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Reframing the Australia–Japan energy relationship

ANALYSIS

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Key findings

- Australia and Japan are pursuing divergent energy transition strategies, which could position fossil fuels as a major fault line in the relationship. Both countries should hedge their risks and increase their flexibility by jointly testing multiple decarbonisation pathways. Investment and policy should then be adapted and coordinated around evidence of the most promising technologies as they evolve.

- Green iron currently holds the highest potential for collaboration. Importing green iron from Australia, instead of making it onshore, would enable Japan to reduce its energy consumption by nearly 1.1 exajoules, or 70 per cent more than Japan's entire planned nuclear energy use in 2040; offer almost half of the emissions reductions the country aims to achieve between 2030 and 2040; and bolster the future competitiveness of its steel and downstream industries.

- For Australia, Japanese investment and demand will be important in establishing a foothold in green export industries, including green iron, which have the potential to offset the coming structural decline in its fossil fuel revenues. These industries would give substance to Australia's ambitions to become a renewable energy superpower, while enhancing both countries' trust in each other and strategic weight in the net zero economy.

Executive summary

What is the problem?

Australia and Japan both aim to reach net zero emissions by 2050 while growing their economies amid rapid technological change. Their trade relationship amplifies the risks, yet also offers opportunities to mitigate them — opportunities yet to be fully grasped.

Japan plans to decarbonise through coupling fossil gas with carbon capture and storage, and using hydrogen and ammonia as fuel. These technologies are uneconomic and likely to remain so. If they fail, Japan risks dependence on unmitigated fossil fuels, missed emissions targets, exposure to carbon tariffs, and loss of competitiveness in steelmaking and all downstream industries. Japan needs a way to mitigate these risks.

Australia, meanwhile, faces rising domestic and international pressure over its status as the world's third-largest fossil fuel exporter. It is pursuing an alternative: harnessing abundant renewable energy to produce green export commodities under the Future Made in Australia plan, with green iron at its core. But Australia cannot do this alone — it will need investment at scale, technology, and demand to ensure these green industries get off the ground.

What is the solution?

Despite divergent visions of the energy transition, Japan and Australia have a shared interest in collaborating. Doing so would hedge against risks in their respective chosen pathways, and maximise their flexibility to adjust policy as technologies evolve. Carbon pricing is the core technology-neutral policy tool, but this paper focuses on targeted policies designed to address innovation failures in industries of national significance.

Japan and Australia should establish a process to cooperatively test multiple decarbonisation pathways, adapting and coordinating policies and investment as technological winners emerge.

This will likely favour Japan importing green iron made in Australia — the "Australia option" — enabling Japan to significantly reduce its industrial energy demand and emissions, while offsetting the expected decline in Australia's fossil fuel export revenues. Jobs associated with ironmaking would shift to Australia, but in doing so, Japan would ensure the viability of its far more abundant, and higher-value, jobs in steelmaking.

Whatever the outcome, however, this process will leave both countries better prepared — and their partnership stronger.

Introduction

When the head of a major Japanese investor stood before politicians and industry figures at an event in the Australian parliament in March 2023, few expected him to lambast his Australian hosts for "quiet quitting" the liquefied natural gas (LNG) export business.[1]

Those attending the event were reportedly stunned. But the remarks reflected growing Japanese unease over recent Australian gas policy changes, as well as a deeper fear that Australia — its most important energy supplier — was now prioritising climate action over the energy needs of trading partners.

Since then, Australia's message to Japan has been consistent: Australia is committed to remaining a reliable energy supplier. That message, however, belies an uncomfortable truth: both countries are pursuing divergent climate and energy strategies that place different emphases on the role of fossil fuels. This could see tensions flare again, or worse, become a major fault line in the relationship.

Japan seeks to reach net zero by coupling imported LNG with carbon capture and storage, as well as by using hydrogen and ammonia as fuel. These technologies are likely to remain prohibitively costly, placing Japan's emissions targets, energy security, and the competitiveness of its steel and downstream industries at risk.

Australia, meanwhile, faces growing domestic and international pressures over its role as a major fossil fuel exporter. It currently affirms gas as a transition fuel, but does not specify how long that transition period will last for its exports. Australia eventually hopes to replace coal and gas exports with low or zero carbon goods, such as green iron. But it cannot do this without significant foreign investment, technology development, and demand.

Despite different visions, cooperation between Australia and Japan is necessary given the depth of uncertainty in technological development. Neither country can know with certainty which route to net zero will prove lowest in cost or most politically durable.

The goal, therefore, must be to increase "option value" — the agility to pursue the most efficient technologies as they develop — while accelerating the rate of learning.

This paper proposes a model of collaboration, testing, and policy adjustment that provides a way for Australia and Japan to jointly invest in the most promising technological pathways, despite their different starting points. As technologies evolve and winners emerge, it will facilitate better alignment in strategies.

This approach recognises that we are no longer dealing only with questions of economic efficiency, but with resilience and risk mitigation in pursuit of major national objectives — decarbonisation, competitiveness, energy security, and diplomatic standing.

Australia and Japan are not alone in facing a profound reconfiguration of trade relationships. Jointly navigating the energy transition would set a powerful example for others to follow, showing that it is possible to navigate the demands of energy security, climate policy, and economic change in tandem. For these two long-standing partners, the new energy trade can renew their partnership and carry it far beyond the fossil age.

Australian fossil fuel exports: A looming decline

Australia is in the process of decarbonising its domestic economy, which accounts for approximately 1 per cent of total global emissions.[2] Under the Paris Agreement, Australia has set a target of reducing domestic emissions by between 62 and 70 per cent below 2005 levels by 2035, and a longer-term target of net zero emissions by 2050.

