UK Ammonia Alliance

# The UK's low-carbon ammonia opportunity

Eight steps to unlocking innovation, investment and strengthening national security

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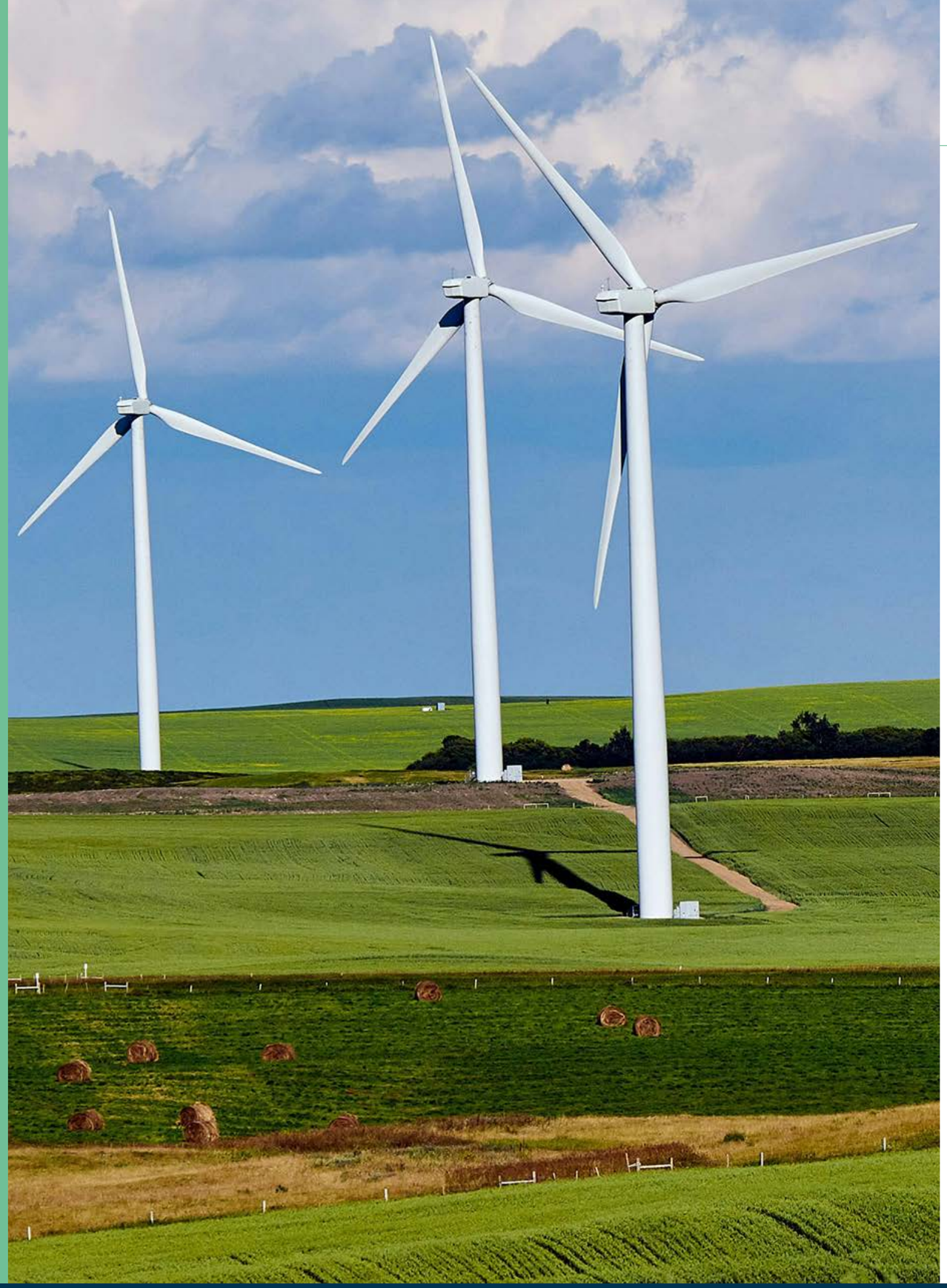


# Executive summary

**Ammonia is essential to the UK's economy, supporting vital industries including farming, manufacturing, and defence. It is already a well-established industry, underpinned by a global network of producers, importers, and distributors. With new innovations, ammonia also has significant potential in sustainable fuel, hydrogen, and energy applications.**

The emergence of low-carbon ammonia therefore offers a strategic opportunity for the UK to enhance energy resilience, strengthen national security, and accelerate the decarbonisation of its industries. This also includes the potential to develop the country's own at-scale, domestic low-carbon ammonia production, reviving capacity the UK recently lost.

Produced by reacting hydrogen and nitrogen, ammonia is already the second most widely produced chemical globally, with approximately 70% used in fertilisers to sustain global agriculture.

However, conventional ammonia production is emissions-intensive, responsible for around 2% of worldwide $CO_2$ emissions. As global demand for ammonia is expected to rise by 40% by 2050, there is a clear need to decarbonise ammonia production and adopt low-carbon ammonia widely across sectors.

Low-carbon ammonia, which is produced using either renewable energy or carbon capture and storage, provides a credible pathway to reduce industrial emissions and increase food security. Low-carbon ammonia can also act as a hydrogen carrier, sustainable maritime fuel, and energy store, supporting the UK's clean power and hydrogen ambitions. Globally, over 400 low-carbon ammonia projects are already under way, signalling strong momentum and investment potential.

The UK is well-placed to lead in this emerging market. It has a skilled industrial base, longstanding experience in the ammonia industry, world-class research and innovation, and existing ports and logistics infrastructure capable of handling ammonia imports and exports. Globally, this offers significant potential for the UK to gain a larger share of the international market and become a trading and bunkering hub for low-carbon ammonia.

Domestically, adopting low-carbon ammonia across the economy offers an opportunity to accelerate industrial decarbonisation, while creating jobs, attracting investment, and strengthening supply chains across the nations and regions of the UK.

To seize these opportunities, coordinated action is needed between Government and industry.

To drive this action forward, the UK Ammonia Alliance (UKAA) industry group was launched in October 2025, recognising both ammonia's strategic value across the economy and the UK's significant leadership opportunity. The UKAA – which includes Founding Members AFC Energy, Air Products, Blended Products, Clean Air Power, Exolum, Green Cat Hydrogen, HYCAP, Industrial Chemicals Limited, Mitsubishi Heavy Industries, N-Gen Energy and Statkraft – aims to accelerate the growth of the UK's ammonia industry and drive adoption of low-carbon ammonia across sectors.

For its part, the UK Government has begun to increase collaboration between departments and agencies on ammonia research and policy development, which will be critical to supporting novel applications for ammonia. The UKAA welcomes this activity taking place within Whitehall and is grateful for the early engagement the Alliance has had with Government since our launch.

