India Netherlands Bilateral Session

Seas of Opportunity: India–Netherlands Collaboration for a Sustainable Maritime Future

"Excellencies, distinguished delegates from the Netherlands and India, esteemed representatives from government, industry and academia..... A very good morning to all."

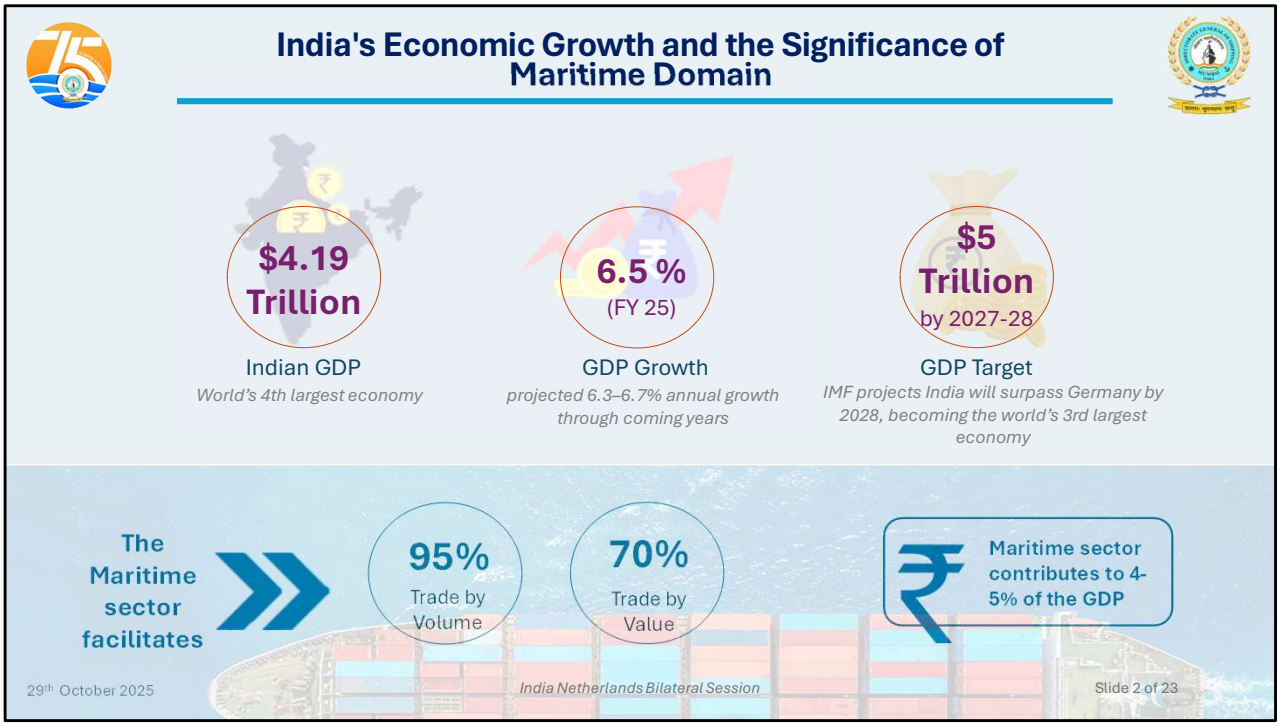
It gives me great pleasure to welcome you to this ***India–Netherlands Bilateral Session****, held under the theme* ***'Seas of Opportunity: India–Netherlands Collaboration for a Sustainable Maritime Future.'***
Today's gathering stands as a testament to the long-standing maritime bond between our two nations, a partnership built on shared values of innovation,

sustainability, and cooperation across oceans.

The Netherlands has long been recognised as a global leader in maritime engineering, smart port solutions, and sustainable logistics. India, on its part, is rapidly transforming its maritime sector under flagship programmes such as ***Maritime India Vision 2030****,* ***Harit Sagar Guidelines*** *and* ***Maritime Amrit Kaal Vision 2047****, all of which place environmental responsibility and technological advancement at the forefront.*

This bilateral platform provides an invaluable opportunity to exchange ideas, explore synergies, and build collaborative frameworks that advance the global green shipping and digital port agenda.

Together, India and the Netherlands can co-create pathways that drive the twin goals of economic prosperity and environmental stewardship.
As we begin today's session, let us reaffirm our shared vision of a sustainable maritime future, one where technology, trade, and climate responsibility move forward hand in hand. With that, I extend my warmest welcome to all participants and look forward to a meaningful dialogue throughout the day.

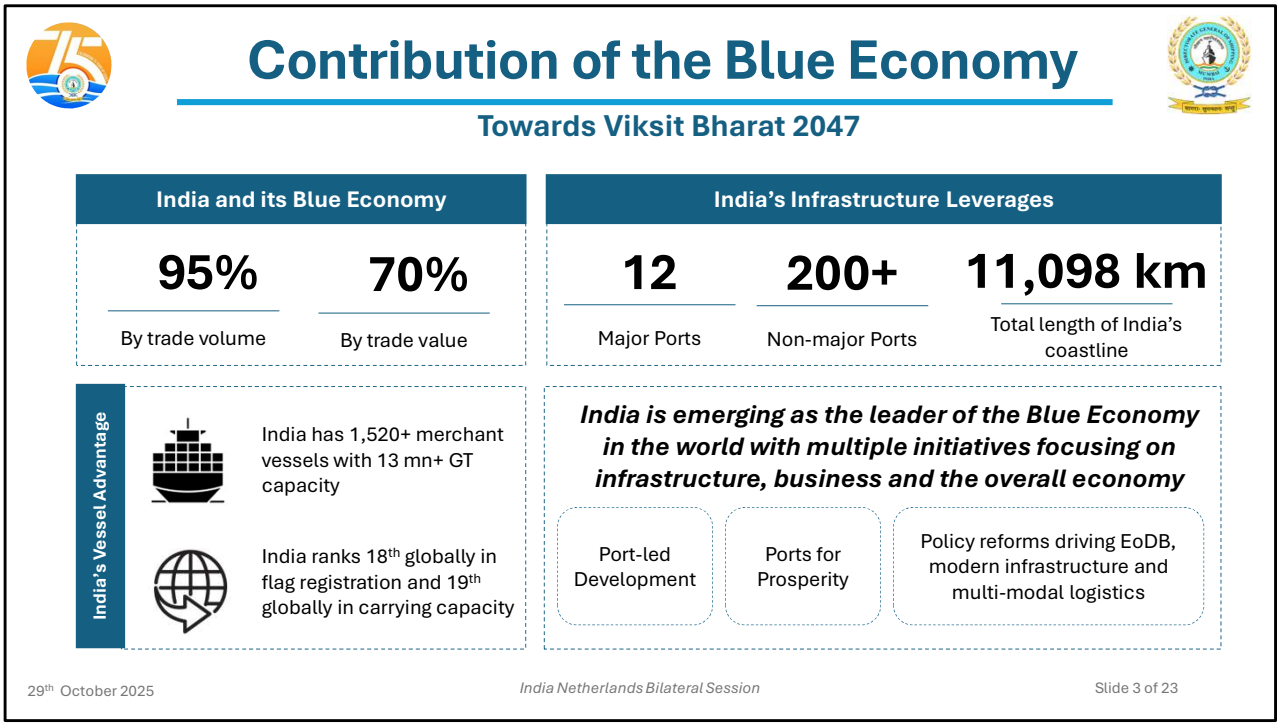


India's Economic Growth and the Significance of Maritime Domain

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.



