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GUIDELINES FOR USE OF FIBRE-REINFORCED PLASTICS (FRP) WITHIN SHIP STRUCTURES

"Economic Advantages and Limited Environmental Concerns of Fiber-Reinforced Plastics (FRP) in Ship Structures for Developing Nations"

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SUMMARY

Executive summary: Fiber-Reinforced Plastics (FRPs) present a revolutionary substitute for steel in shipbuilding, attributed to their exceptional strength-to-weight ratio, resistance to corrosion, and enhanced fuel efficiency.

Their robustness and insulating properties render them suitable for extreme marine environments, while materials such as GFRP can potentially decrease CO2 emissions by as much as 90%, thereby aiding India in achieving its net zero targets by 2070. Nevertheless, obstacles persist regarding recycling process, high upfront costs, and a lack of technical expertise in developing countries. From an economic perspective, FRPs foster innovation, generate employment opportunities, and encourage industrial diversification; however, they necessitate investment in both training and infrastructure. Policy measures should be prioritized financial incentives, the establishment of industrial cluster and fostering international partnerships .Update the regulations such as the SOLAS and the 2010 FTP CODE must encompass FRP fire testing, recyclability, regional approvals to guarantee the safe, sustainable and economically feasible incorporation of composites into future ship designs which has been briefly discussed in this paper.

Strategic Directions: PARAGRAPH 2

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Action to be taken: PARAGRAPH 2

Related documents: IMO Resolution MSC.307(88), IMO Circular MSC.1/Circ.1002

1. Economic Implications And Challenges In Adoption of Fiber-Reinforced Plastic In Developing Nations

Technology Leapfrogging: FRP enables developing countries to bypass expensive steel yards by embracing contemporary, automated, modular shipbuilding, which requires less capital and facilitates quicker industrial growth.

Job Creation: FRP shipyards generate employment opportunities in manufacturing, assembly and maintenance that necessitate less specialized training compared to steel, thereby expanding job availability.

Multiplier Effect: The expansion of FRP shipbuilding stimulates the polymer resin, logistics, training, and research industries, and enhancing overall industrial development.

Challenges:

- **Initial Investment Concerns:** Transitioning to FRP shipbuilding involves considerable initial investments, posing challenges for developing nations.

- **Skill Gap and Training Needs:** There exists a skill gap in handling FRP materials, making training programs for shipbuilders essential.

- **Regulatory Framework:** Developing nations often lack regulations specific to FRP, necessitating clear standards for safety and usage.

2. Policy Recommendations for developing nations aiming to harness the economic and strategic advantages of implementing Fiber Reinforced Polymer (FRP) in ship structures

2.1 Policy Recommendation 1

- **Strategic Grants and Subsidies:** Governments should establish targeted grants, tax incentives, or subsidy programs to encourage private sector investment in FRP manufacturing facilities. These incentives reduce risks for early investors, foster industrial growth, and accelerate technology adoption.

- **Industrial Cluster Development:** Creating FRP manufacturing within industrial clusters can improve economies of scale, support related industries (such as resin, fiber production, and tooling), and develop localized value chains that lower costs and stimulate innovation.

- **Technology Partnerships:** Encourage joint ventures between local businesses And established international FRP manufacturers. Such partnerships facilitate knowledge transfer, provide access to advanced manufacturing techniques, and promote sustainable industrial development.

2.2 Policy Recommendation 2

- Invest in workforce development by utilizing vocational programs, Apprenticeships, and certifications in FRP fabrication, quality assurance, and Advanced manufacturing to maintain a consistent supply of skilled shipyard Workers.
- Collaborate with universities and technical institutes to incorporate composite engineering and maritime material science into their curricula,

promoting research and innovation.
- Encourage government–industry technology transfer initiatives that invite foreign FRP specialists for training, workshops, and knowledge-sharing to enhance local expertise and facilitate the adoption of global best practices.

2.3 Policy Recommendation 3

- **Modernize Standards:** Collaborate with maritime authorities and classification Societies to update shipbuilding codes, guaranteeing that FRP structures Possess well-defined certification pathways that enhance safety, compliance, and investment.
- **Adopt International Norms:** Synchronize national regulations with global standards (ISO, IMO, IACS) to increase export potential and facilitate international approvals.
- **Engage Stakeholders:** Create forums that unite policymakers, industry experts, certifiers, and operators to ensure that regulations evolve in accordance with composite technology and industry requirements.

3. Recommendations for change in amendments in SOLAS and the 2010 FTP CODE for developing nations for the better utilization of FRP

To enhance the safety and broader application of fiber reinforced plastics , The prescriptive use of FRP beyond alternative design should be allowed and explicit prescriptive standards for FRP in smaller vessels and non critical area of ships

Key Recommendations:

3.1 Fire Test Procedures: Amend the 2010 FTP Code to introduce tiered testing specifically tailored to reflect the realities of regional FRP production in developing countries.

3.2 Capacity Building: Create prescriptive FRP standards for smaller vessels and non-critical areas to reduce reliance on complex alternative design methods.

3.3 Local Materials: Permit region-specific approval of local resins, fibers, and methodologies, as long as they meet essential fire, structural, and toxicity standards.

3.4 Certification & Training: Require FRP yards to obtain certification and ensure that inspectors and craftsmen receive regular training, with compliance linked to potential safety subsidies.

3.5 End-of-Life: Incorporate guidelines for the recyclability and disposal of FRP to support adherence to future environmental regulatory frameworks

3.6 Capacity & Assistance: Tackle the shortcomings in trained surveyors, certification programs, and access to testing by necessitating IMO-led technical support, subsidized facility usage, and regionally customized Codes for effective national implementation.

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