To support further collaboration and establish a supportive policy framework to capture the UK's ammonia opportunity, the UKAA proposes eight policy recommendations to unlock innovation, strengthen national security, and boost global competitiveness.

# Recommendations

**1. Recognise the role of low-carbon ammonia in the future economy**

Government and industry should both acknowledge ammonia's strategic role across sectors, including agriculture, transport, manufacturing, hydrogen and energy. The Department for Energy Security and Net Zero (DESNZ) should include low-carbon ammonia in the updated UK Hydrogen Strategy, alongside an assessment of future demand and supply. Industry will support this by developing a Low-Carbon Ammonia Roadmap, evidencing strategic end-use cases and adoption pathways.

**2. Commit to producing an Ammonia White Paper in 2026**

An Ammonia White Paper should bring together policies and ambitions across government departments. It should include a comprehensive framework to develop the UK's low-carbon ammonia industry (alongside other hydrogen derivatives), providing clarity and confidence for investors and innovators across the ammonia value chain. Industry will support this by sharing evidence and expertise on ammonia research and development (R&D) and safety.

**3. Adopt a low-carbon ammonia production target**

The UK Government should adopt a low-carbon ammonia production target, aiming to replace the strategic production capacity the UK has lost. This will provide investors and industry with a clear signal of intent for the development of the UK market for low-carbon ammonia (as it did to stimulate early growth in the UK's hydrogen market), in turn driving innovation, job creation and investment, including in R&D and upskilling. Industry will provide Government with evidence on the level of investment and high-value jobs that an ambitious production target can deliver.

**4. Take action to support the development of the UK market for low-carbon ammonia**

Government should take action to support the UK becoming a global trading hub for low-carbon ammonia. This can include:

- Assessing the case for a strategic national ammonia reserve.
- Engaging with distributors to establish current fluidity and barriers in the market.
- Developing a fast-track permitting route for small-scale demonstration projects to accelerate deployment and learning.
- Mapping required ammonia storage and logistics infrastructure to facilitate trade at key strategic locations around the UK.

**5. Extend suitable hydrogen funding mechanisms to incentivise the use of hydrogen carriers and derivatives, and low-carbon ammonia in particular, as a flexible energy store and reliable power source**

DESNZ should expand the Hydrogen to Power Business Model to include ammonia-to-power projects and extend the Hydrogen Storage Business Model to include ammonia as a hydrogen storage solution. Supporting ammonia under these mechanisms would accelerate deployment, strengthen energy security, and enable flexible, low-carbon power generation complementary to hydrogen systems.

**6. Commit to developing a UK standard for low-carbon ammonia**

To underpin growth in trade, the UK should develop a standard for low-carbon ammonia by 2027, modelled on the Low Carbon Hydrogen Standard and aligned with international certification schemes. Industry is ready to work with Government on the development of a standard, such as through a Low-Carbon Ammonia Working Group.

**7. Review and introduce safety regulations that consider ammonia as a fuel, in addition to an industrial chemical and feedstock**

Modernising safety regulations will enable new power, hydrogen, and maritime applications while maintaining the highest safety standards currently applied to ammonia. The UKAA will convene an ammonia safety working group to share evidence and best practice with Government.

**8. Introduce a streamlined permitting process that recognises ammonia as a fuel**

Streamlining permitting for ammonia used in emerging applications, subject to robust safety demonstration, would send a clear signal to investors and help the UK capture early-mover advantages in global ammonia markets.

SECTION 1: SETTING THE SCENE

# What is ammonia and why does it matter?

**Ammonia is a gas which is vital for many parts of modern life. As the second most widely produced chemical commodity globally[1], ammonia has long been a key ingredient in fertilisers, refrigeration, and manufacturing.**

Ammonia is produced by reacting hydrogen and nitrogen under pressure; predominantly via the well-established Haber-Bosch manufacturing process[2] at scale.

With around 70% of worldwide production used in fertilisers[3], ammonia is essential for feeding our growing global population. Ammonia is also indispensable across a range of vital industries.

Figure 1: Current, widespread uses of ammonia

**Fertilisers:** Ammonia is the primary source of nitrogen, necessary for plant growth. It is used to produce a range of nitrogen compounds for fertilisers.

**Dyes:** Ammonia is an alkaline compound which can control or buffer the pH, allowing for dye to bind to hair or fibres.

**Industrial chemicals:** Ammonia is used as a precursor for producing other chemicals such as nitric acid, hydrazine, cyanides, and amino acids.

**Synthetic fibres:** Ammonia is necessary to form many synthetic fibres such as nylon, acrylics, and aramids (e.g. Kevlar).

**Refrigerants:** As an efficient heat absorber, ammonia is used in refrigeration, with zero ozone depletion potential compared to other heat absorbers.

**Explosives:** Ammonia is critical to the defence industry, as a reactant for producing ammonium nitrate, a key ingredient for many commercial explosives.

**Plastics:** Ammonia is a building block for creating nitrogen-containing polymers that make up many plastics, used in a wide range of consumer goods and industrial products.

**Pharmaceuticals:** Ammonia is necessary for the pharmaceutical industry. It facilitates reactions and provides nitrogen – a key element in the compounds found in many medicines.

### Case Study: Blended Products – ensuring the reliable supply of ammonia to critical UK industries

For 22 years Blended Products has been supplying the gases and chemicals that keep critical industries running. Operating at the midstream–downstream interface of the ammonia value chain, Blended manages the safe transfer of anhydrous ammonia from production sites to its own UK storage facilities. From there, the ammonia is supplied to end users across cold storage, food processing, and large-scale refrigeration systems.

The company's Aquamonia™ range is trusted across multiple sectors. In food and beverage manufacturing, it supports cleaning and pH control in clean-in-place systems and surface sanitation. The tile, ceramics, pulp, and paper industries use it for glaze preparation, de-inking, and process stabilisation, while chemical and pharmaceutical manufacturers value its purity and consistency for neutralisation and reagent processes.

As industries transition toward low-carbon, sustainable chemical solutions, demand for ammonia continues to grow. Backed by a strong national distribution network, ISO 9001:2015 certification, and a commitment to doing what's right, Blended provide safe, reliable, and high-performing ammonia solutions to customers across the UK.

Today, new innovations mean that ammonia can also be used as a hydrogen carrier, energy store, and fuel[4] – with significant potential to accelerate the UK's hydrogen economy, decarbonise our shipping industry, and drive forward the energy transition.

Figure 2: Novel, growing uses of ammonia

**Sustainable fuel:** Ammonia can replace fossil fuels in internal combustion engines. For example, it has significant potential as a zero-carbon fuel to power ship engines. Ammonia can also be used in fuel cells to produce electricity.

