of security personnel at critical points.

Surveillance and Monitoring Systems

- Installation of high-definition CCTV cameras with real-time monitoring.
- Use of motion detectors and intrusion alarms.
- Integration of cybersecurity measures to protect digital assets and sensitive information.

Submission for Approval

The PFSP is submitted to the relevant designated authority for review. The approving body assesses the plan's effectiveness and ensures compliance with international security regulations, such as the **International Ship and Port Facility Security (ISPS) Code**.

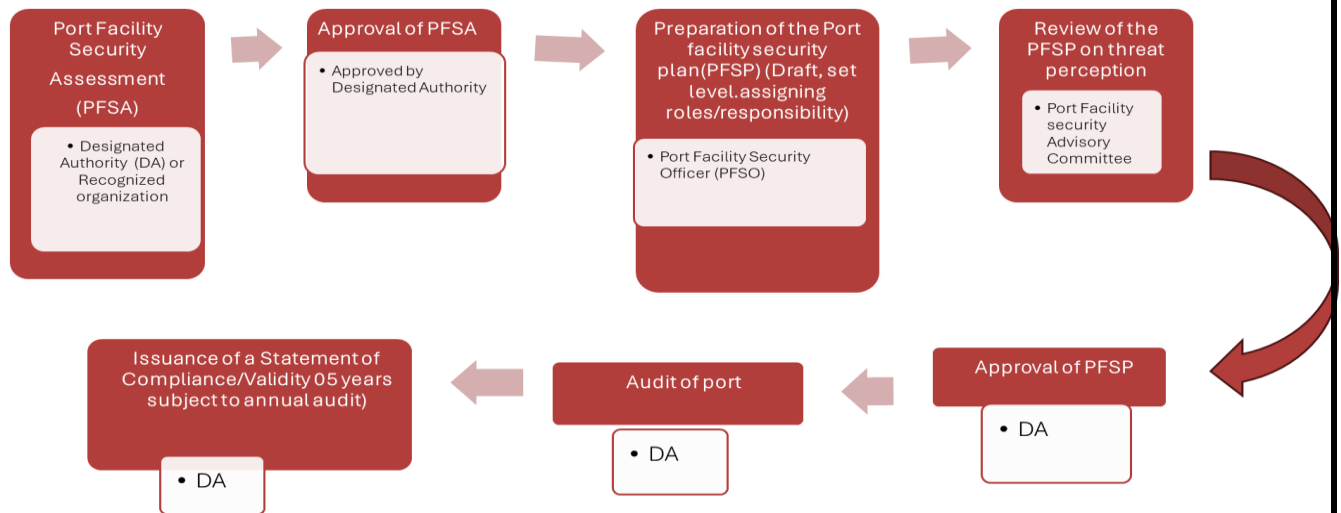
Verification Audits and Inspections

Periodic audits and inspections are conducted to verify that the security measures outlined in the PFSP are correctly implemented. These audits include:

- On-site inspections to assess physical security infrastructure.
- Drills and simulations to evaluate emergency response capabilities.
- Review of security logs and records to detect potential vulnerabilities.

Failure to meet security standards may result in penalties, loss of certification, or operational restrictions.

ISPS Compliance Process Flow Chart for Port:



Conclusion:

The **Bureau of Port Security** would be providing regulatory and oversight functions relating to security of vessels and port facilities. But the role of BoPS should not conflict with the requirements stipulated in the ISPS Code. Since ISPS Code is under the SOLAS Convention, the DG Shipping being the Maritime Administrator of the Country will be the final authority for implementation of ISPS Code. The DGS should utilize the services and expertise which may be available with BoPS. It should mainly focus on developing framework and procedures for Security and **coordinating port security measures** and ensuring compliance with security requirements at the national level.

However, BoPS will not exercise independent authority over critical security functions such as the approval of ship security plans, audits of ships and port facilities, international enforcement, maritime threat assessments, and the issuance of security levels. These responsibilities will remain within the purview of the DGS, ensuring consistency with international maritime security obligations.

Therefore, BoPS will not have any independent jurisdiction over critical functions that are integral to the ISPS Code's implementation, such as:

- Approval of Ship Security Plans (SSPs)
- Auditing of Ships and Port Facilities
- Issuance of International Ship Security Certificates (ISSCs)
- International Enforcement of ISPS Code Provisions
- Issuance of Security Levels (which govern the level of security to be maintained at ports and on ships)

These responsibilities will remain firmly within the purview of DG Shipping. By maintaining the DG Shipping's authority over these critical security functions, India will be in alignment with international maritime security obligations under the ISPS Code and the SOLAS Convention.

Indian Global Maritime Safety Platform



Indian Global Maritime Safety Platform

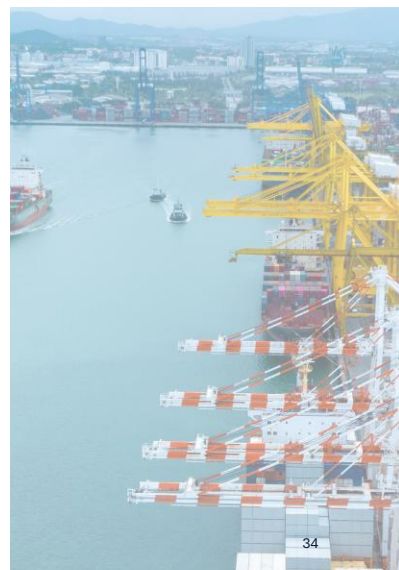


Purpose

To establish a unified digital platform that improves maritime safety, promotes risk-free professional practices, and aligns with international standards and India's maritime vision.

Objective

- 01 Deliver real-time safety dashboards and analytics across devices.
- 02 A multilingual repository for circulars, advisories, and IMO guidelines.
- 03 Host 30–40 animated safety videos over 3 years, integrated into a learning system.
- 04 An AI-driven maritime incident database using tools like Power BI/Tableau.
- 05 Support the “Zero Incident” vision through training, compliance, and real-time monitoring.



The Indian Global Maritime Safety Platform is envisaged as a unified digital ecosystem aimed at enhancing maritime safety, strengthening compliance, and promoting standardized professional practices across the maritime sector. The platform is conceptualized to align national maritime safety initiatives with international standards, while supporting India's broader vision of a safe, secure, and technologically enabled maritime domain.

At its core, the platform seeks to integrate multiple safety-related functions into a single, accessible interface, thereby enabling real-time monitoring, improved decision-making, and streamlined information dissemination. It is designed to serve as a centralized repository and operational tool for stakeholders across the maritime ecosystem, including regulators, port authorities, shipping operators, and maritime professionals.

One of the key objectives of the platform is to provide real-time safety dashboards and analytics that can be accessed across devices. This capability will enable continuous monitoring of maritime activities, identification of risk patterns, and data-driven decision-making, thereby enhancing situational awareness and operational efficiency. In addition, the platform aims to host a multilingual repository of circulars, advisories, and International Maritime Organization (IMO) guidelines, ensuring wider accessibility and uniform understanding of regulatory requirements.

The platform also incorporates a strong focus on capacity building and awareness. It proposes the development and integration of 30 to 40 animated safety videos over a three-year period, which will be embedded within a structured learning system. This initiative is intended to improve training outcomes, reinforce safety culture, and ensure consistent dissemination of best practices across diverse stakeholder groups.

Further, the platform envisions the creation of an AI-driven maritime incident database, leveraging analytical tools such as Power BI and Tableau. This database will facilitate advanced

analysis of incident trends, root cause identification, and predictive insights, thereby supporting proactive risk management and policy formulation.

An overarching objective of the platform is to contribute towards achieving a “Zero Incident” vision in the maritime sector. This will be pursued through a combination of enhanced training, improved compliance mechanisms, and real-time monitoring capabilities. By integrating data, technology, and regulatory frameworks, the platform aims to reduce the occurrence of maritime incidents and improve overall safety outcomes.

Overall, the Indian Global Maritime Safety Platform represents a forward-looking initiative that leverages digital technologies to transform maritime safety governance. It brings together monitoring, compliance, training, and analytics into a cohesive framework, thereby strengthening the Directorate’s ability to ensure safe and efficient maritime operations while aligning with global best practices.

DGCOMM Centre



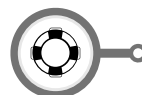
DGCOMM CENTRE



24/7 Situational Awareness:
Constant oversight of vessel activity for safety & security.



Distress Call Command:
Immediate reception Ship Security Alert System (SSAS).



Search And Rescue Coordination with Indian Coast Guard and other stakeholders



Centralizes communication and orchestrates responses to all marine incidents.

9

The Directorate General Communication Centre (DGCOMM Centre) functions as the central operational hub for maritime incident monitoring, communication, and coordinated response under the Directorate General of Shipping. It serves as a critical enabler in ensuring maritime safety, security, and real-time situational awareness across Indian waters.

The DGCOMM Centre operates on a 24/7 basis, maintaining continuous oversight of vessel movements and maritime activity. This constant monitoring capability allows for early detection of anomalies, potential risks, and emergency situations, thereby supporting proactive as well as reactive response mechanisms. The Centre integrates multiple data sources and communication channels to provide a comprehensive operational picture, which is essential for effective maritime governance and incident management.

A key function of the DGCOMM Centre is the handling of distress communications, including the immediate reception and processing of alerts from systems such as the Ship Security Alert System (SSAS). Upon receipt of such alerts, the Centre initiates prompt verification and escalation protocols, ensuring that relevant authorities are informed without delay and that appropriate response actions are triggered.

The Centre also plays a central role in coordinating search and rescue (SAR) operations in collaboration with the Indian Coast Guard and other relevant stakeholders. This involves real-time information sharing, resource mobilization, and operational coordination to ensure timely assistance during maritime emergencies. The DGCOMM Centre acts as a single-point

communication interface, facilitating seamless coordination among multiple agencies involved in incident response.

In the event of maritime casualties or security incidents, the Casualty Branch operates through the DGCOMM Centre as the primary reporting and response coordination unit. It ensures that all incidents are systematically recorded, assessed, and responded to based on their severity, location, and jurisdiction. The response framework is structured to enable both coordination of external agencies and execution of necessary actions within the Directorate's mandate.

Overall, the DGCOMM Centre centralizes maritime communication and orchestrates response mechanisms across the maritime domain, ensuring that incidents are managed in a timely, coordinated, and effective manner. It significantly enhances the Directorate's capability to respond to emergencies, uphold maritime safety standards, and maintain security within the Indian maritime domain.

Long Range Identification and Tracking



LRIT -LONG-RANGE IDENTIFICATION AND TRACKING



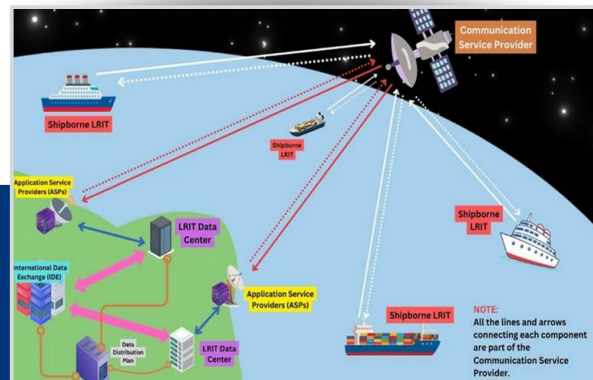
LRIT extends a nation's maritime vision beyond the coastline, enabling secure and intelligent oversight of global vessel movements.

Global Vessel Tracking

Maritime Domain Awareness

Security & Compliance

Search & Rescue



10



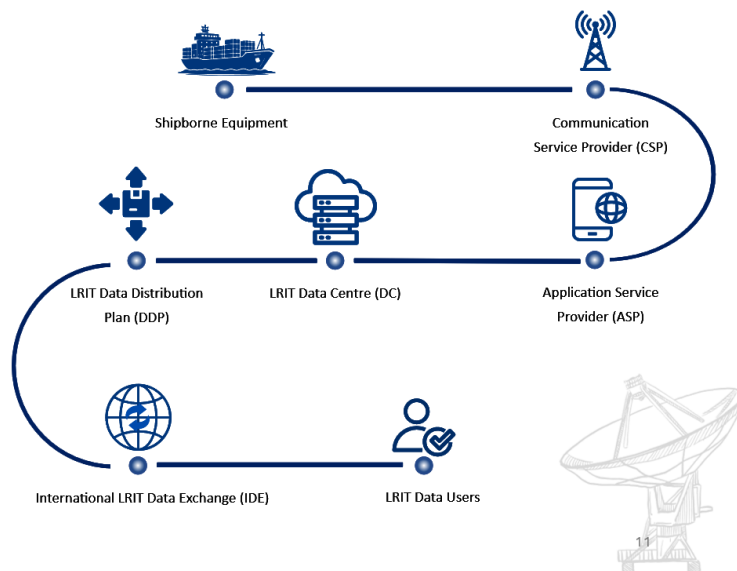
LRIT FUNCTIONING



The LRIT system transmits a vessel's identity, position, and timestamp via satellite from shipborne equipment.

This data is routed through Communication and Application Service Providers to dedicated Data Centres.

Distribution is controlled by a Data Distribution Plan, while global routing is handled by the International Data Exchange.



The Long-Range Identification and Tracking (LRIT) system is a satellite-based maritime surveillance mechanism established under the International Maritime Organization (IMO) framework to enhance global maritime security, safety, and domain awareness. It enables the identification and tracking of vessels beyond coastal radar limits, thereby extending a nation's maritime visibility well into international waters.

At its core, LRIT allows flag States, coastal States, and port States to obtain information regarding a vessel's identity, position, and time of reporting. This capability significantly strengthens maritime domain awareness by providing a reliable and continuous flow of vessel movement data across global sea lanes. By extending surveillance beyond territorial waters, LRIT supports monitoring of vessels approaching national jurisdictions and contributes to early risk detection and threat assessment.

The system operates through shipborne equipment installed onboard vessels, which transmits data at regular intervals via satellite communication. This information is routed through Communication Service Providers (CSPs) and Application Service Providers (ASPs) to designated LRIT Data Centres (DCs). The distribution of this data is governed by a structured Data Distribution Plan (DDP), ensuring that only authorized users receive relevant information. At the global level, the International LRIT Data Exchange (IDE) facilitates secure and standardized data sharing between different national and regional data centres.

From an operational standpoint, LRIT plays a critical role in supporting multiple maritime functions. It enables global vessel tracking, thereby enhancing maritime security and regulatory compliance. It also contributes significantly to search and rescue (SAR) operations by providing last known positions and movement patterns of vessels in distress situations. Additionally, LRIT strengthens monitoring and enforcement mechanisms by enabling authorities to verify vessel routes, detect deviations, and ensure adherence to international maritime regulations.

In the Indian context, the LRIT system enhances the Directorate's capability to monitor vessels far beyond the coastline, complementing existing coastal surveillance systems. It provides an additional layer of intelligence for maritime security, incident response, and regulatory oversight. By integrating LRIT data into the broader maritime governance framework, the Directorate is able to maintain a comprehensive and real-time understanding of vessel movements, thereby supporting safe, secure, and efficient maritime operations.

Overall, LRIT serves as a critical tool in modern maritime governance, bridging the gap between coastal monitoring systems and global vessel tracking requirements. It reinforces international cooperation, improves situational awareness, and strengthens the ability of maritime administrations to respond effectively to emerging challenges in the maritime domain.

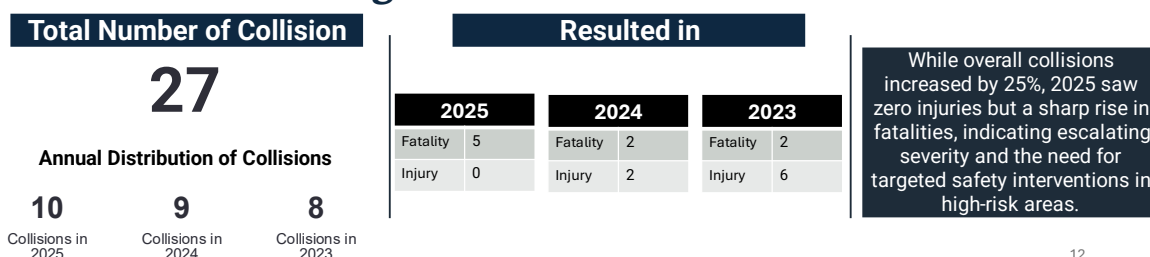
Maritime Casualties Overview [2023- 2025]



Overview of Marine Casualties from 2023-2025



Overview of Fishing Vessel Collisions from 2023-2025



12

The analysis of marine casualties over the period 2023 to 2025 indicates a notable upward trend in reported incidents, reflecting evolving operational dynamics within the maritime sector. The total number of reported incidents increased from 153 in 2023 to 186 in 2024 and further to 214 in 2025, representing an overall rise of nearly 40 percent over the three-year period. This increase can be attributed to a combination of factors, including heightened maritime activity, increased operational risk exposure, and improved reporting and monitoring mechanisms.

The rising trend underscores the growing complexity of maritime operations and the need for strengthened surveillance, compliance, and incident response frameworks. While an increase in reported incidents may partly reflect better awareness and reporting discipline, it also highlights areas where preventive measures and safety interventions require further attention.

A focused assessment of fishing vessel collisions during the same period reveals additional insights into sector-specific risks. A total of 27 collision incidents involving fishing vessels were recorded between 2023 and 2025, with annual distributions of 8 incidents in 2023, 9 in 2024, and 10 in 2025. This gradual increase indicates a consistent risk pattern in coastal and nearshore operations, where fishing vessels often operate in proximity to commercial shipping routes.

