



Future colours

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As maritime stakeholders evaluate zero-carbon fuel options, the verification of carbon intensity, as well as the full lifecycle impact of these fuels, will present a significant challenge. Ammonia and hydrogen, two of the most promising long-term alternative fuel candidates for shipping's energy transition, are often produced using fossil fuels. This situation poses a dilemma for fuel purchasers in distinguishing between a fuel produced using non-renewable methods and one mixed with fuel molecules produced using green sources. Modern technology could lift the barrier of tracing the true carbon intensity to prevent mislabelling and illicit blending.

Without assurance, the industry will be left idling to cope with uncertainty. Cheaper and more carbon-intense versions of hydrogen and ammonia will be rife, and with the operational cost of fuel still being a key driver for business decisions in shipping, corners will be cut.

Grey, blue, and green

Hydrogen and ammonia have different carbon footprints based on the energy source used at production. They are thus categorised as grey, blue, or green to highlight their carbon intensity and production method. Grey fuels are produced using fossil fuels and are moderate-to-high in carbon footprint. This category can include grey hydrogen, created from natural gas or methane using

steam methane reformation, and grey ammonia, produced from hydrocarbon feedstocks.

Blue fuels are also produced using fossil fuels. However, the carbon emissions from the production process are captured and safely stored using carbon capture usage and storage technology, making these fuels low-carbon.

Green fuels are produced using renewable sources and are, therefore, zero-carbon options; an indicative example is hydrogen which is created by using clean electricity from surplus renewable energy sources (such as solar or wind power). This type of green hydrogen can be directly used to produce green ammonia.

Currently, less than 0.1% of the production facilities globally are dedicated to water electrolysis, which is the source of hydrogen for both green production processes.

However, as the demand for green fuels increases, the number of facilities is also expected to increase. With this growth, the amount of high-purity product coming from green processes will equally increase.

Technology's role in future fuel assurance

In a recent report jointly published by the Lloyd's Register's Maritime Decarbonisation Hub and Safetytech Accelerator, *Tracing the true carbon intensity of sustainable marine fuels*, the role of innovative technologies in the end-to-end assurance of the green fuel supply chain is presented. The report features a collaboration of two technology vendors, TYMLEZ and Authentix, who each apply a different yet complementary approach to confirming the green credentials of a fuel.

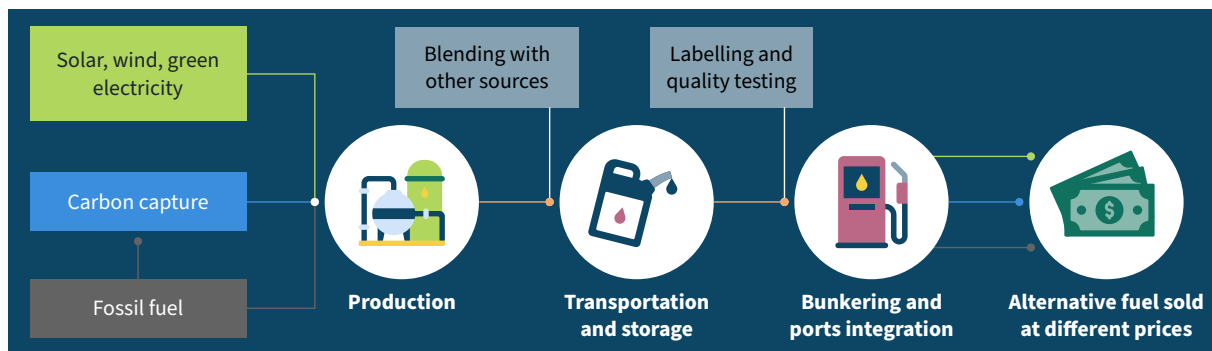
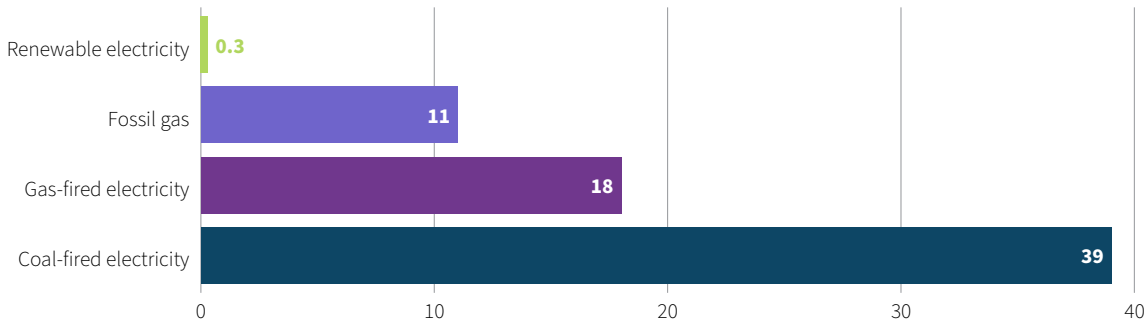




