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Key Barriers in Japan's Renewable Energy Development

Innovative regional approaches demonstrate scalable models to overcome national transmission, regulatory, and utility challenges

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Key Findings

Japan's renewable energy growth has slowed recently, creating a widening gap with national targets and raising concerns about meeting the country’s 2030 goal of 36%–38% renewables and achieving carbon neutrality by 2050.

Structural challenges, including electric utilities' reluctance to invest in renewable energy, the underutilization of Non-Fossil Certificates (NFCs), grid constraints and curtailment, and the lack of financial and regulatory transmission frameworks, have hindered the integration of renewable electricity in Japan's power system.

Major Japanese electric utilities, which control about 75% of installed capacity, have shown minimal investment in domestic renewables, prioritizing fossil fuel and nuclear assets instead. Weak enforcement of the 44% non-fossil fuel obligation further reinforces this trend.

Regional initiatives in Fukushima and Akita illustrate effective models for accelerating renewable deployment. These approaches can be scaled nationally by reforming transmission regulation and financing, supporting proactive zoning and planning, promoting the use of power purchase agreements (PPAs), and addressing the urban-rural development gap.

Executive Summary

There is an increasing gap between Japan's renewable energy targets and actual deployment. While the country has significantly expanded its installed renewable energy capacity since the Feed-in Tariff (FIT) was introduced in 2012, renewable energy development has slowed. There are concerns about whether Japan can meet its 2030 target of 36%–38% renewables in the power generation mix and achieve carbon neutrality by 2050.

Fossil fuel proponents argue that renewables cannot ensure a stable energy supply, using this narrative to justify continued reliance on fossil fuels, especially liquefied natural gas (LNG). The latest 7th Strategic Energy Plan (SEP) reflects this view and includes a scenario where LNG imports increase if renewable expansion remains sluggish.

Structural and institutional bottlenecks have prevented renewable electricity from effectively integrating into Japan's national grid. From 2010 to 2023, the share of renewable energy in electricity generation rose from 9.5% to 22.9%. However, annual growth rates have declined, curtailment has increased, and future deployment is uncertain.

In fiscal year (FY) 2023, renewable power generation increased by just 5.9%, the lowest rate since 2010, and curtailment reached a record high of 1.88 gigawatt-hours (GWh). This highlights an imbalance between capacity expansion and electricity system integration, driven by grid inflexibility, weak planning coordination, and market misalignment.

A key structural issue is the limited commitment of major electric utilities to domestic renewable energy development. Despite owning around 75% of Japan's installed power capacity, they have invested minimally in proven technologies such as solar and wind. Instead, fossil fuel and nuclear assets are prioritized, and the limited renewable energy projects implemented are overseas. Weak regulatory enforcement encourages this reluctance to shift to renewables. Although utilities legally must source 44% of their total electricity from non-fossil sources by 2030, there are no financial penalties for non-compliance, and market incentives remain underdeveloped.

Utilities have also underutilized the Non-Fossil Certificate (NFC) system, which allows them to meet procurement targets without owning generation assets. Most NFCs purchased are derived from non-renewables, such as nuclear. Limited supply and a lack of transparency have further discouraged meaningful participation.

Grid access and curtailment remain persistent challenges. In resource-rich regions such as Kyushu and Hokkaido, renewable developers face delays and high grid access costs. Limited transmission capacity and dispatch rules that prioritize thermal power plants (exempting them from curtailment below 30%-50% of output) further restrict renewable generation.

Japan lacks a comprehensive framework for transmission development. Renewable generation is concentrated in rural and coastal areas, while demand centers are in metropolitan regions. Long-

distance transmission remains underdeveloped due to complex permitting processes and transmission operators' limited finances. This creates a physical and economic gap between renewable energy supply and demand.

The urban-rural divide is further reflected in renewable energy development patterns. Urban areas face land scarcity and higher project development costs, while rural regions host most large-scale renewable installations. Coordinated policies and infrastructure investment are needed to connect these locations.

Several regions in Japan have demonstrated that meaningful progress is possible. Prefectures such as Fukushima, Saga, Akita, and Hokkaido have set local renewable energy targets, engaged communities, and mobilized regional finance to support clean energy expansion. These subnational efforts have increased renewable deployment and offer replicable models.

Japan should focus on scaling these successful regional approaches instead of relying on fossil fuels for backup. Priorities should include reforming grid access rules, modernizing market design, strengthening enforcement of existing NFC obligations for major utilities, and enabling deployment paths such as power purchase agreements (PPAs).

Introduction

Amid rising concerns over climate change and energy security, countries are accelerating their shift to renewable energy. Japan aims to achieve carbon neutrality by 2050 and increase the share of renewables to 36%–38% of its total power generation by 2030.

Despite these targets, the country's renewable energy deployment has significantly slowed in recent years. The rapid expansion following the Feed-in Tariff (FIT) introduction in 2012 has stalled, hindered by sluggish solar and wind installations, persistent grid constraints, frequent curtailment, rigid market structures, and reluctance from major utilities.

Policymakers, industry, and government-backed thinktanks suggest that Japan may need to continue or extend its reliance on fossil fuels for energy security. The latest 7th Strategic Energy Plan (SEP) reflects this view and includes a contingency scenario where renewables fall short and imports of liquefied natural gas (LNG) rise.[1]

Including this high fossil fuel scenario underscores the perception that renewables alone may be insufficient to meet Japan's energy security needs. Many Japanese stakeholders argue that a high penetration of renewables would jeopardize the stability of the electricity system.

[1] Agency for Natural Resources and Energy. Energy supply and demand outlook for fiscal year 2040. December 2024.

This report challenges that assumption and finds that perceptions of renewable energy as unreliable or insufficient are premature and risk becoming a self-fulfilling outcome.

Several regions — such as Fukushima, Saga, Akita, Hokkaido, and others — are achieving meaningful progress in renewables deployment through local targets and policy implementation, community engagement, land use planning, infrastructure investments, and regional financial collaboration.

Current Status of Renewable Energy in Japan

This section provides an overview of national trends in power capacity, generation, and technology composition, especially since the introduction of the FIT in 2012 and the transition to the Feed-in Premium (FIP) scheme in 2022. While total capacity has increased, new installations and generation growth have slowed significantly in recent years.

From FIT to FIP

Japan implemented the Renewables Portfolio Standard (RPS) law in 2003, which mandated that utilities should procure a certain share of electricity from renewable sources. However, due to limited targets and weak incentives, renewable deployment remained modest.[2] A residential solar surplus buyback scheme followed in 2009 but was insufficient for large-scale expansion. After the 2011 Fukushima nuclear accident, the government recognized the urgent need to shift away from nuclear and scale up renewables, leading to the introduction of the FIT in 2012.

The FIT scheme required utilities to purchase renewable electricity at fixed prices, incentivizing the development of new projects and spurring rapid expansion, particularly in solar photovoltaic (PV) installations. However, increasing consumer prices, market distortions, and rapidly falling renewable technology costs prompted a policy shift.