These targets, however, do not cover the emissions embodied in Australia's exports, which make a far more significant contribution to climate change than its domestic economy. Australia is the world's third-largest fossil fuel exporter (trailing only Russia and the United States), and when the emissions from burning these fuels is taken into account, Australia's global contribution rises to 4.5 per cent — more than three times its domestic footprint.[3]

Australia has not set a clear policy pathway for phasing out exported emissions. To the contrary, Australia's stated policies affirm gas, which accounts for approximately 10 per cent of total export value, as a "transition fuel"[4] , and Australia's Future Gas Strategy notes that "LNG still has a clear role to play in 2050 and beyond".[5] The recently approved extension to the North West Shelf gas project illustrates this disjunct. Estimated to produce more than 4 billion additional tonnes of CO2-equivalent over its life, or the equivalent of around nine times Australia's annual domestic emissions, the project is licensed to operate until 2070 — two decades after Australia aims to reach net zero at home.[6]

Similarly, coal represents almost 15 per cent of Australia's annual exports, of which Japan is the leading customer.[7] New or expanded coal mines have continued to attract private investment and secure regulatory approval under successive Australian governments.

Australia's fossil fuel exports will come under pressure in a number of ways.

Climate impacts

The emissions embedded in existing LNG and coal mines far exceed the global carbon budget — the scientific consensus on the maximum emissions allowable while restraining global temperature rise to less than 2 degrees Celsius.[8]

For Australia, the consequences of exceeding these global thresholds will be severe. The government's recent National Climate Risk Assessment details Australia's high vulnerability as global temperatures rise, including to more severe floods, bushfires, and droughts, inundation of coastal communities, heat-related deaths, and significant economic costs.[9] As climate-related disasters intensify, disruptions to supply chains and trade infrastructure will create cascading impacts for trade-dependent economies such as Australia.

Economic decline

Australian fossil fuel exports have been a significant source of national wealth. Combined revenues from coal, gas, and oil exports in 2024–25 were around AU$137 billion.[10] While the large majority of profits accrue to foreign shareholders, Australia's annual tax receipts from the fossil fuel industry averaged around AU$27 billion from 2019 to 2024.[11] Australian Bureau of Statistics records indicate that direct wages paid by oil, gas, and coal producers averaged around AU$11 billion,[12] while payments to contractors and other indirectly employed workers are large but unreported.

Yet Australia can no longer depend on these industries for growth. In the near term, a combination of declining demand and global oversupply could see coal and LNG revenues decline by almost AU$30 billion.[13] In particular, increased LNG production from Qatar and the United States is expected to cause a global glut in the next two years, placing downward pressure on prices.[14]

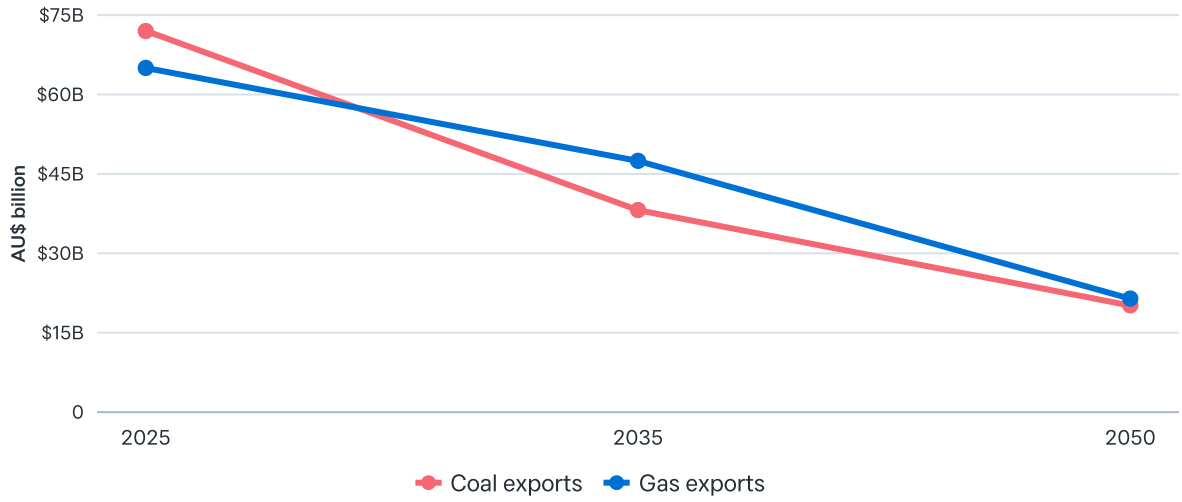
Over the medium term, the global fossil fuel industry will enter a period of structural decline. Based on stated policies, the International Energy Agency models global demand for coal peaking before 2030, and natural gas demand levelling off by around 2035.[15]

These global trendlines will have profound consequences for Australia's economic model. The Australian Treasury's "baseline" scenario projects national coal production decreasing by 47 per cent by 2035 and 72 per cent by 2050, while gas and LNG production declines by 27 per cent by 2035 and 67 per cent by 2050.

FIGURE 1

Australia's coal and gas production: outlook

Change in output for coal and gas from 2025



Source: 2025 figures based on DISR Resources and Energy Quarterly. Trend to 2035 and 2050 based on Australian Treasury 'Baseline Scenario' modelling

Political necessity

At the same time, climate change remains a major concern in Australia, particularly among younger voters.[17] According to the 2025 Lowy Institute Poll, 84 per cent of Australians see climate change as at least an "important" threat, and 54 per cent as a "critical threat" to Australia's interests in the next ten years.[18]

In the two most recent federal elections, independent candidates advocating progressive climate positions defeated major party candidates in a number of battleground seats.

