Good morning respected dignitaries, distinguished panel members, industry leaders, members of the Institute of Marine Engineers, and colleagues from across the maritime fraternity.
It is indeed a privilege to be here at COMARSEM 2026 in Kochi, a city that has historically stood at the crossroads of maritime trade and continues to remain one of India's most vibrant maritime hubs.

COMARSEM has, over the years, evolved into more than just a technical seminar. It has become a platform where policy, industry, academia and technology converge to exchange ideas and shape the future direction of the maritime sector. The diversity of participants present here today reflects the growing recognition that maritime progress is not driven by a single institution, but by collaborative effort and shared responsibility.

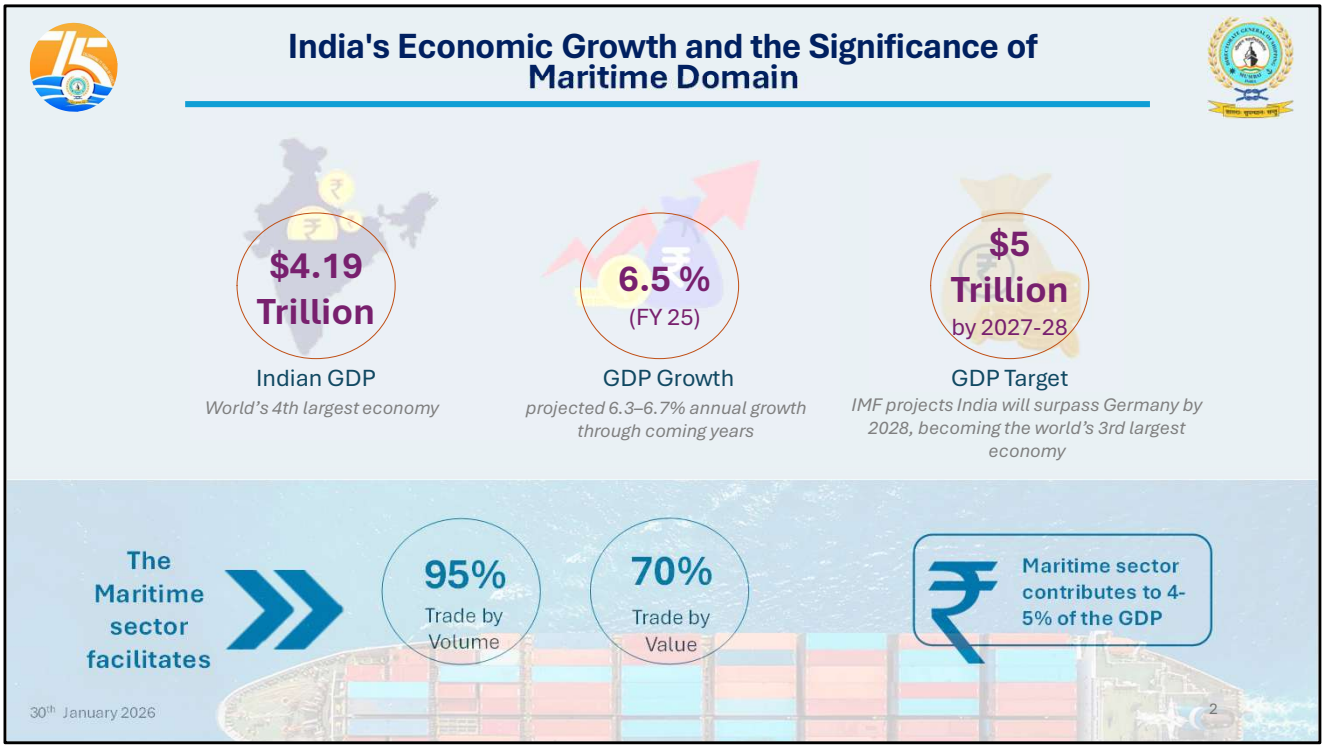
The maritime domain today is undergoing a period of significant transition — driven by global energy shifts, environmental commitments, technological disruption and changing trade patterns. In such a context, forums like COMARSEM play a critical role in enabling informed dialogue, fostering innovation and strengthening partnerships between regulators, industry stakeholders and knowledge institutions.

I would also like to acknowledge the organisers, the Institute of Marine Engineers (India), Kochi Branch, for consistently bringing together such a wide spectrum of expertise and for providing a meaningful platform for constructive engagement. The presence of technical

experts, shipbuilders, classification societies, port authorities and young professionals here today is a strong indicator of the sector's collective commitment to progress.

As we move forward through today's discussions, the objective is not only to deliberate on challenges, but to identify actionable pathways — pathways that enhance safety, sustainability, competitiveness and resilience of Indian shipping.

And with that context, let me take you through the broader perspective that frames our approach to the maritime sector today.

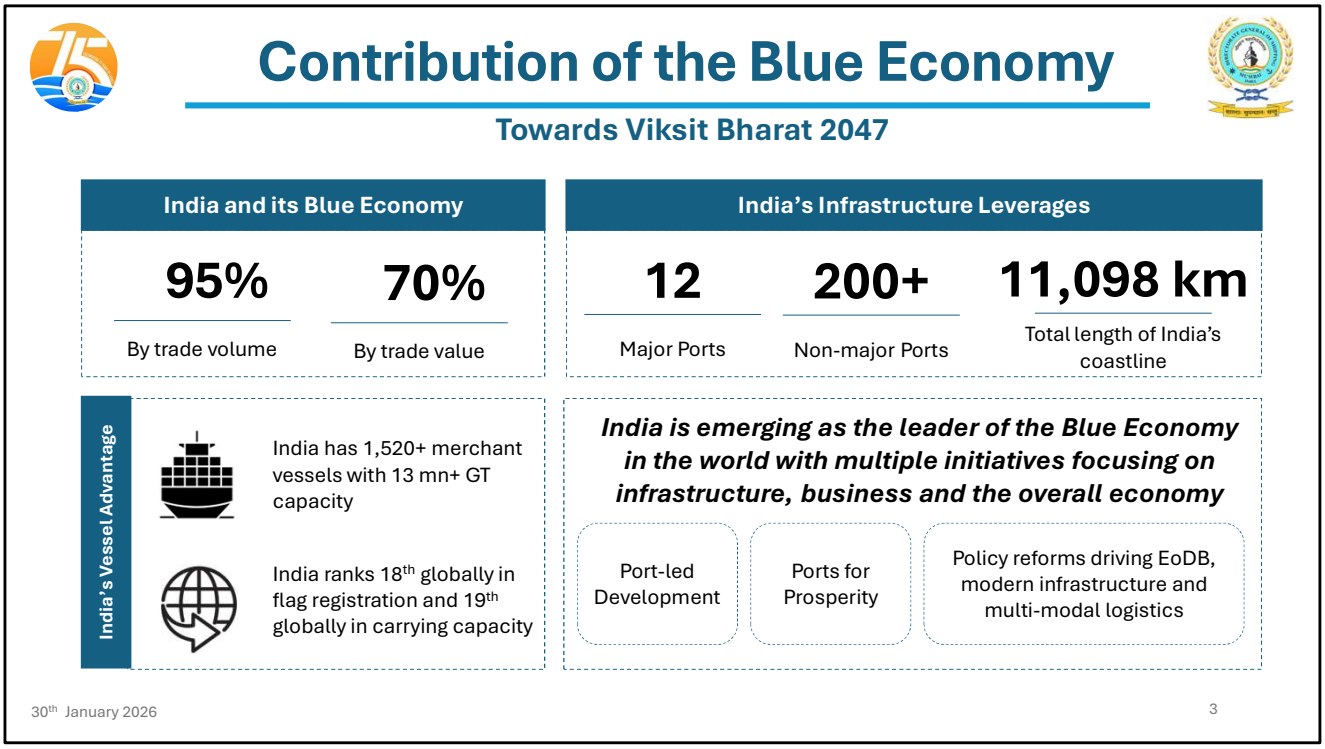


India's Economic Growth and the Significance of Maritime Domain

India today stands as the **world's fourth largest economy** with a GDP of **USD 4.19 trillion**, recording a growth rate of **6.5% in FY 2025**. With a projected growth trajectory of **6.3 - 6.7% annually**, the nation is firmly on course to achieve the **USD 5 trillion milestone by 2027 - 28**. The International Monetary Fund projects that by 2028, India will surpass Germany to emerge as the **world's third largest economy**, underscoring its growing global economic stature.

The maritime sector has been a critical enabler of this economic rise, **facilitating nearly 95% of India's trade by volume and 70% by value**. Beyond trade, the sector directly contributes **4–5% to the national GDP**, making it not only a backbone of India's commerce but also a strategic lever for sustained growth.

The synergy between economic expansion and maritime activity highlights a fundamental truth, India's economic ambitions are deeply intertwined with its maritime strength. As the country advances towards its vision for **Viksit Bharat @ 2047**, the maritime domain will continue to serve as the lifeline of trade, connectivity and strategic resilience.



Contribution of the Blue Economy

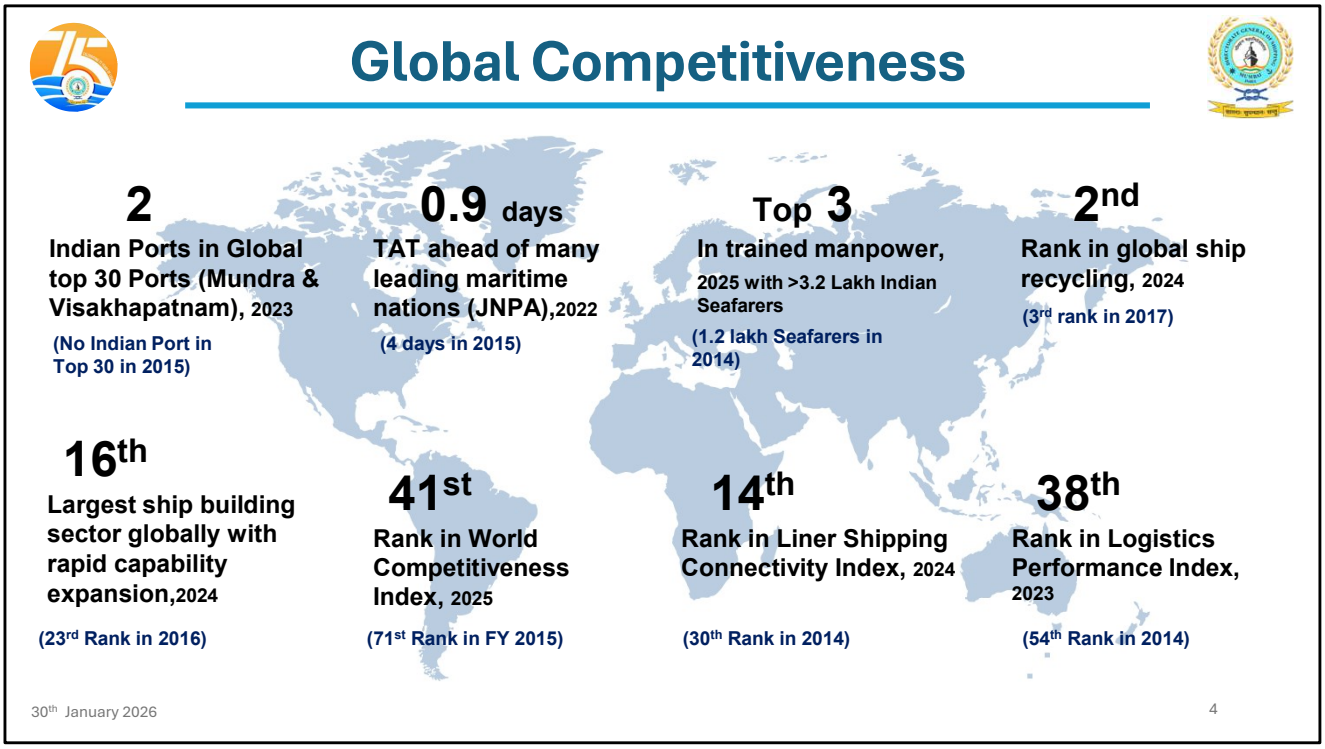
The Blue Economy lies at the heart of India's economic and strategic rise, accounting for **95% of trade by volume and 70% by value**. With **12 major ports, 200+ non-major ports, and an extensive coastline of 11,098 km**, India possesses one of the largest maritime infrastructures in the world, giving it a natural advantage in connecting markets and enabling prosperity.

India's fleet strength has also grown steadily, with **1,520+ merchant vessels aggregating over 13 million GT capacity**. On the global stage, India now ranks **18th in flag registration and 19th in carrying capacity**, underscoring its expanding role in global shipping while contributing significantly to supply chain resilience.

The Government has positioned the Blue Economy as a **pillar of Viksit Bharat 2047**, with a strong emphasis on **port-led development, multimodal logistics, and ease of doing business reforms**. Initiatives under Sagarmala, Harit Sagar, and Maritime India Vision 2030 have transformed ports into hubs of efficiency, green practices, and integrated logistics.

Thus, India's Blue Economy is not just about scale, but about direction, moving towards sustainability, competitiveness, and strategic influence. As the world transitions towards cleaner and more resilient maritime operations, India's leadership in the Blue Economy offers

a model of how infrastructure, business, and policy can be aligned to deliver long-term growth and global impact.



Global Competitiveness

India's maritime sector has undergone a significant transformation in global rankings, reflecting improvements in efficiency, manpower, recycling, and overall competitiveness. From ports and logistics to shipbuilding and seafarer supply, India today stands as a pivotal player in global maritime trade.

Ports in Global Top 30: In 2015, no Indian port featured among the world's leading container hubs. By 2023, **Mundra and Visakhapatnam** have both entered the **global top 30 ports**, a testament to capacity expansion, operational efficiency, and international connectivity.

Turnaround Time (TAT): Vessel turnaround time at **JNPA improved from 4 days in 2015 to just 0.9 days in 2022**, placing India ahead of many advanced maritime nations and showcasing the results of digitalisation and port modernisation.

Trained Manpower: With more than **3.2 lakh Indian seafarers in 2025**, up from 1.2 lakh in 2014, India ranks in the **global top 3 for maritime manpower**. This includes a growing strength of women seafarers, reinforcing India's role as the **second-largest supplier of trained seafarers worldwide**.

Global Ship Recycling: India has strengthened its global leadership in ship recycling, moving

Global Ship Recycling: India has strengthened its global leadership in ship recycling, moving from **3rd rank in 2017 to 2nd rank in 2024**. With over 115 Hong Kong Convention–compliant yards at Alang, India's recycling practices now directly contribute to safe and sustainable global tonnage disposal.

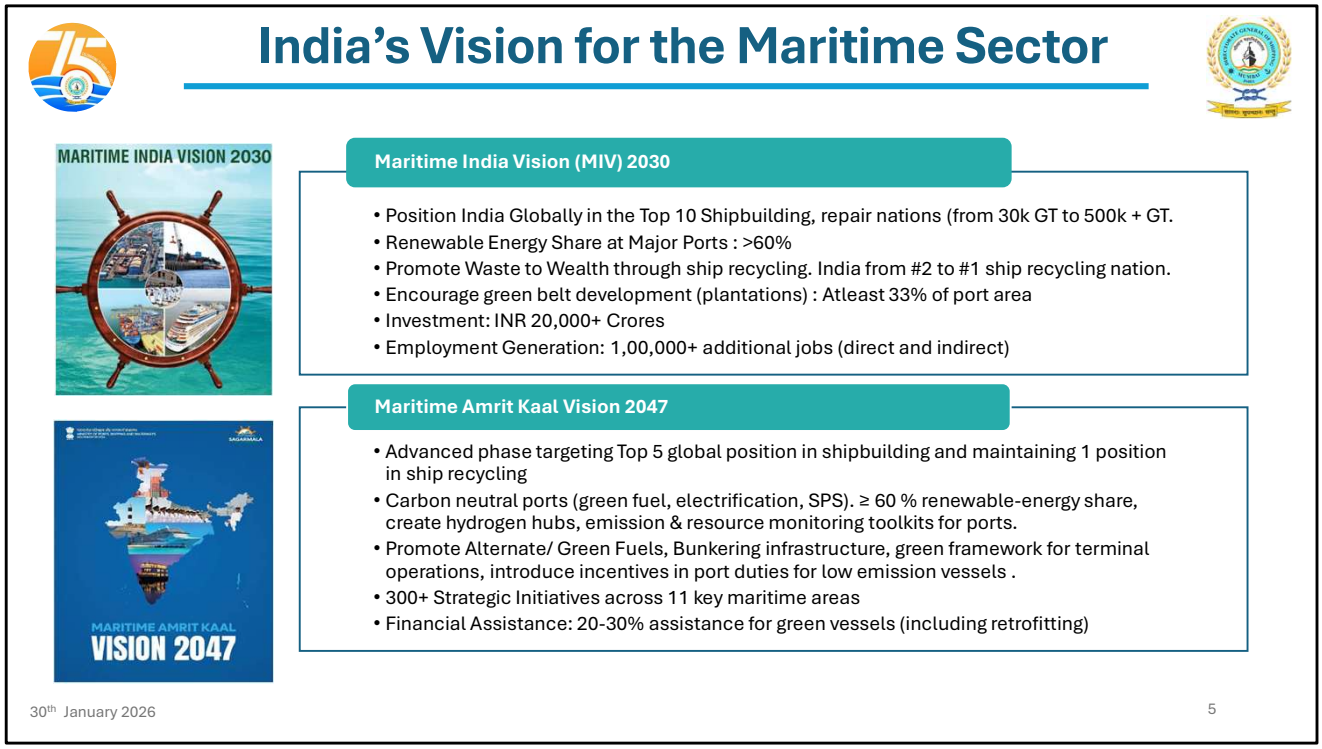
Shipbuilding Sector: India's shipbuilding industry has advanced from **23rd globally in 2016 to 16th in 2024**, backed by financing reforms, capacity expansion, and the recent ₹69,725 crore package aimed at building a globally competitive ecosystem.

World Competitiveness Index: India's steady economic reforms and maritime sector efficiencies have elevated its position from **71st in FY 2015 to 41st in 2025**, signalling stronger global competitiveness across infrastructure, logistics, and trade facilitation.

Liner Shipping Connectivity Index: India's connectivity to global trade routes has improved dramatically, climbing from **30th in 2014 to 14th in 2024**, driven by expanded port capacity, greater container handling efficiency, and integration into global liner networks.

Logistics Performance Index: On the **World Bank LPI**, India has risen from **54th in 2014 to 38th in 2023**, particularly excelling in vessel turnaround and port efficiency. This improvement enhances India's role in global supply chains and strengthens its credibility as a logistics hub.

Taken together, these eight indicators highlight a decade of **policy-driven transformation and operational improvements**. India has shifted from being a lagging participant to an emerging global maritime leader — building resilience, strengthening competitiveness, and aligning with its vision of becoming a top maritime nation by **Viksit Bharat 2047**.



India's Vision for the Maritime Sector

Focus: Decarbonization & Sustainability – MIV 2030 and MAKV 2047

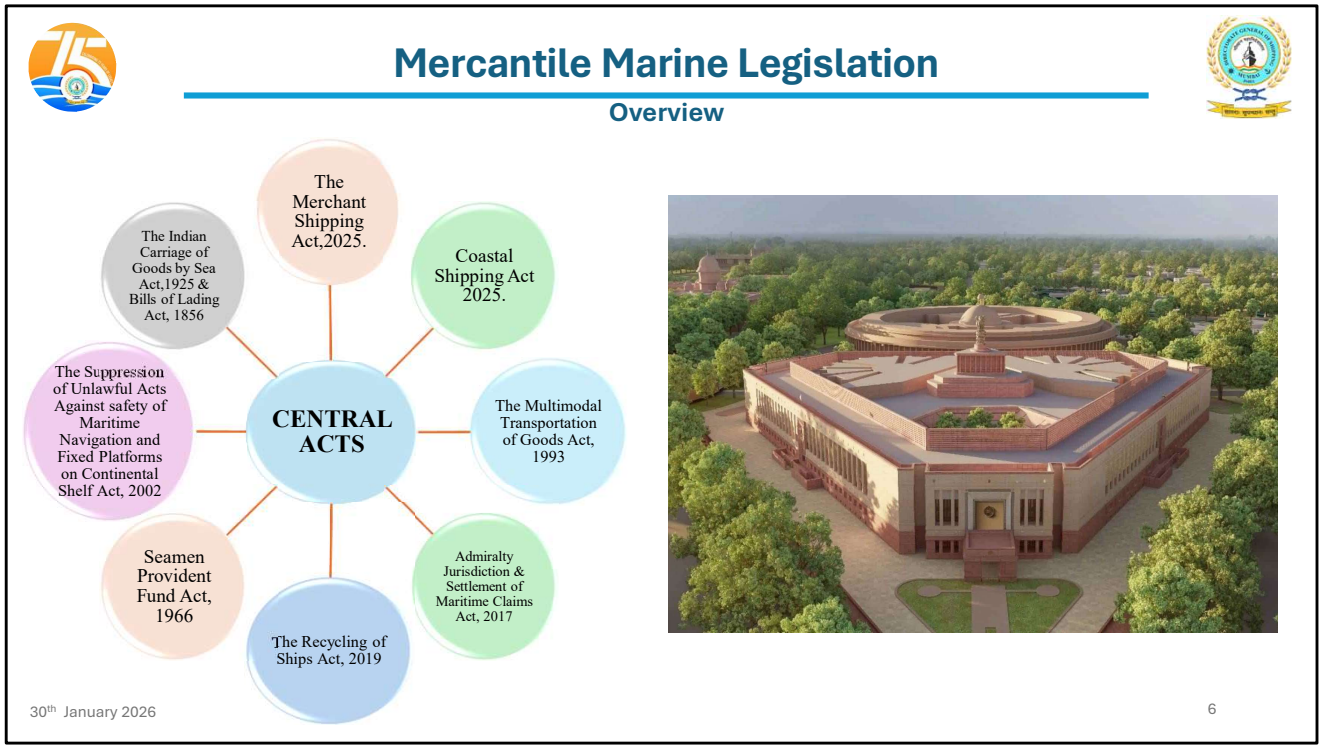
India's maritime growth strategy is deeply anchored in sustainability and green transition. Both the *Maritime India Vision 2030* and *Maritime Amrit Kaal Vision 2047* outline clear, actionable pathways to decarbonize the sector.

Under **Maritime India Vision 2030**, the focus is on immediate-term transformation, positioning India among the world's top ten shipbuilding nations while driving sustainability across ports and shipping. The plan calls for achieving **over 60% renewable energy share at Major Ports**, promoting **Waste-to-Wealth** through ship recycling, and **green belt development covering at least 33% of port areas**. These measures are aimed at reducing emissions, improving air quality, and making ports self-reliant in clean power.

Moving forward, **Maritime Amrit Kaal Vision 2047** builds on this foundation to deliver **carbon-neutral ports** powered by **green fuels, electrification, and shore power supply**. It envisions the creation of **Hydrogen hubs**, **emission and resource monitoring toolkits**, and strong **incentive mechanisms** such as **port dues discounts for low-emission vessels**.

Both MIV & MAKV, emphasizes the integration of **alternate fuels**, including **LNG, biofuels, hydrogen, ammonia** and plan to extend **20–30% financial assistance for green vessels and**

retrofitting initiatives. Together, these steps ensure that India's maritime sector transitions towards a low-carbon, resilient, and future-ready ecosystem , aligned with IMO's Net Zero 2050 ambition and India's national climate commitments.



Mercantile Marine Legislation

At the outset, it is important to recognise that the strength of any maritime nation rests not only on its ports, ships or trade volumes, but equally on the robustness of its legislative framework.
India's maritime regulatory ecosystem has evolved over decades, responding to technological advancements, international conventions and the changing nature of global trade.

The slide before you presents an overview of the key Central Acts that collectively shape the legal and operational foundation of Indian shipping. These legislations are not isolated instruments; rather, they function as an interconnected framework that governs safety, commerce, dispute resolution, crew welfare, environmental compliance and emerging maritime domains.

At the core is the Merchant Shipping Act, which serves as the principal statute governing registration, safety standards, certification and overall regulation of Indian vessels. Complementing this are specialised legislations such as the Coastal Shipping Act, which strengthens domestic maritime trade, and the Multimodal Transportation of Goods Act, which integrates maritime transport with broader logistics networks.

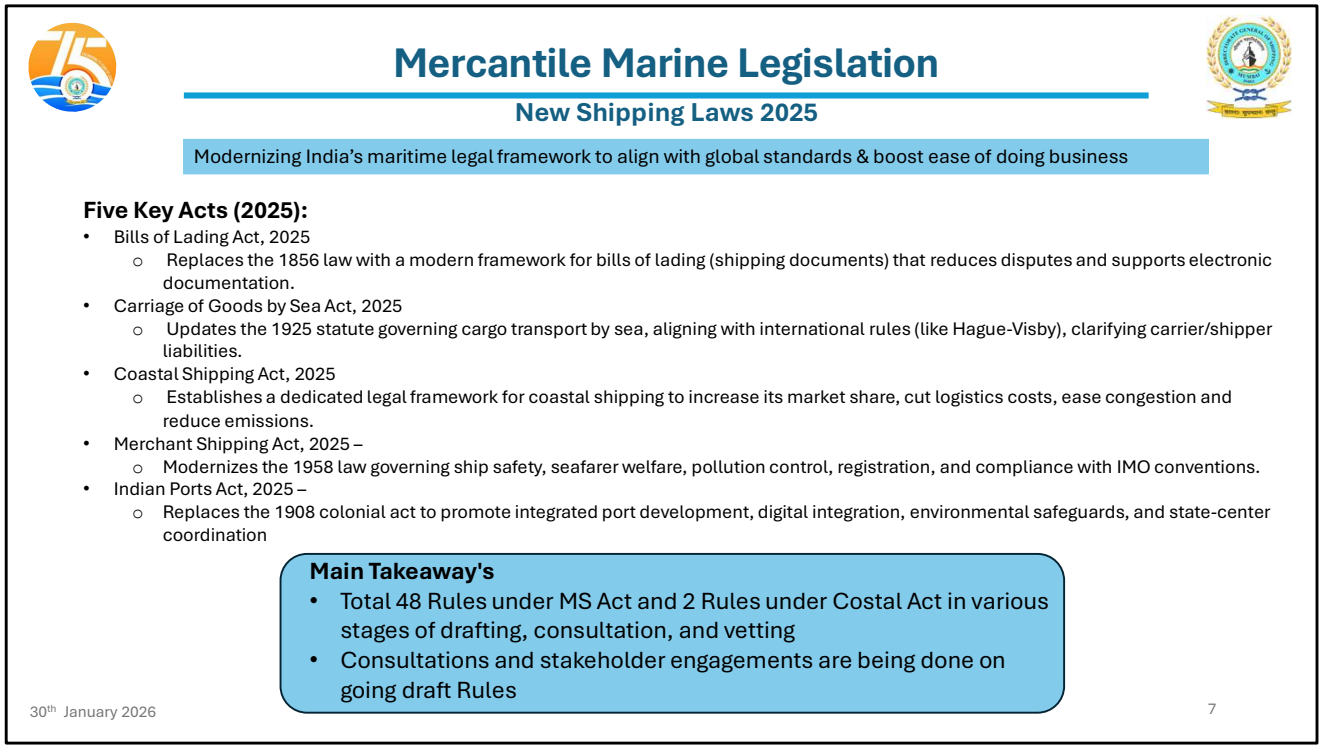
Equally significant are the Acts that safeguard maritime workers and industry stakeholders —

including the Seamen Provident Fund Act, and the Admiralty Jurisdiction and Settlement of Maritime Claims Act, which provides legal clarity in matters of maritime disputes and claims. The Recycling of Ships Act reflects India's commitment to environmentally sound and internationally compliant ship recycling practices, positioning the country as a responsible global leader in this domain.

Additionally, legacy legislations such as the Carriage of Goods by Sea Act and Bills of Lading Act continue to underpin contractual and commercial certainty, while specialised safety legislations address unlawful acts against maritime navigation and offshore platforms.

What this comprehensive legislative architecture enables is predictability, transparency and investor confidence. It provides the maritime sector with a stable legal environment that encourages innovation while ensuring safety, environmental responsibility and global alignment.

And this strong legislative base is precisely what allows India to not only regulate its maritime sector effectively, but also to steer future reforms with confidence and credibility.



Mercantile Marine Legislation: New Shipping Laws 2025

Building on the broader legislative framework that we just discussed, India is now entering a significant phase of legal modernization in the maritime sector.

The New Shipping Laws of 2025 represent a conscious effort to align our regulatory architecture with contemporary global standards while simultaneously improving ease of doing business and operational efficiency.

What we are witnessing is not merely an amendment exercise, but a comprehensive restructuring of core maritime statutes that have governed the sector for decades. These reforms respond to evolving trade practices, digital transformation, environmental commitments and the increasing integration of maritime logistics with global supply chains.

The Bills of Lading Act and the updated Carriage of Goods by Sea framework are particularly important from a commercial standpoint. They modernize legacy provisions, introduce clarity in carrier and shipper liabilities and support electronic documentation — which is increasingly becoming the norm in global shipping transactions. This reduces disputes, improves turnaround time and enhances legal certainty for international trade.

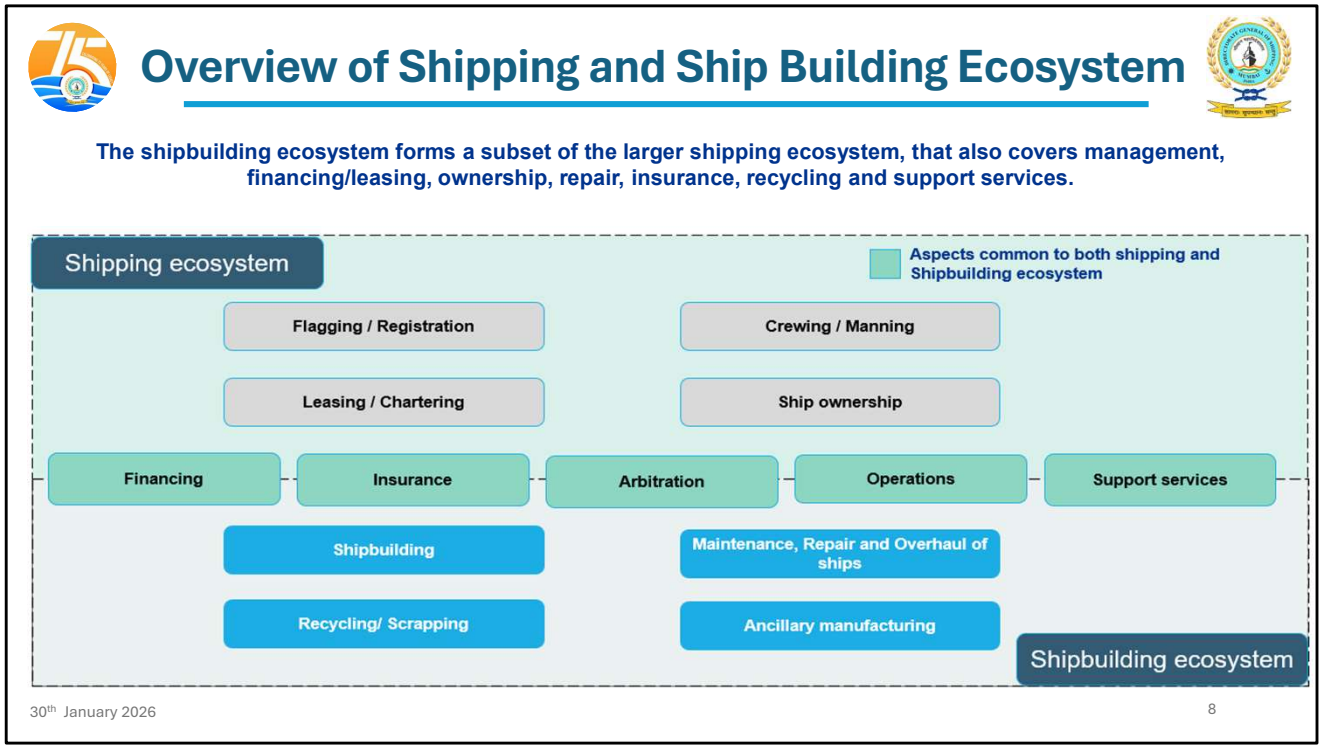
The Coastal Shipping Act and the revised Merchant Shipping Act expand the scope from

commerce to safety, seafarer welfare and pollution control. They recognize that maritime growth must be balanced with responsibility, compliance and protection of human and environmental interests. At the same time, the Indian Ports Act signals a shift toward integrated and digitally enabled port governance, strengthening coordination between central and state authorities.

Collectively, these five key legislations create a legal ecosystem that is more transparent, technology-enabled and internationally compatible. They enhance investor confidence, support innovation and position India to respond proactively to future maritime challenges rather than reactively adjusting to them.

