Institute for Energy Economics and Financial Analysis

Briefing Note

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Japan's ammonia co-firing strategy constrained by cost, supply, and timing

- *Ammonia co-firing in coal-fired power plants (CFPPs) is a key component of Japan's power sector decarbonization strategy, with targets of 20% co-firing by 2030, rising to 50% or more after 2030, and reaching 100% by 2050. Four subsidy programs support these targets by promoting the ammonia supply chain and its use in power generation.*
- *Escalating costs at the Blue Point Complex in the United States (US), expected to be Japan's largest ammonia source, could make ammonia co-fired power generation more expensive than existing renewable energy in Japan. IEEFA analysis finds that 20% ammonia co-firing is expected to cost between 145% and 220% more than onshore wind, and between 240% and 464% more than commercial solar.*
- *Despite subsidy support, ammonia co-firing deployment lags behind the Japanese government's timeline. To date, only one CFPP unit has achieved 20% co-firing at scale, while four others are expected to reach that level between fiscal years (FY) 2027 and 2030. Japan's projected ammonia demand exceeds current global traded volumes, constraining future supply.*
- *The budget allocated for ammonia subsidies in Japan could be better invested in commercially proven technologies, including renewable energy, battery energy storage systems, and grid infrastructure. These alternatives offer a more cost-effective and reliable pathway to achieving the country's decarbonization goals, while strengthening energy security and reducing costs for businesses and households.*

Ammonia co-firing in coal-fired power plants (CFPPs) is a key component of Japan's decarbonization roadmap. In the absence of a coal phase-out commitment, the government envisions using ammonia co-firing as a means of reducing emissions from existing CFPPs. Government subsidies support this strategy by promoting the development of the ammonia supply chain and related technologies.

Meeting Japan's future ammonia demand for coal co-firing will require substantial new supply. One of the country's most significant prospective sources is the Blue Point Complex under development in Louisiana, United States (US). The project is expected to produce "blue ammonia," using natural gas as one of the main inputs and carbon capture and storage (CCS) to capture and sequester the resulting emissions. Two Japanese companies own stakes in the project and have announced offtake agreements with the developer. Once imported to Japan, the ammonia would primarily be used for co-firing in CFPPs.

However, significant challenges remain. Ammonia production with CCS on the US Gulf Coast is costly, limiting its competitiveness relative to Japan's existing renewable energy sources. Commercial viability of ammonia co-firing requires substantial government subsidies, which could increase electricity costs for consumers. Japan's ability to import sufficient ammonia to meet its co-firing targets is also uncertain.

As Japan reviews its long-term decarbonization pathway, there remains an opportunity to evaluate whether continued investment in ammonia co-firing delivers the best value relative to proven commercial alternatives. Expanding investment in renewable energy, battery energy storage systems, and grid infrastructure could support emissions reductions, strengthen energy security, and reduce energy costs for businesses and households.

Japan's ammonia strategy and the significance of Blue Point Complex

Since announcing its 2050 carbon neutrality goal in June 2021, the Japanese government has positioned ammonia as an important pillar of its decarbonization strategy, particularly in the power sector. In April 2026, the government reaffirmed its targets to achieve 20% ammonia co-firing rate in Japan's CFPPs by 2030, rising to 50% or more after 2030, and reaching 100% by 2050.

To support these targets and broader decarbonization efforts, the government introduced four subsidy programs promoting the production and use of ammonia and hydrogen, with a combined budget of JPY586 billion (USD3.7 billion) in fiscal year (FY) 2025.

Table 1: Subsidy programs supporting ammonia and hydrogen in Japan

Subsidy	Purpose	Administering agency	Revenue source	FY2025 budget
Fuel Ammonia Supply Chain Establishment	Support research and development and demonstration projects for core ammonia-related technologies.	NEDO	Government supplemental budget	JPY69.8 billion (USD435.3 million)
Contract-for-Difference	Subsidize the cost gap between low-carbon hydrogen and ammonia on the one hand and existing fuels on the other for up to 15 years.	JOGMEC	GX Transition Bond	JPY35.7 billion (USD222.6 million)
Hub Development Program	Infrastructure development for transporting and storing ammonia, hydrogen, and related fuels.	METI, MLIT	GX Transition Bond	JPY5.7 billion (USD35.5 million)
Long-Term Decarbonized Power Source Auction	Guarantee 20 years of revenue for low-emission power sources, including new or retrofitted ammonia coal co-fired power plants.	OCCTO	Capacity levy on electricity retailers	JPY474.8 billion (USD3 billion)

Total: JPY586 billion (USD3.7 billion)

Source: NEDO; METI; OCCTO.