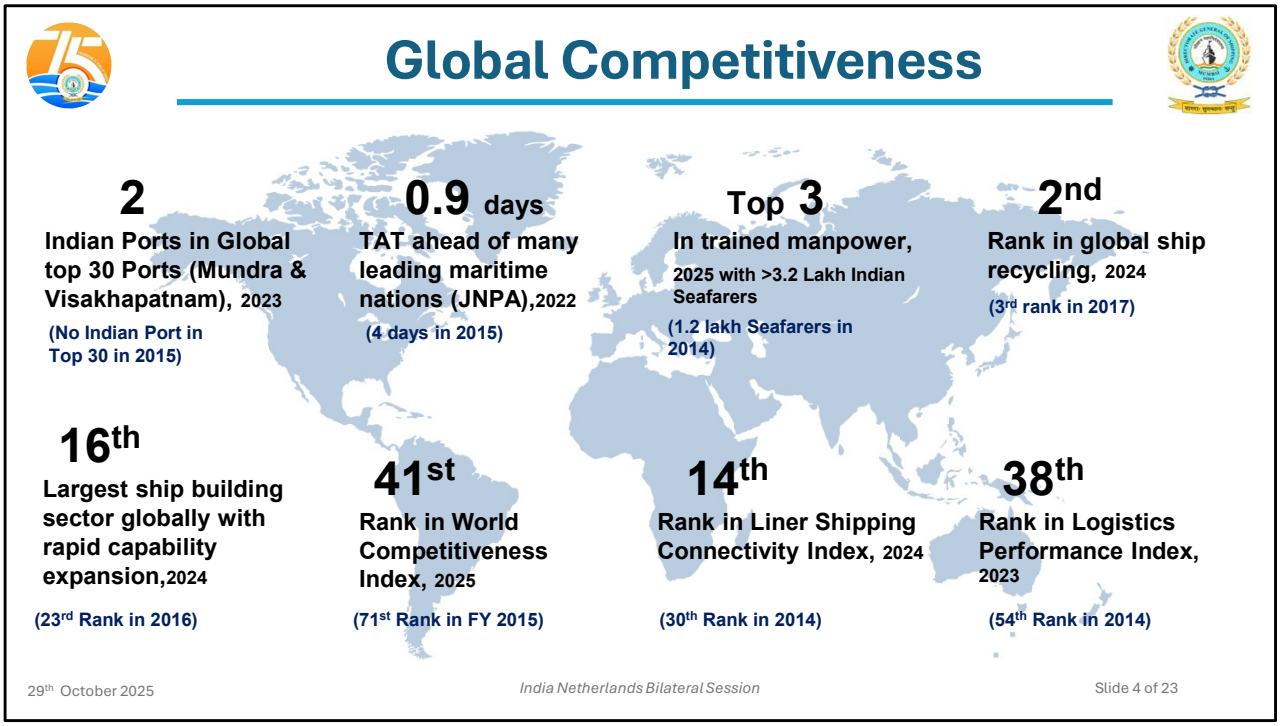
Contribution of the Blue Economy

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 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.

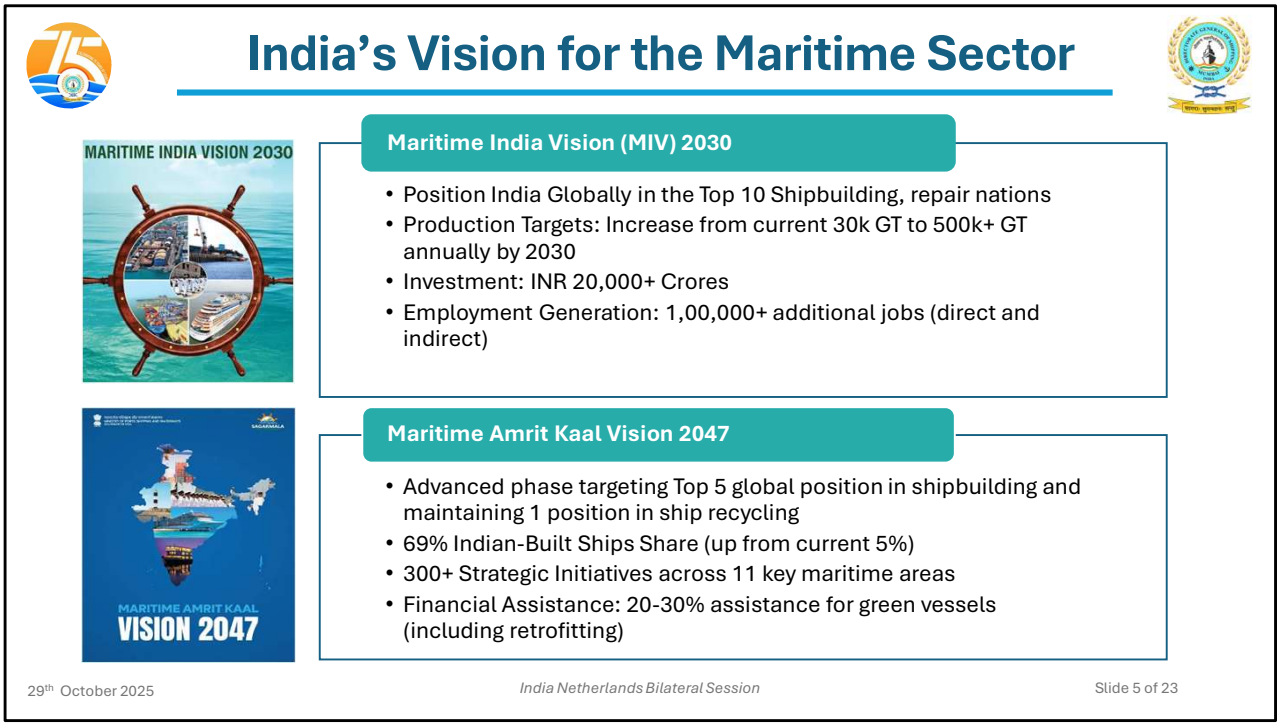
Shipbuilding Sector: India's shipbuilding industry has advanced from **23rd globally in 2016 to 16th in 2024**, backed by financing reforms, capacity expansion, and the recent ₹69,725 crore package aimed at building a globally competitive ecosystem.

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

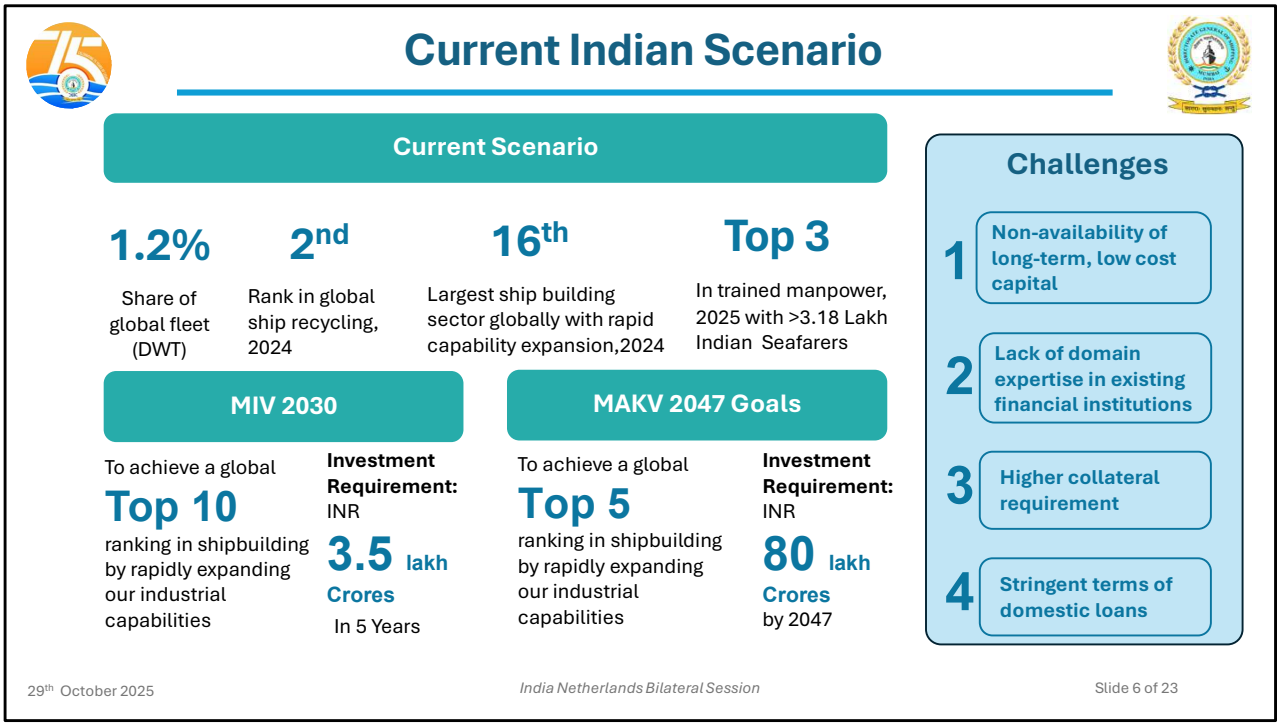
India's maritime strategy is anchored in two long-term frameworks - **Maritime India Vision 2030 (MIV 2030)** and **Maritime Amrit Kaal Vision 2047 (MAKV 2047),** which together chart a pathway for transforming India into a global maritime power.

Maritime India Vision 2030 sets a 10-year blueprint aimed at positioning India among the world's **top 10 shipbuilding and repair nations**. It seeks to raise production from the current **30,000 GT to over 500,000 GT annually by 2030**, supported by an investment of **₹20,000+ crore**. The vision also targets the creation of over **1,00,000 new jobs** (direct and indirect) while strengthening domestic repair, recycling, and logistics ecosystems.