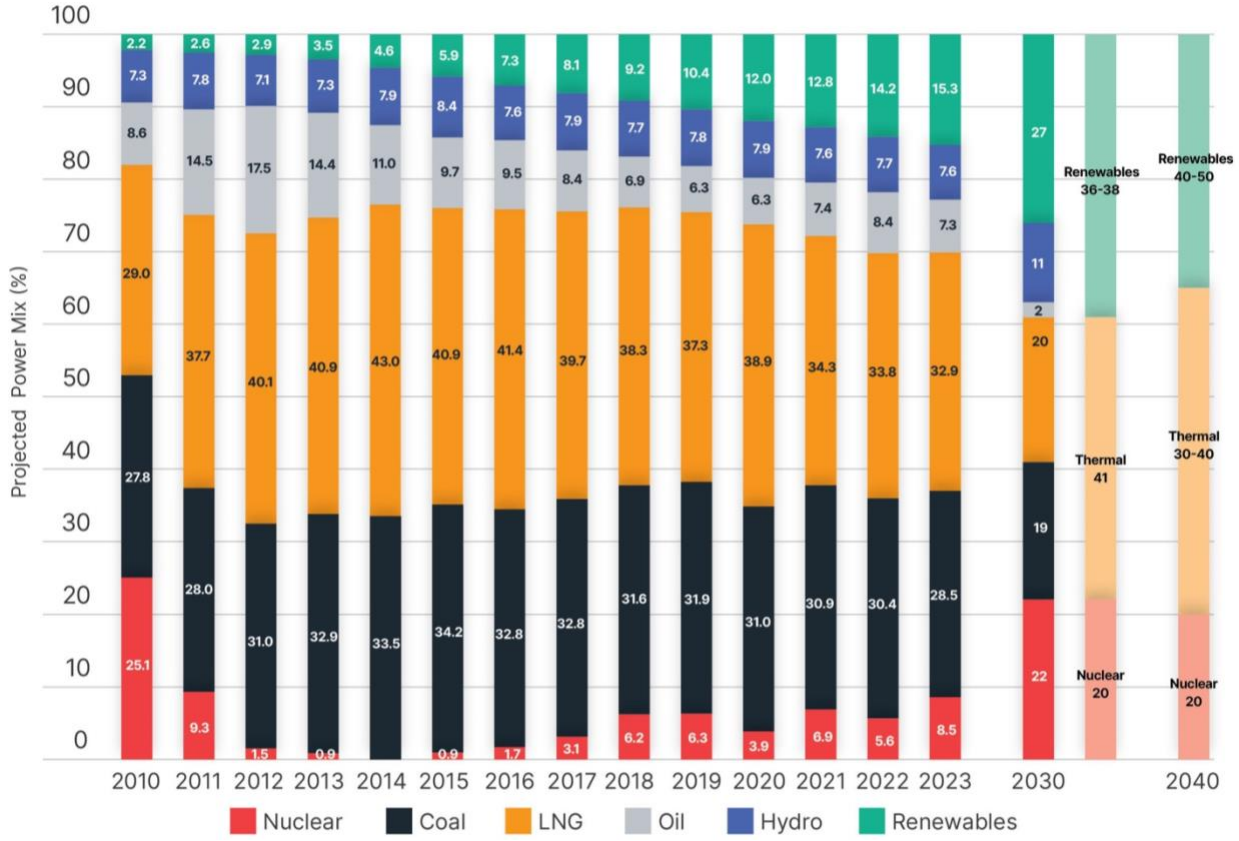
In 2022, the FIP system was introduced to promote market integration of large-scale renewables. The FIT scheme remained available for specific, smaller-scale technologies. Unlike the FIT, which guarantees a predetermined purchase price for renewable energy, the FIP provided a variable premium in addition to wholesale electricity market prices, encouraging producers to participate in wholesale markets and develop more flexible business models, including storage and aggregation.[3]

[2] Energy Information Center. 日本の再エネ普及を左右した RPS 制度の歴史を見る、2017 年度から 5 年間で段階的に廃止 10 June 2016.

[3] Agency for Natural Resources and Energy. FIP System. 24 June 2022. The FIT system has not been completed. The size of facilities eligible for the FIP system varies yearly depending on the type of power source and installation method, and only the FIP system is permitted for new certifications above a specific size. Generally, facilities of 50 kilowatts (kW) or more are eligible for the FIP system, while residential solar power generation of less than 10kW and onshore and offshore wind power of less than 50kW are only eligible for the FIT system.

The FIT led to the share of renewables in Japan's energy mix increasing quickly after 2012, while total generation in the country fell. In 2023, Japan's electricity generation was 14.3% lower than in 2010, due to demographic trends and energy efficiency measures. In contrast, renewable energy — which included solar, wind, hydropower, biomass, and geothermal — rose to a 22.9% share in power generation in 2023, from 9.5% in 2010. Excluding hydropower, it grew sixfold from 2.2% of the total generation mix to 15.3% (Figure 1).[4]

Figure 1: Power Generation in Japan (2010–2023) and Targets (2030 and 2040)

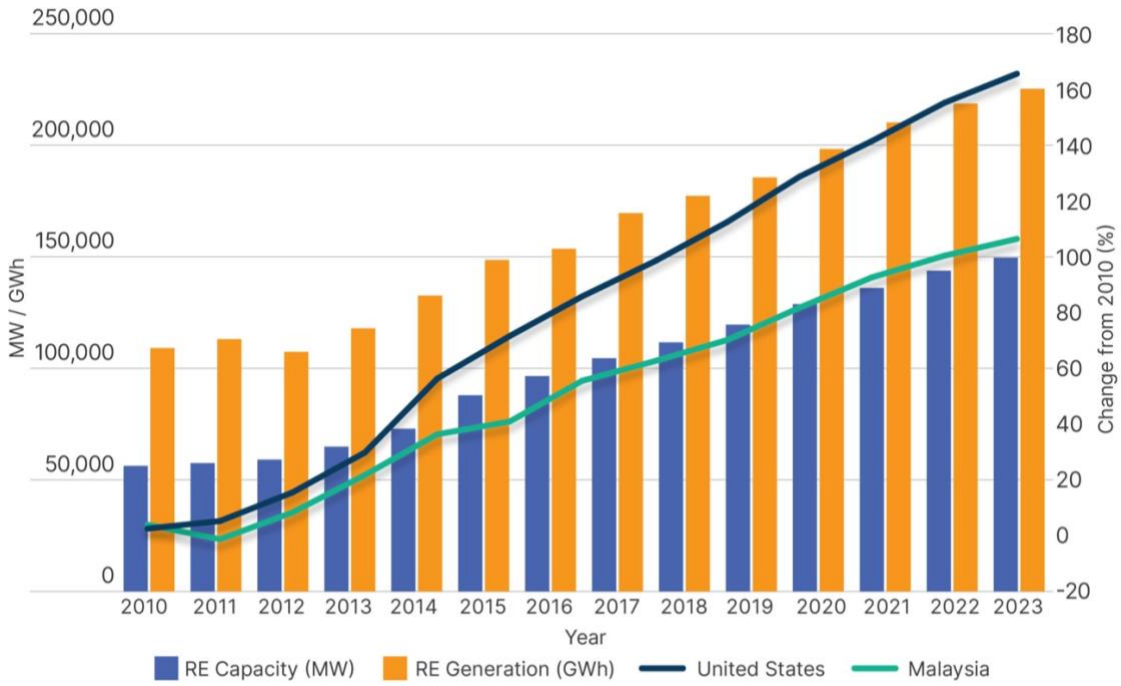


Note: For 2040, the ratios are established on the base-scenario.
Source: Agency for Natural Resources and Energy.

Similarly, renewable energy capacity grew 166% compared to 2010 (Figure 2). Total renewable capacity certified by FIT, including pre-FIT installations, reached 119.49 gigawatts (GW) in fiscal year (FY) 2023. 80%, or 78.65GW, of this amount is currently operational while the remainder is being developed.[5]

[4] Agency for Natural Resources and Energy. Energy Supply and Demand Results for Fiscal Year 2023. 22 November 2024.
[5] Agency for Natural Resources and Energy. The current state of renewable energy in Japan and overseas. October 2024.

Figure 2: Japan's Renewable Energy Capacity and Generation Increments (2010-2023)



Note: In Japan, the definition of renewable energy varies depending on the applicable law. In this case, it follows the classification used in the Strategic Energy Plan, which outlines the country's medium- to long-term energy policy. Accordingly, renewable energy includes solar, wind, geothermal, biomass, and hydroelectric power.
Source: IRENA, Agency for Natural Resources and Energy.