**Power generation:** When burned in gas turbines, engines, or used in fuel cells, ammonia can provide flexible, low-carbon power generation. This contributes to decarbonisation in remote areas, where grid connection costs and timeframes are prohibitive.

**Energy storage:** Due to its high energy density, ammonia can be easily stored in bulk as a liquid at moderate temperatures and pressures. This means that it can provide strategic energy reserves and a source of backup power.

**Hydrogen carrier:** Hydrogen has many valuable uses across industry. However, it is challenging and expensive to store and transport, as it needs extremely low temperatures or very high pressures. Ammonia is a more efficient and affordable way to transport and store hydrogen, because it can be transformed back into hydrogen when needed, using ammonia cracking technology.

### Case Study: Mitsubishi Heavy Industries H-25 ammonia-powered gas turbine

Mitsubishi Heavy Industries, Ltd. ("MHI") is global leader in gas turbine technology for power generation, advancing ammonia-to-power applications with potential to deliver zero carbon electricity.

Ammonia offers high energy density as a fuel that can be used where hydrogen infrastructure is limited. There is therefore a unique opportunity for ammonia-to-power using existing ammonia infrastructure, especially ports.

MHI has developed direct ammonia firing capability (without converting to hydrogen) in its H-25 gas turbine (40MW class, up to 60 MW in combined cycle). To meet strict nitrogen oxides (NOx) emission targets and avoid ammonia leakages, a highly efficient Selective Catalytic Reduction (SCR) system is employed. MHI's ammonia direct firing combustor was successfully tested under real conditions in Japan.


### Case Study: Scaling low-cost hydrogen with AFC Energy's ammonia crackers

AFC Energy plc, a UK-based hydrogen energy solution provider, established its subsidiary Hyamtec in 2024 to capitalise on the market opportunity for more cost-effective hydrogen, harnessing the benefits of ammonia as a hydrogen carrier.

Hyamtec's latest offering is Hy5, a containerised ammonia cracking hydrogen generator capable of producing up to 500kg of low-cost hydrogen per day, which reduces the need for hydrogen storage. In 2025, AFC Energy formed a joint venture with Industrial Chemicals Group Limited (ICL) to commercially produce and sell this unsubsidised hydrogen starting in 2026.

By importing low-carbon ammonia and using their cracking and ammonia-to-power systems, AFC Energy plans to supply clean power at scale to decarbonise hard-to-electrify sectors, including heavy industry and transport.

# The value of low-carbon ammonia

**Ammonia production currently relies heavily on fossil fuels, primarily natural gas and coal, making it one of the most emissions-intensive industrial commodities. This process generates approximately 620 million metric tonnes of combined direct and indirect $CO_2$ emissions annually – roughly 2% of global emissions[5].**

As the world's population grows, so too will the demand for ammonia. With over 240 million metric tonnes of ammonia[6] produced each year, demand is projected to rise 40% by 2050, according to the International Energy Agency (IEA).

This presents a significant global challenge: the world needs more ammonia, but fewer greenhouse gas emissions.

To meet this challenge, industry has been developing methods to produce ammonia using renewable energy, and carbon capture and storage (CCS) technologies. The emergence of low-carbon ammonia therefore has significant potential.

Transitioning to this sustainable alternative offers a route to decarbonise vital sectors, like agriculture and manufacturing, while advancing the energy transition and reducing exposure to volatile, global fossil fuel costs.

In recognition of this significant opportunity, the production of low-carbon ammonia is quickly scaling-up around the world. Bloomberg analysis suggests that 92% of new ammonia supply added between 2024 and 2030 will be low-carbon, accounting for 13% of total global ammonia supply by 2030[7].

Already, at least 428 unique low-carbon ammonia production facilities have been announced around the world, according to the Ammonia Energy Association (AEA), as of August 2024[8]. Among these, there are major low-carbon ammonia production plants that have already reached Final Investment Decision (FID) or begun construction.

**Table 1: Major low-carbon ammonia projects (FID/under construction)**

| Project | Main Partners | Location | Capacity | Energy Source | Status |
|---|---|---|---|---|---|
| Blue Point Complex | CF Industries, Mitsui & Co., JERA Co. | Louisiana, USA | 1.4 MTPA | Natural gas with CCS | FID: April 2025; production expected: 2029 |
| Beaumont New Ammonia | Woodside Energy; OCI; Linde; ExxonMobil | Texas, USA | 1.1 MTPA | Natural gas with CCS | Under construction; low-carbon production expected 2026 |
| TA'ZIZ ammonia production facility | TA'ZIZ; Mitsui & Co., Fertiglobe, GS Energy Corporation | Al Ruwais, UAE | 1 MTPA | Natural gas with CCS | Under construction; production expected 2027 |
| AM Green Kakinada ammonia project | AM Green Ammonia | Andhra Pradesh, India | 1 MTPA by 2026; 5 MTPA by 2030 | Solar, wind, pumped storage hydropower | FID August 2024; production expected 2026 |
| ACME Duqm Green Ammonia Project | ACME Group | Duqm, Oman | 100,000 TPA initially; expanded to 1.2 MTPA | Solar | Under construction; production expected 2027 |
| NEOM Green Hydrogen Complex | ACWA Power; Air Products; NEOM | NEOM, Saudi Arabia | 1.2 MTPA | Wind, solar, storage | Under construction (over 80% complete); production expected 2027 |

Much of the ammonia to be produced from these projects is intended for export, predominately to Europe and Asia. For example, the ACME project has a binding offtake agreement with Norwegian fertiliser company Yara; similarly, Mitsui & Co. has agreed to purchase a certain amount of the ammonia from the TA'ZIZ facility to supply to Japanese and other Asian markets. Air Products will be the exclusive ammonia offtaker from NEOM, to be used in applications including decarbonising the transport and industrial sectors.

# The UK's ammonia leadership opportunity

**With its world-class research and innovation base, industrial expertise, and location as an import/export hub, the UK is well-positioned to lead the global transition to low-carbon ammonia.**

The UK was an early adopter and major player in the industrial production of ammonia in the early 1900s, following the invention of the Haber-Bosch process which converts nitrogen and hydrogen into ammonia.

In the early 20th Century, large British industrial companies such as Imperial Chemical Industries emerged as leaders in the production of ammonia in the UK. Following World War II, the ammonia industry became a core element of the UK's industrial economy, driven by the need for cheaper food production and manufacturing. The UK was home to significant ammonia production sites, including at Billingham, Teesside, and Ince, Cheshire.

However, in the early 2020s, surging natural gas prices led to the closure of two of the UK's major ammonia production plants. As gas costs rose further following Russia's invasion of Ukraine, the last remaining large-scale domestic ammonia plants ceased production.