Looking further ahead, **Maritime Amrit Kaal Vision 2047** is an advanced phase of India's maritime ambitions, aligned with the country's goal of becoming a developed economy by 2047. It aspires to secure a **top 5 global position in shipbuilding** while maintaining India's leadership in **ship recycling**. With more than **300 strategic initiatives spanning 11 key areas**, MAKV 2047 envisions

raising the share of Indian-built ships from **5% to nearly 69%**, backed by **20–30% financial assistance for green vessels and retrofitting**.

These visions are not limited to infrastructure growth but also focus on **sustainability, innovation, and global integration**. By 2047, India's maritime sector is expected to be a major contributor to GDP growth, employment generation, and global supply chain resilience. Together, MIV 2030 and MAKV 2047 reaffirm India's commitment to becoming a **leading Blue Economy**, driven by green growth, digitalization and strategic partnerships.



Current Indian Scenario

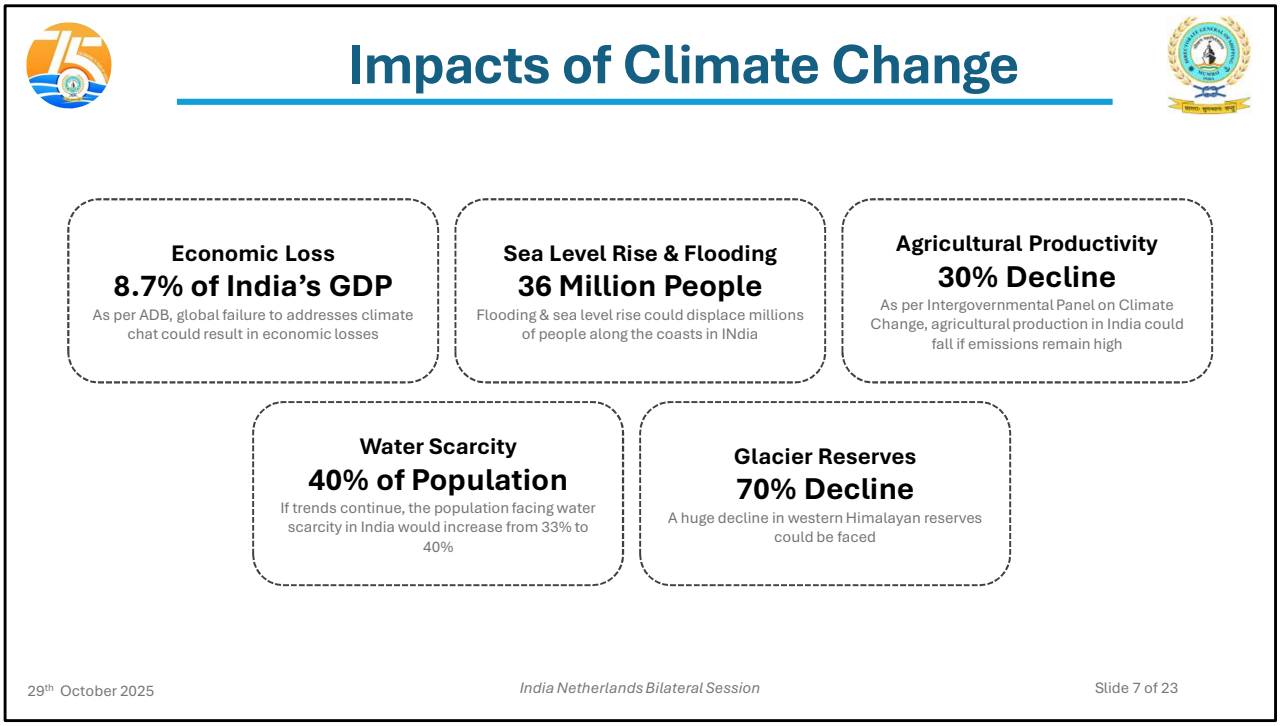
India stands today as a significant maritime nation with growing capabilities across fleet ownership, shipbuilding, ship recycling and seafaring manpower. While our share in the global fleet is currently at 1.2 percent (Dead Weight Tonnage) as per PIB 2021, India already ranks second in global ship recycling and is emerging as the 16th largest shipbuilding country with a rapid expansion trajectory. By 2025, India is positioned among the top three in the world for trained maritime manpower with over 3.18 lakh seafarers.

To achieve our long-term maritime ambitions under Maritime India Vision 2030, India targets entering the global top 10 in shipbuilding, which will require industrial scaling and an estimated investment of ₹3.5 lakh crore over the next five years. Looking ahead to Maritime Amrit Kaal Vision 2047, the goal is to reach the top five globally, supported by a cumulative investment of nearly ₹80 lakh crore by 2047.

However, the sector faces structural challenges in accessing finance. There is limited availability of long-term, low-cost capital, compounded by a lack of

maritime domain expertise within financial institutions. Higher collateral requirements and stringent lending conditions further restrict domestic shipbuilding growth.

This juncture presents both an opportunity and a challenge. India must bridge the gap between ambition and capital strength to fully position itself as a global maritime manufacturing and manpower hub.



Impacts of Climate Change

"When the coastlines retreat, so does the confidence of a maritime nation."

Climate change is no longer a future threat. it is a lived reality for India. As one of the world's most climate-vulnerable nations, India faces multidimensional risks that directly affect its economy, coastal communities, food security, water systems, and maritime infrastructure.

Economic Impact
The Asian Development Bank (ADB) estimates that unchecked climate change could reduce India's GDP by up to **8.7% by 2100**. Extreme weather events, disruption of supply chains, damage to coastal port assets, and loss of productivity will place immense pressure on national development goals.

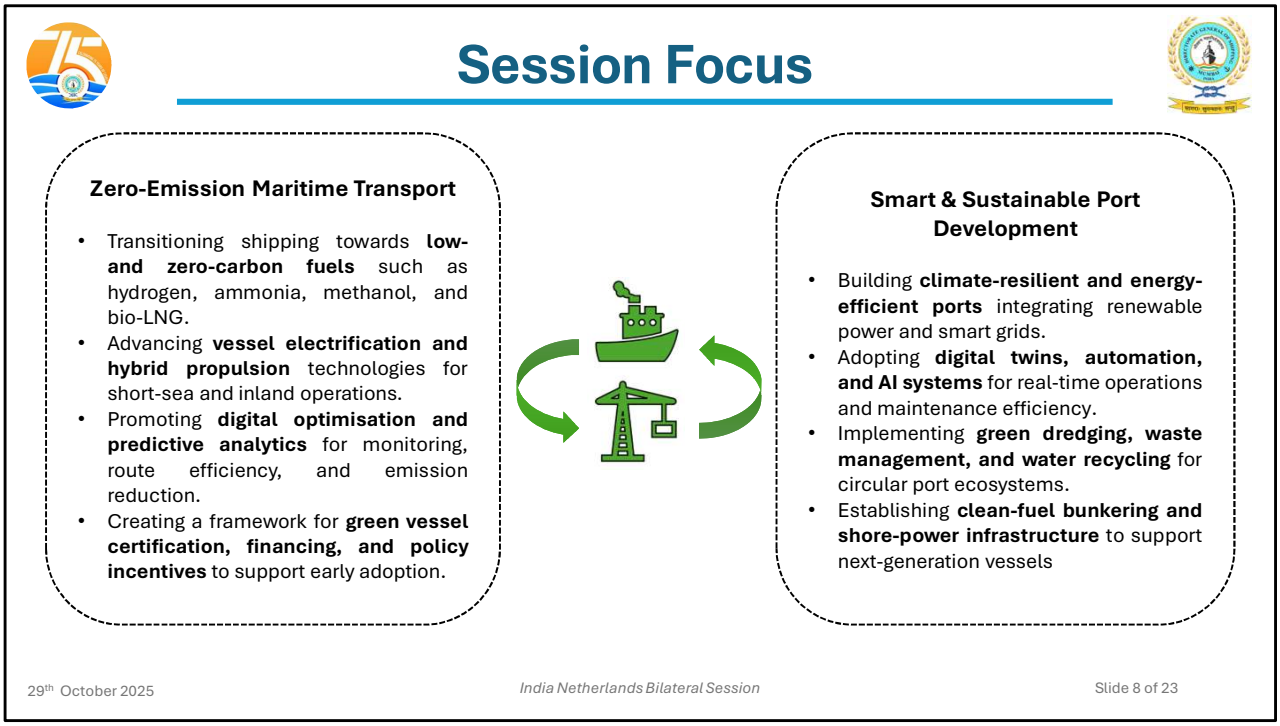
Sea Level Rise & Coastal Displacement
Over **36 million Indians** are at risk of displacement due to sea-level rise and coastal flooding, particularly in low-lying states such as West Bengal, Odisha, Tamil Nadu, and Gujarat. India's 7,500 km coastline and major ports are

increasingly exposed to storm surges and saline water intrusion, threatening maritime trade and livelihoods.