In terms of consequences, the severity of these collisions shows a concerning shift. While overall collisions increased moderately, the nature of outcomes reflects increasing fatality risks. Fatalities recorded in such incidents rose from 2 in 2023 to 2 in 2024 and further to 5 in 2025. At the same time, reported injuries decreased from 6 in 2023 to 2 in 2024 and further to zero

in 2025. This shift suggests that while the number of incidents has not escalated sharply, the severity of outcomes in certain cases has intensified, indicating potential gaps in safety preparedness, response effectiveness, or operational conditions.

These trends point to the need for targeted interventions in high-risk areas, particularly in relation to fishing vessel operations. Enhanced awareness programs, improved vessel tracking and communication systems, stricter adherence to navigation protocols, and better coordination between fishing communities and commercial shipping operators are critical to mitigating such risks.

Overall, the data highlights the importance of a strengthened and integrated maritime safety framework, combining improved monitoring, regulatory enforcement, and stakeholder engagement. The insights derived from these trends can inform policy decisions, operational strategies, and safety initiatives aimed at reducing incidents and enhancing maritime safety across the Indian maritime domain.

Major Maritime Incidents



Major Maritime Incidents



MAERSK FRANKFURT Fire

The MAERSK FRANKFURT fire (19 July 2024, 33 NM off Goa) was addressed through coordinated deployment of ICG surface and aerial assets, dispatch of ETV *Water Lily*, aerial DCP drops, and mobilisation of a 19-member salvage team. Gas monitoring, dewatering, and pollution surveillance were undertaken with **no marine spill reported**, alongside Port of Refuge planning and inter-agency coordination.



MSC ELSA 3 Sinking

The MSC ELSA 3 sinking (May 2025, 13 NM off Kerala) involving 643 containers and 367 MT HFO triggered immediate SOP-led coordination by DGS, with ICG deployment, **spill containment**, and a three-pronged **salvage plan**. **~720 MT of nurdles were recovered**, multi-state **shoreline impact was managed**, and oil removal operations were completed under coordinated oversight.



WAN HAI 503 Fire

The WAN HAI 503 fire and underdeck explosion (09 June 2025, 44 NM off Kerala) involving **1,754 containers, including 143 IMDG units** and ~2,000 MT HFO, was managed through SOP-led DGS coordination, ICG firefighting and aerial surveillance, **salvage mobilisation**, and **dual tow operations**, preventing pollution and **securing Port of Refuge at Jebel Ali**.

13

A review of recent major maritime incidents highlights the complexity and scale of emergency response operations undertaken within the Indian maritime domain, as well as the critical role of coordinated multi-agency action led by the Directorate General of Shipping. These incidents demonstrate the operational readiness, response capability, and inter-agency coordination mechanisms in place to manage high-risk maritime emergencies effectively.

The fire onboard *MAERSK FRANKFURT* in July 2024, approximately 33 nautical miles off Goa, was addressed through a coordinated deployment of Indian Coast Guard surface and aerial assets, along with the dispatch of Emergency Towing Vessel (ETV) *Water Lily*. Aerial dispersant (DCP) operations, salvage team mobilisation, and continuous gas monitoring and dewatering activities were undertaken to stabilise the vessel. Importantly, no marine pollution was reported, and response efforts included proactive planning for a Port of Refuge and close coordination among all relevant authorities.

The sinking of *MSC ELSA 3* in May 2025, around 13 nautical miles off the Kerala coast, presented a complex environmental and salvage challenge, involving a significant cargo load and fuel onboard. The incident triggered immediate response under established Standard Operating Procedures (SOPs), with active coordination by DGS and deployment of Indian Coast Guard resources. Spill containment measures were implemented, and a structured salvage plan was executed in phases. Approximately 720 metric tonnes of nurdles were recovered, and shoreline impact across multiple states was effectively managed. Oil removal operations were carried out under strict oversight, ensuring controlled mitigation of environmental risks.

The *WAN HAI 503* incident in June 2025, involving a fire and underdeck explosion approximately 44 nautical miles off the Kerala coast, further underscored the need for rapid and coordinated response mechanisms. The vessel was carrying a large number of containers, including hazardous cargo classified under the IMDG Code. Response actions included firefighting operations by the Indian Coast Guard, aerial surveillance, salvage mobilisation, and dual tow arrangements to stabilise and relocate the vessel. These efforts successfully prevented a major pollution event and facilitated safe handling through Port of Refuge arrangements.

Collectively, these incidents highlight the increasing scale and complexity of maritime emergencies, particularly involving container vessels carrying hazardous cargo and fuel. They demonstrate the effectiveness of SOP-driven response frameworks, the importance of real-time coordination between maritime authorities, and the critical role of surveillance, salvage, and pollution control measures in mitigating risks.

The learnings from these incidents reinforce the need for continued strengthening of preparedness mechanisms, enhancement of response infrastructure, and closer integration of stakeholders across the maritime ecosystem. They also underline the importance of proactive planning, including Port of Refuge strategies and environmental risk management, in ensuring that large-scale maritime incidents are managed efficiently with minimal impact on life, property, and the marine environment.

Navigational Safety at Ports Committee



Navigational Safety at Ports Committee



Current initiative

The Navigational Safety at Port Committee (NSPC) is looking into onboarding the safety audits of all ports including the Major Ports into its ambit.



Current Status

A new NSPC notification has been forwarded to the ministry, and a checklist and form have been prepared at the National Single Window System (NSWS) and Sagarmala. External support is being provided to develop a geospatial platform.

Ongoing Initiatives

The NSPC is working on revising Form 1 and integrating the ISPS checklist and forms on the NSWS platform, which is currently in the testing phase.



15

The Navigational Safety at Ports Committee (NSPC) serves as a key institutional mechanism for strengthening navigational safety standards across ports in India. It functions as a coordinated platform to review, standardize, and enhance safety practices, particularly in relation to vessel movement, port operations, and risk mitigation within port limits.

As part of its current initiative, the NSPC is examining the inclusion of safety audits for all ports within its ambit, including Major Ports. This marks a significant step towards establishing a uniform and comprehensive safety assessment framework across the country's port ecosystem. By bringing all ports under a common audit structure, the initiative aims to ensure consistency in safety standards, improve compliance, and identify systemic gaps in navigational safety practices.

In terms of current status, a revised NSPC notification has been forwarded to the Ministry for consideration, indicating progress towards formalizing the expanded scope of the Committee. In parallel, efforts have been undertaken to develop standardized checklists and reporting formats, which have been integrated into digital platforms such as the National Single Window System (NSWS) and Sagarmala. These steps are aligned with the broader objective of digitization and streamlined governance, enabling efficient data capture, monitoring, and analysis of safety parameters across ports. Additionally, external technical support is being leveraged to develop a geospatial platform, which is expected to further enhance situational awareness and decision-making capabilities.

The NSPC is also progressing with ongoing initiatives aimed at refining and operationalizing the audit framework. This includes the revision of Form 1 and the integration of International Ship and Port Facility Security (ISPS) Code-related checklists into the NSWS platform. The

integration process is currently in the testing phase, reflecting a transition towards a more structured, technology-driven approach to safety oversight.

Overall, the work being undertaken by the NSPC represents a shift towards a standardized, digitized, and data-driven navigational safety framework for ports in India. By combining regulatory oversight with digital tools and unified processes, the initiative is expected to significantly strengthen safety governance, improve compliance monitoring, and support safer and more efficient port operations across the maritime sector.

International Ship and Port Security



International Ship and Port Security



ISPS Code

The International Ship and Port Facility Security (ISPS) Code is a comprehensive set of global security measures designed to enhance the security of ships and port facilities.



ISPS Compliance

ISPS rules have been notified in the Indian Gazette, and a comprehensive ISPS checklist has been provided on the National Single Window System (NSWS) platform.



Responsibility

- Approve port facility security assessments
- Approve port and ship security plans
- Verify the implementation of security plans
- Carry audits of ships and ports
- Issue statements of compliance for ports and ship security certificates

16

The International Ship and Port Facility Security (ISPS) Code constitutes a globally recognized regulatory framework developed under the International Maritime Organization (IMO) to strengthen maritime security and safeguard ships and port facilities against security threats. Introduced as part of the SOLAS Convention, the ISPS Code establishes a structured approach to risk assessment, security planning, and implementation of preventive measures across the maritime domain.

The Code mandates a comprehensive set of security requirements for both ships and port facilities, including the conduct of security assessments, development of security plans, and establishment of defined security levels. These measures are designed to ensure preparedness against potential threats such as unauthorized access, smuggling, piracy, and other security-

related incidents. By standardizing security practices internationally, the ISPS Code facilitates secure maritime trade and enhances confidence in global shipping operations.

In the Indian context, the provisions of the ISPS Code have been formally notified through the Gazette, thereby making compliance mandatory for applicable ships and port facilities. To support implementation and streamline compliance processes, a comprehensive ISPS checklist has been developed and integrated into the National Single Window System (NSWS). This digital integration enables standardized data capture, improved monitoring, and efficient processing of compliance-related submissions, aligning with the broader objective of digitized maritime governance.

The Directorate General of Shipping plays a central role in ensuring effective implementation and oversight of ISPS requirements. Its responsibilities include the approval of port facility security assessments and security plans, as well as the approval of ship security plans in accordance with regulatory provisions. The Directorate also verifies the implementation of approved security measures through inspections and audits, ensuring that both ships and port facilities maintain compliance with prescribed standards.

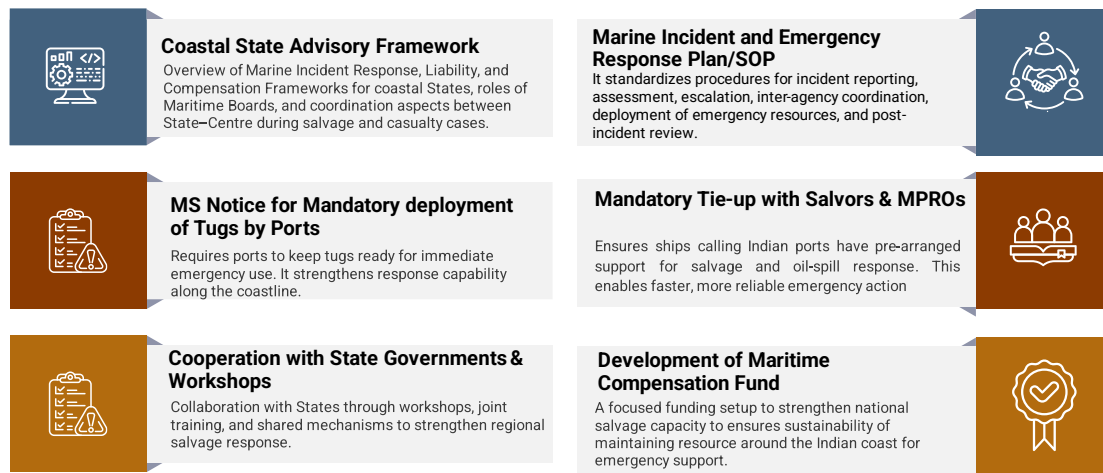
Additionally, the Directorate is responsible for conducting audits of ships and port facilities to assess adherence to ISPS requirements and identify areas for improvement. Based on compliance verification, it issues Statements of Compliance for port facilities and relevant certification for ships, thereby formally recognizing adherence to international security standards.

Overall, the ISPS framework serves as a critical pillar in maritime security governance, integrating regulatory oversight, operational preparedness, and compliance assurance. Its implementation in India, supported by digital platforms and structured audit mechanisms, contributes significantly to enhancing the security posture of the maritime sector and ensuring alignment with international best practices.

DGS Initiatives for Maritime Safety and Casualty Response



DGS Initiatives for Maritime Safety and Casualty Response



17

The Directorate General of Shipping has undertaken a series of structured initiatives aimed at strengthening maritime safety, enhancing casualty response mechanisms, and establishing a coordinated national framework for managing maritime incidents. These initiatives reflect a shift towards a more proactive, standardized, and integrated approach to incident preparedness and response across the Indian maritime domain.

A key initiative in this regard is the development of a Coastal State Advisory Framework, which provides a comprehensive overview of marine incident response, liability, and compensation structures for coastal States. It clearly outlines the roles and responsibilities of State Maritime Boards and establishes coordination mechanisms between the Centre and States during salvage and casualty situations. This framework is intended to bring clarity to jurisdictional aspects and ensure seamless coordination during complex maritime emergencies.

Complementing this, a standardized Marine Incident and Emergency Response Plan, along with detailed Standard Operating Procedures (SOPs), has been developed. These SOPs define the end-to-end process for incident reporting, assessment, escalation, and response coordination. They also provide guidance on the deployment of emergency resources, inter-agency coordination, and post-incident review, thereby ensuring a structured and timely response to maritime casualties.

To strengthen on-ground response capability, a Merchant Shipping Notice has been issued mandating ports to ensure the availability of tugs for immediate emergency deployment. This requirement enhances the ability to respond quickly to incidents such as vessel breakdowns,

groundings, or fires, particularly in port approaches and coastal areas, thereby reducing response time and mitigating potential risks.

In addition, the Directorate has emphasized the need for mandatory tie-ups between vessels and certified salvors and Marine Pollution Response Organizations (MPROs). This ensures that ships calling at Indian ports have pre-arranged access to salvage and oil spill response services, enabling faster and more reliable emergency intervention in the event of an incident.

Recognizing the importance of stakeholder coordination, the Directorate is actively engaging with State Governments through workshops, joint training programs, and collaborative platforms. These efforts are aimed at strengthening regional response mechanisms, building capacity, and ensuring alignment between various stakeholders involved in maritime safety and salvage operations.

Further, the development of a dedicated Maritime Compensation Fund is being pursued to support national salvage and emergency response capabilities. Such a fund would provide financial backing to maintain critical resources and infrastructure required for handling maritime emergencies, ensuring sustainability and readiness across the coastline.

Overall, these initiatives collectively contribute to building a robust maritime safety ecosystem, characterized by clear regulatory frameworks, enhanced preparedness, improved coordination, and strengthened response capabilities. They position the Directorate to effectively manage maritime incidents while safeguarding life, property, and the marine environment.

Regulatory Compliance and Packaging Standards for Dangerous Goods (DG)



Regulatory Compliance & Packaging Standards for Dangerous Goods (DG)



Parallel Increase in Dangerous Goods Movement

- ▶ Expanding exports in electronics, chemicals, pharmaceuticals and energy are driving a parallel increase in DG movement, including embedded DG cargo.



Robust Regulatory Alignment

- ▶ under the IMDG Code, Aircraft (Carriage of Dangerous Goods) Rules, 2025 and IATA DGR (2025) is critical to managing emerging DG risks, particularly batteries.



Certified, IMDG-compliant packaging

- ▶ supported by national standards such as BIS IS 18149:2023 ensure uniform requirements for DG classification, packaging, marking, handling and emergency preparedness

19

The movement of Dangerous Goods (DG) has witnessed a significant rise in recent years, driven by the rapid expansion of sectors such as electronics, chemicals, pharmaceuticals, and energy. This growth has led to a parallel increase in the transportation of hazardous materials, including embedded DG cargo such as lithium batteries within consumer products. As global trade intensifies, the safe handling, packaging, and transportation of such goods have become critical to ensuring maritime safety and environmental protection.

In this context, robust regulatory alignment with international frameworks is essential. The International Maritime Dangerous Goods (IMDG) Code forms the cornerstone of maritime DG regulation, providing standardized guidelines for classification, packaging, labeling, stowage, and documentation. Complementing this, the Aircraft (Carriage of Dangerous Goods) Rules, 2025 and the IATA Dangerous Goods Regulations (DGR) ensure consistency across multimodal transport systems. Such harmonization is particularly important for managing emerging risks, especially those associated with lithium-ion batteries and other high-risk materials that are increasingly prevalent in global supply chains.

A key aspect of DG safety lies in the use of certified, IMDG-compliant packaging systems. Packaging standards play a crucial role in preventing leaks, spills, and accidents during transit, thereby minimizing risks to life, property, and the marine environment. In India, national standards such as BIS IS 18149:2023 have been developed to align with international requirements and ensure uniformity in DG classification, packaging, marking, and handling procedures. These standards also support emergency preparedness by ensuring that DG consignments are properly identified and managed throughout the logistics chain.

The emphasis on regulatory compliance and standardized packaging reflects a broader shift towards strengthening safety governance in the handling of hazardous materials. By ensuring adherence to internationally recognized frameworks and reinforcing national standards, the Directorate aims to mitigate risks associated with DG transportation and enhance the overall safety and resilience of maritime operations.

Overall, the integration of global regulatory standards with national frameworks, coupled with the adoption of certified packaging systems, is essential for managing the increasing complexity of DG movement. These measures not only support safe and efficient trade but also contribute to safeguarding the marine environment and ensuring compliance with international maritime safety obligations.