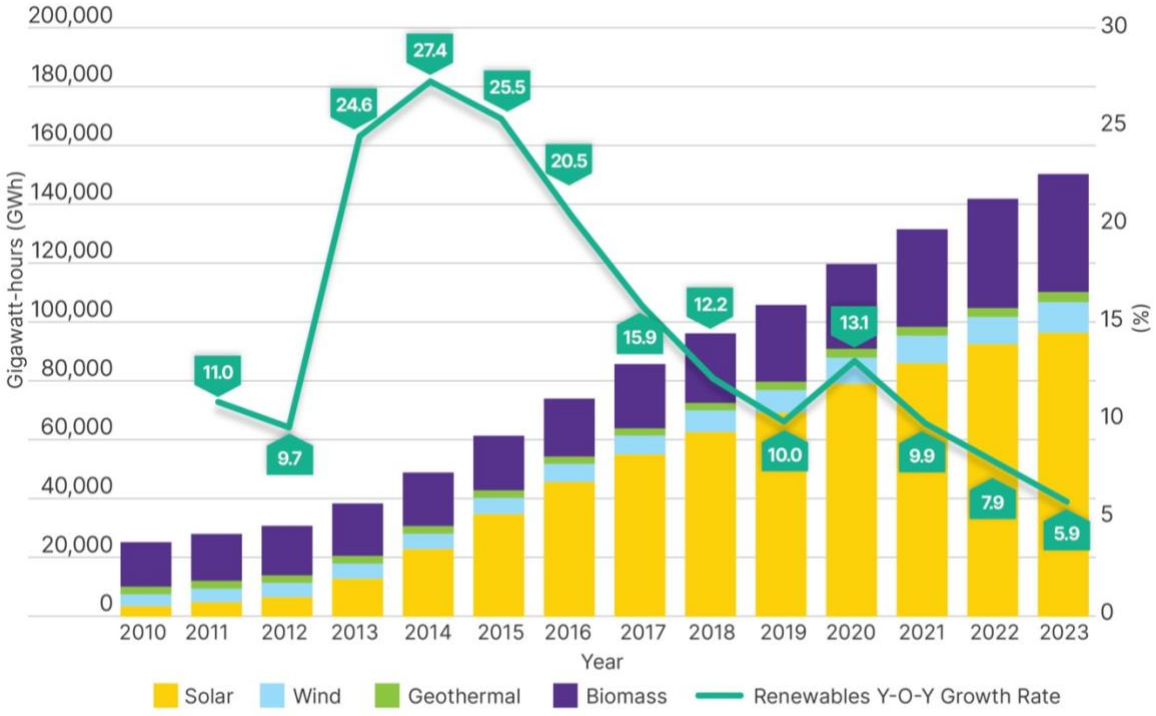
However, new installations under FIT and FIP have declined, and in 2023, renewable power generation grew by just 5.9% — the lowest annual growth rate since 2010 (Figure 3). Several factors have contributed to this slowdown. Under the FIT scheme, prices have decreased, and eligible technologies are limited, while unpredictable costs have jeopardized stable project development under the FIP system. Additionally, curtailment risk has increased significantly because of insufficient grid capacity. Consequently, revenue forecasts for new projects have become less certain.[6]

The new FIP scheme poses particular challenges for small and medium-sized enterprises (SMEs), which lack the financial resilience to withstand the fluctuating revenues from a tariff tied to the wholesale market price. Without access to grid-balancing infrastructure such as battery storage, these operators risk incurring losses even while generating electricity — reversing the logic underpinning FIT-driven investment.

[6] Japan Photovoltaic Energy Association. Issues and requests for regulatory and institutional reforms to promote the expansion of solar power generation. 22 March 2024. Page 16.

The financial strain is evident. In FY2024, Japan saw a record 52 renewable energy project developers exit the market — including eight bankruptcies with liabilities over JPY10 million, double the number recorded in the previous year.[7]

Figure 3: Renewables Generation and Year-over-year Growth Rate in Japan



Note: Renewables generation excludes hydro power generation.
Source: Agency for Natural Resources and Energy.

The 7th Strategic Energy Plan

Every three to four years, the Japanese government updates its Strategic Energy Plan (SEP), a key policy document that guides the long-term development of the country's energy sector. The latest plan, the 7th SEP, was finalized in February 2025. It aims for a power generation mix in 2040 that consists of 40%–50% renewable energy (including hydropower), 30%–40% thermal power (without specifying exact shares of coal, LNG, and oil), and 20% nuclear. Table 1 provides a breakdown of planned renewable technologies.

[7] Teikoku Databank. 「発電所」の倒産・休廃業解散動向（2024 年度). 06 May 2025.

Table 1: Japan's Renewable Power Generation and Targets

	FY2010	FY2023	FY2030	FY2040
Renewables (Total)	9.50%	22.90%	36-38%	40-50%
	109,100GWh	225,300GWh	336,000 -353,000GWh	440,000 - 600,000GWh
Solar	0.30%	9.80%	14-16%	23-29%
	3,500GWh	96,500GWh	129,000 -146,000GWh	253,000 -348,000GWh
Wind	0.30%	1.10%	5%	4-8%
	4,000GWh	10,500GWh	51,000GWh	44,000 -96,000GWh
Hydro	7.30%	7.60%	11%	8-10%
	83,800GWh	74,800GWh	98,000GWh	88,000 -120,000GWh
Geothermal	0.20%	0.30%	1%	1-2%
	2,600GWh	3,400GWh	11,000GWh	11,000-24,000 GWh
Biomass	1.30%	4.10%	5%	5-6%
	15,200GWh	40,100GWh	47,000GWh	55,000-72,000 GWh

Note: Total projected power generation for 2030 under the 6th Strategic Energy Plan (SEP) is 934,000 gigawatt-hours (GWh) and for 2040, under the 7th SEP, is 1,100,000GWh to 1,200,000GWh.
Source: Agency for Natural Resources and Energy; Ministry of Economy, Trade and Industry.

These targets do not meet Japan's international commitments. At the G7 summit in 2023, Japan formally pledged to achieve a "fully or predominantly decarbonized power sector by 2035".[8] However, the SEP still envisions up to a 40% share of fossil fuels by 2040. During the 28th Conference of the Parties (COP), Japan committed to tripling its renewable energy capacity, alongside 132 other countries. While the SEP contains some capacity targets for new renewables technologies — including 20GW of next-generation solar and 30GW to 40GW of offshore wind by 2040 — it does not specify overall renewable energy targets.

Additionally, the 7th SEP contains a contingency in case of slow renewables deployment. In this scenario, renewables could fall below the 40% share targeted by 2040, while the fossil fuel share could remain higher. The inclusion of this contingency reflects the sentiment that renewables may be insufficient for energy reliability and price reductions.[9, 10]

