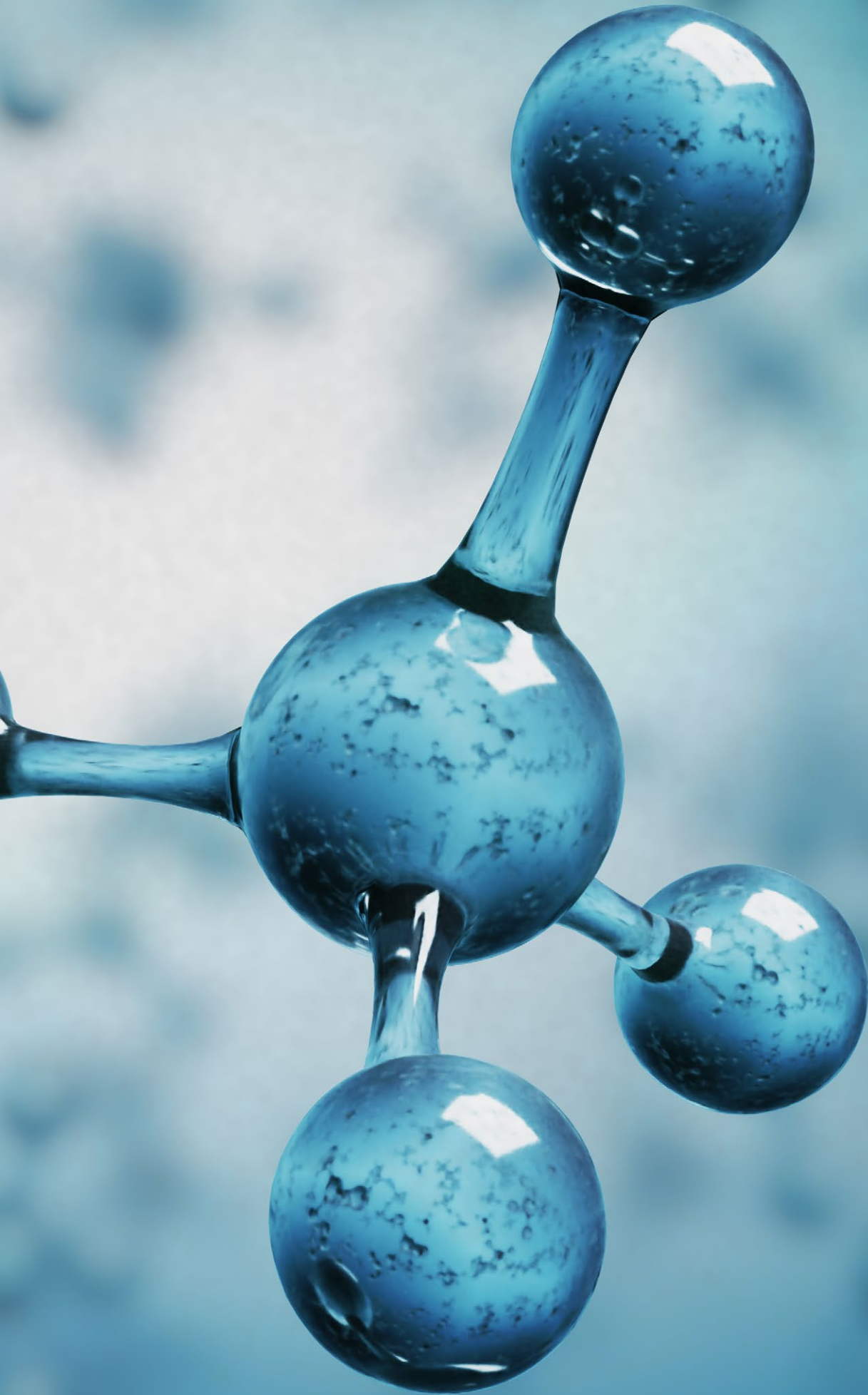


# Ammonia and Methanol: Fuelling the Energy Transition







LOW-CARBON AMMONIA HAS IMPORTANT APPLICATIONS IN AGRICULTURE AND SHIPPING



Hydrogen has significant potential to enable the transition to a clean, low-carbon energy system through its use as fuel for power or as a feedstock in industry.



With increasingly stringent emissions regulations and net zero-carbon energy goals tied to Glasgow Climate Pact targets, it seems clear that multiple clean energy solutions will be needed in the short to medium term. Hydrogen has significant potential to enable the transition to a clean, low-carbon energy system through its use as fuel for power or as a feedstock in industry.

There are two forms of hydrogen which are particularly useful - green and blue. Green hydrogen is produced using renewable electricity while blue hydrogen is produced from natural gas with carbon dioxide emissions captured and stored underground.

Hydrogen can be transported by converting the hydrogen molecule into an energy carrier such as ammonia, methanol or liquid organic hydrogen carriers. Ammonia is considered the most promising carrier since it does not release any carbon emissions if used as a fuel, it has well-established logistics and

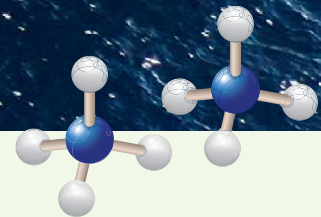
there are mature end markets for the product. Approximately 192 million tonnes of ammonia were produced worldwide in 2020, with global trade estimated at around 19 million tonnes.