MoUs with International Group P&I Club



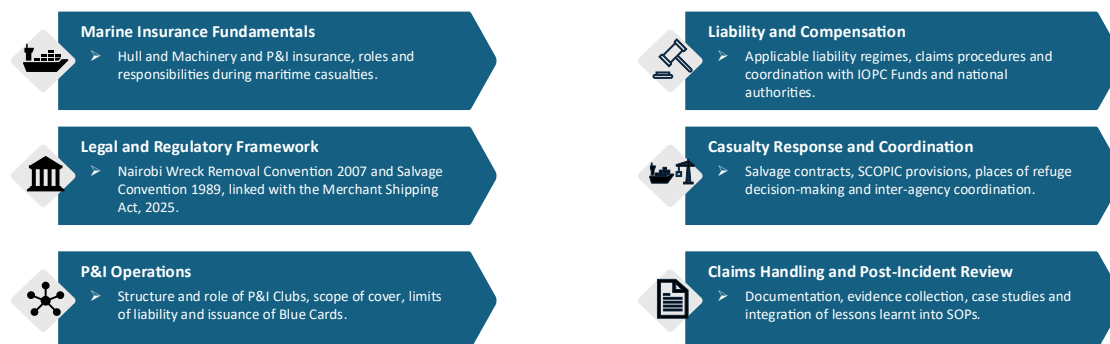
MoUs with International Group P&I (IG P&I) Club



IGP&I
International
Group of
P&I Clubs

The MoU establishes a non-binding framework between DGS and the International Group of P&I Clubs to enhance preparedness and coordinated response to major maritime casualties, including pollution and wreck removal, through joint training and operational coordination in line with statutory responsibilities.

Priority Capacity Building Areas



20

The Directorate General of Shipping has entered into a Memorandum of Understanding (MoU) with the International Group of Protection and Indemnity (P&I) Clubs to strengthen national preparedness and enhance coordinated response mechanisms for major maritime casualties. The MoU establishes a non-binding collaborative framework that facilitates knowledge exchange, capacity building, and operational coordination in areas such as pollution response, wreck removal, and liability management, in alignment with statutory and international obligations.

This engagement is particularly significant given the central role played by P&I Clubs in the global maritime insurance ecosystem, especially in covering third-party liabilities arising from maritime incidents, including oil pollution, wreck removal, cargo claims, and personal injury. By partnering with the International Group, the Directorate gains access to global best practices, technical expertise, and established response frameworks that are critical for managing complex maritime emergencies.

The MoU identifies several priority capacity-building areas to strengthen institutional capabilities. These include foundational aspects of marine insurance, covering both Hull and Machinery and P&I insurance, along with their respective roles and responsibilities during maritime casualties. This understanding is essential for effective coordination between regulators, shipowners, insurers, and response agencies during incident management.

Another key focus area is the legal and regulatory framework governing maritime incidents, including conventions such as the Nairobi International Convention on the Removal of Wrecks, 2007 and the International Convention on Salvage, 1989. These are aligned with domestic legislation such as the Merchant Shipping Act, 2025, ensuring that international obligations are effectively translated into national regulatory practice.

The MoU also addresses liability and compensation mechanisms, including claims procedures and coordination with international compensation regimes such as the International Oil Pollution Compensation (IOPC) Funds, along with national authorities. This is critical for ensuring timely and structured handling of financial liabilities arising from maritime incidents.

Operational aspects of casualty response form another major component, with emphasis on salvage contracts, including SCOPIC provisions, decision-making related to Ports of Refuge, and inter-agency coordination. These elements are vital for effective on-ground response and minimizing environmental and economic impacts during maritime emergencies.

Additionally, the framework covers P&I operational structures, including the scope of coverage, limits of liability, and issuance of Blue Cards, which are essential for compliance with international liability conventions. It also emphasizes claims handling and post-incident review processes, including documentation, evidence collection, case study development, and integration of lessons learned into Standard Operating Procedures.

Overall, the MoU with the International Group of P&I Clubs represents a strategic step towards strengthening India's maritime casualty response ecosystem. By integrating international expertise with national frameworks, it enhances preparedness, improves response efficiency, and ensures that maritime incidents are managed in a structured, coordinated, and legally robust manner.

Anti Piracy Initiatives



Anti Piracy Initiatives



MoPSW Anti Piracy Contingency Plan

The ministry coordinates with COSAPH and IMGGO to implement contingency plans for piracy incidents in key maritime regions like Somalia, Gulf of Guinea, and the Red Sea.



Periodical Circulars & Advisories

The ministry issues regular circulars and maritime security advisories to keep the industry informed about the latest piracy threats and mitigation strategies.



Dedicated Maritime Security Branch

A specialized maritime security branch was established in 2006 to address the escalating Somali piracy threat and coordinate anti-piracy initiatives across stakeholders.

22

The Directorate General of Shipping, in coordination with the Ministry of Ports, Shipping and Waterways (MoPSW), has undertaken a series of structured initiatives to address the evolving threat of maritime piracy and enhance the security of Indian seafarers and vessels operating in high-risk areas. These initiatives are aligned with international best practices and aim to ensure preparedness, timely response, and effective coordination across stakeholders.

A key component of the anti-piracy framework is the MoPSW Anti-Piracy Contingency Plan, which provides a structured mechanism for responding to piracy incidents in high-risk regions such as the Gulf of Aden, Gulf of Guinea, and the Red Sea. The plan involves coordination with international and regional bodies, including the Contact Group on Piracy off the Coast of Somalia (CGPCS) and maritime security agencies, to ensure that Indian vessels and seafarers receive timely support and guidance during piracy-related emergencies. This coordinated approach enhances situational awareness and enables effective response planning in regions prone to piracy.

In addition to contingency planning, the Directorate issues periodic circulars and advisories to the maritime industry, providing updates on emerging piracy threats, risk-prone zones, and recommended mitigation measures. These advisories play a crucial role in ensuring that shipping companies, vessel operators, and seafarers remain informed and prepared, thereby reducing vulnerability to piracy incidents. The dissemination of best management practices and security guidelines further supports preventive measures onboard vessels.

To institutionalize maritime security efforts, a dedicated Maritime Security Branch has been established within the Directorate. Originally set up to address the surge in piracy incidents off the Somali coast, the branch continues to function as the focal point for coordinating anti-piracy initiatives, engaging with international organizations, and liaising with stakeholders across the maritime sector. It plays a central role in policy formulation, incident monitoring, and response coordination.

Overall, these initiatives reflect a comprehensive and proactive approach to maritime security, combining policy frameworks, operational preparedness, and stakeholder engagement. By strengthening coordination mechanisms, enhancing information dissemination, and institutionalizing security functions, the Directorate aims to safeguard Indian maritime interests and ensure the safety of seafarers operating in piracy-prone regions.

Suraksha Sarvapratham

Safety First – Institutionalising a Culture of Maritime Safety



Maritime operations inherently involve exposure to risk — whether during navigation at sea, cargo operations at port, machinery handling, confined space entry or interaction with heavy equipment. While regulatory frameworks and international conventions provide the structural backbone for safety compliance, incidents continue to occur due to operational lapses, human error, inadequate documentation or insufficient training reinforcement.

Recognising this, the Directorate General of Shipping (DGS) proposes to launch a focused safety campaign titled “**Suraksha Sarvapratham**” (**Safety First**). The initiative aims to institutionalise a preventive safety culture across Indian-flag vessels and among Indian seafarers serving globally.

The campaign seeks to ensure that seafarers are able to discharge their duties in a structured, risk-aware and safety-compliant environment, both at sea and during port operations.

Core Objectives of the Campaign

The Suraksha Sarvapratham initiative is guided by four primary objectives:

1. Reduction in Accidents and Near Misses

To systematically reduce the frequency and severity of onboard accidents through structured preventive interventions.

2. Strengthening Incident Documentation and Analysis

To ensure detailed recording of all safety incidents, near misses and hazardous occurrences at sea and in port.

3. Root Cause Identification and Preventive Strategy Development

To analyse incident data in order to identify recurring patterns, systemic gaps and operational vulnerabilities.

4. Institutionalisation of Safety Culture

To embed safety awareness as a behavioural norm rather than a compliance obligation.

The initiative moves beyond reactive investigation toward structured risk anticipation and mitigation.

Structured Incident Recording and Data Analytics

A central component of the campaign will be the systematic recording of:

- Personal injury incidents
- Machinery failures
- Cargo handling accidents
- Navigational near misses
- Port operation hazards

By building a centralized database of reported events, DGS will be able to:

- Identify trends across vessel types
- Map risk-prone operational areas
- Recognize training deficiencies
- Recommend targeted corrective measures

The emphasis will be on converting isolated incident reports into actionable safety intelligence.

Web-Based Learning and Digital Training Support

To reinforce safety practices, the campaign will leverage digital platforms for structured learning.

Key elements include:

- Web-based learning management systems for safety training
- Development of free online safety modules
- Refresher courses on critical operational procedures
- Scenario-based learning tools

These digital modules will support continuous professional development and ensure accessibility across geographic locations.

The objective is to make safety training dynamic, easily accessible and regularly updated.

Promotion of Proactive Safety Culture

Safety culture cannot be achieved solely through regulation; it requires behavioural reinforcement.

The campaign will promote:

- Strict adherence to established safety protocols
- Transparent reporting of near misses without fear of reprisal
- Leadership accountability onboard vessels
- Periodic safety audits and awareness drives

In addition, innovative tools such as AI-based safety awareness videos and interactive learning formats may be deployed to enhance engagement and comprehension.

The long-term goal is to ensure that safety is perceived not as a compliance requirement but as a professional obligation.

Safer Working Environment and Human-Centric Focus

The campaign recognises that seafarer well-being is central to safe operations. By reducing accident frequency and operational risk exposure, the initiative contributes to:

- Improved physical safety onboard
- Reduced psychological stress associated with hazardous conditions
- Enhanced operational confidence
- Stronger trust in regulatory oversight

Creating a safer working environment also improves morale and supports retention within the maritime workforce.

Expected Outcomes

If implemented effectively, Suraksha Sarvapratham is expected to:

- Reduce accident frequency and severity over time
- Improve quality and consistency of incident reporting
- Enhance compliance with international safety standards

- Strengthen India's reputation as a responsible maritime administration
- Foster a sustained culture of safety across Indian seafarers globally

The initiative aligns with broader objectives of maritime governance reform and workforce protection.

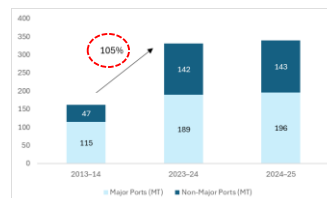
Growth and Progress in India's Coastal Shipping Ecosystem



- Cost-effective for bulk and long-haul cargo, especially over >500 km distances.
- Lower unit transport cost vs. road; reduced fuel consumption per tonne-km.
- Significantly lower GHG emissions, making it a greener logistics option

- Helps reduce India's high logistics costs.
- Eases congestion on saturated rail corridors and national highways.
- Improves energy efficiency and lowers the carbon footprint of freight.

- Maritime transport emits far less CO₂ per cargo unit than road transport.
- Coastal shipping acts as a key lever for green logistics and decarbonisation.



- Coastal cargo throughput reached **339 MT** in FY **2024-25**,
- Volumes have more than doubled (**+110%**) from 161 MT in FY 2013-14 to 339 MT in FY 2024-25, reflecting a CAGR of **~7%**.

Coal Iron ore Petroleum products

Cement Foodgrains Steel Fertilizers

.....

Despite these inherent advantages, coastal shipping has historically remained underutilised, with a significant proportion of cargo continuing to move through road and rail networks. This has contributed to higher logistics costs, congestion across transport corridors and increased environmental impact. However, with the growing emphasis on multimodal logistics integration, efficiency optimisation and decarbonisation, coastal shipping is increasingly being repositioned as a key pillar of India's national transport and logistics strategy.

India is naturally well-positioned to expand coastal shipping due to its geographical and infrastructural strengths. The country has a coastline exceeding 11,000 kilometres, complemented by an extensive network of approximately 14,000 kilometres of navigable inland waterways. In addition, India has a well-distributed network of major and non-major ports located along key trade corridors on both the eastern and western coasts.

Page 339 of 394

as Deendayal Port Authority, Jawaharlal Nehru Port Authority, Mumbai Port, Paradip Port Authority, Syama Prasad Mookerjee Port and Visakhapatnam Port Authority, among others. These clusters are interconnected through established coastal routes, forming a network of origin-destination pairs that facilitate cargo movement across the country.

Despite this extensive potential, the share of coastal shipping in India's overall freight movement remains relatively modest when compared to road and rail transport. Unlocking this latent capacity is essential for improving logistics efficiency and reducing system-wide costs.

Current Scenario and Growth Trends

Coastal shipping in India has witnessed steady growth in recent years, reflecting gradual improvements in policy support and operational adoption. Coastal cargo throughput at Indian ports has more than doubled over the past decade, increasing from approximately 161 million tonnes in 2013–14 to about 339 million tonnes in 2024–25, representing an overall growth of around 110 percent and a compound annual growth rate of approximately 7 percent.

This growth has been driven by increased utilisation of both major and non-major ports. Major ports continue to handle a significant share of coastal cargo, while non-major ports have also shown substantial growth, indicating broader participation across the port ecosystem.

The cargo mix transported through coastal routes is dominated by bulk and energy commodities, including coal, iron ore, petroleum products, crude oil, cement, steel, fertilisers and foodgrains. In addition, containerised cargo is also increasingly being moved through coastal shipping, particularly in the context of transshipment and feeder services.

Ports such as Paradip and Deendayal have emerged as key hubs for coastal cargo movement, supported by their strategic location and cargo handling capabilities. While the growth trajectory is positive, the overall contribution of coastal shipping to total freight movement remains below its potential, indicating significant scope for further expansion.

Strategic Importance of Coastal Shipping

Coastal shipping plays a vital role in enhancing the efficiency and resilience of India's logistics system. It is particularly advantageous for bulk and long-haul cargo movement over distances exceeding 500 kilometres, where it offers lower unit transport costs compared to road transport.

In terms of energy efficiency, maritime transport consumes significantly less fuel per tonne-kilometre, making it one of the most cost-efficient modes of transport. This directly contributes to reduced logistics costs for industries and improves competitiveness in domestic and international trade.

Coastal shipping also serves as a critical mechanism for decongesting overburdened road and rail networks. By shifting cargo movement to sea routes, it helps reduce traffic on highways

and rail corridors, leading to improved operational efficiency across the overall transport system.

National-Level Benefits

At a macroeconomic level, coastal shipping contributes to multiple national objectives. It supports reduction in India's relatively high logistics costs, which is essential for improving industrial competitiveness and trade efficiency. By easing congestion on saturated land-based transport networks, it enhances reliability and reduces transit time variability.

Further, coastal shipping improves overall energy efficiency in freight movement by reducing dependence on fuel-intensive transport modes. This has direct implications for cost savings, energy security and sustainability.

The modal shift towards coastal shipping also facilitates large-scale movement of bulk commodities in an efficient manner, thereby strengthening supply chains for key sectors such as energy, infrastructure and manufacturing.

Alignment with Climate and Sustainability Goals

One of the most significant advantages of coastal shipping lies in its environmental performance. Maritime transport emits substantially lower carbon dioxide per unit of cargo compared to road transport. As a result, increased adoption of coastal shipping can contribute to reducing the carbon footprint of freight movement.

This aligns closely with India's broader climate commitments and its push towards green logistics systems. Coastal shipping acts as a key enabler for decarbonisation by promoting low-emission transport alternatives and supporting the transition towards sustainable supply chains.

Policy and Institutional Measures

Recognising the strategic importance of coastal shipping, the Government of India has initiated several policy and regulatory measures to strengthen the sector. A proposed Coastal Shipping Bill, 2025 aims to establish a modern legal framework aligned with international cabotage practices, providing clarity and consistency in regulation.

In addition, a target has been set to achieve approximately 230 million tonnes of coastal cargo movement by 2030, supported by initiatives such as the development of a National Coastal and Inland Shipping Strategic Plan and the creation of a National Database for Coastal Shipping to improve planning, monitoring and decision-making.

These measures are intended to create an enabling ecosystem that encourages greater participation of shipping operators, facilitates investment and promotes modal shift towards coastal transport.

Role in Green and Blue Economy Transition

Coastal shipping is a key enabler of both the Blue Economy and the Green Economy. By connecting ports, industrial clusters and hinterland regions, it supports integrated maritime development and enhances economic linkages across regions.

At the same time, its low-emission profile and energy efficiency make it central to the transition towards sustainable logistics systems. As India advances its decarbonisation agenda under frameworks such as Maritime India Vision and long-term national development strategies, coastal shipping is expected to play an increasingly important role.

Coastal State Workshops



Coastal State Workshops



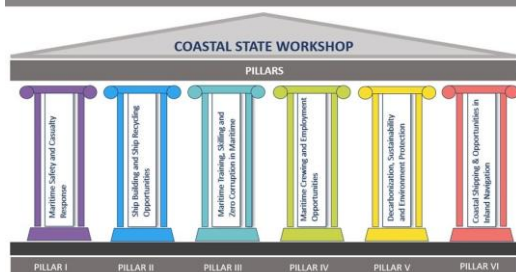
Rationale

The Coastal State Workshop is being organised by the Directorate General of Shipping to strengthen Centre - State coordination in maritime governance, address key challenges, and align State initiatives with national maritime priorities.

Objective

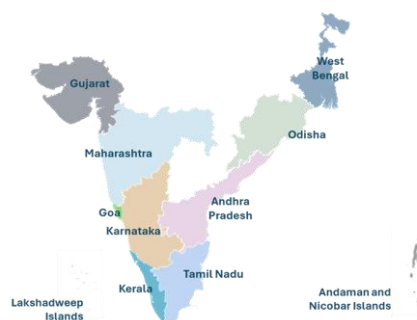
The workshop aims to facilitate focused deliberations on State-specific maritime issues, promote stakeholder coordination, and support aligned development across key sectors such as maritime safety, shipbuilding, sustainability, coastal shipping, and connectivity.