Agricultural Productivity Decline
The **IPCC projects a 30% decline** in India's agricultural output if high-emission trends persist. Heat stress, erratic monsoons, and shifting rainfall patterns endanger food security and rural incomes, further intensifying migration pressure on coastal and urban zones.

Water Stress
Today, one-third of India's population faces water scarcity. By 2050, this number could rise to **40%**, as Himalayan ice melt, reduced river flows, and rising evaporation diminish freshwater availability. Climate-linked water stress will aggravate interstate river disputes and strain urban water systems.

Glacier Loss & Himalayan Risk
The Western Himalayan glaciers may witness up to a **70% decline**, jeopardizing perennial river systems such as the Ganga, Brahmaputra, and Indus. This impacts drinking water, irrigation, hydropower, and ecological stability, directly affecting India's long-term maritime and riverine logistics.



Session Focus

"The focus of today's session lies in linking two critical dimensions of the maritime decarbonization journey — zero-emission maritime transport and smart, sustainable port development."

*On the one hand, achieving **zero-emission maritime transport** calls for a decisive transition away from conventional fossil-based fuels towards **low- and zero-carbon alternatives** such as hydrogen, ammonia, methanol, and bio-LNG. These clean fuels form the foundation of the next generation of green shipping.*

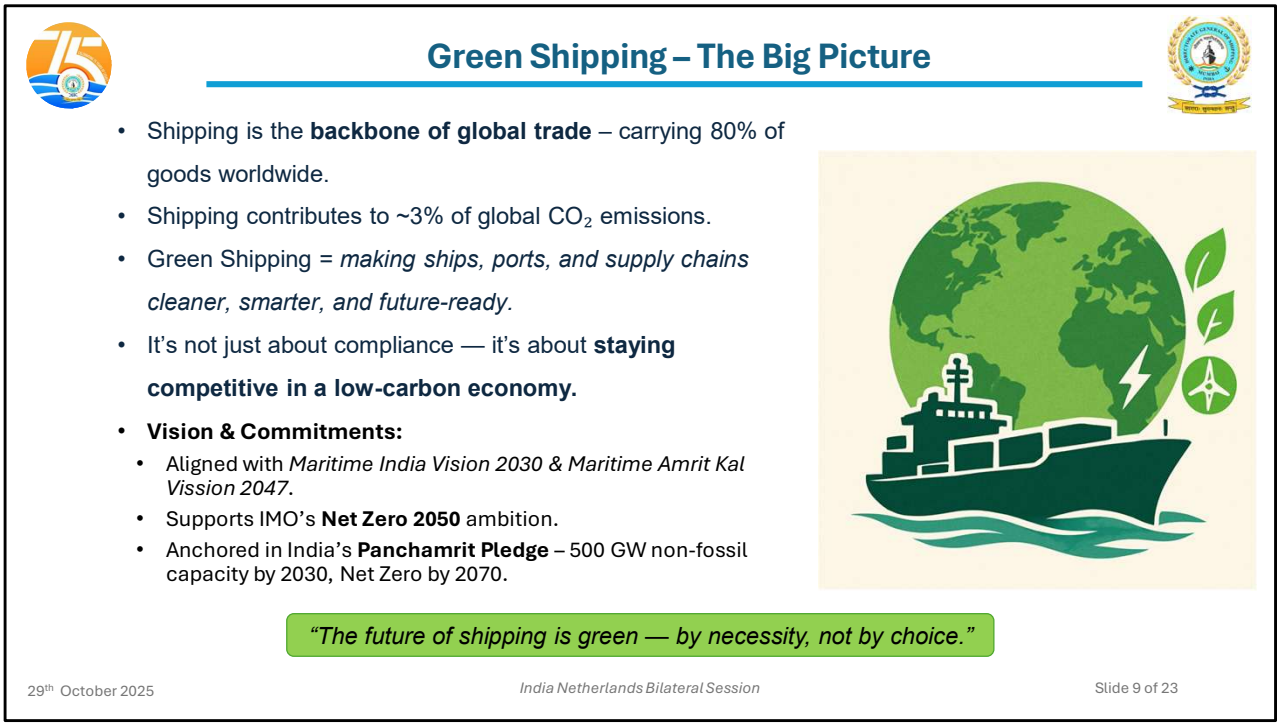
*Equally important is the shift towards **vessel electrification and hybrid propulsion systems**, particularly for coastal and inland operations. Coupled with **digital optimisation and predictive analytics**, these technologies enhance operational efficiency, enable route-level emission tracking, and reduce fuel consumption across the fleet.*

*To ensure that the industry's move toward cleaner energy is both practical and scalable, work is also underway to create a framework for **green vessel***

certification, green financing, and targeted policy incentives *that support early adopters and technology innovators in this space.*

The second pillar of this session is ***Smart and Sustainable Port Development****, which recognises that ports must evolve in tandem with ships. The objective is to build* ***climate-resilient and energy-efficient ports*** *powered by renewable sources and smart grids, supported by* ***automation, AI systems, and digital twins*** *that enable real-time operations and predictive maintenance.*
Ports will also play a pivotal role in circular economy practices through ***green dredging, waste management, and water recycling****. Moreover, the establishment of* ***shore-power and clean-fuel bunkering infrastructure*** *will ensure that next-generation vessels can seamlessly operate within an integrated green ecosystem.*

Together, these two focus areas reflect an interconnected vision — where clean ships operate from smart ports, driving a fully decarbonized and digitally empowered maritime future.



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.

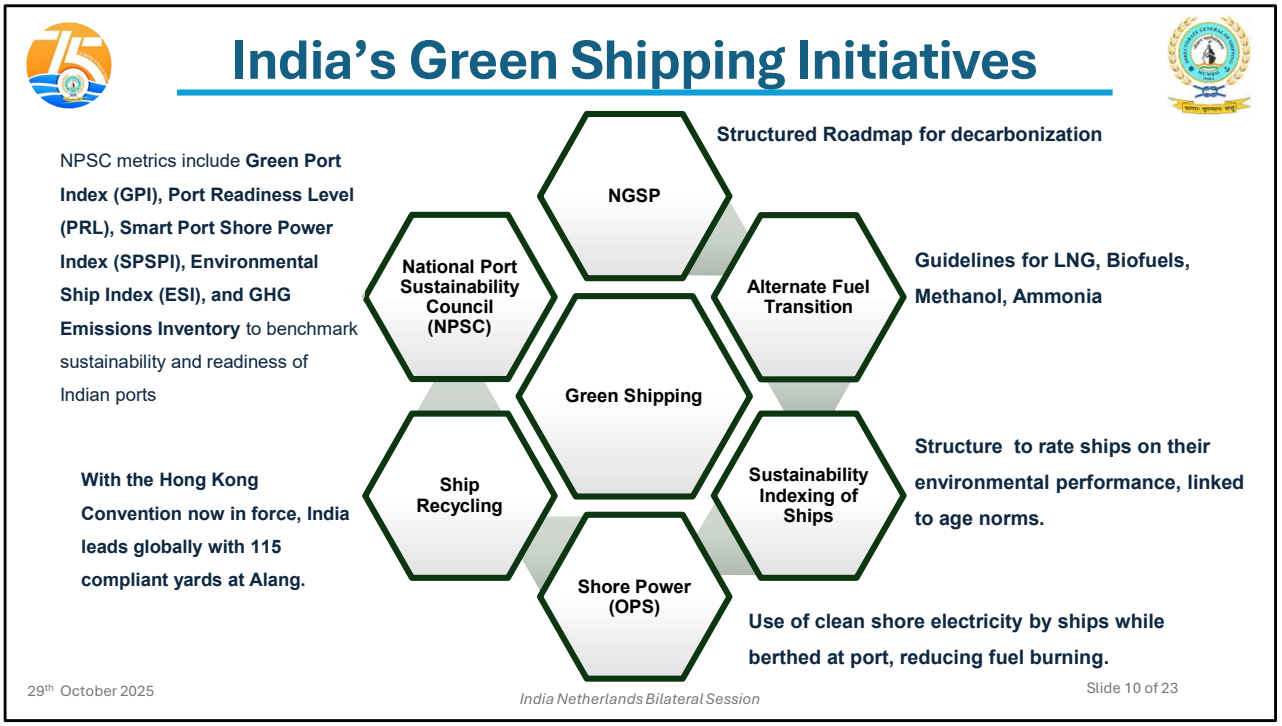
Green Shipping is not just about compliance, it is about transforming **ships, ports, and supply chains into cleaner, smarter, and future-ready systems**. In a low-carbon economy, sustainability is synonymous with competitiveness, and the maritime sector cannot afford to lag behind.