To date, the public debate on climate change has largely focused on domestic mitigation. But public scrutiny of Australia's exported emissions will continue to intensify, especially in the context of Australia presiding over negotiations at the UN climate summit, COP31, in Antalya, Türkiye, in 2026.

Diplomatic pressure

Australia will also face heightened international scrutiny as other countries judge Australia's climate leadership aspirations against its actions. Inaction on exported emissions could engender reputational risks with broader implications for Australia's interests.

Under the UN Framework Convention on Climate Change, the fossil fuel emissions that Australia exports are formally attributed to the countries that import and release them. However, a recent International Court of Justice advisory opinion concluded that continued production of fossil fuels may constitute an "internationally wrongful act".[19] While it is unclear how this finding will translate into concrete legal obligations on fossil fuel producers, it is already being invoked by climate advocates and will increase diplomatic pressure on Australia.[20]

Among Australia's Pacific Island neighbours, leaders have long identified climate change as the single greatest threat to their security.[21] Australia is actively competing with China to bolster its influence in the Pacific, and Prime Minister Anthony Albanese has acknowledged that serious action on climate change is the "entry fee" for credibility in the region.

Domestic emissions mitigation is only one part of that fee. Australia's Pacific neighbours expect Australia to demonstrate it is serious about phasing out fossil fuel exports. The lack of a credible plan could erode trust and political solidarity, and hamper Australia's regional influence.

Renewable energy superpower opportunity

Australia has a direct stake in mitigating further costs from intensifying climate change, protecting its economy from the structural decline of fossil fuels, and bolstering its international credibility on climate action.

At the same time, Australia's significant mineral and renewable energy resources position it uniquely to be a beneficiary of the global energy transition.[22] The Australian Government wants the country to become a large-scale exporter of energy-intensive green commodities, utilising its comparative advantage in renewable energy, minerals, and biomass. If it succeeds, Australia could mitigate a much larger proportion of global emissions than it contributes — as much as 9 per cent of 2021 emissions.[23]

Together, these factors provide a compelling basis for transitioning from a fossil superpower to a renewable superpower.

Why Japan must pivot from fossil fuel dependence

Japan is the world's fourth-largest economy and seventh-largest emitter of greenhouse gases, representing approximately 2 per cent of global emissions.[24] Like Australia, Japan has committed to achieving net zero emissions by 2050, and it has a mid-term target of reducing emissions by 60 per cent on 2013 levels by 2035.[25]

Due to a lack of natural resources, Japan is highly energy insecure. It produces only 15 per cent of the energy it consumes,[26] and depends on imported fossil fuels for the balance. Because of this dependency, Japan, more than most states, sees energy security through the prism of national security. The oil shocks of the 1970s drove Japan to take a diversified approach to energy sources and suppliers, with a focus on ensuring stable and cost-effective supply. Australia is the largest of these suppliers, accounting for 34 per cent of Japan's total energy imports (in gigajoules) in 2022.

Japan's LNG strategy

Following the oil shocks of the 1970s, Japan underwrote and helped to build much of the global LNG supply chain, including Australia's LNG export industry.[28] It now continues to invest in infrastructure and purchase volumes of LNG in excess of its domestic needs, with the explicit goal of "enhancing LNG security" and maintaining "Japan's influence in the international LNG market".[29] The Government of Japan encourages firms to handle (purchase for domestic consumption and resale to third countries) at least 100 million tonnes of LNG annually, ostensibly as a buffer in the event of supply chain disruptions and energy demand volatility. It maintains this target, even though its domestic consumption declined to around 63 million tonnes in 2023.

In doing so, Japan has positioned itself as an LNG hub for Southeast Asia, reselling a greater volume of LNG than it imports from Australia.[30]

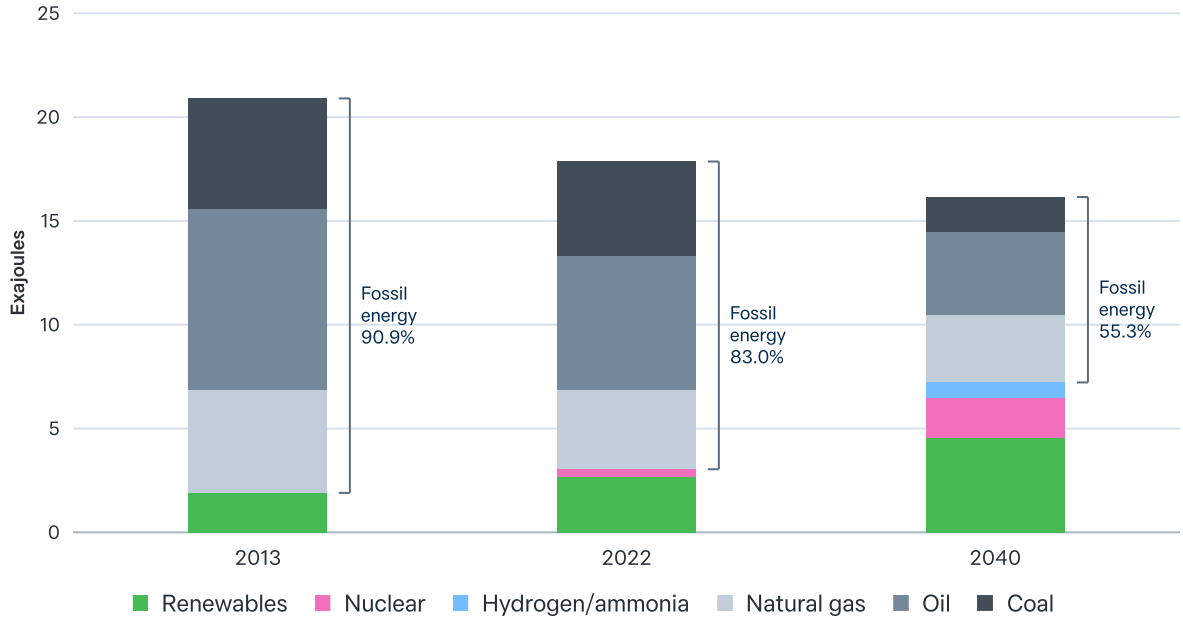
Japan's Seventh Strategic Energy Plan aims for approximately 55 per cent of primary energy to come from fossil fuel sources (oil, gas, and coal) by 2040.[31] The plan outlines efforts to reduce the use of coal, but carves out a clear ongoing role for LNG as a "transition" fuel. Like Australia, Japan does not articulate when this transition period might end.