Despite these closures, the UK's longstanding ammonia heritage means that there is still a wealth of skills, expertise, and legacy infrastructure in the UK. Businesses specialising in ammonia logistics, transport, storage, and distribution continue to operate widely across the UK, supplying ammonia for industrial applications and fertilisers. With new, low-carbon ammonia production plants announced in the UK, and pioneering R&D taking place in low-carbon ammonia technology, the opportunity to become a global leader in low-carbon ammonia is within reach.

With its geographical location making it a key hub for imports and exports, the UK is already home to major ports equipped to handle and store ammonia. This includes Teesside, which hosts large chemical storage facilities that serve the local chemical cluster and supply imported ammonia to CF Fertilisers' adjacent Billingham complex. Similarly, at the UK's busiest port complex on the banks of the Humber, there is established ammonia handling capacity at Saltend Chemicals Park.

These advantages mean there is strong potential for the UK to become a global trading and bunkering hub for low-carbon ammonia. They present the opportunity to scale global markets and gain a larger share of international trade, building on the UK's existing value chains and creating new ones to support novel ammonia applications.

In addition to a global leadership opportunity, the UK also has a significant domestic opportunity. By promoting wider adoption of low-carbon ammonia, the UK can attract investment into ammonia products, technology, facilities, and infrastructure – creating high-value jobs, boosting British supply chains, and driving industrial growth across our nations and regions. Alongside widespread economic benefits, low-carbon ammonia offers a viable route to decarbonise the UK's vital industries and accelerate the energy transition.

Solutions for decarbonising 'hard-to-electrify' industries are particularly important within the context of the UK's legally binding target of achieving net zero by 2050, and the Government's mission to achieve clean power by 2030. Adoption of low-carbon ammonia in fertilisers, industrial chemicals, and manufacturing will help to reduce greenhouse gas emissions from across these sectors, for which there are few decarbonisation alternatives.

Embracing low-carbon ammonia for power generation, and as a direct fuel for maritime, will be critical to achieving these clean energy ambitions, as well as for complying with international regulations. For example, at the time of writing, the International Maritime Organisation (IMO) was set to adopt the Net-Zero Framework in October 2025, setting a new fuel standard for ships and a global pricing mechanism for emissions from 2027. In its 2025 Maritime Decarbonisation Strategy[9], the UK Government indicated that it will seek to align upcoming domestic maritime regulations with these international standards. While the IMO's decision has since been adjourned for a year, there remains strong support for the Framework. Within the UK and across the EU, industry and delegations have been vocal in their calls for this outcome to provide a strategic opportunity for these economies to demonstrate leadership and gain technological advantages by maintaining a focus on the Net-Zero Framework standards.

Furthermore, the UK has put in place ambitious, world-leading policy frameworks to support the development of the UK hydrogen economy, key to decarbonising heavy industry and transport. Within this context, there is a strategic value for the UK in utilising low-carbon ammonia to accelerate the delivery of hydrogen to industry. Building up robust supply chains for low-carbon ammonia, both through reliable import partners and domestic production, will pay dividends for UK energy security by reducing exposure to global, volatile fossil fuel costs.

Combined, these factors underscore the significant, strategic role for low-carbon ammonia in achieving a sustainable and secure future for the UK. While other countries' governments have put in place supportive frameworks for low-carbon ammonia, the UK must match this ambition – and go beyond. With the right government policies and approach from industry, this is a challenge that the UK can meet.

# Global policy support for low-carbon ammonia

**As low-carbon ammonia production projects progress across the world, many governments are employing policy initiatives to accelerate the low-carbon ammonia sector, recognising its transformative potential.**

Some governments are taking a strategic approach to promoting low-carbon ammonia production, export, and adoption – recognising ammonia as a key future industry. Policy initiatives generally fall into five categories: direct subsidies for production; capital investment; contracts for difference schemes and auctions; demand-side policies; and supportive regulation. Countries with production incentives typically do so via subsidy schemes for low-carbon hydrogen, from which ammonia can also be produced.

Multiple countries have focused on the strategic role of ammonia within their national hydrogen strategies. For example, Australia's Hydrogen Strategy[10] identified ammonia as one the most prospective hydrogen demand sectors, and therefore prioritised hydrogen production for the purpose of exporting ammonia. It recognised the importance of decarbonising ammonia production itself, as well as the value of low-carbon ammonia to decarbonising hard-to-abate industrial sectors. The Strategy identified a need for Government support to ensure that Australia's green hydrogen and ammonia production industries are globally competitive. Further, through the specific Western Australia Government's Renewable Hydrogen Strategy, investment was made to establish hydrogen hubs and provide a Renewable Hydrogen Fund to decarbonise the production processes for green products, including ammonia.

Similarly, India is scaling up green ammonia production under its National Green Hydrogen Mission, offering subsidies, grid access incentives, and long-term offtake contracts through Government tenders while positioning itself as a global export hub for green ammonia.

Other countries are taking an approach that balances production incentives with demand-side incentives for low-carbon ammonia import and uptake. As the first country to launch a national Hydrogen Strategy in 2017, Japan has embedded a strong focus on stimulating hydrogen and ammonia demand in its energy policies. In its 2021 Sixth Strategic Energy Plan, Japan recharacterised ammonia from a 'new energy' to a future fuel and carrier that will also play a role in power supply. It set ambitious targets for domestic hydrogen and ammonia use and has focused on building up robust supply chains, both domestic and with international partners, to reduce reliance on volatile global fossil fuel markets and strengthen its energy security.

Table 2: Selected incentives for low-carbon ammonia, by country

| Country/Region | Main Incentives | Type of Incentive | How it Works |
|---|---|---|---|
| **Australia** | Hydrogen Production Tax Incentive[11] | Direct subsidy (OpEx) | Refundable tax credit of AUD $2 per kg of green hydrogen produced, for up to 10 years. This will lower the cost of green ammonia derived from this hydrogen. |
| | Hydrogen Headstart Program[12] | Grants (CapEx) | Production credits for large-scale green hydrogen projects, also expected to produce ammonia. |
| | Western Australia Renewable Hydrogen Fund | Grants (CapEx) | Grants for feasibility studies and capital works projects. |
| | Safeguard Mechanism | Regulation | Regulatory obligation to reduce emissions, incentivising fossil-based ammonia producers to switch to using renewable hydrogen as a feedstock. |
| **Canada** | Clean Hydrogen Investment Tax Credit[13] | Capital support (CapEx) | 15-40% in refundable tax credits on capital cost of low-carbon hydrogen or ammonia projects, depending on their carbon intensity. Also offers 15% investment tax credit for equipment used to convert low-carbon hydrogen into ammonia. |
| | Carbon Capture, Utilization, and Storage (CCUS) Investment Tax Credi[14] | Capital support (CapEx) | Refundable tax credit for up to 60% of capital cost of CCUS equipment, which can be used to produce low-carbon ammonia. |