6 PILLARS OF THE COASTAL STATE WORKSHOP



To establish a continuous, collaborative mechanism to accelerate maritime growth and coastal shipping development across India's coastline.

The Coastal state workshop is an annual initiative engaging all 11 coastal states on maritime and coastal shipping development.



28

India's maritime ecosystem operates across a federal structure, where coastal states play a significant role in areas such as port operations, coastal shipping, shipbuilding, ship recycling, fisheries interface, environmental protection and maritime manpower development.

While national policies provide overarching direction, effective implementation requires structured coordination with State Maritime Boards, port authorities and local maritime stakeholders.

In this context, the Directorate General of Shipping proposes to institutionalize a series of **Coastal State Workshops** aimed at strengthening maritime governance, advancing capacity building and fostering collaborative implementation of national maritime priorities at the state level.

These workshops are intended not merely as consultative events, but as structured engagement platforms to align state-level initiatives with national maritime vision frameworks including Maritime India Vision 2030 and long-term sustainability objectives.

Strategic Objectives

The Coastal State Workshops are designed with the following core objectives:

- Strengthen coordination between DGS and State Maritime Boards
- Identify state-specific maritime opportunities and challenges
- Facilitate structured dialogue on shipbuilding, ship recycling and coastal shipping
- Promote safety, skilling and compliance frameworks
- Support sustainability and decarbonisation initiatives at regional level

The workshops aim to translate national maritime policy into actionable state-level engagement.

Six-Pillar Framework

The workshops will be structured around six thematic pillars, ensuring comprehensive coverage of key maritime domains.

Pillar 1: Maritime Safety and Casualty Response

This pillar will focus on:

- Strengthening casualty reporting mechanisms
- Enhancing coordination between port authorities, coastal states and DGS during incidents
- Promoting compliance with safety standards
- Building capacity for emergency preparedness and response

The objective is to reduce maritime accidents and improve coordinated response capabilities.

Pillar 2: Shipbuilding and Ship Recycling Opportunities

This pillar will explore:

- State-level shipbuilding capacity
- Ship repair clusters
- Ship recycling potential in coastal regions

- Policy incentives and infrastructure gaps

The aim is to identify industrial growth opportunities while ensuring regulatory compliance and environmental safeguards.

Pillar 3: Maritime Training, Skilling and Zero Corruption in Maritime

This pillar addresses:

- Expansion of maritime training infrastructure
- Skill development aligned with emerging technologies and green fuels
- Strengthening transparency in maritime certification and training processes
- Promoting integrity and zero tolerance toward corruption

The focus is to enhance human capital development and governance standards.

Pillar 4: Maritime Crewing and Employment Opportunities

This pillar will discuss:

- Increasing employment opportunities for seafarers
- Strengthening state-level engagement with crewing agencies
- Promoting zero tolerance in crewing and manning irregularities
- Addressing welfare concerns of seafarers

This directly supports India's ambition to increase its share in the global maritime workforce.

Pillar 5: Decarbonization, Sustainability and Sea & Environment Protection

This pillar integrates environmental governance at the state level, covering:

- Port sustainability initiatives
- Alternative fuel readiness
- Shore-to-ship power systems
- Waste management and marine pollution control
- Alignment with Green Port Index parameters

The objective is to mainstream environmental compliance and decarbonisation across coastal states.

Pillar 6: Coastal Shipping and Multimodal Shift

This pillar focuses on:

- Promoting coastal shipping as a cost-efficient and lower-emission transport mode
- Strengthening inland navigation integration
- Enhancing multimodal logistics connectivity
- Identifying infrastructure and policy bottlenecks

The emphasis is on shifting cargo movement toward more sustainable transport modes.

Expected Outcomes

The Coastal State Workshops are expected to deliver:

- Improved alignment between central and state maritime priorities
- Identification of state-specific development roadmaps
- Enhanced safety and compliance awareness
- Acceleration of shipbuilding and recycling clusters
- Strengthened decarbonisation and sustainability implementation
- Increased employment and skill development pathways

Over time, these workshops can evolve into a regular consultative mechanism bridging policy formulation and ground-level execution.

Coastal Cargo Promotion Scheme



Coastal Cargo Promotion Scheme



The Union Budget 2026–27 introduces a dedicated **Coastal Cargo Promotion Scheme** to accelerate the shift of freight movement from road and rail to India's extensive network of waterways

Rationale

The formulation of CCPS is necessitated by:

- **High logistics cost** as a percentage of GDP
- **Under-utilization of** coastal berth capacity
- **Limited private investment** in coastal vessels
- **Tariff and tax** asymmetries between modes
- Need for **green and low-emission transport solutions**
- A **structured incentive framework** is required to make coastal shipping commercially competitive and operationally viable.

Objectives

- To enhance the **modal share of coastal cargo**.
- To **promote domestic shipping and shipbuilding**.
- To **reduce logistics costs** for key commodities.
- To enable **green and sustainable transport solutions**.
- To **strengthen multimodal integration** with inland waterways and ports

- Accelerate shift of freight from road & rail to coastal waterways
- Target modal share increase from 6% to 12% by 2047
- Position water-based transport as central logistics pillar
- Expected outcomes: Lower CO₂, reduced fuel use, logistics cost savings
- Supports 'Aatmanirbhar Bharat' & 'Viksit Bharat 2047' goals

The Coastal Cargo Promotion Scheme (CCPS), introduced in the Union Budget 2026–27, represents a targeted policy intervention aimed at accelerating the modal shift of freight movement from road and rail to coastal and water-based transport systems. The scheme is positioned as a strategic enabler to unlock the full potential of India's extensive coastline and inland waterway network, while addressing long-standing structural inefficiencies in the logistics sector.

Background and Rationale

India's logistics sector continues to face structural challenges, particularly in terms of high logistics costs as a percentage of GDP when compared to global benchmarks. A significant portion of freight movement remains concentrated on road and rail networks, leading to congestion, higher fuel consumption and increased environmental impact.

At the same time, coastal shipping infrastructure, including berth capacity at ports, remains underutilised. Despite the presence of a large coastline and multiple ports, the modal share of coastal shipping in overall freight movement remains relatively low. This indicates a gap between available capacity and actual utilisation.

Another critical issue is the limited level of private investment in coastal vessels. The absence of assured cargo volumes and competitive commercial frameworks has discouraged investment in fleet expansion, particularly in the domestic shipping segment. In addition, tariff and tax asymmetries between transport modes have created an uneven playing field, making coastal shipping less competitive compared to road and rail.

There is also an increasing need to transition towards green and low-emission transport solutions. Given the environmental advantages of maritime transport, coastal shipping presents a viable pathway for reducing emissions in the logistics sector.

In this context, the formulation of CCPS is driven by the need to establish a structured incentive framework that can make coastal shipping commercially viable, operationally efficient and environmentally sustainable. The scheme aims to bridge the gap between potential and actual utilisation by addressing both demand-side and supply-side constraints.

Objectives of the Scheme

The Coastal Cargo Promotion Scheme is designed with a set of clearly defined objectives that align with broader national logistics and sustainability goals.

A primary objective is to enhance the modal share of coastal cargo in India's overall freight movement. By encouraging a shift from land-based transport to sea routes, the scheme seeks to optimise the distribution of cargo across different transport modes.

The scheme also aims to promote domestic shipping and shipbuilding. By creating demand for coastal shipping services, it is expected to stimulate investment in Indian-flag vessels and strengthen the domestic maritime industry.

Reduction in logistics costs is another key objective. Coastal shipping offers lower unit transport costs, particularly for bulk and long-distance cargo, and increased adoption is expected to translate into cost savings for key industries.

The scheme is also aligned with the objective of enabling green and sustainable transport solutions. By promoting maritime transport, which has a lower carbon footprint compared to road transport, the scheme contributes to India's decarbonisation efforts.

Further, CCPS seeks to strengthen multimodal integration by improving linkages between coastal shipping, inland waterways and port infrastructure. This integration is essential for achieving seamless cargo movement and improving overall logistics efficiency.

Strategic Outcomes and Expected Impact

The implementation of CCPS is expected to accelerate the shift of freight movement from road and rail to coastal waterways. This modal shift is critical for reducing congestion on highways and rail corridors, while improving efficiency across the logistics network.

A key target under the scheme is to increase the modal share of coastal shipping from the current level of approximately 6 percent to around 12 percent by 2047. Achieving this target would represent a substantial transformation in India's logistics structure and significantly enhance the role of maritime transport.

The scheme also aims to position water-based transport as a central pillar of India's logistics system. By integrating coastal shipping into mainstream freight movement, it seeks to create a more balanced and resilient transport network.

From an environmental perspective, the expected outcomes include reduction in carbon emissions, lower fuel consumption and improved energy efficiency. These benefits align with India's climate commitments and support the transition towards sustainable logistics systems.

In economic terms, reduced logistics costs and improved efficiency are expected to enhance the competitiveness of Indian industries, particularly those dependent on bulk cargo movement. The scheme also has the potential to generate employment in shipping, port operations and related sectors.

Alignment with National Priorities

The Coastal Cargo Promotion Scheme is closely aligned with broader national initiatives and long-term development strategies. It supports the objectives of Atmanirbhar Bharat by promoting domestic shipping capacity and reducing dependence on foreign logistics systems.

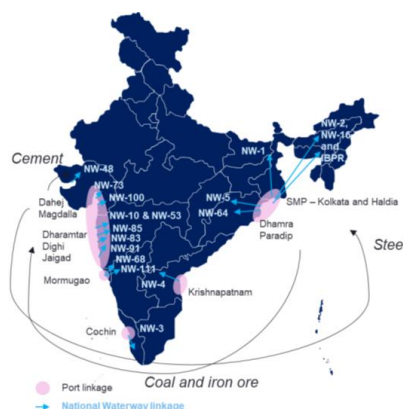
The scheme also contributes to the vision of Viksit Bharat 2047 by strengthening infrastructure, improving logistics efficiency and supporting sustainable economic growth. In addition, it complements existing frameworks such as Maritime India Vision and national decarbonisation strategies.

By integrating economic, environmental and strategic objectives, CCPS serves as a comprehensive policy instrument that addresses multiple dimensions of India's logistics transformation.

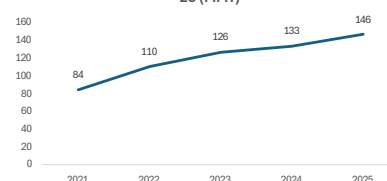
Inland Waterway Utilization



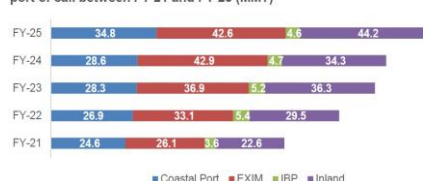
Present Scenario of Inland Waterways Utilization



Trend of traffic volumes between FY-21 and FY-25 (MMT)



Snapshot of Inland waterways traffic volumes as per voyage / port of call between FY-21 and FY-25 (MMT)



Coastal traffic typically forms ~ 25-30% of the total IWT sector traffic volume currently handled on the national waterways.

Preliminary Developmental Interventions

- 1 First and last mile connectivity
- 2 Cargo handling and storage infrastructure
- 3 Deployment of cargo vessels / barges

February 26
26

Inland Water Transport (IWT) is emerging as an important component of India's multimodal logistics framework, offering a cost-effective, energy-efficient and environmentally sustainable mode of cargo movement. It involves the transportation of goods through rivers, canals, backwaters and other navigable inland water bodies. In the Indian context, inland waterways are increasingly being positioned as a complementary mode to coastal shipping, road and rail, particularly for bulk cargo and long-distance freight movement.

Despite having a vast network of navigable waterways, inland water transport in India has historically remained underutilised. However, in recent years, there has been a visible shift towards strengthening the sector, supported by policy initiatives, infrastructure development and growing recognition of its role in reducing logistics costs and enabling green transportation.

Inland Waterways Network and Operational Landscape

India has declared 111 National Waterways, out of which 29 are currently operational, with cargo movement actively taking place on a subset of these waterways. Notably, a significant portion of inland waterway cargo traffic is concentrated on around 14 operational waterways, indicating that utilisation remains clustered and uneven across the network.

Major waterways such as National Waterway 1 (Ganga-Bhagirathi-Hooghly system), National Waterway 2 (Brahmaputra) and key west coast and east coast waterways are playing a leading role in cargo movement. These waterways are linked to major ports such as Kolkata, Haldia,

Paradip, Dhamra, Krishnapatnam, Cochin and Mormugao, creating an integrated network that connects hinterland production centres with maritime gateways.

The inland waterway network is particularly suited for movement of bulk commodities, including coal, iron ore, cement and steel, which require high-volume, low-cost transportation over long distances. Port linkages further enhance the role of inland waterways in supporting both domestic cargo movement and EXIM trade.

Traffic Trends and Growth

Inland waterway cargo movement has shown consistent growth over the past five years, reflecting increasing adoption and improving infrastructure support. Traffic volumes have increased from approximately 84 million metric tonnes (MMT) in FY 2020–21 to around 146 MMT in FY 2024–25.

This steady upward trajectory demonstrates growing confidence in the sector and indicates the impact of ongoing policy and infrastructure interventions. The year-on-year increase in traffic volumes highlights the gradual transition towards integrating inland waterways into mainstream logistics operations.

A detailed snapshot of traffic composition shows that inland waterway cargo includes multiple segments such as coastal-linked cargo, EXIM cargo, inland cargo and inter-port barge (IBP) movements. Inland cargo and IBP movements form a substantial portion of total traffic, while coastal-linked cargo accounts for approximately 25 to 30 percent of total inland waterway traffic. This reflects the strong interlinkage between coastal shipping and inland waterways in the overall logistics ecosystem.

Cargo Composition and Movement Patterns

The cargo profile in inland waterways is dominated by bulk and industrial commodities. Coal and iron ore constitute a major share of traffic, driven by demand from power plants and steel industries. Cement movement is also significant, particularly along western coastal and inland routes. In addition, steel cargo movement between eastern and southern regions is facilitated through inland waterways and port-linked routes.

The movement pattern typically involves integration between inland waterways and coastal shipping, where cargo is transported via inland routes to ports and further moved through coastal or international shipping routes. This multimodal integration enhances efficiency and reduces reliance on road and rail transport.

Role of Inland Waterways in Logistics Efficiency

Inland water transport offers significant advantages in terms of cost and energy efficiency. Compared to road and rail, it consumes less fuel per tonne-kilometre, making it a highly

economical mode for bulk cargo movement. This is particularly relevant for long-distance transportation where cost savings can be substantial.

The use of inland waterways also contributes to reducing congestion on highways and railway networks, thereby improving overall logistics system efficiency. By shifting a portion of cargo movement to waterways, pressure on saturated land-based infrastructure can be alleviated.

From a systems perspective, inland waterways support the development of a multimodal logistics network, enabling seamless movement of goods across different modes of transport. This integration is essential for achieving end-to-end logistics optimisation.

Environmental and Sustainability Benefits

Inland water transport aligns closely with India's environmental and sustainability objectives. It generates significantly lower greenhouse gas emissions compared to road transport, making it a cleaner mode of freight movement.

The shift towards inland waterways contributes to reducing the carbon footprint of logistics operations and supports India's broader climate commitments. It also reduces air pollution and fuel consumption, thereby contributing to improved environmental outcomes.

As part of the green logistics transition, inland waterways are expected to play a critical role in promoting low-carbon transportation and supporting sustainable supply chains.

Key Challenges and Developmental Gaps

Despite the positive growth trends, several challenges continue to limit the full utilisation of inland waterways.

One of the primary constraints is inadequate first-mile and last-mile connectivity. Efficient integration with road and rail networks is essential to ensure seamless cargo movement to and from waterways. Without such connectivity, the potential benefits of inland transport cannot be fully realised.

Another major gap lies in cargo handling and storage infrastructure. Many waterways lack adequate terminals, mechanised handling facilities and warehousing infrastructure, which affects operational efficiency and scalability.

The availability of suitable vessels and barges is also a critical factor. Limited deployment of cargo vessels tailored to inland navigation conditions restricts capacity and affects service reliability.

These challenges highlight the need for focused developmental interventions to strengthen the supporting ecosystem for inland water transport.

Developmental Interventions and Way Forward

To address the existing gaps and accelerate growth, targeted interventions are required across multiple dimensions.