In essence, the direction of these reforms is very clear — stronger alignment with international norms, smoother trade facilitation, greater digital adoption and reinforced safety and environmental governance.

And this legal modernization provides the necessary foundation upon which policy initiatives and sectoral growth strategies can effectively be built.



Overview of Shipping and Shipbuilding Ecosystem

Before we move into specific policy or regulatory aspects, it is useful to step back and look at the broader ecosystem that sustains maritime activity.
Shipping and shipbuilding are often viewed as separate domains, but in reality, they are deeply interconnected parts of a much larger value chain.

The shipping ecosystem extends far beyond the movement of vessels at sea. It includes registration and flagging, crewing and manning, leasing and chartering, ownership structures, insurance, financing, arbitration mechanisms and a wide range of operational and support services. These elements collectively determine how efficiently and competitively maritime trade functions.

Within this larger framework sits the shipbuilding ecosystem, which is not merely about constructing vessels. It encompasses maintenance, repair and overhaul, ancillary manufacturing, recycling and scrapping, as well as technology integration and design innovation. Shipbuilding therefore acts both as an industrial base and as a lifecycle support system for the shipping sector.

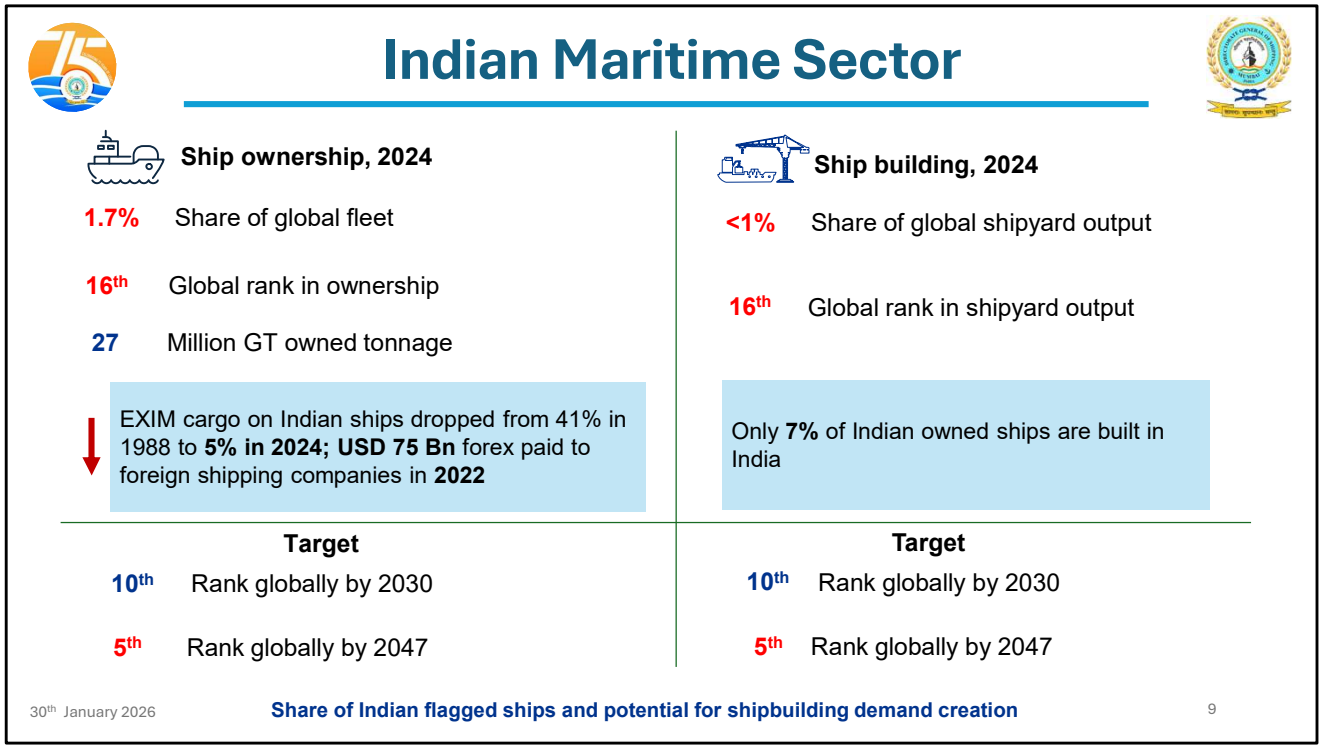
What is important to recognise is the strong overlap between the two ecosystems. Financing, insurance, arbitration, operations and support services serve as common pillars, linking ship

creation, operation and end-of-life management into one continuous cycle. This interdependence is what enables resilience and sustainability within the maritime domain.

From a policy perspective, this integrated view is essential. Decisions taken in shipbuilding impact operational efficiency, environmental performance and cost structures in shipping. Similarly, shipping demand influences industrial investment, employment generation and technological advancement in shipyards and allied industries.

In essence, when we speak of strengthening maritime capacity, we are not referring to isolated improvements, but to reinforcing this entire ecosystem — from design and construction to operation, maintenance and eventual recycling.

And it is this holistic ecosystem perspective that guides many of the policy and regulatory initiatives we will discuss next.



Indian Maritime Sector

This slide provides a snapshot of where India currently stands in the global maritime landscape, both in terms of ship ownership and shipbuilding capacity.
It highlights not only our existing strengths, but also the gaps and opportunities that shape the policy direction going forward.

On the ship ownership side, India accounts for roughly a small share of the global fleet, placing us in the mid-teens in terms of global ranking. While this indicates a visible presence, it also signals that our share does not yet reflect the scale of India's trade volumes or economic stature. The owned tonnage is substantial in absolute terms, yet comparatively modest when viewed against leading maritime nations.

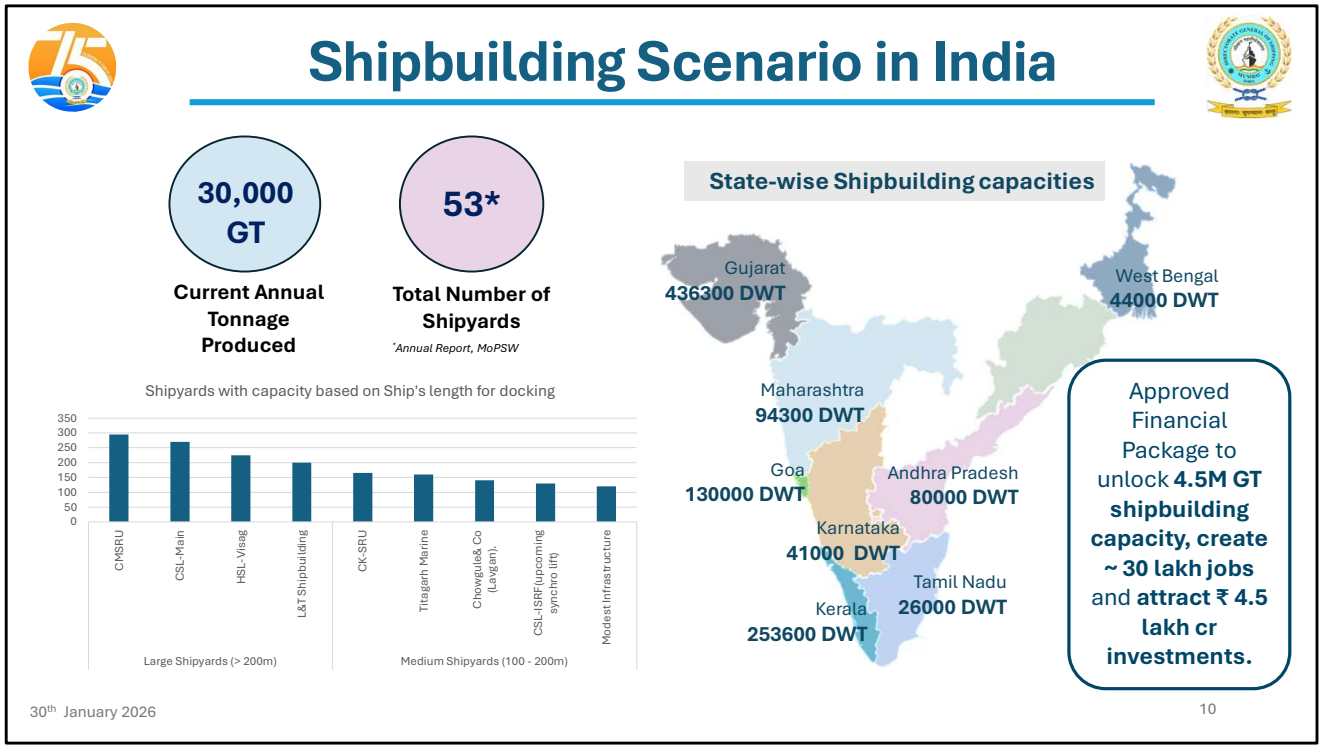
A particularly important trend to note is the decline in the proportion of India's export-import cargo being carried on Indian-flagged vessels over the decades. This has direct economic implications, including significant outflow of foreign exchange towards foreign shipping lines. It underscores the strategic need to strengthen domestic fleet capacity and encourage Indian ownership and flagging.

On the shipbuilding front, the situation is even more revealing. India's contribution to global shipyard output remains limited, and only a small fraction of Indian-owned ships are currently

constructed within the country. This gap represents both a challenge and a major opportunity — because increased domestic shipbuilding not only supports shipping capacity but also stimulates industrial growth, employment and technology development.

The targets articulated here are therefore not merely aspirational rankings. Moving into the top ten by the end of the decade and further upward by the centenary horizon reflects a structured ambition to enhance competitiveness, self-reliance and global positioning. These goals are closely linked to policy initiatives in financing, infrastructure, skill development and regulatory facilitation.

In essence, this slide captures the dual narrative of the Indian maritime sector — a growing presence with immense potential, and a clear roadmap for scaling both ownership and shipbuilding capacity in a coordinated and sustainable manner.



Shipbuilding Scenario in India

India's shipbuilding sector is at a **nascent but strategically critical stage**. Despite having a long coastline and 53 shipyards (as per MoPSW Annual Report), the country currently produces only **30,000 GT annually**, which is a small fraction compared to global leaders like China, South Korea, and Japan.

State-wise Capacities

Gujarat leads the sector with **436,300 DWT**, thanks to strong industrial clusters and its coastal industrial base.

Kerala (253,600 DWT) and **Goa (130,000 DWT)** follow, with a mix of public and private yards catering to both defence and commercial orders.

Other contributors include **Maharashtra (94,300 DWT)**, **Andhra Pradesh (80,000 DWT)**, **West Bengal (44,000 DWT)**, **Karnataka (41,000 DWT)**, and **Tamil Nadu (26,000 DWT)**. This distribution highlights both the **geographic spread of capacity** and the under-utilisation of existing infrastructure.

Yard Capacities & Capabilities

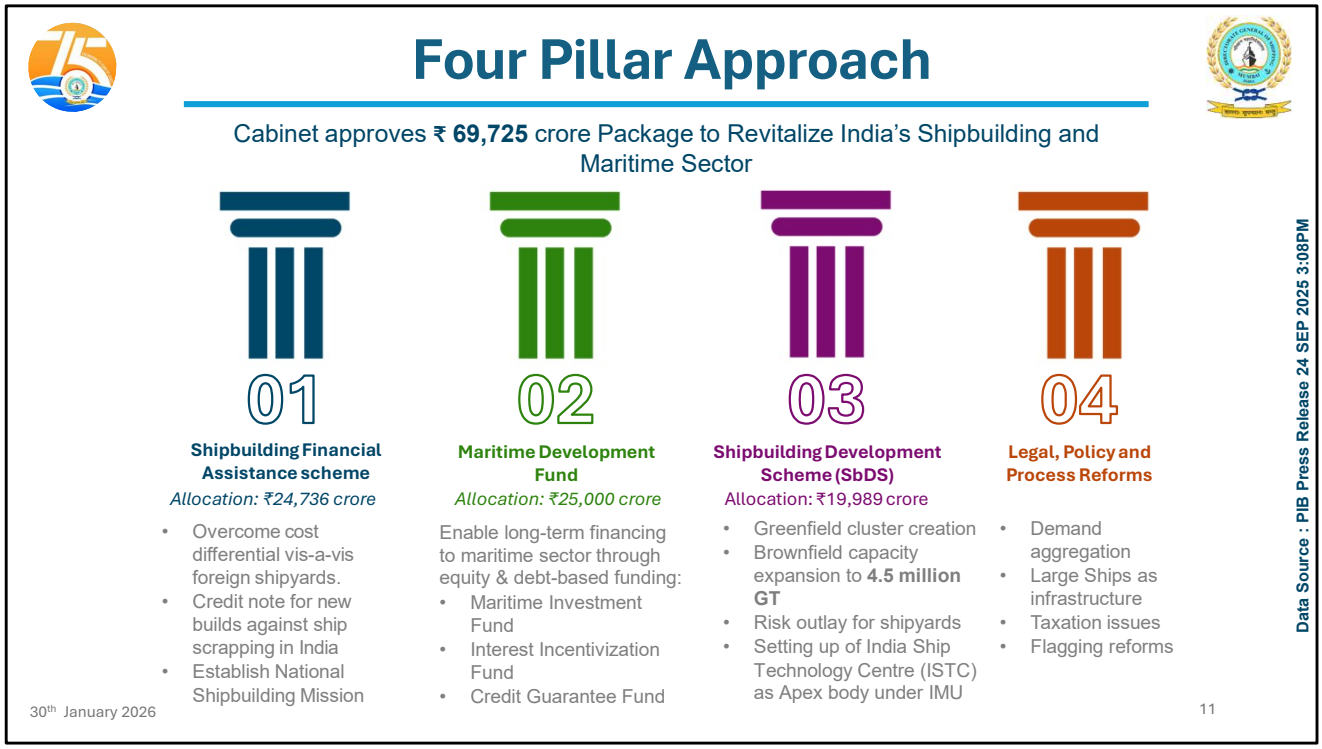
India has a handful of large shipyards capable of handling vessels >200m in length — such as **Cochin Shipyard Limited (CSL), Hindustan Shipyard Ltd. (HSL), L&T Shipbuilding, and**

Central/State-run units like CMSRU and CKSRU.
Medium shipyards like **Timblo, Chowgule, Titagarh Marine, CSL's smaller yards** and others handle repair, retrofits, and mid-sized vessels.
However, compared to international peers, India suffers from **low productivity, high financing costs, and limited scale economies**.

Policy & Investment Push
The Government has approved a **financial package to unlock 4.5 million GT of shipbuilding capacity**, with the potential to:
Generate **~30 lakh direct and indirect jobs**,
Attract **₹4.5 lakh crore in investments**,
Enable India to become a **competitive global player** while reducing dependence on foreign-built ships.

Strategic Importance
Shipbuilding is not just an industrial sector, it is a **strategic enabler**:
Strengthens national security by ensuring **domestic capacity for defence and merchant fleets**.
Boosts **exports of vessels and green technology** in the long run.
Creates linkages with allied industries — **steel, engineering, design, marine electronics**, and services.
Positions India to capture a share of the **$70 billion global shipbuilding market**.

India's shipbuilding potential is large but untapped. With policy support, financing reforms, and capacity unlocking, the sector can shift from a marginal 30,000 GT output today to millions of GT tomorrow, creating jobs, saving forex, and boosting strategic autonomy.



Four Pillar Approach

The Government of India has approved a **₹69,725 crore revitalization package** for the shipbuilding and maritime sector. This approach rests on **four strategic pillars**, each addressing a critical gap in India's maritime ecosystem- finance, infrastructure, capacity building, and regulatory reform.

Pillar 1: Shipbuilding Financial Assistance Scheme (₹24,736 crore)
Designed to **bridge the cost differential** between Indian and foreign shipyards, ensuring domestic yards remain competitive.
Provides **credit notes** for new shipbuilding linked to ship recycling in India, integrating sustainability with incentives.
Includes the establishment of a **National Shipbuilding Mission** to provide long-term policy continuity.

Pillar 2: Maritime Development Fund (₹25,000 crore)
Aims to enable **long-term, low-cost financing** for the maritime sector via equity and debt funding.
Includes sub-funds such as:

Maritime Investment Fund – to channel capital into greenfield projects.

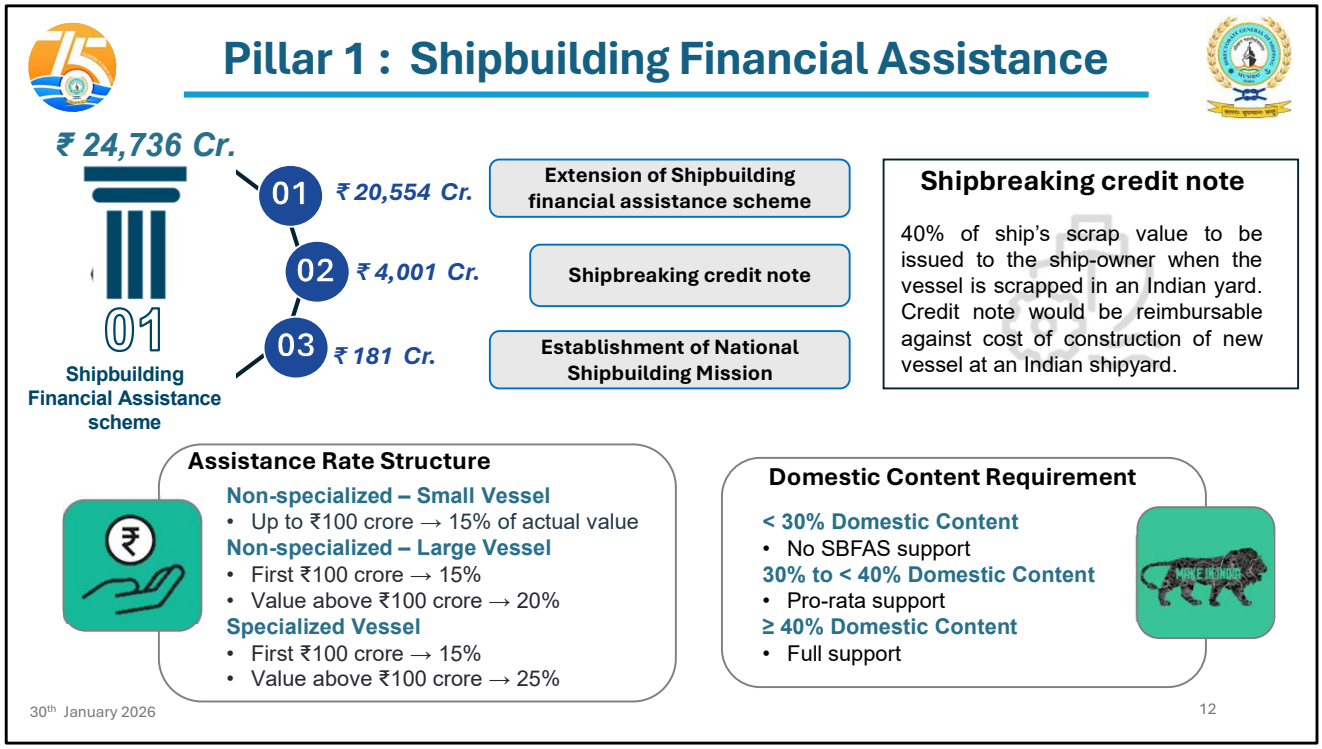
Interest Incentivization Fund – to reduce borrowing costs for shipyards.
Credit Guarantee Fund – to reduce lender risk and unlock financing for vessel owners and builders.

Pillar 3: Shipbuilding Development Scheme (SbDS) (₹19,989 crore)
Focused on **capacity expansion and technology development**:

Establishment of **greenfield shipbuilding clusters**.
Brownfield expansion to raise capacity to **4.5 million GT**.
Risk outlay provision to protect shipyards from financial exposure.
Setting up the **India Ship Technology Centre (ISTC)** under IMU as an apex R&D and training body for advanced shipbuilding technologies.

Pillar 4: Legal, Policy, and Process Reforms
Demand aggregation across PSU, defence, and private shipping to secure consistent order books for Indian shipyards.
Recognition of **large ships as infrastructure**, unlocking easier access to long-term credit and incentives.
Addressing **taxation anomalies** and simplifying GST/customs regimes for shipbuilders.
Flagging reforms to incentivize Indian ownership of ships and reduce outflow of foreign exchange.

The four-pillar approach provides a **holistic framework** for India's shipbuilding revival. With financing support, capacity expansion, institutional R&D, and regulatory reforms, the package seeks to transform India into a **globally competitive shipbuilding hub**, aligned with Maritime India Vision 2030 and Maritime Amrit Kaal Vision 2047.



NGSP Pillar 1: Shipbuilding Financial Assistance

This pillar focuses on strengthening India's shipbuilding capacity through targeted financial support and incentive mechanisms.
The objective here is not only to increase the number of vessels built domestically, but to create a competitive and self-sustaining shipbuilding ecosystem that can serve both national and international demand.

A significant allocation has been earmarked under the Shipbuilding Financial Assistance framework, which reflects the government's recognition that shipbuilding is a capital-intensive industry requiring long-term policy stability and fiscal backing. The approach combines direct financial assistance, credit incentives and institutional mechanisms to encourage both private and public investment in Indian shipyards.

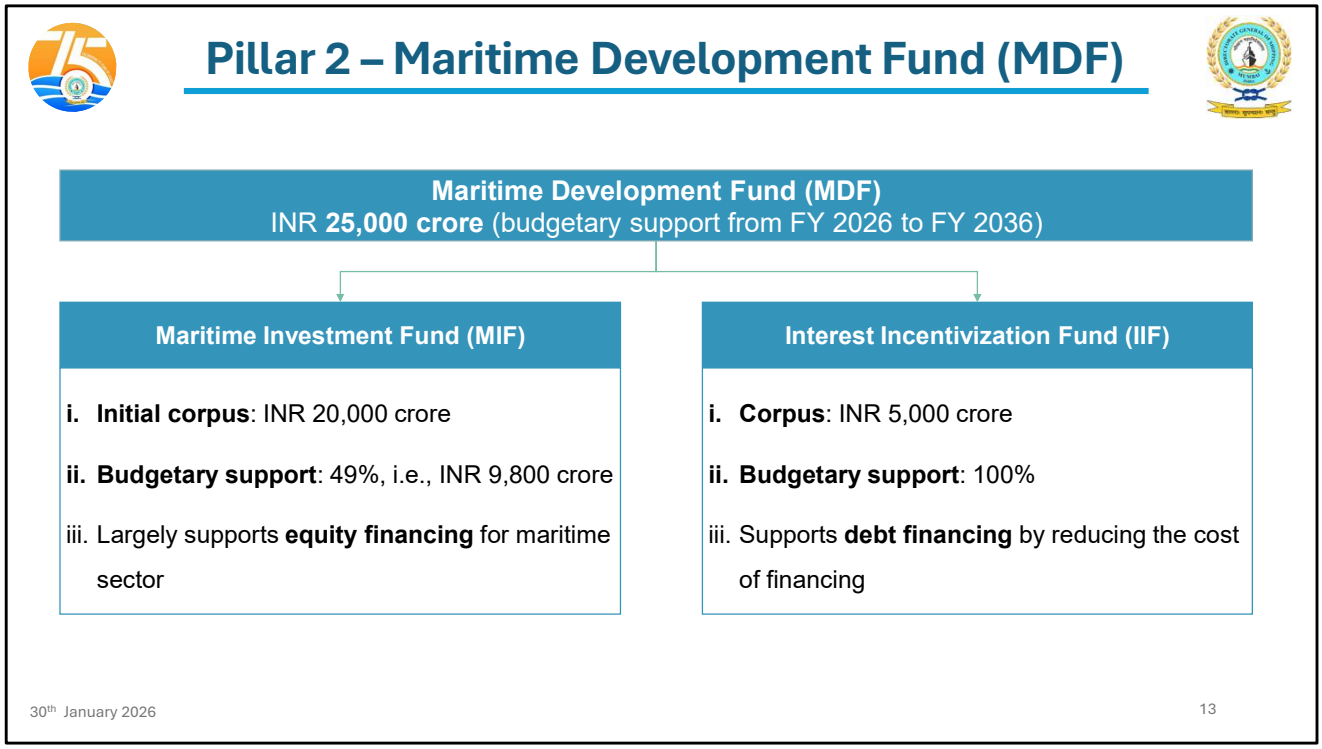
One of the key components is the extension of the existing financial assistance scheme, ensuring continuity and predictability for shipbuilders. This is complemented by the shipbreaking credit note mechanism, which creates a circular value chain — incentivising vessel scrapping in Indian yards while simultaneously encouraging the construction of new vessels domestically. By allowing a portion of the scrap value to be reimbursed against new vessel construction, the policy effectively links recycling with fresh industrial demand.

The establishment of a National Shipbuilding Mission adds an institutional dimension to this pillar. It provides a coordinated platform for policy alignment, technology adoption and industry-academia collaboration, thereby ensuring that financial incentives are supported by structural reforms and skill development.

The assistance rate structure has been designed to accommodate different vessel categories and sizes, ensuring that both small and large shipyards benefit. Specialised vessels receive higher incentives, recognising their technological complexity and higher value addition potential. This differentiated approach prevents a one-size-fits-all model and instead supports sectoral diversity.

Another critical aspect is the domestic content requirement. The policy encourages higher local value addition by linking the extent of financial support to the percentage of domestic content in ship construction. This not only boosts indigenous manufacturing and ancillary industries, but also aligns with broader self-reliance and "Make in India" objectives.

Overall, this pillar serves as the economic foundation for expanding India's shipbuilding footprint. It reduces entry barriers, enhances competitiveness and creates a multiplier effect across employment, technology and industrial growth — thereby positioning shipbuilding as a strategic national industry rather than a purely commercial activity.



NGSP Pillar 2: Maritime Development Fund (MDF)

The second pillar addresses one of the most critical constraints in the maritime sector — access to affordable and adequate financing.
While policy intent and regulatory reforms are essential, large-scale maritime growth ultimately depends on the availability of long-term capital at competitive rates. The Maritime Development Fund is designed precisely to bridge this gap.

The Fund represents a substantial multi-year financial commitment aimed at strengthening both investment and credit access across the maritime value chain. Its structure is intentionally divided into two complementary components, each targeting a different financing need.

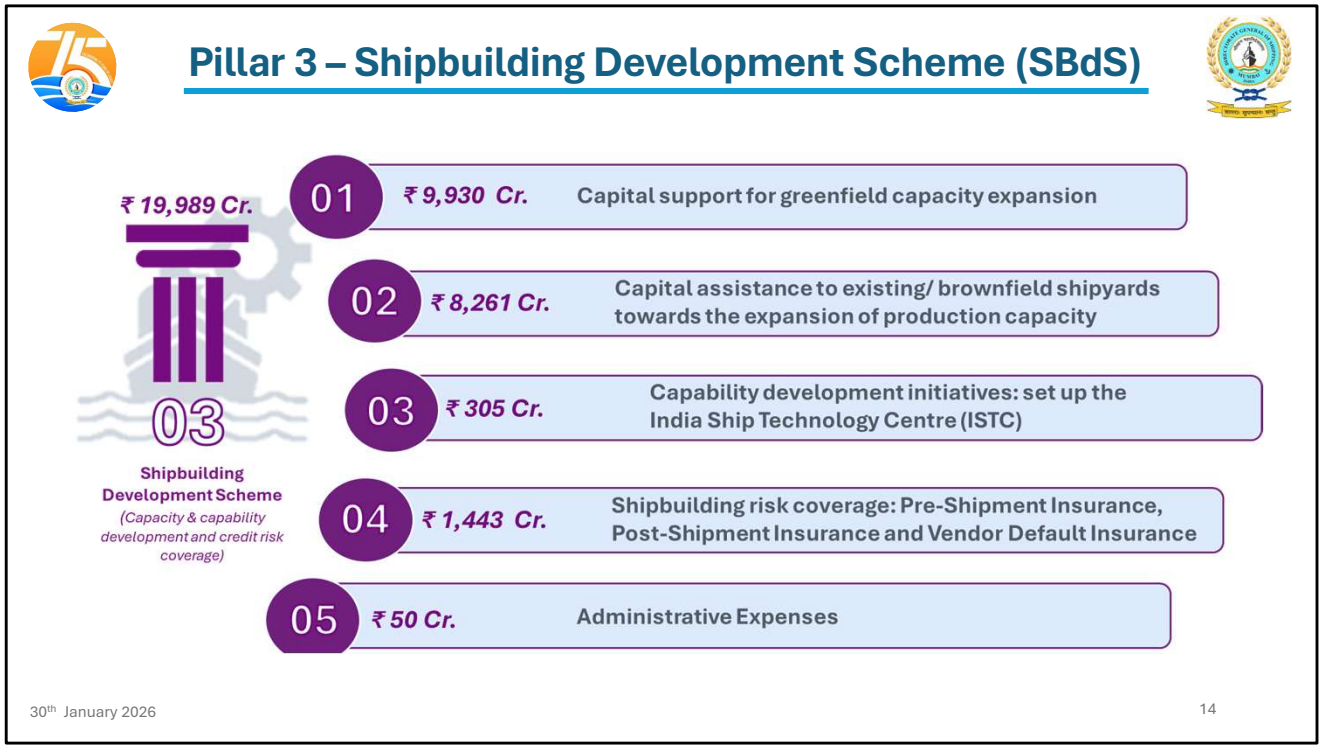
The Maritime Investment Fund focuses primarily on equity participation. This enables the government and institutional investors to support strategic maritime projects, shipbuilding ventures and infrastructure initiatives where long gestation periods and higher risk profiles often deter private capital. By providing equity support, the Fund reduces the financial burden on project promoters and improves overall project viability.

Parallel to this, the Interest Incentivization Fund is structured to address the cost of borrowing. Maritime projects are typically capital-intensive and debt-dependent, and high interest rates can significantly affect profitability and competitiveness. By subsidizing or reducing the

effective interest burden, this component ensures that viable projects are not delayed or abandoned due to financing costs.

What is important to note is the balance between equity and debt support. One side strengthens ownership and long-term capital infusion, while the other improves liquidity and affordability.

Together, they create a comprehensive financial ecosystem capable of supporting ship acquisition, shipbuilding, port infrastructure, green technology adoption and ancillary industries.
In essence, this pillar transforms financing from a bottleneck into an enabler. It provides predictability to investors, encourages private participation and ensures that ambitious maritime growth targets are backed by a robust financial framework rather than relying solely on policy declarations.



Pillar 3: Shipbuilding Development Scheme (SBdS)

The third pillar moves from financing support to capacity and capability creation within the domestic shipbuilding industry.

While financial incentives and credit access are essential, long-term competitiveness depends equally on physical infrastructure, technological capability and risk mitigation mechanisms. This pillar is therefore designed as a comprehensive industrial development framework rather than a single incentive scheme.

A major portion of the allocation is directed toward capital support for greenfield shipyard development. This enables the establishment of new facilities with modern infrastructure, advanced production technologies and environmentally compliant processes. Such investments are critical for expanding national shipbuilding capacity and reducing dependence on foreign yards.

