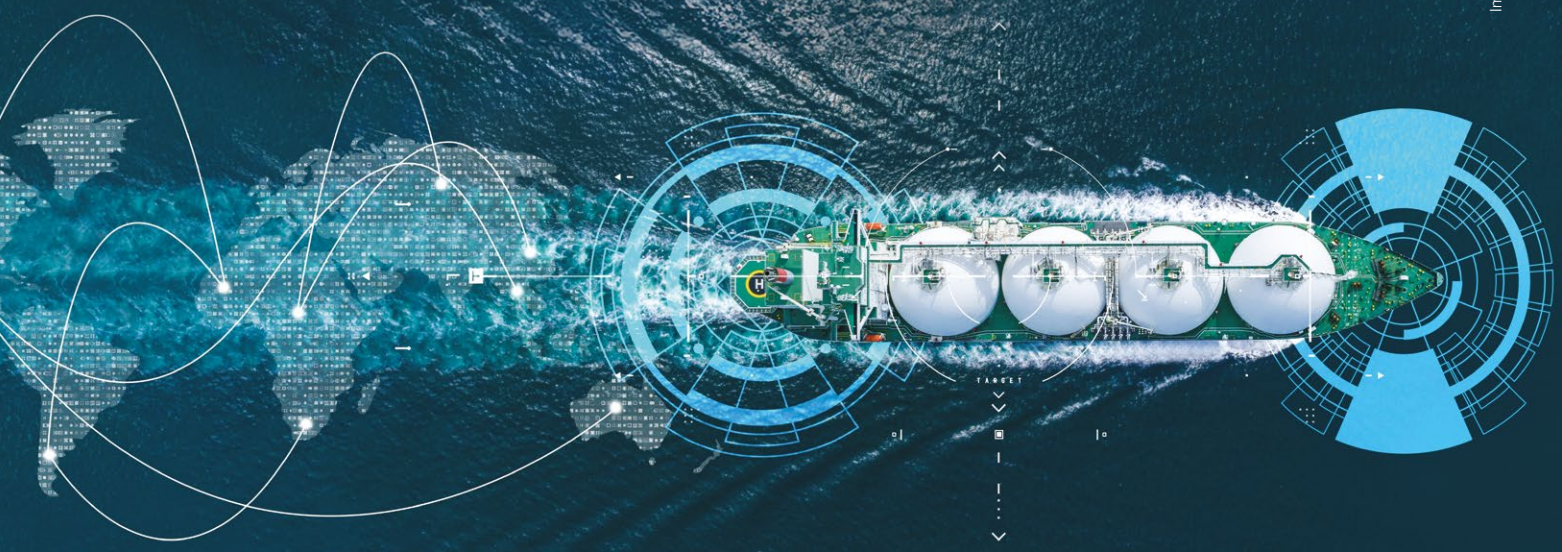
Track and trace



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Lesley Bankes-Hughes catches up with **Dr Prapisala Thepsithar** for a progress report on the GCMD's ongoing series of biofuel trials

The Global Centre for Maritime Decarbonisation (GCMD) was launched in Singapore in August 2021 with the intention of supporting shipping's energy transition by, amongst other initiatives, running a series of trials and pilots to lower the barriers for broad market adoption of low-/ zero-carbon solutions.

The approach of the non-profit organisation is to prioritise real-world testing, translating 2D recommendations to into 3D solutions. By simulating commercial conditions, GCMD's learnings can be translated directly into knowledge based on robust analyses of generated data or collated information. These learnings are then validated by project partners, and shared openly with the ecosystem.

At its inception, GCMD had six industry partners – BHP, BW Group, Eastern Pacific Shipping, Foundation Det Norske Veritas, Ocean Network Express and Seatrium (formerly Sembcorp Marine). GCMD also receives funding from the Maritime Port Authority (MPA) for qualifying research and development programmes and projects. Since then, over 100 centre- and project-level partners have joined – contributing funds, expertise and in-kind support to accelerate the deployment of scalable low-carbon technologies and lowering adoption barriers.

A key strand of work at the Centre is its drop-in biofuels assurance project which was first announced in July 2022. In February 2023, GCMD announced the completion of two supply chain trials of biofuel blends sourced from different origins. The trials took place between October 2022 and February 2023 and focused on two biofuel blends: Used Cooking Oil Methyl Ester (UCOME), a type of Fatty Acid Methyl Ester (FAME), blended with very low sulphur fuel oil (VLSFO) and UCOME blended with high sulphur fuel oil (HSFO).

On these first two supply chain trials, GCMD worked with Chevron and TotalEnergies Marine Fuels (TEMF); these fuel suppliers have existing contracts with, and were nominated by, the shipowners and charterers that are involved in the trials.

After the trials had concluded, *Bunkerspot* spoke with Dr Prapisala Thepsithar, Projects Director at GCMD and Laura Ong, TEMF's Head of Bunker Sales and Operations, to discuss some of the outcomes of the TEMF pilot (*Bunkerspot* April/May 2023). At the time, Dr Thepsithar emphasised that much work remained to be done to develop an assurance framework to be put in place as the availability of green bunker fuels scales up.

'That's why in the current project we are focusing on biofuels – FAME, HVO, UCOME – because they are available and generally compatible with existing bunkering infrastructure, storage systems and marine engines,' she said.

A key challenge around the use of biofuels is establishing the provenance of the feedstock used in their production, and the first two trials used synthetic DNA tracer technologies to establish the origin of the products and tracked their journey along the fuel supply chain. Commenting after these pilots, Dr Thepsithar said that: 'Initial field trials surfaced some challenges with replicating and reproducing results. However, these hurdles are not insurmountable. By understanding the limitations of tracers, we can incorporate their application into a framework that delivers consistent and robust performance, achieving the intended outcomes.'