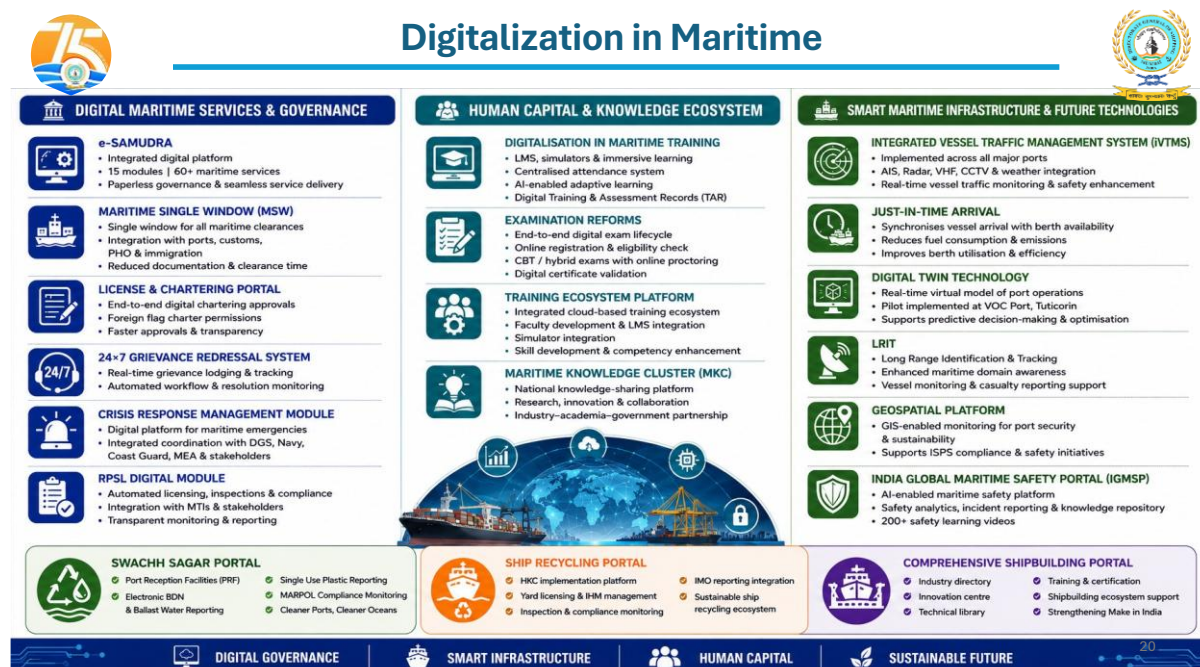
Improvement in first and last mile connectivity is essential to ensure seamless integration of inland waterways with the broader logistics network. This includes development of road and rail linkages to key terminals and ports.

Strengthening cargo handling and storage infrastructure is another priority. Development of modern terminals, mechanised loading and unloading systems and warehousing facilities will enhance operational efficiency and attract higher cargo volumes.

Deployment of dedicated cargo vessels and barges suited for inland navigation is critical for scaling up capacity. This includes promoting investment in vessel construction and facilitating fleet expansion.

In addition, continued policy support, institutional coordination and investment in digital systems for traffic monitoring and management will be important for long-term development of the sector.

Digitalization in Maritime



Cyber Resilience in Maritime Governance



Strengthening Cyber Resilience in Maritime Governance



Recognizing the increasing digitalization of maritime operations, DGMA has initiated robust cybersecurity transformation. A unified cybersecurity compliance framework has been developed, aligning with global standards such as:

NIST
National Institute of
Standards and Technology

- National Institute of Standards and Technology (NIST) Cybersecurity Framework
- ISO/IEC 27001 (Information Security)
- ISO 22301 (Business Continuity)
- ISO 31000 (Risk Management)
- European Union Agency for Cybersecurity (ENISA) Guidelines
- National regulations including Ministry of Electronics and Information Technology (MeitY), National Critical Information Infrastructure Protection Centre (NCIIPC), Standardisation Testing and Quality Certification Directorate (STQC) norms



This comprehensive approach aims to ensure end-to-end cybersecurity compliance for all digital and maritime systems, including port infrastructure and Vessel Traffic Management Systems (VTMS).

61



Building Institutional Cyber Resilience



The Digital Personal Data Protection (DPDP) Act, 2023: Any breach of sensitive DGS data exposes seafarers, stakeholders, and candidates to legal risks, reputational harm, and e-governance disruption.

1.

Real-time monitoring
using **SIEM (Q Radar)**

2.

**Cyber Crisis
Management Plan
(CCMP)** for rapid
containment.

3.

**Access controls & PAM
(ARCON)** to prevent
unauthorized **data
exfiltration**

To institutionalize cybersecurity governance, DGS has designated a **Chief Information Security Officer (CISO)** as per MeitY and NCIIPC guidelines.

1.

Steering the **Information
Security Steering
Committee**

2.

Implementing a
cybersecurity roadmap

3.

Coordinating with
national cybersecurity
institutions

62

The increasing digitalisation of maritime operations—covering ports, vessels, logistics systems and e-governance platforms—has significantly enhanced efficiency but has also introduced **new and complex cybersecurity risks**. Recognising this evolving threat landscape, DG

Shipping (DGMA) has initiated a comprehensive programme to strengthen **cyber resilience across maritime governance systems**, ensuring protection of critical infrastructure, sensitive data and operational continuity.

India's maritime ecosystem, comprising major and non-major ports and integrated logistics systems, is undergoing rapid transformation under initiatives such as **Sagarmala and Maritime India Vision**. This transition towards automation, AI-driven logistics and real-time monitoring has made cybersecurity a **strategic imperative rather than a technical requirement**.

Emerging Cyber Risk Landscape

The maritime sector is increasingly exposed to sophisticated cyber threats, including ransomware attacks, phishing campaigns and supply-chain vulnerabilities. The rise in cyber incidents globally highlights the urgency of strengthening cybersecurity frameworks.

A notable example is the **NotPetya cyberattack on Maersk in 2017**, which disrupted global shipping operations, halted port terminals and caused losses exceeding \$300 million. This incident demonstrated that:

- Cyber risks can have **global cascading impacts**
- Third-party systems can act as **entry points for attacks**
- **Business continuity and disaster recovery** are critical
- Cybersecurity must be embedded into **maritime safety frameworks**

With increasing adoption of digital tools such as Vessel Traffic Management Systems (VTMS), port automation and online regulatory platforms, vulnerabilities have expanded across both IT and operational technology environments.

Unified Cybersecurity Compliance Framework

To address these challenges, DGMA has developed a **comprehensive cybersecurity compliance framework aligned with global and national standards**, ensuring a structured and consistent approach to risk management.

The framework aligns with:

- National Institute of Standards and Technology (NIST) Cybersecurity Framework
- ISO/IEC 27001 (Information Security Management)
- ISO 22301 (Business Continuity Management)
- ISO 31000 (Risk Management)
- European Union Agency for Cybersecurity (ENISA) Guidelines

- National standards under MeitY, NCIIPC and STQC

This integrated approach ensures **end-to-end cybersecurity coverage across all maritime digital systems**, including port infrastructure, e-governance platforms and traffic management systems.

Operational Cybersecurity Measures

To translate the framework into actionable controls, DGMA has implemented multiple operational measures to strengthen cyber defence and incident response capabilities.

Real-Time Monitoring and Detection

Advanced monitoring systems such as **SIEM (QRadar)** are deployed to enable continuous surveillance of applications and infrastructure. These systems detect anomalies such as unusual access patterns or large-scale data movements, enabling early identification of threats.

Cyber Crisis Management Plan (CCMP)

A structured Cyber Crisis Management Plan has been established to ensure rapid containment and response to cyber incidents. This includes predefined playbooks for system isolation, forensic investigation and recovery.

Access Control and Data Protection

Robust access management mechanisms, including **Privileged Access Management (PAM) solutions such as ARCON**, are implemented to prevent unauthorised data access and exfiltration. Data encryption is enforced both at rest and in transit.

Alignment with DPDP Act, 2023

The Digital Personal Data Protection (DPDP) Act, 2023 introduces stringent requirements for protection of personal data, breach reporting and accountability. Given that DGMA handles sensitive data of seafarers, stakeholders and candidates, compliance with the Act is critical.

A breach in DGMA systems could result in:

- Legal liabilities and regulatory penalties
- Exposure of sensitive personal and operational data
- Disruption of e-governance services
- Reputational damage and loss of stakeholder trust

To address this, DGMA has embedded DPDP requirements into its cybersecurity framework, ensuring:

- Defined breach reporting protocols and timelines

- Escalation mechanisms to Data Protection Officer (DPO) and CISO
- Compliance with reporting obligations to regulatory authorities
- Strong data governance and protection measures

Institutional Cyber Resilience Framework

Cyber resilience is being institutionalised through governance structures and organisational mechanisms.

Chief Information Security Officer (CISO)

A dedicated CISO has been designated in line with MeitY and NCIIPC guidelines to lead cybersecurity strategy and implementation.

Information Security Steering Committee

A governance body has been established to oversee cybersecurity initiatives, policy implementation and risk management.

Cybersecurity Roadmap Implementation

A structured roadmap is being executed to enhance cyber preparedness, covering infrastructure, processes, training and compliance.

Coordination with National Agencies

DGMA actively coordinates with national cybersecurity institutions to align with best practices and strengthen response capabilities.

Comprehensive Cybersecurity Approach

DGMA's approach to cybersecurity extends beyond technical controls to include organisational and behavioural measures:

- **Incident Reporting and Escalation Mechanisms** ensuring timely response
- **Vendor and Supply Chain Risk Management** to address third-party vulnerabilities
- **Awareness and Training Programmes** to reduce human error and phishing risks
- **Regular Testing and Simulation Exercises** to validate preparedness
- **Continuous Improvement Framework** based on post-incident learnings

This holistic model ensures that cybersecurity is embedded across **people, processes and technology**.

Significance

Strengthening cyber resilience is critical for safeguarding India's maritime sector and ensuring uninterrupted operations.

Key strategic outcomes include:

- Protection of **critical maritime infrastructure and digital systems**
- Ensuring **continuity of port and shipping operations**
- Safeguarding **sensitive data and national security interests**
- Enhancing **global credibility and compliance with international standards**
- Supporting **digital transformation and smart maritime initiatives**

E-Samudra



E- Samudra



Objectives

The primary objective of this envisaged project is to undertake an IT transformation exercise and enable all the processes in the DGS through the implementation of a **Comprehensive e-governance solution**.

1

Transition to paperless system for improved transparency and faster service delivery.

2

Automate shipping and seafarer operations, internal administration, and maintenance.

3

Integrate with Ministry of Ports, Shipping, and Waterways' IT systems for unified dashboards.

4

Enhance e-Governance operations, user interactions, and ease of doing business.

Modules and Processes

Coastal Branch Sailing Vessel Seamen	
IT and e-governance - Common Processes (Profile Creation and Availing Services) - Common Processes for Departments	
Crew Branch Seafarer-Related Processes & Available Services	
Engineering Branch - Service Providers - Auditors for ISM Audits	- Recognized Organization - Survey & Certification - Ports
Nautical Branch - Ship Registration - Shipping Entity Profile & Available Services	
Commercial Matter - Multimodal Transport Operators - Ship Chartering	
F.A.A.P.P - Budget Preparation - Accounts	- Audits - Public Procurement

15 modules and 62 sub-processes

Project Features

- Streamlined Document Accessibility
- Compliance monitoring
- Data Sharing
- Audit and Administrative Process
- Operational Efficiency
- Data analysis
- Cloud DC & Server Security Services
- Cloud Network Security Services
- Mobile App for e-Samudra users

53

E-Samudra is a flagship digital transformation initiative envisaged to modernise and integrate the functioning of the Directorate General of Shipping (DGS) through a **comprehensive e-governance solution**. The platform is designed to transition the maritime regulatory ecosystem from fragmented, paper-based processes to a **fully digital, integrated and service-oriented system**, thereby enhancing efficiency, transparency and ease of doing business.

Objective and Strategic Intent

The primary objective of E-Samudra is to undertake a **holistic IT transformation across all functional domains of DGS**, enabling seamless delivery of services to stakeholders including shipowners, operators, seafarers and regulatory authorities. The platform aims to digitise and standardise processes across departments, ensuring uniformity, accountability and faster service delivery.

A key focus is the transition towards a **paperless governance framework**, which not only improves transparency but also reduces processing time and administrative burden. In addition, the system is designed to automate core maritime functions, including shipping operations, seafarer management, internal administration and maintenance activities.

Another important objective is **integration with the Ministry of Ports, Shipping and Waterways' digital ecosystem**, enabling unified dashboards, data exchange and coordinated decision-making across institutions. This integration supports a broader vision of a connected and data-driven maritime governance system.

The initiative also aims to enhance user interaction and stakeholder experience by simplifying procedures, improving accessibility of services and strengthening compliance mechanisms.

Modules and Functional Coverage

E-Samudra has been designed as a **modular platform covering 15 major modules and 62 sub-processes**, ensuring comprehensive coverage of all operational and administrative functions within DGS.

The platform integrates multiple branches and functional areas:

Coastal	Branch
Covers processes related to sailing vessels and seamen, supporting regulatory oversight and service delivery for coastal operations.	

IT	and	e-Governance	Module
Includes common processes such as user profile creation, service access and standardised workflows applicable across departments. It also ensures inter-departmental process harmonisation.			

Crew	Branch
Handles seafarer-related processes, including certification, service records and access to services, thereby streamlining crew management systems.	

Engineering	Branch
Covers a wide range of technical and regulatory functions, including:	

- Service providers and recognised organisations

- Auditors for ISM (International Safety Management) audits
- Survey and certification processes
- Port-related technical compliance

Nautical

Branch

Focuses on ship registration and management of shipping entities, including maintenance of vessel records and associated services.

Commercial

Matters

Addresses aspects such as multimodal transport operators and ship chartering processes, linking regulatory oversight with commercial shipping activities.

Finance, Accounts, Audit and Public Procurement (FAAPP)

Covers financial management functions including budgeting, accounts, audits and procurement processes, ensuring transparency and financial discipline.

This comprehensive coverage ensures that E-Samudra functions as a **single integrated platform for all DGS operations**, eliminating silos and enabling coordinated workflows.

Key Features and Capabilities

E-Samudra incorporates several advanced features that enhance its effectiveness as a digital governance platform:

- **Streamlined Document Accessibility**
Enables easy submission, retrieval and management of documents through a centralised digital repository.
- **Compliance Monitoring**
Facilitates real-time tracking of regulatory compliance across vessels, operators and service providers.
- **Data Sharing and Integration**
Supports seamless exchange of information across departments and with external stakeholders, reducing duplication and improving coordination.
- **Audit and Administrative Process Management**
Strengthens governance through structured workflows for audits, approvals and administrative actions.
- **Operational Efficiency Enhancement**
Automation of processes reduces manual intervention, minimises errors and improves turnaround time.
- **Data Analytics and Decision Support**
Provides analytical capabilities for performance monitoring, trend analysis and informed decision-making.

- **Cloud-based Infrastructure and Security**
Incorporates cloud data centre and network security services, ensuring scalability, reliability and protection of sensitive data.
- **Mobile Application Enablement**
Extends platform accessibility to users through mobile applications, enhancing convenience and real-time interaction.

Strategic Significance

E-Samudra represents a critical step in the digital transformation of India's maritime governance framework. By integrating diverse functions into a single platform, it enhances operational transparency, reduces administrative inefficiencies and improves service delivery.

The platform also strengthens India's alignment with global best practices in maritime administration, supporting compliance with international standards and facilitating smoother interaction with global stakeholders.

From a broader perspective, E-Samudra contributes to:

- **Ease of Doing Business in the maritime sector**
- **Improved regulatory oversight and compliance enforcement**
- **Enhanced data-driven governance and policy formulation**
- **Integration with national digital and logistics ecosystems**

License and Chartering Portal

India's maritime sector requires strict compliance, especially for foreign flagged vessels operating in Indian waters. Getting a chartering license for foreign flag vessels is a legal requirement for smooth maritime operations and compliance with safety, security and trade regulations.

Having a chartering license for foreign-flagged vessels in India has many advantages for businesses and operators:

- **Legal Compliance:** Operating with a valid license ensures strict compliance with Indian maritime laws, with no penalties or operational delays.
- **Market Access:** Licenses allow access to Indian ports for commercial and industrial activities, and more trade opportunities.
- **Safety and Security:** Licensed vessels are required to meet strict occupational health and safety certification so that assets, crew and cargo are protected.
- **Simplified Procedures:** Digitized licensing process reduces administrative burden and turnaround time.

- **Crew Opportunities:** Licensing rules support employment and training of Indian seafarers through mandatory crew composition norms.
- **Environmental Compliance:** License requirements often include certifications related to environmental safety, pollution control and sustainable maritime operations.

All these benefits of having a chartering license for foreign-flagged vessels in India contribute to operational efficiency, international trade growth and maritime safety.

Companies engaged in international freight forwarding, logistics, or multimodal transport should also consider registering as a Multimodal Transport Operator (MTO) in addition to having a chartering license for foreign-flagged vessels in India. MTO registration is essential for businesses that coordinate shipments across multiple transportation modes, including sea, air, road, and rail.

DG Shipping's eSamudra portal has made the process of getting a Chartering License for Foreign Flag Vessels in India easy and transparent and made license available in 24 hours, allowing Indian and foreign entities to comply with statutory requirements seamlessly.

4 Modules

Development of four modules is pivotal initiative that will significantly enhance the Directorate General of Shipping's capabilities in ensuring safety, efficiency, and service excellence. Our focus is on the development of specialized modules for Grievance Redressal, Crisis Management, Maritime Training Institutes (MTI), and Recruitment and Placement Services License (RPSL).

These modules represent a strategic advancement in our commitment to streamlining operations, improving stakeholder engagement, and ensuring the highest standards of maritime safety and training.