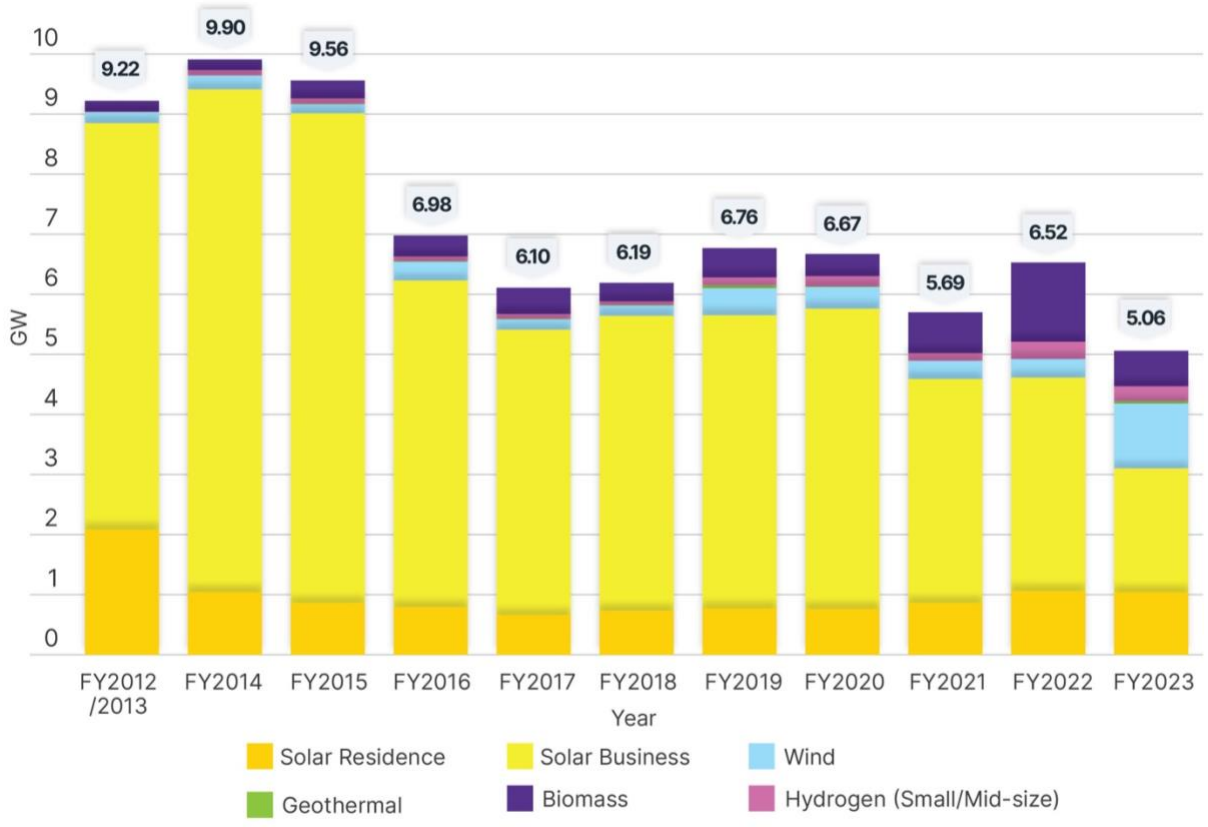
[8] G7 Ministers' Meeting on Climate, Energy and Environment. G7 Climate, Energy and Environment Ministers' Communique. 16 April 2023.
[9] Institute for Global Environmental Strategies (IGES). IGES 1.5°C Roadmap: An action plan for Japan - more ambitious emissions reduction and a prosperous, vibrant society. December 2023.
[10] Climate Integrate. Decarbonizing Japan's Electricity System – Policy Change to Trigger a Shift. 01 March 2023.

Solar Power

Solar power remains the primary driver of Japan's renewable expansion. In 2023, solar PV generated nearly 30 times more electricity than in 2010, accounting for 9.8% of the total electricity output.[11] Yet, growth has slowed. Annual capacity additions under the FIT and FIP schemes fell from a peak of 9.4GW in FY2014 to 3.1GW in FY2023, a 33% drop from the previous year (Figure 4).

To meet the 2030 target of 14%–16% solar generation (Table 1), an average growth of between 4.2%–6.1% and an additional 25GW–38GW of capacity will be needed, based on calculations by the Institute for Energy Economics and Financial Analysis (IEEFA). To achieve carbon neutrality by 2050, Japan would need about 400GW of solar capacity — more than five times the current level.[12]

Figure 4: Annual Installed Capacity of Renewable Energy Approved by Feed-in Tariff (FIT)



Source: Ministry of Economy, Trade and Industry.

[11] Agency for Natural Resources and Energy. Energy Supply and Demand Results for Fiscal Year 2023. 22 November 2024. Page 5.
[12] Japan Photovoltaic Energy Association. PV OUTLOOK 2050. Revised on 23 January 2024.

Wind Power

Wind power generation rose from 4,016 gigawatt-hours (GWh) in FY2010 to 10,492GWh in FY2023, increasing its share from 0.3% to 1.1%.[13] In FY2023, output grew 12.9% boosted by two new wind projects. However, this pace remains inadequate. Meeting the 2030 target of 5% (about 51,000GWh) requires an average annual growth of at least 25.3% — more than double the 2023 rate. Even if all 19GW of FIT-certified wind capacity becomes operational by 2030, output would reach only 31,643GWh. The actual installed capacity currently in operation is 6.3GW, including the capacity predating the FIT and FIP schemes.[14]

Japan has substantial offshore wind resources[15], with the potential to become a primary power source. However, the country had only 0.3GW operating as of December 2024. In the Vision for Offshore Wind Power Industry report released in 2020, the Japanese government set clear goals to foster a domestic supply chain, promote regional revitalization, and expand deployment with 5.7GW in operation by 2030, around 10GW by 2030, and 30GW–45GW by 2040.[16] This plan has yet to materialize and progress remains slow, a gap implicitly acknowledged in the latest report's emphasis on Exclusive Economic Zone (EEZ) floating offshore wind deployment.[17]

Japan introduced an auction system under the Offshore Renewable Energy Act in 2018 to promote cost efficiency and fair competition. The first round, using the FIT scheme, was completed in December 2021. The government then adopted the FIP scheme from the second round to support offshore wind commercialization and enhance market integration.[18] As of June 2025, three auction rounds have been conducted, awarding 5.1GW of projects. Of this, 4.6GW were chosen through auctions (1.7GW under FIT and 2.9GW under FIP), while 0.5GW was selected through other processes. These projects are expected to come online between 2026 and 2030 (Table 2).

[13] Agency for Natural Resources and Energy. Energy Supply and Demand Results for Fiscal Year 2023. 22 November 2024. Page 5.
[14] Agency for Natural Resources and Energy. The current state of renewable energy in Japan and overseas. October 2024.
[15] Zero Carbon Analytics. Offshore wind in Japan: the untapped potential. 01 June 2023.
[16] 洋上風力の産業競争力強化に向けた官民協議会. 洋上風力産業ビジョン. 15 December 2020.
[17] 洋上風力の産業競争力強化に向けた官民協議会. 洋上風力産業ビジョン（第２次）. 08 August 2025.
[18] 調達価格等算定委員会. 令和４年度以降の調達価格等に関する意見. 04 February 2022. Page 40.

Table 2: Japan's Offshore Wind Auctions Results

Round	Project	Prefecture	Capacity	FIT/ FIP	Price JPY/kWh	Winner (planned turbines)	Committed Operation Date
1	Noshiro-Mitane-Oga	Akita	494 MW	FIT	13.26	Mitsubishi-led consortium (38 × GE 12.6 MW turbines)	Dec-28
	Yuri Honjo	Akita	845 MW	FIT	11.99	Mitsubishi-led consortium (65 × GE 12.6 MW turbines)	Dec-30
	Choshi	Chiba	403MW	FIT	16.49	Mitsubishi-led consortium (31 × GE 12.6 MW turbines)	Sep-28
	Goto (floating)	Nagasaki	17MW	FIT	36.00 (fixed)	Toda Construction/ENEOS/ Osaka Gas/ Kansai Electric/ INPEX/ Chubu Electric	Jan 2026 (Extended from the original plan Jan 2024)
2	Happo- Noshiro	Akita	360MW	FIP	3	ENEOS/Iberdorola/Tohoku Electric (25x Vestas 15MW turbines)	Jun-29
	Oga-Katagami-Akita	Akita	315MW	FIP	3	JERA/J-POWER/Itochu/Tohoku Electric (21 x Vestas 15MW turbines)	Jun-28
	Murakami-Tainai	Niigata	684MW	FIP	3	Mitsui/RWE/Osaka Gas (38 x GE 18MW turbines)	Jun-29
	Saikai-Enoshima	Nagasaki	420MW	FIP	22.18	Sumitomo/TEPCO (28 x Vestas 15MW turbines)	Aug-29
3	Sea of Japan (South)	Aomori	600MW	FIP	3	JERA/Green Power Investment(GPI)/Tohoku Electric (41 × Siemens Gamesa 15MW turbines)	Jun-30
	Yusa	Yamagata	450MW	FIP	3	Marubeni /KEPCO/BP/Tokyo Gas/ Marutaka (30 × Siemens Gamesa 15MW turbines)	Jun-30

Source: Agency for Natural Resources and Energy.