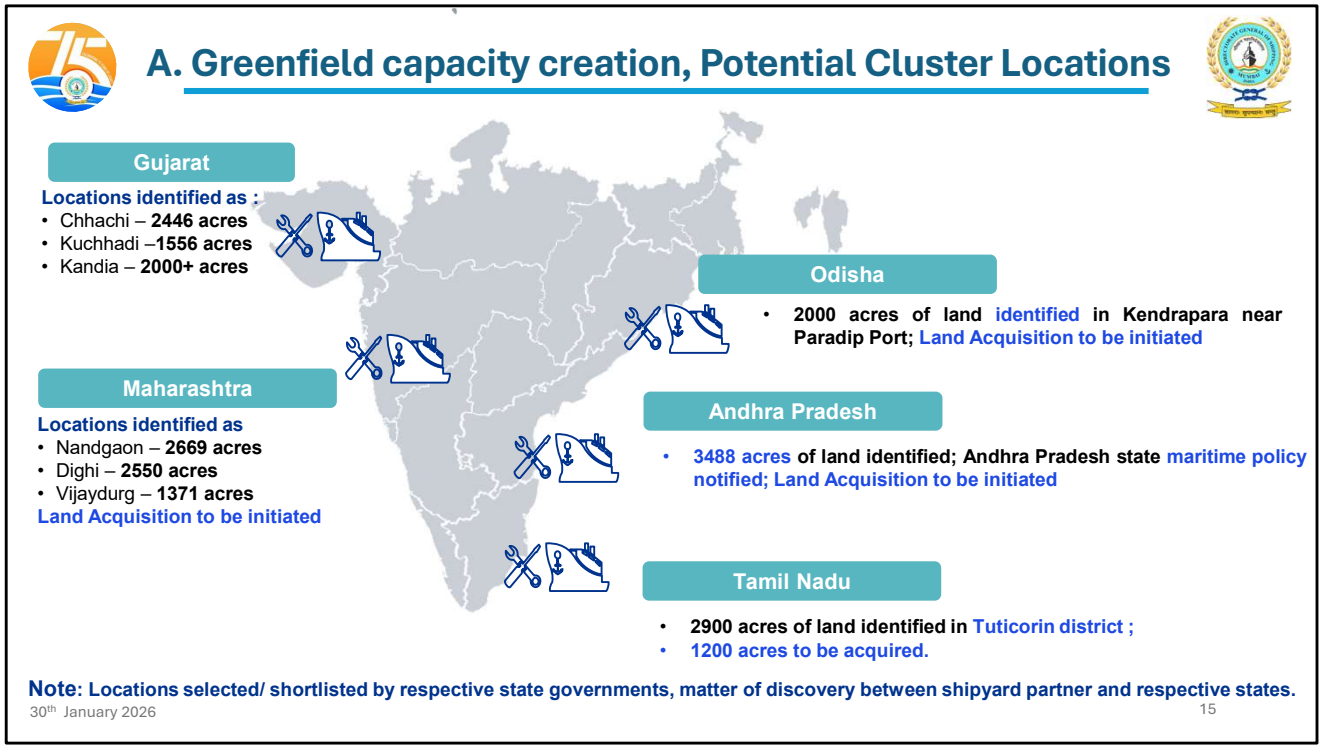
Alongside greenfield expansion, substantial assistance is also earmarked for brownfield development — meaning the upgradation and expansion of existing shipyards. This ensures that the current industrial base is not left behind, but instead modernised to handle larger vessels, specialised ships and technologically advanced builds. This dual approach balances new capacity creation with optimisation of existing assets.

Another important component of this pillar is capability development. The establishment of dedicated technology and research centres strengthens innovation, design capability and skill enhancement within the sector. This element ensures that India's shipbuilding ecosystem evolves from being primarily manufacturing-oriented to becoming knowledge-driven and technologically competitive on a global scale.

Risk coverage forms the next critical dimension. Shipbuilding projects involve long construction cycles and high capital exposure, which can discourage private participation. By introducing mechanisms such as pre-shipment and post-shipment insurance along with vendor default coverage, the scheme reduces financial uncertainty and improves confidence among both builders and investors.

Finally, provision for administrative and implementation expenses ensures that the scheme is supported by effective governance, monitoring and evaluation structures. This is essential for maintaining transparency, efficiency and accountability in execution.

In essence, this pillar is about building the structural backbone of the shipbuilding industry — expanding capacity, strengthening technological capability and de-risking industrial investment — so that financial incentives translate into sustainable and scalable industrial growth.



Pillar 3A: Greenfield Capacity Creation – Potential Cluster Locations

This slide moves from the conceptual framework of greenfield capacity creation to the geographical dimension — identifying potential locations where large-scale shipbuilding clusters can realistically be developed.

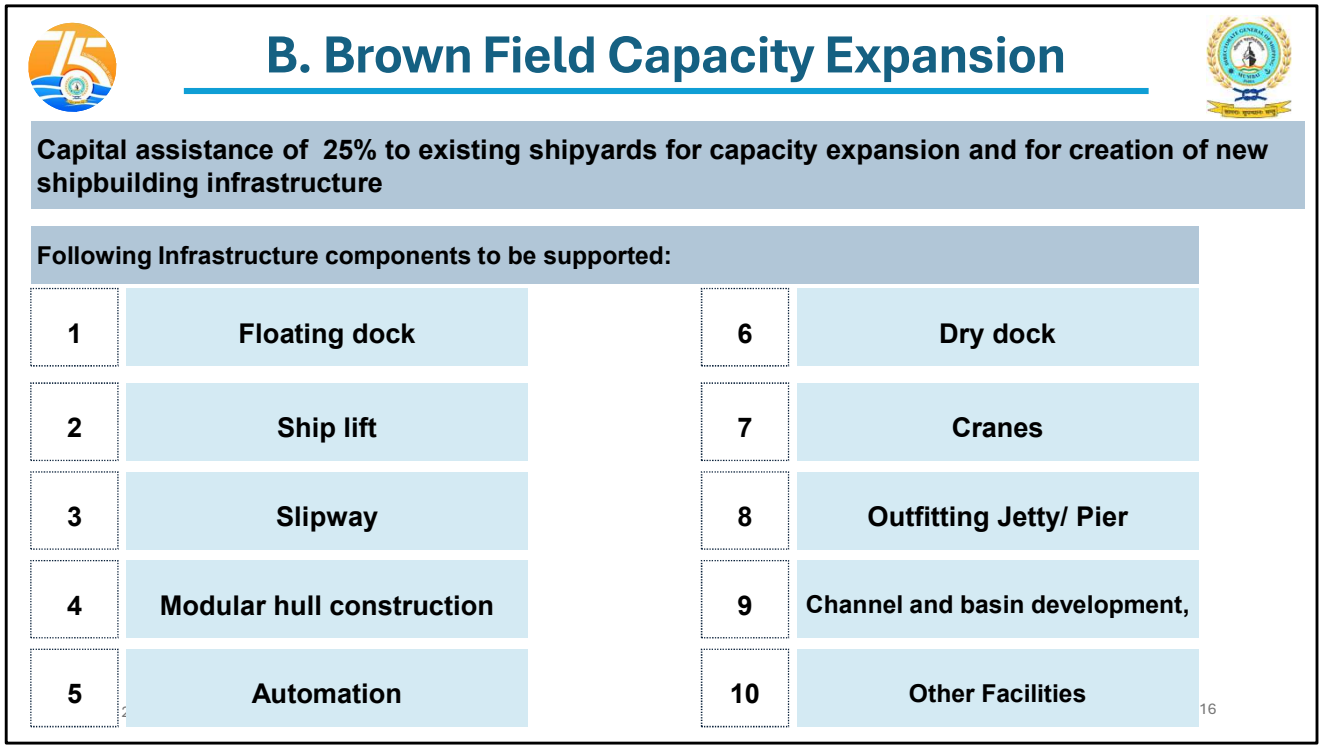
The emphasis here is on strategic coastal states that already possess port infrastructure, industrial ecosystems or policy readiness to support maritime expansion.
Several states have proactively identified sizeable land parcels suitable for integrated shipbuilding clusters. These locations are not random selections; they are based on proximity to deep-draft ports, availability of coastal frontage, existing industrial corridors and connectivity to hinterland logistics networks. The scale of land identified — often spanning thousands of acres — indicates an intention to develop not just standalone shipyards but comprehensive maritime industrial zones.

Gujarat and Maharashtra, for instance, benefit from long coastlines, established port networks and strong industrial bases, making them natural frontrunners for cluster development. Similarly, eastern and southern coastal states are emerging as strong contenders due to their port-led development strategies and supportive maritime policies. The presence of identified land banks demonstrates readiness at the state level, which is crucial for timely execution.

Another important point is that many of these sites are currently in different stages of land acquisition or policy notification. This reflects the collaborative nature of the initiative, where central policy support is complemented by state-level facilitation. The process is dynamic and involves coordination between shipyard developers, state governments and regulatory authorities to ensure that development aligns with environmental norms and long-term urban planning considerations.

From a strategic perspective, distributing clusters across multiple coastal regions reduces geographic concentration risk, promotes balanced regional development and creates competitive industrial ecosystems rather than monopolistic hubs. It also enhances resilience by ensuring that supply chains and production capacities are not dependent on a single region.

In essence, these potential cluster locations represent the physical manifestation of the greenfield capacity vision — translating policy intent into tangible industrial infrastructure that can support scale, employment generation and technological advancement across the maritime sector.



Brownfield Capacity Expansion

While greenfield development focuses on creating entirely new shipbuilding ecosystems, this component addresses the equally important need to strengthen and modernise existing shipyards.
Many Indian shipyards already possess foundational infrastructure and skilled manpower, but often lack the capital required for expansion, technological upgrades and capacity enhancement. Brownfield support is therefore designed to unlock the latent potential of these facilities.

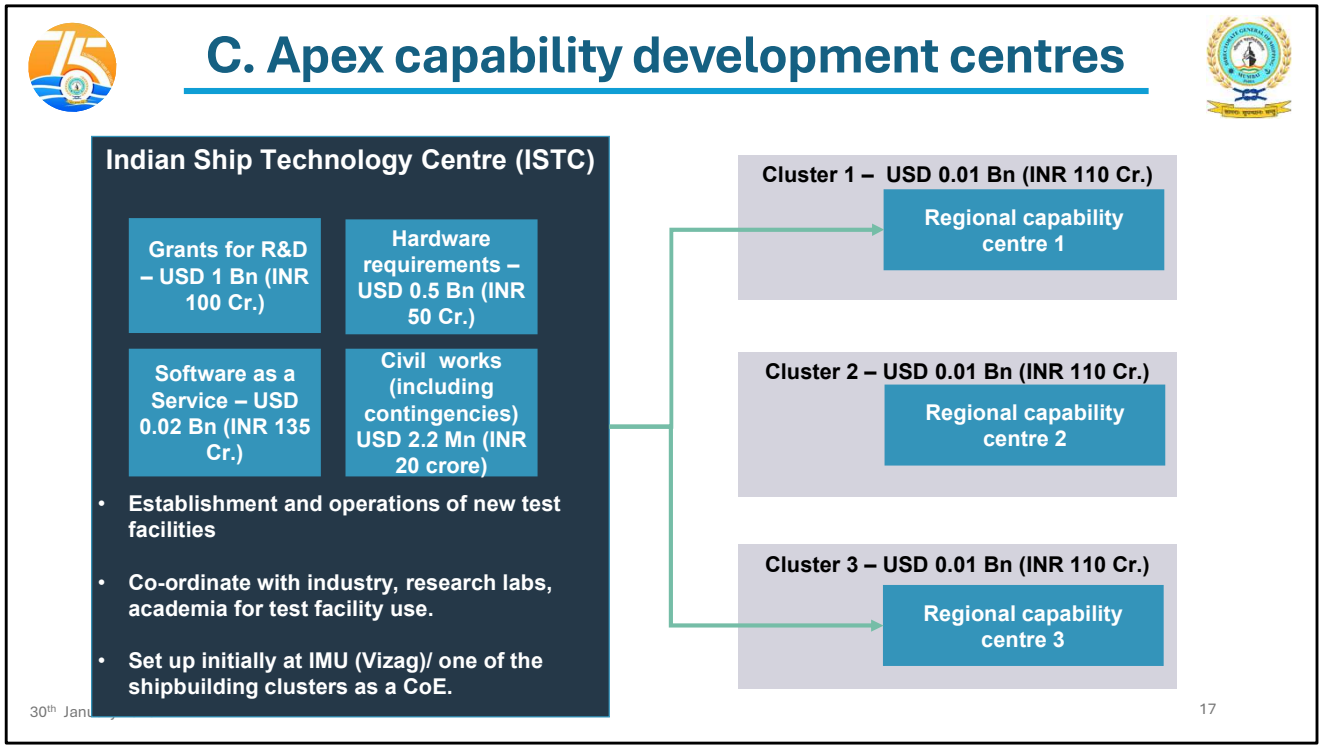
A defined percentage of capital assistance is extended to existing shipyards for infrastructure augmentation and modernization. This approach is both time-efficient and cost-effective, as it leverages existing assets rather than building from scratch. Upgrading operational shipyards allows quicker scaling of national capacity while minimising environmental and land-use challenges associated with entirely new developments.

The support framework covers a wide range of infrastructure components that are critical to modern shipbuilding efficiency. Facilities such as floating docks, dry docks and ship lifts directly influence the size and type of vessels that a yard can handle. Enhancements in these areas allow Indian shipyards to compete for larger and more complex ship orders in both domestic and international markets.

Equally important are production and technological upgrades. Slipways, modular hull construction facilities and automation systems significantly improve build speed, precision and quality control. These elements are essential for transitioning from traditional fabrication methods to modern, assembly-line-style ship construction that global competitors already employ.

Operational efficiency is further strengthened through investments in cranes, outfitting jetties and pier facilities, which streamline post-construction processes and reduce turnaround time. Channel and basin development ensure safe navigation and accessibility for larger vessels, while the provision for other auxiliary facilities allows flexibility to address site-specific requirements.

In essence, brownfield capacity expansion ensures that the existing shipbuilding ecosystem evolves in parallel with new capacity creation. It prevents industrial obsolescence, improves competitiveness and accelerates national shipbuilding growth without waiting for entirely new infrastructure cycles to mature.



Apex Capability Development Centres (Indian Ship Technology Centre – ISTC)

This pillar is focused on **capability creation**, not just physical shipyard capacity. The proposal is to establish an **Indian Ship Technology Centre (ISTC)** as an apex capability development institution, with linked **regional capability centres** across shipbuilding clusters.

On the ISTC side, the slide highlights four investment buckets:

Grants for R&D – USD 1 Bn (INR 100 Cr.)
This is intended to directly support **research, design innovation and technology development** in shipbuilding, including testing programmes, prototypes and applied R&D aligned to industry needs.

Hardware requirements – USD 0.5 Bn (INR 50 Cr.)
This covers creation of **specialised hardware infrastructure** required for capability development — such as testing equipment, labs, simulation and validation infrastructure and other critical technical assets.

Software as a Service – USD 0.02 Bn (INR 135 Cr.)
This is meant for **digital capability enablement** — access to design and engineering tools, modelling platforms, simulation software, digital twins, production planning and quality

systems as required.

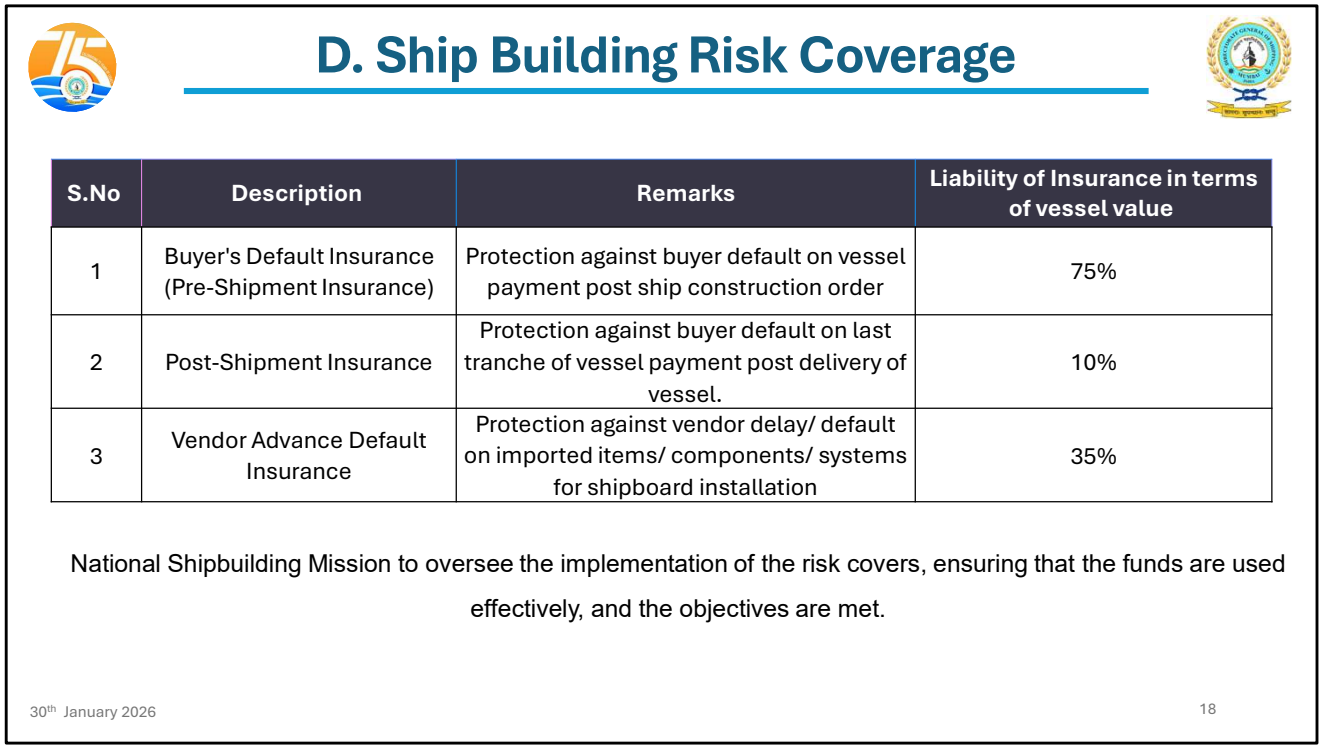
Civil works (including contingencies) – USD 2.2 Mn (INR 20 crore)
This covers the **physical set-up of the centre** including basic infrastructure, building works and associated contingencies needed to operationalise the institution.

Operationally, ISTC will do three things as outlined:
Establish and operate new test facilities that can serve the shipbuilding ecosystem as common infrastructure
Coordinate with industry, research labs and academia so the facilities are actually utilised and solve real shipbuilding problems
Set up initially at IMU (Vizag) / one of the shipbuilding clusters as a CoE, so it is anchored in a strong maritime academic base while staying connected to industry

The model envisages **three regional capability centres**, one per cluster:
Cluster 1 – USD 0.01 Bn (INR 110 Cr.) → Regional capability centre 1
Cluster 2 – USD 0.01 Bn (INR 110 Cr.) → Regional capability centre 2
Cluster 3 – USD 0.01 Bn (INR 110 Cr.) → Regional capability centre 3

The intent is that these regional centres act as **distributed access points** for capability development so that shipyards and associated ancillaries in different regions are not dependent on one central facility.

Overall, the key message of this pillar is: **building ships at scale requires not only financing and yard infrastructure, but also a national technology backbone — shared testing, R&D support and accessible capability centres — to raise design, quality and competitiveness to global benchmarks.**



Shipbuilding Risk Coverage

This component of Pillar 3 focuses on **risk mitigation in shipbuilding contracts**, which is critical because shipbuilding projects are capital-intensive, long-gestation and exposed to both buyer and supplier side uncertainties. The slide outlines **three specific insurance mechanisms**, each linked to a defined percentage of vessel value.

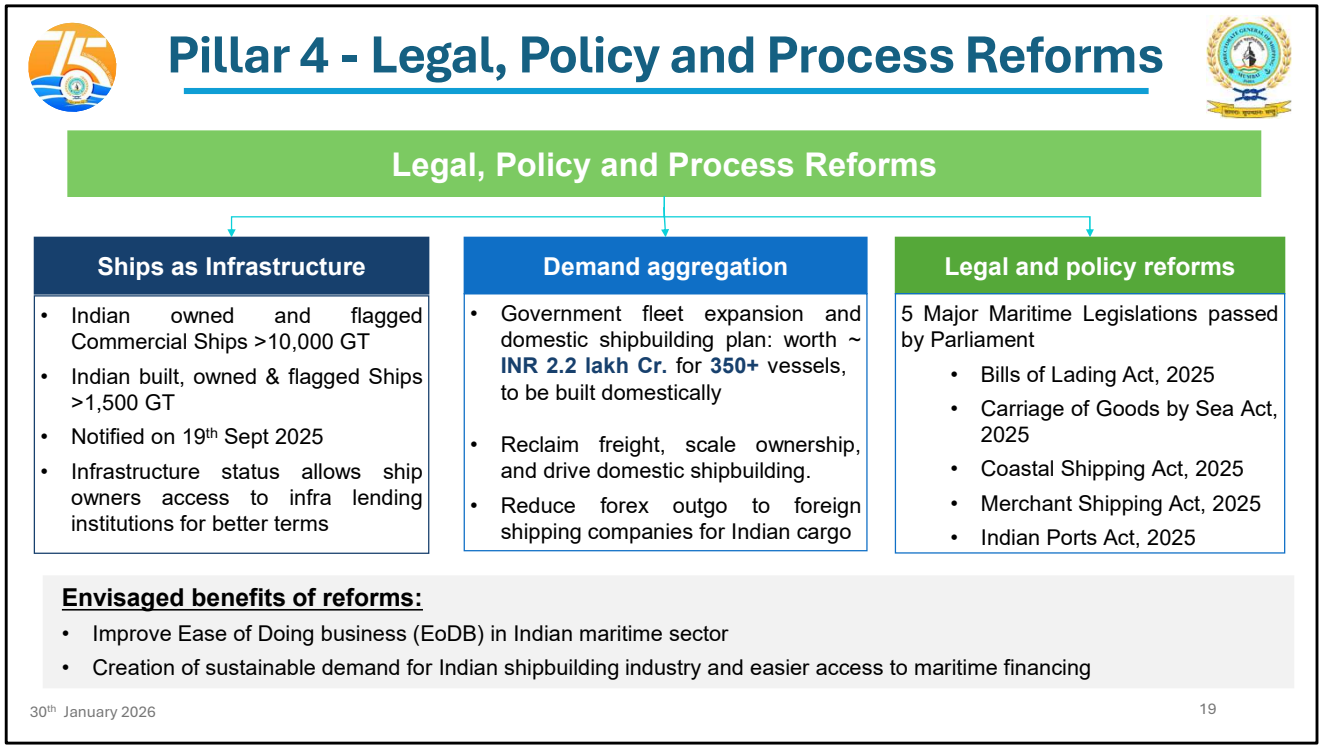
First – Buyer's Default Insurance (Pre-Shipment Insurance)
This provides protection **during the construction phase**, specifically against a situation where the buyer defaults on payment after the ship construction order has already commenced.
The **liability coverage here is up to 75% of the vessel value**, which is the highest among the three instruments, reflecting the high financial exposure of the shipyard during early and mid-construction stages.

Second – Post-Shipment Insurance
This instrument addresses the risk **after delivery of the vessel**, particularly where the buyer defaults on the **last tranche of payment**.
The **coverage is 10% of the vessel value**, as this generally corresponds to the final instalment or retention amount due upon handover.

Third – Vendor Advance Default Insurance
This mechanism protects shipyards from **supplier or vendor delays or defaults**, especially for **imported items, specialised components or critical shipboard systems**.
The **liability coverage here is 35% of the vessel value**, recognising the dependency of modern shipbuilding on global supply chains and high-value imported equipment.

Collectively, these three instruments create a **balanced risk shield across the entire shipbuilding lifecycle** —
from construction phase risk,
to delivery and payment completion risk,
to upstream vendor and component risk.

the **National Shipbuilding Mission** will oversee implementation. This ensures that the risk coverage mechanisms are **standardised, monitored and utilised effectively**, rather than being fragmented or inconsistently applied across shipyards. The intent is to build **confidence among shipyards, lenders and investors**, thereby improving project bankability and encouraging higher domestic shipbuilding participation.



Pillar 4: Legal, Policy and Process Reforms

This slide summarises the **non-financial reforms** being pursued to strengthen India's shipping and shipbuilding ecosystem — through **infrastructure status, demand creation and legal modernisation**.

1) Ships as Infrastructure
The first reform is granting **infrastructure status** to specific categories of ships:
Indian owned and flagged commercial ships above 10,000 GT
Indian built, owned and flagged ships above 1,500 GT
This was **notified on 19 September 2025**.
The intent is to enable shipowners to access **infrastructure lending** — typically meaning **longer tenure financing and improved terms** from infrastructure-focused lenders, which reduces cost of capital and supports fleet expansion.

2) Demand aggregation
The second reform is **demand creation through government-led aggregation**.
As indicated on the slide, the **government fleet expansion and domestic shipbuilding plan** is estimated at approximately **INR 2.2 lakh crore**, covering **350 plus vessels** to be **built domestically**.

The purpose is to:
Create a predictable orderbook for Indian shipyards
Reclaim freight and scale Indian ship ownership
Reduce forex outgo to foreign shipping companies for carriage of Indian cargo
In simple terms, demand aggregation ensures that shipyards are not investing in capacity without visibility of sustained demand.

3) Legal and policy reforms
The third component is the **modernisation of the maritime legal framework**, with **five major maritime legislations passed by Parliament**:
Bills of Lading Act, 2025
Carriage of Goods by Sea Act, 2025
Coastal Shipping Act, 2025
Merchant Shipping Act, 2025
Indian Ports Act, 2025

Together, these reforms are aimed at aligning India's maritime governance with contemporary requirements — including smoother trade documentation, clearer liability and compliance frameworks, stronger coastal shipping enablement and improved port governance.

Envisaged benefits
Overall, the reforms are expected to:
Improve Ease of Doing Business in the Indian maritime sector
Create sustainable demand for shipbuilding and enable **easier access to maritime finance**

Ship Recycling – India's Global Leadership

Ship recycling is not just an industry - it is a **strategic pillar of India's maritime economy** and the global circular economy. The process dismantles end-of-life ships to recover steel and other valuable materials, reducing the demand for virgin raw inputs while cutting costs and emissions.

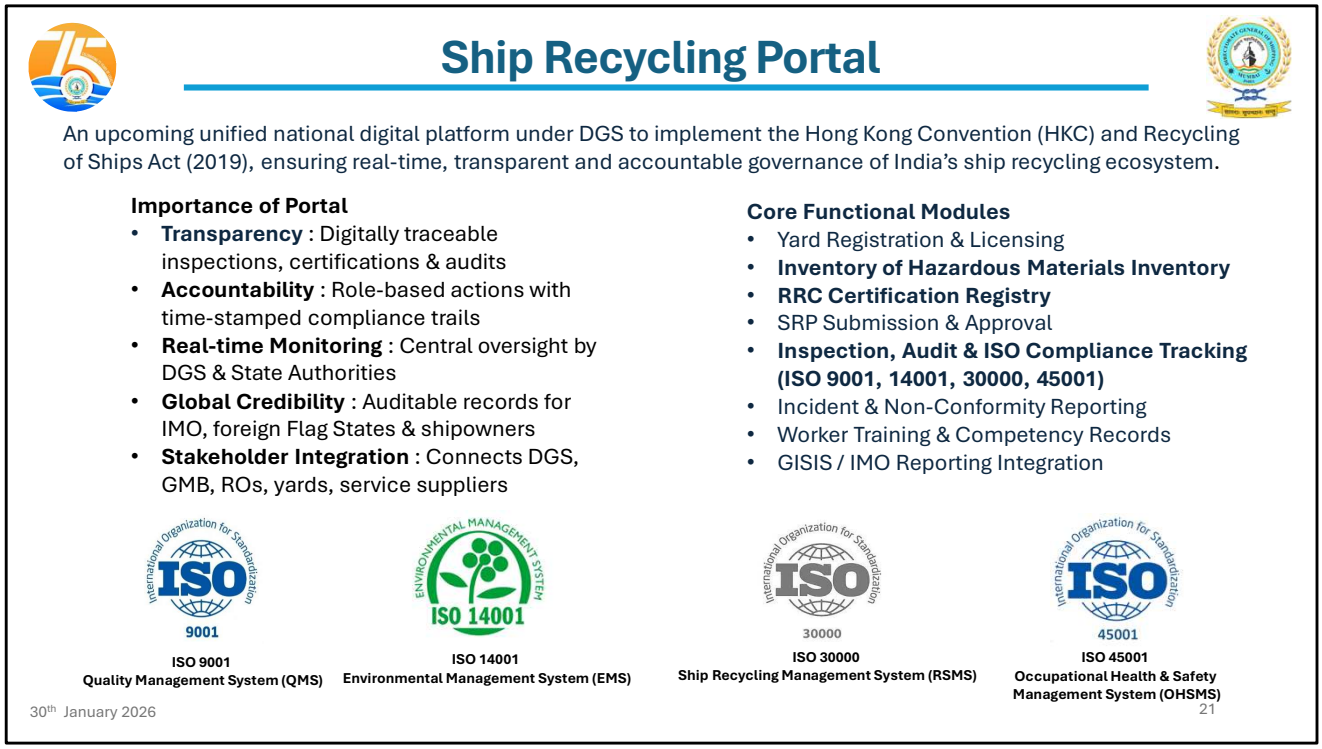
India today stands as the **global leader in ship recycling**, with the Alang–Sosiya cluster in Gujarat being the world's largest ship recycling facility. The entry into force of the **Hong Kong Convention (HKC) on 26 June 2025** has further elevated India's role, as it is the **only nation with more than 100 HKC-compliant yards (115 facilities)**.

This sector contributes significantly to India's industrial ecosystem by:
Handling **30–35% of global ship recycling tonnage annually**, consolidating India's leadership.
Meeting **20–25% of India's ferrous scrap demand**, reducing import dependency and saving valuable forex.
Feeding the **Green Steel ecosystem**, providing low-carbon inputs that align with India's net-zero ambitions.

The impact is equally socio-economic. Ship recycling directly employs **15,000+ workers**,

while creating indirect livelihood opportunities for thousands more in logistics, scrap processing, and allied services. The industry has become a driver of **inclusive growth**, while embedding high safety and environmental standards under HKC compliance.

By anchoring itself as the hub of HKC-compliant recycling, India not only ensures **sustainable resource recovery** but also strengthens its position as a **global leader in maritime sustainability**.



Ship Recycling Portal

The Ship Recycling Portal is being developed as India's national digital command platform for implementing the Hong Kong Convention (HKC) and the Recycling of Ships Act, 2019. Its purpose is to centralise every regulatory, safety and environmental function into a unified digital architecture, replacing fragmented documentation and manual oversight with real-time, auditable governance. Post-HKC entry into force, digital traceability will be essential to retaining India's leadership in global ship recycling.

The portal will enable complete life-cycle governance, from yard registration and licensing to issuance of Ready-for-Recycling Certificates (RRC), monitoring of hazardous materials and oversight of ISO-certified processes. Role-based access and time-stamped actions will ensure accountability by DGS, Gujarat Maritime Board and State Pollution Control Boards. Integration with GISIS and IMO reporting systems will provide global credibility by ensuring transparent access for foreign Flag States, classification societies and shipowners.

Beyond compliance, the portal institutionalises digital monitoring of inspections, surveillance logs, incident reporting and corrective actions. Worker training records, safety drills, waste disposal data and non-conformity reports will be digitally stored, building a permanent regulatory archive. This transition marks a strategic shift from physical inspection dependency to data-driven environmental governance, positioning India as the first digitally governed ship

recycling nation under HKC.

ISO Standards

To operationalise HKC requirements, Indian recycling yards are adopting a comprehensive ISO framework that strengthens transparency, worker safety and environmental stewardship.

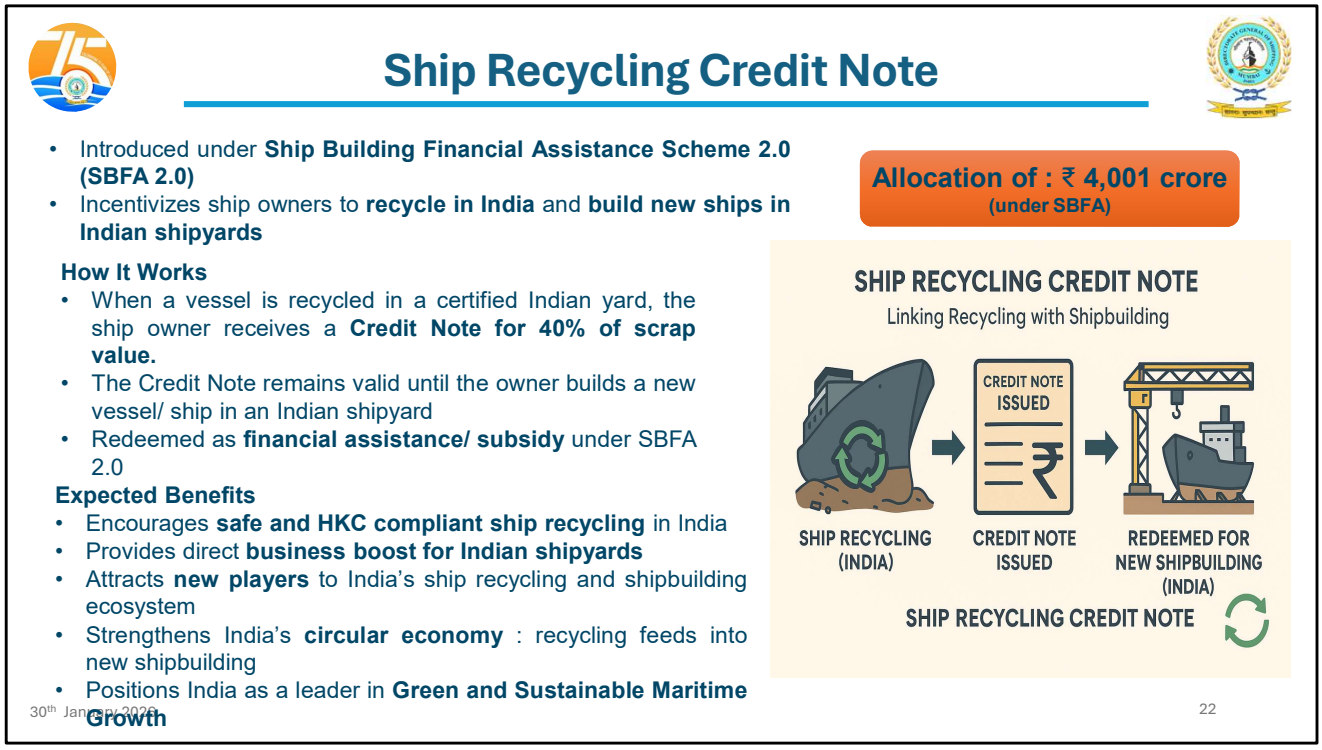
ISO 9001 – Quality Management System
Ensures procedural discipline, documentation integrity and continuous improvement across recycling operations. It is the baseline for demonstrating reliability to international shipowners.