24x7 Grievance Redressal Module



E-Navik (24x7 Grievance Redressal System)

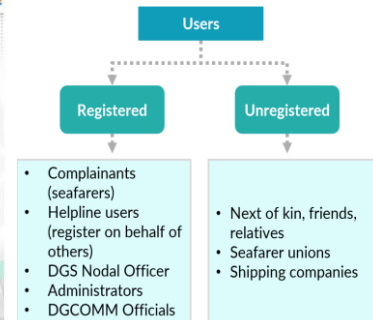


Aims to provide a single digital platform for **24x7** effective lodging, tracking, and resolution of seafarer grievances.

- Streamlined and transparent grievance management
- Enhanced accountability and efficiency
- Timely redressal of issues
- Centralized database for analytics and improvement

Key Functions

- ✓ Lodging and categorization of grievances
- ✓ Automated routing to concerned officers
- ✓ Investigation and resolution tracking
- ✓ Communication and feedback mechanism
- ✓ Real-time monitoring and reporting



54



24 x 7 Grievance Redressal System



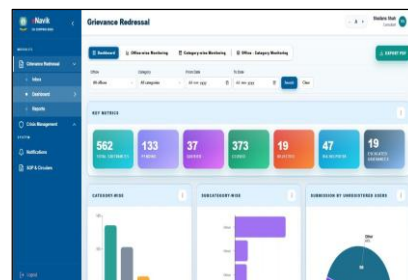
DGS System to provide a single digital platform for 24x7 effective lodging, tracking, and resolution of seafarer grievances.

Aim

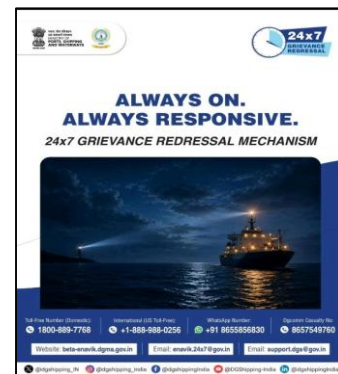
- Streamlined and transparent grievance management
- Enhanced accountability and efficiency
- Timely redressal of issues
- Centralized database for analytics and improvement

Current Status

- eNavik Portal has went live for beta release on 15.05.2026. (<https://beta-enavik.dgma.gov.in/>)
- Extensive Social Media Campaign is currently ongoing since 15.05.2026 and will be live till 23.06.2026
- Go-live is expected for August 2026



24x7 Grievance Redressal Module



27

E-Navik is a dedicated digital platform developed to provide a **centralised, round-the-clock grievance redressal mechanism for seafarers**, addressing issues related to employment, safety, welfare, fraud and overseas emergencies. The system reflects a strong institutional commitment towards **seafarer welfare, transparency and accountability**, ensuring that concerns are addressed in a timely and structured manner.

Objective and System Overview

The primary objective of E-Navik is to establish a **single, integrated digital interface** that enables effective **lodging, tracking and resolution of grievances on a 24x7 basis**. Given the

global and time-sensitive nature of maritime employment, the system ensures that seafarers and related stakeholders have continuous access to support mechanisms irrespective of location.

The platform is designed to:

- Streamline grievance handling processes
- Improve transparency and traceability in complaint resolution
- Enhance accountability across responsible authorities
- Enable timely redressal of issues through structured workflows

Additionally, E-Navik serves as a **centralised database of grievances**, facilitating analysis, trend identification and policy-level improvements in seafarer welfare frameworks.

Key Functional Components

E-Navik incorporates a structured and automated grievance management lifecycle, ensuring efficiency and consistency in handling cases.

Lodging and Categorisation of Grievances

The system enables users to register complaints through a standardised digital interface, with categorisation based on the nature of the issue. This ensures proper classification and prioritisation of cases.

Automated Routing to Concerned Authorities

Once a grievance is registered, it is automatically routed to the appropriate officers or departments responsible for handling the issue. This eliminates delays associated with manual forwarding and ensures faster initiation of action.

Investigation and Resolution Tracking

The platform supports end-to-end tracking of grievance status, including investigation progress and resolution timelines. This provides visibility to both administrators and complainants.

Communication and Feedback Mechanism

E-Navik enables continuous communication between stakeholders, allowing users to receive updates and provide feedback. This strengthens transparency and builds trust in the system.

Real-time Monitoring and Reporting

The system provides real-time dashboards and reporting tools for monitoring grievance trends, response times and resolution efficiency. This enhances oversight and supports data-driven decision-making.

User Ecosystem and Accessibility

E-Navik is designed to cater to a broad spectrum of users, ensuring inclusivity and accessibility across the maritime community.

Registered Users include:

- Seafarers (primary complainants)
- Helpline users acting on behalf of others
- DGS Nodal Officers and Administrators
- DGCOMM officials involved in grievance handling

Unregistered Users include:

- Next of kin, friends and relatives of seafarers
- Seafarer unions
- Shipping companies

This dual-access structure ensures that grievances can be raised not only by seafarers themselves but also by concerned stakeholders, thereby strengthening the support network for maritime personnel.

Operational Features

The system operates as a **24x7 grievance redressal mechanism**, supported by helpline and digital communication channels. It enables reporting of a wide range of issues, including employment disputes, safety concerns, fraudulent practices and emergency situations faced by seafarers globally.

The availability of continuous support ensures that critical cases, particularly those involving overseas emergencies, can be addressed without delay.

Strategic Significance

E-Navik plays a crucial role in strengthening India's maritime governance framework by prioritising **seafarer welfare and protection**. Its significance extends beyond grievance handling to broader institutional and policy dimensions:

- Enhances **transparency and accountability** in grievance redressal processes
- Strengthens **trust between seafarers and regulatory authorities**
- Enables **data-driven policy interventions** through centralised analytics
- Supports compliance with **international maritime labour and welfare standards**
- Improves India's reputation as a responsible maritime nation

E- Navik - Crisis Response Management Module



E-Navik (Crisis Response Management Module)



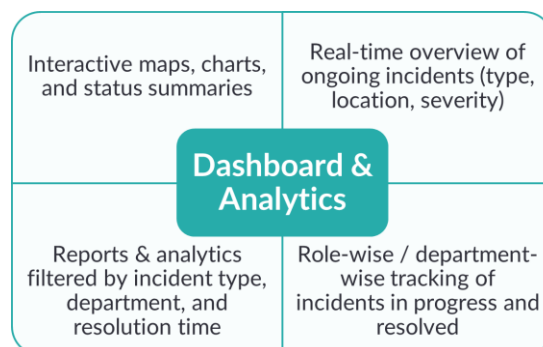
Aims to ensure a **rapid, coordinated, and technology-enabled response** to maritime crisis through an integrated digital platform.

Core Objectives

- ✓ Enable real-time reporting and tracking of maritime incidents.
- ✓ Facilitate coordination among multiple stakeholders (DGS, MoPSW, MEA, Navy, Coast Guard, etc.). Ensure incident management from initiation to resolution.
- ✓ Provide live updates, alerts, and analytics.
- ✓ Generate post-crisis reports for evaluation and policy improvement.

Key Enablers

- ✓ Digital incident reporting & categorization.
- ✓ Automated action plans with assigned tasks and deadlines.
- ✓ Resource mobilization tools for quick response.
- ✓ Real-time communication and discussion boards for stakeholder collaboration.
- ✓ Analytics dashboards with role-wise data and trends.



55

The E-Navik Crisis Response Management Module is an advanced extension of the broader E-Navik platform, designed to enable a **rapid, coordinated and technology-driven response to maritime incidents and emergencies**. The module serves as a centralised digital system for managing crisis situations across the maritime domain, ensuring seamless coordination among multiple stakeholders and facilitating real-time decision-making.

Objective and System Framework

The primary objective of the Crisis Response Management Module is to establish an **integrated digital platform for end-to-end incident management**, covering the entire lifecycle from reporting and escalation to resolution and post-incident analysis.

Given the complexity and time-sensitive nature of maritime emergencies—ranging from safety incidents and environmental hazards to operational disruptions—the module is designed to ensure **real-time visibility, structured coordination and efficient resource deployment**.

The system enables:

- Continuous monitoring and tracking of incidents
- Centralised coordination among key stakeholders including DGS, Ministry of Ports, Shipping and Waterways, Ministry of External Affairs, Indian Navy, Coast Guard and other agencies

- Timely dissemination of alerts and updates
- Data-driven assessment and response planning

Core Functional Objectives

The module is structured around key operational objectives that enhance crisis management capabilities:

Real-time Reporting and Tracking

The system allows immediate reporting of maritime incidents through a digital interface, enabling authorities to track developments in real time and initiate prompt response actions.

Multi-Stakeholder Coordination

A major focus of the module is to facilitate seamless coordination among multiple agencies involved in crisis response. By providing a unified platform, it ensures that all stakeholders operate with a shared understanding of the situation.

End-to-End Incident Management

The platform supports the entire incident lifecycle, from initial reporting and escalation to investigation, resolution and closure, ensuring structured and accountable handling of crises.

Live Updates and Alert Mechanisms

The system provides continuous updates, notifications and alerts, enabling stakeholders to stay informed and respond proactively to evolving situations.

Post-Crisis Evaluation and Reporting

The module generates detailed reports and analytics after incident resolution, supporting evaluation, learning and policy improvements for future preparedness.

Key Enablers and System Capabilities

The effectiveness of the Crisis Response Management Module is driven by a set of digital enablers that enhance responsiveness and coordination:

- **Digital Incident Reporting and Categorisation**
Standardised formats for reporting incidents ensure accurate classification and prioritisation.
- **Automated Action Plans**
The system generates predefined workflows with assigned responsibilities and timelines, ensuring timely execution of response actions.
- **Resource Mobilisation Tools**
Enables quick identification and deployment of resources required for managing emergencies.

- **Real-time Communication Platforms**
Integrated communication channels and discussion boards facilitate continuous interaction among stakeholders.
- **Role-based Analytics and Dashboards**
Provides customised data views for different departments and authorities, enabling focused monitoring and decision-making.

Dashboard and Analytics Framework

A central feature of the module is its **comprehensive dashboard and analytics system**, which provides real-time situational awareness and actionable insights.

Key functionalities include:

- **Interactive maps, charts and status summaries** for visual representation of incidents
- **Real-time overview of ongoing incidents**, including type, location and severity
- **Filtered reports and analytics** based on parameters such as incident type, department and resolution time
- **Role-wise and department-wise tracking** of incidents, including those in progress and resolved

This dashboard-centric approach enhances transparency, enables faster decision-making and supports effective coordination during crisis situations.

Strategic Significance

The Crisis Response Management Module significantly strengthens India's maritime emergency preparedness and response framework. Its strategic importance lies in:

- Enhancing **response speed and coordination** during maritime emergencies
- Improving **situational awareness through real-time data and analytics**
- Strengthening **inter-agency collaboration** across national and international stakeholders
- Supporting **evidence-based policy formulation** through post-incident analysis
- Aligning with global best practices in **maritime safety and crisis management**

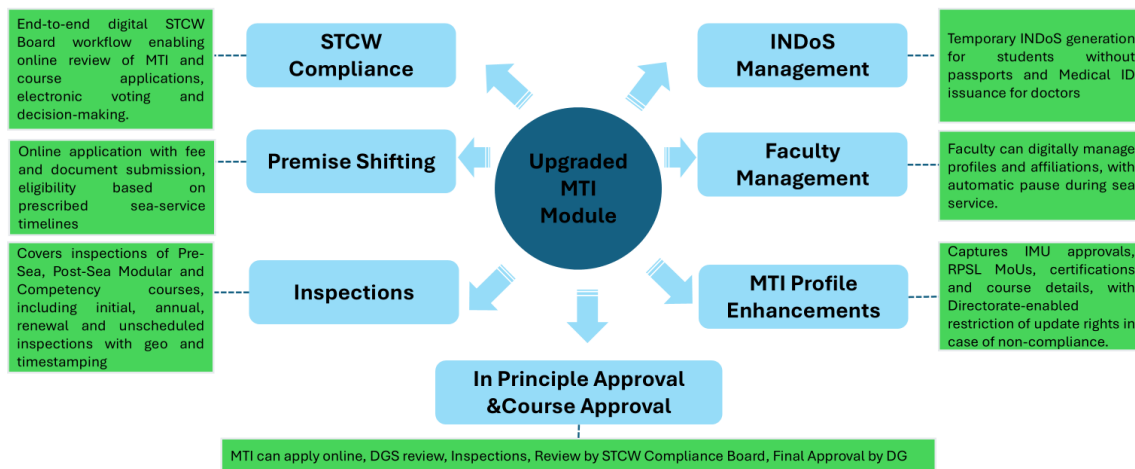
Maritime Training Institutes (MTI) Module



Maritime Training Institute Module



Aims to enhance efficiency, compliance, and transparency in the **Maritime Training Institutes (MTI)** ecosystem through digital automation and seamless integration.



30

The E-Navik Maritime Training Institute (MTI) Module is a specialised digital component aimed at transforming the functioning of India's maritime training ecosystem through **automation, transparency and regulatory integration**. The module is designed to streamline processes related to Maritime Training Institutes, ensuring compliance with international standards while enhancing operational efficiency and governance.

Objective and System Framework

The primary objective of the MTI Module is to establish an **end-to-end digital framework for managing, monitoring and regulating Maritime Training Institutes** in India. It seeks to enhance efficiency, strengthen compliance with STCW (Standards of Training, Certification and Watchkeeping) requirements and improve transparency across all training-related processes.

The module enables:

- Digitisation of regulatory approvals and institutional workflows
- Standardisation of processes across institutes
- Real-time monitoring of compliance and performance
- Seamless interaction between institutes and the Directorate

By integrating all MTI-related functions into a unified system, the platform supports a **structured, accountable and technology-driven training ecosystem**.

Core Functional Components

The module is built around multiple functional areas that collectively cover the lifecycle of maritime training management.

STCW Compliance Framework

The system enables a fully digital workflow for STCW Board processes, including online review of MTI applications, electronic voting and decision-making. This ensures faster approvals while maintaining regulatory rigour and transparency.

Premise Shifting and Institutional Approvals

Institutes can apply online for premise shifting, including submission of documents and fee payments. The system incorporates eligibility checks based on prescribed sea-service timelines and regulatory criteria, ensuring structured evaluation of applications.

Inspection and Audit Management

The module covers inspections for pre-sea, post-sea modular and competency courses. It includes initial approvals, annual renewals and unscheduled inspections, enabling continuous monitoring of institutional compliance.

Batch Management System

A key feature of the module is the structured management of training batches. The system enforces a **minimum 25 percent batch upload requirement**, along with dynamic batch size control and intake regulation. It also provides an online correction request mechanism, ensuring accuracy and accountability in student data.

Institutional and Administrative Enhancements

The MTI Module incorporates several enhancements aimed at strengthening institutional governance and operational efficiency.

INDoS Management

The system supports management of INDoS (Indian National Database of Seafarers) records, including provision for temporary INDoS generation for students without passports and medical ID issuance for doctors. This ensures continuity in training processes and regulatory compliance.

Faculty Management System

Institutes can digitally manage faculty profiles, affiliations and service records. The system includes provisions for automatic pause in faculty service records during periods of sea service, ensuring accurate tracking of faculty availability and compliance.

MTI Profile and Regulatory Controls

The module captures key institutional data including approvals, RPSL MoUs, certifications and course details. It also enables the Directorate to enforce regulatory controls, including restriction of update rights in cases of non-compliance, thereby strengthening oversight.

System Integration and Governance

The MTI Module is designed as part of the broader E-Navik ecosystem, ensuring integration with other maritime governance systems. This enables:

- Centralised data management across institutions
- Improved coordination between regulatory departments
- Real-time visibility into institutional performance and compliance

The system also supports digital record-keeping and audit trails, enhancing transparency and accountability in regulatory processes.

Strategic Significance

The MTI Module plays a critical role in strengthening India's maritime training framework by ensuring alignment with global standards and improving institutional governance.

Its strategic importance includes:

- Enhancing **quality and standardisation of maritime training**
- Strengthening **compliance with STCW and international norms**
- Improving **efficiency in approvals, inspections and monitoring**
- Enabling **data-driven decision-making for policy and regulation**
- Supporting development of a **skilled and globally competitive seafarer workforce**

Recruitment and Placement Services License (RPSL) Module



E-Navik (Recruitment & Placement Service License (RPSL)



Aims to strengthen transparency, compliance, and efficiency in **Recruitment & Placement Service License (RPSL)** operations through automation and digital integration.

KEY FUNCTIONALITIES:

1. {	Comprehensive Inspection Program (CIP)	5. {	Non-RPSL License (Technicians)
2. {	MLC Board Integration	6. {	Appeal Management
3. {	Seafarer / Technician Sign-On/Offs	7. {	Change Requests & Contract Updates
4. {	Fee Payments & Bank Guarantees	8. {	Integration with MTI System

57

The E-Navik RPSL Module is a dedicated digital framework aimed at strengthening the regulation and governance of **Recruitment and Placement Service License (RPSL) agencies**, which play a critical role in facilitating employment of Indian seafarers. The module is designed to enhance **transparency, compliance and operational efficiency** by digitising end-to-end processes related to licensing, monitoring and service delivery.

Objective and System Framework

The primary objective of the RPSL Module is to establish a **structured, technology-driven system for managing recruitment and placement activities** within the maritime sector. By transitioning from manual processes to a digital platform, the module ensures better oversight of RPSL agencies, reduces scope for irregularities and improves service delivery standards.

