

## Uses of ammonia

**Today, 80 percent of ammonia produced is used to bring nitrogen to plants. Tomorrow, ammonia will drive the green fuel transition in shipping, and provide hydrogen to industries in need of decarbonization, as ammonia can be produced with very low greenhouse gas emissions.**

### Decarbonized food

The agrifood systems are responsible for around 30 percent of global greenhouse gas (GHG) emissions. A considerable portion of these emissions stem from the production of nitrogen-based fertilizers and must be cut to meet the targets in the Paris Agreement.

Clean ammonia offers the opportunity to significantly reduce the carbon footprint of production of nitrogen-based fertilizers. The demand for clean ammonia in crop nutrition and other conventional applications is expected to increase from modest levels in 2025 to about 90 million tons in 2050.

### Shipping fuel

The global emissions from shipping are estimated to be around 1,000 million tons of CO<sub>2</sub> equivalents annually, or 2,9

percent<sup>i</sup> of the world's global emissions. The 2023 GHG Strategy of the International Maritime Organization (IMO) includes a commitment to ensure update of alternative zero and near-zero GHG fuels by 2030.

Clean ammonia is emerging as a promising fuel option for the international shipping industry that is produced and consumed with minimal greenhouse gas emissions. Ammonia can be used as a fuel for different classes of ships and the cost is expected to be lower than for alternative solutions. Ammonia does not require cooling to extreme temperatures and has a higher energy density than liquid hydrogen.

Clean ammonia as a shipping fuel can be transported by ship to its destination, and port terminals can use ammonia bunkering stations and infrastructure in the same

manner as for conventional fuels today. Ammonia-fueled ships are expected to be ready from 2024-2025. The market for clean ammonia as a shipping fuel is expected to grow to 182 million tons in 2050.<sup>ii</sup>

### Carrier of clean energy

Liquid ammonia contains more hydrogen than liquid hydrogen itself, making it an efficient hydrogen carrier. Ammonia can store massive amounts of hydrogen-based energy for long periods of time and is easy to transport.

This becomes particularly helpful to connect hydrogen production and consumption sites, which are often geographically distant and lack existing transportation infrastructure, such as pipelines to transport hydrogen.

<sup>i</sup>) Source: IMO (2020): Fourth Greenhouse Gas Study 2020.  
<sup>ii</sup>) Source: Market study by Arkwright for Yara, 2021.

Ammonia is a molecule composed of one nitrogen and three hydrogen atoms (NH<sub>3</sub>). For more than 100 years, ammonia has been known as a key component in fertilizer to enhance crops and ensure food production around the globe. Today, 80 percent of ammonia produced is used to bring nitrogen to plants. Tomorrow, ammonia will help us bring hydrogen to power transportation and industry as a fuel. Not only is ammonia a carbon-free chemical that does not emit CO<sub>2</sub> when burned, it can also be produced in a low carbon manner. Using clean ammonia in new ways will help us cut emissions all over the world.