By the same date, Japan aims for about 28 per cent of primary energy to come from renewable sources. It is widely accepted that in this task Japan faces significant challenges compared to a country such as Australia.

FIGURE 2

Japan's primary energy supply: outlook

By source



Source: Government of Japan, Ministry of Economy, Trade and Industry, Outlook for Energy Supply and Demand in FY2040 (reference material), February 2025, slide 28

There are clear energy security, climate, and economic reasons why Japan must accelerate its transition away from fossil fuels.

Energy security

The risk of trade disruption has grown significantly in recent years, posing an extremely serious threat to an import-dependent Japan. Geopolitical tensions and hot conflicts have mounted in a multipolar world, with Russia's war on Ukraine illustrating potential consequences for the fossil fuel trade. The United

States and China have shown a willingness to use their economic heft, and countries' vulnerabilities, to extract concessions. The World Trade Organization has been defanged. Intensifying climate change increases the likelihood of conflict within and between countries.

Japan's investment in global LNG supply chains may have made sense as a response to the oil shocks of the 1970s. But it is a fragile response to today's challenges. It leaves Japan's energy supply vulnerable to conflict, coercion, and disruption.

A more resilient strategy is available: if Japan can maximise the domestic use of renewable energy and alternatives such as nuclear power, while offshoring energy-intensive industries to reduce demand, it will finally relieve itself of this Sword of Damocles.

Climate impacts

Asthe seventh-largest global emitter already experiencing severe weather impacts, Japan has a clear national interest in acting on climate change. Rising global temperatures exacerbate risks including disruptions to its energy and water supplies, inundation of low-lying and coastal populations due to sea-level rise, and economic losses and deaths from more intense typhoons.[33]

Emissions targets

Japan's strategy for reaching net zero by 2050 places a heavy burden on mitigation technologies that are unlikely to be price competitive or viable at scale, including carbon capture and storage, hydrogen, and ammonia.

Carbon capture and storage (CCS) promises to capture emissions from fossil fuel combustion and sequester them underground. But as the International Energy Agency (IEA) reports, the history of CCS is one of "underperformance" and "unmet expectations".[34] While the CCS project pipeline has grown substantially, and optimism about its prospects vary, most projects to date have either failed or performed well below their stated capacity goals.[35] Costs are high: in China, CCS is expected to double the cost of coal power generation.[36] To achieve commercial viability, almost all large-scale CCS projects involve enhanced oil and gas recovery, using injected CO2 to force additional fossil fuels from the ground.[37] The combustion of that oil and gas raises net emissions, making around 80 per cent of today's CCS projects incompatible with net zero.

CCS performance may improve, and it is most likely to play a role in hard-to-abate sectors. But technical and cost challenges make the delivery of emissions

reductions at scale unlikely.[38] Japan faces additional costs: it has limited onshore sequestration opportunities,[39] such that CO2 captured in Japan must be compressed and shipped for injection in other countries. Every ship importing coal or LNG will require several ships dedicated to exporting CO2.

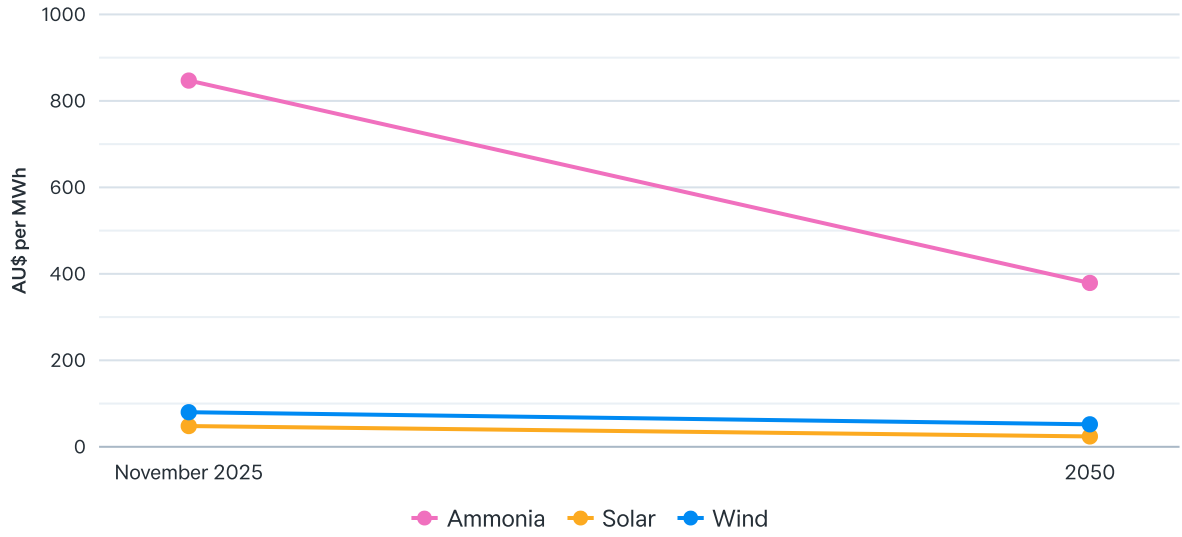
Japan has also begun trialling co-combustion of ammonia in coal power stations, a fuel that is presently made from natural gas but may be made from green hydrogen (the latter being necessary if ammonia is to reduce emissions).[40] The government targets ammonia imports of 3 million tonnes by 2030, initially for co-firing with fossil fuels, and for large-scale mono-firing by 2050.[41]

This, too, will be an extremely expensive pathway to net zero. Transporting energy via ammonia results in energy losses between 66 and 80 per cent, so energy from green ammonia will cost at minimum 3–5 times as much as the original renewable energy — and that is before counting the capital and operating costs of ammonia production and transport.[42] The International Renewable Energy Agency (IRENA) cost estimates for green ammonia today and in 2050 are an order of magnitude too high to compete with direct renewable electricity.

