



Green Technology- Implementation Roadmap (Short Term)



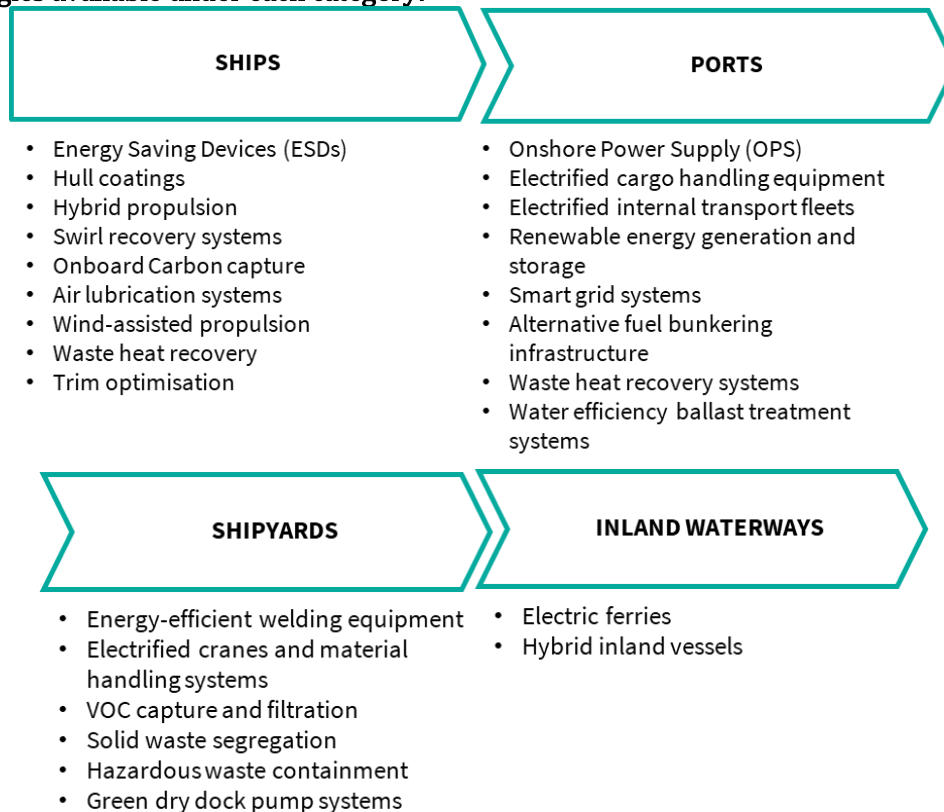
Definition of Green technology:

Green Technologies refer to ship, port, shipyard, and maritime infrastructure systems that demonstrably reduce greenhouse gas emissions or improve energy efficiency across the maritime value chain. These include technical, operational, and digital solutions that deliver measurable environmental performance improvements in vessel operations and port activities.

Areas where Green technology is applied:



Technologies available under each category:



Challenges for India for applying Green Technologies to the Maritime sector:

1. **No clear national baseline on what is installed:** India does not currently maintain a consolidated national database capturing adoption of energy saving technologies, hybrid systems, digital optimisation tools, or retrofit outcomes.
2. **Retrofits are technically complex and mostly imported:** Advanced efficiency and decarbonisation technologies are largely developed and supplied internationally, while domestic shipyard capability for complex retrofits remains limited, increasing cost exposure and implementation risk.

3. **Financing Constraints for Retrofits:** Retrofit costs vary significantly depending on vessel size and technology type. Indian banks traditionally finance asset acquisition rather than performance-based retrofits, and green maritime lending frameworks are still evolving domestically. In the absence of verified performance data, lenders face difficulty assessing risk.
4. **Cyclical Shipping Market and Volatile Earnings:** Shipping markets are highly cyclical. Freight rate volatility directly affects cash flows and payback capacity. During downturns, capital expenditure on retrofits is typically deferred.

India must first address the identified structural and technical gaps in order to create a clear and practical pathway for the adoption of green technologies. Accordingly, the following short-term implementation actions are proposed.