Bottlenecks and Challenges in Japan's Renewable Energy Development

The recent slowdown in Japan's renewable energy expansion is attributable to institutional, technical, and local challenges. After switching from a FIT regime to a FIP scheme, solar PV and wind projects have faced grid connection constraints, output curtailments, transmission connection cost-sharing issues, and land use planning challenges.

Contributing factors include political and corporate reluctance to transition to renewables and limited use of relevant policies. Technical and infrastructure constraints causing curtailment, and geographic discrepancies between renewable development costs and benefits, create additional obstacles.

This section will explore the following challenges:

1. Reluctance of electric utilities toward renewable energy investment
2. Underutilization of Non-Fossil Certificates (NFCs)
3. Grid connection constraints and output curtailment
4. Lack of financial and regulatory transmission frameworks
5. Urban versus rural renewable energy development

Reluctance of Electric Utilities Toward Renewable Energy Investment

Major utilities in Japan have been slow to invest substantially in proven renewable energy technologies like wind and solar, and legal obligations requiring procurement are currently limited.

Japan's Energy Supply Structure Advancement Act directs electricity retailers selling over 500GWh annually to ensure that 44% of their supply in 2030 is sourced from non-fossil sources (nuclear and renewables).[19] This requirement aimed to align clean energy investment by utilities with the 4th SEP from 2014.[20, 21, 22] However, it lacks penalties for insufficient clean energy procurement.

The Electric Power Industry for a Low Carbon Society Council adopted a voluntary emissions reduction goal for utilities, aiming to limit average greenhouse gas emissions to 0.25 kilograms of

[19] Ministry of Environment. Measures to combat global warming in the electric power industry. 09 February 2018. Page 2.
[20] Ministry of Economics, Trade and Industry. Long-term Energy Supply and Demand Outlook. July 2015.
[21] Agency for Natural Resources and Energy. 高度化法の中間目標について. 26 August 2022. Page 19.
[22] E-Gov. The Energy Supply Structure Advanced Act. 01 April 2016.

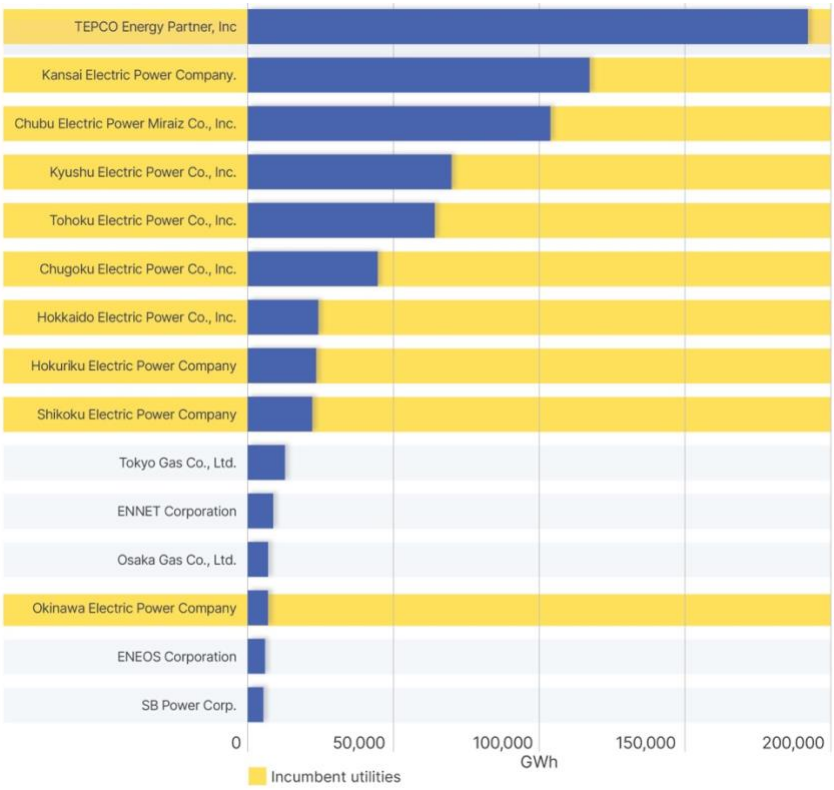
carbon dioxide equivalent per kilowatt-hour (kg CO_2/kWh) or less by 2030.[23] As of FY2023, the emissions intensity was 0.422kg CO_2/kWh[24], which is higher than the 2030 target.

Retailers can meet the 44% target by:

1. Increasing their own renewable or nuclear power generation
2. Purchasing electricity with NFCs from other generators

In FY2023, 69 electricity retailers sold over 500GWh. The top nine were dominated by incumbent utilities[25], excluding Okinawa Electric Power (Figure 5). These utilities were subject to the 44% non-fossil fuel obligation stipulated under the Energy Supply Structure Advancement Act.

Figure 5: Japan's Top 15 Electricity Retailers Exceed 500GWh Sales (2023)

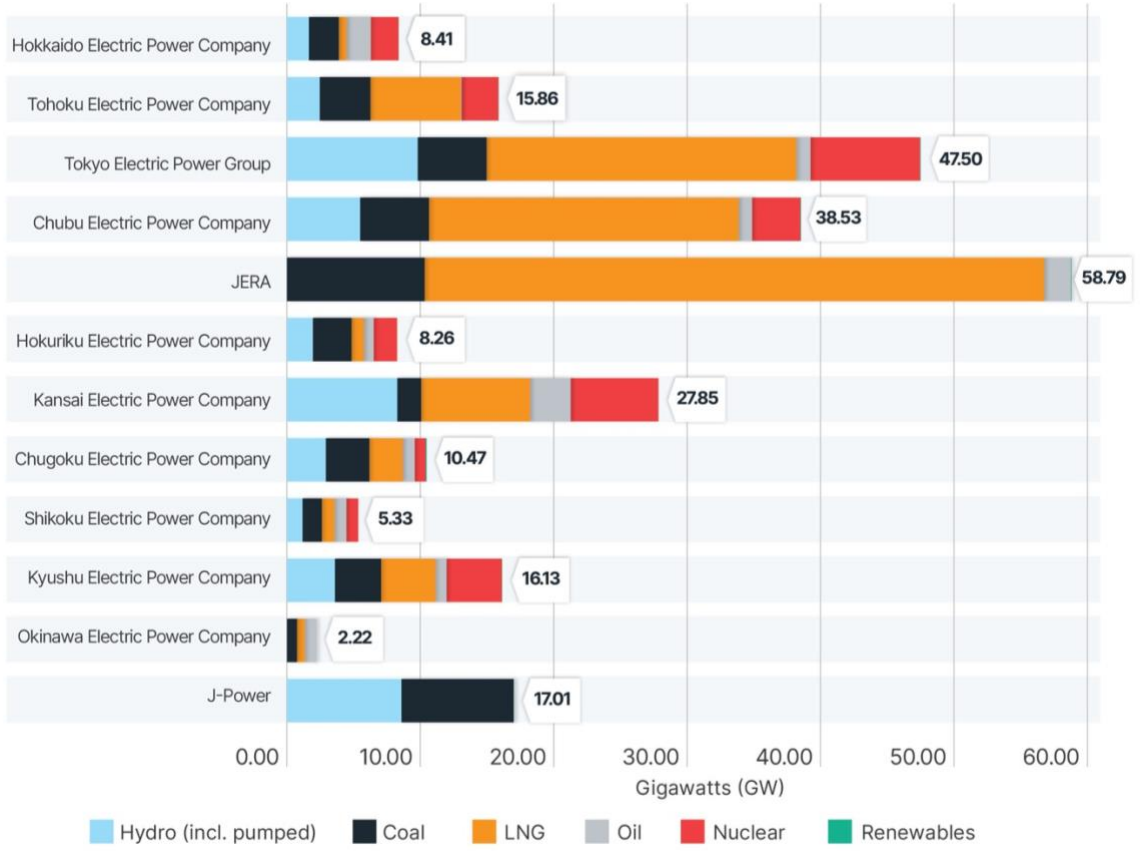


Note: Tokyo Electric Energy Partner is a retail company of Tokyo Electric Power Company Holdings (TEPCO). Chubu Electric Power Miraiz is a retail company of Chubu Electric Power Company Group.
Source: The Energy Information Center.