Note: The total budget for the Fuel Ammonia Supply Chain Establishment program is shown, as no annual breakdown is available. The LTDA figure refers to allocations to all power sources classified as "decarbonized," excluding LNG-fired power plants in FY2025.

JOGMEC = Japan Organization for Metals and Energy Security; LNG = Liquefied Natural Gas; LTDA = Long-Term Decarbonized Power Source Auction; METI = Ministry of Economy, Trade and Industry; MLIT = Ministry of Land, Infrastructure, Transport and Tourism; NEDO = New Energy and Industrial Technology Development Organization; OCCTO = Organization for Cross-regional Coordination of Transmission Operators.

Japanese companies have responded to these targets and subsidies by pursuing projects and technological development across the ammonia supply chain, both domestically and internationally. The most significant is the Blue Point Complex in Louisiana, described by Japan's Ministry of Economy, Trade and Industry (METI) as the country's "first large-scale low-carbon ammonia supply chain project."

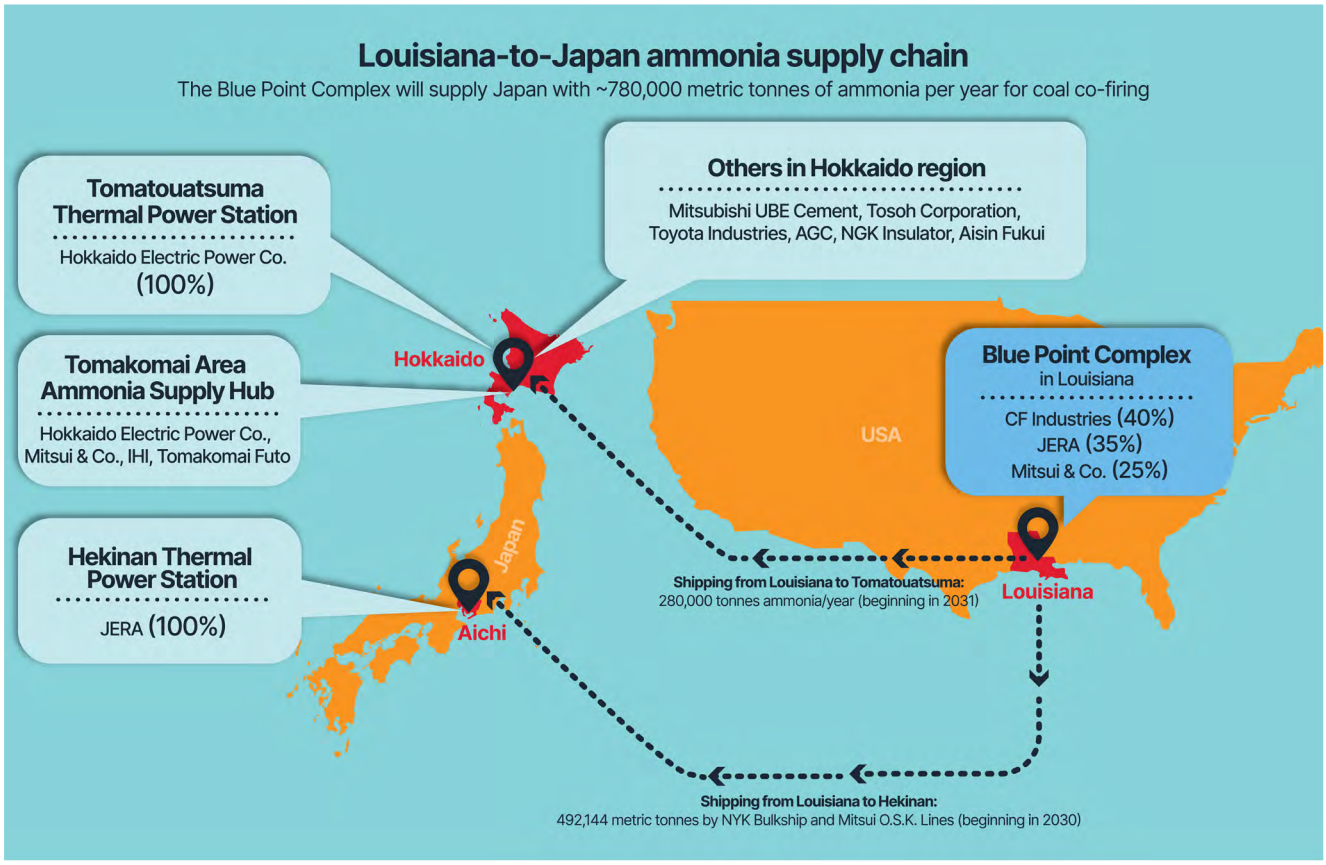
Developed by leading ammonia producer CF Industries, Blue Point is a 1.4 million tonnes per annum (MTPA) ammonia production facility with CCS. Two Japanese companies hold stakes in the project — JERA (35%) and Mitsui & Co. (25%) — which reached final investment decision in April 2025 and is scheduled to begin production in 2029.

