

CMEC Maritime Knowledge Series

"Maritime Sustainability – Global Perspectives and Opportunities for India"

The CMEC Maritime Knowledge Series, lecture on "Maritime Sustainability – Global Perspectives and Opportunities for India" was held on Tuesday, 7 October 2025, at Gulmohar Hall, India Habitat Centre, New Delhi. The speakers of the session included, Dr. SSV Ramakumar, CTO of AM Green and Mr Manish Tripathi, AM Green and was moderated by Dr Shishir Shrotriya, Head CMEC. The lecture focused on the International Maritime Organisation's (IMO) Net-Zero Framework and the prospects it offers for India's maritime sector.



Lecture Highlights

IMO Net-Zero Framework: Regulatory Milestone

The lecture focused on the draft IMO Net-Zero Framework, approved at MEPC 83 in April 2025, which establishes the first global mandatory greenhouse gas (GHG) emissions limits and pricing mechanism for an entire industry. Its primary goal is to achieve net-zero GHG emissions in shipping by 2050, applying compliance obligations to vessels over 5,000 gross tonnage. The framework is structured around three key pillars. The 'technical element' mandates annual GHG fuel intensity (GFI) reduction targets on a well-to-wake lifecycle basis, covering about 85% of international shipping CO₂ emissions. Ships must update their Ship Energy Efficiency Management Plans (SEEMP) to align with these targets. The 'economic element', introduces dual-tier penalties to drive compliance: direct compliance targets require a 17% reduction by 2028 and 43% by 2035, with non-compliance penalized at \$100/tonne CO₂e, while a lower base target incurs a \$380/tonne CO₂e penalty.

The speakers also explained the ‘Reward Mechanism’, which offers incentives for ships using fuels with ≤ 19 gCO₂e/MJ, tightening to ≤ 14 g by 2035, and exceeding direct compliance, providing rewards valued between \$30 and \$228/tonne CO₂e, funded through tradeable surplus units and the IMO Net-Zero Fund.

Decarbonization Trajectory and Legislative Status

The framework’s aggressive reduction timelines surpass previous regulations. Unlike earlier approaches targeting only pollutants or efficiency, this framework mandates annual GHG reductions backed by strict financial penalties. The direct compliance route incentivizes rapid green technology adoption, while base targets provide a fallback with stiffer penalties, driving economic viability for sustainable solutions. Approved by 63 of the 104 member states at MEPC 83, including India, the regulation awaits formal adoption at MEPC. The framework will undergo a tacit acceptance period of at least ten months, scheduled to enter into force by March 2027, with mandatory compliance implemented from January 2028. The speakers explained that the detailed IMO guidance will be further issued on fuel definitions, methodologies, and governance.

Global Perspectives on Green Fuels

The lecture highlighted that the framework is expected to drive significant growth in the clean fuel sector, projecting demand for around 65 million tonnes per annum of green ammonia by 2030, as the global shipping industry works toward achieving at least a 10% market share for zero-emission fuels. Currently, the share of non-fossil fuels in shipping remains below 1%, highlighting the urgent need for rapid scaling and investment in alternative energy sources. Although waste-based biofuels are being developed as transitional options, their limited feedstock availability means they could only meet about 4.9% of total maritime energy demand. This limitation positions green ammonia—recognized for its zero-carbon content and major emissions reduction potential—as the leading and most sustainable alternative fuel.

The speakers also explained the key advantages which strengthen the case for green ammonia, its Zero-Carbon Profile that allows for almost complete elimination of CO₂ emissions, achieving well-to-wake values as low as 16.7 g CO₂e/MJ. Operational benefits include a high energy density and easier onboard storage and handling compared to hydrogen. The infrastructure leverage factor is also significant, as existing global ammonia networks, particularly those supporting fertilizer production and logistics, can be efficiently adapted to serve as bunkering and distribution systems. Finally, Green Ammonia scaling potential was explained to be over \$25 billion, in announced global production projects aligned with the IMO’s net-zero strategy. Major infrastructure expansions are already progressing at key maritime hubs such as Rotterdam—where a major pilot was completed in April 2025—Singapore’s Jurong Island, which is undergoing extensive upgrade work, and Dalian, which launched the world’s first dedicated green ammonia bunkering operation in July 2025.

Green Ammonia Trade and Infrastructure Development

The speaker discussed about emerging bunkering hubs like Rotterdam and Singapore, are expected to set standards for global green ammonia infrastructure. Australia will likely become the top exporter, controlling nearly half the global supply due to renewable energy resources and favourable shipping geography. India's plans to build green bunkering facilities at Tuticorin and Kandla, supported by the ₹25,000 crore Maritime Development Fund, demonstrate strategic intent to become a competitive supplier and bunkering hub for green fuels.

The session discussed the successful pilot projects at ports worldwide and the ongoing transformation, including Egypt (East Port Said's 2M tonnes/yr project), Japan (first dedicated large ammonia bunkering ship by 2027), and advances in port readiness for green bunkering operations—which collectively indicate rapid global movement toward zero-carbon shipping logistics.

Key Takeaways of the Talk - India's Strategic Position and Opportunities

India's decisive vote in favour at MEPC 83 positioned it for leadership in maritime decarbonization, ensuring a voice in implementation negotiations. The alignment of the IMO regulation with India's National Green Hydrogen Mission, Maritime Vision 2030, and Maritime Amrit Kaal Vision 2047 supports ambitious green fuel production and export targets. Existing renewable energy advantages (190 plus GW capacity), cost-efficient production models, and robust policy incentives give India a key comparative advantage.

India's ports, including Tuticorin, Paradip and Kandla, which are piloting green ammonia bunkering infrastructure, are positioned to serve both domestic and international shipping fleets. National Shipping Corporation retrofits and PSU charters for green fuel vessels are also being planned for 2027. Port-level incentives, financial support for early adoption, and comprehensive government-backed financing and insurance schemes will further catalyse India's transition.

Policy Supports and Industrial Ecosystem

India's integrated approach to maritime decarbonization combines strong policy measures, industrial collaboration, and strategic incentives to accelerate the transition toward green fuels. Under the *Maritime Amrit Kaal Vision 2047* and *Harit Sagar Framework*, all major ports are mandated to establish green fuel capabilities by 2035, aligning with global net-zero objectives. Complementing this, the *National Green Hydrogen Mission*, with an outlay of ₹19,744 crore, provides production-linked incentives and transmission charge waivers to enhance green hydrogen and ammonia adoption.

Additional government incentives such as port queue priority, berth dues rebates, financing assistance, and price hedging mechanisms are designed to support early movers in the sector. The *Make in India* initiative further strengthens the domestic industrial base by leveraging India's extensive ammonia infrastructure developed for the fertilizer industry, positioning the country for large-scale indigenous production.

Discussions highlighted how India can achieve ambitious IMO and national decarbonization targets through rapid policy alignment, infrastructure expansion, and technological innovation. India is well placed to emerge as a global hub for green fuel production, export, and bunkering—especially in green ammoniasupported by cost advantages, proactive policy measures, and the potential for Indian-flagged and Indian-owned vessels to lead in fleet conversion and sustainable fuel adoption.