[23] The Federation of Electric Power Companies of Japan. 電気事業におけるカーボンニュートラル行動計画.
[24] The Electric Power Council for a Low-Carbon Society. 2023 年度 CO2 排出実績（確報値）について. 16 April 2025.
[25] Japan's 10 incumbent utilities are: Hokkaido Electric Power Company, Tohoku Electric Power Company, Tokyo Electric Power Company (TEPCO), Hokuriku Electric Power Company, Chubu Electric Power Company, Kansai Electric Power Company (KEPCO), Chugoku Electric Power Company, Shikoku Electric Power Company, Kyushu Electric Power Company, Okinawa Electric Power Company.

However, major utilities, including J-POWER and JERA, have made little progress expanding their renewable capacity, despite holding approximately 75% of Japan's total installed capacity (267GW).[26] Fossil fuels still dominate their portfolios, and renewables currently account for only around 0.3% of total capacity (Figure 6).[27]

Figure 6: Installed Power Capacity (Maximum Power Output) of Japan's Electric Companies



Note: Data as of February 2025. Renewables include solar, wind, geothermal, and exclude biomass, disposal, and battery. Since TEPCO and Chubu Electric Power integrated their thermal power operations into JERA, they no longer own thermal power facilities themselves. Therefore, JERA's thermal power generation capacity is allocated based on the shareholding ratio — 50% TEPCO Holdings and 50% Chubu Electric Power — while the power generation facilities of TEPCO Renewable Power are consolidated under TEPCO Holdings.
Source: Agency for Natural Resources and Energy.

The largest electricity provider in Japan, Tokyo Electric Power Company (TEPCO), holds just 51 megawatts (MW) of solar and wind power[28], a mere 0.01% of its total capacity (Figure 6). TEPCO plans to develop 600MW–700MW of new renewable power by 2030. However, only about 200MW–300MW would be located in Japan (mainly as offshore wind). 400MW–600MW would be added

[26] Agency for Natural Resources and Energy. 電力調査統計. As of February 2025.
[27] Agency for Natural Resources and Energy. 電力調査統計. As of February 2025. Renewables do not include hydropower.
[28] TEPCO. Annual Report 2024. 2024. Page 97.

through overseas projects involving hydro and offshore wind development.[29] Even if the utility achieves the domestic maximum target of 300MW, the share of renewables in its power mix would increase to only around 6.5%.

Similarly, JERA — Japan's largest thermal power operator, providing 21.6% of national capacity — aims to develop 20,000MW of offshore wind and solar power by 2035 in domestic and overseas markets.[30] However, as of February 2025, its domestic renewable capacity remains only 27.9MW[31] — barely 0.05% of its total output.

Underutilization of Non-Fossil Certificates (NFCs)

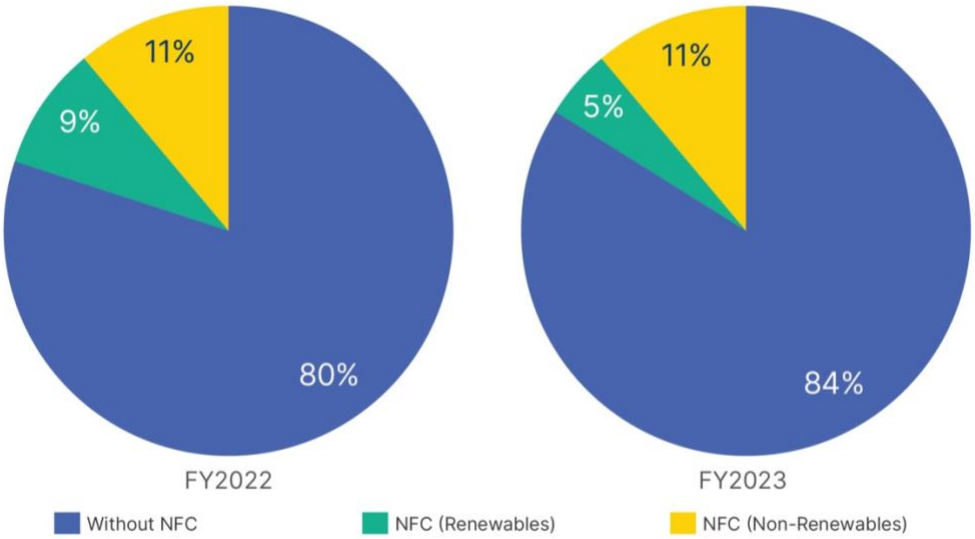
In addition to directly owning renewable energy generation facilities, utilities can meet government targets by purchasing "non-fossil power" certificates. These tradeable certificates represent the environmental value (the zero-carbon dioxide [CO_2] emission attribute) of electricity generated from non-fossil sources, such as renewables and nuclear power.[32] They allow companies to claim non-fossil power use without physical ownership.

In 2018, the Japanese government launched a 'non-fossil value trading market' at the Japan Electric Power Exchange (JEPX) to trade the cost of non-fossil power.[33] Non-fossil generators receive NFCs for each kilowatt-hour (kWh) of electricity generated.[34] Retail electricity suppliers can purchase these certificates to help meet the 44% non-fossil target by 2030. NFCs are categorized as renewable — derived from wind, solar, hydro, and biomass — or non-renewable, primarily from nuclear. However, major utilities have underutilized the NFC scheme.

For example, TEPCO aimed to increase its NFC use to 17.82% in FY2023.[35] However, its actual utilization reached only 16% (Figure 7), falling short of its internal target and down from 20% in FY2022.[36] Of this 16%, only 5% was attributable to renewable-designated NFCs, while the remaining was from the non-renewable category.

[29] TEPCO. Annual Report 2023. 2023. Page 78.
[30] JERA. Growth strategy towards realization of 2035 Vision. 17 May 2024.
[31] Agency for Natural Resources and Energy. 電力調査統計.
[32] Japan Electric Power Exchange (JEPX). Non-Fossil Value Trading Market Rules, Article 10. Page 2.
[33] The Energy Information Center. Non-fossil value trading market.
[34] Japan Electric Power Exchange (JEPX). Non-Fossil Value Trading Market Rules, Article 11. Page 3.
[35] TEPCO Energy Partner. 他社購入・販売電力料. 04 April 2023. Page 6.
[36] TEPCO Energy Partner. 他社購入・販売電力料. 04 April 2023. Page 6.

Figure 7: TEPCO's Use of Non-Fossil Fuel Certificates (NFCs)



Note: NFC (renewables) includes hydropower, renewables terminated FIT scheme, and biomass. NFC (non-renewables) includes nuclear and waste power.
Source: TEPCO Energy Partner.