The Blue Point Complex is crucial to Japan's ammonia strategy as it is expected to supply the fuel for the country's largest ammonia-coal co-firing project. From February 2030, JERA will procure 492,144 metric tonnes of ammonia annually from Blue Point, primarily for its Hekinan Thermal Power Station — Japan's largest CFPP with a capacity of 4.1 gigawatts (GW). JERA plans to commence commercial operations of 20% ammonia co-firing at Hekinan's Unit 4 in FY2027, and will also provide some of Blue Point's ammonia supply to Europe and Asia.

Hekinan Power Station's 1GW Unit 4 is Japan's only CFPP to have demonstrated ammonia co-firing at scale. Between April and June 2024, the unit completed the 20% ammonia co-firing demonstration. JERA aims to achieve over 50% co-firing in two units by FY2028 and transition to 100% in the 2040s. The company considers the success of the ammonia co-firing demonstration at Hekinan crucial to its decarbonization strategy and uses data from the plant to calculate avoided carbon emissions.

Ammonia from the Blue Point Complex is also expected to supply other Japanese facilities. Mitsui plans to import 280,000 tonnes of ammonia annually for Hokkaido Electric Power's Tomatouatsuma Thermal Power Station and the industrial furnaces of several other companies from January 2031. Meanwhile, Hokkaido Electric plans to commercially operate 20% ammonia co-firing in one unit at Tomatouatsuma Thermal Power Station in FY2030, increasing to over 50% from 2035, and reaching 100% in the 2040s.

Figure 1: Louisiana-to-Japan ammonia supply chain



Source: CF Industries; Mitsui & Co.; Ammonia Energy Association.

Japanese government subsidies have signaled strong support for offtake from the Blue Point Complex. In December 2025, JERA and Mitsui were awarded Contract-for-Difference subsidies for ammonia imports from Blue Point. In March 2026, two ammonia import hubs — at Hekinan Power Station and in Tomakomai, Hokkaido Prefecture, where Tomatouatsuma Power Station is located — also received funding under the Hub Development Program. The total subsidy amounts have not been disclosed.

Ammonia co-firing faces significant cost challenges

Japan's ammonia co-firing strategy is likely to be heavily reliant on significant government subsidies, as producing and transporting blue ammonia is expensive. These costs could reduce the competitiveness of ammonia co-firing relative to other power generation technologies in the country.

Cost pressures begin upstream, with the estimated capital cost of the Blue Point Complex continuing to rise. In 2022, when CF Industries first announced plans to develop the project as a joint venture with Mitsui, it was estimated to cost more than USD2 billion. In 2023, the estimate increased to USD3 billion, attributed to a tight labor market and inflationary pressures. By 2025, the estimated cost had increased further to USD4 billion. CF Industries plans to begin construction in 2026, targeting completion in 2029.