The project has progressed since then, with a third trial taking place last July at the Port of Vlissingen in the Netherlands. This trial involved GoodFuels supplying around 200 metric tonnes of pilot fuel that formed the basis of a B30 biofuel blend of hydro-

treated vegetable oil (HVO) and marine gasoil (MGO). The trial took place on the *Kaupaung*, an LPG dual-fuelled gas carrier operated by Eastern Pacific Shipping (EPS). On this occasion, GCMD worked with Control Union and IDS to use an element-based tracer in the HVO to assure its origination and quantity in the biofuel blend. This trial was also noteworthy because the tracer was dosed in line with HVO and blended with MGO onboard the bunker vessel.

Catching up with Dr Thepsithar in early April for a progress update on the biofuel trials, she emphasised the difference between the two earlier Singapore trials and the one carried out in Vlissingen.

'First of all [the feedstock] is renewable and the contents of HVO are very similar to that of MGO,' she said.

'If you do standard laboratory analysis you won't be able to differentiate them. You can only use certain methods, like carbon dating ,i.e., which measures the ratio between carbon isotopes carbon-12 and carbon-14. This analysis is able to differentiate between biogenic carbon, and fossil carbon.'

The use of an element-based tracer in a biofuel blend containing similar molecules in their constituents, i.e., HVO and MGO, is key, as it acts as a "quantifier" and thus enables the verification of the contracted biofuel blend ratio in the bunker fuel, i.e., B30 having 30% biofuels.

In the Dutch trial, the biofuel blend was used as a pilot fuel. As Dr Thepsithar explained, HVO is generally known for being more stable than FAME – and it is also almost chemically identical to diesel – so there should be no concerns over its stability as a pilot fuel.

A common concern of the technical feasibility of biofuels as alternative green marine fuel is the limited scope of current trials. This lack of extensive testing raises questions on the performance of biofuels after extended periods of storage on board vessels.

In terms of the ongoing GCMD biofuel trials, Dr Thepsithar said the focus is on tracking the integrity of the biofuel and biofuel blend across the supply chain over a period of five months. While trials using FAME supplied from the Port of Singapore have not shown any significant degradation against fuel quality standards (ISO 8217), the long-term impact of biofuels on overall vessel performance remains undocumented and unavailable to the public. This lack of data warrants a thorough investigations to build confidence in biofuels as a green marine fuel solution to achieve maritime's decarbonisation targets.

> 'The GCMD is now preparing a series of white papers on the outcomes of the biofuel trial, encompassing issues such as traceability, biofuel quality and supply chain optimisation'

Returning again to the issue of feedstock provenance, Dr Thepsithar said that in addition to deploying a DNA tracer, as in the case of the first two trials, the GCMD initiative is also looking at the 'fingerprint' of the

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> *Dr Prapisala Thepsithar, GCMD*

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biofuel itself. For FAME, the fingerprint is a crucial indicator of its origins (i.e., traceability to their feedstocks) and its properties.

GCMD is currently working on its fourth trial, originating from Rotterdam, which involves the supply of FAME blended with VLSFO and the use of another type of tracer. This trial is slated for the first half of the year.

Digitalisation is currently another of shipping's buzzword, with the analysis of significant amounts of data leading to optimisation of vessel operations, routing, fuel consumption, etc. Dr Thepsithar said that the data and information from the Centre's supply chain trials will form the basis by which the upcoming quality, quantity and GHG abatement assurance framework will be articulated. She believes this framework can serve as a strong foundation for developing a digital-enabled platforms that can help deploy the assurance framework for drop-in green fuels broadly.

The International Maritime Organization is now moving to assess marine fuels based on their respective well-to-wake GHG emissions profile, as opposed to current tank-to-wake limits. Some EU environmental legislation is also taking this approach. However, to quantify the well-to-wake emissions of marine fuel is not without its challenges.

In terms of accounting for 'upstream' emissions of biofuels originating from its feedstock and production, Dr Thepsithar said that this is well accounted for by the ISCC certification methodology. However, when considering the emissions associated with transporting biofuels from the country of origin to the country of use, GCMD is, again, keen to take a 'real world' approach to ensure that GHG emissions on this "section" of the supply chain are accurate.

She further explained that GHG emissions figures can be impacted by factors, such as the size of and distance travelled by liquid bulk carriers transporting the fuel. Whilst standard conversion factors offer a simpler way to calculate GHG emissions, they may not accurately reflect the GHG footprint of parcel sizes and distance travelled. Recognising the potential financial impact of inaccurate GHG footprint calculations, such as carbon taxes and price premiums, GCMD is actively developing more accurate methodologies for evaluating the GHG emissions of biofuels.

Looking ahead, Dr Thepsithar said that GCMD plans to execute a supply chain out of the US to lend robustness of the assurance framework. It will also explore the use of crude algae oil 'because we think it has the potential to scale the availability and use of biofuels'.

GCMD is now preparing a series of white papers on the outcomes of the biofuel trials, encompassing issues, such as traceability, biofuel quality, supply chain optimisation and abatement costs, and these will be published across the year in 2024.

For Dr Thepsithar, a question emerging from all the biofuel trials that GCMD has conducted is, 'How does all the information collated inform the bigger picture on the assurance for drop-in green fuels?'.

'We endeavour to do something different for each trial,' she said. 'So, by blending in all these different tracers into the fuel ranging from smaller to larger batches, we aim to evaluate if success extends to larger batches. Our approach is on scalability in the real world, moving from 200 tonnes to 5,000 tonnes of fuel.'

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