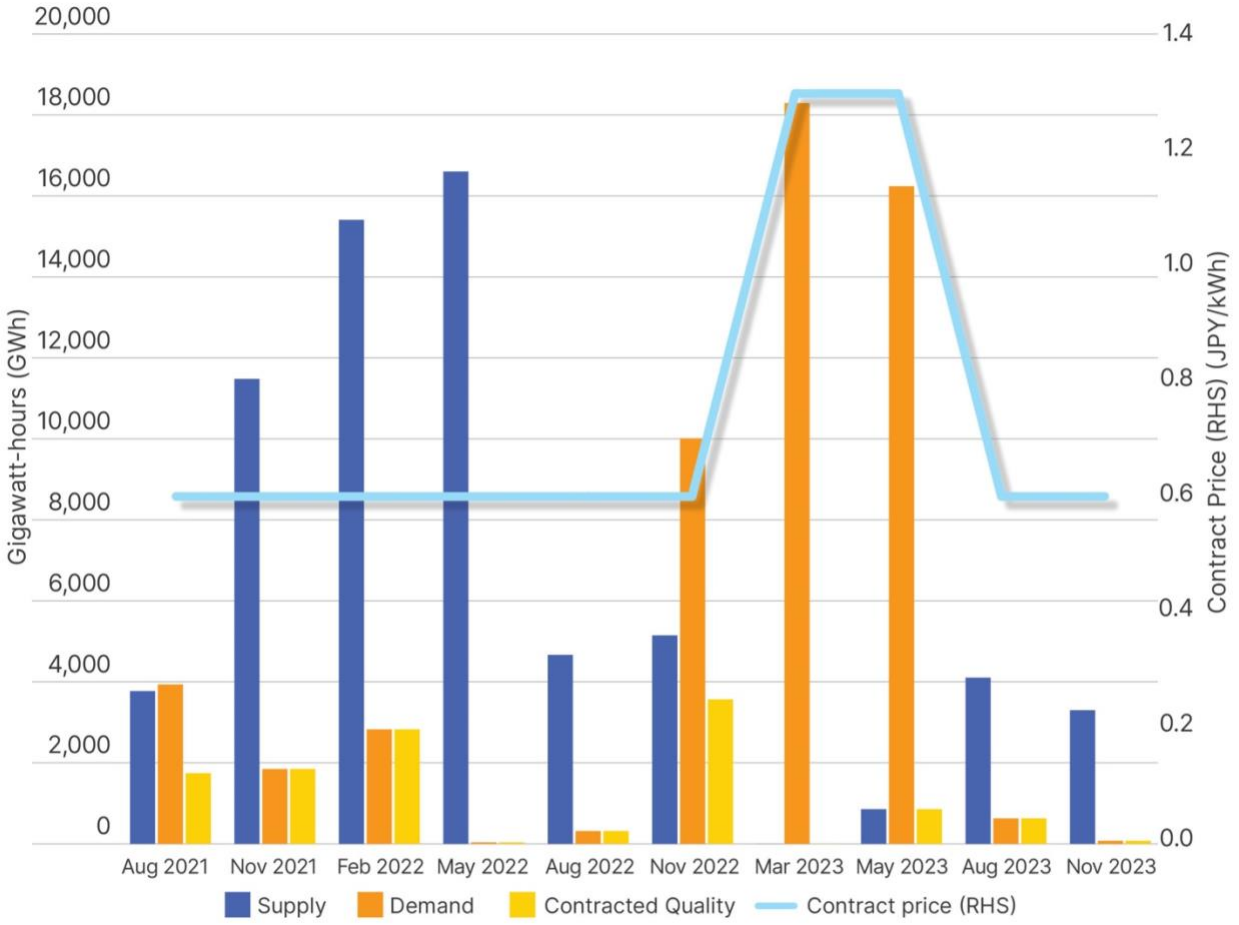
This decrease in utilization rate may have resulted from the surge in contract prices caused by the supply-demand balance. The supply of non-FIT renewable energy remained limited, and demand far exceeded supply in the auctions held in February and May 2023. In 2021 and 2022, the contract price was JPY0.6/kWh, but doubled in the two auctions in 2023, increasing to JPY1.3/kWh.

Based on TEPCO's electricity sales volume for FY2023 (228.7 billion kWh[37]) and the insufficient non-fossil fuel power generation ratio (32%), the maximum procurement cost would be JPY9.56 trillion. Comparatively, Tokyo Renewable Power, a TEPCO subsidiary that handles renewable energy operations, had an equipment investment cost of JPY38.7 billion in 2023.

If NFCs covered the shortfall, the cost would be 25 times higher. Due to the reduced auction volumes caused by supply shortages, the stipulated prices surged. Power companies may have reduced NFC purchases to avoid high procurement costs, especially since there are no penalties for non-compliance.

[37] TEPCO. 2023 年度報告書. 24 May 2024. Page 1.

Figure 8: Auction Results of Non-Fossil Fuel Certificates (Non-FIT and Renewables)



Source: Japan Electric Power Exchange.

Other major utilities have also underutilized NFCs. Kansai Electric, the second-largest electricity retailer, used 20.7% NFCs in FY2024, with only 4.7% classified as renewable.[38] Chubu Electric, ranked third, used an even lower 16% in FY2023 (3% renewable, 13% non-renewable).[39] Similarly, Kyushu Electric, the fourth-largest utility, relied less on fossil fuels due to nuclear power constituting about 40% of its energy mix. It reported a 19% NFC utilization rate in FY2023 (6% renewable, 13% non-renewable)[40], which increased slightly to 22% in FY2024 (8% renewable, 14% non-renewable).[41]

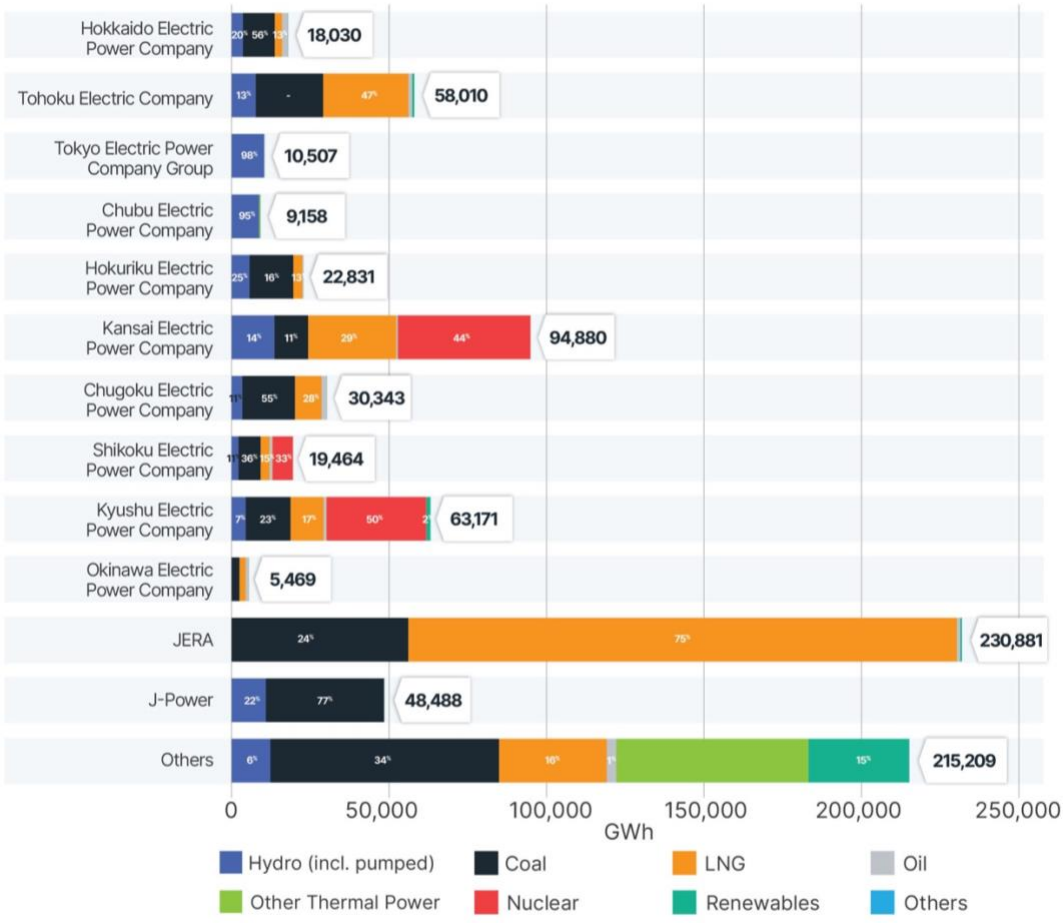
Despite the growing importance of NFCs under the 44% obligation, large utilities continue to purchase relatively few certificates, and transparency around attributes (such as origin and