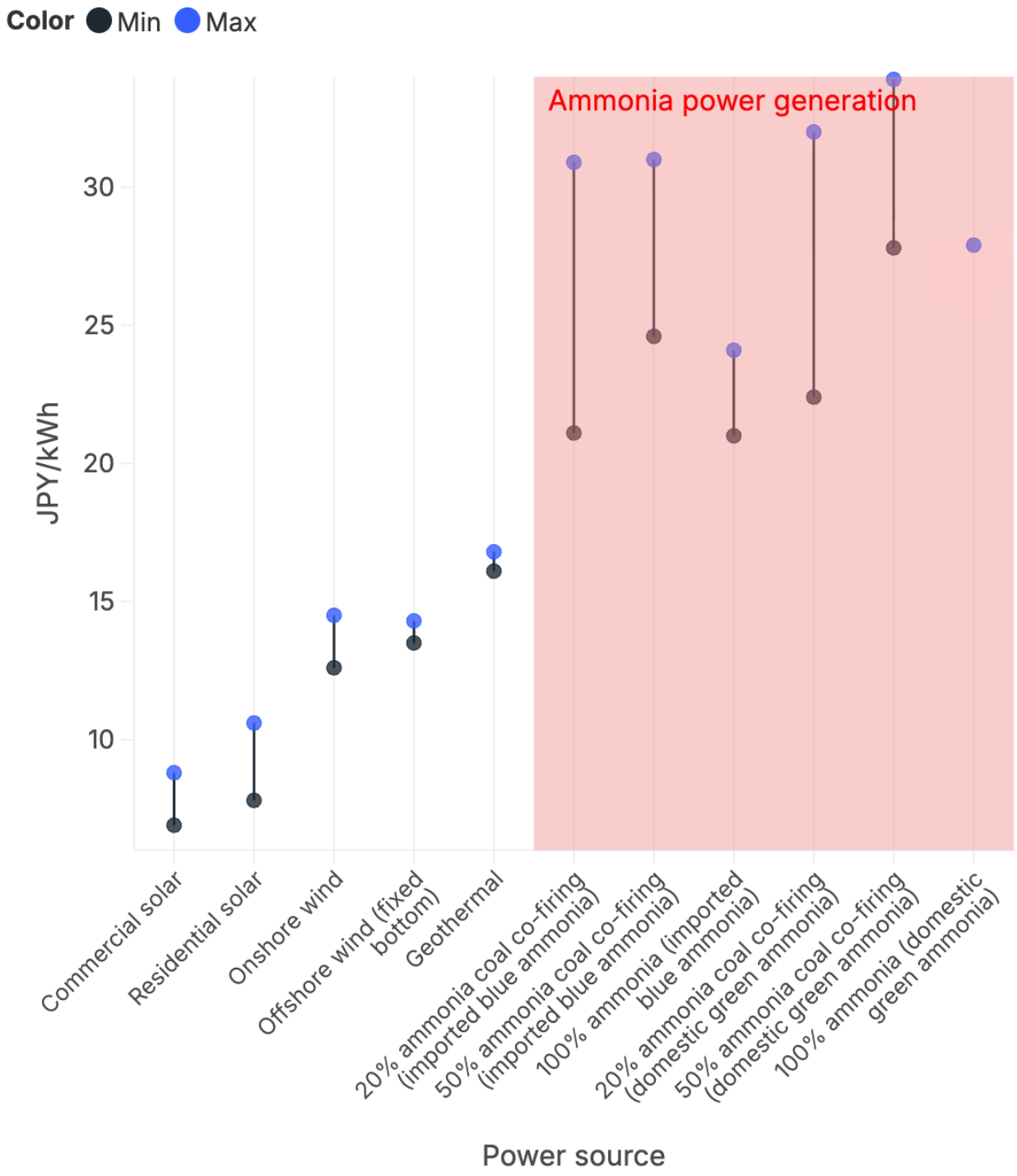
These project-level cost increases are compounded by broader inflationary pressures in the US construction sector. US construction input prices increased by nearly 10% year-over-year in May 2026, driven by tariffs and higher oil prices amid the Iran conflict. At the same time, US natural gas prices — a key input to ammonia production — have become more volatile since 2016 and are expected to increase further.

Similarly, CCS projects have experienced rising costs and project delays. CF Industries and its partners plan to produce ammonia through autothermal reforming (ATR) — a process in which natural gas, oxygen, and steam are mixed in a burner to produce ammonia and hydrogen — and sequester carbon emissions through CCS. However, the Institute for Energy Economics and Financial Analysis (IEEFA) has documented cost overruns and delays in CCS projects across regions and sectors. No commercial-scale ATR ammonia or hydrogen facilities worldwide have captured the carbon released. CF Industries has acknowledged that CCS technology's failure to capture, transport, and sequester carbon dioxide would inhibit its ability to produce, certify, and market low-carbon ammonia.

High and rising production costs would ultimately increase downstream prices in Japan. Even with government subsidies supporting ammonia production and its use in the power sector, electricity generated from ammonia co-firing would be significantly more expensive than existing alternatives. Ammonia co-firing emissions may also exceed expectations due to challenges associated with CCS.