The system focuses on:

- Digitisation of licensing and compliance processes
- Real-time monitoring of recruitment and placement activities
- Integration with other maritime systems such as MTI modules
- Strengthening governance through audit trails and accountability mechanisms

This contributes to safeguarding the interests of seafarers while ensuring adherence to national and international regulatory frameworks, including Maritime Labour Convention (MLC) provisions.

Core Functional Components

The module incorporates a comprehensive set of functionalities that cover the lifecycle of RPSL operations.

Comprehensive Inspection Programme (CIP)

The system enables structured inspection and audit of RPSL agencies, ensuring compliance with regulatory requirements. Digital tracking of inspections enhances transparency and accountability.

MLC Board Integration

Integration with MLC-related processes ensures that recruitment practices are aligned with international labour standards. This facilitates better monitoring of welfare and employment conditions of seafarers.

Seafarer / Technician Sign-On and Sign-Off Management

The module captures and tracks sign-on and sign-off data for seafarers and technicians, ensuring accurate record-keeping and regulatory compliance throughout the employment lifecycle.

Fee Payments and Bank Guarantee Management

Digital processing of fee payments and management of bank guarantees simplifies financial compliance, reduces delays and ensures traceability of transactions.

Advanced Functional Capabilities

The module also incorporates additional features that enhance operational flexibility and regulatory control:

Non-RPSL License Management (Technicians)

Provision for handling licensing and regulatory aspects related to technicians who may not fall under standard RPSL frameworks, ensuring comprehensive coverage of maritime workforce segments.

Appeal Management System

Enables digital submission and processing of appeals related to licensing decisions, ensuring a transparent and structured grievance resolution mechanism for RPSL agencies.

Change Requests and Contract Updates

The system allows agencies to submit requests for modifications in contracts or operational details, which can be reviewed and approved through defined workflows.

Integration with MTI System

Seamless integration with the Maritime Training Institute module ensures alignment between training, certification and recruitment processes, enabling a cohesive maritime workforce management system.

Governance and Compliance Impact

The RPSL Module significantly strengthens regulatory oversight by providing:

- **End-to-end visibility of recruitment and placement activities**
- **Standardised processes for licensing, inspections and compliance**
- **Digital audit trails for monitoring and enforcement**
- **Improved data accuracy and transparency**

By ensuring that all transactions and processes are recorded digitally, the system reduces the risk of malpractice and enhances trust among stakeholders.

Significance

The module plays a critical role in improving the overall governance of India's maritime labour ecosystem. Its strategic importance includes:

- Enhancing **protection and welfare of seafarers** through regulated recruitment practices
- Strengthening **compliance with MLC and international labour standards**
- Improving **ease of doing business for RPSL agencies** through streamlined processes
- Enabling **data-driven policy formulation and monitoring**
- Supporting development of a **transparent and accountable maritime workforce ecosystem**

ERP for SWFS and SPFO

The Seamen's Provident Fund Organization (SPFO), established under the Seamen's Provident Fund Act, 1966 (Act No. 4 of 1966), is entrusted with the administration, implementation, and monitoring of the Seamen's Provident Fund Scheme, which has been operational retrospectively since July 1, 1964. The scheme is designed to provide retirement security and social protection to Indian seafarers, along with essential financial support to their families in the event of the seafarer's demise.

The SPFO allows seafarers to avail non-refundable and final withdrawals based on eligibility, and in FY 2022–23, it processed over 1,849 claims amounting to ₹86.43 crores, reflecting its vital role in the financial well-being of maritime workers. The governance structure of SPFO ensures balanced representation from the Government, Employers, and Employees on its Board, reinforcing its mandate to protect the rights and entitlements of all stakeholders in the seafaring community.

Development of an Enterprise Resource Planning (ERP) system that aims to automate SWFS's business processes.

- i. Complete automation of various Welfare Scheme applications and their processing
- ii. Complete automation of Gratuity Scheme application and their processing
- iii. Accounting Section (To check cashflow through various contributors and beneficiaries)

Development of an Enterprise Resource Planning (ERP) system that aims to automate SPFO's business processes.

1. Complete automation of Provident Fund Management
2. Automation of Payment section
3. Provident Fund Scheme Management
4. Complete automation of Financial Management
5. Compliance and Audit

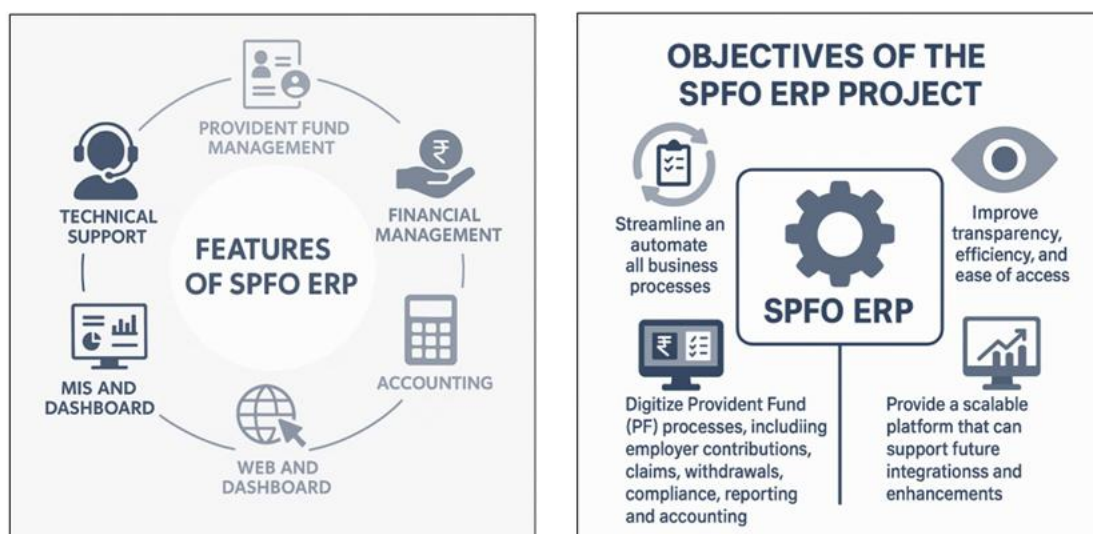
In addition to provident fund contributions, SPFO also receives ex-gratia and annuity payments from shipping companies, which are credited to individual seafarer accounts and invested once they cross predefined thresholds. Investment operations are carried out in accordance with regulatory guidelines, with surplus balances—beyond a set liquidity threshold—transferred to registered investment advisors, while a portion is retained to ensure timely settlement of withdrawal claims. This liquidity management mechanism enables the SPFO to maintain operational continuity, ensure timely payments, and fulfil its fiduciary responsibilities.

The Seamen's Provident Fund Organization (SPFO), under the administrative control of the Ministry of Ports, Shipping and Waterways (MoPSW), has embarked on a flagship digital initiative to modernize and automate its operations through the development of a comprehensive Enterprise Resource Planning (ERP) system. The ERP initiative aims to create

an end-to-end digital platform that integrates and streamlines all core functional areas of SPFO to ensure efficient, transparent, and user-centric service delivery to both seafarers and employers.

The envisioned system will include modules for Provident Fund (PF) Management, Financial Accounting, Scheme Application Processing, Investment and Levy Tracking, GST and Tax Compliance, Payroll, Budgeting, and Technical Support Management. A user-friendly web portal will serve as the central access point, enabling seamless processes such as registration, contribution tracking, automated eligibility checks, withdrawal processing, real-time compliance monitoring, and approvals.

The new system should work seamlessly without any dependencies on the existing applications such as the legacy PF management software and Tally software for account maintenance.



In essence, the SPFO and SWFS ERP project marks a pivotal step in India's maritime digital transformation journey, aimed at elevating the governance, accessibility, and operational efficiency of seafarer welfare and provident fund services. The project is administered and driven by the Crew branch of Directorate general of Shipping with the support of the IT and E governance Branch for technical support.

Maritime Knowledge Cluster

The Maritime Knowledge Cluster (MKC) is an ambitious, future-ready initiative launched under the aegis of the Directorate General of Shipping (DGS), Ministry of Ports, Shipping and Waterways (MoPSW), Government of India. It is envisioned as a centralized, digital knowledge and services platform that aims to unify and empower India's maritime ecosystem.

Recognizing the growing importance of the maritime domain in the national and global economy, the MKC is designed as a strategic response to the fragmented, siloed, and under-optimized flow of maritime knowledge and services across the country. The MKC serves as a multi-dimensional e-platform that brings together a wide array of maritime stakeholders—government authorities, regulatory bodies, shipping companies, seafarers, maritime educational and training institutions, port authorities, legal and insurance firms, classification societies, surveyors, shipbuilders, environmental experts, start-ups, researchers, and investors—under a single digital umbrella. It is not merely an information repository but a collaborative, interactive, and service oriented digital cluster, tailored to meet the diverse and evolving needs of the maritime sector.

The initiative is structured around 15 well-defined thematic verticals covering all core and allied domains such as Shipping Development, Ports, Shipbuilding, Ship Recycling, Maritime Safety & Security, Sustainability & Maritime Decarbonization, Maritime Services, Seafarers' Corner, Research & Innovation, and Policy Consultation, among others. Each vertical is equipped with specialized sub-verticals and service modules, making the platform both comprehensive and navigable.



Objectives of MKC under MIV 2030 and MAKV 2047

-  Drive Collaborative and Strategic Research by fostering collaboration among key institutions
-  Enhance Industry Partnerships under key research areas
-  Promote Skill Development and Capacity Building
-  Collaboration across domestic and international stakeholders in the maritime sector.
-  Adapt to Emerging Challenges and Innovations
-  Niche areas in for India to contribute to global research development
-  Atmanirbhar Bharat initiatives considered to make Indian Maritime sector self-reliant

The MKC also acts as a catalyst for innovation and industry-academia collaboration, working closely with premier institutions like the National Technology Centre for Ports, Waterways, and Coasts (NTCPWC), Centre for Inland and Coastal Maritime Technology (CICMT), Indian Maritime University (IMU), and National Institute of Oceanography (NIO). Through these partnerships, MKC facilitates advanced research, new policy ideas, skill development, and sustainable technological solutions.

(NTCPWC), Centre for Inland and Coastal Maritime Technology (CICMT), National Institute of Oceanography (NIO), and Indian Maritime Universities (IMUs) for strategic maritime research. Indian maritime knowledge cluster to focus on:

- a) Enhancing research and development (R& D) capacities at IMUs/M TIs
- b) Focused research across strategic topics
- c) Onboarding 10+ industry players across 5 research thrusts of ports, shipbuilding, dredging and logistics industries
- d) Creating a taskforce under Indian Maritime Center to drive collaboration across domestic/international network

Additionally, steps to promote and partner with all public/ private shipyards, ports and logistics service providers (LSPs) to offer customized skill development courses for becoming the best highend training / upskilling partner for marine / Port sector workers should also be evaluated.

The platform is also aligned with India's aspiration to achieve Aatmanirbhar Bharat (self-reliant India), as it encourages domestic innovation, supports indigenous maritime businesses, and increases digital governance within the sector. The MKC is expected to enhance maritime data transparency, empower evidence-based policymaking, reduce duplication of efforts across ministries and institutions, and enable real-time coordination for strategic maritime decisions.

By institutionalizing the Maritime Knowledge Cluster as a permanent, evolving infrastructure under the vision of MIV 2030 and MAKV 2047, India positions itself not just as a global maritime trade hub, but also as a leader in maritime thought, innovation, and sustainable development. The MKC, thus, becomes an enabler and catalyst for India's ambition to emerge as a maritime superpower.

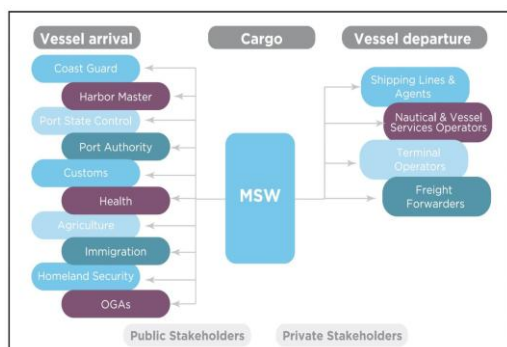
Maritime Single Window



Maritime Single Window



A Maritime Single Window (MSW) is a digital platform that allows ship owners, operators, and agents to submit all necessary documentation electronically in a single-entry point to various authorities (customs, port health, immigration, and other regulatory bodies) involved in maritime operations.



Stakeholder		Integrated
Designated Ports	85 Exim Ports	Yes
Immigration		Technical Integration for Immigration is under way
Customs		Email notification for customs integration has been deployed
PHO		Yes

Benefits

1. Reduction in Cargo Clearance Time
2. Port Turnaround Time Improvement
3. Savings on Documentation and Compliance

52

The Maritime Single Window (MSW) represents a transformative digital initiative aimed at streamlining and modernising maritime regulatory processes in India. It is designed as a **centralised, single-entry digital platform** that enables shipowners, operators and agents to electronically submit all mandatory documentation related to vessel arrival, stay and departure to multiple regulatory authorities through a unified interface. This aligns with the **International Maritime Organization (IMO) mandate on facilitation of maritime traffic (FAL Convention)** and reflects India's commitment to enhancing ease of doing business in the maritime sector.

Concept and Functional Framework

Traditionally, maritime operations required multiple submissions of documents to different agencies such as customs, immigration, port health, port authorities and other regulatory bodies, leading to duplication, delays and inefficiencies. The MSW eliminates this fragmentation by creating a **single digital interface** through which all stakeholders interact.

The platform integrates the complete vessel lifecycle at ports, covering:

- **Vessel Arrival Processes:** Involving agencies such as Coast Guard, Port Authority, Customs, Immigration, Health, Agriculture and other government agencies
- **Cargo Handling and Documentation:** Enabling seamless data exchange between shipping lines, terminal operators and freight forwarders

- **Vessel Departure Formalities:** Ensuring coordinated approvals and clearances through a unified system

By acting as a **central data exchange hub**, MSW ensures that information submitted once is shared across all relevant authorities, thereby reducing redundancy and improving coordination between public and private stakeholders.

Stakeholder Integration and Coverage

The MSW platform has been progressively implemented across India's maritime ecosystem and currently covers **85 EXIM ports**, reflecting its nationwide adoption and scalability.

Key stakeholder integration includes:

- **Port Authorities / Designated Ports** – Fully integrated
- **Port Health Organisation (PHO)** – Integrated for health-related clearances
- **Customs** – Email-based notification system deployed as an interim integration mechanism
- **Immigration Authorities** – Technical integration currently under implementation

This phased integration approach ensures that all critical regulatory bodies are gradually brought onto a **common digital ecosystem**, enabling end-to-end digitisation of port clearance processes.

Operational Impact and System Performance

Since its operationalisation, the Maritime Single Window has demonstrated strong adoption and measurable improvements in maritime operations. A significant proportion of vessels calling at Indian ports are now reporting through the platform, indicating a **high level of industry acceptance and compliance**.

The system also provides:

- **Real-time monitoring dashboards** for tracking vessel documentation and compliance
- **Standardised data formats**, ensuring uniformity across ports
- **Improved coordination between agencies**, reducing procedural bottlenecks

Through continuous stakeholder engagement, including regular review meetings and system enhancements, the platform is being refined to address operational challenges and improve user experience.

Key Benefits and Outcomes

The implementation of MSW has resulted in several tangible benefits for the maritime ecosystem:

1. Reduction in Cargo Clearance Time

By eliminating repetitive documentation and enabling parallel processing across agencies, MSW significantly reduces the time required for cargo and vessel clearances.

2. Improvement in Port Turnaround Time (TAT)

Faster documentation and coordinated approvals contribute to reduced vessel waiting time, leading to improved port efficiency and higher throughput.

3. Cost Savings in Documentation and Compliance

Digital submission reduces administrative costs, paperwork and compliance burden for shipping lines and logistics operators.

Strategic Significance

The Maritime Single Window is a critical enabler in India's broader digital maritime transformation and logistics modernisation agenda. Its significance extends beyond operational efficiency:

- **Enhances Ease of Doing Business** by simplifying regulatory procedures
- **Strengthens Global Competitiveness** by aligning with international best practices
- **Supports Multimodal Logistics Integration** by linking port processes with digital logistics platforms
- **Improves Transparency and Accountability** through digital audit trails and real-time tracking
- **Reduces Environmental Impact** by minimising delays, thereby lowering fuel consumption and emissions

Introduction of the IMO Shadow Portal

The storyline progresses to a more specialized platform: the **IMO Shadow Portal**, which aligns India's maritime governance with international maritime standards.

The portal aims to create a **unified digital-first ecosystem** to enhance:

- Preparedness before IMO committee meetings,
- Cross-ministry collaboration,
- Structured documentation and review workflows,
- Transparency and institutional memory.

The portal supports 11 major functions including document uploads, agenda reviews, feedback compilation, task creation, structured committee collaboration, and real-time interaction between delegates.

An important part of this slide is the **International Maritime Organisation Structure**, showing alignment with key IMO committees such as:

- MSC (Maritime Safety Committee)
- MEPC (Marine Environment Protection Committee)
- LEG (Legal Committee)
- TCC (Technical Cooperation Committee), etc.

This portal strengthens India's **global maritime diplomacy**, ensuring that India's voice is informed, coordinated, and impactful at IMO platforms.

National Coastal Database Portal



National Coastal Database Portal



The National Database of Coastal Shipping is intended to serve as a publicly-accessible, electronic portal that collects and displays key information about India's coastal trade.

