

Global Hydrogen and Nitrogen Markets: Comprehensive Research Report

Prepared by: Walmer Family Fund

Date: April 2026

Classification: Investment Research

Executive Summary

The global hydrogen and nitrogen markets stand at a pivotal inflection point in 2026. Hydrogen, long dominated by fossil-fuel-derived “grey” production for refining and chemicals, is undergoing a structural transformation toward low-carbon variants — green (electrolytic) and blue (with carbon capture) — driven by energy transition mandates and industrial decarbonization imperatives. Nitrogen, the backbone of global food security through fertilizer production, faces acute near-term supply disruptions from the ongoing Iran-Middle East conflict while navigating a longer-term transition toward green ammonia and sustainable agriculture.

Together, these two markets are deeply intertwined: ammonia — the primary nitrogen fertilizer precursor — is itself a hydrogen derivative, meaning the decarbonization of hydrogen production directly reshapes the economics of global nitrogen supply. For long-term investors, both markets offer substantial growth potential alongside significant geopolitical, technological, and regulatory risk.

Part I: The Global Hydrogen Market

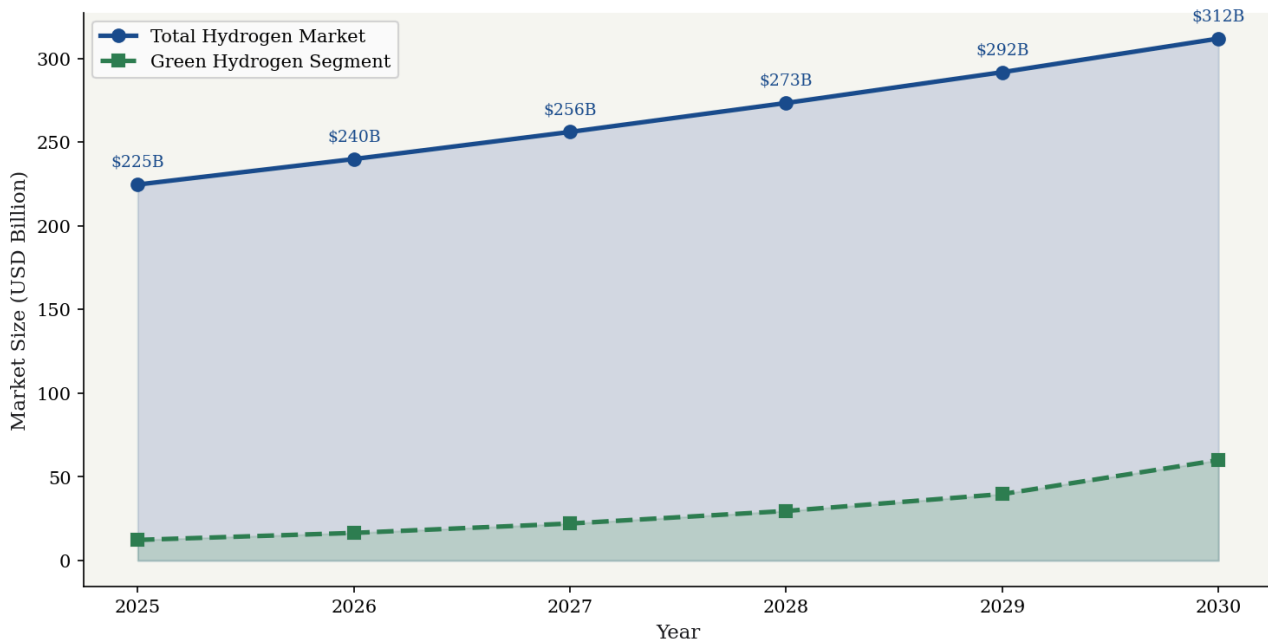
1.1 Current Market State

Global hydrogen demand reached approximately **100 million tonnes (Mt)** in 2024, representing a 2% increase from 2023 and consistent with overall energy demand growth. ¹ The overwhelming majority of this demand — roughly 95% — is met by fossil-fuel-derived hydrogen: approximately 62% from natural gas (steam methane reforming, or SMR), 19% from coal gasification, and the remainder from oil and industrial by-product streams. ²

The overall hydrogen market was valued at approximately **USD 224.66 billion in 2025** and is projected to reach **USD 311.89 billion by 2030**, growing at a compound annual growth rate (CAGR) of approximately 6.8%. ³ The green hydrogen segment alone, valued at USD 12.31 billion in 2025, is forecast to expand dramatically to **USD 231.32 billion by 2035**, reflecting a CAGR exceeding 30%. ⁴

Segment	2025 Market Size	2030 Projection	CAGR
Total Hydrogen Market	USD 224.66 billion	USD 311.89 billion	6.8%
Green Hydrogen	USD 12.31 billion	~USD 60 billion	30%+
Hydrogen Generation	USD 157.81 billion	USD 226.37 billion	7.5%

Global Hydrogen Market Size Forecast (2025-2030)



Demand remains highly concentrated in two traditional sectors: **oil refining** (where hydrogen is used for desulfurization and upgrading) and **ammonia production** (for fertilizers). These two applications together account for approximately 85% of all hydrogen consumed globally. New applications in steel, transport, and power generation remain nascent, collectively representing less than 5% of current demand. [1](#)

1.2 Production Landscape and Clean Hydrogen Progress

Despite the scale of the market, clean hydrogen production remains marginal. The IEA's Global Hydrogen Review 2025 confirms that only approximately **1 Mt of low-carbon hydrogen** was produced in 2024 — just 1% of total demand — underscoring the vast gap between policy ambition and commercial reality. [1](#)

Global investment in clean hydrogen production is expected to grow by approximately **70% in 2025**, reaching an estimated USD 6 billion directed toward electrolysis capacity. [5](#) China leads global electrolyzer deployment, accounting for over half of committed renewable hydrogen capacity worldwide. The European Union, the United States, and Australia are the next most active markets, supported by subsidy frameworks including the U.S. Inflation Reduction Act's Section 45V hydrogen production tax credit and the EU's Hydrogen Bank auction mechanism.