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,

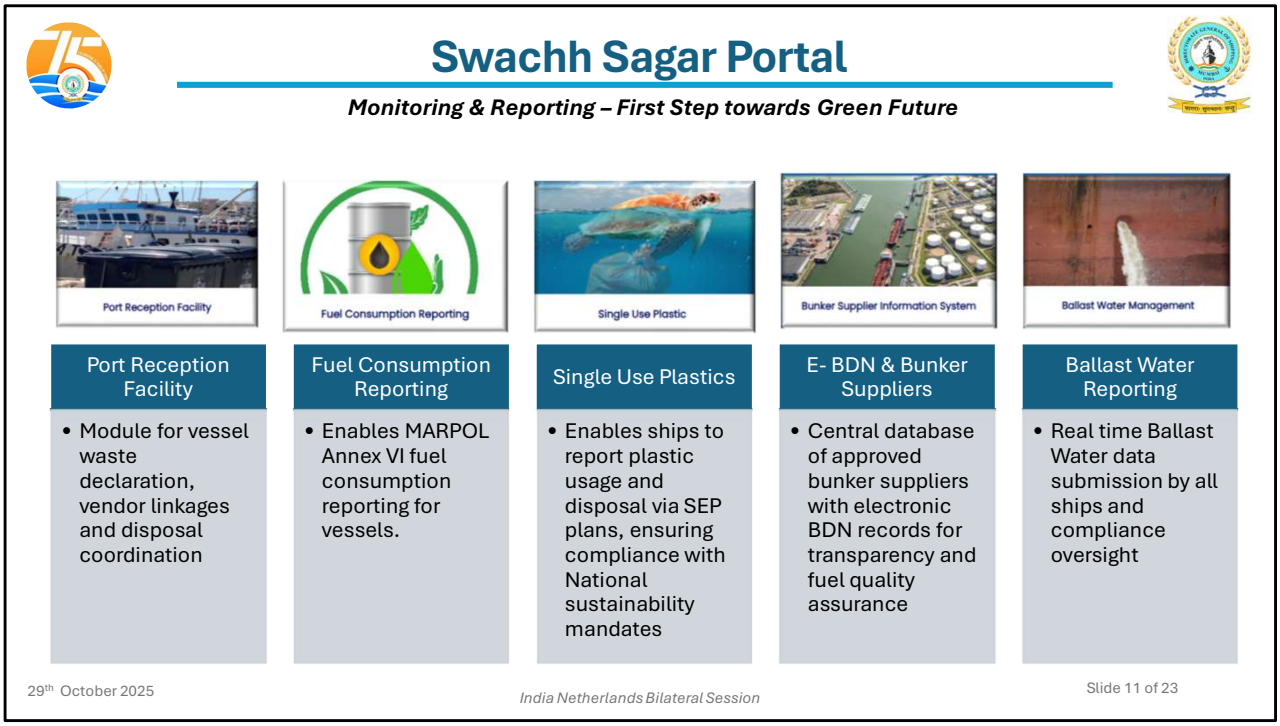
and green ammonia. These fuels are being introduced through detailed guidelines to support a phased shift from transitional to zero-carbon fuels.

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.



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.

National Green Shipping Policy

Maritime Vision for a Green Future

The NGSP is India's strategic response to the global decarbonisation mandate, a policy blueprint designed to secure maritime growth while transitioning towards clean energy, sustainable ships and climate-resilient ports.

Key Transition Pillars:

- Green Ships
- Green Ports
- Green Fuels
- Green Recycling
- Green Financing & Collaborations

Strategic Intent

To position India as a **global hub for green shipping and future fuels**, enabling industry to move from regulatory compliance to global competitiveness and leadership.

Draft NGSP Document under Review

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The National Green Shipping Policy (NGSP) is India's comprehensive roadmap to align the maritime sector with global decarbonisation goals while ensuring economic growth and competitiveness. As highlighted in the consultative document (2025), NGSP is not just an environmental initiative, but a strategic shift to position India as a global hub for **green shipping, green fuels, green ports, and maritime innovation**. It builds on international mandates such as the IMO's 2023 GHG Strategy and domestic commitments announced under COP-26 *Panchamrit*.

The policy integrates sustainability across the maritime value chain, focusing on low-emission vessel technologies, alternative fuel infrastructure, regulatory reform, and green financing mechanisms. It also aligns with major national frameworks – **Maritime India Vision 2030, Amrit Kaal Vision 2047, Sagarmala and Harit Sagar guidelines** – creating a unified and future-ready maritime strategy.

Key Transition Pillars

Green Ships:
Promotion of energy-efficient vessel designs, retrofits, zero-emission propulsion, and mandatory green certification. NGSP envisions India becoming a shipbuilding and retrofit hub for low-carbon vessels.

Green Ports:
Port decarbonisation through shore power (OPS), electrified equipment, green corridors, emission monitoring, and renewable integration (solar, wind, hydrogen bunkering).

Green Fuels:
Adoption of biofuels, LNG, methanol, hydrogen and ammonia under a phased fuel transition plan. The policy promotes domestic fuel production and bunkering hubs to make India a **future fuel supply nation**.

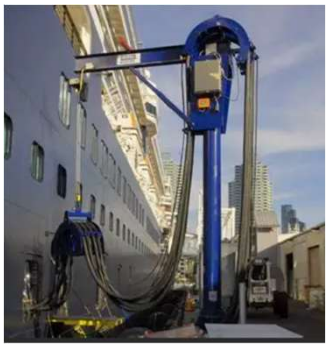
Green Recycling:
Modernisation of Alang and other ship recycling yards under HKC-compliant practices, with circular economy principles, hazardous waste control, and global recycling leadership.

Green Finance & Collaboration:
Creation of national green maritime funds, tax incentives, ESG-linked financing, PPP models, and international partnerships to support innovation and equitable transition.

Strategic Intent
The core objective of NGSP is to **shift India from regulatory compliance to global leadership** in green shipping. By integrating technology, sustainability, and economy, India seeks to become a maritime nation that exports *solutions, not emissions*. The policy emphasises a just and equitable transition, ensuring inclusion of industry, labour, MSMEs, and coastal communities.

Shore to Ship

What is Shore Power?
Electricity supplied from the shore to berthed ships, allowing engines to be switched off and eliminating fuel combustion while docked.



Why It Matters
- Cuts **CO_2, NOx, SOx and Particulate Matter** emissions in port zones
- Improves **Air Quality and ESG scores** for Indian ports
- Supports compliance with **IMO CII, GHG & Green Port Index**

Implementation Status in Indian Ports
- **Kamarajar Port** - 500 kW, 400V, 50-60 Hz in Coal Berth 1 & 2
- **VO Chidambaranar Port** - 305 kW, 400V 60Hz in VOC Berth 2 & 3
- **Jawaharlal Nehru Port Authority** - SPS used for Tugs. SPS for all terminals planned (45MVA; INR 600 crore expected)

Possible Financing options

Blended finance → *govt + MDBs + private capital.*

Green/blue bonds → *specifically earmarked for OPS infra.*

PPP models → *private players co-invest in OPS roll-out.*

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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.