ISO 14001 – Environmental Management System
Addresses pollution prevention, hazardous waste handling and resource control. It demonstrates alignment with global expectations for safe dismantling and coastal environmental protection.

ISO 30000 – Ship Recycling Management System
The core ISO standard specific to ship recycling under HKC. It governs implementation of IHM, Safe-for-Hot-Work certifications, containment of toxic substances and controlled dismantling protocols.

ISO 45001 – Occupational Health & Safety Management System
Protects workers through structured risk assessment, PPE enforcement, emergency response planning and health surveillance. It elevates human safety to audit-ready international standards.

Collectively, these ISO certifications move Indian yards from compliance demonstration to institutional credibility, assuring shipowners, classification societies and global regulators that end-of-life vessels are dismantled with full environmental and human safety assurance.



Ship Recycling Credit Note

The **Ship Recycling Credit Note (SRCN)** is one of the most innovative financial instruments introduced under the **Shipbuilding Financial Assistance Scheme 2.0 (SBFA 2.0)** with an allocation of **₹4,001 crore**. It directly links India's ship recycling strength with the growth of its shipbuilding industry.

How It Works

When a vessel is dismantled in a **certified Indian ship recycling yard**, the shipowner is issued a **Credit Note worth 40% of the vessel's scrap value**.
This Credit Note remains valid until the shipowner invests in building a **new vessel in an Indian shipyard**.
The note is then **redeemed as financial assistance/subsidy** under SBFA 2.0, lowering the effective cost of new builds in India.

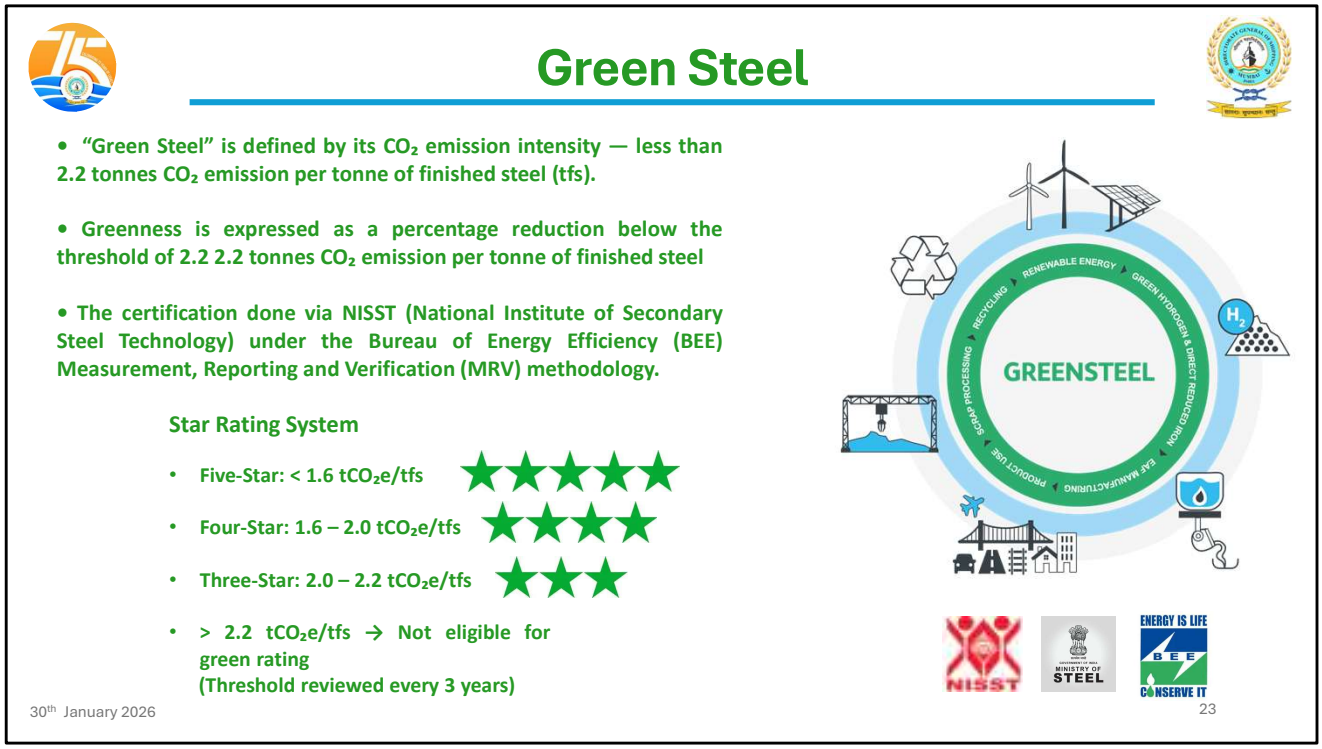
Expected Benefits

Boosts HKC-compliant recycling: Encourages safe, environmentally sound, and **Hong Kong Convention (HKC) aligned ship recycling** practices.
Strengthens shipbuilding: Directly channels recycling activity into **new orders for Indian shipyards**, ensuring business continuity.
Expands ecosystem participation: Incentivizes **new players**—both domestic and foreign—

to engage with India's recycling and shipbuilding ecosystem.
Promotes circular economy: Scrap steel and materials from recycling feed into the production of new ships, cutting raw material dependence.
Sustainability leadership: Positions India as a **global leader in green and sustainable maritime growth**, combining recycling, green steel, and shipbuilding.

Strategic Importance
SRCN acts as a **bridge policy**, ensuring that India's dominance in recycling (30–35% of global share) translates into a **thriving shipbuilding industry**.
It enhances India's image as the **only country with over 100 HKC-compliant yards** while simultaneously supporting its ambition to become a **shipbuilding hub**.
By tying together **scrap recovery, circular economy, and green shipbuilding**, it creates a **self-sustaining maritime growth cycle**.

The Ship Recycling Credit Note is a **game-changer**, as it uniquely integrates recycling with new construction, creating a **virtuous cycle of sustainability, industrial growth, and employment**.



Green Steel : Driving Low-Carbon Industrial Transition

Steel is the backbone of infrastructure and shipbuilding, but it is also one of the most carbon-intensive industries. The concept of **"Green Steel"** aims to transform this challenge into an opportunity by reducing the **CO_2 emission intensity below 2.2 tonnes of CO_2 per tonne of finished steel (tfs)**.

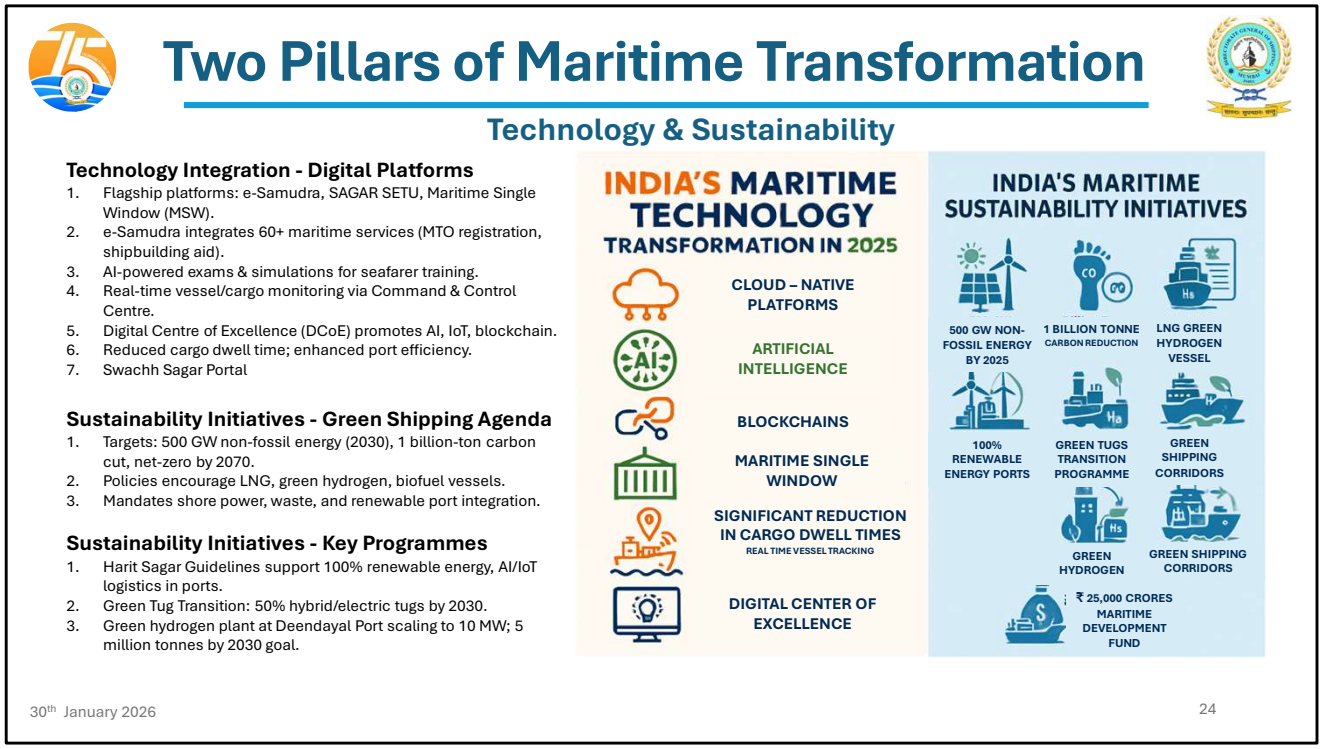
Greenness is measured as the percentage reduction in emissions below this threshold. Certification is carried out by the **National Institute of Secondary Steel Technology (NISST)** under the **Bureau of Energy Efficiency (BEE)**, using global-standard **Measurement, Reporting and Verification (MRV) methodologies**.

A **star rating system** makes this framework transparent and globally competitive:
Five-Star: < 1.6 tCO_2e/tfs
Four-Star: 1.6 – 2.0 tCO_2e/tfs
Three-Star: 2.0 – 2.2 tCO_2e/tfs
Above 2.2 tCO_2e/tfs: Not eligible for green certification

The threshold will be reviewed every three years, ensuring constant ambition in line with climate goals.

Green Steel is not just about lowering emissions,it is about **embedding recycling, renewable energy, hydrogen and energy efficiency** into steel production, linking ship recycling and scrap recovery directly with India's **circular economy vision**. This makes India's maritime sector a critical contributor to the **Green Steel ecosystem**, reinforcing both industrial competitiveness and sustainability.

Emissions Covered :
Scope 1 : Direct emissions from steel making
Scope 2 : Indirect emissions from purchased electricity
Scope 3 : Agglomeration, pellet making, coke making, beneficiation, raw materials



Two Pillars of Maritime Transformation

India's maritime transformation is being led through two parallel and reinforcing pillars, Technology integration and Sustainability adoption. On the technology front, flagship digital platforms such as e-Samudra, SAGAR SETU and the Maritime Single Window are reshaping port, fleet and regulatory services. These platforms integrate over sixty maritime functions, from vessel registration to shipbuilding support, while AI-powered exams, simulations and real-time command centres are modernising training and operational visibility.

The Digital Centre of Excellence is now promoting advanced technologies such as AI, IoT and blockchain, targeting reduced cargo dwell times, predictive logistics and enhanced transparency. Initiatives like the Swachh Sagar Portal and automated monitoring systems are creating a unified digital maritime ecosystem.

Parallel to this, India's sustainability pillar is anchored in national commitments — 500 GW of non-fossil energy by 2030 and one billion tonnes of carbon reduction. Maritime policies now actively promote LNG, green hydrogen and biofuel-based vessels, alongside mandatory adoption of shore power, waste reception and renewable port integration.

Through programmes such as the Harit Sagar Guidelines, Green Tug Transition and the planned 10 MW hydrogen facility at Deendayal Port, India is aligning port infrastructure with

future fuel readiness. Together, these two pillars position India not only to meet regulatory compliance but to emerge as a global leader in green, intelligent and future-ready maritime operations.

Green Shipping – The Big Picture

- Shipping is the **backbone of global trade** – carrying 80% of goods worldwide.
- Shipping contributes to ~3% of global CO_2 emissions.
- Green Shipping = *making ships, ports, and supply chains cleaner, smarter, and future-ready.*
- It's not just about compliance — it's about **staying competitive in a low-carbon economy.**
- **Vision & Commitments:**
  - Aligned with *Maritime India Vision 2030 & Maritime Amrit Kal Vission 2047*.
  - Supports IMO's **Net Zero 2050** ambition.
  - Anchored in India's **Panchamrit Pledge** – 500 GW non-fossil capacity by 2030, Net Zero by 2070.

"The future of shipping is green — by necessity, not by choice."

30th January 2026 25

Green Shipping – The Big Picture

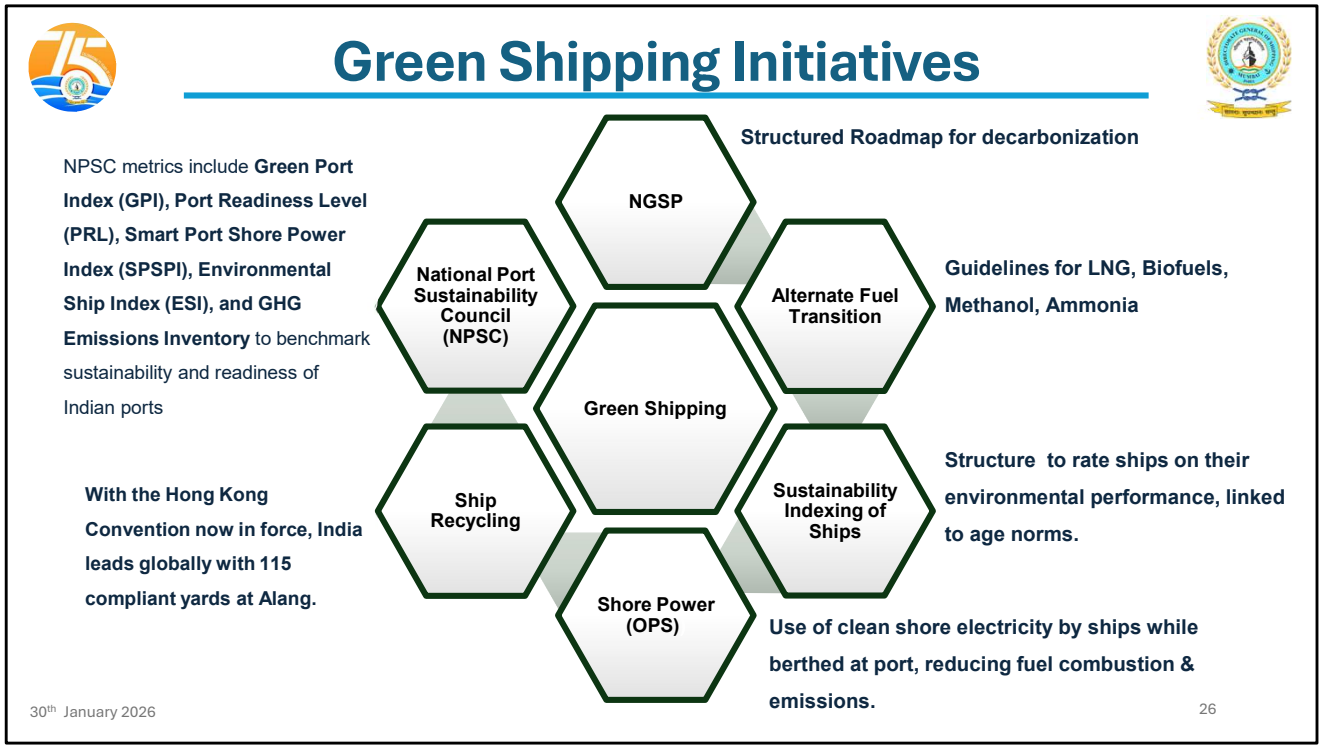
Shipping is the backbone of world trade, carrying nearly **80% of global goods**. But it is also responsible for **~3% of global CO_2 emissions**, making decarbonisation one of the most pressing challenges of our time.

Green Shipping is not just about compliance, it is about transforming **ships, ports, and supply chains into cleaner, smarter, and future-ready systems**. In a low-carbon economy, sustainability is synonymous with competitiveness, and the maritime sector cannot afford to lag behind.

India's approach aligns ambition with action:

Maritime India Vision 2030 and **Maritime Amrit Kaal Vision 2047** embed sustainability into long-term growth strategies.
India supports the **IMO's Net Zero 2050** ambition, strengthening its role as a responsible maritime nation.
Through the **Panchamrit Pledge**, India has committed to 500 GW of non-fossil capacity by 2030 and Net Zero by 2070, anchoring maritime decarbonisation within the national clean energy agenda.

The **future of shipping is green by necessity, not by choice.** Green shipping is not a burden but an opportunity: to reduce costs, attract green finance, and ensure India remains at the forefront of global maritime competitiveness.



India's Green Shipping Initiatives

India's maritime decarbonization roadmap is evolving from isolated compliance measures into an integrated national strategy under the broader vision of *"Samudra Shuddhih, Rāṣṭrasya Vṛiddhih."* This transformation is being driven by coordinated initiatives that target vessels, ports, fuel ecosystems, and regulatory governance.

At the institutional level, the formation of the **National Port Sustainability Council (NPSC)** reflects a shift toward performance-based benchmarking in port operations. The council employs indicators such as the *Green Port Index (GPI), Port Readiness Level (PRL), Environmental Ship Index (ESI)* and *GHG Emissions Inventory*, ensuring Indian ports are globally aligned on sustainability, electrification, and green infrastructure standards.

A central pillar of green transition is the **National Green Shipping Plan (NGSP)**, which provides a structured roadmap for decarbonisation of both ports and ships. The plan not only sets targets for reducing port emissions but also outlines future bunkering corridors for alternative fuels such as LNG, biofuels, methanol, and green ammonia. These fuels are being introduced through detailed guidelines to support a phased shift from transitional to zero-carbon fuels.

On the vessel front, **Sustainability Indexing of Ships (SIS)** is being introduced to rate ships

based on environmental performance, integrating parameters such as fuel type, age, emissions, and onboard energy efficiency. This index will be directly linked to regulatory incentives and port access policies, encouraging shipowners to modernise fleets and retire obsolete, high-emission tonnage.

Shore Power (Onshore Power Supply - OPS) forms another critical component, aimed at eliminating auxiliary engine use while ships are docked. By supplying clean electricity directly at berth, OPS significantly reduces particulate emissions, sulphur oxides, and carbon output in port cities. Pilot installations at major ports such as VOC and JNPA are now being expanded to create OPS-enabled green corridors.

Ship recycling also contributes to India's green leadership. With the Hong Kong Convention now in force, India leads the world with over **115 HKC-compliant recycling yards at Alang**, integrating environmentally safe dismantling practices and hazardous waste management. This positions India as a responsible global hub in the circular economy for ships.

Together, these initiatives illustrate India's transition from a compliance-driven maritime nation to a climate-responsible maritime power. By integrating policy (NGSP), infrastructure (OPS), market readiness (alt-fuels), and regulatory reform (SIS, NPSC), India is preparing not only to meet IMO's 2050 targets but to set new benchmarks for green maritime leadership.

National Green Shipping Policy (NGSP)

The **National Green Shipping Policy (NGSP)** represents **India's comprehensive maritime decarbonisation roadmap**, designed to align the shipping and port ecosystem with global climate imperatives while simultaneously safeguarding economic growth, trade competitiveness and industrial development. As articulated in the consultative framework, NGSP is **not merely an environmental initiative**, but a **strategic transformation agenda** intended to position India as a **global hub for green ships, green fuels, green ports and maritime innovation**.

The policy draws momentum from **international drivers** such as the **IMO 2023 GHG Strategy** and India's **COP-26 Panchamrit commitments**, while remaining anchored in domestic maritime priorities. It adopts a **value-chain approach**, embedding sustainability across vessel design, fuel transition, port infrastructure, ship recycling, digital governance and financial mechanisms. Importantly, NGSP does not operate in isolation; it is structurally aligned with **Maritime India Vision 2030, Maritime Amrit Kaal Vision 2047, Sagarmala, and Harit Sagar guidelines**, thereby creating a **unified and forward-looking national maritime strategy** rather than fragmented initiatives.

Key Transition Pillars

Green Ships

Focuses on **energy-efficient vessel design, retrofitting of existing fleets, adoption of zero- and low-emission propulsion systems, and progressive green certification norms**. The long-term intent is to establish India as a **shipbuilding and retrofit hub** for next-generation low-carbon vessels serving both domestic and international markets.

Green Ports

Targets **port decarbonisation through shore power (OPS), electrification of cargo-handling equipment, renewable energy integration, emission monitoring systems, green corridors, and alternate fuel bunkering infrastructure**. Ports are envisioned as **multi-energy maritime hubs** supporting both operational efficiency and environmental stewardship.

Green Fuels

Promotes a **phased transition toward alternative marine fuels** including **biofuels, LNG, methanol, hydrogen and ammonia**, coupled with domestic production ecosystems and bunkering networks. The objective is to evolve India from a fuel importer to a **future global supplier of green marine fuels**.

Green Technology & Innovation

Encourages **digitalisation, data-driven maritime operations, hybrid propulsion systems, energy-saving devices, automation and indigenous technology development**, ensuring that innovation becomes a cross-cutting enabler across ships, ports and regulatory systems.

Green Recycling

Envisions **modernisation of ship recycling clusters such as Alang** through **Hong Kong Convention-compliant practices**, strengthened hazardous-waste management, circular-economy principles and safe labour standards, positioning India as a **global leader in environmentally sound ship recycling**.

Green Financing & Collaboration

Calls for **dedicated green maritime funds, ESG-linked financing, fiscal incentives, blended finance models, PPP structures and international cooperation frameworks** to de-risk investments and ensure equitable transition pathways for both large enterprises and MSMEs.

Green Skill Development & Capacity Building

Recognises that technological transition must be matched by **human capital readiness**, through structured training programmes, certification reforms, institutional strengthening and continuous professional development across seafarers, port personnel, recyclers and regulators.

Strategic Intent

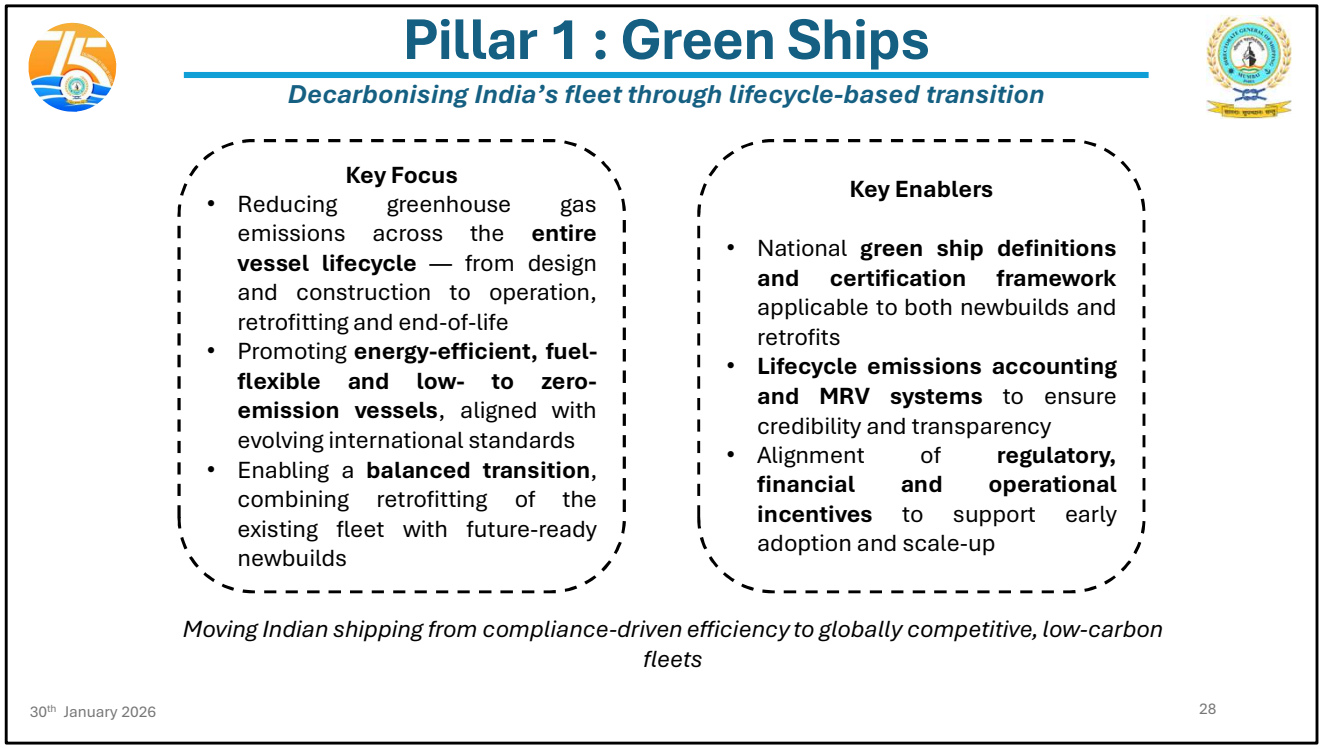
At its core, NGSP seeks to **shift India's maritime sector from reactive regulatory compliance to proactive global leadership**. The emphasis is on creating a maritime ecosystem that **exports technology, services and green solutions rather than**

environmental externalities. The policy underscores a **just and inclusive transition**, ensuring that industry stakeholders, labour forces, coastal communities, MSMEs and emerging enterprises are integrated into the transformation journey.
In summary, NGSP functions as **India's national reference framework for green maritime transformation**—linking sustainability with competitiveness, innovation with governance and environmental responsibility with long-term economic resilience.

Maritime INDIA @ Net Zero – Multi-Stakeholder Workshop

To operationalise the vision of the National Green Shipping Policy and translate policy intent into implementation-ready pathways, the **Maritime INDIA @ Net Zero Workshop** was convened on **14–15 January 2026 at the India Habitat Centre, New Delhi (Hybrid Mode)**. The workshop was jointly organised by the **Directorate General of Shipping (DGS)** and the **National Centre of Excellence for Green Ports & Shipping (NCoEGPS) at TERI**, bringing together ministries, regulators, industry leaders, ports, shipping companies, fuel providers, financial institutions, academia and international partners.

The two-day engagement served as a **high-level action-planning and governance platform**, enabling session-wise deliberations across all NGSP pillars including green ships, ports, fuels, recycling, finance, technology and capacity building.



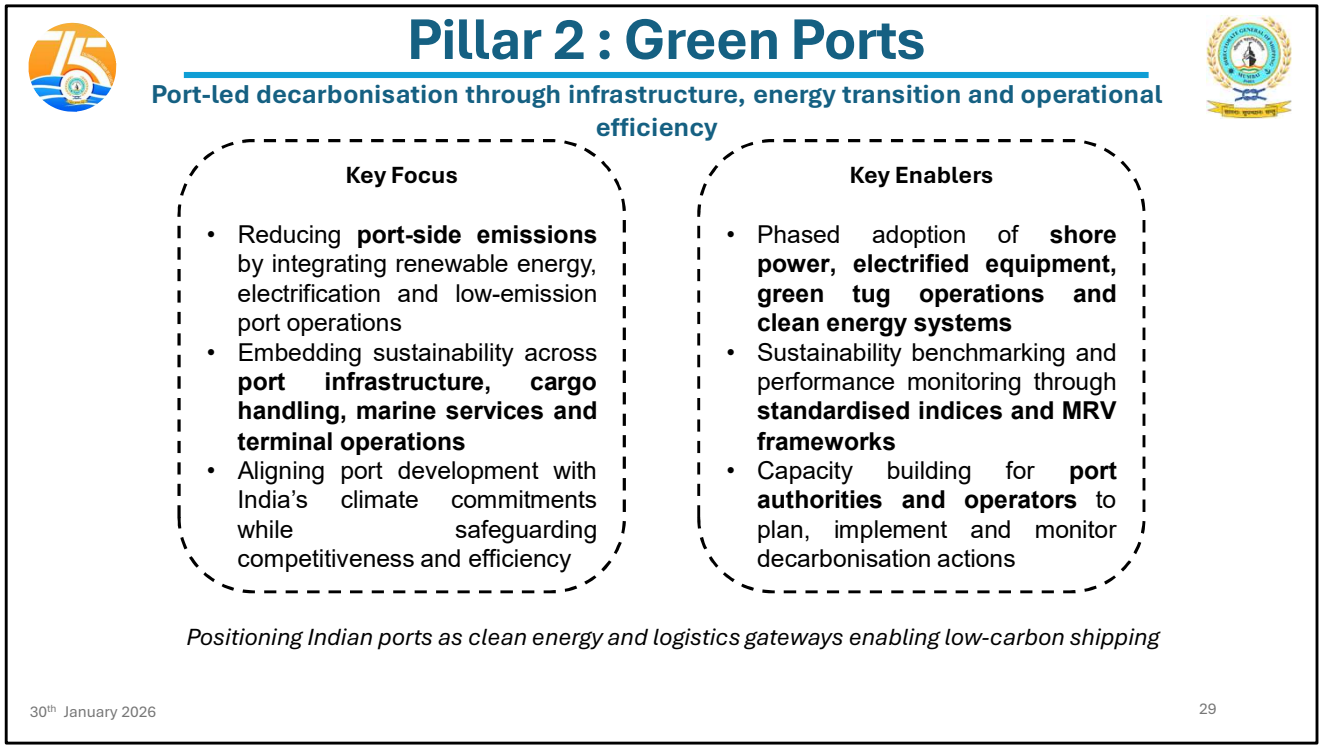
NGSP Pillar 1: Green Ships

Pillar 1, **Green Ships,** is centred on **decarbonising India's vessel fleet through a lifecycle-based transition approach.** The idea is not limited to reducing fuel consumption during operations, but to address emissions **across the entire ship lifecycle** — from design and construction, to operation, retrofitting, and finally end-of-life recycling.

The pillar promotes the development and adoption of **energy-efficient, fuel-flexible and low- to zero-emission vessels**, ensuring that Indian shipping remains aligned with evolving international environmental standards and IMO decarbonisation pathways. At the same time, the transition is designed to be **phased and balanced** — encouraging retrofitting of the existing fleet alongside the gradual induction of green newbuild vessels, rather than an abrupt and economically disruptive shift.

A key enabling element under this pillar is the creation of **clear national green ship definitions, certification standards and compliance frameworks** applicable to both new ships and retrofits. This brings uniformity, transparency and confidence for shipowners, shipyards and financial institutions. Complementing this is the emphasis on **lifecycle emissions accounting and MRV (Monitoring, Reporting and Verification) systems**, which allow measurable tracking of progress and ensure credibility of emission reduction claims.

Overall, the Green Ships pillar aims to move Indian shipping **from compliance-driven efficiency towards globally competitive, low-carbon fleets**, strengthening both environmental sustainability and long-term economic competitiveness of the maritime sector.