The ING Think analysis published in January 2026 characterizes the sector as “stuck in the pilot phase,” noting that while global clean hydrogen production is expected to double to approximately **1.8 Mt per annum** by the end of 2026, this remains far below the volumes required for material decarbonization impact. [6](#)

1.3 Key Players

The hydrogen market is served by a combination of industrial gas majors, integrated energy companies, and emerging pure-play developers.

Company	Headquarters	Primary Role
Linde plc	Dublin, Ireland	Industrial gas production, distribution, infrastructure
Air Liquide S.A.	Paris, France	Industrial gas, large-scale green H ₂ projects
Air Products & Chemicals	Allentown, USA	Industrial gas, NEOM green H ₂ project (FID 2023)
Shell plc	London, UK	Blue hydrogen, refinery integration
ExxonMobil	Irving, USA	Blue hydrogen, CCS-integrated production
Engie S.A.	Paris, France	Green hydrogen, European projects
Aker Horizons	Fornebu, Norway	Green hydrogen development
Plug Power	Latham, USA	Electrolyzers, green hydrogen production
Nel ASA	Oslo, Norway	Electrolyzer manufacturing

1.4 Demand Drivers

Refining and Chemicals (Existing Demand): Stricter sulfur regulations in marine fuels (IMO 2020) and transportation fuels continue to sustain strong demand for hydrogen in refinery desulfurization. Ammonia synthesis for agriculture remains the single largest end-use application.

Steel Decarbonization: The steel sector accounts for approximately 7–9% of global CO₂ emissions. Direct Reduced Iron (DRI) processes using green hydrogen — pioneered commercially by HYBRIT in Sweden — offer a pathway to near-zero-emission steel. HYBRIT aims to produce 5 Mt of green steel annually by 2030. ⁷ The steel sector is widely regarded as one of the most credible near-term demand anchors for green hydrogen.

Shipping and Aviation: The International Maritime Organization’s (IMO) 2050 net-zero target and the EU’s FuelEU Maritime regulation are driving interest in ammonia and methanol as hydrogen-derived marine fuels. The IEA projects bioenergy, hydrogen, and hydrogen-based fuels will rise from less than 1% of shipping and aviation energy today to approximately 15% by 2030 and 80% by 2050. ⁸

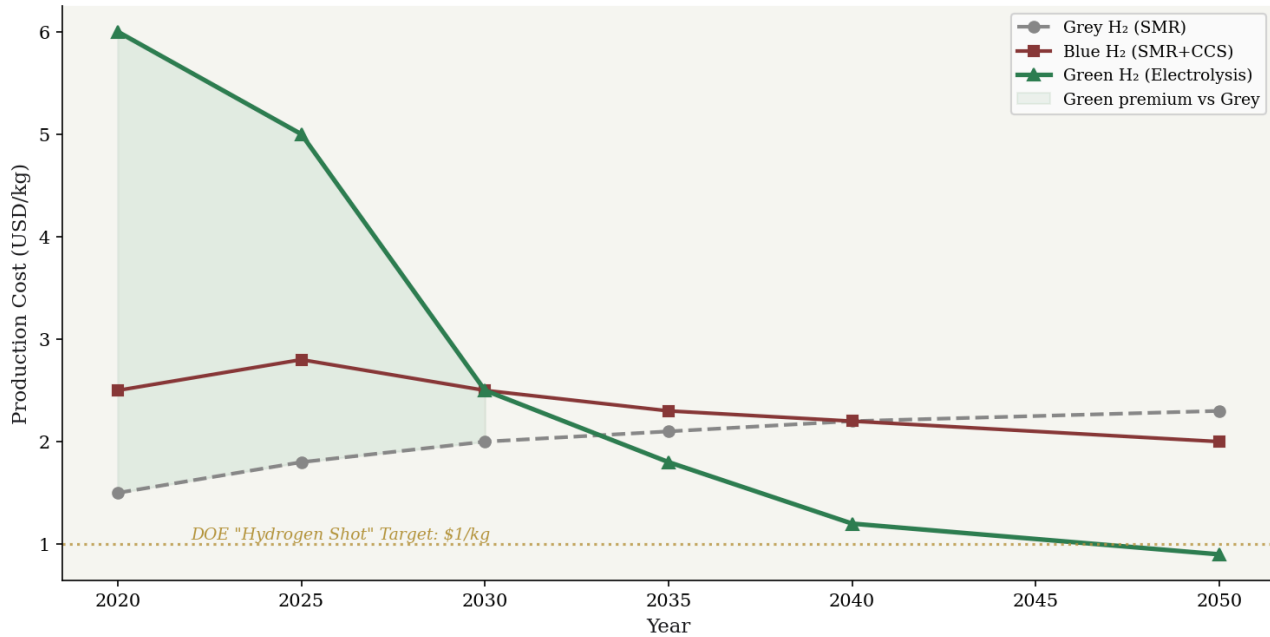
Power Generation: Hydrogen co-firing in gas turbines and fuel cells for grid balancing are emerging applications, particularly in Japan and South Korea, where domestic energy security concerns amplify the appeal of imported hydrogen.