Table 2: Selected incentives for low-carbon ammonia, by country (continued)

| Country/Region | Main Incentives | Type of Incentive | How it Works |
|---|---|---|---|
| **European Union** | European Hydrogen Bank[15] | Direct subsidy (OpEx) | Competitive auctions offer successful bidders a fixed price (up to €4.5) per kg of low-carbon hydrogen produced, lowering the cost of ammonia derived from this hydrogen. |
| | H2Global | Contract for Difference (OpEx) | Competitive double auctions offering successful bidders a fixed price, 10-year supply contract for green ammonia. Available to EU and non-EU projects. |
| | Important Projects of Common European Interest (IPCEI) Hydrogen[16] | Grants (project specific) | EU Member States provide state aid for large-scale, cross-border projects in hydrogen value chain, including ammonia. |
| | Carbon Border Adjustment Mechanism[17] | Import tariff | Puts a carbon price on the greenhouse gas emissions of imported goods, including ammonia. This will improve the cost-competitiveness of low-carbon ammonia produced in the EU. |
| | Renewable Energy Directive III (RED III) | Regulation | Sets binding targets to increase the EU's renewable energy use. It will require renewable fuels of non-biological origin (RFNBOs) to account for 42% of hydrogen used in industry, effectively establishing a mandate for use of low-carbon ammonia in fertiliser production. |
| | Connecting Europe Facility for Transport (CEF) | Grants (project specific) | Provides support to build new or upgrade transport infrastructure, including funding to develop ammonia supply and bunkering facilities in ports. |
| **India** | Strategic Interventions for Green Hydrogen Transition[18] | Direct subsidy (CapEx & OpEx) | Offers funding per Kw for domestic manufacturing of electrolysers (used in green ammonia production). Also includes an auction for financial incentives to produce green hydrogen and ammonia. |
| | 25-year waiver of interstate transmission system charges | Regulation | Waives transmission charges between states for renewable energy used to produce green hydrogen or ammonia. |
| | Green shipbuilding fund | Direct subsidy (CapEx & OpEx) | 30% financial assistance for construction of vessels using clean fuels, including ammonia. |
| **Japan** | Hydrogen Society Promotion Act[19] | Contract for Difference (OpEx); DEVEX for infrastructure; regulation | 15-year subsidies awarded by auction for suppliers of both domestic and imported hydrogen and derivatives for use in Japan.<br>Subsidies for developers of domestic transport and storage facilities, including for ammonia.<br>Exemptions from specific regulations and permitting rules to speed up projects. |
| **South Korea** | Clean Hydrogen Power Generation Auction Scheme[20] | Contract for Difference (OpEx) | 15-year subsidies awarded by auction for power generation based on low-carbon hydrogen and ammonia. Also supports ammonia co-firing in existing coal power plants, anchoring demand for imported low-carbon ammonia. |
| | R&D and facility investment tax credits[21] | Capital support (CapEx); R&D support (OpEx) | 40-50% tax credits for R&D expenses and 15-25% tax credits for facility investment in clean hydrogen and derivatives infrastructure. |
| **United States** | Clean Hydrogen Production Tax Credit (45V)[22] | Direct subsidy (OpEx) | Offers up to $3 per kg of clean hydrogen produced, depending on its $CO_2$ emissions intensity. This hydrogen can be used as a feedstock for ammonia, lowering the cost of low-carbon ammonia. |
| | Carbon Capture and Sequestration Tax Credit (45Q) | Direct subsidy (OpEx) | Provides a fixed cash value ($85) per metric tonne of $CO_2$ captured and stored. |
| | Investment Tax Credit (48C) | Capital support (CapEx) | 30% tax credit for investments in low-carbon manufacturing equipment or retrofitting existing facilities, to reduce greenhouse gas emissions by at least 20%. |

# Recognising ammonia's strategic value

**Ammonia already has strategic value for its essential role in the global food system; in industrial applications such as the production of plastics, pharmaceuticals, and textiles; and uses in the defence sector. In the coming years, ammonia will also have a growing role to play as a direct fuel, for example in decarbonising maritime shipping, and as an energy carrier and store for hydrogen.**

Governments in Germany and Japan have already integrated low-carbon ammonia into their hydrogen strategies.

- Germany approved an import strategy for hydrogen and hydrogen derivatives[23] in July 2024. The strategy recommended ammonia as the most efficient shipping-based import method and provided a clear framework for the import of hydrogen and its derivatives into Germany.
- The Japanese Government's latest Basic Hydrogen Strategy (2023)[24] recognised the requirement for ammonia to meet domestic hydrogen supply targets. It set forth a strong focus on developing an international hydrogen and ammonia supply chain and associated infrastructure.

In response, the UK Government has started to increase collaboration between departments and agencies on ammonia research, policy development, and funding mechanisms. This is particularly important for the development of policies that can support new and emerging use cases.

**UK Maritime Innovation Hub**

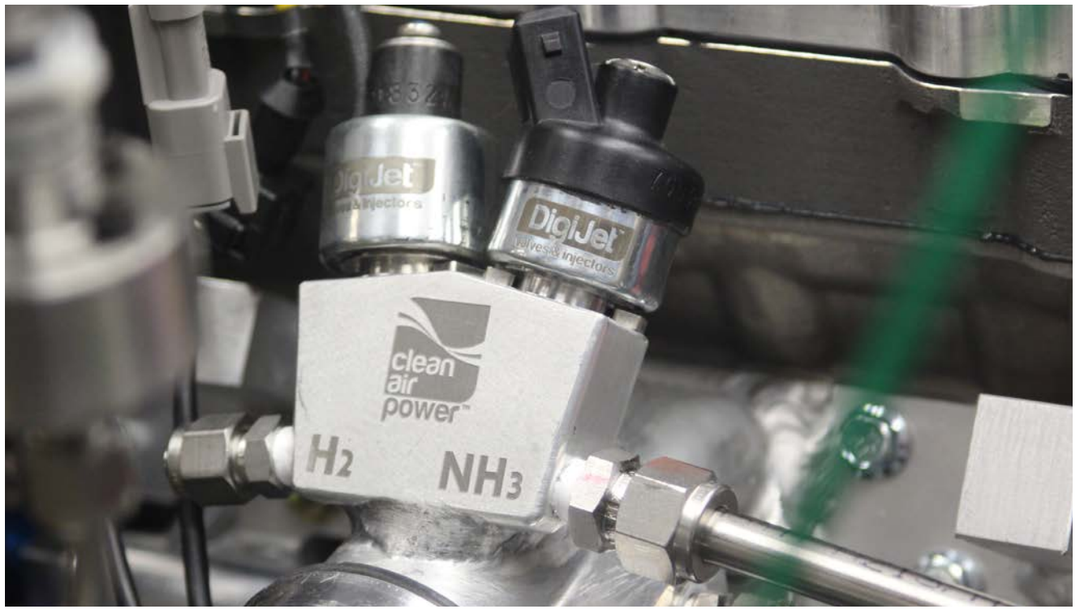
Plans for a UK Maritime Innovation Hub were announced in the Maritime Decarbonisation Strategy (March 2025). Launching in April 2026, the Hub will be hosted by DfT executive agency the Maritime and Coastguard Agency. It will act as a guide through the regulatory journey, offering tailored support to vessel operators, shipbuilders, start-ups, and technology developers. The aim is to streamline approval processes, reduce regulatory risk, and accelerate timelines to enable faster deployment of innovative maritime solutions – such as for ammonia as an alternative fuel.