Short Term (0-6 Months)

To address the absence of a verified baseline on currently installed technologies, India shall undertake the following action:

- A. Establish National Green Technology Baseline:
 1. DGS shall **issue a circular** mandating all Indian-flagged vessels >400 GT, major ports, and registered shipyards to gather survey responses for technology disclosure **within 90 days**.
 2. **Data collection window of 1-3 months** during which survey data collected should be rolled out as 3 separate forms: i) for ships and inland vessels ii) for ports iii) for yards
 3. **Sample questions** for Ships are indicated below:

Question	Installation Status	Options
1. Has Engine Power Limitation (EPL) or Shaft Power Limitation (ShaPoLi) been implemented for EEXI compliance?	Installed / Not Installed	EPL / ShaPoLi / None
2. Are hull or propeller Energy Saving Devices (ESDs) fitted?	Installed / Not Installed	Pre-swirl stator / Mewis duct / PBCF / Air lubrication / Multiple / None
3. Is a Waste Heat Recovery (WHR) system installed?	Installed / Not Installed	Power generation / Thermal recovery only / None
4. Is the vessel equipped with Shore Power (OPS) connection capability?	Operational / Installed but not used / Not Installed	HVSC compliant / Non-HVSC / None
5. Is the propulsion system certified as alternative-fuel ready by Class?	Certified / Under design approval / Not Ready	LNG Ready / Methanol Ready / Ammonia Ready / Hydrogen Ready
6. Are fuel storage and safety systems compliant with IGF Code for low-flashpoint fuels?	Fully compliant / Partially compliant / Not compliant	LNG / Methanol / Other
7. Is any hybrid propulsion or	Installed / Not Installed	Battery assist / PTO/PTI

electrical assist system installed?		shaft generator / Full electric mode / None
8. Is Onboard Carbon Capture (OCC) installed or space reserved for future installation?	Installed / Space reserved / Not considered	Post-combustion capture / Other
9. Is real-time fuel performance monitoring and digital voyage optimization system deployed?	Fully implemented / Partially implemented / Not Installed	Fuel monitoring / Trim optimization / Voyage optimization
10. Has the vessel undergone energy efficiency retrofits in the last 5 years?	Yes / No	Propeller upgrade / Hull coating upgrade / Engine tuning / Multiple

4. The **survey output** should be clearly defined, based on the responses the readiness level for ships, ports and yards should be divided into:

Tier	Ships / Vessels	Ports	Shipyards
Tier 1 – Advanced Readiness	Alternative-fuel ready or operating on low/zero carbon fuels; Hybrid/electric systems installed; ≥ 2 energy efficiency technologies; OCC space allocated	Shore power operational; Green fuel bunkering capability (LNG/Methanol/Ammonia/H ₂); Electrified cargo handling equipment	Proven capability to design/retrofit vessels for alternative fuels; Class-approved green conversion projects executed
Tier 2 – Transitional Readiness	EEXI compliant (EPL/ShaPoLi); ≥ 1 Energy Saving Device installed; Digital fuel monitoring system in use; Technically feasible for retrofit within 3–5 years	Shore power planned or partially installed; Basic infrastructure for future bunkering; Energy monitoring systems in place	Engineering capability for efficiency retrofits; Limited experience with alternative fuel systems; Basic green design competence
Tier 3 –Low Readiness	Regulatory minimum compliance only; No major efficiency upgrades; No alternative fuel preparedness	No shore power; No alternative fuel bunkering plans; Conventional operations only	No demonstrated capability for green retrofit or alternative fuel vessel construction

5. DGS is then ready to publish the “**National Green Technology Inventory Report**” along with estimated **CAPEX** for the next step

B- Alongside the national baseline survey, within 6–9 months, DGS shall complete a **global benchmarking study** comparing available retrofit technologies in terms of capital cost, installation time, efficiency and emission reduction performance, training requirements, and technical complexity, and assess their applicability to the Indian fleet.

6. Create a **list of available technologies** for the 4 segments identified above. List of probable technologies also shared above.

7. For each retrofit type **collect this data** for benchmarking:

Parameter	Output Required
Capital Cost	USD million per vessel (range by vessel size)
Installation Time	Weeks in dry dock
Efficiency Gain	% fuel savings or gCO ₂ /kWh reduction
GFI Impact	Estimated reduction vs baseline fuel
Yard Capability Requirement	Infrastructure & tooling requirement
Crew Training Requirement	Additional certification / hours required
Class Approval Complexity	Moderate / High / Extensive
Payback Period	Years (under current fuel price and carbon pricing scenarios)