1.5 Pricing and Cost Dynamics

Grey hydrogen (SMR, unabated) currently costs approximately **USD 1.0–2.5/kg** depending on natural gas prices. Blue hydrogen (SMR with CCS) costs approximately **USD 1.5–3.5/kg**. Green hydrogen (electrolysis using renewable electricity) costs approximately **USD 3.5–8.0/kg** in most markets today, though costs vary significantly by location and renewable resource quality.

The cost trajectory for green hydrogen is the central variable in long-term market development. PwC projects hydrogen production costs will decrease by approximately **50% through 2030**, with continued decline to 2050. ⁹ A quantitative review published in *Sustainable Energy & Fuels* (2024) found that production costs are predicted to almost halve by 2050 and fall by a third by 2030 relative to 2020 levels. ¹⁰ The U.S. Department of Energy’s “Hydrogen Shot” program targets USD 1/kg (“1-1-1”: 1 kg, 1 dollar, 1 decade), with analysis from Harvard Business School suggesting this target is achievable by 2030 under favorable policy and scale conditions. ¹¹

Hydrogen Production Cost Trajectory by Type (2020-2050)



Part II: Short-Term Hydrogen Outlook (2025–2030)

2.1 Near-Term Headwinds

The hydrogen sector entered 2026 in a period of significant recalibration. Several high-profile project cancellations and delays in 2025 — including BP and Engie’s withdrawal from Oman projects, Saudi Aramco’s downward revision of blue ammonia targets, and Air Products’ shareholder challenges related to the NEOM project — have tempered earlier optimism. [12](#)

The key near-term challenges are:

Offtake insecurity: Most large-scale green hydrogen projects require long-term offtake contracts to achieve bankability, but end-users in steel, chemicals, and transport remain reluctant to commit at current price levels. Securing offtake is described by Wood Mackenzie as the single most critical barrier to commercial-scale project development. [12](#)

Regulatory complexity: Europe’s Renewable Fuels of Non-Biological Origin (RFNBO) rules — which require strict additionality, temporal correlation, and geographic correlation for electrolytic hydrogen to qualify for subsidies — have added USD 1.0–2.0/kg to production costs for many projects. The European Commission’s November 2025 Low-Carbon Fuels Delegated Act and the opening of the Hydrogen Bank auction to non-RFNBO projects signals a policy correction, but uncertainty persists. [12](#)

U.S. policy uncertainty: The Inflation Reduction Act’s Section 45V hydrogen tax credit remains a critical demand signal for U.S. projects, but regulatory guidance on qualifying criteria has created uncertainty for developers.

2.2 Near-Term Opportunities

Despite headwinds, several developments are expected to define the 2026–2030 period positively:

India’s cost leadership: Indian developers have submitted aggressive bids in green hydrogen auctions, with some claiming production costs below USD 2/kg by 2030. If deliverable, India could emerge as a major low-cost green hydrogen exporter to Europe and Japan. [12](#)

Ammonia cracking infrastructure: Investment in ammonia cracking capacity — converting imported ammonia back to hydrogen at the point of use — is expected to reach commercial scale by 2026–2027, enabling Japan and South Korea to import hydrogen in ammonia form at lower cost. [12](#)

China's scale advantage: China's dominance in electrolyzer manufacturing (>50% of global capacity) is driving rapid cost reductions. Chinese green hydrogen projects are already achieving costs below USD 3/kg in regions with abundant solar and wind resources.

Hydrogen generation market growth: The hydrogen generation market is projected to grow from USD 157.81 billion in 2025 to USD 226.37 billion by 2030 at a CAGR of 7.5%, driven by expanding industrial applications and policy-driven clean hydrogen mandates. ³

Part III: Long-Term Hydrogen Outlook (2030–2050)

3.1 Demand Scenarios

Long-term hydrogen demand projections vary widely depending on the pace of energy transition. A 2025 academic review found that global hydrogen demand could range from **18.8 to 381.3 Mt per year by 2050**, depending on technological advancement and policy ambition. ¹³ The IEA's Net Zero Emissions by 2050 scenario requires hydrogen demand to approximately triple from today's levels, with new energy sectors (steel, transport, power) rising from 5% of demand in 2030 to **54% by 2050**. ¹⁴

The U.S. Energy Information Administration (EIA) projects hydrogen production will increase by approximately **80% by 2050** compared to 2024 in most scenarios, with natural gas remaining the dominant feedstock absent aggressive policy intervention. ¹⁵

IRENA's 1.5°C scenario envisions hydrogen constituting approximately **12% of final energy demand by 2050**, with global trade in hydrogen and hydrogen derivatives (ammonia, methanol, synthetic fuels) reaching significant scale. ¹⁶

3.2 Cost Trajectory to 2050

The economics of green hydrogen are expected to improve dramatically over the next two to three decades, driven by learning curves in electrolyzer manufacturing, declining renewable electricity costs, and economies of scale. Key projections include:

- **By 2030:** Green hydrogen costs could fall to USD 1.5–3.0/kg in optimal locations (high solar irradiance, low-cost renewable electricity), approaching cost parity with grey hydrogen in some markets.
- **By 2040:** Green hydrogen is expected to become cost-competitive with unabated grey hydrogen in most major markets, assuming continued renewable cost declines.
- **By 2050:** Production costs could fall to USD 0.7–1.5/kg in the most favorable locations, making green hydrogen the lowest-cost hydrogen source globally. ^{9 10}

3.3 Sectoral Transformation

The long-term hydrogen market will be shaped by three transformative applications:

Green Steel: The transition from blast furnace to DRI-electric arc furnace steelmaking using green hydrogen represents a multi-decade capital replacement cycle worth trillions of dollars globally. Europe's Carbon Border Adjustment Mechanism (CBAM), which imposes carbon costs on imported steel, is accelerating this transition.

