Argus Green Ammonia Strategy Report

Table of Contents, key features and insightful extracts

Gain competitive advantage with our unique, essential report focused on the currently embryonic but potentially huge market for ammonia as a low or zero carbon energy carrier.
Market Reporting
Consulting
Events

Argus Green Ammonia Strategy Report
illuminating the markets

Key market trends analysed

The projected volume and drivers of growth in the market for ammonia as a decarbonized energy carrier

Ammonia's position in the fuel mix in the new decarbonized fuel economy and sectors expected to adopt ammonia as a fuel

The factors likely to determine the development of low carbon ammonia capacity and locations likely to become key supply hubs

Key questions addressed

What will green ammonia cost to produce, and how will those costs develop?

What is the global forecast for low or zero carbon ammonia demand to 2050, and in which end-use segments?

What is the key position of ammonia as a fuel or feedstock in the new energy economy?

What key blue and green ammonia projects are being developed?

Will regulation, carbon taxes or incentives be required to unlock the potential of low or zero carbon ammonia projects?

Region by region assessment of potential for development of low/zero carbon ammonia capacity, including production costs, competitive position and potential government support

Overview of the key macro trends and factors driving decarbonisation and the role and position of alternative fuel carriers

Demand forecast for the key ammonia as a fuel markets to 2050, taking in to account its potential against competing low or zero carbon fuels, technical considerations, and likely legislative and regulatory interventions

Direct uses
- As a bunker marine fuel
- For power generation
- For conventional uses, like fertilizers and chemicals

Indirect uses
- Manufacturing
- Power generation
- Transport

Overview of the key market and non-market influences driving the development of ammonia as a fuel.

Overview of the key macro trends and factors driving decarbonisation and the role and position of alternative fuel carriers

Access to the expert consultants behind Argus' long-term market analysis

This comprehensive strategy report is delivered in PowerPoint format (over 300 narrative and graphical slides) and includes essential supporting data

Key benefits

Discover which sectors are the most promising for the use of ammonia for fuel, and why.

Assess the existing ammonia market, its buyers, suppliers and infrastructure.

Quantify the potential size of the future 'ammonia for fuel' market using robust underlying data developed by Argus’ unique multi-commodity, multi-disciplined team.

Develop your understanding of the economics of blue and green ammonia production, and how they will evolve in the future.

Understand the key market and non-market influences driving the development of ammonia as a fuel.
Who should use this report?

- Ammonia and energy traders seeking future opportunities from the energy transition.
- Shipping companies that are looking at low/zero-carbon fuel options to comply with IMO directives, and bunker fuels producers and traders that are looking for opportunities in this sector.
- Power utilities and power generation fuels suppliers looking to understand potential trends in the adoption of low/zero-carbon fuels in key countries, and the implications for the future fuels mix.
- Hydrocarbon producers interested in diversifying their product portfolios in light of increasingly ambitious decarbonization goals.
- Investors seeking to gain a better understanding of the opportunities arising from the recent wave of project activity in the hydrogen/ammonia space.
- Fertilizer and chemical producers seeking to better understand how the development of a market for ammonia as a fuel will impact their business and create new opportunities.
- Technology and Engineering companies looking into opportunities presented by the energy transition.

Our green ammonia expertise

Argus has an established track record of delivering bespoke client studies through our Consulting Services division. We have undertaken a wide range of market studies across a full range of products, including energy, fuels and fertilizer products – with increasing analysis of green ammonia. Project examples include:

<table>
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<tr>
<th>CLIENT</th>
<th>TASK</th>
<th>RESULT</th>
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<tbody>
<tr>
<td>Singapore Prime Minister's Office (PMO): Roadmap to decarbonising the economy</td>
<td>A detailed overview of the global ammonia supply and value chain was provided, with detailed logistics analysis, databases of operating vessels and terminals, as well as an analysis of potential blue/green ammonia levelized costs in all major locations globally. The study included profiles of key players in the ammonia value chain, as well as profiles of major blue/green ammonia projects under development.</td>
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- A major utility company Ammonia market study – supply and value chain, blue/green ammonia cost analysis
- A Major engineering company active in oil and gas and petrochemicals Ammonia market study – technology, industry trends, demand potential for green ammonia
- A major bunker fuel trader Ammonia industry overview and ammonia logistics analysis, with the aim of supporting internal study of ammonia as a marine fuel
Table of contents (summarized)

- Executive Summary
- Decarbonisation – Overview of Current Status and Trends
  - Current programs, mandates and growth
  - Current primary carriers
    - Direct renewable electricity
    - Biofuels and biomass
    - Battery power
- Trends and momentum in decarbonisation drives
  - Government regulations and pledges
  - Corporate and market based initiatives (IOCs, financial institutions)
  - NGOs, pressure groups and general market awareness
- Role of hydrogen in decarbonisation of key sectors
  - Power
  - Land based transportation (road, rail)
  - Long haul transportation (sea, air)
  - Manufacturing (fertilizer, petrochemicals, iron and steel, others)
- Introduction to Ammonia (Existing Market)
  - Main uses
    - Schematic overview of existing supply chain
      - Key producers
      - Traders and distributors
      - Shipping and storage
      - Key buyers
  - Grey ammonia pricing drivers
- Green/Blue/Grey Ammonia as an Energy Carrier
  - Green ammonia production and supply chain analysis
    - Overview
    - Critical technologies and status
  - Demand for Green/Blue Ammonia (Direct and Indirect Uses)
    - Marine Bunker fuel
  - Demand forecast zero emissions fuels
  - Potential zero emission fuel alternative and current status of green ammonia (comparison of relative technologies such as electricity, biofuels, methanol, hydrogen)
- Initiatives in demand side development of green/blue/ grey ammonia as bunker fuels
- Developing regional demand (Asia, Europe, Middle East, US)
- Power Generation
  - Burning ammonia directly as fuel
  - Government mandates and incentives
  - Demand projections
- Conventional uses (fertilizers and chemicals)
  - Recap technology status and price comparison
  - Potential downstream applications
  - Government policies, incentive and mandates (e.g. decarbonization policies in agriculture)
  - Potential development of voluntary premium markets
  - Projected size of green ammonia market in fertilizers and chemicals (scenario discussion)
  - Regional demand analysis
- Indirect uses
  - Back cracking technology development and impact on market size
  - Manufacturing
  - Power generation
  - Transport
- Combined demand side scenarios to 2050
- Blue/Green Hydrogen Ammonia Supply Side Developments
  - Regional review: Export-oriented green ammonia projects
  - South America | Oceania | Southeast Asia | Middle East and North Africa | North America Europe | Russia and the FSU
    - Government support
    - Domestic demand to anchor output
    - Cost structure
    - Key projects
      - Stakeholders
      - Pilot phase sizing
      - Expansion plans timeline and scaling up
      - Downstream target application/region
      - Uncertainties
    - Supply outlook (2020 – 2050)

- Supply Demand Scenario Analysis
  - Scenario development
    - High green/blue ammonia demand scenario | Low green/blue ammonia demand scenario
    - Gap analysis
      - High green/blue demand scenario: Deficit in supplies of green/blue ammonia vis-à-vis demand
      - Low green/blue ammonia demand scenario: Surplus of supplies of green/blue ammonia vis-à-vis demand
      - Implication for trade flows from key exporting regions to import locations
      - Grey ammonia: Enabling the transition
    - Barriers to the transition
    - Cost and pricing scenarios
      - Potential convergence between grey and blue/green levelized costs (over the 2021-2050)
      - Qualitative analysis of cost inflation risks in non-fuel ammonia end uses

- Concluding Thoughts
  - Potential of green/blue ammonia to enable the hydrogen economy
  - Ammonia’s extant advantages
  - Key sectors/regions driving demand