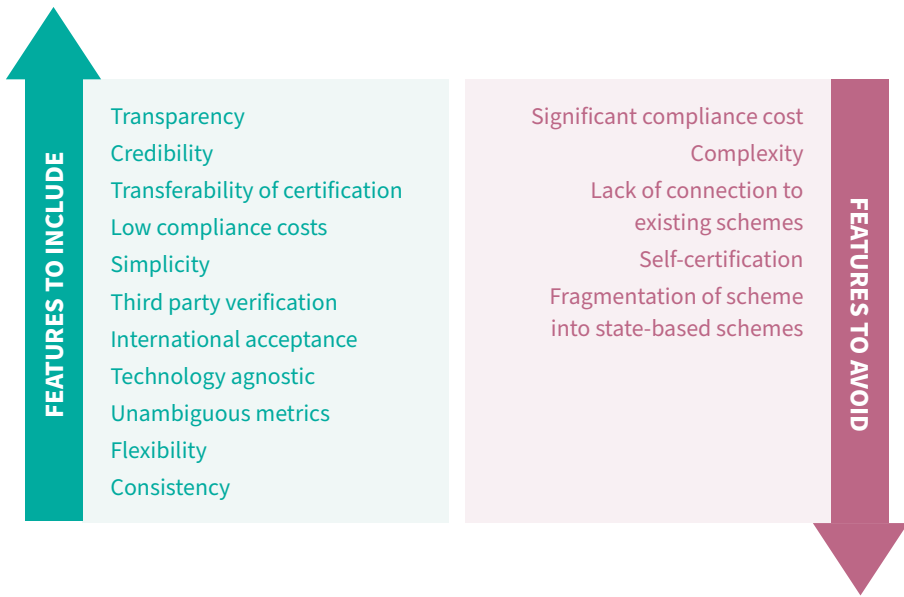
Fig. 1. Carbon emissions from different methods of producing hydrogen

Tonnes of CO₂ emitted per tonne of hydrogen produced



Source: IEA 2019; Hydrogen Council 2021

Fig. 2. Features to include/avoid in designing a GO scheme



TYMLEZ’s guarantee of origin (GO) scheme uses blockchain technology for green hydrogen and green ammonia tracking systems. As part of the solution, each unit of hydrogen or ammonia is certified through a live facility data platform that can capture emission data during the production process, such as water, fuel usage, and grid electricity consumption. Individual technologies and information validation enable the platform. They can follow any methodology, including the procedures of the International Partnership for Hydrogen and Fuel Cells in The Economy, to calculate greenhouse gas emissions.

Moving from the production side to the transportation and bunkering, Authentix proposed using synthetic markers, which are injected into the fuel to detect blending and mislabelling, as well as the origin of the fuel, to assure that it matches the digital signature even after blending.

Authentix has developed a system for liquefied petroleum gas (LPG), which

Source for figs. 2-4: Lloyd’s Register’s Maritime Decarbonisation Hub and Safetytech Accelerator’s Tracing the true carbon intensity of sustainable marine fuels



Photo: Canva