Synthetic Fuels (e-fuels): Green hydrogen combined with captured CO₂ produces synthetic aviation fuels (SAF) and marine fuels. Global aviation hydrogen demand could reach **17 Mt by 2050**, with e-fuels providing a 9% reduction in aviation CO₂ emissions. ¹⁷

Power Sector Balancing: As variable renewable energy penetration increases, hydrogen offers long-duration energy storage and dispatchable generation capacity. This application is expected to become material after 2035 as battery storage economics reach their limits for multi-day storage requirements.

Part IV: The Global Nitrogen Market

4.1 Current Market State

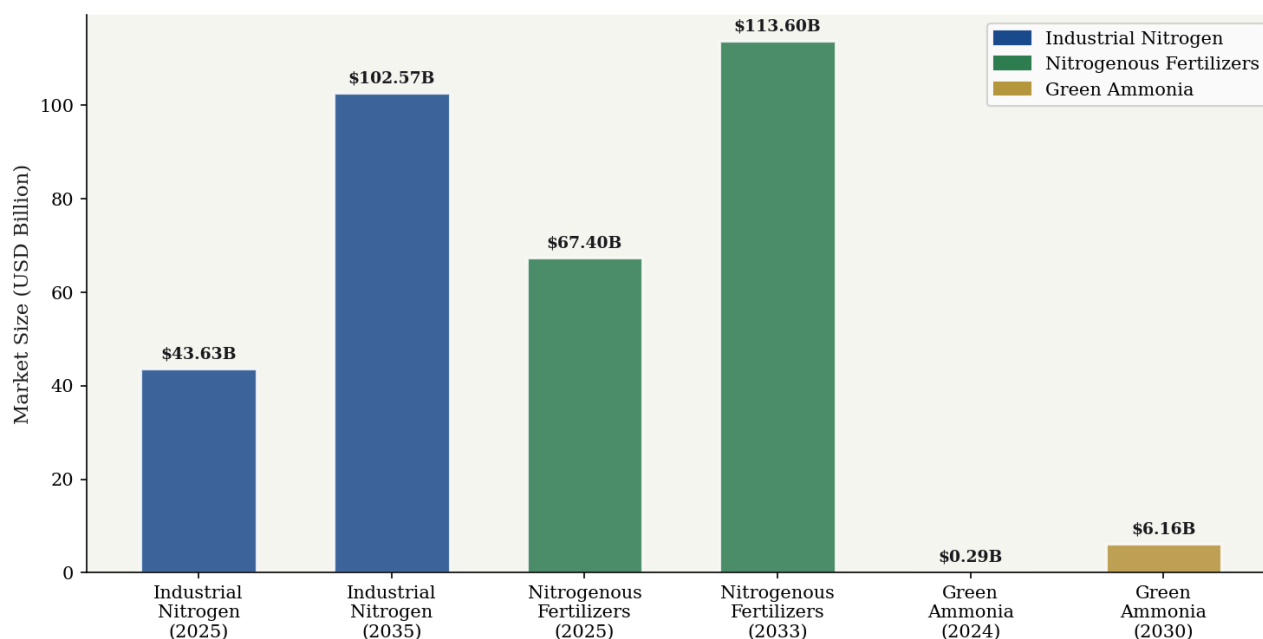
The global nitrogen market encompasses the production and trade of industrial nitrogen gas, ammonia, urea, ammonium nitrate, and related compounds. The market serves two primary end-use categories: **agricultural fertilizers** (approximately 80% of ammonia consumption) and **industrial applications** (chemicals, explosives, refrigerants, food packaging, pharmaceuticals).

The global nitrogen market was valued at approximately **USD 43.63 billion in 2025** (industrial nitrogen gas segment) and is projected to reach **USD 102.57 billion by 2035** at a CAGR of 8.92%.¹⁸ The broader nitrogenous fertilizer market — encompassing urea, ammonia, ammonium nitrate, and related products — was valued at approximately **USD 67.4 billion in 2025** and is projected to reach **USD 113.6 billion by 2033**.¹⁹

Global ammonia production stands at approximately **200 million tonnes annually**, according to the International Fertilizer Association (IFA).²⁰ Urea remains the most widely used nitrogen fertilizer globally, with the Gulf region accounting for approximately **36% of global urea exports** in 2023–2025.²¹

Market Segment	2025 Size	Forecast Year	Projected Size	CAGR
Industrial Nitrogen	USD 43.63 billion	2035	USD 102.57 billion	8.92%
Nitrogenous Fertilizers	USD 67.4 billion	2033	USD 113.6 billion	6.7%
Green Ammonia	USD 0.29 billion	2030	USD 6.16 billion	66.0%

Global Nitrogen Market Segments: Current vs. Forecast



4.2 Key Players

The nitrogen fertilizer industry is dominated by a relatively small number of large-scale producers with access to low-cost natural gas feedstock.