NGSP Pillar 2: Green Ports

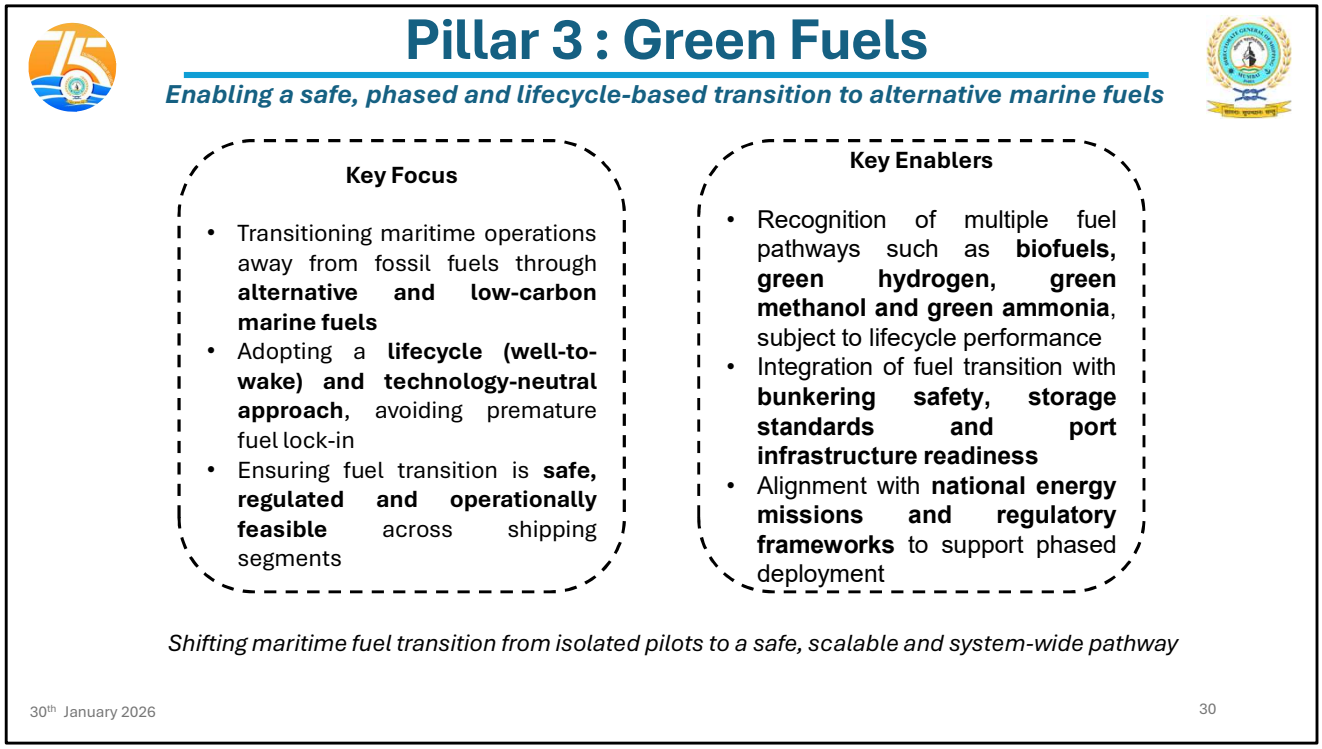
Pillar 2, **Green Ports,** focuses on **port-led decarbonisation**, recognising that ports are not only logistics nodes but also major energy and emission centres. The objective is to systematically reduce **port-side emissions** through infrastructure upgrades, renewable energy integration and improvements in operational efficiency.

The pillar emphasises embedding sustainability across the **entire port ecosystem** — this includes port infrastructure, cargo handling equipment, marine services, terminal operations and hinterland connectivity. Instead of treating sustainability as a standalone initiative, the approach is to make it an **integral design and operating principle** for both existing ports and new port developments. At the same time, competitiveness and efficiency remain critical so that environmental measures do not reduce throughput or increase trade costs.

Key enablers under this pillar include the **phased adoption of shore power systems**, electrified cargo handling equipment, cleaner tug and pilot boat operations, and the transition towards renewable and low-carbon energy sources within port premises. Another major component is the introduction of **standardised sustainability indices, benchmarking tools and MRV frameworks** to measure performance consistently across ports and track emission reductions in a transparent manner.

Equally important is **capacity building for port authorities and terminal operators**, enabling them to plan, implement and monitor decarbonisation strategies effectively.

Overall, the Green Ports pillar positions Indian ports as **clean energy and logistics gateways**, supporting low-carbon shipping while enhancing efficiency, resilience and global competitiveness of India's maritime trade infrastructure.



NGSP Pillar 3: Green Fuels

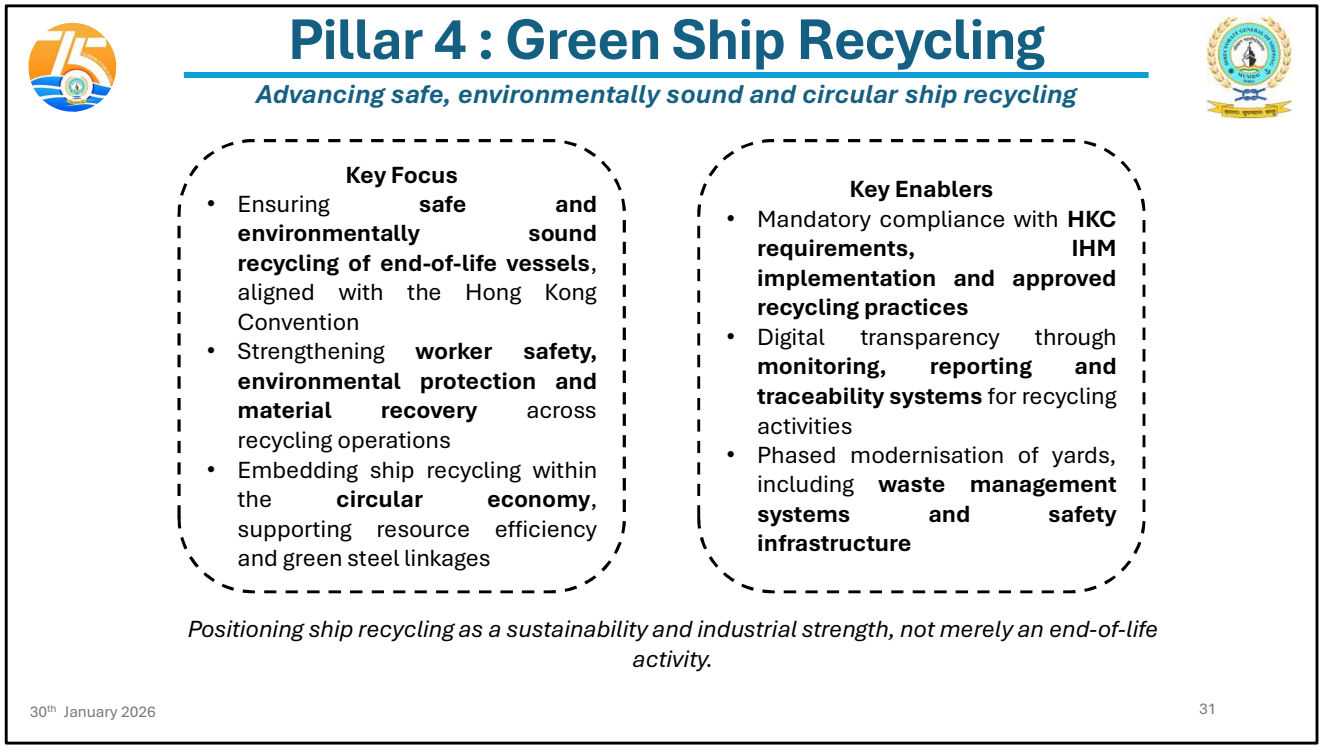
Pillar 3, **Green Fuels,** addresses one of the most critical aspects of maritime decarbonisation, which is the **transition away from conventional fossil fuels towards alternative and low-carbon marine fuels**. The intent is not an abrupt shift, but a **safe, phased and lifecycle-based transition pathway** that remains operationally practical for the industry.

The core focus here is to enable maritime operations to gradually adopt **technology-neutral and lifecycle or well-to-wake approaches**, ensuring that emissions are assessed across the entire fuel value chain rather than only at the point of combustion. This helps avoid premature fuel lock-in and allows flexibility for shipowners and operators as technologies evolve. At the same time, the pillar stresses that the transition must be **safe, regulated and commercially feasible**, recognising the diversity of vessel types and trade routes within the Indian shipping ecosystem.

On the enabler side, the policy recognises **multiple fuel pathways** instead of prescribing a single solution. These include **biofuels, green hydrogen, green methanol and green ammonia**, subject to lifecycle performance and safety standards. Another critical enabler is the integration of fuel transition with **bunkering safety protocols, storage norms and port infrastructure readiness**, ensuring that supply chains and operational ecosystems develop alongside fuel adoption.

Further, alignment with **national energy missions and regulatory frameworks** is essential so that maritime fuel transition is synchronised with broader energy sector developments and industrial policies.

Overall, this pillar aims to move India's maritime fuel transition **from isolated pilot projects to a scalable, system-wide and safety-anchored pathway**, creating long-term certainty for shipowners, ports, fuel suppliers and technology providers.



NGSP Pillar 4: Green Ship Recycling

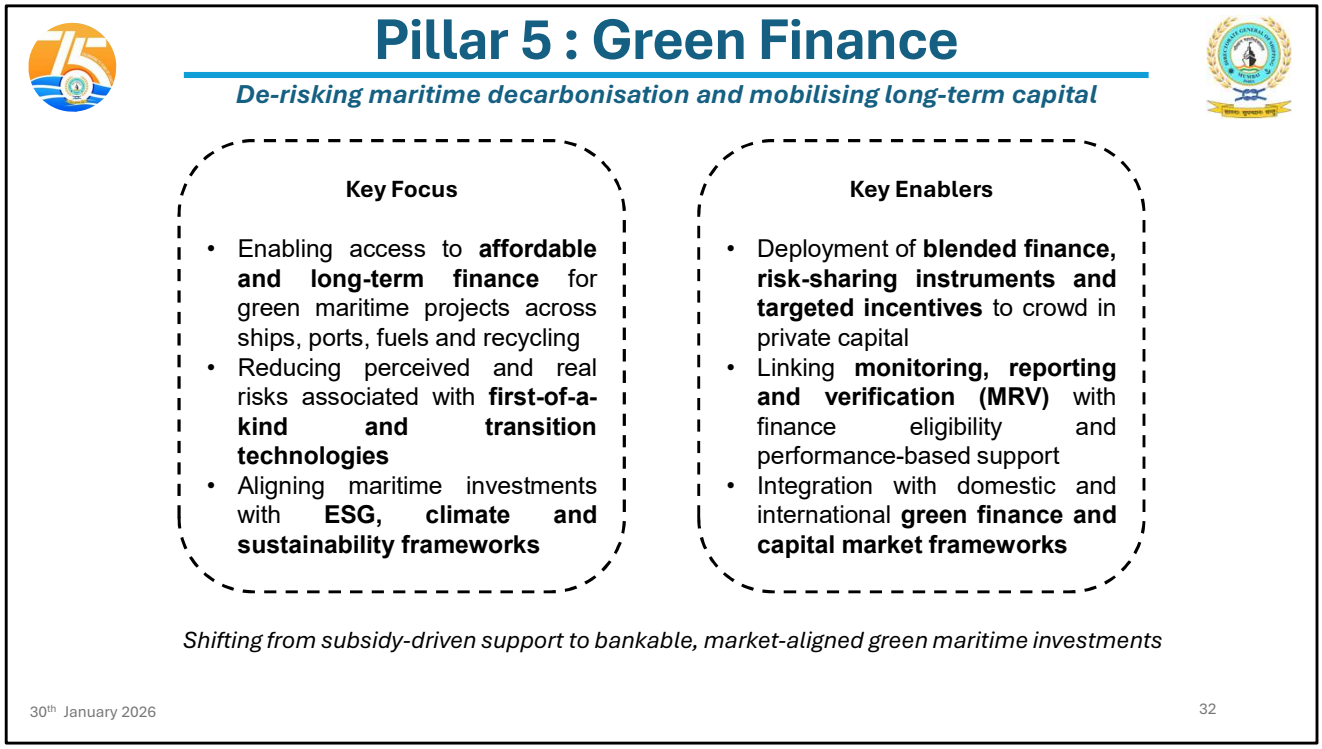
Pillar 4 focuses on **Green Ship Recycling**, which aims to transform ship recycling in India from a purely end-of-life activity into a **safe, environmentally sound and circular economic sector**. The emphasis here is not only compliance, but also positioning India as a **global leader in responsible ship recycling practices**.

The primary focus of this pillar is to ensure that the recycling of end-of-life vessels is conducted in a **safe and environmentally sound manner**, fully aligned with the **Hong Kong Convention** requirements. This includes strengthening **worker safety standards, environmental protection measures and structured material recovery processes** across recycling yards. Another key objective is to embed ship recycling within the **circular economy framework**, enabling efficient reuse of steel and other materials, and creating stronger linkages with the domestic green steel and manufacturing ecosystem.

On the enabler side, the pillar stresses **mandatory compliance mechanisms**, especially the implementation of **Inventory of Hazardous Materials (IHM)** and adoption of approved recycling procedures. It also introduces the concept of **digital transparency**, where monitoring, reporting and traceability systems are used to track vessels and recycling activities in real time, thereby improving credibility and international acceptance.

Further, the policy calls for **phased modernisation of ship recycling yards**, which includes improved waste management systems, upgraded safety infrastructure and environmentally compliant facilities.

Overall, this pillar seeks to reposition ship recycling as a **sustainability and industrial strength for India**, ensuring that economic value, environmental responsibility and worker welfare progress together rather than treating recycling merely as disposal.



NGSP Pillar 5: Green Finance

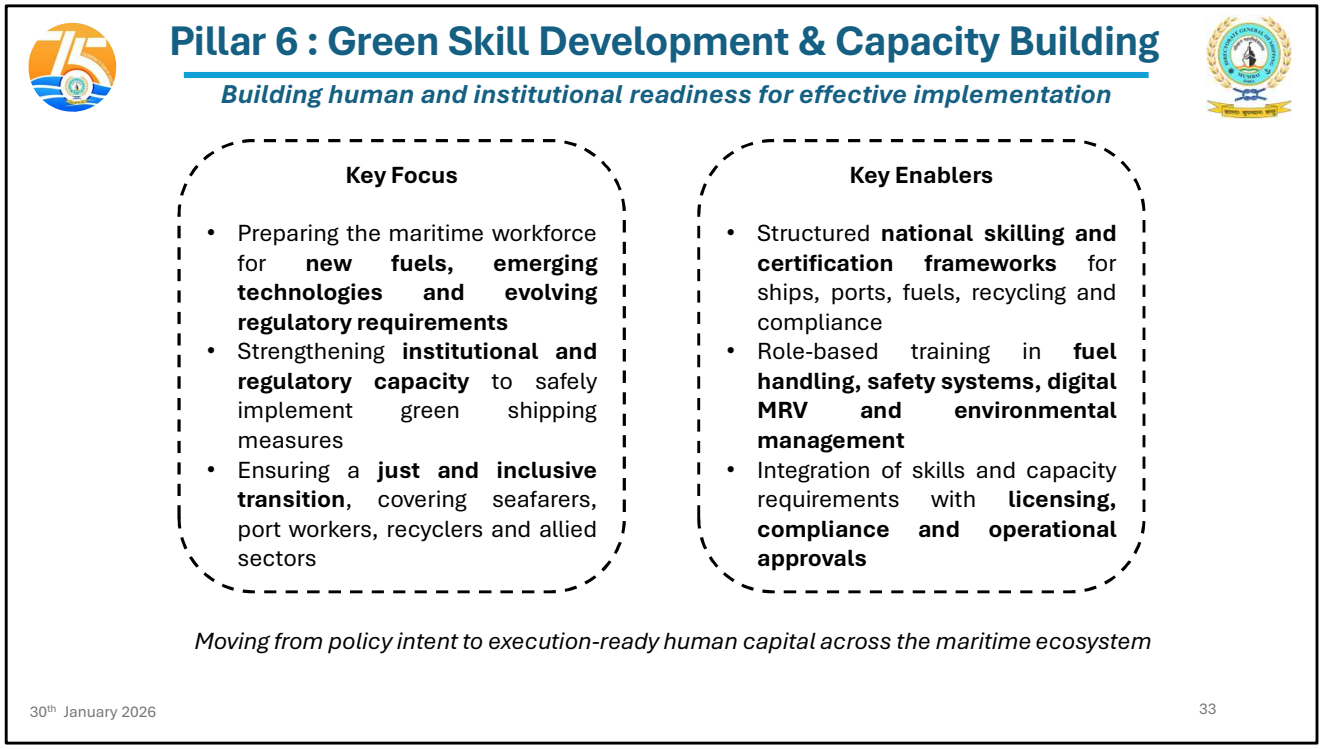
Pillar 5 deals with **Green Finance**, which is essentially the financial backbone of the entire green maritime transition. While the earlier pillars focus on ships, ports, fuels and recycling, this pillar ensures that **adequate and affordable capital is available** to actually implement those transitions at scale.

The core focus here is to **enable access to long-term and affordable finance** for green maritime projects across ships, ports, alternative fuels and recycling infrastructure. The pillar recognises that many decarbonisation technologies are still **first-of-a-kind or transition technologies**, which carry higher perceived and real risks for investors and lenders. Therefore, a key objective is to **reduce these risks** and make such projects bankable rather than subsidy-dependent. Another important aspect is aligning maritime investments with **ESG, climate and sustainability frameworks**, ensuring that funding flows are consistent with both national and international green investment norms.

On the enabler side, the pillar promotes the **deployment of blended finance mechanisms**, risk-sharing instruments and targeted incentives to crowd in private sector capital instead of relying solely on public funding. It also links **Monitoring, Reporting and Verification (MRV) systems** with financial eligibility, meaning that access to incentives or concessional finance is tied to measurable environmental performance and transparency.

Additionally, this pillar emphasises **integration with domestic and international green finance markets**, including capital market instruments such as green bonds and sustainability-linked financing frameworks.

Overall, the intent of this pillar is to **shift the maritime sector from subsidy-driven support towards bankable, market-aligned green investments**, creating a self-sustaining financial ecosystem that can support long-term decarbonisation.



NGSP Pillar 6: Green Skill Development & Capacity Building

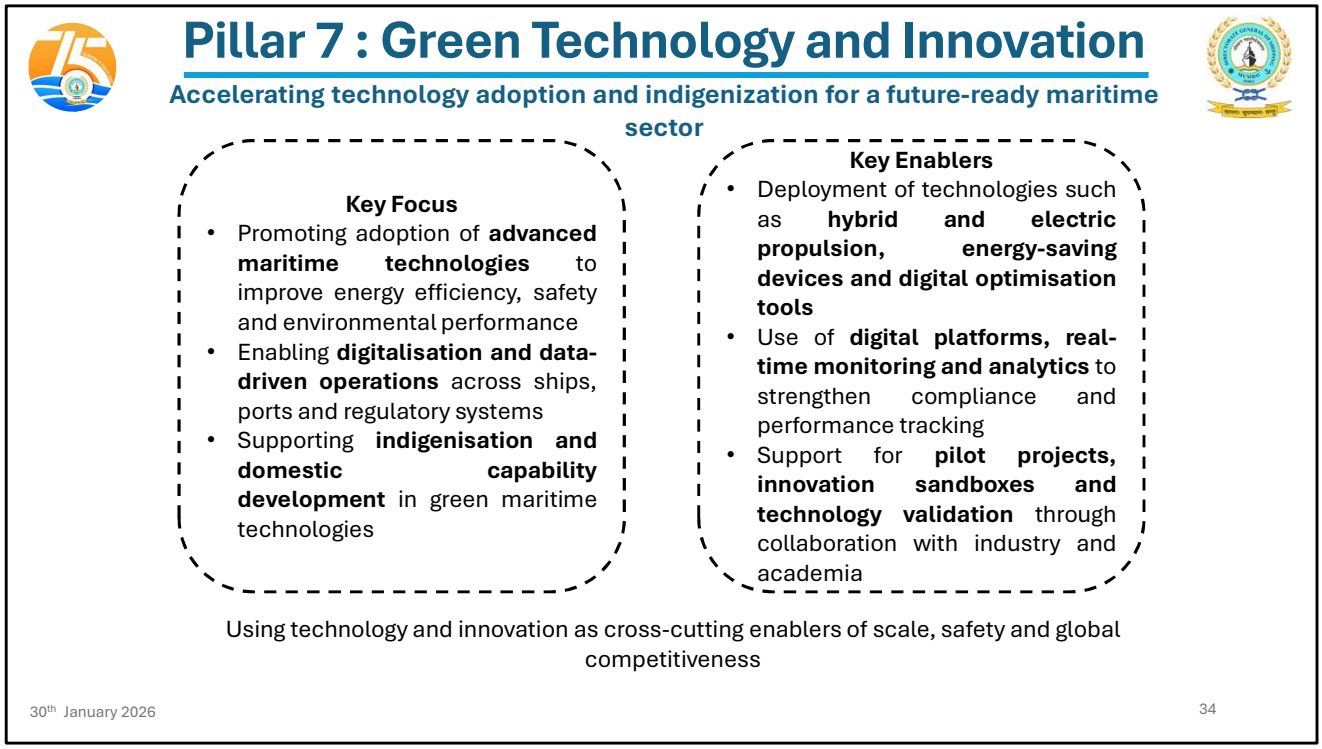
Pillar 6 focuses on the **human and institutional dimension** of the green maritime transition. While earlier pillars deal with infrastructure, finance and technology, this pillar recognises that none of those can be effectively implemented unless the **workforce and regulatory institutions are adequately prepared**.

The primary focus is on **preparing the maritime workforce** for the shift towards new fuels, emerging technologies and evolving regulatory requirements. This includes seafarers, port workers, shipyard personnel, recyclers and allied maritime service providers. Alongside workforce readiness, the pillar also emphasises **strengthening institutional and regulatory capacity** so that authorities are able to safely design, implement and monitor green shipping measures. Another important aspect is ensuring a **just and inclusive transition**, meaning that skill upgrades and reskilling opportunities are available across all segments of the maritime ecosystem, preventing displacement and promoting equitable growth.

From an enabler perspective, the pillar calls for **structured national skilling and certification frameworks** that cover ships, ports, fuels, recycling and compliance functions. It also promotes **role-based specialised training** in areas such as alternative fuel handling, onboard and port-side safety systems, digital Monitoring-Reporting-Verification (MRV) platforms and environmental management practices.

Further, there is an emphasis on **integrating skill requirements with licensing, compliance and operational approvals**, so that capacity building is not treated as an optional activity but becomes embedded within regulatory and operational processes.

In essence, this pillar aims to move the maritime sector **from policy intent to execution-ready human capital**, ensuring that India's green maritime ambitions are supported by a trained, certified and institutionally capable ecosystem rather than just physical infrastructure or financial incentives.



NGSP Pillar 7: Green Technology and Innovation

Pillar 7 acts as the **cross-cutting enabler** for all other transition pillars by focusing on technology adoption, innovation and indigenisation. The intent here is not only to import or adopt global solutions, but to **build domestic capability and long-term technological self-reliance** in green maritime systems.

The key focus under this pillar is threefold.

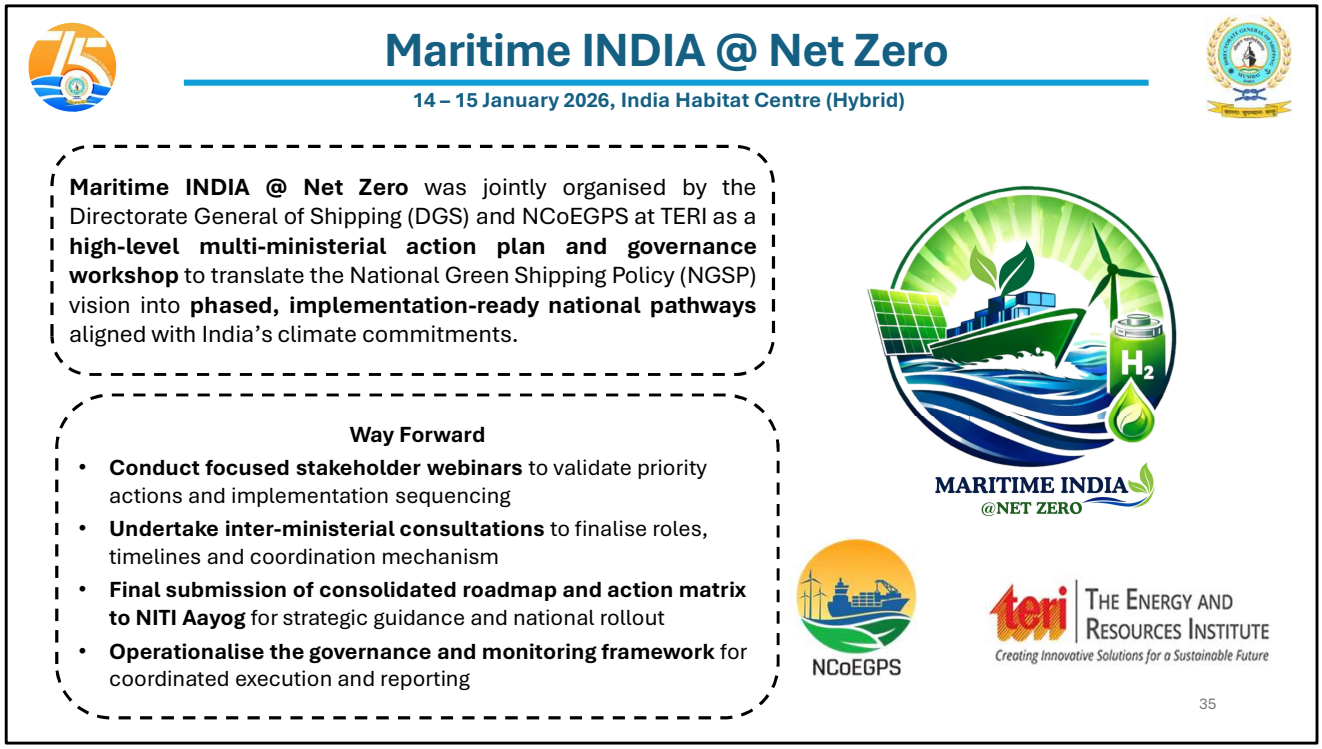
First, it promotes the **adoption of advanced maritime technologies** that directly improve energy efficiency, operational safety and environmental performance of vessels and port infrastructure.
Second, it emphasises **digitalisation and data-driven operations** across ships, ports and regulatory systems — moving from manual or fragmented processes towards integrated digital platforms.
Third, it highlights **indigenisation and domestic capability development**, ensuring that India gradually develops its own manufacturing, design and R&D strengths in green maritime technologies rather than remaining dependent on external suppliers.

From an implementation perspective, the key enablers include the **deployment of hybrid and electric propulsion systems, energy-saving devices and digital optimisation tools** that can

be applied both in new builds and retrofits. There is also a strong push towards **digital platforms, real-time monitoring and analytics**, which strengthen compliance, performance tracking and decision-making for both operators and regulators.

Another important component is the creation of **pilot projects, innovation sandboxes and technology validation mechanisms**. These allow new solutions to be tested in controlled environments before large-scale deployment, while encouraging collaboration between industry, academia and research institutions.

Overall, this pillar positions **technology and innovation as force multipliers** — enabling scale, safety, competitiveness and global alignment of the Indian maritime sector, rather than treating technology merely as a supporting tool.



Maritime INDIA @ Net Zero

This slide sets the overall context of the *Maritime INDIA @ Net Zero* initiative, which was conducted on **14–15 January 2026 at India Habitat Centre in hybrid mode**. The workshop was **jointly organised by the Directorate General of Shipping and NCoEGPS at TERI**, and it was designed not merely as a conference but as a **high-level, multi-ministerial action and governance platform**.

The primary objective of the workshop was to **translate the National Green Shipping Policy vision into phased, implementation-ready national pathways**. In other words, the focus was on moving from policy intent to actionable roadmaps aligned with **India's broader climate and sustainability commitments** rather than remaining at a conceptual discussion stage.

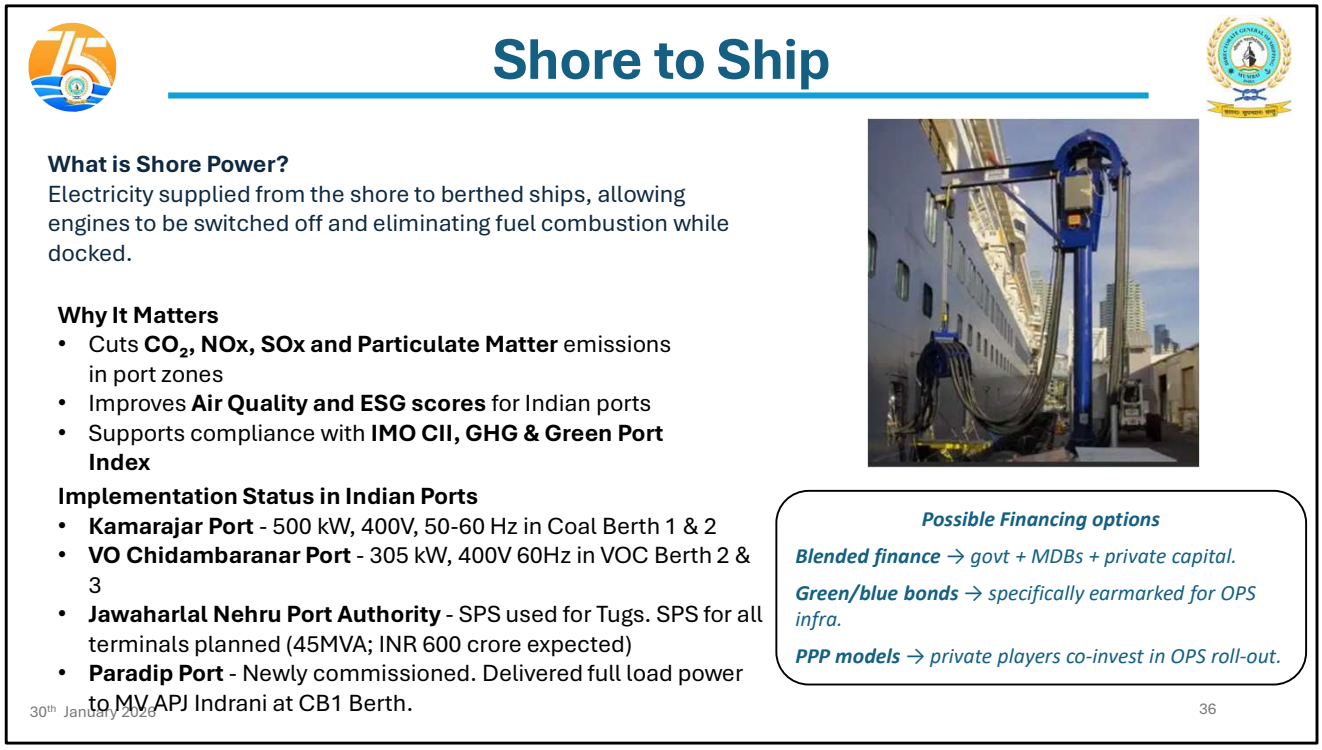
A key strength of the workshop was the **diversity of participation**. It brought together representatives from multiple ministries, regulatory bodies, ports, shipping companies, fuel providers, financial institutions, recycling stakeholders and international partners. This ensured that discussions covered the **entire maritime value chain — ships, ports, fuels, recycling, finance and international collaboration** — instead of addressing them in isolation.

The workshop therefore functioned as a **coordination and convergence mechanism**,

enabling different stakeholders to align priorities, identify gaps and accelerate India's transition toward a **sustainable and low-carbon maritime ecosystem**. It marked a shift from fragmented green initiatives toward a **structured and nationally coordinated decarbonisation pathway** for the maritime sector.

Moving to the **Way Forward**, the next steps are clearly sequential and execution-oriented:
First, the immediate priority is to **distil the workshop outcomes into session-wise action points and develop a consolidated implementation matrix**. This converts discussions into a structured planning tool.
Second, **focused stakeholder webinars** will be conducted to validate priorities, refine sequencing and ensure alignment before formal adoption.
Third, **inter-ministerial consultations** will be undertaken to finalise roles, timelines and coordination mechanisms. This step is critical to avoid siloed execution and ensure accountability.
Fourth, the **consolidated roadmap and action matrix will be submitted to NITI Aayog** for strategic guidance and national-level alignment, effectively linking maritime decarbonisation with broader national policy directions.
Finally, the emphasis shifts to **operationalising a governance and monitoring framework**, ensuring that implementation is measurable, coordinated and continuously reported rather than remaining policy intent on paper.

Overall, this slide reflects a transition from **dialogue to structured execution**, supported by institutional mechanisms and defined next steps.



Shore-to-Ship Power (OPS)

Shore-to-Ship Power (Onshore Power Supply – OPS), commonly referred to as *cold ironing*, enables vessels to switch off their diesel auxiliary engines and draw electricity directly from port infrastructure while berthed. This significantly reduces emissions of **CO_2, NO_x, SO_x and Particulate Matter**, addressing one of the most concentrated sources of pollution in port cities.

OPS is central to India's maritime decarbonisation strategy under *Harit Sagar*, supporting compliance with IMO's CII and aligning with national climate commitments under the Panchamrit and Net Zero 2070 vision. Beyond emissions reduction, OPS improves **ESG scores, port sustainability ratings**, and promotes health benefits for coastal communities.