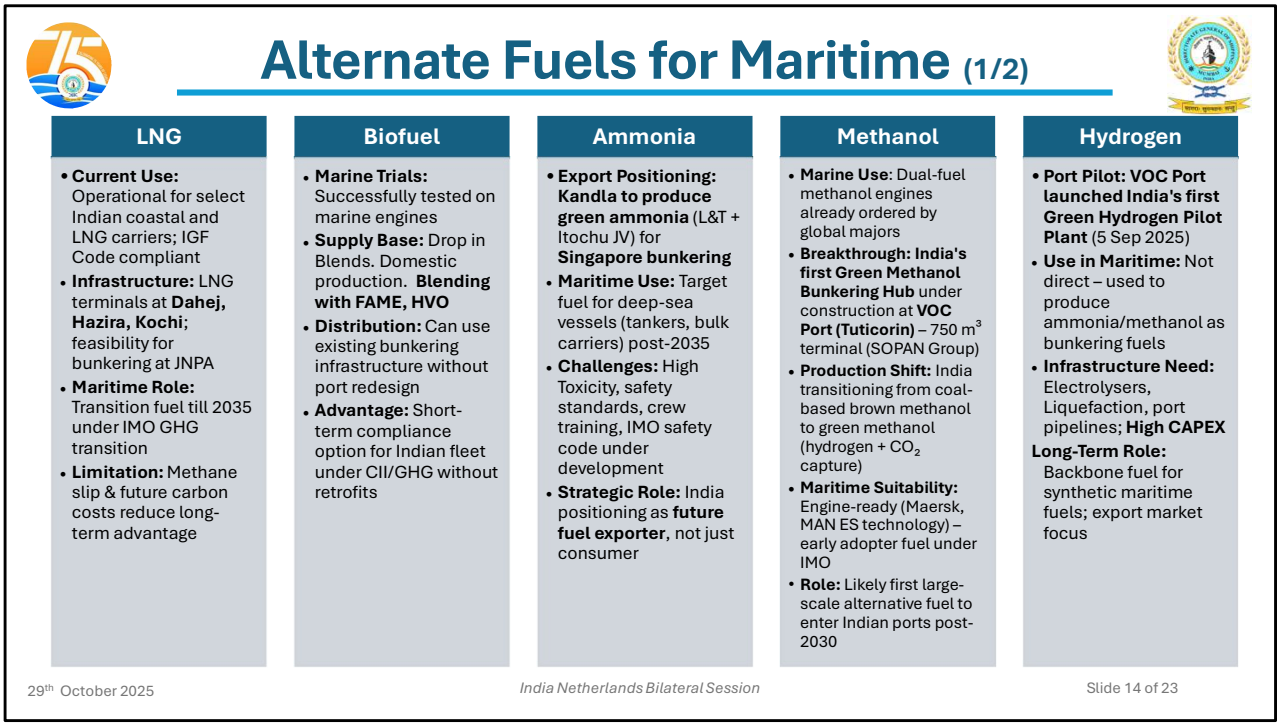
Jawaharlal Nehru Port Authority (JNPA)
Currently uses OPS for port tugs.
₹600 crore, 45 MVA national terminal OPS plan under formulation to become India's largest cold ironing hub.

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



Alternate 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 m^3 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 m^3 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

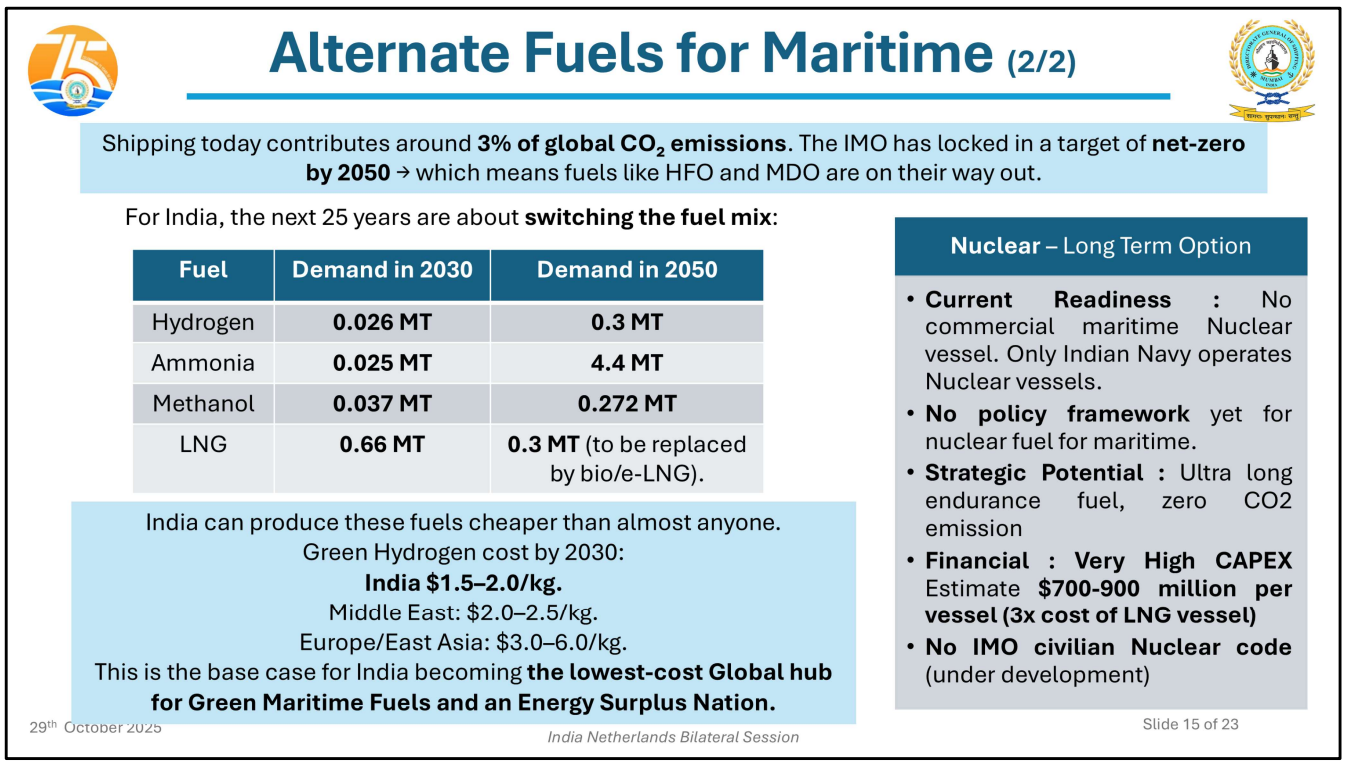
dedicated **safety code** and crew-training standards are finalised.
Challenges : High toxicity handling, new port safety zones, emergency response, and specialised storage/transfer systems.
India's role : Strong **export economics** (renewables + electrolyser scale). India can be a **fuel supplier to 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.

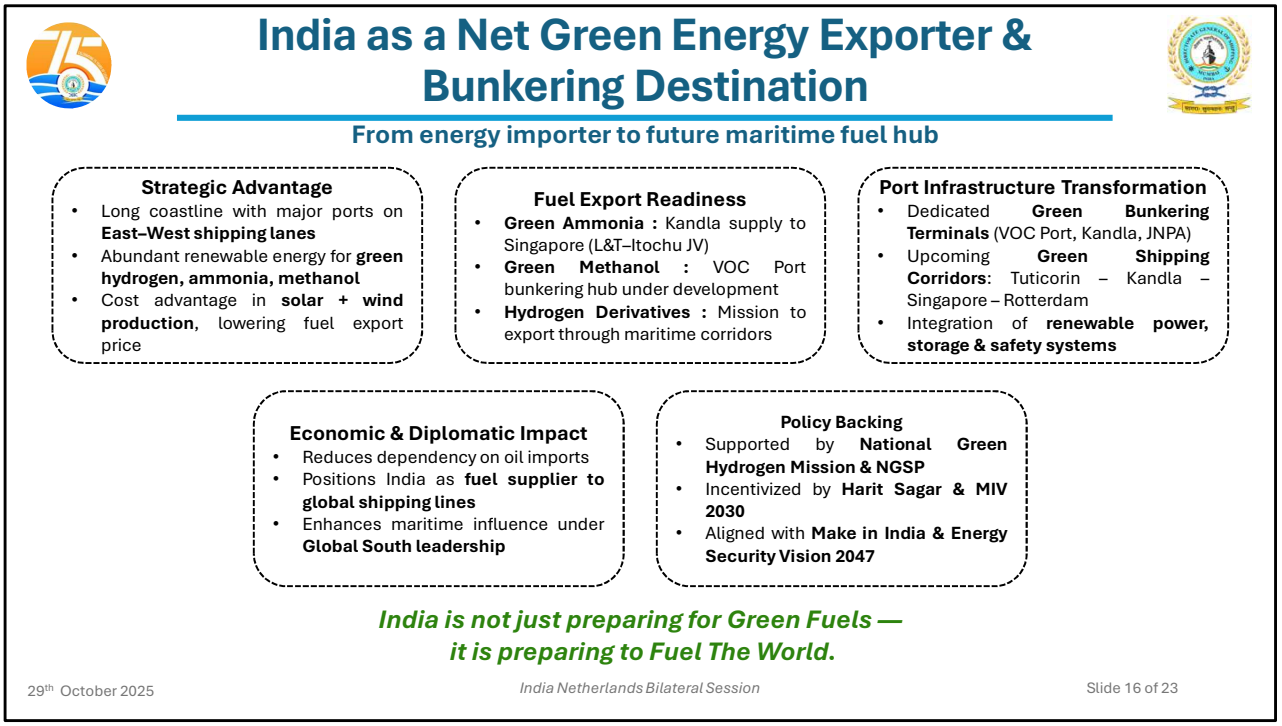
Looking further ahead, nuclear marine propulsion is emerging as a potential long-term

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.