Company	Headquarters	Annual Capacity (approx.)	Key Strength
Yara International ASA	Oslo, Norway	~18 Mt NH ₃ equivalent	Global distribution, low-carbon leadership
CF Industries Holdings	Deerfield, USA	~10.5 Mt NH ₃	North American market dominance
Nutrien Ltd.	Saskatoon, Canada	~14 Mt NH ₃	Integrated potash + nitrogen
OCI N.V.	Amsterdam, Netherlands	~5 Mt NH ₃	Middle East + European production
EuroChem Group	Zug, Switzerland	~8 Mt NH ₃	Russian feedstock access
Sinofert Holdings	Beijing, China	Large domestic scale	China market leadership
Saudi Basic Industries (SABIC)	Riyadh, Saudi Arabia	~5 Mt NH ₃	Low-cost Gulf gas feedstock

4.3 Demand Drivers

Food Security and Population Growth: The fundamental driver of nitrogen fertilizer demand is global food production. The world population is projected to reach approximately 9.7 billion by 2050, requiring a roughly 50–70% increase in food production from 2010 levels. Nitrogen fertilization is directly linked to crop yield — studies confirm that long-term nitrogen application significantly enhances cereal yield and contributes to global food security. ²² Approximately 50% of the world’s current food production is estimated to depend on synthetic nitrogen fertilizers derived from the Haber-Bosch process.

Industrial Applications: Industrial nitrogen gas demand is growing across food and beverage packaging (modified atmosphere packaging to extend shelf life), electronics manufacturing (semiconductor fabrication requires ultra-high-purity nitrogen), pharmaceuticals, and metal manufacturing. Asia Pacific, led by China and India, dominates industrial nitrogen consumption.

Emerging Energy Applications: Ammonia is increasingly viewed as a hydrogen carrier and zero-carbon marine fuel. Japan’s ammonia co-firing program (targeting 20% ammonia co-firing in coal power plants by 2030) and South Korea’s similar initiatives represent a new demand vector for ammonia that is entirely separate from its traditional fertilizer role.

4.4 Current Pricing Environment

Urea prices, the benchmark for nitrogen fertilizer markets, have been highly volatile in recent years. After peaking above USD 900/tonne in 2022 following the Russia-Ukraine war’s disruption of European gas supplies, prices moderated to approximately USD 300–400/tonne through 2024. In early 2026, urea at the port of New Orleans traded at approximately **USD 450/tonne**, up from USD 389/tonne in early 2025, driven by the Iran-Middle East conflict’s disruption of Gulf supply. ²³

The current (April 2026) urea price is approximately **USD 687.50/tonne** globally, reflecting the acute supply shock from Strait of Hormuz shipping restrictions. ²⁴

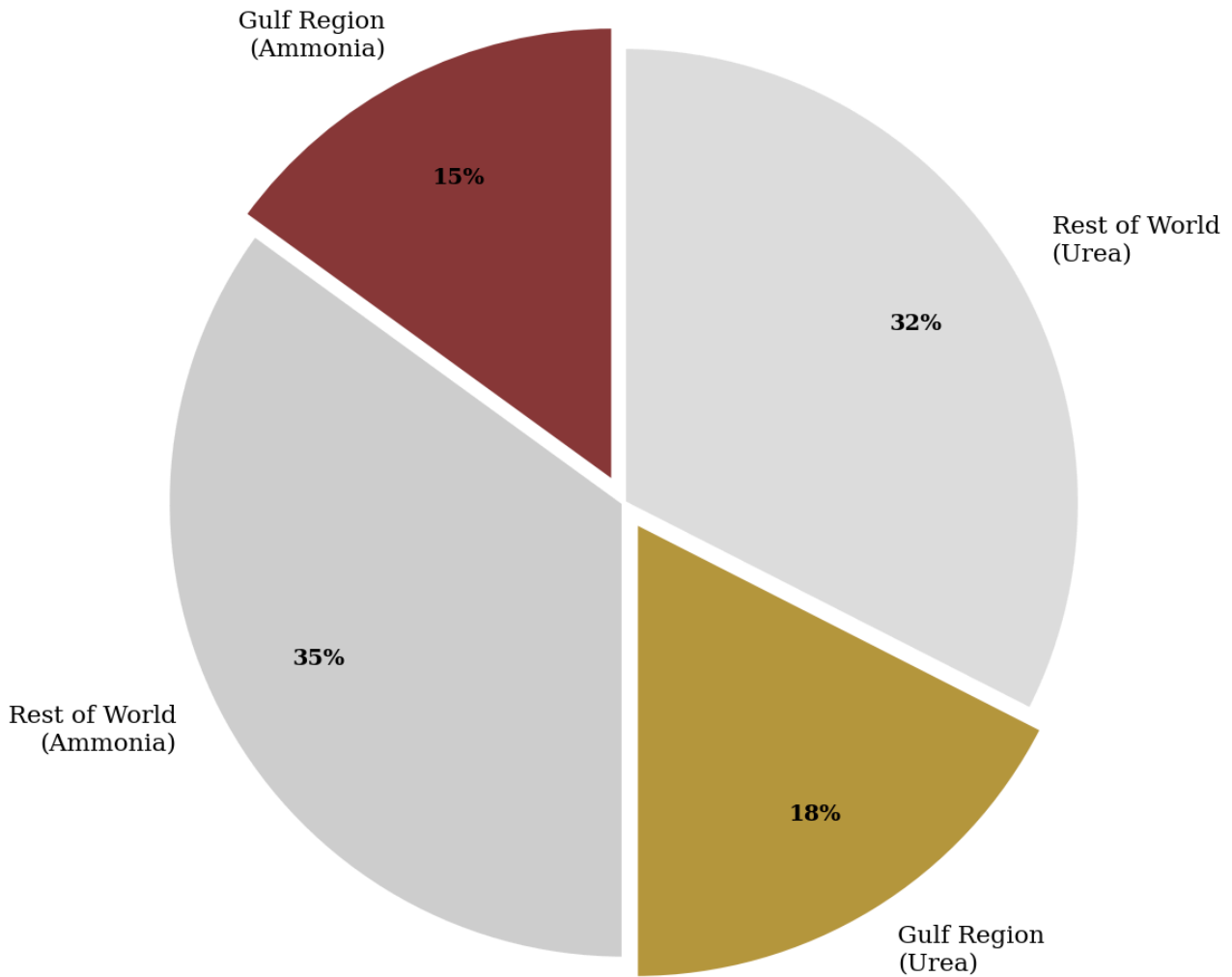
Part V: Short-Term Nitrogen Outlook (2025–2030)