However, with the cost of producing green hydrogen presenting a challenge - even considering efficiency gains and the lower levelised cost of energy for renewable energy - the near-term key to low emissions is commercial blue hydrogen, with blue ammonia and methanol allowing current market access.

**LOW-CARBON AMMONIA**

Industry experts with the international publication house CRU forecast that blue ammonia projects will dominate the project pipeline for the next five years. Beyond 2025, green ammonia projects are expected to take over, with close to 85% of new capacity being green<sup>1</sup>

<sup>1</sup> CRU Low-emission Webinar Feb 2022



as technical developments and economies of scale reduce costs. Currently, it is estimated that 70% of ammonia is used for fertilisers, while the remainder is used for various industrial applications, such as plastics, explosives and synthetic fibres.<sup>2</sup> However, as a hydrogen carrier, it has a role to play in other applications.

In addition to its current main use in the fertiliser industry, low-carbon ammonia has other potential uses which may boost its demand:

#### **Ammonia as a marine fuel:**

There is a growing interest in using ammonia in the transportation sector as a shipping and marine fuel, primarily due to its zero-carbon emissions, and also due to its zero-sulphur content.

This results in lower emissions of particulates and improved air quality and ensures compliance with

<sup>2</sup> IEA Ammonia Technology Roadmap October 2021

IMO 2020 and IMO 2050. Several projects are currently testing the use of ammonia as a marine fuel. The international crop nutrition company, Yara, which is one of the major ammonia producers, is planning to supply a retrofitted North Sea supply vessel with ammonia as a marine fuel by 2024. In addition, a cross-industry consortium of Japanese companies (including Mitsui and Itochu) is considering launching ammonia-fuelled commercial vessels, as well as developing ammonia supply infrastructure in Japan, to provide the shipping industry with an alternative marine fuel to reduce greenhouse gas emissions.

#### **Ammonia in power generation:**

Ammonia can also be burned directly in gas turbines in a mixture with natural gas or hydrogen. Several companies are developing engines and turbines which can use ammonia as a feedstock. For instance, Mitsubishi is developing a gas turbine which can directly take ammonia as feedstock. The ammonia is thermally

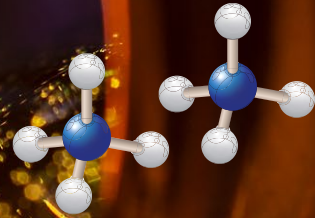
cracked to produce hydrogen, nitrogen and trace amounts of ammonia, and it is used in the gas turbine as fuel. In late 2021, Japan announced its plan to repower its electrical generation infrastructure away from coal, natural gas and nuclear to primarily ammonia-powered by 2050.

Although projected ammonia demand growth for the next 20 years ranges from 1.5% (as projected by international publication Green Markets) up to 2.4% (Yara) annually, use of this petrochemical to carry hydrogen for fuel-cell utilisation can add hundreds of millions of tons of additional demand.

It is to be noted, however, that combustion of ammonia does lead to emissions of nitrous oxide, the abatement of which will likely add further costs.

#### **LOW-CARBON METHANOL**

Like ammonia, methanol has great potential to revolutionise many different industries.



## METHANOL CAN BE BLENDED DIRECTLY INTO GASOLINE OR USED AS A PURE FUEL

Methanol serves the chemical industry as a base material for a broad range of products. It is used in the manufacture of polymer fibres for the textile industry, plastics for packaging, glues, adsorbents/diapers, paints, adhesives and solvents. It also serves as a fuel or fuel additive.

In 2020, with global methanol demand at 87.7 million tonnes, 49% of this demand was channelled into GDP-driven products, with 33% of demand directed to fuel applications.<sup>3</sup> GDP-driven products (formaldehyde, acetic acid, solvents etc.) have been the core of industry demand and are connected with the housing, automotive and appliance industries. Methanol is used as a fuel substitute or fuel enhancer in the form of methyl tertiary butyl ether, biodiesel (as a blend component into

<sup>3</sup> Argus Analytics 2021.

diesel fuels) and dimethyl ether (as an LPG blend stock). Additionally, it can be blended directly into gasoline or used as a pure fuel. Methanol is also seeing growth as a boiler fuel and in industrial cooking stove applications.

### Future prospects

With further diversification in the applications of ammonia and methanol as energy carriers, energy storage mediums, and maritime fuels, drastic market growth for both commodities is expected in the coming years.

In this regard, global producers in the petrochemical industry are already embarking upon low-carbon projects which include blue and green ammonia and methanol projects. CF Industries announced a \$100 million investment to make 20,000

short tons of green ammonia at its Donaldsonville Nitrogen Complex. Yara has almost 100,000 metric tons of pilot projects set to start by 2025 and is developing plans for a further 500,000 metric tons.<sup>4</sup>

The NGC Group has also recognised the opportunities to be derived in this commercial space and has a pipeline of green agenda initiatives. These include a Memorandum of Understanding with Kenesjay Green Limited and an IDB Study to understand the economic parameters of producing green hydrogen locally. Such initiatives will aid in the creation of a sustainable clean energy economy for Trinidad and Tobago. ■

<sup>4</sup> Bloomberg Intelligence: Ammonia Producers face new kind of green opportunity. June 02 2021.