Implementation Progress in Indian Ports

Kamarajar Port (Ennore) – 2024 Commissioning
Commissioned OPS facility in **November 2024**, at a cost of **₹20.5 crore**.
Capacity: **500 kW, 400V, 50–60 Hz**, serving **Coal Berths 1 & 2**
Developed under **Harit Sagar Guidelines**, promoting green port practices.
KPL is actively encouraging vessels to retrofit and connect, supported by trials and

coordination with Paradip Port for a **Green Shipping Corridor (Paradip–Ennore)**.

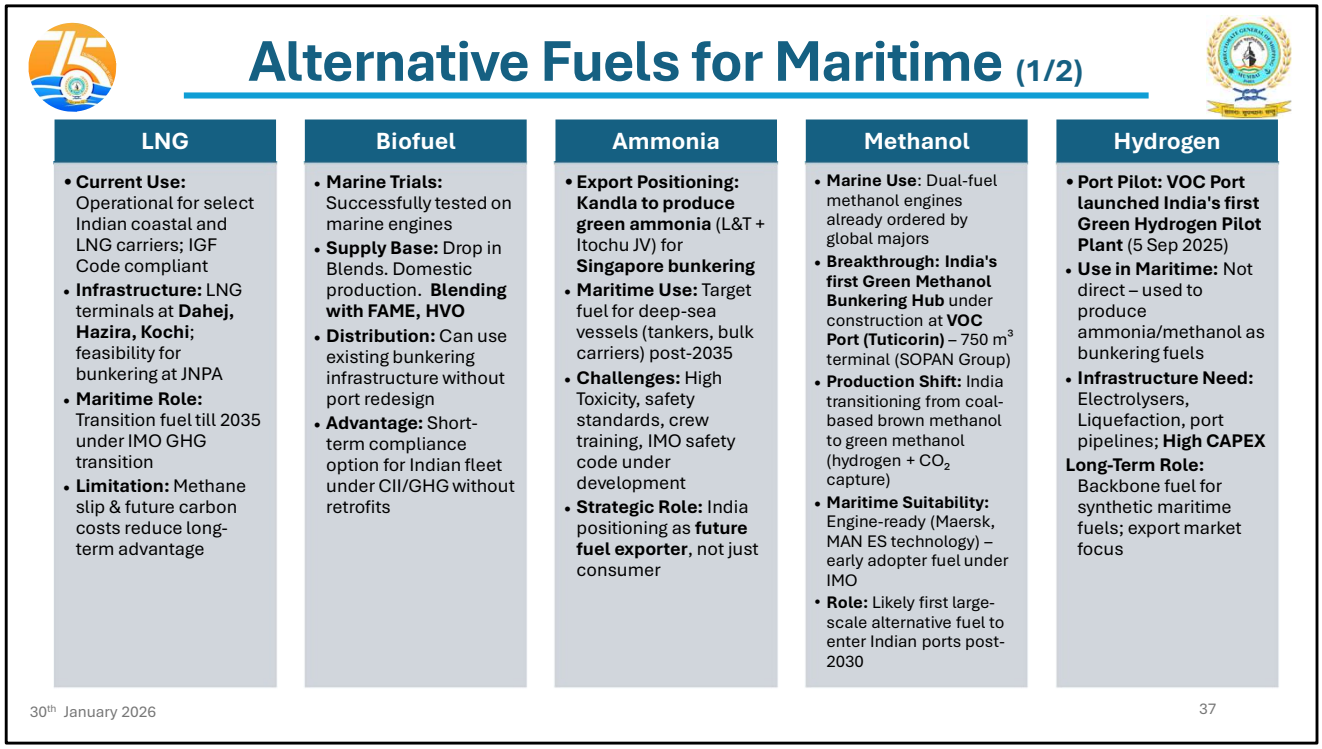
VO Chidambaranar Port (Tuticorin)
OPS installed at **Berths 2 & 3** (305 kW units), supporting auxiliary load supply and positioning VOC as a green maritime pilot port.

Jawaharlal Nehru Port Authority (JNPA)
Currently uses OPS for port tugs.
₹600 crore, 45 MVA national terminal OPS plan under formulation to become India's largest cold ironing hub.

Paradip Port –
Newly commissioned.
Delivered full load power to MV APJ Indrani at CB1 Berth.

Challenges & Opportunities
While ships are currently hesitant due to retrofitting and administrative costs, OPS offers long-term operational benefits:
- Reduced fuel consumption and engine wear
- Lower carbon intensity scores (CII/GHG Index compliance)
- Eligibility for global green incentives and carbon credits

Financing the Transition
- **Blended Finance** – Government + MDBs + private capital
- **Green/Blue Bonds** – Infrastructure-specific debt mechanisms
- **PPP Models** – Terminal operators & energy companies co-investing



Alternative Fuels for Maritime

India's maritime fuel transition will not be "one fuel for all," but a **sequenced multi-fuel pathway** that matches IMO's Net-Zero Framework and the Green Fuel Intensity (GFI) curve. Near-term compliance will lean on drop-in **biofuels** and limited **LNG**; the first scalable alternative expected in Indian ports is **green methanol**; **ammonia** follows for deep-sea ships post-2035; and **green hydrogen** underpins methanol/ammonia production and long-term export play. The strategy links three levers: (i) **domestic fuel manufacture**, (ii) **bunkering hubs & safety codes**, and (iii) **demand signals** created by IMO pricing (RUs) and India's NGSP/Harit Sagar policies.

1) LNG - Transitional Fuel

Current role : Deployed on select Indian coastal/LNG carriers; compliant under IGF Code.
Infrastructure : Import/LNG terminals at **Dahej, Hazira, Kochi**; feasibility for marine bunkering studied at **Kochi & JNPA**.
Why transitional : LNG reduces CO_2 but faces **methane-slip.**
Methane slip is the escape of unburned methane gas into the atmosphere, typically from engines running on natural gas, where incomplete combustion occurs. This phenomenon is a significant concern because methane is a potent greenhouse gas, with a much higher global warming potential than carbon dioxide over the short term. It can occur in a wide range of

applications, including marine engines, stationary engines, and across the entire natural gas supply chain

2) Biofuels - Immediate, Drop-in Compliance
Technical fit : Blends (B20–B100) run on existing marine engines; trials by **Indian Navy & fleet operators** demonstrate operational feasibility.
Supply base : Domestic streams from **ethanol, biodiesel, HVO , FAME** under the National Biofuel Policy; strongest near-term pathway to lower well-to-wake GHG without retrofits.
Ports : Minimal infrastructure change. can use current bunkering networks with sustainability certification.
Role : Near-term CII/GFI relief for Indian fleets; ideal for tugs, OSVs, coastal and inland segments while methanol/ammonia scale up.

3) Methanol
Breakthrough project : India's first Green Methanol Bunkering & Refuelling Hub is **under construction at VOC Port, Tuticorin - 750 m³ terminal (SOPAN Group)**. This is the country's first dedicated maritime methanol node and a key plank of the **Coastal Green Shipping Corridor (Kandla–Tuticorin)**.
Why methanol first : Dual-fuel engines are commercially available (MAN ES, widely ordered by global liners), handling is simpler than ammonia/hydrogen, and safety codes are mature.
Production shift : India must pivot from **coal-based "brown" methanol** to **green methanol** (renewable H_2 + captured CO_2). VOC's **port-based green hydrogen pilot** is a feeder step.
Role & Timing : Likely the **first large-scale alternative marine fuel** to appear regularly in Indian ports **post-2030**, enabling ships to meet tightening GFI thresholds at competitive abatement cost.

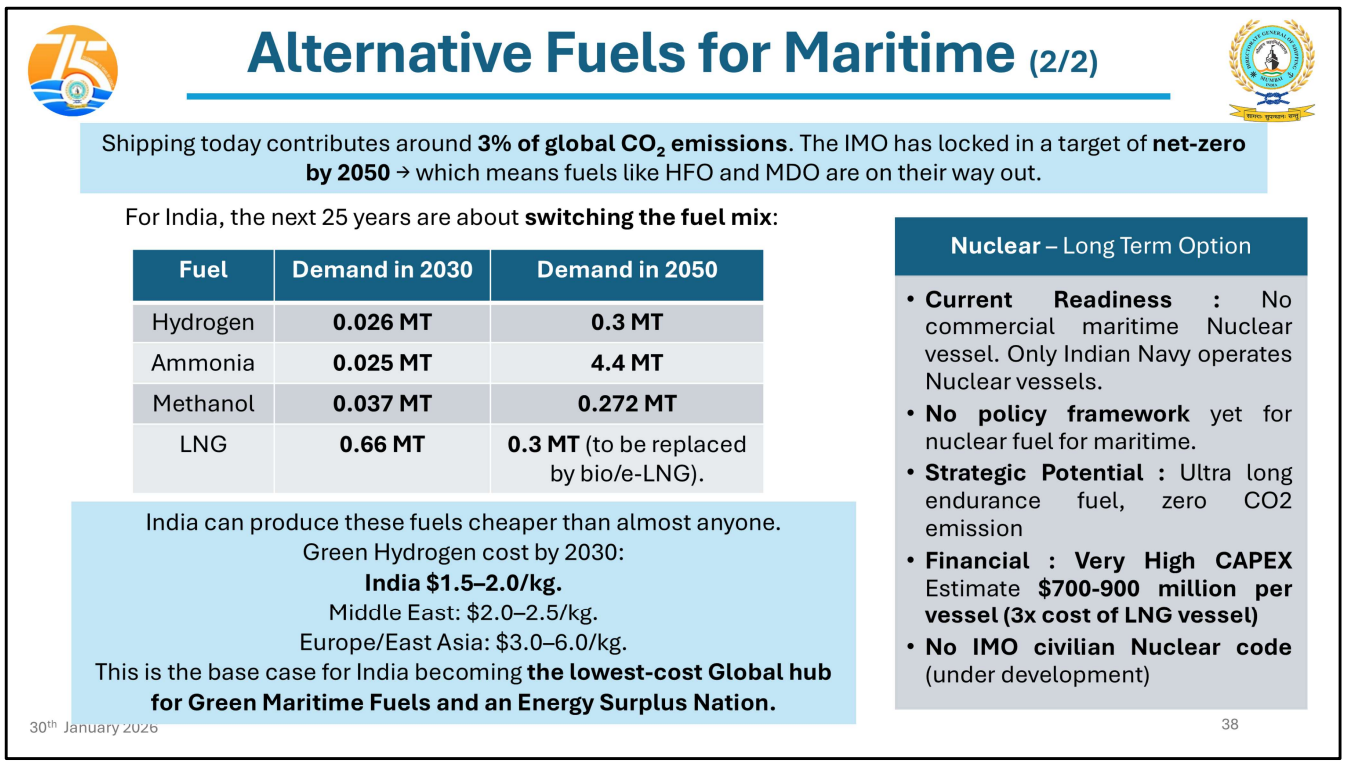
4) Ammonia (Green Ammonia)
Strategic positioning : Kandla is being developed by **L&T Energy GreenTech with ITOCHU** to produce **green ammonia (~300 KTPA)** with **offtake for bunkering in Singapore**. ITOCHU is also developing a **5,000 m³ ammonia bunkering vessel (2027) ,** evidence of real demand creation in the region.
Maritime use : Target fuel for deep-sea tankers/bulkers **post-2035**, once IMO's dedicated **safety code** and crew-training standards are finalised.
Challenges : High toxicity handling, new port safety zones, emergency response, and specialised storage/transfer systems.
India's role : Strong **export economics** (renewables + electrolyser scale). India can be a **fuel supplier to Asian bunkering hubs** while gradually enabling domestic

corridors.

5) Hydrogen (Green H_2)
Port pilot : VOC Port commissioned **India's first port-based Green Hydrogen pilot (10 Nm^3/hr)** on **5 Sep 2025**; foundation stone also laid for the **750 m^3 methanol facility**.
Maritime : Direct shipboard hydrogen (LH_2 at −253 °C or high-pressure gas) is niche in the near term; the **primary role is upstream**, as feedstock for **green methanol and green ammonia**.
Infrastructure : Electrolysers, renewable power, desalination, compression/liquefaction and pipelines. H**igh CAPEX** but central to India's export ambition under the **National Green Hydrogen Mission**.
Role : Backbone energy for synthetic maritime fuels; supports India's positioning as a **net green energy exporter**.

Cross-cutting Enablers India Must Move On
Standards & Safety : Fast-track Indian codes (storage, transfer, firefighting, crew competence) harmonised with IMO/IGF; publish methanol and ammonia bunkering SOPs for pilot ports.
Fuel Certification : Well-to-wake sustainability verification to claim **GFI reductions** and generate **Surplus Units (SU)** under the IMO scheme.
Finance : Use **green/blue bonds**, viability-gap/interest subvention, and **PPP** to de-risk first terminals; align with **NGSP** and **Harit Sagar** incentives.
Domestic Manufacture : Anchor **H_2, CO_2 capture, and e-fuel plants** near high-renewables clusters and port industrial estates to reduce delivered fuel cost.
Early-Mover Demand : Government-linked charters (PSU cargoes, coastal programs) to specify **biofuel/methanol blends** from FY26–27 to seed predictable offtake.

How This Meets IMO GFI Trajectory
2028–2030: Biofuels and limited LNG provide immediate GFI relief; pilots for methanol bunkering (VOC) mature.
2030–2035: Methanol scales in Indian ports; India begins **green ammonia exports**; OPS and efficiency measures cut berth emissions.
Post-2035: Ammonia fuels deep-sea segments; hydrogen-based derivatives dominate; India emerges as a **regional bunker/export hub** for future fuels.



Green Fuel Transition

The maritime sector, responsible for **nearly 3 percent of global CO_2 emissions**, is entering a decisive phase of energy transition to align with the IMO's Net Zero 2050 ambition. This transition demands a structured exit from conventional fuels such as HFO and MDO, and an accelerated shift towards a diversified portfolio of green fuels.

For India, the coming 25 years represent a carefully sequenced fuel substitution strategy. By 2030, LNG is expected to dominate with an estimated demand of **0.66 MT**, before gradually transitioning to bio/e-LNG. Simultaneously, emerging fuels such as hydrogen, ammonia and methanol will scale significantly, with **hydrogen rising from 0.026 MT to 0.3 MT**, and **ammonia from 0.025 MT to 4.4 MT by 2050** , reflecting both global decarbonization trends and domestic industrial capability.

India's strategic advantage lies in fuel economics. By 2030, **green hydrogen production costs in India are projected at $1.5–2.0/kg**, far below Europe and East Asia. This cost leadership positions India to become a global hub for green maritime fuels, enabling both domestic fleet transition and export opportunities.

Looking further ahead, nuclear marine propulsion is emerging as a potential long-term

option for deep-sea and high-endurance operations. With unmatched energy density and zero operational emissions, nuclear could complement the green fuel mix for specific vessel categories — subject to future international regulatory frameworks on safety, liability and waste management.

Therefore, India's fuel transition is not only a compliance response but a strategic opportunity — to secure energy autonomy, build green shipping supply chains and lead the global maritime decarbonisation narrative.

Nuclear Propulsion - Long-Term Strategic Prospect for India

Nuclear propulsion remains a long-term, exploratory option for maritime decarbonisation, with *no commercial nuclear vessels currently operating under the Indian flag*. India's only experience with nuclear-powered ships lies within the defence sector, through the Indian Navy's nuclear submarines (INS Arihant class), which demonstrates indigenous capability in naval nuclear engineering. However, there is **no existing policy or regulatory framework** under DG Shipping or MoPSW for the civilian use of nuclear fuel at sea. While nuclear propulsion offers unmatched strategic potential- **ultra-long endurance and near-zero CO_2 emissions** without the need for refuelling. it comes with significant barriers. The **capital expenditure is extremely high**, estimated at **USD 700–900 million per vessel**, almost *three times the cost of LNG-powered ships*, making commercial viability a major concern. Additionally, **IMO has not yet finalised a civilian nuclear safety code**, with guidelines for Small Modular Reactors (SMRs) still under development. For India, nuclear remains a speculative option beyond 2040, contingent upon global regulatory consensus, public acceptance, liability legislation, and strong international safeguards.

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 (°C)	595	464	630	560
Flashpoint (°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

Data Source : MARIKO (2022) Ammonia as ship fuel, DLR (2023) PtX Fuels in Shipping

30th January 2026

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Alternative Fuels Properties Comparison

This slide provides a **technical comparison of four key alternate marine fuels — E-LNG, Methanol, Ammonia and Hydrogen — across storage, safety and energy performance parameters.**
The purpose here is to highlight that **each fuel pathway comes with distinct trade-offs**, and there is no single universal solution.

Starting with **physical storage properties**,
E-LNG requires cryogenic storage at **–162°C**, ammonia at **–33°C**, while methanol can remain liquid at near-ambient conditions up to about **65°C**, making it comparatively easier from a storage handling perspective.
Hydrogen presents the most demanding storage requirement — either **compressed at very high pressures above 250 bar** or **liquefied at –253°C**, which significantly increases infrastructure complexity.

In terms of **fuel tank size for equivalent energy compared to Marine Diesel Oil**, E-LNG requires about **1.8 times** the volume, methanol **2.5 times**, ammonia **3 times**, and hydrogen between **5 to 7 times**.
This directly affects vessel design, cargo space availability and retrofitting feasibility.

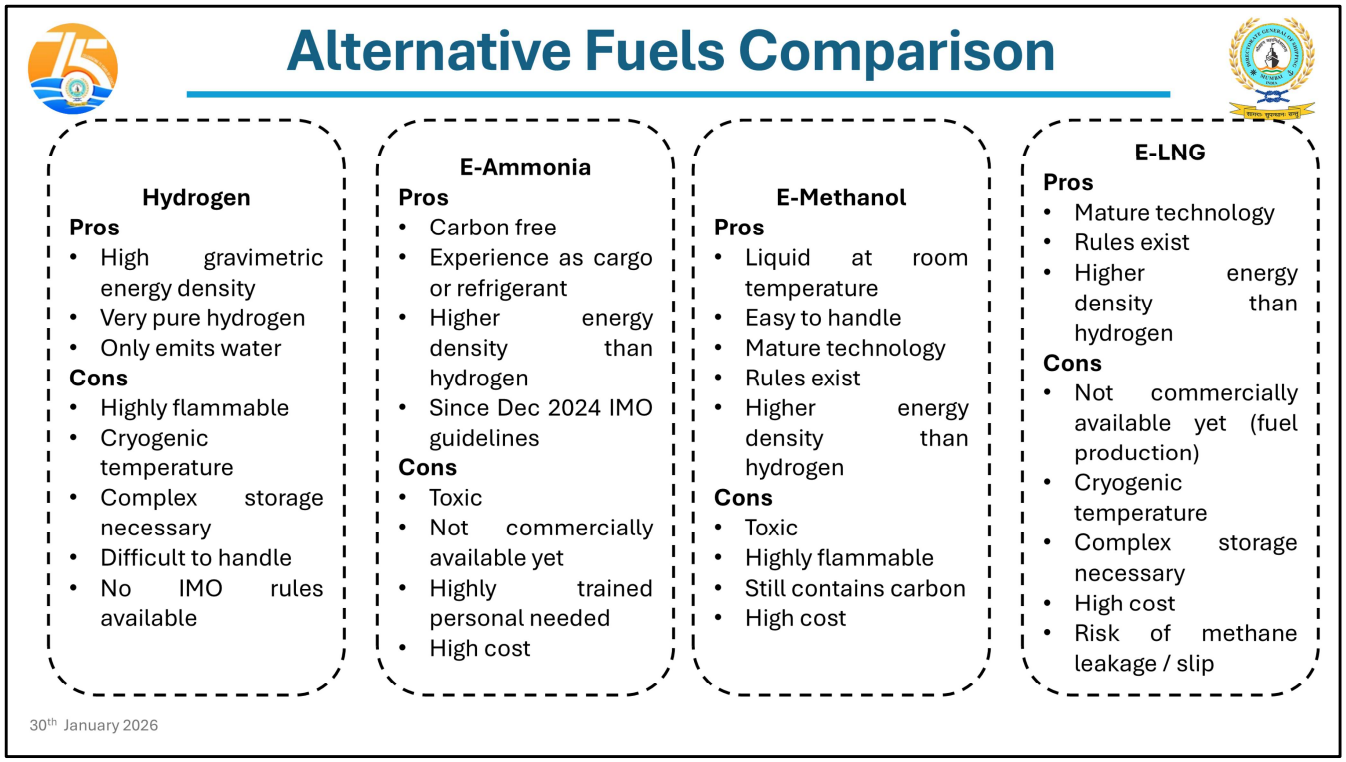
Looking at **flammability limits**, hydrogen has the **widest range at 4% to 75%**, indicating higher ignition risk if leakage occurs. Methanol and ammonia fall in moderate ranges, while methane in LNG is narrower but still significant. This underlines the need for **fuel-specific safety systems and ventilation design**.

For **ignition temperatures**, ammonia is the highest at **630°C**, making it harder to ignite unintentionally, while methanol is lower at **464°C**, indicating relatively higher susceptibility.
Flashpoint values further reinforce safety considerations — ammonia at **132°C** is comparatively safer, methanol at **12°C** is flammable at ambient conditions, while LNG has an extremely low flashpoint of **–188°C**. Hydrogen typically does not have a conventional flashpoint due to its gaseous nature.

From an **energy perspective**, hydrogen shows the **highest lower calorific value at 120 MJ/kg**, but because of its very low density, its **energy per litre is the lowest at 8.5 MJ/L**.
E-LNG provides a balanced profile with **50 MJ/kg LCV and 21.2 MJ/L energy density**, making it volumetrically more efficient. Methanol and ammonia fall in the mid-range but require larger storage volumes.

Overall, this comparison demonstrates that **fuel choice is not purely an emissions decision — it is a combined assessment of storage feasibility, safety characteristics, vessel design implications and energy efficiency.**

Data Sources for this comparison are MARIKO (2022) – *Ammonia as Ship Fuel* and DLR (2023) – *PtX Fuels in Shipping*.



Alternative Fuels Comparison (Pros & Cons Slide)

A **qualitative comparison of four major alternate marine fuels — Hydrogen, E-Ammonia, E-Methanol and E-LNG — focusing on operational advantages and practical challenges.**
The intent is to show that fuel transition decisions are **multi-dimensional**, involving safety, maturity, infrastructure readiness, cost and regulatory alignment.

Hydrogen
Hydrogen offers the **highest gravimetric energy density**, meaning per kilogram it carries more energy than any other fuel here. It is also extremely pure and **emits only water during combustion**, making it environmentally attractive from a tailpipe-emission perspective.
However, the operational challenges are significant. Hydrogen is **highly flammable**, requires **cryogenic or very high-pressure storage**, and demands complex tank and piping systems. Handling protocols are stringent, and at present **comprehensive IMO regulatory frameworks are still evolving**, which adds uncertainty for large-scale deployment.

E-Ammonia
E-Ammonia is **carbon-free at point of use** and benefits from existing global experience in handling ammonia as a **cargo and refrigerant**, giving it some industrial familiarity. It also offers **better volumetric energy density than hydrogen**, and IMO guidelines for ammonia as a fuel pathway have begun emerging, improving regulatory clarity.
On the downside, ammonia is **toxic**, requires specialised crew training, and large-scale green ammonia production is **not yet commercially widespread**. Safety infrastructure, detection systems and emergency response capacity are critical, and the overall **cost remains high**.

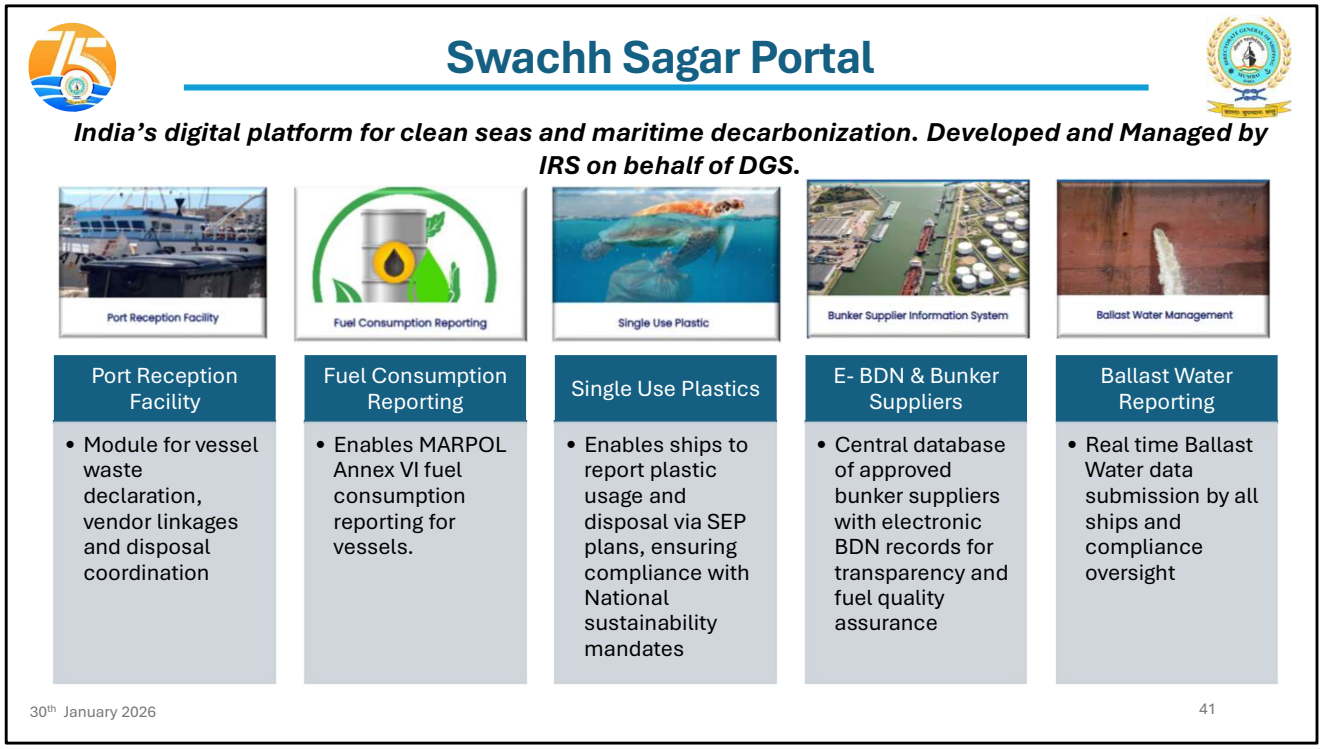
E-Methanol
E-Methanol stands out for being **liquid at near room temperature**, which simplifies storage, bunkering and onboard fuel system design compared to cryogenic fuels. It is **easier to handle**, benefits from **mature engine technologies**, and regulatory rules are already available. Its **energy density is higher than hydrogen**, making it more practical for certain vessel categories.
However, methanol is **toxic and highly flammable**, still **contains carbon in its molecular structure**, and therefore lifecycle emissions depend heavily on the production pathway. Additionally, the **cost of green methanol remains relatively high**.

E-LNG
E-LNG benefits from **technological maturity and existing global LNG infrastructure**, making near-term deployment easier. Rules and classification standards are already well-established, and it provides **better volumetric energy density than hydrogen**, supporting longer voyages without excessive tank space penalties.
The constraints include **continued dependence on cryogenic storage**, **high infrastructure and fuel production costs**, and the risk of **methane slip or leakage**, which can undermine greenhouse gas reduction benefits if not properly controlled. Availability of truly green or synthetic LNG at scale is also still developing.

This comparison reinforces that **no single alternate fuel is universally optimal.** Each option involves a trade-off between **environmental benefit, safety profile, infrastructure readiness, regulatory maturity, cost and vessel suitability.**

Future maritime decarbonisation is therefore likely to follow a **multi-fuel pathway**,

aligned to ship type, voyage profile and regional infrastructure capability rather than a one-fuel transition model.



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

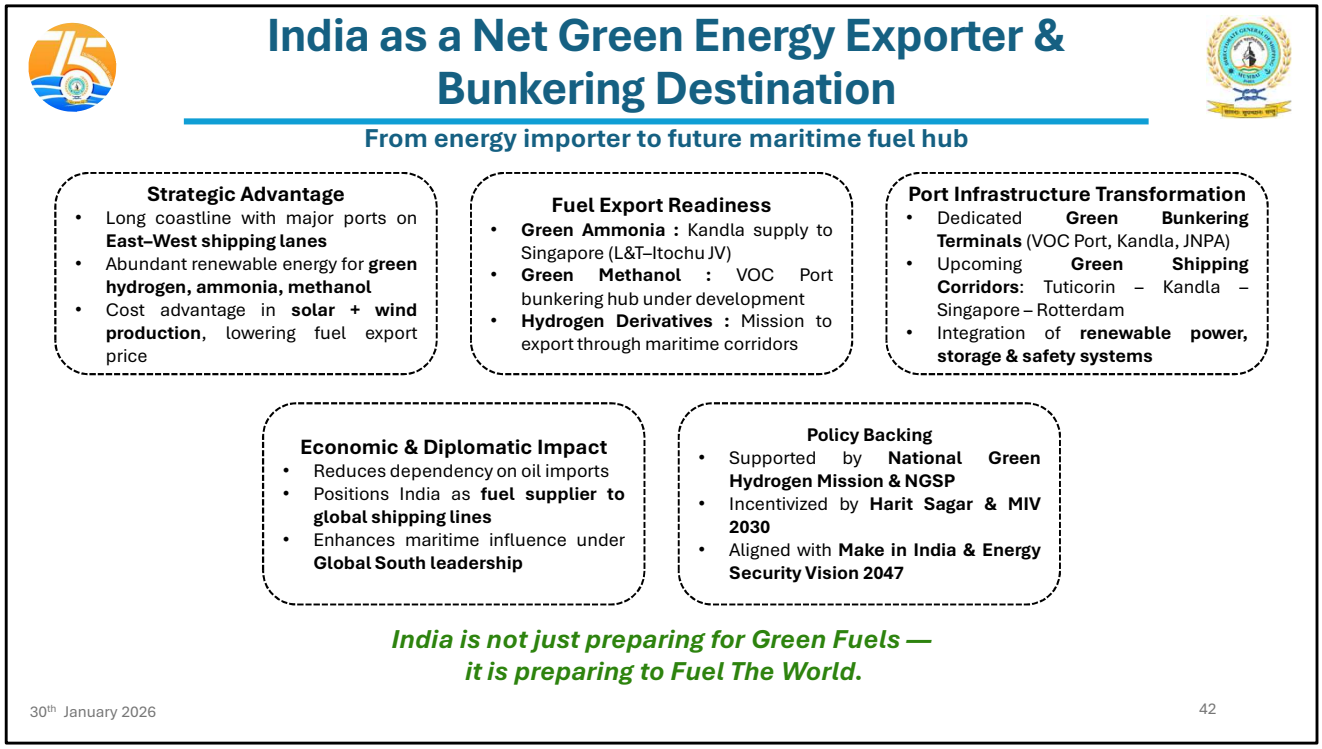
This module creates a national registry of licensed bunker suppliers and mandates issuance of electronic Bunker Delivery Notes (e-BDN) for every fuel transaction. Each e-BDN is time-stamped, digitally signed and serialised, preventing manipulation or use of unregistered suppliers. It improves traceability 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.



India as a Net Green Energy Exporter & Bunkering Destination

India is at the crossroads of a major strategic shift, from being one of the world's largest **importers of fossil fuels** to emerging as a **future global supplier of green maritime fuels** such as **green ammonia, green methanol, and hydrogen derivatives**. This transition is not isolated; it is rooted in domestic policy reforms, renewable energy leadership, and a geopolitical push for *energy independence by 2047* and *Net Zero by 2070*.

1. Strategic Maritime Advantage

With its extensive coastline and central position on **major East–West shipping corridors**, India is geographically primed to become a bunkering and refueling hub for global shipping. India has one of the world's largest solar and wind power expansion programmes, which provides a **cost advantage in producing green fuels**, making exports competitive.

2. Fuel Export Capacity in Motion

India is already laying the groundwork for maritime fuel exports:

Green Ammonia (Export-Oriented Production)

At **Kandla**, a JV between **L&T and Itochu (Japan)** is setting up a large-scale green ammonia plant (~300 KTPA), with committed offtake to Singapore's bunkering market.

Green Methanol (First Bunkering Hub in India)
At **VOC Port, Tuticorin**, construction of a **750 m³ green methanol bunkering terminal** is underway (SOPAN Group). This is India's first dedicated alternative fuel facility for shipping.
Hydrogen Derivatives for Maritime Corridors
Under the **National Green Hydrogen Mission**, India targets **5 MMT green hydrogen** by 2030, largely to convert into **exportable derivatives** (ammonia/methanol) through maritime corridors like **Kandla–Singapore**, **Tuticorin–Rotterdam**, etc.

