Revisiting Japan's Sustainable Growth Strategy Through Energy Security and Green Transformation (GX)

Summary

- **Japan faces geopolitical challenges that make its high level of dependency on fossil fuels imports a security risk.**
- **Strategic investment in clean energy offers a pathway to energy security and strengthening national resilience.**
- **This has the added benefit of allowing Japan to meet its climate goals.**
- **In the interim, as Japan continues to use liquefied natural gas, meeting climate goals will require prioritising supply chain methane abatement.**

Introduction

Midway through 2025, Japan finds itself facing two challenges:

1. Rising security risk.
Heightened geopolitical tensions highlight the risks of Japan's reliance on the import by ship of fossil fuels.

2. A global shift to highly competitive new economy industries.
Industries from clean energy and electrified transport to artificial intelligence are booming globally.

At the same time, Japan is hoping to drive regional revitalisation, with the growth of clean energy generation as one of its brightest hopes.

Japan has committed to a 2050 net-zero target and forged a role as a global leader in climate transition through its commitment to transition finance.[1]

The country's **Green Transformation (GX) Promotion Strategy** aims to support Japanese industry to become a leader in new economy industries, increase domestic clean energy production, and create regional jobs, while advancing climate leadership and energy security.

However, there are three problems:

1. The 7th Strategic Energy Plan (SEP) adopted in February 2025 retains a long-term reliance on imported gas for power generation, despite its potential to expand domestic renewable energy generation.[2] This perpetuates the country's security vulnerabilities.

2. The heightened risk of geopolitical conflict leaves Japan, among major economies, uniquely vulnerable to energy supply disruption. Japan needs to have both the means and confidence to withstand severe geopolitical disruption. A rapid shift to domestic energy generation is no longer just an 'optimal pathway' but is now a critical issue for the resilience of the Japanese economy.

3. Liquified Natural Gas (LNG) emits less Greenhouse Gas (GHG) emissions than coal, *but only marginally less*, and it still has a significant climate risk, compromising climate goals.
Recent research highlights the previously underestimated impact of methane emissions throughout the LNG value chain.[3] While LNG's overall GHG emissions can be lower than other fossil fuels, its continued use locks in GHG emissions not only for Japan, but globally.[4] See Appendix 1.

Given these challenges, in December 2024 Climate Bonds Initiative published a briefing that identified three key opportunities for Japan to establish itself as a global leader in climate action.[5] One key recommendation was to pursue national energy security by increasing green regional revitalisation, which can be done through building domestic renewable energy capacity. This has become increasingly urgent due to rising geopolitical tensions and the growing imperative to achieve climate targets.

Climate Bonds has now revisited developments from the first six months of the year to assess progress and reflect on how ongoing geopolitical risks further highlight Japan's need to address its fossil fuel dependency. By doing so, Japan can simultaneously mitigate geopolitical vulnerabilities, advance regional revitalisation, and strengthen its leadership in meeting climate commitments.

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Japan's energy plan maintains reliance on energy imports

The Cabinet's approval of the 7th Strategic Energy Plan in February confirmed LNG's long-term role in the energy mix. Gas-fired generating capacity is set to increase due to the number of new gas-fired power plants constructed exceeding the number decommissioned.[6]

Energy demand is also projected to rise, driven by factors such as digital transformation (DX), semiconductor manufacturing, and data centre expansion.[7] Without investments in a cleaner alternative, Japan will be forced to further rely on imported fuels to bridge the gap between growing energy demand and supply.

The energy plan's projections for energy to make up 30-40% of the energy mix in 2040, and lack of phaseout date for coal threatens the credibility of the 2050 net zero target. It also describes LNG's importance beyond the 2050 carbon neutrality target, such as using it for feedstock for products such as hydrogen.[8] This implies that LNG is expected to have a long-term role in Japan, inconsistent with climate goals, rather than being used just in the interim for transition.