### Case Study: Clean Air Power – enabling zero-carbon ammonia power with advanced fuel injection

Clean Air Power is a UK-based technology SME working to build a network of ammonia powered clean energy assets. Their proprietary ammonia injection system enables precise, efficient combustion in engines – unlocking clean, flexible power.

The company is leading a consortium to demonstrate how existing engines can be retrofit for real-world applications. This includes shoreside power for ports and maritime auxiliary systems through REACT (Retrofittable Emission-Free Ammonia Combustion Technology). Project REACT, including partners Mahle Powertrain, the University of Nottingham, AFC Energy, and Johnson Matthey, is one of many projects that has secured funding under UK SHORE, a Department for Transport programme delivered with Innovate UK.

The modular, containerised gensets that Clean Air Power is developing offer a viable alternative to fossil fuels in a range of hard-to-electrify sectors. Beyond maritime applications, their technology's scalable and long-duration attributes can support grid-balancing, off-grid industrial power, and AI data centre resilience, bolstering the UK's net zero transition and energy security.




While these are welcome developments, the UK Government can and should go further, faster to maximise the opportunity.

**Recommendation 1: Recognise the role of low-carbon ammonia in the future economy**

- **DESNZ** should recognise low-carbon ammonia, alongside other hydrogen carriers, in the updated UK Hydrogen Strategy.
- This should include reference to ammonia's importance for sectors such as agriculture, shipping, industrial chemicals, energy storage, and power, and how it can also play an important role in the growth of the hydrogen sector, by facilitating efficient and distributed transport and storage as a hydrogen carrier.
- It should also provide an early indication, or commit to an assessment of, the long-term outlook for ammonia demand and supply in the UK, and policies for balancing the two.

Industry will work to develop a roadmap, covering the full ammonia supply chain. The UKAA believes it is incumbent on industry to gather the evidence to present realistic uptake pathways for the strategic end-use cases for low-carbon ammonia. This roadmap will present evidence on the appetite and ability of sectors such as agriculture, maritime, power, and storage to adopt low-carbon ammonia, and both the opportunities and the barriers they face. This will provide Government with useful evidence for future policy making.

**Recommendation 2: Commit to producing an Ammonia White Paper in 2026**

- This White Paper should include detailed evidence on safety, timelines for updating regulations and standards for low-carbon ammonia, and ambitions for international trade.
- Bringing together policies and ambitions from **DESNZ**, **DfT**, **DBT**, and **DEFRA**, this White Paper should provide a comprehensive framework for the development of the low-carbon ammonia industry in the UK, giving industry the confidence to invest in production and import routes, and associated logistics infrastructure and supply chains.
- The UKAA recognises that the Government is becoming increasingly interested in other hydrogen derivatives, and we encourage it to consider these as part of this White Paper too.

Industry commits to working with Government by sharing evidence from trials, connecting officials with world-leading safety experts, and providing commercial insight for the development of detailed sector roadmaps.

# Revitalising domestic production

**Ammonia is critical to supporting food production because it is the key ingredient in most fertilisers. Until recently the UK produced much of its own ammonia at large-scale sites such as Billingham and Saltend. However, these plants are no longer operating, leaving the UK reliant on global markets to supply the ammonia needed to produce fertiliser or the finished product itself. This is a strategic food security risk; for example, most fertiliser imported from the EU is dependent on ammonia, which has in turn been imported from Russia.**

### Closure of UK ammonia plants

From 1918 to 2025 the UK was home to ammonia production facilities that produced up to 1.1Mt of ammonia per year, until rising energy costs led producers such as CF Industries to announce the closure of its Billingham production plant in 2023. At its peak this was the largest ammonia production plant in the UK. Since its closure, the UK farming and food sector has been increasingly dependent on imports. Farming and food industry stakeholders have highlighted that without strategic volumes of domestic production capability, the UK faces greater risks from price volatility and exposure to global supply chain shocks.

With its abundant offshore renewable energy resources, the UK is well-placed to re-start domestic ammonia production, with a specific focus on low-carbon ammonia. Strategically placed production sites can help to ease grid congestion, saving billions of pounds in avoided constraint payments and upgrading transmission infrastructure if ammonia production is situated close to renewable energy hubs.

In addition, as ammonia is easily transported, production need not be constrained by co-locating with demand. Ammonia can be stored or transported to be processed for food, fuel, and defence end uses in other UK locations. Revitalising the UK's domestic ammonia production capabilities therefore offers strategic opportunities for investment, job creation, and resilience across key sectors such as food, fuel, energy, and defence.

**Recommendation 3: Adopt a low-carbon ammonia production target**

- The UK Government should adopt a low-carbon ammonia production target, at a level that seeks to replace the production capacity the UK has lost.
- A production target will provide investors and industry with a clear signal of Government intent for the development of the market for low-carbon ammonia in the UK (as it did to stimulate early growth in the UK's hydrogen market), driving high-value job creation which can support delivery of the Clean Energy Jobs Plan, as well as boosting investment in R&D and upskilling.
- Having domestic production capability for a commodity with a growing global market will also provide the UK with a strategic supply that can support our key industries through unpredictable geopolitical shocks.
- This will also incentivise investment across the ammonia supply chain, including in the supporting storage and logistics infrastructure needed to reduce costs of production whilst enabling the wider marketplace.
- In pursuit of this, **DESNZ** must continue to work at pace to complete HAR2 and launch HAR3 as soon as possible. This existing mechanism presents an opportunity to kick-start domestic production.

UKAA members commit to providing Government with evidence on the level of investment and high-value jobs that an ambitious production target can deliver.

### Case Study: Shetland Hydrogen Project 2 (SHP2)

Statkraft - Europe's largest generator of renewable energy - develops wind, solar, hydropower, storage, grid stability, and green hydrogen in the UK, alongside a thriving markets business. Statkraft intends to downstream process the hydrogen produced at several of its sites to low-carbon ammonia.