FIGURE 3

Ammonia, solar and wind - expected costs

Expected costs by energy source



Source: IRENA Innovation Outlook Ammonia and GenCost 2024-25

Finally, Japan has reopened nuclear plants mothballed after the 2011 Fukushima incident at the rate of around 1 GW per year, but its rate of new plant deployment is less than a quarter of that.[44] This is enough for nuclear to make

only a small contribution by 2050.[45] Acceleration is hampered by community safety concerns, anti-nuclear sentiment, and the high costs of nuclear power.

Imported hydrogen and ammonia will remain extremely expensive, and it appears likely that CCS and nuclear deployment will remain slow. Any of these in isolation would be challenging. In combination, they profoundly undermine Japan's decarbonisation strategy, leaving it dependent on fossil fuels and jeopardising its climate targets.

Economic risks and opportunities

Japan's high-risk decarbonisation strategy endangers its competitiveness as a major industrial economy. If it fails, it increases Japan's exposure to tariffs under the European Union's Carbon Border Adjustment Mechanism and similar measures planned by other jurisdictions.

Japan's commitment to retaining its energy-intensive iron and steelmaking industries complicates its path to net zero. All options for cleanly supplying the large volumes of electricity required for this industry are exorbitantly expensive. Because steel is a critical input into major Japanese industries, competitive weaknesses would be contagious, passing through to its automotive, electronics, and machinery manufacturing sectors.

Investments along the current pathway are costly for both private actors and the national budget. The cost per tonne abated through ammonia co-firing, for example, grossly exceeds the European carbon price. This strategy reduces the public and private resources available for driving innovation in other low or zero-carbon products, in which Japan might otherwise become a major player.

A new Australia–Japan green export partnership

In the fossil age, Australia and Japan have had complementary strengths: one a giant in energy and metal ores, the other a giant in complex manufacturing. As the world moves towards net zero, these relative strengths will persist — but they will reappear in new forms.

The high cost of transporting clean fuels means that Japan will depend substantially on domestic renewables and nuclear power to decarbonise. The upside is that Japan will be more self-sufficient in energy than it has been at any point in the fossil age. The downside is that it will face relatively high energy prices. The more that Japan can import energy-intensive goods, the more this downside is softened: lower domestic energy demand means lower energy prices.

Australia, meanwhile, will lose its lucrative fossil fuel exports. But its advantages in cheap renewable energy production make it the natural home for energy-intensive export industries — particularly green iron — which can offset this loss. It will also export green fuels where there are no good alternatives, particularly in parts of the transport sector. Green iron and green fuels offer a natural starting point for bilateral collaboration.

Green iron

Lowest-cost production of green iron requires the reconfiguration of steel supply chains. Today, Australia exports iron ore to Japan, where it is reduced into iron in blast furnaces that combust metallurgical coal. Iron is then transformed into steel in a basic oxygen furnace, usually in the same integrated production line.

Under a restructured supply chain, ironmaking and steelmaking would be decoupled. Ironmaking is the most energy-intensive step, accounting for around 85 per cent of the energy required to make steel.[46] It is also the technically simplest step and the least sensitive to labour costs. Australia would turn local ores into iron using renewable energy, first by hydrogen direct reduction of iron (H2-DRI) plants and perhaps later via electrolysis. That green iron would then be exported to Japan, for the more complex work of turning iron into the various grades of steel.

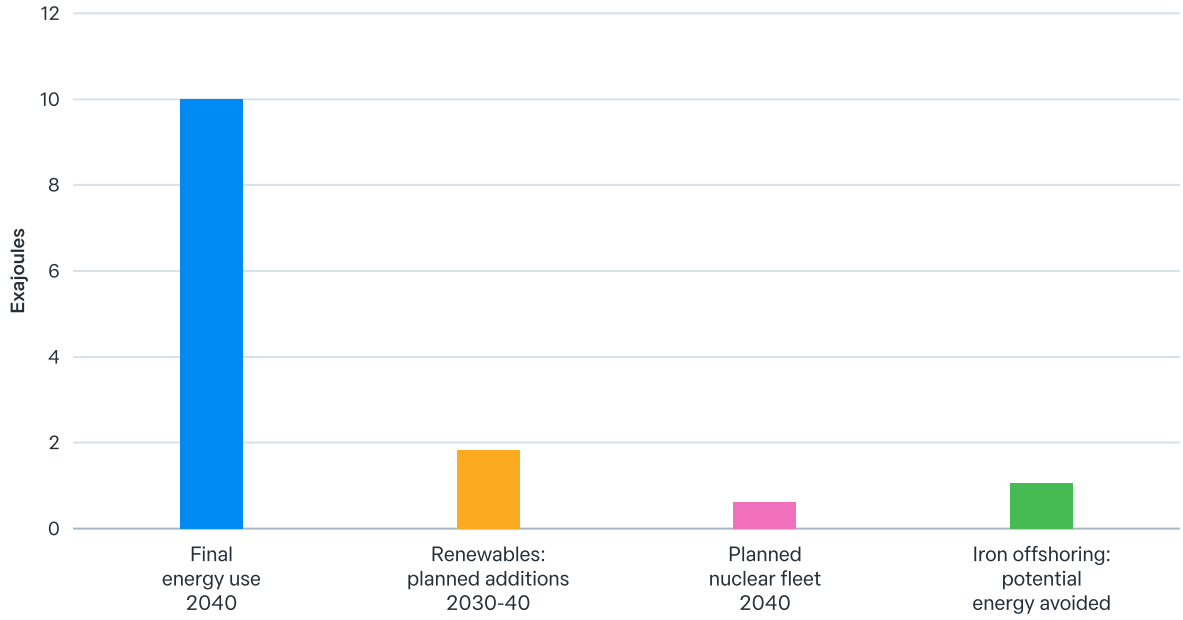
For Australia, turning currently exported iron ore into green iron before shipping to Japan could generate around AU$24 billion in annual revenue.[47] This is a fraction of Australia's total green iron potential of more than AU$300 billion per year.[48]