There have been efforts to construct new LNG plants to replace older coal plants, with the assumption CCUS, hydrogen, and ammonia will be incorporated and used for future decarbonisation.[9] The Japanese government promotes R&D into low-carbon alternatives, such as green ammonia and green hydrogen, that would decarbonise imported LNG.

However, such transition pathways are currently unproven and uncertain, given the volume of hydrogen and ammonia required to decarbonise thermal power plants.

Considering the significant investment required to scale and develop the technologies needed to decarbonise imported fuel, it is important not to rely too much on them, especially when opportunities exist to modernising the grid in such a way as to allow a major scaling-up of domestic renewable energy capacity.

Prioritising investments and growth of renewables could stimulate regional revitalisation and domestic industry growth rather than potentially delaying industrial progress by maintaining reliance on energy imports and exposing Japan to geopolitical volatility.

Escalating geopolitical issues threaten energy security

The current geopolitical climate highlights how Japan's reliance on energy imports leaves its system exposed to global market shocks and instability. Japan's strong presence in the LNG industry began as a strategic response to the 1973 oil crisis, using diversification to strengthen energy security.[10] Since then, LNG supplies have become increasingly vulnerable.

Japan maintains heavy reliance on imported fossil fuels as the country currently depends on international sources for 99.7% of its oil, 97.7% of its LNG, and 99.6% of its coal needs.[11]

In 2025, Japan remains the world's second-largest LNG buyer and hosts three of the five largest megabanks financing LNG projects globally, see Appendix 2.[12] The energy plan states natural gas carries a low geopolitical risk, but Japan's LNG supply chains now face growing geopolitical challenges.

Escalating tensions between Iran, Israel, and the United States have increased instability in the Strait of Hormuz, a key passage which would disrupt 20% of global LNG flows.[13] Japanese ships are already minimizing their presence in the area to reduce exposure to potential conflict.[14] While the Strait is not closed as of July, this highlights a geopolitical vulnerability in the LNG value chain.

Disputes in the South China Sea, particularly between China and the Philippines, also pose a significant risk, as approximately 30% of Japan's LNG imports transit this critical route.[15] Additionally, Russia supplies 9% of Japan's LNG imports, but with many contracts expiring between 2026 and 2033, ongoing sanctions and geopolitical tensions further undermine Japan's energy security and self-sufficiency.[16]

While the latest energy plan acknowledges the need for greater use of renewable energy relative to previous plans, there are also concerns about potential dependencies on other regions for renewable energy technologies such as solar panels and batteries.[17] Japan is addressing this by investing in domestically developing technologies such as perovskite solar cells through issuance of the sovereign Climate Transition Bond.[18]

If Japan can maintain strong relationships with other countries also looking to reduce dependencies for key materials, diversification would keep any dependence on current monopolies short-term compared to long-term fossil fuel reliance.[19]

Given these various risks, Japan's energy supply chains remain exposed to sudden disruptions. Ambitious targets, accelerated action, and further diversification investment will be necessary to achieve energy security and resilience.

Clean energy presents an opportunity for Japan

In light of these vulnerabilities, clean energy presents a key opportunity for Japan to reduce import dependence and build domestic industries while also meeting climate commitments. Accelerating the deployment of domestic renewables, particularly wind and solar, can boost self-sufficiency and drive regional and economic revitalisation.

In June, Japan amended its policy to allow offshore wind power generation facilities in exclusive economic zones (EEZs), reflecting a move to realise the energy plan which aims to increase wind power's share of the national energy mix from the current 1% to between 4% and 8% by 2040.[20]

Further efforts to develop offshore wind in Hokkaido have taken place with new requests for review of Environmental Impact Assessments in Shimamaki by utilities and growing dialogue with international offshore wind developers such as transmission operators from Denmark.[21,22] This is a strong signal of growing momentum between Japan and international partners to accelerate the growth of the offshore wind industry in Japan.