5.1 The Iran-Middle East Supply Shock (2026)

The most significant near-term risk to global nitrogen markets is the ongoing conflict in the Middle East and its impact on Persian Gulf fertilizer and energy supply chains. This represents the most acute supply disruption to nitrogen markets since the Russia-Ukraine war of 2022. Key facts from IFPRI’s April 2026 analysis: ²¹

- The Gulf region accounts for approximately **30% of globally traded ammonia** and **35% of globally traded urea**.
- **Qatar** is the world’s third-largest exporter of natural gas and dominates LNG production in the Gulf — a critical feedstock for nitrogen fertilizer production in India, Pakistan, Bangladesh, and Turkey.
- Iran is the **largest urea exporter in the Gulf region** (per IFA estimates), despite limited official export reporting.
- Shipping restrictions in the Strait of Hormuz have halted fertilizer vessel traffic, causing sharp price increases globally.
- India has already announced fertilizer production cuts due to LNG supply constraints.
- European fertilizer producers have requested government support as natural gas prices surge.

Persian Gulf Share of Global Nitrogen Fertilizer Exports (2025)



*“Higher prices could reduce fertilizer use and lower crop yields if the disruption persists, posing significant food security risks. Most vulnerable are countries heavily dependent on Persian Gulf fertilizer and natural gas — especially in Africa and South Asia.” — IFPRI, April 2026 ²¹ Russia’s parallel export restrictions add further complexity. Russia produced **28.9 million tonnes of nitrogen fertilizer in 2025** but has already limited exports to prioritize domestic supply, compounding the Gulf supply shock. ²⁵*

5.2 Market Resilience and Mitigation

Despite the acute disruption, several factors provide partial market resilience:

U.S. domestic production: The United States produces approximately 65% of its domestic nitrogen fertilizer supply domestically. The Trump administration has suspended the Jones Act for fertilizer transportation and lifted sanctions on Belarusian potash producers to ease supply constraints. CF Industries, with annual capacity of approximately 10.5 Mt on a gross ammonia basis across six U.S. complexes and facilities in Canada and the UK, is well-positioned to serve North American demand. ²⁰

China’s export capacity: China has historically acted as a swing supplier in global urea markets, with the ability to redirect domestic production to export markets when prices rise sufficiently. However, China’s own domestic agricultural demand and export tax policies create uncertainty around this buffer.

Alternative supply routes: Australia, Trinidad and Tobago, and Egypt are alternative urea exporters that can partially compensate for Gulf supply losses, though at higher freight costs.

5.3 Near-Term Price Forecast

Market analysts project urea prices will remain elevated through 2026 at approximately **USD 0.33–0.38/kg globally** (approximately USD 330–380/tonne), with significant upside risk if the Strait of Hormuz remains restricted. ²⁶ The nitrogenous fertilizer market is forecast to grow at a CAGR of approximately **5.3%** through 2030, reaching USD 92 billion, assuming normalization of supply disruptions. ²⁷

Part VI: Long-Term Nitrogen Outlook (2030–2050)

6.1 Structural Demand Growth

Long-term nitrogen demand is underpinned by structural food security imperatives. Global demand for key nutrients (NPK) is projected to increase by approximately 70% by 2050 relative to 2010 levels, driven by population growth and dietary shifts toward protein-intensive foods in developing economies. ²⁸

The nitrogenous fertilizer market is projected to grow from USD 67.4 billion in 2025 to approximately **USD 113.6 billion by 2033**, reflecting sustained agricultural demand. ¹⁹ Industrial nitrogen demand will grow faster, driven by semiconductor manufacturing, food packaging, and the emerging energy applications of ammonia.

6.2 The Green Ammonia Transition

The most transformative long-term development in the nitrogen market is the emergence of **green ammonia** — ammonia produced via electrolysis of water using renewable electricity, rather than the Haber-Bosch process using natural gas. Green ammonia simultaneously decarbonizes fertilizer production and creates a scalable hydrogen carrier for energy trade.

The green ammonia market was valued at approximately **USD 0.29 billion in 2024** and is projected to reach **USD 6.16 billion by 2030** at a CAGR of 66.0%. ²⁹ Some forecasters project even more aggressive growth, with Grand View Research estimating the market could reach **USD 73.05 billion by 2030** at a CAGR of 116.5% — though this reflects the most optimistic scenario assumptions. ³⁰

The economics of green ammonia are improving rapidly as electrolyzer costs decline and renewable electricity prices fall. Yara International delivered industrial-scale low-carbon fertilizers from its Herøya facility in early 2025, marking a significant commercial milestone. ³¹

6.3 Dual-Use Ammonia: Fertilizer and Fuel

Japan's commitment to ammonia co-firing in coal power plants — targeting 20% co-firing by 2030 and 100% ammonia-fired generation by 2050 at selected facilities — creates an entirely new demand category for ammonia that is independent of agricultural cycles. South Korea has announced similar programs. This “power ammonia” demand could add tens of millions of tonnes of annual ammonia demand by 2040–2050, fundamentally reshaping global trade flows.