For Japan, the benefit would be fourfold. First, offshoring ironmaking would allow Japan to reduce its final energy consumption by nearly 1.1 exajoules, or 11 per cent of its final energy use in 2040. This is equal to 70 per cent more than Japan's entire planned nuclear energy use in 2040.

FIGURE 4

Japan: energy avoided by offshoring green iron production

Potential final energy use avoided by offshoring ironmaking is significant compared to other actions



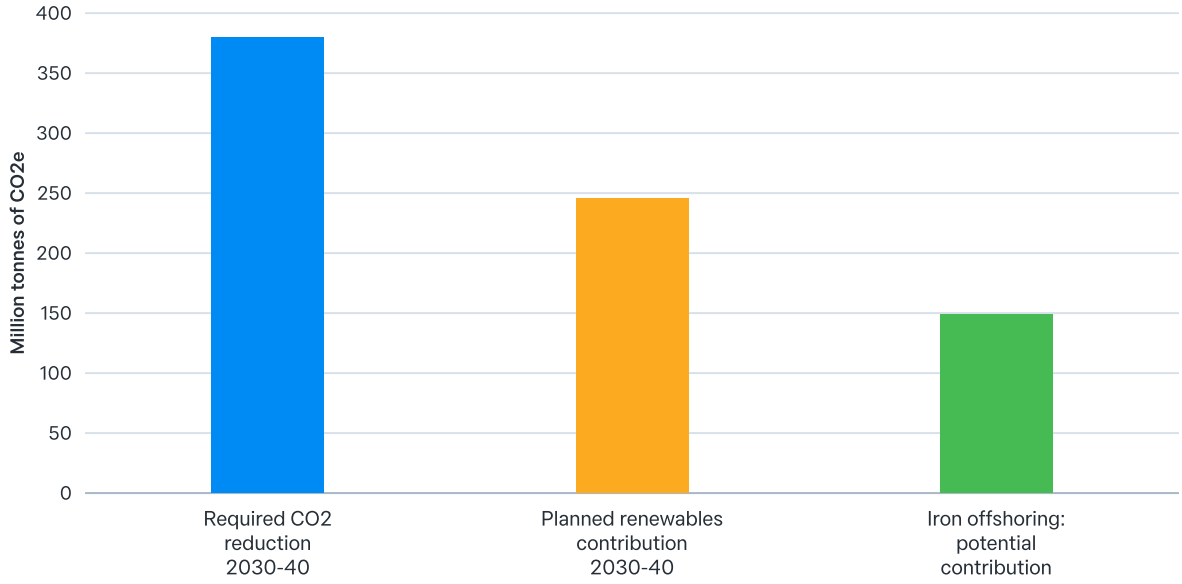
Source: Author analysis based on Outlook for Energy Supply and Demand in FY2040, Nippon Steel factbook 2023, World Steel in Figures 2023, A bottom-up assessment of recent (2016–20) energy use by the global iron and steel industry constrained to match a top-down (International Energy Agency) assessment - ScienceDirect

Second, it would cut Japan's emissions by 14 per cent; enough to cover nearly 40 per cent of its required emissions reductions between 2030 and 2040 to meet its targets.[49]

FIGURE 5

Japan: emissions avoided by offshoring green iron production

Potential emissions avoided by offshoring green iron are around 60 percent of the total emissions reduced by Japan's planned renewables, 2030–40



Source: Author analysis based on Outlook for Energy Supply and Demand in FY2040, World steel in figures 2023", Iron and Steel Technology Roadmap, A bottom-up assessment of recent (2016–20) energy use by the global iron and steel industry constrained to match a top-down (International Energy Agency) assessment - ScienceDirect, BF–BOF Steelmaking CO2 Emissions Reduction Options - Danieli Corus

Third, it would allow Japan to avoid importing significant amounts of costly hydrogen and ammonia. Adding 30 per cent ammonia to blast furnaces would, at today's prices, cost in the order of AU$41 billion per year. The ammonia required to produce one tonne of iron would cost more than finished green iron from an Australian H2-DRI plant.[50] While importing green iron could cut Japan's emissions by 14 per cent, adding 30 per cent ammonia would cut emissions by around 2 per cent.[51]

FIGURE 6

Relative price of iron from ammonia vs renewables

Source: A Green Iron plan for Australia, The Superpower Institute

Fourth, low-cost green iron from Australia would allow Japan's steelmaking industry, and downstream industries dependent on steel, to remain globally competitive as the world moves towards net zero. The cost advantage of importing green iron from Australia is supported by analysis by Japan's Renewable Energy Institute.[52]

While there are strong economic, energy security, and climate reasons for Japan to invest in a green iron supply chain with Australia, measures to carefully manage the social costs of this transition, including the reduction in employment related to ironmaking, will be critical to its political feasibility.