3. Port Infrastructure Transformation
Ports are evolving from cargo hubs to **energy export platforms**:
Dedicated **green fuel terminals** at **VOC Port, Kandla, JNPA**
Coastal **Green Shipping Corridors** being piloted (Tuticorin–Kandla–Singapore–Rotterdam)
Integration of **renewable power, desalination, safety systems**, and bunkering pipelines into port estates under **Harit Sagar Guidelines** and **NGSP**

4. Economic & Diplomatic Impact
India's leadership in green fuel exports has a threefold strategic impact:
Reduces dependence on crude oil imports (currently 85% import-driven energy market)
Positions India as a fuel supplier to global shipping lines transitioning under IMO Net-Zero framework
Strengthens India's diplomatic role as a provider of clean energy to the **Global South**, reinforcing leadership at forums such as OPEC, G20, and COP

5. Strong Policy Backing
Backed by **National Green Hydrogen Mission** and **Draft National Green Shipping Policy (NGSP)**
Incentives via **Harit Sagar**, **Maritime India Vision 2030**, and **Make in India–Energy Security 2047**
PIB statements (July 2025, OPEC Summit):
"India will not only be energy independent by 2047, but will also fuel the world with green energy exports."

Conclusion
India is not simply decarbonizing its ports and ships, it is **building a green energy export economy** around its maritime sector. With methanol bunkering, ammonia

export hubs, and hydrogen corridors already initiated, India is setting the stage to become the **refuelling station of a net-zero maritime world.**

India is not just preparing for Green Fuels…… It is preparing to Fuel the World.

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.

Benefits
- Reduces GHG emissions & pollution.
- Improves air quality in port cities.
- Promotes India's Blue Economy & Green Economy transition.
- Aligns with IMO decarbonization goals & India's Viksit Bharat 2047 vision.

30th January 2026

Green Ports – Driving Sustainable Maritime Growth

"Ports are the beating hearts of global trade, but they are also significant contributors to emissions. The idea of 'Green Ports' is to transform these engines of growth into anchors of sustainability."

The **concept of Green Ports** focuses on designing and operating ports with **minimal environmental impact**. This means integrating **clean energy**, **resource efficiency**, and **circular economy practices** into every aspect of port planning, operation, and logistics.

India has already taken pioneering steps in this direction through several flagship initiatives.

The **Harit Sagar Guidelines**, launched in 2023, provide a **national framework** for green port development, setting out principles for clean energy adoption, pollution control, waste management, and biodiversity protection.

Building upon this, the **National Port Sustainability Council (NPSC)** , **envisaged**, will establish measurable **metrics for emissions, energy use, waste, and community impact**, ensuring that environmental performance becomes a benchmark for all Indian ports.

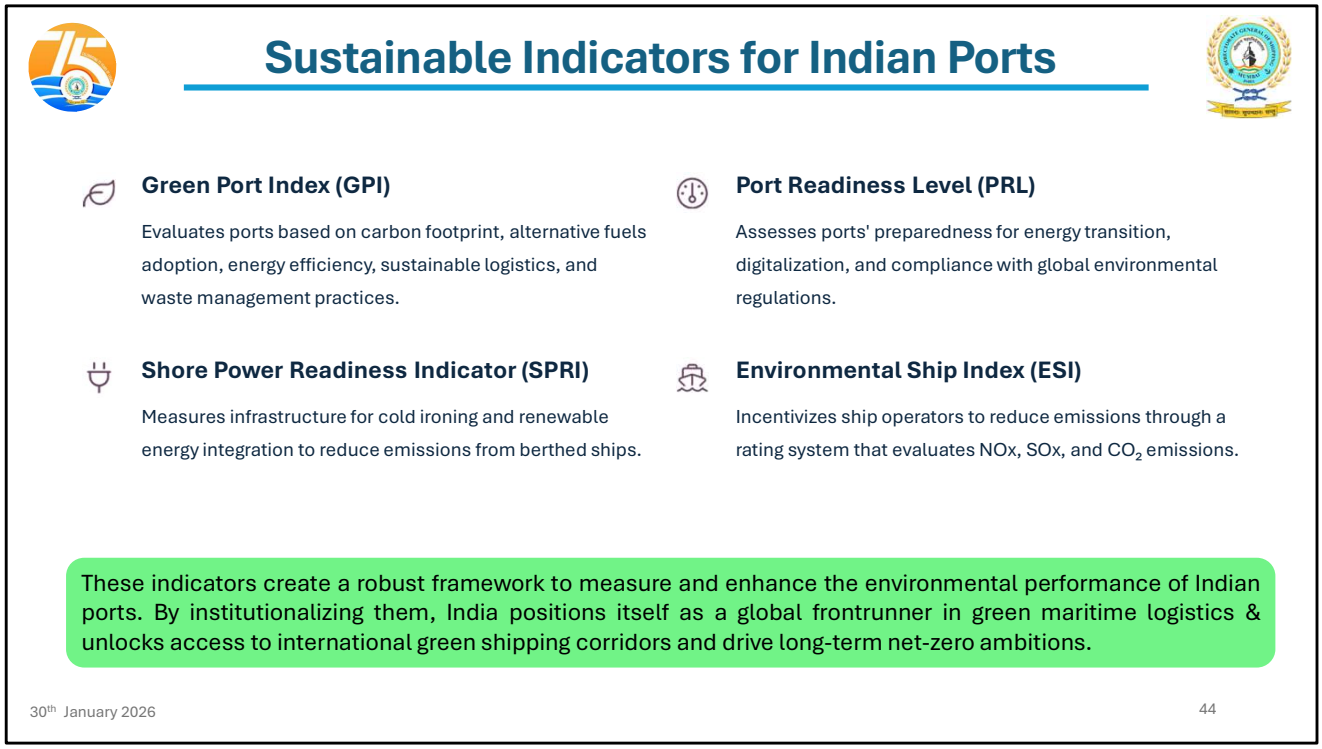
The next major enabler is **Onshore Power Supply (OPS)**, which allows ships at berth to

connect directly to the grid and switch off their auxiliary engines. This single intervention can drastically reduce **CO_2, NOx, and SOx emissions** in port zones, improving air quality and public health in surrounding cities.

Complementing this, the Directorate is driving **Waste and Plastics Management** under **MARPOL Annex V compliance**, ensuring that port reception facilities can handle ship-generated waste and prevent marine pollution.

Together, these efforts yield tangible benefits:
Reduction in greenhouse gas emissions and pollution,
Improved air quality in port-adjacent areas, and
A major boost to India's **Blue and Green Economy transition**.
Importantly, these initiatives are fully aligned with **IMO's decarbonisation goals** and India's long-term national vision , **Viksit Bharat 2047**.

"In essence, Green Ports are not just an environmental necessity — they are the next competitive advantage for India's maritime sector. They signal that economic growth and ecological responsibility can, and must, advance together."



Sustainable Indicators for Indian Ports

To translate the sustainability vision into measurable action, a structured set of indicators has been developed to evaluate and benchmark the environmental and operational performance of Indian ports.

*The first is the **Green Port Index**, which assesses ports on their overall carbon footprint, energy efficiency, use of alternative fuels, and adoption of sustainable logistics and waste management practices. This index provides a clear picture of how each port contributes to reducing emissions and improving environmental stewardship.*

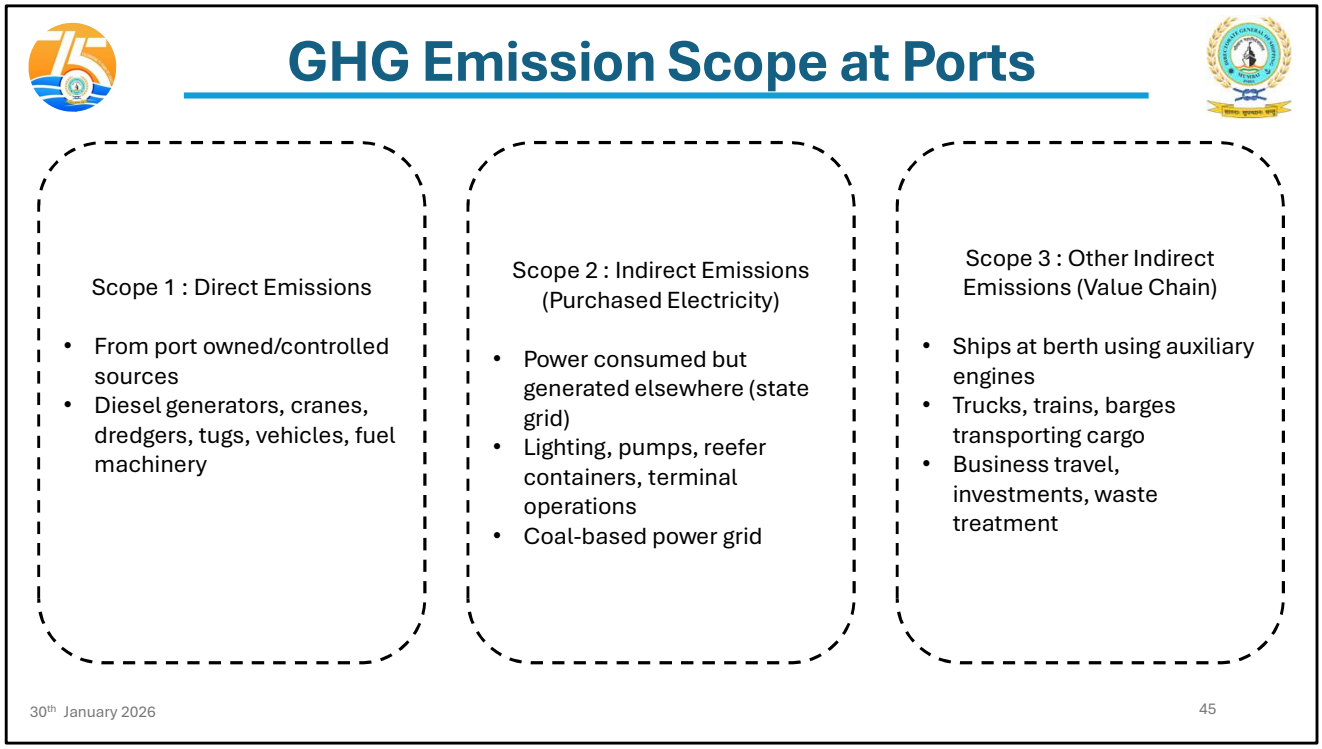
*The **Port Readiness Level**, or PRL, measures how prepared ports are for the transition to cleaner energy systems and digital operations. It evaluates their compliance with global environmental standards and their readiness to adopt emerging technologies.*

*The third parameter is the **Shore Power Readiness Indicator**, which reflects the extent to which ports are equipped with shore-to-ship power infrastructure. This is a crucial enabler in reducing emissions from berthed ships, allowing vessels to draw renewable electricity instead of using onboard auxiliary engines.*

*Finally, the **Environmental Ship Index** encourages ship operators to voluntarily reduce*

emissions by adopting cleaner fuels and technologies. It introduces a transparent rating system that accounts for NOx, SOx, and CO_2 performance, rewarding environmentally responsible operations.

Collectively, these four indicators form a comprehensive framework for driving measurable sustainability across the Indian port ecosystem. By institutionalising these benchmarks, India is positioning its ports as global frontrunners in green logistics and opening pathways for participation in international green shipping corridors under its long-term Net Zero vision."



GHG Emission Scope at Ports

"To address decarbonization effectively, it is essential that we first understand where emissions actually come from within the port ecosystem."

The **Greenhouse Gas (GHG) emission inventory** at ports is categorized under three internationally recognized scopes - **Scope 1, Scope 2 and Scope 3,** as per global reporting standards.

Scope 1 – Direct Emissions:
These are emissions that originate from **port-owned or controlled sources**.
They include **diesel generators, cranes, dredgers, tugs, vehicles, and other fuel-based machinery** operating within the port premises.
Essentially, these are emissions under the port authority's **direct operational control**, and therefore, the easiest to measure, monitor, and manage.

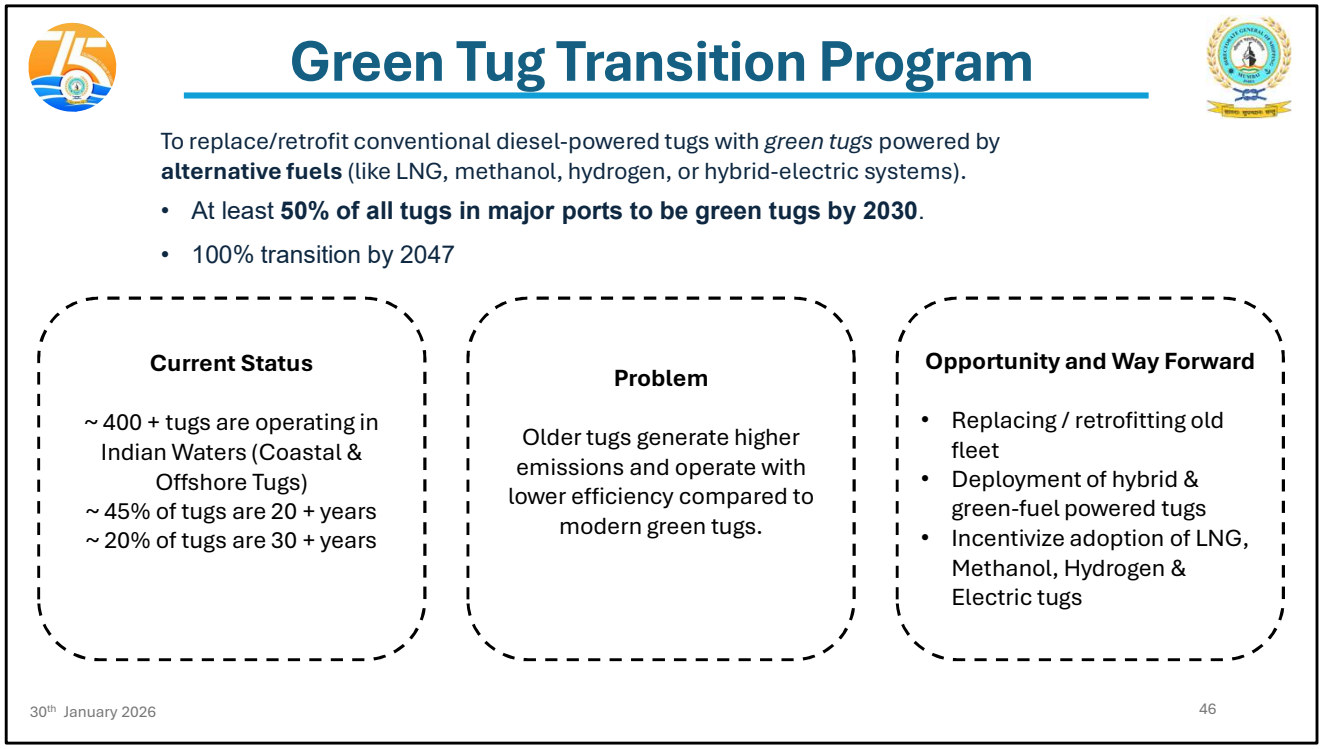
Scope 2 – Indirect Emissions:
These arise from the **purchase of electricity** that is generated elsewhere, typically from the **state grid**.
Although the port does not produce these emissions directly, they are linked to the **energy consumed for lighting, pumping systems, refrigerated containers, and terminal**

operations.
In countries where grid power is largely **coal-based**, Scope 2 emissions form a substantial part of the port's total carbon footprint — highlighting the importance of shifting towards **renewable energy and solar-based supply** for port operations.

Scope 3 – Other Indirect Emissions (Value Chain):
These are the most complex and far-reaching.
They include emissions from **ships at berth using auxiliary engines**, **trucks, trains, and barges transporting cargo**, as well as **business travel, waste treatment, and upstream investments** associated with port operations.

Though these emissions occur outside the direct boundary of the port, they represent the **largest share of overall carbon impact** — making stakeholder coordination and value-chain partnerships crucial for achieving real decarbonisation.

"Recognizing these three scopes allows ports to move from a fragmented to a holistic approach — one where emissions are mapped, mitigated, and monitored across the entire logistics chain."



Green Tug Transition Program

"Tugs are among the most vital assets in port operations, yet they also remain some of the most carbon-intensive. The Green Tug Transition Program represents India's commitment to make even these workhorses of the harbour cleaner, smarter, and future-ready."

Today, more than **400 tugs** operate in Indian waters, serving both coastal and offshore operations. However, nearly **45% of these tugs are over 20 years old**, and about **one-fifth are more than 30 years old**.

These older vessels operate with **lower fuel efficiency**, higher maintenance costs, and significantly **higher emissions**, especially of carbon dioxide, nitrogen oxides, and particulate matter.

Recognizing this challenge, the **Ministry of Ports, Shipping and Waterways** under the **Harit Sagar Guidelines (2023)** has mandated a phased transition towards **green and low-emission port crafts**.

The goal is ambitious yet achievable :
To ensure that **at least 50% of all tugs operating in major ports are green tugs by 2030**, and

To achieve a **100% transition by 2047**.

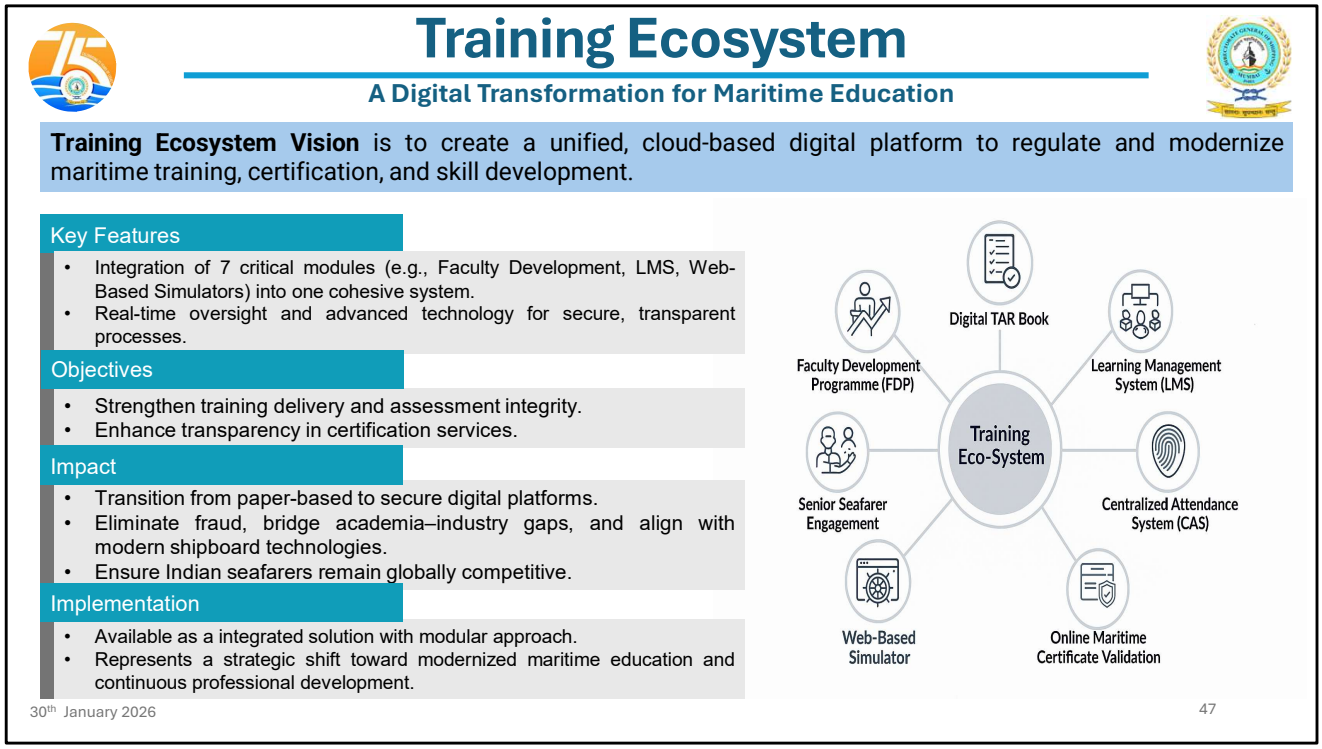
Under these guidelines, all ports are required to **retrofit or replace existing diesel-powered tugs** with vessels powered by **alternative fuels** such as **LNG, methanol, hydrogen, or hybrid-electric propulsion systems**.

These clean-energy conversions align with India's **National Green Hydrogen Mission** and the targets for port decarbonization set under **Maritime Amrit Kaal Vision 2047**.

The **opportunity** here is multifold:
Retrofitting the old fleet not only cuts emissions but also extends vessel life and reduces operational costs.
Deploying hybrid and fuel-flexible tugs creates resilience in fuel sourcing and operational efficiency.
And most importantly, it opens pathways to **incentivize early adopters,** by offering tariff rebates or priority berthing for cleaner vessels, as recommended in the Harit Sagar framework
.

In the long term, India's ports are expected to develop the **infrastructure for bunkering and refuelling of green fuels**, including **green hydrogen and ammonia**, by 2035. This will enable a seamless green transition not only for tugs but for all port craft and coastal vessels.

"In essence, the Green Tug Transition Program is more than a fleet upgrade. It is a statement of intent. It signals that India's ports will lead by example, proving that sustainability and operational efficiency can move together, powered by innovation and responsibility."



Training Ecosystem: A Digital Transformation for Maritime Education

This slide outlines the **Training Ecosystem Vision**, which is essentially about creating a **single, unified cloud-based digital platform** to regulate, standardise and modernise India's maritime training, certification and skill development framework.

The core idea is to move away from fragmented, paper-driven and institute-specific systems towards **one integrated national digital backbone** for maritime education and compliance.

Key Features
The ecosystem integrates **seven critical modules** into one cohesive system.

These include modules such as:
Faculty Development Programme (FDP) – ensuring trainers themselves are continuously upskilled.
Learning Management System (LMS) – centralising course delivery, content and assessments.
Web-Based Simulators – enabling practical training and scenario-based learning digitally.
Digital TAR Book – replacing manual training and assessment records with verifiable digital logs.
Centralised Attendance System (CAS) – preventing proxy attendance and ensuring

authenticity.
Online Maritime Certificate Validation – enabling instant verification of certificates.
Senior Seafarer Engagement – capturing industry expertise and mentorship digitally.

Alongside integration, the platform enables **real-time oversight and advanced technology tools** to ensure transparency, security and auditability of training and certification processes.

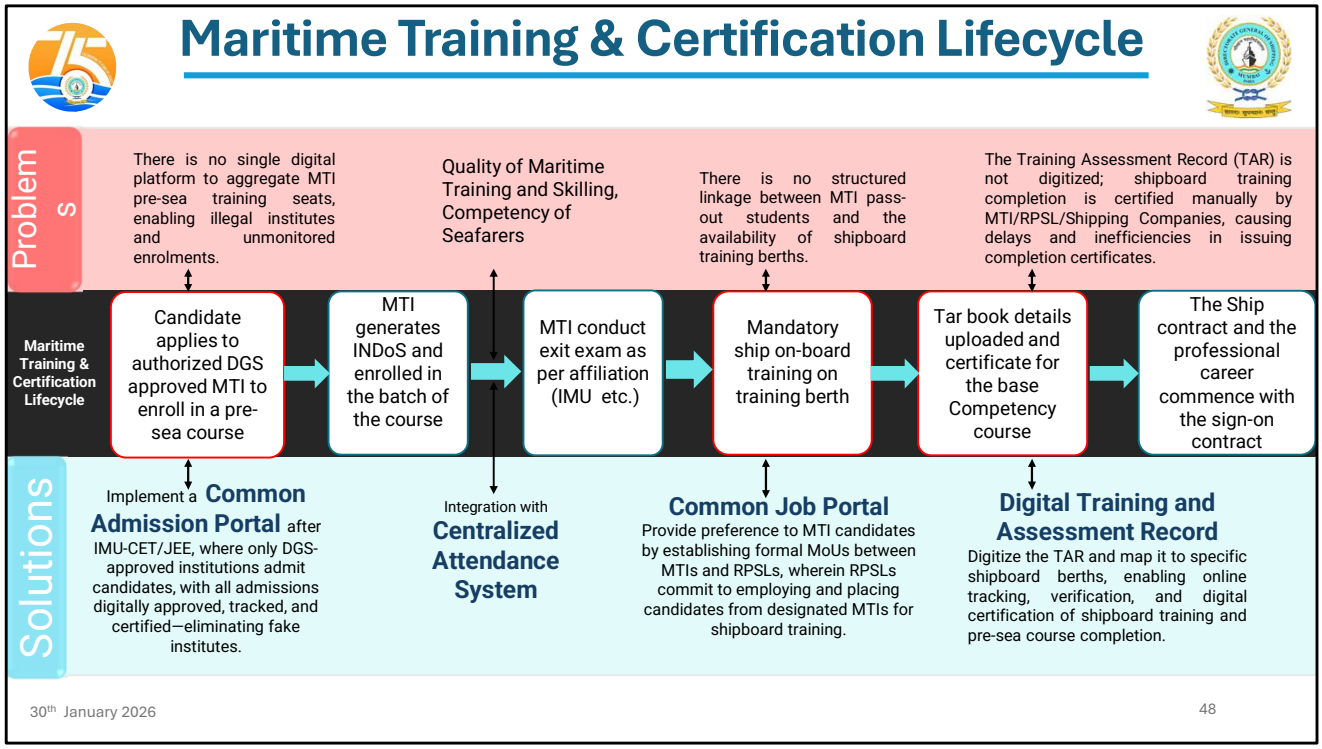
Objectives
The primary objectives are:
Strengthening training delivery and assessment integrity so that certification reflects actual competence.
Enhancing transparency in certification services, reducing manipulation, delays and inconsistencies.
In short, it aims to ensure **credibility, uniformity and trust** in Indian maritime training credentials both domestically and internationally.

Impact
The expected impact is structural rather than incremental:
Shift from paper-based to secure digital platforms, reducing administrative inefficiencies.
Elimination of fraud and duplication, particularly in attendance, logbooks and certificate issuance.
Bridging academia–industry gaps by aligning training modules with modern shipboard technologies and operational needs.
Sustaining global competitiveness of Indian seafarers, ensuring that certification and skills remain internationally recognised.

Implementation Approach
The ecosystem is designed as an **integrated yet modular solution**, meaning individual modules can evolve or scale without disrupting the entire system.
It represents a **strategic shift toward continuous professional development**, digital governance and lifecycle skill tracking rather than one-time certification events.

This initiative is not just digitisation; it is the creation of a **national maritime training infrastructure**, improving integrity, transparency and long-term workforce

readiness for a technology-driven maritime sector.



Maritime Training & Certification Lifecycle

This slide explains the **end-to-end lifecycle of maritime training and certification** in India, highlighting both the **current challenges** and the **proposed digital solutions** to create a transparent, efficient and industry-linked system.

Current Problems Identified

At present, the system is fragmented and largely manual:

No single digital aggregation platform for Maritime Training Institutes (MTIs), which leads to illegal institutes, fake enrollments and lack of seat visibility in pre-sea courses.

Variation in quality of training and skilling, directly affecting the competency and employability of seafarers.

No structured linkage between MTI graduates and shipboard training berths, resulting in delays in career progression.

Training Assessment Records (TAR Books) are not digitised, and completion certificates are issued manually by MTIs or shipping companies, creating inefficiencies and verification challenges.

Existing Lifecycle Flow

The typical journey today is:
Candidate applies to a DGS-approved MTI for a pre-sea course.
MTI generates INDOS and enrolls the candidate in the batch.
Exit examination is conducted as per affiliation norms, generally through IMU or equivalent bodies.
Mandatory onboard ship training is undertaken based on berth availability.
TAR book details are uploaded manually and base competency certificates are issued.
Professional career begins once the candidate signs on to a vessel contract.
While this flow exists, it is **not digitally integrated**, which results in duplication, delays and lack of monitoring.

Proposed Digital Solutions
To address these gaps, the slide proposes four major system-level interventions:
1. Common Admission Portal
A unified digital portal post IMU-CET or JEE where only DGS-approved institutes can admit candidates.
This ensures **central tracking, digital approvals and elimination of fake institutions**.
2. Centralised Attendance System
Integration of attendance records across MTIs to maintain **uniform standards and prevent proxy or manipulation**, directly improving training integrity.
3. Common Job Portal
A structured linkage between MTIs, RPSLs and shipping companies through formal MoUs, ensuring **fair access to onboard training berths and employment pathways** for candidates.
4. Digital Training and Assessment Record (Digital TAR)
Complete digitisation of TAR books mapped to shipboard berths, enabling **real-time tracking, online verification and faster issuance of competency certificates**.

The intent is to transform the lifecycle from a **manual, institute-centric and fragmented model** into a **digitally governed, transparent and industry-integrated ecosystem**.
This ensures **quality assurance, faster career progression, reduced fraud and improved global credibility of Indian seafarer certifications**.

Sagar Mein Yog

Sagar Mein Yog is a **comprehensive wellness program** built on the integration of yoga, mindfulness, emotional resilience, physical health, and spiritual well-being.

- In partnership with **NUSI** and knowledge partner Trijog
- Linked with MIV 2030 **Deliverable 10.16.3**
- SMY is being presented at 136th IMO Council

Way Ahead

- **Formal STCW Approvals** for ToT and Yoga curriculum.
- **Conduct of ToT courses** for MTIs (pre-sea and post-sea phases).
- **Integration of Yoga modules** into all maritime training programmes.
- **Phased implementation plan:** Pre-sea → Post-sea → At-sea.
- **Monitoring & evaluation** mechanism for impact assessment and course correction.

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Sagar Mein Yog

This slide introduces **Sagar Mein Yog (SMY)** as a **holistic wellness initiative for the maritime sector**, designed not merely as a yoga programme but as a **comprehensive mental, physical and emotional well-being framework** for seafarers and maritime professionals.

Concept and Rationale

Sagar Mein Yog integrates **yoga, mindfulness, emotional resilience, physical fitness and spiritual well-being** into a structured programme tailored for maritime life.
The maritime profession involves **long isolation at sea, irregular work cycles, high stress, fatigue and mental health challenges**, and SMY is positioned as a preventive and corrective wellness mechanism rather than a recreational activity.
It is therefore framed as a **structured capacity-building and human sustainability initiative**, not a standalone fitness module.

Institutional Linkages

Implemented **in partnership with NUSI** with **Trijog as the knowledge partner**, bringing domain expertise in counselling and mental wellness.
Linked to Maritime India Vision (MIV) 2030 – Deliverable 10.16.3, which focuses on

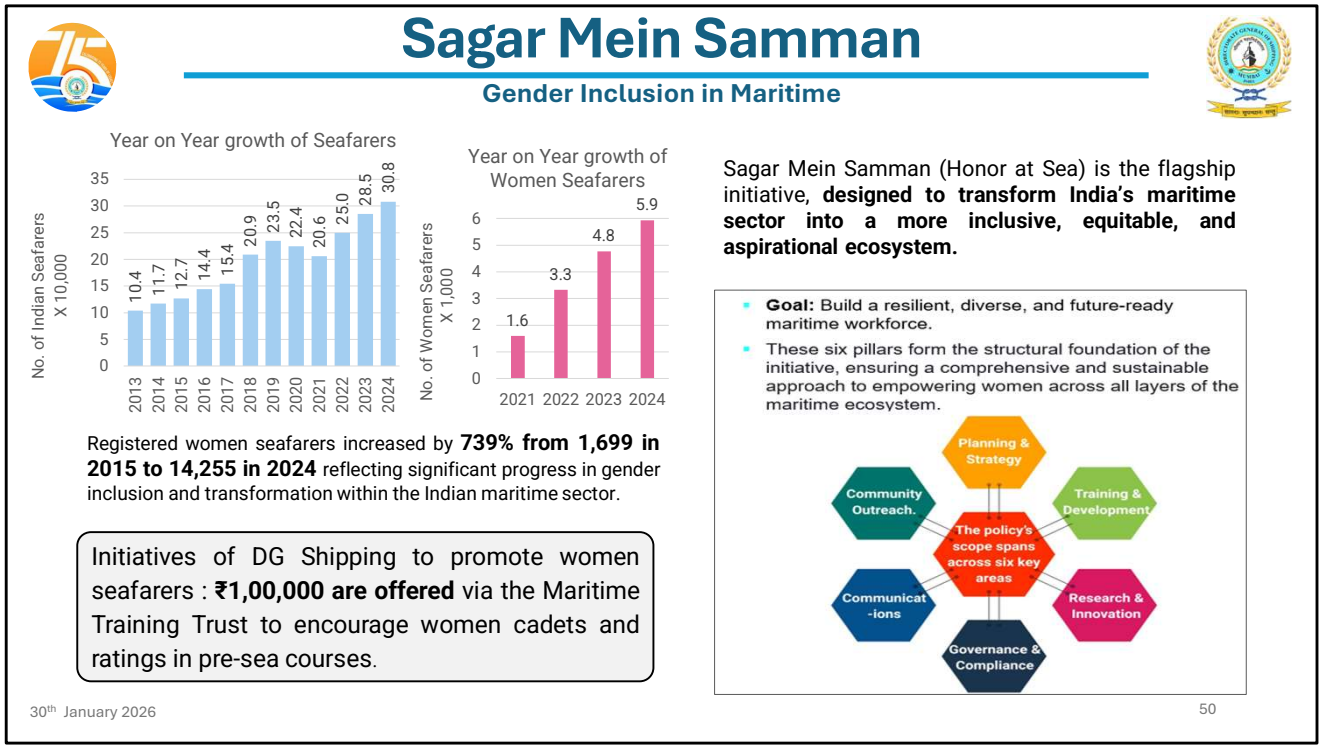
seafarer welfare and well-being.
The programme is also being **presented at the 136th IMO Council**, indicating international visibility and positioning India as a leader in seafarer wellness frameworks.