The convergence of ammonia's roles as fertilizer precursor, hydrogen carrier, and zero-carbon marine fuel creates a uniquely resilient long-term demand profile. Unlike hydrogen, ammonia can be transported and stored using existing infrastructure (refrigerated tankers, port terminals), reducing the infrastructure investment barrier.

6.4 Sustainability Pressures and Nitrogen Efficiency

A countervailing force on nitrogen demand is the growing pressure to improve nitrogen use efficiency (NUE) in agriculture. Currently, approximately 50% of applied nitrogen fertilizer is lost to the environment through volatilization, leaching, and runoff, contributing to water pollution, soil acidification, and nitrous oxide (N₂O) emissions — a greenhouse gas approximately 300 times more potent than CO₂. Regulatory pressure in the EU (Farm to Fork Strategy), China, and increasingly in the U.S. is driving adoption of precision agriculture, enhanced efficiency fertilizers (EEFs), and biological nitrogen fixation alternatives. These trends could moderate demand growth in developed markets while demand in Sub-Saharan Africa and South Asia continues to expand.

Part VII: The Hydrogen-Nitrogen Nexus

7.1 Structural Interdependence

Hydrogen and nitrogen markets are structurally linked through ammonia chemistry. The Haber-Bosch process — which synthesizes ammonia from nitrogen (from air) and hydrogen (from natural gas) — consumes approximately **55 Mt of hydrogen annually**, representing more than half of all global hydrogen demand. This means that the decarbonization of hydrogen production is simultaneously the decarbonization of nitrogen fertilizer production.

Green hydrogen at USD 2/kg enables green ammonia at approximately USD 400–500/tonne — approaching cost parity with conventional ammonia in high-gas-price environments. At USD 1/kg green hydrogen (the U.S. DOE target), green ammonia becomes cost-competitive globally, potentially displacing the entire conventional ammonia industry over a multi-decade capital replacement cycle.

7.2 Investment Implications

For investors, the hydrogen-nitrogen nexus creates several strategic considerations:

Integrated value chain plays: Companies that span green hydrogen production, ammonia synthesis, and fertilizer distribution — such as Yara (which has announced green ammonia partnerships with multiple electrolyzer manufacturers) and OCI (which has invested in green ammonia capacity in the Netherlands and Texas) — are positioned to capture value across the transition.

Infrastructure bottlenecks: Ammonia port terminals, cracking facilities, and pipeline networks represent critical infrastructure chokepoints. Investment in these assets provides exposure to the hydrogen-ammonia trade without direct production risk.

Geopolitical diversification: The current Iran-Middle East crisis illustrates the vulnerability of nitrogen supply chains concentrated in the Persian Gulf. Investors and governments are accelerating efforts to diversify production geographically, favoring regions with abundant renewable energy (Australia, Chile, Morocco, Oman) for green ammonia production.

Part VIII: Risk Matrix

Risk Factor	Hydrogen	Nitrogen	Severity	Time Horizon
Geopolitical supply disruption (Middle East)	Moderate	Critical	High	Near-term (2026)
Policy reversal (IRA, EU Green Deal)	High	Moderate	High	Near-term
Technology cost reduction slower than expected	High	Moderate	Medium	Medium-term
Offtake market development slower than expected	High	Low	High	Near-term
Russia export restrictions / sanctions	Moderate	High	High	Near-term
Carbon pricing acceleration	Low (positive)	High (cost)	Medium	Medium-term
Green ammonia cost competitiveness achieved	Positive	Transformative	High	Long-term
Population growth / food demand	Low	High (positive)	High	Long-term
Nitrogen efficiency improvements (precision ag)	Low	Moderate (negative)	Medium	Long-term

Conclusion

The global hydrogen and nitrogen markets are both undergoing profound structural transitions, though on different timescales and driven by different forces. Nitrogen markets face an immediate crisis — the Iran-Middle East conflict has created the most severe supply disruption since 2022, with urea prices surging and food security risks mounting in vulnerable economies. The long-

term trajectory, however, is one of sustained demand growth anchored by irreducible agricultural necessity and amplified by ammonia's emerging role as a hydrogen carrier and zero-carbon fuel.

Hydrogen markets are in an earlier and more uncertain phase of transformation. The gap between policy ambition and commercial reality remains large — only 1% of current hydrogen demand is met by low-carbon sources — but the cost trajectory for green hydrogen is unambiguously downward, and the sectoral applications in steel, shipping, and aviation provide a credible long-term demand foundation. The 2026–2030 period will be critical: projects that achieve final investment decision and secure offtake in this window will define the commercial architecture of the clean hydrogen industry for decades.

For the Walmer Family Fund, both markets merit attention as long-duration investment themes. The hydrogen-nitrogen nexus — through green ammonia — represents a particularly compelling convergence opportunity, where the decarbonization of one industry (energy) directly enables the decarbonization of another (agriculture), creating compounding value creation potential over a 10–30 year investment horizon.

References

This report is prepared for informational and investment research purposes only. All market size figures represent estimates from third-party research firms and may vary across sources due to differing scope definitions and methodologies. This report does not constitute investment advice.