METI's recent levelized cost of electricity (LCOE) projections show that commercial solar and onshore wind, at JPY10.9 per kilowatt-hour (kWh) and JPY16.3/kWh, respectively, were already significantly cheaper in 2023 than the projected cost of 20% ammonia co-firing in 2040. IEEFA analysis based on METI's projections suggests that 20% ammonia co-firing is expected to be between 145% and 220% more expensive than onshore wind, and between 240% and 464% more expensive than commercial solar, depending on the ammonia production method and whether it is imported or domestically produced.

Figure 2: Levelized cost of electricity (LCOE) by power source for 2040



Source: METI; IEEFA analysis.

Note: METI cost estimates include "policy expenses," which comprise siting costs, host community compensation, research and development expenses, waste disposal, and other back-end costs.

Although METI projects that imported blue ammonia will be marginally cheaper than domestically produced green ammonia, it is still expected to be less cost-competitive than commercial solar, onshore and offshore wind, and geothermal power. Bloomberg New Energy Finance (BNEF) estimates that the cost of blue ammonia imported from the US Gulf Coast will remain high through 2050, even with the 45Q tax credit for US-produced ammonia.

JERA's Hekinan Thermal Power Station and Hokkaido Electric's Tomatouatsuma Thermal Power Station, which plan to co-fire imported ammonia from the Blue Point Complex, exemplify these persistently high costs.

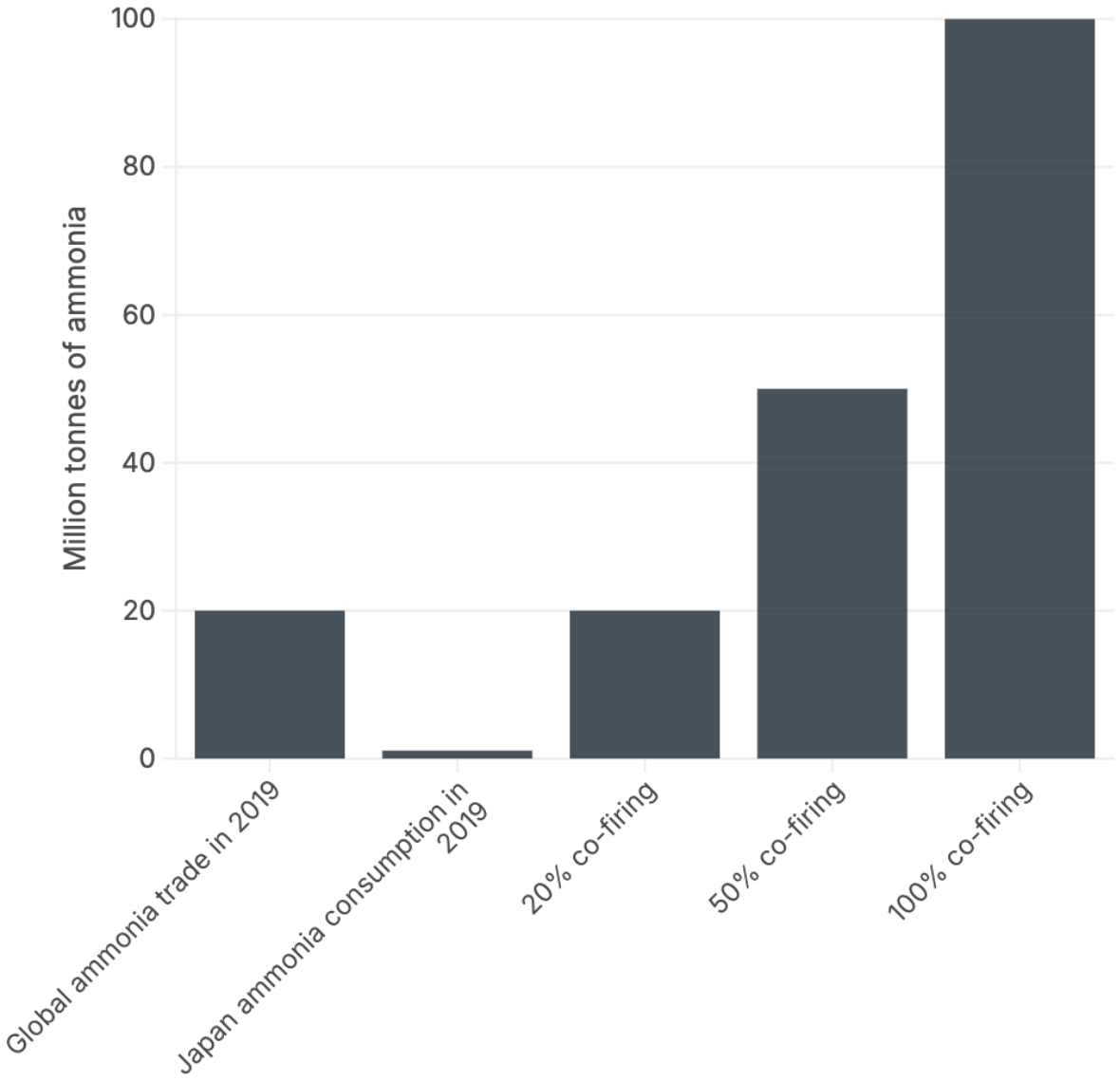
Subsidizing ammonia co-firing could also increase electricity costs for consumers, particularly in the context of the Long-Term Decarbonized Power Source Auction (LTDA). The revenue for the LTDA comes from electricity retailers' capacity contributions to the Organization for Cross-regional Coordination of Transmission Operators (OCCTO), which could potentially be passed on to ratepayers. Weak auction results from CFPP operators in the first two rounds of the LTDA prompted the government to revise the auction framework, introducing preferential treatment for thermal power retrofits, including ammonia co-firing, from FY2025. Consequently, electricity ratepayers would bear the financial burden of subsidizing economically uncompetitive power sources such as ammonia-coal co-firing.