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 m^3 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.

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.

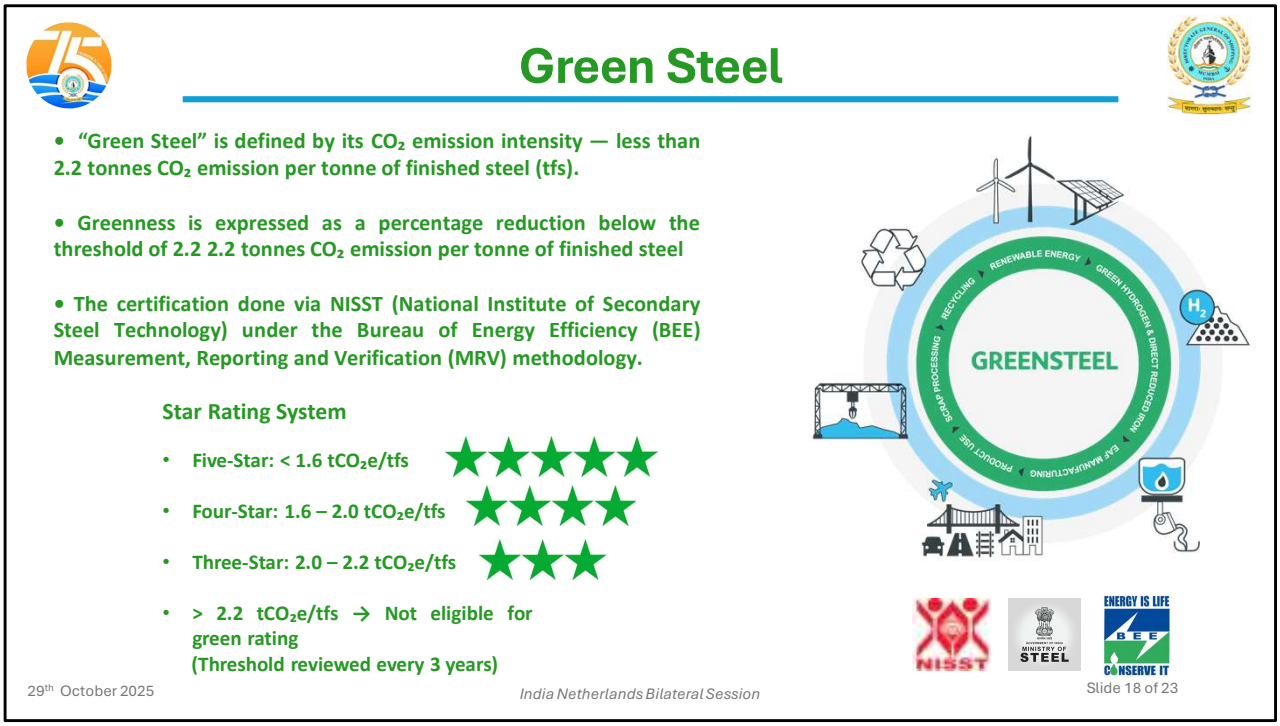
India today stands as the **global leader in ship recycling**, with the Alang–Sosiya cluster in Gujarat being the world's largest ship recycling facility. The entry into force of the **Hong Kong Convention (HKC) on 26 June 2025** has further elevated India's role, as it is the **only nation with more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



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

National Port Sustainability Council (NPSC)

India's port ecosystem today stands at a defining crossroads. With over two hundred ports, including twelve major ports, the sector is witnessing a rapid transformation driven by the global call for decarbonization, digitalization, and climate-resilient growth."

To steer this transformation in a structured and coordinated manner, the Government of India has proposed the establishment of the **National Port Sustainability Council**, or NPSC. This Council will serve as the **apex institutional and advisory body** for guiding India's maritime sector towards a greener and smarter future.

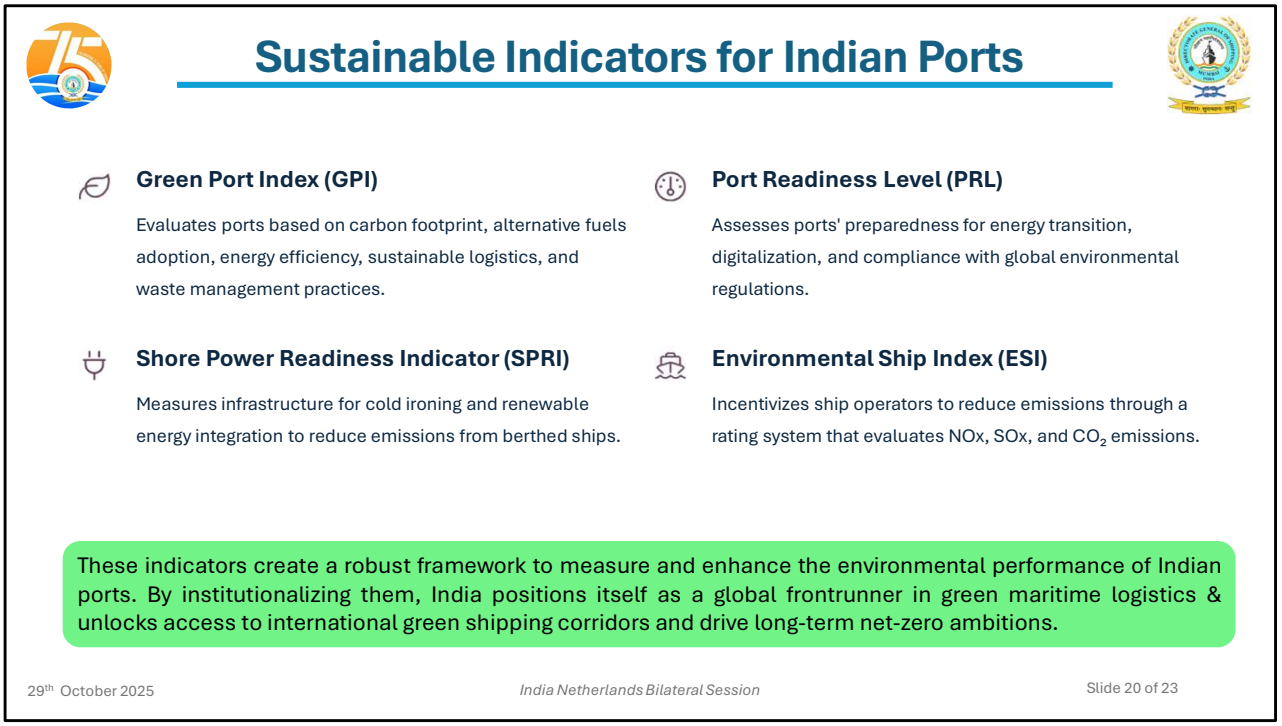
The NPSC is designed to function as a centralised framework that aligns India's port operations with **global benchmarks** such as the IMO's Revised GHG Strategy, the European Union's Fit-for-55 Package, and our own **Maritime Vision 2030**. By harmonizing national policy with international standards, it ensures that Indian ports remain globally competitive and environmentally responsible.
In practical terms, the Council will oversee critical areas such as **emissions**

monitoring, **alternative fuel readiness**, and **port electrification**, while also accelerating the adoption of **digital technologies** for real-time operational efficiency. It will serve as the nodal platform bringing together policymakers, regulators, port authorities, and research institutions under a unified sustainability agenda.

Through this initiative, India is signalling a strong commitment, that our maritime growth will not only be faster, but also cleaner, smarter, and future-ready. The NPSC embodies that vision of transforming India's ports into global models of sustainability and innovation.

In comparison, the **Netherlands has already implemented a robust governance and sustainability framework** through the **Port of Rotterdam Authority**, which is a public entity jointly owned by the Dutch Government and the Municipality of Rotterdam. This authority integrates port management, sustainability, and innovation within a single operational model. Under the Netherlands' national seaport policy, port development is aligned with the global energy transition, and the Port of Rotterdam has set a clear goal to become **climate-neutral by 2050**. Key initiatives such as the **Porthos Project** for CO_2 capture and storage, **hydrogen infrastructure**, **shore-power systems**, and **multi-fuel bunkering** underscore their integrated approach. The port also provides **tariff incentives** to vessels with higher environmental performance and invests heavily in **digital twins and automation** to enhance efficiency.

This comparative framework between India and the Netherlands reinforces a shared global commitment, where India's NPSC can evolve into a similar institution that not only governs policy, but also drives innovation, incentives, and technology integration across the entire maritime value chain.



