

# From hype to reality

by Ashish Anilan, *Sustainability Leader, Bureau Veritas Marine & Offshore,*  
and Dr Jehan Kanga, *Founder & CEO, Rux Energy*

**Harnessing the potential of hydrogen is key to accelerating shipping's energy transition and achieving a low-carbon future in the maritime sector. A front-runner among cleaner energy sources, hydrogen fuel promises to make a significant impact on greenhouse gas (GHG) emission reduction. It stands as a critical solution in helping the maritime industry meet the International Maritime Organization's (IMO) April 2025 updates to net-zero targets "by or around" mid-century, including a lower tier – direct IMO compliance target – reduction rate of 43% by 2035.**

**G**reen hydrogen, which is produced via electrolysis using renewably sourced electricity, offers a kindling prospect for applications in the shipping industry, representing a zero/near-zero carbon option from a well-to-wake perspective, as well as a solution that supports and interoperates with battery storage technologies and renewable deployments.

Pioneering companies, specialist research groups, collaborative R&D projects, and innovative technology developments, alongside new regulations, are driving the transition to hydrogen as a marine bunker. Newly developed initiatives are creating a pathway to increase hydrogen's availability as an economically workable and scalable fuel source, which can serve as a cost-competitive and reliable alternative to marine diesel for the shipping industry.

## No-regrets?

The application of hydrogen technology within the maritime sector is developing at pace. Hydrogen-powered ferries and workboats in Europe and the US are already in operation, the commercial availability of hydrogen fuel cells for maritime applications is expanding, and ship designers and operators are successfully using hybrid systems as an interim solution, all of which are generating further investment. Meanwhile, ports are implementing plans to accommodate future hydrogen demand on their side, with infrastructure adapting with the development of new hydrogen refuelling stations. It is also clear that technological advancements are catching up, a fact that is demonstrated by a new solution by Rux Energy to enhance hydrogen storage and distribution for the maritime sector.

Safety measures and storage solutions have been key challenges to hydrogen adoption in the shipping industry. Although hydrogen is already being used in trains and trucks, these issues have delayed the transition in the maritime sector regarding the development of affordable, high-density, efficient, and safe storage.

Alongside the need for specialist equipment and traditionally larger storage tanks because of its low-energy density, many specific conditions must be met to use and store hydrogen at a useful density, such as very high pressures of above 350 atmospheres or extremely low temperatures of -253 centigrade. This has previously necessitated the use of expensive carbon fibre tanks and has resulted in high energy penalties due to 9-15% losses for compressed hydrogen and 40%-50% losses for liquid hydrogen (LH<sub>2</sub>), meaning lower end-to-end efficiencies.

Additional safety hazards – stemming from the use of ultra-high pressure gas and boiling liquid expanding vapor explosion (BLEVE) risks with LH<sub>2</sub> – have had an exponential impact on costings, that rise as projects scale up, which represents a pertinent issue that, according to Rux Energy, prevents the use of hydrogen as a 'no-regrets' fuel when compared to the costs of using diesel.

The energy requirements and high costs of traditional methods of hydrogen storage have been pushing hard-to-abate end users to continue using fossil fuels or to explore synthetic e-fuels (like methanol, ammonia, or e-kerosene), disincentivising the uptake of hydrogen in maritime applications.

## Filling the void

As a leading classification society, BV supports the development of innovative new solutions by ensuring they meet the

requisite safety and operational standards that enable their deployment. BV has extensive expertise in hydrogen technology, having developed classification rules for hydrogen-fuelled ships, as well as a certification scheme dedicated to renewable hydrogen, and an additional class notation, HYDROGENFUEL-PREPARED, for ships designed to store and use hydrogen.

BV's recent joint development project (JDP) agreement with Rux Energy, Certification of Cryogenic Pressure Vessels for Hydrogen Storage and Transport, is a continuation of work in this area, addressing critical safety and hazard challenges related to hydrogen storage and transport, with the potential to reshape global practices in the sector through the sharing of new findings, particularly with Rux Energy's first-adopter partners and clients in the marine and offshore industries.

Representing the culmination of years of work, Rux Energy's breakthrough solution incorporates its proprietary nanoporous advanced physisorption materials, which fill the whole void of a tank and act like a sponge for hydrogen molecules. This enables the hydrogen to be safely stored at more moderate temperatures and 10-25x lower pressures, coupled with significant improvements in end-to-end energy efficiencies.

This innovation aims to significantly reduce hydrogen supply chain costs by improving storage efficiency at production sites, cutting bulk transport and distribution costs, and eliminating boil-off losses and BLEVE risks. The radical improvements in safety, including the reduction of hydrogen volumes in rapid release in the unlikely event of a catastrophic tank failure, are anticipated to impact regulatory approvals, not to mention insurance and operating costs.



Photo: Serco



Photo: Rux Energy

In addition to progressing the validation and verification of the major safety enhancements provided by Rux Energy's nanoporous materials, the project will also focus on meeting the certification requirements for large-scale hydrogen storage systems for bulk transport, distribution, and use by the road, rail, marine and offshore sectors.

The JDP also aims to support agile refuelling, bunkering, and shore-side power operations in intermodal and port hubs, and to stimulate local supply chain development in Singapore, Australia, the United Kingdom, and Europe. Concurrently, the project aligns to major global cooperation agreements between these four regions, including the Singapore-Australia

Green Economy Agreement 2023, the UK-Australia Renewable Hydrogen

Innovation Partnership (2023), the Australia-EU Green Hydrogen Dialogue (2024), and outcomes of the First UK-EU summit on cross-border hydrogen trade (2025), with key outcomes directly responding to the above governmental priorities.

Rux Energy is targeting construction power and maritime applications as global first-mover industries take the lead on the adoption of hydrogen, illustrated by the company's recently announced MoU with the largest operator of UK-flagged vessels, Serco UK, eventually aiming to bring its certified solutions to a wide range of hard-to-abate applications across land and sea.

**Transformation through partnership**

Achieving ambitious net-zero goals in shipping will only be possible through a dedicated focus on targeted technology deployment combined with an unprecedented level of cross-sector collaboration. Shipping's 'green alliance' collectively needs to implement fresh yet pragmatic approaches, change outdated processes, and establish new partnerships that cover entire supply chains by drawing from expertise beyond the maritime sector.

BV has established its Future Shipping Team for this precise purpose, enabling research and expertise sharing among the BV Group's 80,000 employees across the maritime sector – including the CO<sub>2</sub> value chain, alternative fuels, wind-assisted propulsion, and nuclear energy.

Hydrogen, as part of this equation, is a booming market, with estimates from the European Commission suggesting that "decarbonised hydrogen could meet 24% of global energy demand by 2050." BV's JDP with Rux Energy is an example of a partnership that has the potential to be transformative for hydrogen bulk storage and distribution, supporting the decarbonisation of heavy land transport and maritime sectors, whilst generating a significant leap forward in safety and efficiency. ■



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Rux Energy is developing a low-cost, safe and efficient hydrogen storage solution that will be a game changer for implementing low-carbon emission technologies, with the ambitious goal of becoming the global category leader in hydrogen storage and supply distribution. Our advanced nanoporous materials and bulk hydrogen storage systems make green hydrogen cost-competitive with diesel. Visit [ruxenergy.com](https://ruxenergy.com) to discover more.