Independent studies project that renewables, primarily wind and solar, could supply 70% to 80% of Japan's electricity by 2035, with some estimates as high as 90% by 2050.[23] Achieving these targets could raise energy self-sufficiency to 75% and significantly reduce exposure to global market volatility.[24] However, the government's current plan is less ambitious, targeting renewables at 40–50% of the energy mix and self-sufficiency at 40% by 2040.[25]

In any of these scenarios, realising Japan's renewable energy potential will require rapid investment in grid modernisation, infrastructure, domestic supply chains, and incentives for public–private partnerships. Financial institutions can play a key role by mobilising capital and supporting the development of sustainable finance hubs throughout Japan. Continued engagement with global industry players will enable Japan to incorporate successful strategies from abroad and become a leader in the region.

Five steps for Japan to accelerate decarbonisation of its energy mix:

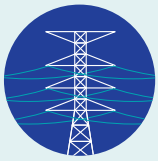
1. While LNG continues to be used, methane abatement must be accelerated

If Japan intends to maintain its reliance on LNG, it is imperative that methane abatement becomes a top priority to safeguard emissions reduction commitments, see Appendix 1. Maintaining a strong position on methane abatement, pursuing finance opportunities, cement Japan's role as a global leader in transition.

The IEA estimates that implementing all abatement technologies currently available across the LNG supply chain could reduce methane emissions by 85% compared to 2024 levels.[26] This can be done through investments in monitoring and reduction technologies such as Leak Detection and Repair (LDAR), through minimising emissions from shipping and increasing collaboration between industry leaders.

Japan can build on the momentum established through joint statements and memoranda of cooperation with industry leaders by further development of financing and incentive mechanisms to support methane abatement initiatives. See Appendix 2 for Japan's influential role in the LNG supply chain.

2. Accelerate grid modernisation and needed infrastructure



The current electricity grid is highly constrained.

The country is separated into three major grid segments (East, West and Hokkaido) that have minimal interonnectivity.

Without better connections between grids, clean energy generated in regions can't be matched with electricity demand in major markets, such as Tokyo.

Japan would have to continue to rely on fossil fuels, compromising climate commitments and self-sufficiency.

In the absence of an integrated grid, renewable generation is highly constrained. Opportunities for regional revitalisation will also be lost.

With integration Japan can unleash renewables.

METI, working with the Organization for Cross-regional Coordination of Transmission Operators (OCCTO), has developed a comprehensive plan for grid, transmission, and interconnector development.

Japan has deep capital pools with a strong appetite for long-dated and secure investments, which the capacity to efficiently absorb the estimated investment required of around 6–7 trillion JPY, around 40 billion USD[27,28].

But implementation of the Master Plan depends on policy decision-making. Action is required.

Rapid action will also help address the growing electricity demand from data centres, semiconductors and use of artificial intelligence, which is increasing the demand for clean energy.

Data centres will be obstructed from accessing the required amounts of clean energy if grid connection from generation sites remain limited.

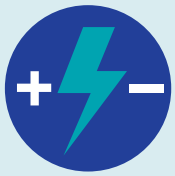
Japan is well positioned to develop and implement the transmission infrastructure required for a modern energy system.

Japanese companies such as Hitachi and Mitsubishi are business and engineering leaders in this field.

As companies approach climate commitment deadlines, Japan should leverage this opportunity to attract international investment.

Engaging in further dialogue with leading international transmission operators can help Japan anticipate potential bottlenecks in its own grid development and enhance its readiness to address them.

3. Enhance energy system and supply chain resilience



As Japan increases its share of variable renewables, grid resilience and flexibility become increasingly critical. Investing in advanced storage technologies, such as batteries and developing virtual power plants will help balance supply and demand, reduce curtailment, and maintain reliability during peak periods or disruptions.

