SUSTAINABLE VESSELS
Green Propulsion & Retrofitting, Accelerating Green Transition in Inland Waterways Sector

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Introduction

- Inland Water Transport (IWT) : A clean, cost-effective and eco-efficient transport mode
- Need for sustainability in vessel operations
- Objective: Green transition through clean propulsion and retrofitting
- Focus on reducing emissions, fuel use, and environmental footprint
- Climate change & decarbonization
- IWAI’s Net Zero commitment

Environmental Challenges....

- Environmental cost of vast and active maritime footprint is massive.
- Cargo movement in IWT sector achieved all time high of 145 MMT in 2024-25 from 18 MMT in 2013-14. This continuous upward trajectory while vital for economic advancement raises concern regarding energy consumption, emissions, waste discharge and overall ecological footprint of the sector.

....Environmental Challenges

- Emissions from diesel-powered vessels (NOx, SOx, PM)
- Fuel inefficiencies
- Water and noise pollution
- Ageing fleet with outdated technologies

REDUCE CARBON EMISSIONS

- Transition towards renewable energy across terminals and vessel operations, with target of > 60% by 2030 and 90% by 2047.
- *Transition to renewal energy in all offices and terminals of IWAI would be achieved by 2026.*
- Electrification of terminal equipment with phased targets : 50% by 2030 and 90% by 2047.
- *16% electrification of terminal equipment completed balance being undertaken in phases to meet the target*.
- Switch to energy efficient technologies, smart building designs and automation across marine infrastructure
- *100% Energy efficient equipment(LEDs) achieved, 3 buildings are green certified*
- *Green Belt Development. 29% target achieved by IWAI.*

REDUCE AND RECYCLE WASTE

- Full integration of waste recycling and management systems, including sewage treatment plants.
- Commitment to zero waste to landfill, zero incineration, zero unauthorized disposal, and zero effluent discharge by 2047.
- Terminal-specific action plans to implement material recovery facilities and hazardous waste compliance frameworks.
- *Reception facility provided in IWAI terminals for garbage, dirty oil, 7 STPs installed.*

PRODUCTIVITY IMPROVEMENT THROUGH DIGITALISATION

- Establishment of Online Terminal Management Systems, Management Information Systems (MIS), and Digital Asset Management platforms. *Jal Samriddhi & Jalyan & Navic Portal*
- Use of predictive maintenance technologies for energy-intensive equipment. *In planning stage for development.*
- Capacity building and training modules to equip terminal and vessel operators with green operational protocols. *Courses commenced at NINI, Patna.*
- **Digital Twins & AI:** Using data to optimize vessel turnaround time, reducing idle emissions

WHAT ARE SUSTAINABLE VESSELS?

- Maritime emissions contribute ~3% to global GHG
- Sustainability mandates from IMO, MIV 2030, and draft National Green Shipping Policy
- Use of clean fuels (electric, hydrogen, biofuels)
- Energy-efficient design
- Low-emission propulsion systems
- Advanced monitoring and control systems

SMART GREEN SHIPPING

- In risk averse industry like shipping, decarbonisation is not about compliance – its about making informed strategic choices that support operational resilience, safety and financial sustainability.
- One option is wind / solar assisted propulsion which is cost effective with long term access to clean renewable energy that significantly reduces fuel consumption and emissions.
- By cutting fuel dependency, it strengthens operational resilience – a growing priority as global energy markets become increasingly volatile.

Green Propulsion Technologies

- Electric propulsion (battery-based)
- Hybrid systems (diesel-electric)
- LNG propulsion
- Methanol
- Hydrogen fuel cells
- Solar-assisted propulsion
- Wind assisted propulsion

Comparison of Propulsion Options

Type	Emissions	Fuel Cost	Infra Need	Suitability
Diesel	High	High	Low	Existing
Electric	Zero	Low	Medium	Short trips
Hybrid	Medium	Medium	Medium	Transitional
Hydrogen	Zero	High	High	Future-ready
Solar Assist	Zero	Low	Low	Supplemental
Wind	Zero	Low	Medium-High	Future-ready

Retrofitting of Existing Vessels

- Conversion of diesel vessels to hybrid/electric
- Hull optimization and lightweight & high strength materials
- Upgraded engines and emission control systems
- Installing energy-efficient smart propulsion systems
- Propeller optimization
- Emission scrubbers and filters for air pollution reduction
- Integration of solar panels and battery banks
- *Proposals received from shipbuilders / OEMs for retrofitting*

Green Vessels - IWAI

- Hybrid Electric Catamarans
  - 8 Ordered on CSL,
  - 2 delivered and operating in Ayodhya & Varanasi,
    6 vessels delivery by year end
  - 1 in tendering stage
- Hydrogen Fuel Cell Catamarans – ready for operations in Varanasi
- Proposal for development of methanol

Engines and construction of 2 vessels as pilot case

- Proposals for replacing aging fleet in next 10 years

Policy & Regulatory Support

- Inland Vessels Act 2021 and rules: Enabling provisions for green technologies
- Special Category rules framed for boosting green technology in Inland Vessels including autonomous vessels
- Incentives for retrofitting & new green vessels
- Make-in-India incentives
- Maritime India Vision 2030: Green port & vessel targets
- Green Shipping Guidelines by MoPSW

Infrastructure Requirements

- Onshore power supply & charging stations *(17 OPS & 4 EV Stn completed & 4 in pipe line by IWAI)*
- Hydrogen refuelling terminals (future) – *Proposal under discussions*
- Maintenance & retrofitting facilities – *Study by NTCPWC in progress*
- Training centre's for green tech operations – *8 RCoE being set up*
- Course module developed and *training commenced* for hybrid electric and hydrogen fuel cell catamarans at NINI, Patna
- Course for terminal, ship builders, ship repairers under development under guidance of IMU.

Challenges & Solutions

Challenges	Solutions
High initial cost	Subsidies, PPP models, Green finance, Viability Gap Funding (VGF), and green tax benefits, Green bonds and blended finance
Infra gaps	Phased infra development
Tech readiness	Pilot projects and R&D, AI-based route optimization & fuel efficiency tools
Skilled manpower	Targeted training & upskilling

Way Forward….

- Incentivising market and mandate change
- Promote R&D in indigenous green marine tech. Boost innovation through increased funding.
- Encourage retrofitting through financing support
- Creation of bunkering ecosystem for types of fuel
- Build a network of green IWT corridors
- Transition is not optional – it’s urgent

....Way Forward

- Collaboration is the key- across spectrum
- Empowering local shipyards and technology providers
- Create a knowledge based platform for easy access to stakeholders of information's related to sector
- Mandatory emission norms for IWT
- Skill development and certification
- Carbon credit eligibility for green initiatives
- Improve design and delivery of green initiatives

THANK YOU