Concerns about the cost and lifecycle emissions of ammonia co-firing are also influencing corporate electricity procurement decisions. In its March 2025 technical criteria update, RE100 — a global initiative of businesses committed to 100% renewable energy use in their operations — excluded coal co-firing, including ammonia co-firing, from its renewable electricity claims. This change, which takes effect from the 2027 disclosure cycle, applies to over 90 Japan-headquartered firms and more than 220 international companies operating in the country, potentially limiting demand for electricity generated from ammonia co-firing.

Meeting Japan's ammonia import needs will be challenging

Beyond cost, the volume of ammonia required to fulfill Japan's co-firing strategy also poses a significant supply challenge. Japan currently consumes about 1.08MTPA of ammonia, mainly as a nitrogen feedstock and for industrial uses. Achieving 20% co-firing in Hekinan Power Station's Unit 4 requires 500,000 tonnes of ammonia annually, which Blue Point is expected to supply from 2029. This is equivalent to nearly half of Japan's current annual ammonia consumption.

Figure 3: Japan's ammonia demand exceeds 2019 global trade volumes

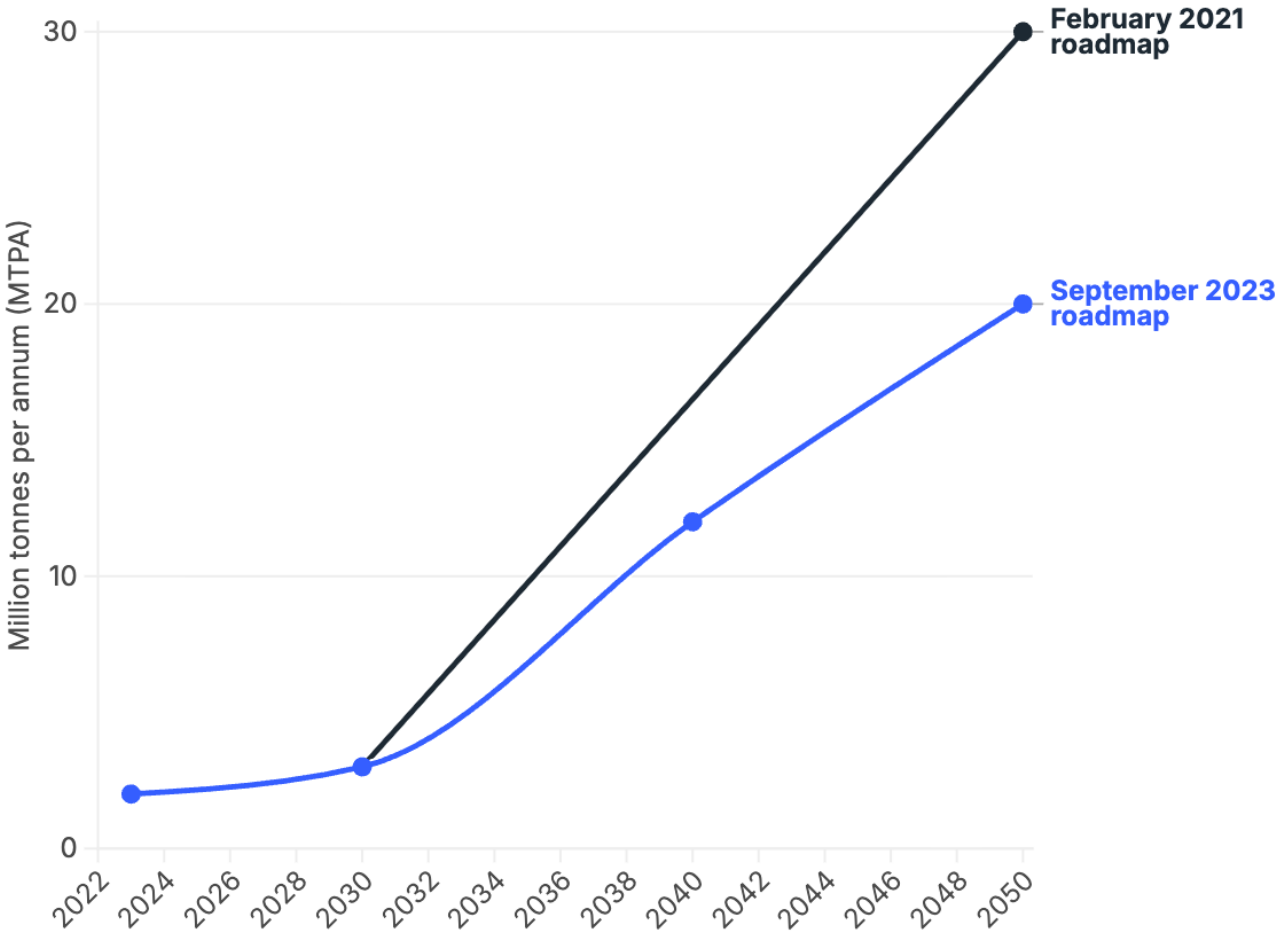


Source: Institute for Global Environmental Studies.

If Japan achieves a 20% co-firing rate across all CFPPs operated by regional electric utilities, it would require approximately 20MTPA of ammonia, equivalent to the global ammonia trade volume in 2019. Given the economic challenges of ammonia co-firing, developing ammonia supply chains at a scale sufficient to meet Japan's targets appears unlikely.

Against the backdrop of these challenges, METI downgraded its ammonia demand outlook for 2050. While METI's original projection in 2021 targeted consuming 30MTPA of ammonia fuel by 2050 to meet its co-firing strategy, its updated forecast in 2023 was lowered to approximately 20MTPA.