The Government of Japan and Tokyo Metropolitan Government have led these efforts with large-scale battery subsidies.[29]

Solutions such as large-scale batteries help with supply issues by storing electricity when there is a surplus to be discharged when there is a shortage.[30] Increasing the capacity of production during off-peak times also helps with lower dependence on imported fossil energy.

These solutions strengthen the overall resilience of the energy system, supporting the stable integration of renewables as they come online. Importantly, they also enhance regional energy security by decreasing dependencies. Diversifying the supply chain of transition infrastructure can build domestic supply chains such as through the investment of domestically made perovskite solar cells.

Through clear policy signals and clarity of subsidy provision, Japan can instil confidence among domestic industry players and overcome the uncertainties that currently limit sustained investment.[31]

Companies investing in renewable energy generation will be more likely to pursue long-term development of the sector, even in the face of short-term market volatility or supply chain dependencies.

4. Follow international best practice to fast-track energy markets

Japan has taken important steps to streamline permitting and engage local communities in renewable energy development. International examples demonstrate that ambitious and coordinated action can deliver even faster and results.

Germany's rapid expansion of wind and solar power was enabled not only by supportive policies and competitive auctions, but also by significant investment in grid and storage infrastructure. Scotland's expansion of offshore wind highlights the value of accelerated project permitting and strong engagement with local stakeholders. By building domestic trust and collaboration, Scotland has supported its own industry and maximised the economic benefits of renewable energy growth, with offshore wind energy having a potential capital value of around 100 billion (approximately 19 trillion Japanese Yen).[32]

For Japan, these experiences underscore the importance of combining policy ambition with coordinated investment and streamlined processes to unlock the full potential of the clean energy transition.

5. Implement the nuclear restart, but present it as a transitional step

The Japanese Government's decision to restart nuclear plants is an important step toward decarbonisation, alongside an ongoing commitment to a long-term shift to renewables.

But, while nuclear power has low operational emissions, there is widespread concern among Japanese citizens about its risks. Trust is an issue.

Transparency on safety, progress, and waste will help rebuild trust, as will a focus on nuclear as a transitional measure to maintain existing energy supply, rather than new investment, to be reviewed once fossil fuels have been retired.

Conclusion

Historically, Japan has played a pivotal role in global LNG markets, acting as a large importer and reseller of LNG to meet both international and domestic energy demands. However, as the global energy system rapidly transitions towards renewable energy, continued reliance and support for fossil fuel imports will only increase Japan and the region's financial and environmental vulnerabilities.

In light of the current geopolitical situation, it is crucial for Japan to reconsider its approach to LNG. While Japan talks of prioritising LNG in the short term it is i fact exacerbating the country's energy imports vulnerability, at the same time that heightened geopolitical tensions threaten security.

A security focus will mean quickly investing in METI's grids and transmission plan so as to renewable energy generation opportunities in regional Japan to be developed.

The momentum and leadership shown by Japan in issuing the Climate Transition Bond as part of its Green Transformation (GX) Strategy is commendable and should be further strengthened. But global political disruption highlights the need for a faster renewable energy transition.

> "If Japan can on-shore the energy it needs through transitioning to renewable energy sources, it will increase its geopolitical flexibility and independence."[33]
>
> Council on Strategic Risks

By recognising the interconnections between climate, the economy, and geopolitics, Japan can shape policies that not only mitigate risk but also unlock new pathways towards a competitive and sustainable society. Building on the five considerations outlined above, Japan has the opportunity to lead the region's clean energy transition while strengthening domestic resilience.

Appendices

Appendix 1: Methane emissions across the LNG supply chain threaten GX emissions targets

While Japan's GX Strategy promotes the S+3E principles and LNG as a transition fuel, growing scientific evidence on methane emissions across the LNG supply chain raises critical concerns about whether the environmental objective is truly feasible.