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.*

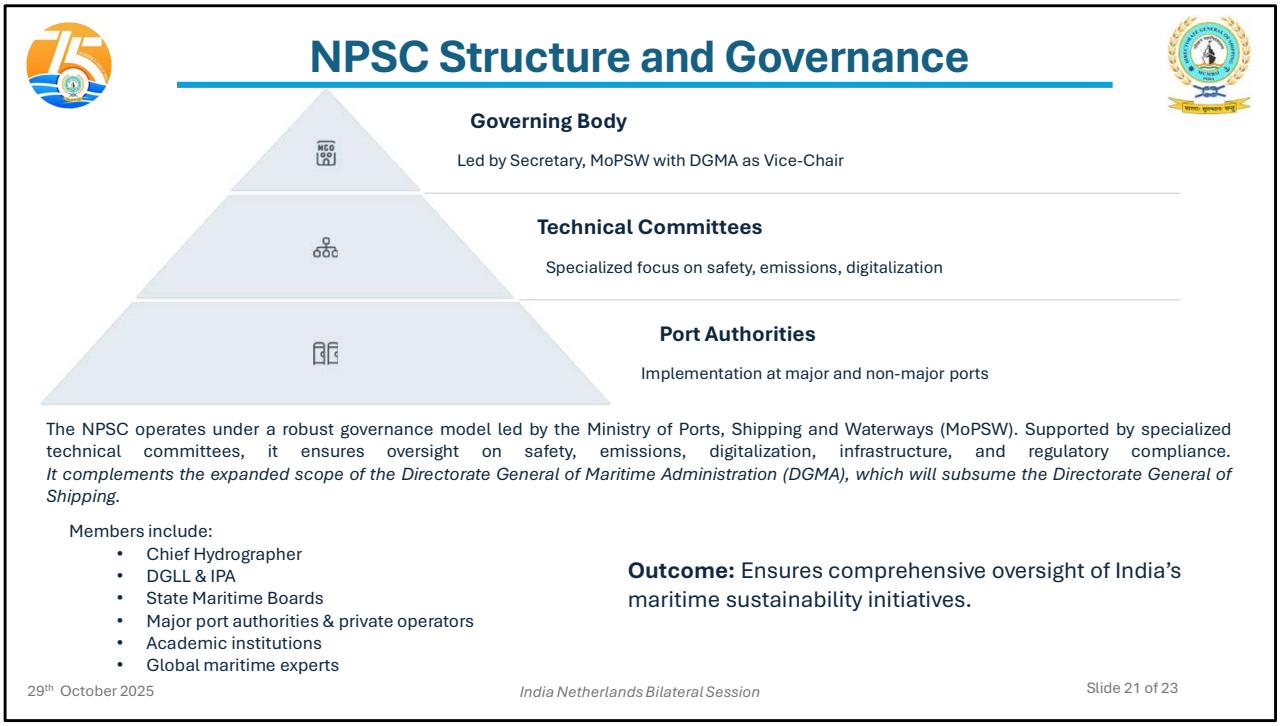
*The **Port Readiness Level**, or PRL, measures how prepared ports are for the transition to cleaner energy systems and digital operations. It evaluates their compliance with global environmental standards and their readiness to adopt emerging technologies.*

*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."



NPSC Structure and Governance

To ensure that sustainability in the port sector is not pursued in isolation but through an integrated and accountable system, the National Port Sustainability Council will operate under a clear and robust governance framework.

*At the apex of this structure is the **Governing Body**, chaired by the Secretary, Ministry of Ports, Shipping and Waterways, with the Director General of Maritime Administration serving as Vice Chair. This high-level body will guide overall policy, strategy, and regulatory coherence for India's green and digital port transformation.*

*Supporting it are a set of **Technical Committees** with focused expertise in areas such as safety, emissions management, infrastructure readiness, and digitalisation. These committees will drive domain-specific initiatives, ensuring that standards and innovation remain central to implementation.*

*The third layer comprises the **Port Authorities**, both major and non-major, who will translate these policies into on-ground actions. They will lead the execution*

of sustainability measures, from electrification and fuel transition to monitoring and compliance, ensuring that every port aligns with national and global targets.

The Council's membership includes a wide spectrum of institutions, from the Chief Hydrographer, DGLL and Indian Ports Association to state maritime boards, private port operators, academic experts, and international advisors. This inclusive model ensures that every stakeholder in India's port ecosystem has a seat at the table.

In essence, the NPSC framework complements the expanded scope of the ***Directorate General of Maritime Administration****, creating a unified system for policy, regulation, and implementation. The outcome is clear, a single, coordinated platform that ensures comprehensive oversight and sustained progress toward India's maritime sustainability goals.*

India–Netherlands Partnership Outlook

At this juncture, I would like to highlight the deep and evolving partnership between India and the Netherlands, one rooted in maritime heritage, but now steering decisively toward a sustainable and digital future.

*The collaboration between our two nations has taken a major leap this year at **India Maritime Week 2025**, where we formally launched the **Green and Digital Shipping Corridors** between **Rotterdam and Mumbai**. This corridor represents more than a trade route, it symbolises a shared commitment to climate action, innovation, and cleaner oceans.*

*Through this initiative, we are laying down a framework for **clean-fuel trade, digital port systems, and technology collaboration,** all key enablers of our collective Net Zero vision. It directly aligns with India's target to reduce **70% of carbon emissions per ton of cargo by 2047** under our national maritime decarbonisation roadmap.*

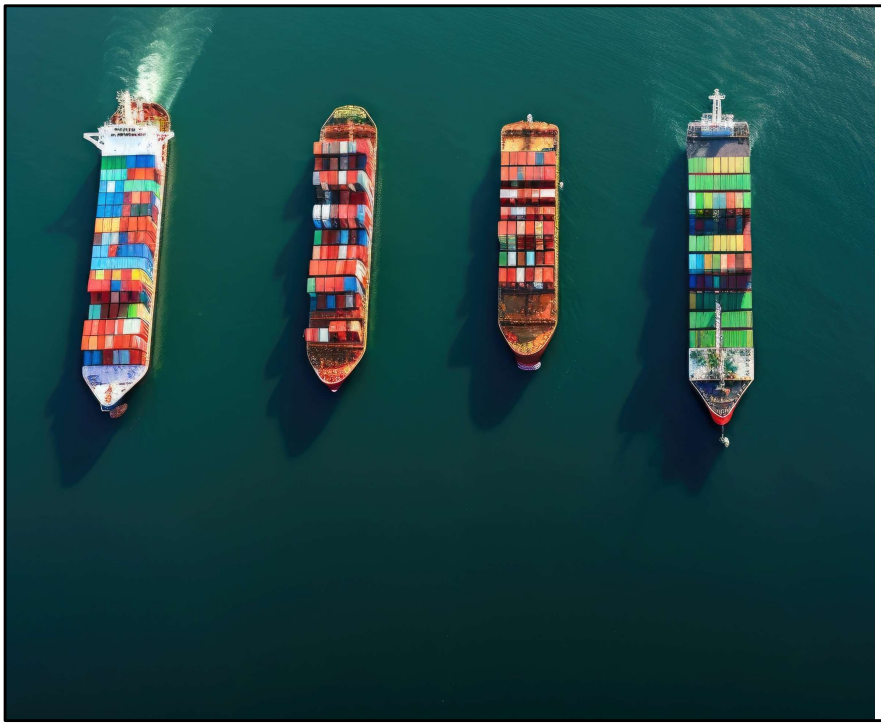
The Indo–Dutch cooperation is anchored on three major synergies. First, the

*development of **green corridors and zero-emission routes**, such as the Rotterdam–Mumbai pathway, enabling the export of **green hydrogen, ammonia, and methanol** from India. This builds upon the Indo–Dutch agreement earlier this year to expand the Rotterdam–Kandla corridor for hydrogen and e-fuel logistics.*

*Second, the creation of **innovation ecosystems** that combine Dutch expertise in port digitalisation and automation with India's research and development. This includes joint work on **vessel retrofitting, digital twins, and emission monitoring frameworks**.*

*And third, our focus on **capacity building and regulatory collaboration,** establishing bilateral working groups on safety codes, policy alignment, and workforce training. These steps ensure that our progress on sustainability is matched by readiness at the human and institutional levels.*

Together, these partnerships reaffirm that maritime cooperation is not just about connecting ports, but about connecting people, ideas, and shared purpose — for a cleaner, more resilient maritime world.



Just as the seas connect nations, partnerships connect possibilities. Turning waves of collaboration into currents of sustainable growth.

Thank you