Figure 4: METI downgraded its 2050 ammonia consumption target



Source: METI; IEEFA analysis.

Opportunity remains to reassess ammonia co-firing

Japan's ammonia co-firing strategy faces significant economic and supply challenges. Blue ammonia production at projects such as the Blue Point Complex would be costly, making it less competitive relative to existing power sources in Japan. Ammonia co-firing would also require substantial government subsidies to be viable, with these costs ultimately passed on to Japanese ratepayers. These factors could weaken domestic demand for ammonia co-fired electricity. In addition, it remains uncertain whether Japan would be able to secure sufficient ammonia imports to meet its targets.

Japan still has time to reassess its ammonia co-firing strategy, particularly given the widening gap between government targets and planned deployment. While the government aims for all coal plants to achieve 20% co-firing by 2030, only four CFPP units plan to begin commercial operation at that rate between FY2027 and FY2030, indicating a much slower pace of deployment.

These challenges highlight the opportunity to reassess the role of ammonia co-firing within Japan's broader decarbonization strategy. Prioritizing investment in commercially proven technologies, including renewable energy, battery energy storage systems, and grid infrastructure, could provide a more cost-effective pathway to decarbonization while strengthening energy security and lowering electricity costs for businesses and households.

About IEEFA

The Institute for Energy Economics and Financial Analysis (IEEFA) examines issues related to energy markets, trends and policies. The Institute's mission is to accelerate the transition to a diverse, sustainable and profitable energy economy. www.ieefa.org

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