Low-carbon ammonia will play a key role in the energy transition, with Statkraft's SHP2 expected to produce around 280,000 tonnes of ammonia each year once operational in the early 2030s. The need to decarbonise hard-to-reach sectors, along with new opportunities for ammonia as a low-carbon energy carrier, means the market is expected to grow substantially by 2050.

# Trade – accelerating decarbonisation

**Demand for low-carbon ammonia is expected to far exceed supply in the coming years because of its potential to play a key role in decarbonising the maritime, power, and energy storage sectors. One estimate of the scale of UK demand for low-carbon ammonia for shipping alone could be 12-24 Mt a year by 2050[25]. This calls for the UK to consider how and where it will source the low-carbon ammonia needed to meet this growing demand.**

Creating a policy environment for the UK to become a global trading hub for low-carbon ammonia would be a strategic step with benefits for trade in both directions.

Encouraging trade with a network of global producers presents opportunities for the UK to demonstrate expertise in handling and attract investment into port infrastructure. It can also support the decarbonisation of hard-to-abate sectors and diversification of energy supplies. Meanwhile, work on re-starting domestic production provides strategic energy security benefits and supply chain opportunities. The UK's proximity to major ports and industry in North-West Europe, combined with its extensive liquid fuels and chemicals storage and logistics infrastructure, offers a potential market for traders of certified low-carbon molecules.


**Recommendation 4: Take action to support the development of the UK market for low-carbon ammonia**

There are a series of near-term steps Government can take to make the UK an attractive destination for trading low-carbon ammonia.

- **DBT** should engage with distributors to establish current fluidity and barriers in the market. This will ensure that Government has the evidence needed to take forward actions that can smooth the path for the anticipated increase in the volume of low-carbon ammonia traded to and from the UK.
- Similarly, **DBT** should map the required ammonia storage and logistics infrastructure to facilitate trade at key strategic locations around the UK. This will help to identify where investment may be needed to upgrade or expand infrastructure to ensure that ammonia can be handled and transported efficiently.
- **DESNZ, DfT and DEFRA** should assess the potential for a national ammonia reserve to act as a strategic asset for the UK – this could be available in a flexible manner for seasonal energy storage and other uses to protect the UK against global shocks, such as the increase in the price of fertiliser following Russia's invasion of Ukraine.
- The relevant UK permitting agencies (the **Environment Agency**, Scottish Environment Protection Agency, Natural Resources Wales, and Northern Ireland Environment Agency) should introduce a fast-track permitting route to unlock initial small-scale, low-carbon ammonia projects that can provide insights on safety, efficiency, and handling to inform large-scale applications in future.

UKAA members will work closely with end users to understand their needs and share this evidence with Government. As a group of innovative companies investing heavily into R&D, we will also provide regular feedback from trials and early-stage projects to government departments and agencies to help inform their decision making.

# Funding mechanisms

**Government funding mechanisms have proven invaluable in giving developers of clean energy technologies the certainty needed to make investment into new UK projects. Increasing the share of clean power in the system supports the transition to net zero while also delivering a new generation of investment, infrastructure, well-paid jobs, and skills. Examples of successful Government schemes include the Contract for Difference scheme for onshore and offshore wind, the Feed in Tariff for rooftop solar, and the Hydrogen Production Business Model.**

At present, the domestic production of low-carbon ammonia is indirectly supported through the Government's successful Hydrogen Production Business Model. Meanwhile, the use of low-carbon ammonia in transport applications, such as maritime and Non-Road Mobile Machinery (NRMM), is supported by the Road Transport Fuel Obligation scheme administered by DfT. The scale of the opportunity for low-carbon ammonia in the UK is closely tied to that of hydrogen.

The UK has considerable wind resource potential, far exceeding the 31GW already installed[26]. However, wind power is also an intermittent resource – supply will never perfectly align with demand. Furthermore, the greatest potential for production is either offshore or in regions with low population density, and grid upgrades are required to carry the electricity produced to where there is demand.

The production of low-carbon ammonia using green hydrogen, fed by wind power that would otherwise be curtailed, is a promising option for making use of this excess power to increase our energy and food security.

**Recommendation 5: Extend suitable hydrogen funding mechanisms to incentivise the use of hydrogen carriers and derivatives, and low-carbon ammonia in particular, as a flexible energy store and reliable power source**

- **DESNZ** should allow ammonia-to-power to be supported under the Hydrogen to Power Business Model. Analysis suggests that ammonia-to-power can be supported using a Dispatchable Power Agreement-style mechanism – which DESNZ is already designing for hydrogen-to-power. As a hydrogen carrier and energy vector, ammonia is complementary to direct hydrogen-to-power. This action will allow faster deployment than designing a new scheme.
- **DESNZ** should also support ammonia, alongside other hydrogen carriers, as a hydrogen storage solution under the Hydrogen Storage Business Model. Dedicated ammonia storage hubs are an essential component of the supply chain, not only in terms of safe product handling and providing market resilience, but also in terms of enabling market access and scalable supplies for producers and end-users, driving economies of scale through pooling and ensuring efficient asset utilisation, all of which will help reduce production costs. Ammonia can act as a decentralised, flexible complement to large-scale hydrogen storage in salt caverns. It can provide low-carbon dispatchable power and play an important role in future hydrogen network balancing, with energy stored as ammonia and cracked into hydrogen on demand. This will strengthen both UK energy security and the transition to clean power whilst also creating the demand visibility that the supporting supply chain requires to invest in storage capacity.
- **HMT and DESNZ** should work together to extend the Climate Change Levy exemption on green hydrogen so that it fully covers the energy inputs for low-carbon ammonia production. This ensures that UK production of low-carbon ammonia does not face higher carbon taxes than grey ammonia production.
- **DESNZ** should also bring the reference price for hydrogen derivatives, including ammonia, to parity with non-derivative uses. At present, the Hydrogen Production Business Model uses a reference price of 1.2x UK natural gas for hydrogen sold as a feedstock, specifically low-carbon ammonia and methanol. This presents a barrier to the development of the UK's low-carbon ammonia production capability, by making domestic production projects less competitive with other hydrogen end uses.

Industry will share evidence with Government on the merits and challenges of ammonia's role as an energy and storage vector, including through forums such as the Hydrogen to Power and Hydrogen Storage Business Model expert groups.

# Trade – standards and certification

**Demand for low-carbon hydrogen and hydrogen derivatives is increasing. In the hydrogen sector, the UK Low Carbon Hydrogen Standard (LCHS) is facilitating the development of hydrogen production projects to meet this demand.**

Alongside the first UK Hydrogen Strategy (2021), Government published a consultation on developing a low-carbon standard for hydrogen; the first version of the LCHS was finalised in 2022. This initiative has been vital in giving prospective low carbon hydrogen producers the certainty needed to bring forward production projects that either rely on Government support or on policies that have adopted the Standard.