Key Objectives are:

1

Develop and implement a centralized, secure, and scalable database system for all coastal shipping activities in India.

2

Ensure real-time data capture and reporting from ports, shipping operators, and government agencies.

3

Provide analytics and reporting capabilities to support policy decisions and operational planning.

4

Enable the public, policymakers and industry participants to monitor the status of coastal shipping, assess compliance, and support the development of the Strategic Plan.

5

These purposes are set out in the Act, which requires the Director-General to maintain the database on a web portal and make it available for public access

58

The National Coastal Database Portal is envisaged as a **centralised, publicly accessible digital platform** for capturing, managing and disseminating comprehensive data related to coastal shipping in India. It is designed to serve as a **single source of truth** for all stakeholders by consolidating information on coastal trade, vessel movements, cargo flows and operational metrics across ports and shipping systems.

The initiative addresses a long-standing gap in the availability of structured and real-time data for coastal shipping, which is critical for **policy formulation, operational planning and monitoring of sectoral performance**.

Objective and System Framework

The primary objective of the portal is to develop and implement a **secure, scalable and integrated database system** that captures all relevant data associated with coastal shipping activities across the country. The system is intended to bring together data from multiple sources, including ports, shipping operators and government agencies, into a unified platform.

A key feature of the portal is its ability to enable **real-time data capture and reporting**, ensuring that stakeholders have access to up-to-date information on cargo movement, vessel operations and logistics trends. This enhances transparency and supports more informed decision-making at both operational and strategic levels.

The platform is also designed to provide **advanced analytics and reporting capabilities**, enabling users to analyse trends, assess performance and identify areas for improvement. This

is particularly important in the context of promoting coastal shipping and achieving modal shift targets under national logistics strategies.

Functional Scope and Data Integration

The National Coastal Database Portal integrates data across the coastal shipping value chain, including:

- Port-level cargo handling and vessel traffic data
- Shipping operator inputs on vessel deployment and cargo movement
- Regulatory data from government agencies
- Operational metrics related to turnaround time, cargo volumes and route utilisation

By consolidating these data streams, the portal enables a **holistic view of coastal shipping operations**, facilitating coordination across stakeholders and improving system efficiency.

Accessibility and Stakeholder Engagement

The portal is intended to be **publicly accessible**, allowing a wide range of stakeholders to access relevant information. This includes:

- Policymakers and government authorities
- Industry participants such as shipping lines, logistics providers and port operators
- Researchers and analysts
- General public and other interested stakeholders

By making data openly available, the portal promotes transparency and encourages greater participation in the coastal shipping ecosystem.

Policy and Regulatory Alignment

The development of the National Coastal Database Portal is anchored in a statutory framework, which mandates the Director-General to **maintain and operate the database through a web-based platform and ensure its availability for public access**.

This regulatory backing ensures continuity, accountability and standardisation in data collection and dissemination processes.

Significance

The portal plays a crucial role in strengthening the data backbone of India's coastal shipping sector. Its strategic importance includes:

- Enabling **data-driven policymaking and strategic planning**
- Supporting monitoring of **modal share and coastal shipping performance**
- Enhancing **transparency and accountability** across stakeholders
- Facilitating **compliance tracking and regulatory oversight**
- Supporting development and implementation of the **National Coastal and Inland Shipping Strategic Plan**

By providing reliable and timely data, the portal acts as a key enabler for achieving national objectives related to logistics efficiency and modal shift.

Ship Recycling Portal



Ship Recycling Portal



An upcoming unified national digital platform under DGS to implement the Hong Kong Convention (HKC) and Recycling of Ships Act (2019), ensuring realtime, transparent and accountable governance of India's ship recycling ecosystem

Importance of Portal

- **Transparency** : Digitally traceable inspections, certifications & audits
- **Accountability** : Role-based actions with time-stamped compliance trails
- **Real-time Monitoring** : Central oversight by DGS & State Authorities
- **Global Credibility** : Auditable records for IMO, foreign Flag States & shipowners
- **Stakeholder Integration** : Connects DGS, GMB, ROs, yards, service suppliers

Core Functional Modules

- Yard Registration & Licensing
- **Inventory of Hazardous Materials Inventory**
- **RRC Certification Registry**
- SRP Submission & Approval
- **Inspection, Audit & ISO Compliance Tracking (ISO 9001, 14001, 30000, 45001)**
- Incident & Non-Conformity Reporting
- Worker Training & Competency Records
- GISIS / IMO Reporting Integration

60

The Ship Recycling Portal is an upcoming unified national digital platform under the Directorate General of Shipping, envisaged to enable **end-to-end digital governance of India's ship recycling ecosystem**. The portal is being developed to support implementation of the **Hong Kong International Convention for the Safe and Environmentally Sound**

Recycling of Ships (HKC) and the **Recycling of Ships Act, 2019**, ensuring a framework that is **transparent, accountable and aligned with global standards**.

The initiative is aimed at transforming ship recycling from a largely process-driven regulatory system into a **digitally integrated, real-time monitored ecosystem**, strengthening India's position as a global leader in sustainable ship recycling.

Objective and System Framework

The primary objective of the Ship Recycling Portal is to establish a **centralised digital platform that connects all stakeholders and processes** involved in ship recycling, including regulatory authorities, ship recycling yards, recognised organisations, service providers and international bodies.

The portal is designed to:

- Enable **real-time tracking of compliance and operational activities**
- Digitise approvals, certifications and inspections
- Create a **single source of truth for all ship recycling data**
- Facilitate **regulatory oversight and enforcement** by DGS and State Authorities

By integrating multiple functions into a unified system, the portal ensures **end-to-end visibility across the ship recycling lifecycle**, from vessel entry into yards to final dismantling and waste management.

Importance and Governance Impact

The Ship Recycling Portal addresses key governance challenges in the sector and delivers multiple systemic benefits.

Transparency

The platform enables digitally traceable processes for inspections, certifications and audits, ensuring that all activities are recorded and verifiable.

Accountability

Role-based access and time-stamped compliance trails ensure that responsibilities are clearly defined and actions are auditable, strengthening regulatory enforcement.

Real-time Monitoring

The system provides centralised oversight to DGS and State Maritime Authorities, enabling continuous monitoring of yard operations and compliance status.

Global Credibility

By maintaining auditable digital records aligned with international frameworks, the portal enhances India's credibility with IMO, foreign flag states and global shipowners.

Stakeholder Integration

The platform connects key stakeholders including DGS, Gujarat Maritime Board, Recognised Organisations, recycling yards and service providers, enabling coordinated operations and data sharing.

Core Functional Modules

The portal is structured around a set of core modules that cover all critical aspects of ship recycling governance:

Yard Registration and Licensing

Digital processing of registration and licensing of recycling yards, ensuring compliance with statutory and international requirements.

Inventory of Hazardous Materials (IHM) Management

Maintenance and tracking of hazardous material inventories for vessels, ensuring safe handling and disposal in accordance with regulatory norms.

Ready for Recycling Certificate (RRC) Registry

Centralised registry for issuance and validation of RRCs, ensuring that only compliant vessels enter the recycling process.

Ship Recycling Plan (SRP) Submission and Approval

Digital submission, review and approval of SRPs, enabling structured planning and monitoring of recycling activities.

Inspection, Audit and ISO Compliance Tracking

Comprehensive tracking of inspections and audits, including compliance with international standards such as ISO 9001, ISO 14001, ISO 30000 and ISO 45001.

Incident and Non-Conformity Reporting

Mechanism for reporting and monitoring incidents, deviations and non-compliance events, enabling timely corrective action.

Worker Training and Competency Records

Maintenance of workforce training data and competency records, ensuring adherence to safety and skill requirements.

GISIS / IMO Reporting Integration

Integration with global reporting systems such as IMO GISIS, enabling seamless international reporting and compliance.

Significance

The Ship Recycling Portal is a critical enabler for strengthening India's leadership in the global ship recycling industry. Its strategic importance includes:

- Ensuring **full compliance with HKC and national legislation**
- Enhancing **environmental and safety standards in recycling operations**
- Supporting **circular economy and green steel initiatives**
- Improving **ease of doing business for shipowners and recycling yards**
- Enabling **data-driven policy formulation and monitoring**
- Strengthening India's position as the **world's largest and most compliant ship recycling destination**

Humans as the Paramount Element in Maritime Industry



Humans as the Paramount Element in the Maritime Industry



Human element is of paramount importance in the maritime industry as human skills, judgement and welfare drive maritime safety.

Issues of Criminalisation

- Seafarers face legal threats or undue blame for operational incidents, often without due process.

Digital Records



Creation transparent digital records, ensuring fair accountability and reducing wrongful criminalisation

Certification and Assessment



Certification and Assessment and global data sharing detect and respond quickly to abandonment or criminalisation cases

Issues of Abandonment

- Seafarers stranded without pay, support, or repatriation, due to company financial/ legal issues

Digital Platforms



support real-time crew tracking, payroll management, and welfare monitoring, reducing the risks of abandonment

Communication and Grievance Platforms



Support for distress situations, with human-centered policies and tech tools for a just and humane maritime ecosystem

Technology acts as an enabler for protecting seafarer rights, supporting welfare, and strengthening accountability in line with the document's focus on human-centric maritime development

66

The maritime sector is undergoing an unprecedented transformation driven by decarbonisation, digitalisation, automation and evolving regulatory expectations. Despite these technological advancements, the **human element remains the most critical factor in ensuring safe, efficient and sustainable maritime operations.**

Ships may increasingly incorporate advanced digital systems, autonomous technologies and data-driven decision tools, but the **judgement, experience, professionalism and wellbeing of seafarers continue to form the foundation of maritime safety and operational reliability.** International maritime safety frameworks, including those under the International Maritime Organization (IMO), consistently recognise that **a large proportion of maritime incidents are influenced by human factors**, such as decision-making processes, operational fatigue, communication gaps or organisational pressures.

Therefore, strengthening the human dimension of maritime operations is not only a welfare issue but also a **core safety and governance priority for the global maritime industry.**

The slide highlights two major concerns that are increasingly being discussed in global maritime governance: **criminalisation of seafarers and abandonment of seafarers.**

Issues of Criminalisation of Seafarers

One of the most concerning developments in the maritime sector is the **increasing criminalisation of seafarers following maritime incidents.**

In certain cases involving accidents, pollution events or operational failures, seafarers have been subjected to **legal prosecution, detention or undue blame even before full investigation of the incident is completed**. This situation may arise when local legal frameworks hold ship personnel directly responsible for incidents that may actually result from systemic failures such as technical malfunction, inadequate safety management systems, regulatory ambiguity or operational pressures imposed by shipping companies.

Such circumstances can undermine the principles of **fair investigation and due process**, which are essential for maintaining confidence among maritime professionals. The fear of criminalisation may discourage open reporting of operational issues and could negatively impact the safety culture within the maritime industry.

To address this concern, there is increasing emphasis on the creation of **transparent digital documentation systems** that record operational activities, safety compliance and decision-making processes onboard ships. These digital records help ensure accountability while protecting seafarers from wrongful accusations by providing verifiable evidence of operational conduct.

The integration of **digital logs, automated monitoring systems and tamper-proof operational records** can help improve transparency and fairness in post-incident investigations. By establishing reliable data trails, such systems help regulators and investigators determine the actual causes of incidents and prevent unjust criminalisation of maritime personnel.

Issues of Abandonment of Seafarers

Another major human welfare issue in the maritime sector is the **abandonment of seafarers by shipowners or operators**.

Abandonment typically occurs when shipowners face financial distress, legal disputes or bankruptcy, leaving crew members stranded onboard vessels or in foreign ports without wages, repatriation arrangements or basic support. Such situations can place seafarers in extremely vulnerable circumstances, often without access to adequate food, medical care or legal assistance.

The issue of abandonment has received increasing international attention in recent years, with several global institutions highlighting the need for stronger monitoring and accountability mechanisms.

To address this challenge, digital solutions are emerging as important tools for **crew welfare monitoring and transparency in employment practices**. Digital platforms can support real-time crew tracking, contract monitoring, wage payment verification and welfare status updates.

Through integrated maritime digital platforms, authorities and shipping companies can monitor the **status of crew contracts, payroll compliance and repatriation arrangements**, thereby

reducing the risk of abandonment and enabling early intervention in cases where crew welfare may be compromised.

Role of Certification, Data Sharing and Regulatory Oversight

Effective protection of seafarer rights requires **robust certification and global information-sharing mechanisms** among maritime authorities, training institutions and international organisations.

Certification and assessment systems play a vital role in ensuring that seafarers possess the necessary competencies to operate safely in increasingly complex maritime environments. At the same time, global databases and regulatory networks allow authorities to **identify emerging issues such as abandonment cases or wrongful criminalisation** and coordinate responses across jurisdictions.

Data-sharing frameworks also allow faster identification of non-compliant operators, enabling regulators to intervene before situations escalate into serious human welfare concerns.

Importance of Communication and Grievance Mechanisms

An effective maritime ecosystem must also provide **accessible communication channels through which seafarers can raise concerns, report grievances and seek assistance in distress situations**.

Grievance redressal systems, helplines and digital communication platforms allow seafarers to report issues related to contractual disputes, safety concerns, harassment or welfare challenges. These platforms ensure that seafarers remain connected with regulatory authorities and welfare organisations even while operating in remote maritime environments.

By combining human-centred policies with technology-enabled communication tools, the maritime sector can create a more **transparent, accountable and supportive environment for maritime professionals**.

Technology as an Enabler of Human-Centric Maritime Governance

While technological transformation is rapidly reshaping maritime operations, technology should not be viewed as a replacement for human capabilities but rather as a **support system that strengthens human performance and welfare**.

Digital technologies such as automated recordkeeping systems, crew management platforms and integrated maritime databases can enhance accountability while protecting seafarer rights. When designed properly, these tools enable better monitoring of working conditions, fair treatment of personnel and improved operational transparency.

The adoption of such technologies reflects the growing global consensus that **future maritime development must remain human-centric**, ensuring that innovation in shipping and port operations is accompanied by stronger safeguards for seafarer wellbeing.

Human-Centric Maritime Development

Ultimately, the long-term sustainability of the maritime industry depends on maintaining a strong focus on the **human element**.

Seafarers remain the backbone of global maritime trade, responsible for operating vessels, managing complex systems and responding to emergencies in challenging environments. Protecting their rights, ensuring their welfare and supporting their professional development are essential for maintaining safety standards and operational reliability across the maritime sector.

A balanced approach that integrates **technological innovation with human-centred governance frameworks** will be essential for building a maritime ecosystem that is not only efficient and sustainable but also fair and resilient.

Formation of Bharat Maritime Insurance Pool



Formation of Bharat Maritime Insurance Pool



The sharp rise in war-risk insurance premiums due to the Hormuz crisis has significantly escalated logistics costs for Indian shipping and cargo. The union cabinet approved a dedicated maritime insurance pool.

Bharat Maritime Insurance Pool (BMI Pool)

Approved by Union Cabinet on 18 April 2026

Pool is backed by sovereign guarantee of

₹12,980 Cr.

Objectives to ensure:

- Continuity of maritime insurance coverages
- Reduction in additional war-risk premium burden on Indian shipowners and cargo owners
- Stability of shipping operations during geopolitical disruptions

The escalation of war-risk conditions in the Strait of Hormuz region has led to a **sharp increase in maritime war-risk insurance premiums**, significantly raising logistics and shipping costs for Indian shipowners and cargo interests.

In addition, tightening underwriting capacity in global insurance markets has created **uncertainty in availability of cover for high-risk routes**, impacting operational continuity and trade flows.

To address this, a **dedicated national maritime insurance mechanism** has been instituted.

Cabinet Approval

- The **Bharat Maritime Insurance Pool (BMI Pool)** has been approved by the **Union Cabinet on 18 April 2026**
- Designed as a **structured national response to elevated war-risk pricing and constrained insurance availability**
- Focused on supporting **India-linked maritime trade in high-risk corridors**

Financial Backing / Risk Support

- Backed by a **sovereign guarantee of ₹12,980 crore**
- Enhances:
 - **Risk-bearing capacity of the pool**
 - **Credibility and confidence for participating insurers**
- Enables continued underwriting **even under elevated conflict-related risk scenarios**

Objectives of BMI Pool

Continuity of Insurance Coverage

- Ensures uninterrupted availability of **war-risk insurance for Indian vessels and cargo**
- Addresses gaps when commercial markets tighten or withdraw capacity

Reduction in Premium Burden

- Mitigates **excessive war-risk premium escalation**
- Helps contain **logistics and freight cost inflation**

Stability of Maritime Operations

- Provides **predictability in risk pricing and coverage**
- Supports uninterrupted shipping operations during geopolitical disruptions

Expected Impact / Significance

Trade Facilitation

- Ensures continuity of **India-bound and India-origin cargo flows**
- Reduces disruption in critical supply chains

Cost Moderation

- Sovereign-backed pooling helps:
 - Smoothen extreme premium spikes
 - Reduce volatility in insurance costs

Operational Confidence

- Improves decision-making for:
 - Routing
 - Scheduling
 - Cargo planning
- Especially in high-risk maritime zones

National Resilience

- Establishes a **long-term institutional mechanism**
- Strengthens India's ability to manage **maritime risk exposure during geopolitical crises**

Strategic Assessment

The BMI Pool represents a **proactive policy intervention to stabilise maritime insurance markets**, ensuring that geopolitical disruptions do not translate into disproportionate trade and logistics shocks for India.
