

Latest report from Maritime Technologies Forum (MTF) spotlights safe adoption of onboard carbon capture in the maritime industry

by Hamid Daiyan, *ABS Sustainability Manager, MTF Member*,
and Gwilym Stone, *UK MCA Deputy Director for Regulations and Standards, MTF Member*

The shipping industry faces a challenge today in reducing greenhouse gas (GHG) emissions. Recognizing that international shipping contributes to global emissions, the International Maritime Organization (IMO) has set an ambitious goal of achieving net-zero emissions from ships by or around 2050. Hitting this target will most likely require multiple approaches, including energy efficiency solutions, alternative fuels, and other new technologies. One solution currently being developed as a promising measure for mid-term maritime decarbonization is onboard carbon capture and storage (OCCS).

Post-carbon capture technology involves capturing CO₂ from the ship's exhaust, storing it onboard, and eventually transferring it to shore for permanent storage or utilization, particularly when the CO₂ originates from biogenic sources. While OCCS offers exciting possibilities, its effectiveness still needs careful validation. Additionally, clear protocols for accurate and robust monitoring and verifying the captured carbon are essential.

Currently, there are no international regulations governing OCCS on ships. IMO acknowledges OCCS's potential and has initiated discussions to outline the necessary guidelines. The Organization's Maritime Safety Committee is developing a roadmap to identify which committees should be responsible for creating these new regulations. Meanwhile, the European Union is also considering OCCS within its Fit for 55 climate plan.

The recent study by the Maritime Technologies Forum (MTF) highlights OCCS's potential but emphasizes that clear international regulations on both safety and environmental performance are crucial for its safe adoption.

The path to wider adoption

For OCCS to become practical, several conditions need to be met. First, the downstream infrastructure and process for managing captured CO₂. This downstream value chain involves transportation, storage, as well as the potential utilization of captured CO₂. This requires a significant investment in port facilities. Furthermore, implementing an orderly system to monitor, report, and verify the captured and stored CO₂ is vital.

Cost is another key factor influencing the wider adoption of OCCS. Installing and running OCCS equipment involves high expenses, as the technology demands

considerable amounts of energy for capturing and liquefying CO₂. Innovations in technology, improvements in equipment design, and policy-driven incentives could all help lower costs and make OCCS a more attractive option for shipowners and operators.

The path to the wide adoption of OCCS also comes with several safety considerations. Ships using OCCS should be able to handle impurities in captured carbon due to their possible impact on material integrity, operational stability, and crew safety. Crew members need training on how to operate and maintain OCCS systems, including managing potential emergencies. Another safety aspect is that receiving terminals (or vessels) must also develop the capacity to handle the captured CO₂ safely.

Further dialogue needed

Due to the absence of international regulations governing the safe installation and



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operations of OCCS, classification societies have taken action to address this need separately. They have developed guidelines and requirements to support the safe design and operation of OCCS on vessels rather than enhancing operational performance or efficiency. Most of these guidelines currently focus on chemical absorption technology, the most advanced method for onboard carbon capture.

While classification societies have taken great steps forward, there are still several topics that need further dialogue and consideration. For instance, it would be beneficial for the industry to agree on a standard method for managing impurities in captured CO₂. Additionally, establishing clear guidelines regarding CO₂ toxicity, particularly for vessels not regulated by the International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk, is another area for discussion.

For OCCS to gain traction, different stakeholders should collaborate actively.

Policymakers should consider incorporating OCCS into existing regulatory frameworks – such as the Energy Efficiency Design Index/Efficiency Existing Ship Index, Carbon Intensity Indicator – and the EU's emission regulations in a clear and consistent manner. Offering financial incentives to offset the initial high costs and funding ongoing research will further help adoption.

Port authorities also have an important role to play. They should evaluate and upgrade port infrastructure to support OCCS operations, facilitating safe transfers and handling of captured CO₂ from ships.

Shipping companies have the opportunity to advance OCCS technologies by investing in pilot projects and collecting real operational data. Additionally, integrating OCCS operations into existing safety management systems can be beneficial. A focus on crew training regarding these new systems will also be key to successful implementation.

Part of a broader decarbonization strategy

The implementation of onboard carbon capture and storage presents a promising opportunity for reducing shipping's greenhouse gas emissions and supporting global climate goals. However, achieving widespread adoption requires international regulations, a robust downstream infrastructure, and ensuring that efficiency is high and, thus, costs will be manageable.

Regulatory frameworks need to be carefully designed to ensure they complement broader decarbonization strategies and do not incentivize increased fossil fuel use by potentially focusing on existing vessels powered by fossil fuels, and the capability of OCCS to capture and potentially reuse CO₂ from bio-sources presents an opportunity to create more sustainable and circular fuel systems in the maritime industry. ■



MTF is a forum of flag states and classification societies established to provide technical and regulatory expertise to benefit the maritime industry. The role of the MTF is to work together on research that it publishes for the maritime sector and draw on regulatory expertise to be able to offer unbiased advice to the shipping industry. The flag state administrations include Maritime Bureau, Ministry of Land, Infrastructure, Transport and Tourism, Japan; the Norwegian Maritime Authority; the Maritime and Coastguard Agency, UK; and the Maritime and Port Authority of Singapore (MPA). The classification society members are ABS, DNV, LR, and ClassNK. Visit [maritimetechnologiesforum.com](https://www.maritimetechnologiesforum.com) to learn more.