1. IEA, “Global Hydrogen Review 2025 — Executive Summary,” September 2025. <https://www.iea.org/reports/global-hydrogen-review-2025/executive-summary>
2. IEA, “Global Hydrogen Review 2024,” October 2024. <https://iea.blob.core.windows.net/assets/89c1e382-dc59-46ca-aa47-9f7d41531ab5/GlobalHydrogenReview2024.pdf>
3. MarketsandMarkets, “Hydrogen Market Report 2025–2030,” 2025. <https://www.marketsandmarkets.com/Market-Reports/hydrogen-market-132975342.html>
4. Precedence Research, “Green Hydrogen Market Size to Hit USD 231.32 Billion by 2035,” 2025. <https://www.precedenceresearch.com/green-hydrogen-market>
5. Hydrogen Insight, “Global investment in clean hydrogen production expected to grow by 70% in 2025: IEA,” June 2025. <https://www.hydrogeninsight.com/production/global-investment-in-clean-hydrogen-production-expected-to-grow-by-70-in-2025-iea/2-1-1829577>
6. ING Think, “Hydrogen stuck in the pilot phase,” January 2026. <https://think.ing.com/articles/energy-hydrogen-stuck-in-the-pilot-phase/>
7. RSC Publishing, “Green hydrogen: a strategic energy vector for achieving net-zero emissions by 2050,” 2025. <https://pubs.rsc.org/en/content/articlehtml/2025/se/d5se00902b>
8. IEA, “Aviation and Shipping,” September 2023. <https://www.iea.org/reports/aviation-and-shipping>
9. PwC, “Green hydrogen economy — predicted development of production costs,” 2021. <https://www.pwc.com/gx/en/industries/energy-utilities-resources/green-hydrogen-cost.html>
10. Frieden, F. & Leker, J., “Future costs of hydrogen: a quantitative review,” *Sustainable Energy & Fuels*, 2024. <https://pubs.rsc.org/en/content/articlehtml/2024/se/d4se00137k>
11. Harvard Business School, “Could Clean Hydrogen Become Affordable at Scale by 2030?,” January 2024. <https://www.library.hbs.edu/working-knowledge/could-clean-hydrogen-become-affordable-at-scale-by-2030>
12. Wood Mackenzie, “Hydrogen: 5 things to look for in 2026,” January 2026. <https://www.woodmac.com/news/opinion/hydrogen-2026-outlook/>
13. Gomonov, K. et al., “The growing demand for hydrogen: current trends, sectoral analysis, and future projections,” *Unconventional Resources*, Elsevier, 2025. <https://www.sciencedirect.com/science/article/pii/S2666519025000421>
14. Wood Mackenzie, “Hydrogen: the outlook to 2050,” July 2025. <https://www.woodmac.com/news/opinion/hydrogen-the-outlook-to-2050/>
15. U.S. Energy Information Administration, “Natural gas remains the largest source of hydrogen in our projections,” August 2025. <https://www.eia.gov/todayinenergy/detail.php?id=65845>

16. IRENA, "Global hydrogen trade to meet the 1.5°C climate goal," July 2022.
https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2022/Jul/IRENA_Global_hydrogen_trade_part_1_2022_.pdf
17. Oesingmann, K. et al., "Hydrogen in aviation: A simulation of demand, price dynamics, and CO₂ emission reduction potentials," *International Journal of Hydrogen Energy*, 2024.
<https://www.sciencedirect.com/science/article/pii/S0360319924010723>
18. Precedence Research, "Nitrogen Market Size to Hit USD 102.57 Billion by 2035," November 2024.
<https://www.precedenceresearch.com/nitrogen-market>
19. Grand View Research, "Nitrogenous Fertilizer Market Size | Industry Report, 2033," 2025.
<https://www.grandviewresearch.com/industry-analysis/nitrogenous-fertilizer-market>
20. CF Industries, "Key Questions About Fertilizer and Its Price Answered," March 2026.
<https://www.cfindustries.com/newsroom/2026/2026-fertilizer-prices-faq>
21. Hebebrand, C. et al., "The Iran war's impacts on global fertilizer markets and food production," IFPRI Blog, April 2026.
<https://www.ifpri.org/blog/the-iran-wars-impacts-on-global-fertilizer-markets-and-food-production/>
22. Nitrogen fertilization and food security, *Food and Energy Security*, 2022.
<https://www.sciencedirect.com/science/article/abs/pii/S2211912422000426>
23. CME Group, "Fertilizer Prices Surge Ahead of a Critical Planting Season," March 2026.
<https://www.cmegroup.com/openmarkets/agriculture/2026/Fertilizer-Prices-Surge-Ahead-of-a-Critical-Planting-Season.html>
24. Trading Economics, "Urea — Price — Chart — Historical Data," April 2026. <https://tradingeconomics.com/commodity/urea>
25. Straits Times, "Russia curbs some nitrogen fertilizer exports as war hits supply," March 2026.
<https://www.straitstimes.com/world/europe/russia-curbs-some-nitrogen-fertilizer-exports-as-war-hits-supply>
26. Expert Market Research, "Urea Price Trend 2026 | Forecast, History, Chart & Index," 2026.
<https://www.expertmarketresearch.com/price-forecast/urea-price-trends>
27. Yahoo Finance, "Nitrogenous Fertilizer Market Set to Soar Past USD 92 Billion by 2030," August 2023.
<https://finance.yahoo.com/news/nitrogenous-fertilizer-market-set-soar-131500895.html>
28. European Commission JRC, "Demand for key nutrients (NPK) in the year 2050," 2016.
https://esdac.jrc.ec.europa.eu/projects/NPK/Documents/Freiburg_Demand_for_key_nutrients_in_2050_Drescher.pdf
29. MarketsandMarkets, "Green Ammonia Industry worth \$6.16 billion by 2030," December 2024.
<https://www.marketsandmarkets.com/PressReleases/green-ammonia.asp>
30. Grand View Research, "Green Ammonia Market Size, Share & Growth Report, 2030," 2023.
<https://www.grandviewresearch.com/industry-analysis/green-ammonia-market-report>
31. Matrix BCG, "Yara International Competitive Landscape," March 2026. <https://matrixbcg.com/blogs/competitors/yara>