Yet while ironmaking is the most energy-intensive part of the steel supply chain, it is relatively labour-light. According to a European Union case study, an estimated 10 per cent of jobs in the EU steel sector are directly related to ironmaking, while 90 per cent of jobs are in steelmaking and downstream finishing activities.[53] Japan should similarly view offshoring green ironmaking to Australia as an opportunity to ensure the viability of far more abundant, and higher value, jobs in steelmaking.

History provides a striking precedent: Japan was the equal second-largest producer of aluminium in the world in 1970, but the OPEC oil shock prompted it

to exit the industry. This contributed to the shift of aluminium smelting to Australia, where energy costs were cheaper. Japanese government, business, and labour unions worked together to implement a suite of employment management, assistance, and reallocation measures.[54] Japan today is greatly better off for the closure of aluminium smelters, which would otherwise aggravate its energy security and emissions challenges.

Eventual large-scale imports of green iron from Australia would need to be grounded in trust that Australia will remain a stable and reliable partner. This is in keeping with the overall direction of Australia's relationship with Japan. Australia's recent decision to award Japan a tender for the construction of Mogami-class naval frigates, as well as expanding cooperation on critical minerals processing, reflects the convergence in strategic outlook between Canberra and Tokyo. Cooperating on green iron, a sector of national significance for both countries, would serve to bolster that relationship.

China is also investing in green hydrogen and green steel production technologies. While it will be a competitor in the industry, China's limited renewable resource endowment may similarly make green iron imports from Australia attractive.[55] Australia, along with other countries with rich renewables endowments, will benefit from Chinese advances in electrolyser technologies, as they have from Chinese advances in solar and wind technologies.

Green fuels

Importing green fuels makes no economic sense where there are good alternatives, such as generating electricity locally or importing energy-intensive goods. Sometimes, however, there are no good alternatives. Green fuels will be essential for some segments of the transport sector, including aviation, long-range shipping, and heavy-duty road freight. Stores of green transport fuels may also contribute to grid stabilisation during typhoons and other events that interrupt renewable energy production.

The most important green fuels are hydrogen, ammonia, methanol, and sustainable aviation fuel (SAF). Hydrogen and ammonia require only water and electricity as an input, while methanol and SAF also require a source of carbon.

Expected production costs are similar on a per-Megajoule basis.[56] Methanol and SAF have large advantages in terms of transport costs, safety, and compatibility with existing infrastructure, but the availability of biomass will be a significant constraint.

For Australia, the opportunity is to supply part of Japan's green fuel needs. If Australia covered 25 per cent of Japan's needs by mid-century, the total export value would reach around AU$20 billion. [57]

Producing these fuels in Japan would be prohibitively expensive. Japan has among the highest-cost renewable energy in the world, and its scarcity of land would make it reliant on biomass imports. Australia has a superabundance of both resources.

If Japan were to produce enough green fuels to cover its own needs, it would require around 239 TWh and 10 million tonnes of biomass annually. Importing green fuels would avoid these costs, while eliminating up to 12 per cent of national emissions. Costs are presently high, but expected to decline significantly over time.

Broader cooperation

Australia has expertise managing renewable-heavy and decentralised power grids, given its world-leading uptake of rooftop solar. It can be a reliable supplier of many critical minerals needed by green industries, such as lithium and nickel. Japan has broad and deep technical expertise, and can lead the development of next-generation renewables, power storage, hydrogen carriers, power-to-fuel, and other technologies that will be essential for the green trade and Australia's decarbonisation.

Both have strong geopolitical interests in diverse and robust green supply chains that do not leave the region dependent on monopolistic sellers or politically unstable partners. Today, Australia and Japan are among the most strategically aligned countries in Asia, and are actively increasing their investments in military cooperation and deterrence capabilities. An economic partnership built on growing, rather than shrinking, industries would strengthen these bonds for the long term.

Geographic proximity not only reduces transport costs, but also eliminates the bottlenecks that endanger supply from other countries, for example the Middle East. And most importantly, Australia and Japan have established strong trust built on half a century of trade.

Finally, success in the bilateral energy transition could serve as a model for joint regional decarbonisation efforts, with Japan and Australia leveraging each other's strengths to support electrification, renewable deployment, grid connectivity, and industrial decarbonisation in Southeast Asia — a growing centre of global energy demand.

How to make it happen

Australia cannot become a renewable energy superpower unless it collaborates with its major trading partners. Australia needs capital, skills, technology transfers, and demand for its green commodities. Partners' strategies and timelines will vary, and will sometimes conflict with those of Australia. That need not be an obstacle to collaborating wherever Australia and its trade partners can find agreement.

Japan and Australia agree on general goals. Both countries are committed to net zero by 2050, and share an interest in achieving net zero at lowest cost. Both will benefit from expanded investment in green industries where they hold comparative advantage. And both share an interest in managing the risk of accelerating climate impacts, and of being left behind in the global energy transition.

Disagreement lies in the particulars. The principal difference between Japan and Australia is in the envisioned technical pathway: Japan emphasises improvements to the current production model, with incremental gains won through efficiency, green fuel imports, and CCS. Australia emphasises more profound reorganisation of production and trade around renewable energy, albeit with internal tension around the role of gas as a transition fuel.

This disagreement is unlikely to be resolved in the near term. Technical pathways involve genuine uncertainty, and national politics imposes real constraints. But neither is it necessary to fix on a single optimal pathway to net zero in advance. Instead, the most fruitful way forward is to identify the next set of policies that reduce downside risks and expand upside opportunities — a strategy that maximises "option value" and the capacity to adapt should the present strategies prove unsound.