Wellness Dimensions Covered
The circular graphic on the right illustrates that SMY is not limited to physical yoga but covers **multi-dimensional wellness**, including:
Emotional wellness – stress management and psychological balance
Physical wellness – fitness, stamina and lifestyle discipline
Occupational wellness – work satisfaction and fatigue management
Social wellness – interpersonal relations and onboard harmony
Environmental and climatic wellness – adaptability to sea conditions
Intellectual and cultural wellness – cognitive engagement and awareness
Spiritual wellness – inner balance and mindfulness
Economic wellness – financial awareness and long-term security mindset

This makes SMY a **360-degree human performance and resilience model** for maritime professionals.

Way Ahead / Implementation Path
The next steps are structured and regulatory-aligned:
Formal STCW approvals for both **Training of Trainers (ToT)** and Yoga curriculum to ensure global acceptability.
Conduct of ToT programmes for MTIs, covering both **pre-sea and post-sea phases**, so trainers are standardised.
Integration of yoga and wellness modules into existing maritime training curricula, rather than creating parallel systems.
Phased rollout plan – starting with **pre-sea institutes**, then **post-sea courses**, and eventually **at-sea deployment**.
Monitoring and evaluation mechanisms to measure impact, collect feedback and allow course correction.

Sagar Mein Yog is positioned as a **human-centric maritime reform**, aiming to improve **seafarer mental health, productivity, safety performance and long-term career sustainability**.
It signals a shift from purely technical competency frameworks to **balanced human wellness and resilience in the maritime ecosystem**.



Sagar Main Samman - Gender Inclusion in Maritime

This slide highlights the **progress and policy direction of gender inclusion in the Indian maritime sector**, with a specific focus on the **rise in women seafarer participation** and the institutional initiatives driving this change.

Overall Seafarer Growth Context

On the left side, we see the **year-on-year growth of total Indian seafarers** from 2013 to 2024.

The numbers indicate a **steady expansion of India's maritime workforce**, crossing **30 thousand seafarers by 2024**.

This broader growth is important because gender inclusion is not happening in isolation — it is occurring alongside **overall sectoral expansion**, which provides more employment opportunities and capacity for diversification.

Women Seafarer Growth Trend

The central chart specifically captures **women seafarer growth**:

2021 – 1.6 thousand

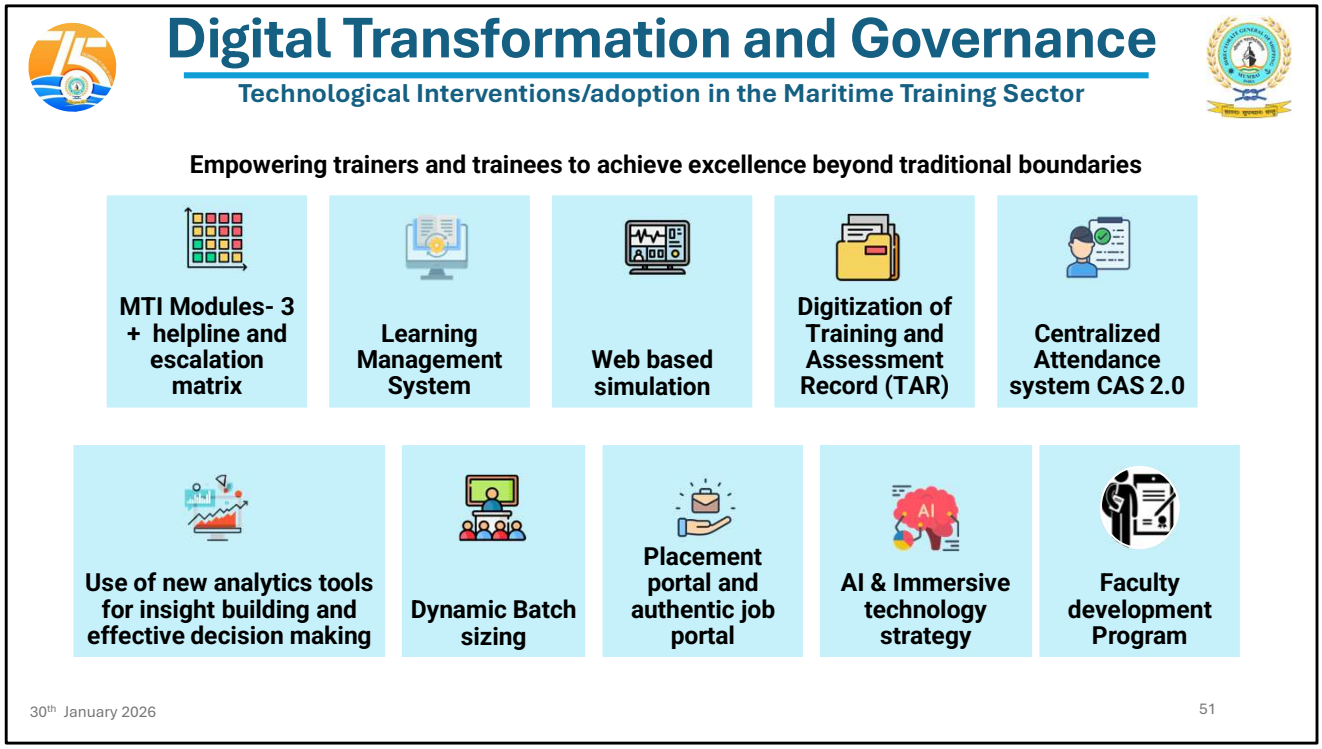
2022 – 3.3 thousand

2023 – 4.8 thousand
2024 – 5.9 thousand
This shows **almost a four-fold rise in just four years**, indicating that targeted policy measures and awareness programmes are producing **visible and measurable impact**.
A key statistic reinforcing this trend is the **739% increase in registered women seafarers**, rising from **1,699 in 2015 to 14,255 in 2024**.
This reflects not just participation, but a **structural shift toward inclusivity and acceptance** within the maritime ecosystem.

Institutional Financial Support
To actively encourage entry into maritime careers, the Directorate General of Shipping provides **₹1,00,000 financial assistance** through the **Maritime Training Trust** for women cadets and ratings enrolling in pre-sea courses.
This is significant because financial barriers are often the **primary deterrent**, and this incentive directly addresses accessibility and affordability.

Sagar Mein Samman – Structural Inclusion Initiative
On the right side, the slide introduces **Sagar Mein Samman (Honor at Sea)** as the **flagship inclusion initiative** designed to transform India's maritime sector into a **more inclusive, equitable and aspirational ecosystem**.
Its goal is to build a **resilient and diverse maritime workforce**, and it operates through **six structural pillars**:
Planning & Strategy
Training & Development
Research & Innovation
Governance & Compliance
Communications
Community Outreach
These pillars ensure that gender inclusion is not treated as a one-time programme but as a **continuous, system-wide reform** embedded in policy, training, industry engagement and monitoring.

Key Message
The slide collectively conveys that **gender inclusion in maritime is transitioning from awareness to institutionalisation**.
Through **data-backed growth trends, financial incentives and structured initiatives like Sagar Mein Samman**, India is positioning its maritime workforce to be **diverse, future-ready and globally competitive**, rather than merely compliant with equality norms.



Digital Transformation and Governance

Technological Interventions in Maritime Training

This slide presents the **digital and governance reforms being undertaken to modernize India's maritime training ecosystem**, with the objective of **empowering both trainers and trainees to achieve excellence beyond traditional boundaries**.

Core Digital Platforms and Systems

At the top row, the focus is on **foundational digital infrastructure**:

MTI Modules 3 + Helpline & Escalation Matrix –

Establishes structured grievance redressal, monitoring and accountability for Maritime Training Institutes. It ensures that institutions remain compliant and issues are addressed through a **transparent escalation chain** rather than informal channels.

Learning Management System (LMS) –

Acts as the **central academic backbone**, enabling standardized course delivery, e-content, progress tracking and assessment management across institutes.

Web-Based Simulation –

Provides **remote and virtual training environments**, allowing cadets to practice operational scenarios without physical constraints. This is particularly relevant for cost-intensive shipboard simulations.

Digitization of Training and Assessment Record (TAR) –
Converts manual TAR books into **secure digital records**, reducing delays, eliminating forgery risks and enabling faster certification validation.
Centralized Attendance System (CAS 2.0) –
Ensures **real-time attendance tracking and authenticity**, linking biometric or digital verification to institutional records and regulatory oversight.

Data, Intelligence and Governance Tools
The second row moves beyond infrastructure to **decision-making and ecosystem strengthening tools**:
Analytics Tools for Insight Building –
Supports policy makers and regulators with **data-driven dashboards**, enabling forecasting of seat capacity, pass-out ratios, placement trends and compliance gaps.
Dynamic Batch Sizing –
Allows institutes to **optimize intake based on demand, infrastructure and faculty strength**, avoiding both overcrowding and underutilization.
Placement Portal and Authentic Job Portal –
Bridges the **gap between training and employment**, ensuring verified job opportunities and reducing the risk of fraudulent placements.
AI & Immersive Technology Strategy –
Introduces **next-generation training approaches** such as VR-based ship operations, AI-assisted assessment and adaptive learning systems to align Indian maritime training with global best practices.
Faculty Development Program (FDP) –
Strengthens the **human capital side of digital transformation**, ensuring that instructors are technologically competent and pedagogically updated.

Key Message
The slide collectively conveys that digital transformation in maritime training is not limited to software adoption. It is a **holistic governance reform combining technology, analytics, institutional accountability and human capacity building**. The intent is to move from **paper-based, fragmented and reactive systems** to a **connected, transparent and intelligence-driven ecosystem**, thereby enhancing credibility, efficiency and global competitiveness of India's maritime education and certification framework.

Transparency and Zero Tolerance for Fraud

Digital Transformation for Maritime Education

This slide highlights the **governance and integrity framework** being introduced to ensure **transparency, accountability and zero tolerance towards fraud in maritime training and certification processes**.

The main objective is to **eliminate fake institutes, unauthorized admissions, forged certificates and unmonitored enrollments** by establishing a **structured digital complaint and resolution mechanism** that is accessible, traceable and time-bound.

Structured Grievance Redressal Flow

The arrow at the top represents a **clear end-to-end escalation pathway**, ensuring that every concern raised by cadets, parents or stakeholders is formally addressed rather than ignored.

Issue Raising Channels

Complaints or queries can be raised through **Call, SMS or WhatsApp**, making the system inclusive and easy to access even for candidates from remote locations.

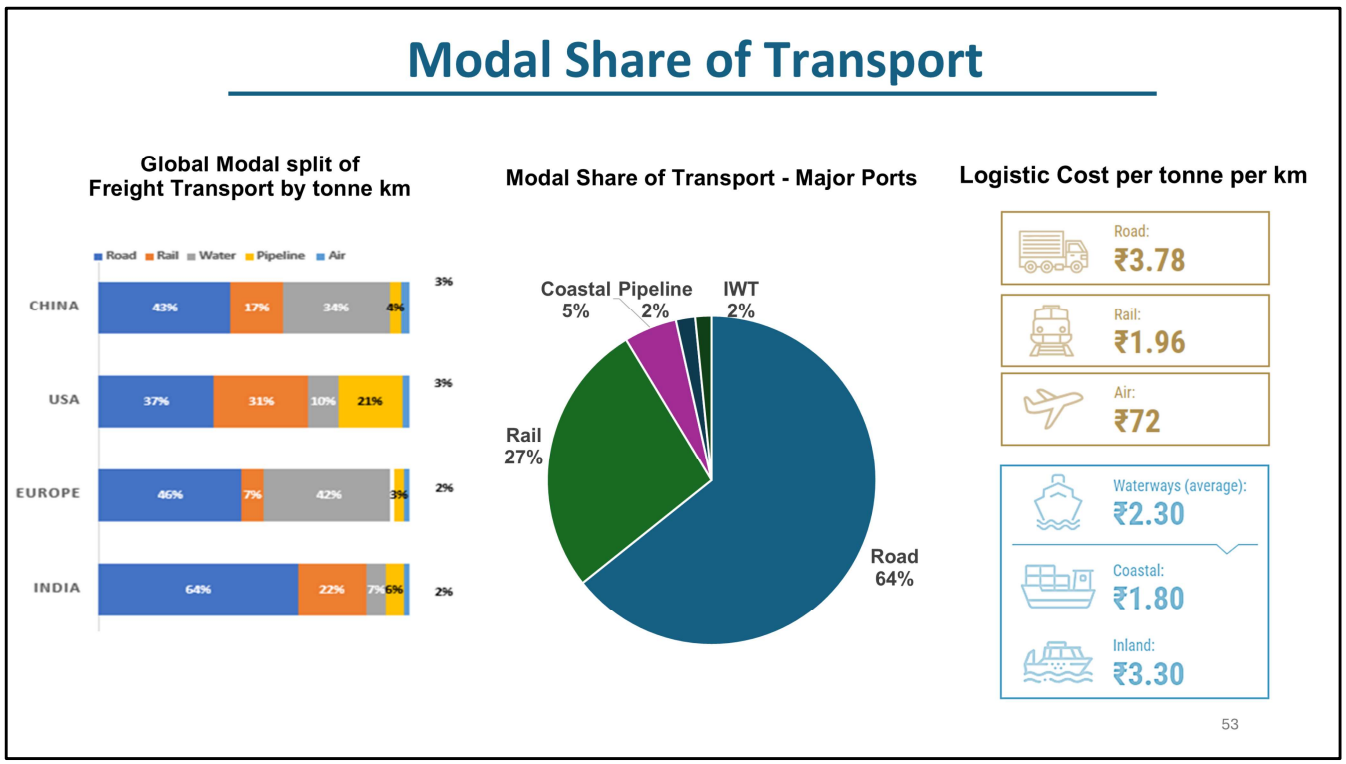
Dedicated Helpline Window (09:00 AM – 06:00 PM)

A **fixed operational helpline** ensures institutional accountability and prevents ad-hoc or unofficial communication channels.

Escalation Mechanism
If a query is unresolved at the first level, it is automatically **moved up the escalation matrix**, ensuring supervisory review and faster intervention.
Follow-up and Guidance
Beyond mere complaint logging, the system emphasizes **continuous support, counselling and corrective direction**, ensuring the stakeholder is not left without closure.
Analysis, Correction and Recurrence Prevention
The final step moves from reactive resolution to **systemic improvement**, where patterns of complaints are studied to prevent repeat violations and strengthen regulatory enforcement.

The images at the bottom represent **awareness campaigns, institute inspections, conferences, and official communication material**, indicating that the approach is not limited to back-end digital systems but is supported by:
Public awareness drives
Institute verification and approval processes
Stakeholder meetings and industry engagements
Official helpline publicity and compliance messaging

This slide communicates that digital transformation in maritime education is equally about **ethical governance and trust building** as it is about technology.
By combining **accessible complaint channels, structured escalation, active follow-up and data-driven corrective actions**, the Directorate ensures a **credible, transparent and fraud-resistant maritime training ecosystem**, reinforcing confidence among cadets, institutions and industry stakeholders.



This slide on modal share of transport gives us a clear comparative picture of freight movement patterns worldwide and in India—and underscores the opportunities for efficiency gains in our logistics sector.

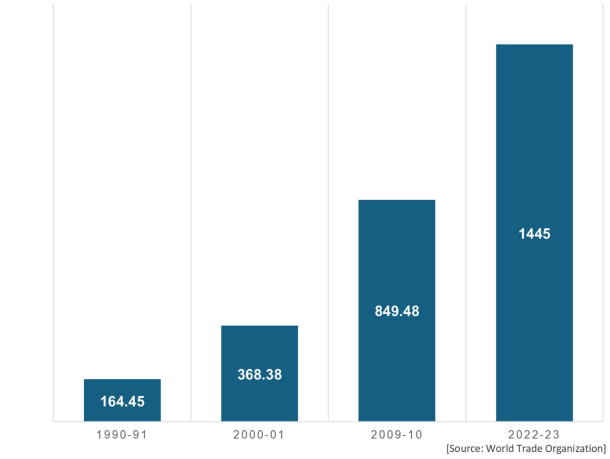
As seen in the global modal split, India relies more heavily on roads, with 64% of our freight moving by road, compared to 43% in China, 37% in the USA, and 46% in Europe. In contrast, many leading economies use a much higher share of rail, water, and pipelines for freight, reflecting a more balanced and cost-efficient modal mix.

When focusing on cargo movements at major ports, road transport again dominates at 64%, followed by rail at 27%, with coastal, pipeline, and inland waterways making up just a small fraction. This heavy road reliance contributes to higher logistics costs, with road transport costing ₹3.78 per tonne-kilometre, while rail is nearly half at ₹1.96, and coastal shipping even lower at ₹1.80.

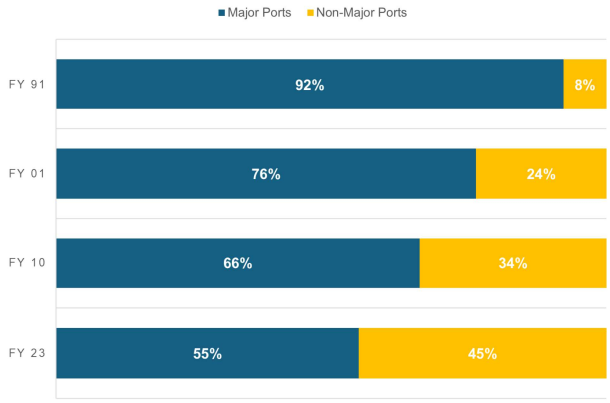
The message is clear: to optimize costs and sustainability, India must accelerate the shift towards rail and water-based modes, which offer proven economic and environmental gains. Strategic investments in multimodal infrastructure can help rebalance this modal share—making logistics more competitive and propelling India's trade and economic growth.

Cargo through Indian Ports

Decreasing share of Major Ports as compared to Non-Major Ports over the years



Cargo Handled in MMT



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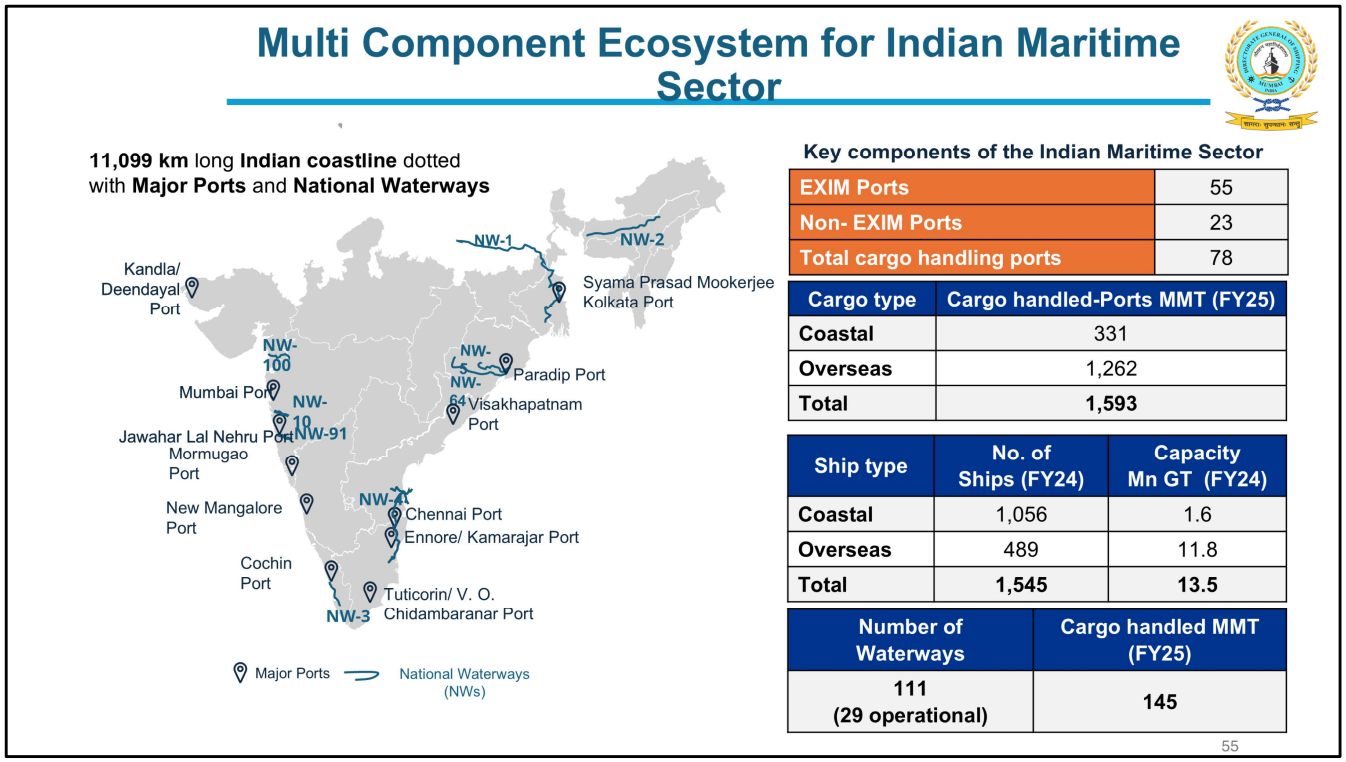
““Cargo volumes have grown massively—from 164 million tonnes in 1990–91 to over 1,445 million tonnes in 2022–23. But just as significant is the changing balance between major and non-major ports. In 1991, major ports carried over 90% of the load. Today, non-major ports handle nearly half of India’s cargo. This diversification strengthens resilience and expands our capacity.”



Multi-Component Ecosystem for Indian Maritime Sector

This slide provides a **macro-level snapshot of India's maritime ecosystem**, showing how **ports, shipping, cargo movement, and inland waterways** together form an integrated logistics and trade network rather than isolated components.

Indian Coastline and Strategic Geography

India has an **11,099 km long coastline**, which is one of the longest in the world and provides natural access to major international sea lanes.

The map highlights **Major Ports** along both the western and eastern coasts and overlays the **National Waterways (NWs)** that connect hinterland regions to maritime gateways.

Key waterways shown include **NW-1 (Ganga–Bhagirathi–Hooghly system)**, **NW-2 (Brahmaputra)**, **NW-3 (West Coast Canal in Kerala)**, and southern and central corridors such as **NW-4 and NW-5**, demonstrating multimodal connectivity potential.

Port Infrastructure – EXIM and Domestic Capacity

The right panel quantifies port distribution:

EXIM Ports – 55

Non-EXIM Ports – 23
Total Cargo Handling Ports – 78
This indicates that India's port system is not only focused on international trade but also supports **coastal and domestic logistics**, strengthening internal supply chains and regional trade flows.

Cargo Handling Profile (FY25)
Coastal Cargo – 331 MMT
Overseas Cargo – 1,262 MMT
Total Cargo Throughput – 1,593 MMT
The numbers show that **overseas trade dominates overall throughput**, but coastal cargo still represents a significant share, reinforcing the government's push for **coastal shipping and modal shift from road to sea** for efficiency and emission reduction.

Shipping Fleet Composition (FY24)
Total Ships – 1,545
- **Coastal Vessels – 1,056**
- **Overseas Vessels – 489**

Total Gross Tonnage – 13.5 Mn GT
- Coastal fleet contributes **1.6 Mn GT**
- Overseas fleet contributes **11.8 Mn GT**

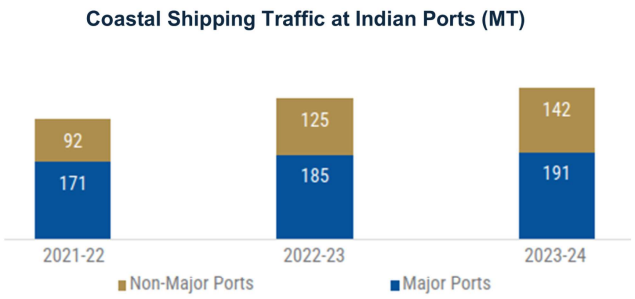
This reflects a **numerically larger coastal fleet**, but **higher tonnage concentration in overseas vessels**, indicating that international trade ships are fewer but significantly larger in capacity.

National Waterways and Inland Cargo
Total Declared Waterways – 111, of which **29 are operational**.
Cargo handled via Inland Waterways – 145 MMT (FY25).
This highlights the **emerging but still developing role of inland waterways**, which is crucial for **cost-effective bulk transport, decongestion of highways, and sustainable logistics planning**.

India's maritime strength lies in the **interlinkage between sea ports, shipping fleet, coastal logistics, and inland waterways**. The ecosystem is gradually shifting toward **multimodal integration**, where ports are not standalone nodes but part of a **connected logistics grid** that supports both domestic economic growth and international trade competitiveness.

Coastal Shipping - Traffic

1. Coastal shipping is in its early stages but showing promising growth.
2. Traffic increased 26% from 264 million tonnes in 2021-22 to 333 million tonnes in 2023-24.
3. Non-major ports saw 54% growth; major ports grew by 11% during this period.
4. Government aims to scale coastal cargo to 1,300 million tonnes by 2047 under Maritime Amrit Kaal.
5. Recent policies and dedicated coastal berths promote sustainable and efficient domestic shipping.
6. Key commodities include petroleum, oil, lubricants, coal, cotton, tiles, soda, ash, wheat, and containerized cargo (especially on the west coast).
7. Challenges include limited handling capacity and vessel availability.
8. Greater push from government and private sectors can unlock huge sustainable and economic potential.



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Coastal shipping in India, though still developing, is on a strong growth trajectory. Over the past three years, coastal cargo traffic has surged by 26%, jumping from 264 million tonnes in 2021-22 to 333 million tonnes in 2023-24. Notably, non-major ports have outpaced major ports, registering an impressive 54% growth compared to 11% at major ports.

The government's ambitious target is to scale coastal cargo to 1,300 million tonnes by 2047 as part of the Maritime Amrit Kaal Vision. India’s extensive coastline of 11,098 kilometers and the presence of over 200 ports present a unique opportunity to expand coastal trade.

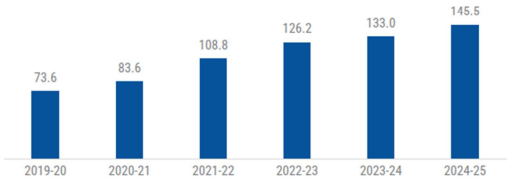
Recent infrastructure upgrades—such as dedicated coastal berths—are making domestic logistics more sustainable and efficient. Key commodities moving through coastal routes include petroleum, oil, lubricants, coal, cotton, tiles, soda, ash, wheat, and containerized cargo, especially along the west coast.

However, challenges remain, predominantly in handling capacity and vessel availability. With continued support and investment from both government and private sectors, coastal shipping has the potential to become a highly sustainable and economical mode of transport, unlocking vast economic and environmental

benefits for the nation.

Inland Waterways

Cargo Movement Through IWT (million MT)



Key Inland Waterways

NW-1 (Ganga – Haldia to Allahabad):

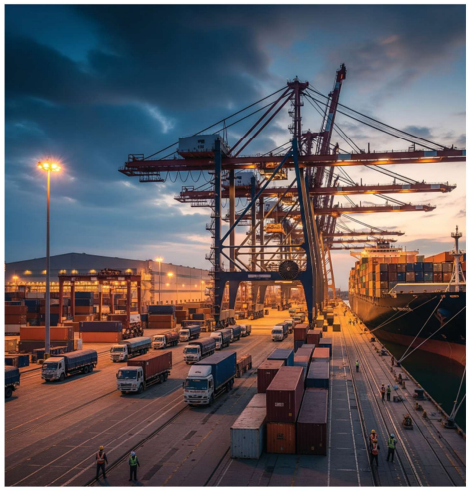
- Majority (~90%) cargo movement involves lighterage operations at Kolkata, transferring cargo to smaller vessels via port's outer reaches.
- Minimal actual long-haul cargo movement upstream due to draft restrictions and infrastructure limitations.

NW-2 (Brahmaputra – Dhubri to Sadiya):

- Limited cargo movement because of shallow depths beyond Narayanganj, causing vessels to run aground and incur losses.
- Navigation is considered safe only up to Chandpur; beyond that, operators lack reliable depth info.
- High risks and uncertain conditions reduce usage for long-haul cargo.

NW-3 (West Coast Canal – Kerala):

- Short, mostly horizontal waterway serving regional transport in Kerala.
- Serves as local cargo route due to limited length and stable road network. Remains niche, not a large-scale cargo corridor.

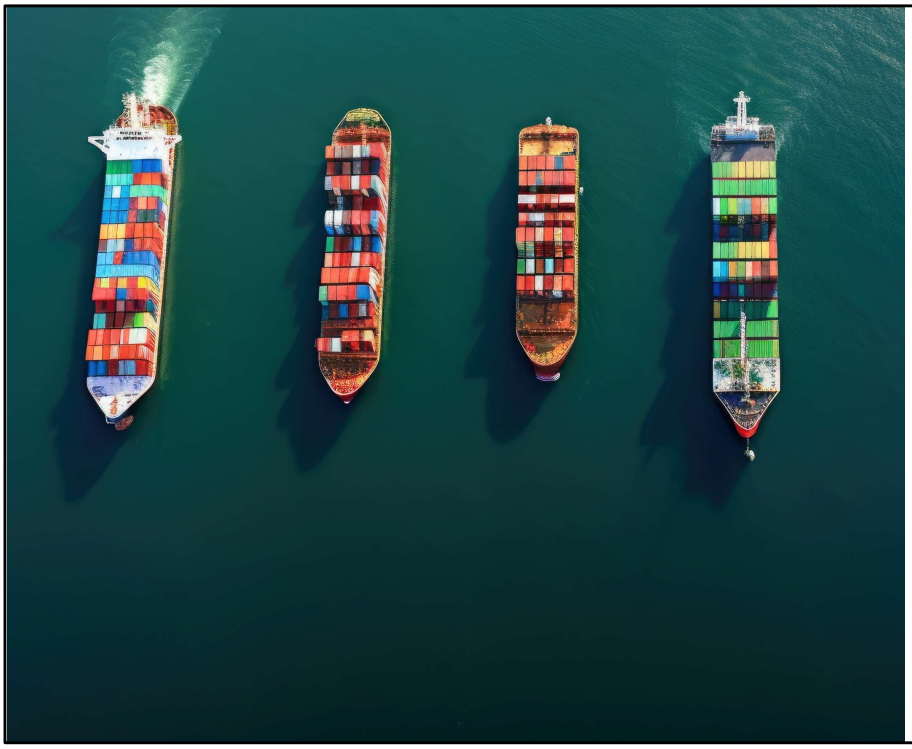


India's inland waterways have registered significant cargo movement growth, with volumes projected to reach 145.5 million tonnes in 2024-25. This marks a powerful testament to the potential of our riverine logistics.

Focusing on our key corridors:
NW-1, stretching from Haldia to Allahabad along the Ganga, remains the busiest. Here, almost 90% of cargo activity is centered on lighterage operations in Kolkata—transferring goods onto smaller vessels through the port's outer reaches. Yet, true long-haul movement upstream is still constrained by draft limits and infrastructure gaps.
NW-2, on the Brahmaputra from Dhubri to Sadiya, faces limited throughput beyond Narayanganj due to shallow depths causing groundings and losses. Navigation is generally safe only up to Chandpur, with unreliable depth information and high risks further restricting its use for long-haul logistics.
NW-3, the West Coast Canal in Kerala, is a shorter, more localized waterway serving regional connectivity. Its modest length and the effectiveness of Kerala's road network mean it remains a niche option, not a major cargo corridor.

In summary, while the operational environment for inland waterways is steadily improving, further investment and navigational enhancements will be crucial to

unlock their full potential for national logistics.



संगच्छध्वं
संवदध्वं
सं वो मनांसि
जानताम्।

"Move together,
speak together,
may your minds
be in harmony."
(Rigveda 10.191.2)

सत्यमेव जयते
Ministry of Ports,
Shipping & Waterways
Government of India