Research shows that the coal value chain has significantly higher CO_2 emissions than LNG, especially considering end-use emissions, even when the LNG is shipped over long distances.[34] Due to this, LNG is commonly regarded as the key to the needed energy transition within Japan, despite substituting one fossil fuel for another. However, comparing LNG to coal shows only a relative improvement, as it involves evaluating one carbon-intensive fuel against another fossil fuel.

Additionally, research has exposed a critical issue: the methane emissions throughout the LNG supply chain.

Methane is a potent Greenhouse Gas (GHG), with a Global Warming Potential (GWP) 28-36 times greater than CO_2 over a 100-year period.[35]

These emissions occur throughout the entire LNG lifecycle; from extraction to liquefaction, transport, and ultimately, combustion, which poses a significant challenge to reducing LNG's climate impacts.

IEA's report, released in June 2025, assert that 70% of methane emissions occur upstream and liquefaction, shipping and downstream operations make up the remaining 30%.[36] In the same report, the IEA estimates that of the GHG emissions in the LNG supply chain, 30% are methane emissions, which escape to the atmosphere. Most of this is categorised under Scope 1, making these emissions largely outside the control of consumers.

Methane emissions also persist during LNG transportation. In LNG-powered ships, unburned methane can escape through the exhaust system, referred to as methane slip, which contributes to GHG emissions and reduces overall fuel efficiency. Depending on the type of carrier ship, average methane slip has been found to range from 0 (steam turbine) to 6% (dual or tri-fuel diesel electric carriers), with 65% of the market share having .2%-6% methane slip in addition to CO_2 emissions.[37]

The report from the IEA found that reducing methane leaks would cut 25% of annual LNG emissions, with half coming at no net cost.

Based on the fossil fuel demand estimated in the IEA's Stated Policies Scenario, which does not assume governments will reach all stated goals, targeted methane mitigation solutions in the fossil fuel sector could prevent around 0.1°C rise in global temperatures by 2050.[38]

This figure highlights the climate impact of unabated methane emissions and shows that, without effective mitigation, LNG continues to contribute substantially to global warming. Moreover, this estimate does not account for the additional emissions from CO_2, underscoring the broader climate risks associated with LNG use.

Appendix 2: Japan's Role in the LNG supply chain

Japan's plays an influential role in the LNG supply chain and will continue to do so with the Ministry of Economy, Trade and Industry (METI)'s target for Japanese industry to meet 100 million tonnes per annum (mtpa) of LNG transactions by 2030.[39]

Using this role in the industry, Japan advocates for methane abatement initiatives such as the Global Methane Pledge (GMP), an international initiative launched at COP26 to cut global methane emissions and provide key satellite GHG data to support policymaking in Asia.[40]

Japan also leads the Coalition for LNG Emission Abatement toward Net-zero (CLEAN initiative), which unites stakeholders to reduce methane emissions across the LNG value chain. In 2025, the coalition consists of 27 LNG producers and consumers collaborating by leveraging importer purchasing power, collecting project-specific emissions data, enhancing transparency through producer dialogue, and sharing best practices for emission reduction.[41]

In 2023, 11% of Japan's LNG supply chain emissions were empirically measured and 62% were estimated and reported to United Nations Environment Programme's Oil and Gas Methane Partnership 2.0 (OGMP 2.0).[42]

However, these efforts risk being undermined by ongoing investments in LNG infrastructure both domestically and internationally. Even as utilities and oil and gas companies such as JERA and Osaka Gas develop ambitious renewable energy projects and set long-term CO_2 reduction targets while contributing to advancing methane abatement and transparency, they continue to pursue new LNG contracts and infrastructure.[43]

To truly lead in the energy transition and set a strong example for the region and the world, Japan must accelerate the scaling of domestic renewable energy capabilities and reduce its reliance on fossil gas, rather than relying on incremental improvements to the LNG value chain. With the US retreating from methane regulation and climate partnerships, Japan may assume greater leadership in methane abatement, but its dual role as a climate advocate and LNG investor remains a significant challenge to its net-zero ambitions.

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