- Risks to the development of green/blue ammonia supply chains
- Infrastructure development costs
  - Capital costs and project financing
  - Handling
  - Storage
  - Transportation
- Technology
  - Maritime sector
  - Power generation
  - Cracking of ammonia
  - Alternative hydrogen carriers: Technological progress
  - Other decarbonization options
  - Policy direction
  - Regulations and certifications
  - Government support (direct or indirect)

Benefits of choosing Argus

- Multi-commodity experience
  - Our ammonia, marine fuels, power and energy transition experts are widely respected, while our consulting division has a proven track record of delivering highly valuable bespoke green ammonia projects to clients.

- Price reporting, short and mid to long-term outlook expertise
  - Our ammonia and marine fuels price reporting is market-leading - we have produced a shadow price based on LCOA (Levelized Cost of Ammonia).
  - Our short and mid to long term outlook services are highly respected, connecting clients with valuable data and insight.

- Methodology and comprehensive cost model
  - Argus employ robust, best in class analytics methodology and a constructed cost model with assumptions tested in the market place.

- Extensive network within the Industry
  - We are early members of the AEA (Ammonia Energy Association) and produce a range of industry-leading green ammonia conferences, workshops and digital events - ensuring our clients benefit from our relationships with the key personalities in the sector.
Argus’ consulting division delivers best-in-class fully bespoke consulting solutions, including market-specific research and analysis. We provide clients with business strategy support; due diligence; customized analysis; research; supply, demand and price forecasts; and strategic market research on local and international fertilizer markets.

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<tr>
<th>Consultancy portfolio</th>
<th>Types of work</th>
<th>Types of clients</th>
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<tbody>
<tr>
<td>Market studies (Market demand, supply or price focused)</td>
<td>▶ Market entry or evaluation&lt;br&gt;▶ Competitor analysis&lt;br&gt;▶ Marketing and sales strategy&lt;br&gt;▶ Sourcing strategy&lt;br&gt;▶ Supply chain analysis</td>
<td>▪ Producers and suppliers&lt;br&gt;▪ Fertilizer and chemical producers&lt;br&gt;▪ Raw material suppliers, including energy companies&lt;br&gt;▪ Cooperatives&lt;br&gt;▪ Technology suppliers and engineering companies</td>
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<td>Marketability (Price focused)</td>
<td>▶ Pricing support&lt;br&gt;▶ Support for off-take agreement negotiation</td>
<td>▪ Organisations&lt;br&gt;▪ Trade and industry associations&lt;br&gt;▪ Government organisations&lt;br&gt;▪ International institutions</td>
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<td>Project evaluation or financing (Project focused)</td>
<td>▶ Project evaluation for financing/permitting, e.g. (pre-) feasibility/scoping studies</td>
<td>▪ Financial institutions&lt;br&gt;▪ Buyers and traders&lt;br&gt;▪ Investors&lt;br&gt;▪ Hedge funds&lt;br&gt;▪ Banks</td>
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<tr>
<td>Transaction support (Company focused)</td>
<td>▶ Process, procurement or sales improvement&lt;br&gt;▶ Benchmarking</td>
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<tr>
<td>Performance improvement (Operation/company focused)</td>
<td>▶ Process, procurement or sales improvement&lt;br&gt;▶ Benchmarking</td>
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<tr>
<td>Regulatory and policymaking advice</td>
<td>▶ Advice on policy</td>
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<tr>
<td>Other types</td>
<td>▶ Litigation&lt;br&gt;▶ Survey/interview&lt;br&gt;▶ Event attendance&lt;br&gt;▶ Expert opinion</td>
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Contact us for more information

In times of increased market volatility and transition, it’s more essential than ever to have access to Argus’ accurate, reliable market intelligence founded on robust methodology, produced by our industry-leading experts.

Speak to our team to discover how we can support you and your business.

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