The LCHS is also an important tool in driving demand for low-carbon hydrogen. It provides end users with confidence that the hydrogen they purchase is a genuinely low carbon alternative. In future, and with updates to align with the standards of key trading partners, it could also underpin international trade in hydrogen.

Almost all ammonia produced and traded in the global market today is produced by using natural gas or coal to power the Haber-Bosch process. This process emits almost twice the amount of $CO_2$ per tonne of ammonia than in crude steel production. With the IEA forecasting a 40% increase in global ammonia production by 2050 under its Stated Policies Scenario3, this must change.

A framework for recognising low-carbon ammonia could have a similar effect to the LCHS in increasing investment into low-carbon ammonia, for use in new and emerging applications such as in low-carbon products and as a sustainable fuel.

It is also widely expected that most low-carbon hydrogen will be transported internationally in the form of ammonia. As a product with established infrastructure and supply chains, it will be most practical to develop standards that suit the metrics and thresholds that underpin the existing global trade system.

**Recommendation 6: Commit to developing a UK standard for low-carbon ammonia**

- To grow the UK's share of global trade of low-carbon ammonia and ammonia solutions, the UK should commit to developing a standard for low-carbon ammonia by 2027. This should seek alignment with certification schemes developed by international ammonia industry bodies, with the aim of giving investors, producers, and end users greater certainty about claims of low-carbon ammonia.
- To ensure timely development, the low-carbon ammonia standard should take learnings from, and be modelled on, the LCHS. This would also ensure it is compatible with the LCHS by providing certainty on the carbon intensity of ammonia as a feedstock for producing low-carbon hydrogen.
- This standard should also account for the risks and safeguards that are unique to ammonia, such as controls around losses through the supply chain and air quality impacts.
- In developing a standard for low-carbon ammonia, the UK should look to align with regulatory initiatives emerging from key international trading partners such as Japan and the EU, to support free trade through import and export.

Industry is ready to work with Government on the development of a standard, and would welcome the introduction of a Low-Carbon Ammonia Working Group or similar to facilitate formal and ongoing collaboration with Government.

# Safety and regulation

**Given its many uses, including in the production of fertilisers, plastics, medicines, and dyes, ammonia has been traded globally for decades. However, it is also toxic and can be explosive, and is highly regulated across production, storage, transportation, distribution, and handling. Infrastructure and regulations to ensure the safe handling and management of ammonia have been developed over time.**

In the UK, ammonia is currently classified as a chemical. This classification supports the necessary transport and distribution of ammonia as an industrial chemical across the UK. However, without also classifying ammonia as a fuel, current UK regulations are a barrier to its deployment for low-carbon power generation, hydrogen applications, and use as a maritime fuel. They also place higher compliance and safety costs on the industry and end user, as good practices for smaller format ammonia installations are not yet widely known or implemented. The development of new use cases for ammonia and its potential impact on some of the most hard-to-abate sectors, such as maritime and long duration energy storage, calls for a new era of safety and regulation.

The UKAA is clear that safety must remain of the utmost importance. Changes to guidance on handling ammonia and regulating its use should build on those structures already in place, while allowing for innovation and scale-up at a pace that allows the UK to become an international leader in new applications and updated infrastructure.

**Recommendation 7: Review and introduce safety regulations that consider ammonia as a fuel, in addition to an industrial chemical and feedstock**

- Reviewing and updating safety regulations to treat ammonia as a fuel, in addition to a chemical, is a critical first step to ensuring that the UK can rapidly develop the projects and infrastructure for emerging use cases of low-carbon ammonia, such as in power, hydrogen, and maritime applications.
- The UK should seek to maximise its geographical advantage as an import / export hub and home to significant port infrastructure. By taking timely action to introduce regulations that treat ammonia as a fuel, the UK has the potential to lead in becoming a major bunkering destination for the maritime industry.
- The primary Government agencies with responsibility for this regulation are the **Health and Safety Executive** and the **Environment Agency**, however there is likely a need for input from other Government departments such as **DESNZ** and **DfT**.

The UKAA commits to establishing an ammonia safety working group, including industry and academic experts, and collaborating with international partners. This group will develop and provide evidence on best practices in ammonia safety and share learnings on safe ammonia use in novel ammonia applications, with a view to support the development of appropriate regulations and facilitate international alignment.

### Case Study: Ammonia field experiments demonstrate safety of emerging applications

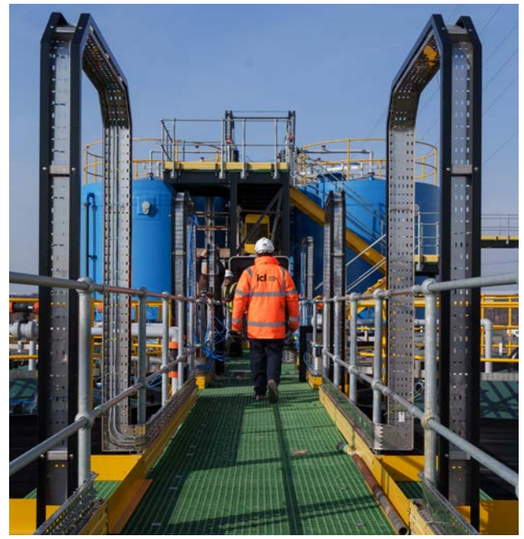
In 2023, Air Products and DNV conducted ammonia field experiments at Spadeadam, UK, generating evidence to modernise safety frameworks for emerging energy applications. The programme explored refrigerated and ambient pressurised ammonia releases under real-world conditions, providing critical insights for risk management.

The programme's findings strengthen the case for updating UK regulations to support the use of ammonia in hydrogen production, for direct use in power generation and maritime fuels, and strategic storage, while maintaining rigorous safety standards. Air Products' leadership in this work underpins the UKAA's commitment to convene an ammonia safety working group, ensuring best practice and data-driven guidance are shared with Government to enable safe deployment of low-carbon ammonia across the UK economy.

**Recommendation 8: Introduce a streamlined permitting process that recognises ammonia as a fuel**

- The UK Government should streamline the permitting process for ammonia in select applications. This will send a strong signal to industry and investors about the UK's ambitions in ammonia.
- Actions to encourage innovation and the faster approval of new applications, subject to rigorous safety demonstration and meeting necessary regulations, can ensure the UK benefits from the anticipated growth in the market for ammonia production, trade, technologies, and associated infrastructure.

The UKAA commits to working collaboratively with Government to demonstrate the safety case for new applications of ammonia as a fuel, and will provide timely evidence from R&D trials to help shape future policy development.



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