Deeper collaboration also depends on both Australian and Japanese policymakers acknowledging the depth of uncertainty and the scale of its attendant risks, and therefore pursuing a flexible strategy. The Japanese management principle of *genchi genbutsu* underscores the value of learning through practice.

The first-best strategy consistent with this approach is effective carbon pricing, which rewards all innovations in least-cost abatement. Neither Japan nor Australia have robust carbon pricing regimes, although they do have partial substitutes in place and plans for their expansion. The challenge is making these systems effective by raising the (shadow) price of carbon, expanding coverage, and ideally securing interoperability.

Governments also employ more targeted policies, which, if well designed, play an important role: they can help to overcome market failures that disadvantage innovative early-movers and that discourage investment in common-user infrastructure. The costs of these market failures, and the benefits of their correction, are largest for industries in which countries hold a comparative advantage. For Australia and Japan, coordinated policy regimes can ensure that the technologies most relevant to their shared trade relationship are developed at scale.

In the near term, Australia should work with Japan to advance the latter's strategy. This means addressing market failures affecting investment in ammonia and hydrogen exports, where there will be niche use cases in Japan's hard-to-abate sectors. It could also share technical information on respective CCS trials, identify potential carbon sequestration sites, and work to remove other barriers.

Japan, in turn, should coordinate with Australia to support early commercial-scale green iron plants as well as the upstream renewable energy projects that will feed them. One avenue worthy of exploration is extending Green Transformation (GX) incentives to majority Japanese-owned plants in Australia — for example, access to green bonds, green steel incentives, and mechanisms that reduce project risk — at a level of support comparable to that offered by Australia. Japan could also consider extending funding streams under the Japan Bank for International Cooperation (JBIC), the Japan Organization for Metals and Energy Security (JOGMEC), and the Japan Green Innovation Fund managed by the New Energy and Industrial Technology Development Organization (NEDO) to green iron projects in Australia. For its part, incentives under Australia's Future Made in Australia policy should be made available to Japanese investments in green iron in Australia.

In our view, green iron production in Australia is likely to result in lower costs and greater benefits to both countries. But whichever strategy proves successful, markets on both sides will be ready to expand it.

To embed this model of collaboration, we propose a three-stream approach:

Shared vision

At the political level, both countries should affirm their joint commitment to net zero by 2050, and recognise the uncertainty surrounding technical pathways and future carbon tariff regimes. Framing cooperation around "option value" creates common ground. Green steel is a logical early focus: the sector is highly emissions-intensive, and both countries see opportunity in positioning their industries for a net-zero global economy. Green fuels is the second-largest opportunity, though its growth depends on further technical advances.

Joint learning and planning

A bilateral mechanism should be established with a mandate to: identify the range of possible technology cost pathways and carbon tariff environments; identify what emerging data tells us about the likelihood of different futures; understand the consequences for economic competitiveness and climate abatement; and recommend harmonised policies. This could take the form of a new Australia–Japan Energy Transition Council,[58] or an expanded Japan–Australia Resources and Energy Dialogue with standing functions. Key priorities could include:

1. **Tracking and closing zero-carbon price gaps.** For green iron, the initial gap is estimated at around AU$170 per tonne in Australia.[59] The gap is several times larger for an ammonia-based strategy[60] and lower than IEA estimates for CCS steelmaking — although much uncertainty exists.[61]

2. **Overcoming technological barriers.** Priorities include flexible ironmaking, green ironmaking with hematite ores, hydrogen transport and storage, hydrogen and ammonia safety, and efficient biomass production for methanol and sustainable aviation fuels.

3. **Understanding accelerating climate damage.** Emerging evidence on tipping points may generate unexpected political and geopolitical changes, and possible surges in ambition and carbon tariffs.

This mechanism should report to, and become a central pillar of, the Australia–Japan Ministerial Economic Dialogue, which should continue to bring together ministers for trade, climate, energy, resources, and industry, as well as representative business leaders.

Joint implementation and co-investment

The mechanism should scope and advance policies that support private investments that test each country's intended strategies — Australia collaborating with Japan on ammonia development and removing obstacles to CCS, and Japan testing green iron production in Australia. First, the case for broad carbon pricing in both countries will endure, supporting market actors to make efficient choices. Second, targeted policies will remain significant and essential for addressing market failures in innovation and infrastructure. Australia and Japan should aim to equitably share the costs of early industry development, in proportion to the attendant benefits for each country. For green iron, Australia's hydrogen subsidies promise to close around AU$120 per tonne of the green price gap. Japan's GX subsidies and planned carbon pricing regime may drive demand for green steel, especially if subsidies can be afforded some international reach.

This framework ensures that collaboration is both principled and practical: building resilience through a shared vision, adaptive learning, and tangible co-investment. It is an iterative process: together we feel our way towards 2050, each step of investment and regulation informed by what we have learned in the last.

Conclusion

As the world moves towards net zero, Australia and Japan's significant fossil fuels trade leaves them exposed to a multitude of economic, energy security, and climate risks. At the same time, both countries have a critical opportunity to become leaders of a clean energy economy.

To seize this opportunity, Australia and Japan must work together. They should commit to a process of collaboration, co-investment, learning, and adaptation. At present, green iron and green fuels offer the strongest potential benefits while allowing Australia and Japan to play to their traditional comparative advantages and economic complementarities. But other more promising technological pathways may emerge.

Japan and Australia are no strangers to cooperation. In the past, they have jointly established new industries such as the global LNG trade, and restructured old ones as circumstances changed — as was the case with aluminium.

The global energy transition now presents transformational opportunities. If they succeed, both countries will have jointly laid the foundations of their future prosperity, made tangible progress towards their climate goals, bolstered their energy security, and strengthened trust in a critical partnership at a time of heightened global instability. This would set a powerful example to the world.

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