[38] The Kansai Electric Power Co., Inc. 当社の電源構成比・非化石証書使用状況【２０２４年度実績】.
[39] Chubu Electric Power Miraiz Co., Inc. 当社の電源構成および非化石証書の使用状況（2023 年度実績値）.
[40] Kyushu Electric Power Co. Inc. 当社の非化石証書使用状況（2023 年度実績）.
[41] Kyushu Electric Power Co. Inc. 当社の非化石証書使用状況（2024 年度実績）.

technology type) remains limited. While Japan's Agency for Natural Resources and Energy (ANRE) administers the scheme, non-compliance carries no financial penalties. Instead, the Ministry of Economy, Trade and Industry (METI) may issue recommendations, guidance, or orders to retailers that fail to meet targets. In recent years, METI has notified underperforming entities, highlighting the gap between legal obligations and practical enforcement.

Power generation also reflects this trend of limited NFC utilization and persistent reliance on fossil fuels. In FY2023, major electric utility groups were responsible for about 74% of Japan's total electricity generation, with the remaining 26% provided by other power producers. Among the major utilities, fossil fuels accounted for 40% to 100% of the electricity mix, while renewables comprised only 0% to 2% (Figure 9).

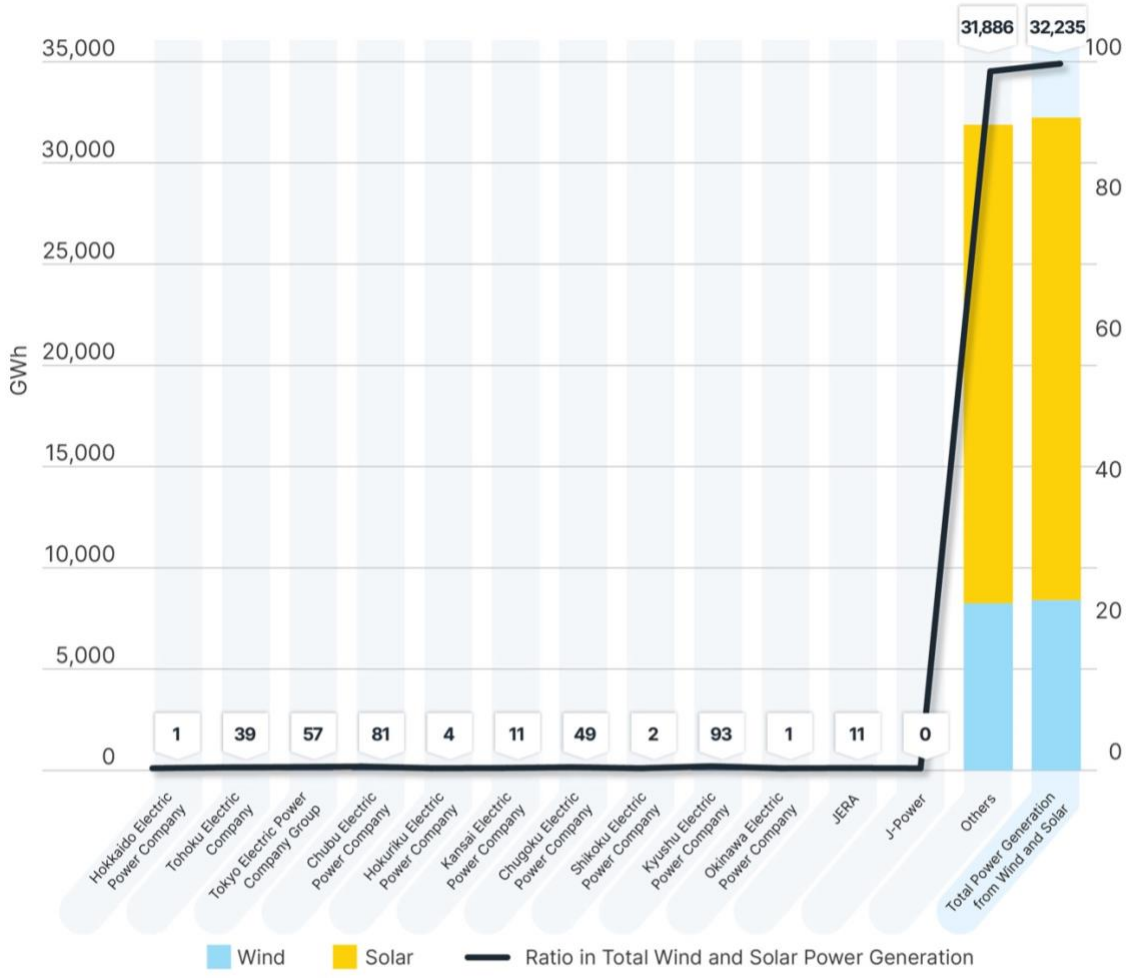
Figure 9: Power Generation by Major Power Companies versus Others (2023)



Note: Renewables include wind, solar, geothermal and battery energy storage systems.
Source: Agency For Natural Resource and Energy.

Conversely, new power companies have actively invested in solar and wind, accounting for 24.9% of the country's total capacity[42] and generating approximately 15% of total electricity output and 93% of total renewable energy power. Notably, when focusing on solar and wind generation, these non-major power producers generate nearly 99% of the electricity (Figure 10), highlighting the critical role of independent and smaller entities in driving Japan's renewable energy deployment. These companies tend to be smaller, more agile, and structurally incentivized to pursue decentralized renewable projects that offer quick returns under schemes like FIT and FIP. In fact, for many new entrants, renewable energy is the only viable market entry point, as high capital costs and regulatory challenges make fossil fuel-based generation inaccessible.

Figure 10: Wind and Solar Power Generation by Top 12 Electric Companies and Others (2023)



Source: Agency For Natural Resource and Energy.

[42] Agency for Natural Resources and Energy. 電力調査統計. 1-(1) 電気事業者の発電所数、出力. As of February 2025.

Incumbent utilities remain heavily invested in fossil fuels and have made limited progress in increasing non-fossil power. A significant share of the electricity supplied is often sourced from their own thermal power plants, making it financially challenging to increase renewable procurement without reducing output from existing fossil fuel assets.

Although the law mandates a 44% share of non-fossil power sources by 2030, enforcement mechanisms remain weak, and NFCs remain underutilized. Domestic investment in renewables also remains limited, as many utilities continue prioritizing renewable energy development overseas, where profitability is higher and policy frameworks are more stable.

New entrants alone cannot achieve Japan's national climate and energy goals. Accelerated investments and structural reforms from incumbent utilities are needed to meet the country's 2030 targets. Delays in domestic decarbonization hinder the clean energy transition, threaten industrial competitiveness, increase electricity costs, and exacerbate energy security risks. While international expansion is a valid business strategy, Japan's major utilities should advance the domestic renewable transition.

Grid Connection Constraints and Output Curtailment

Grid connection difficulties and output curtailment are two of Japan's most significant barriers to renewable energy development. These constraints are particularly acute in regions like Kyushu and Hokkaido, where natural renewable resources are abundant but infrastructure, market design, and institutional rules have lagged. This section explores how these challenges intersect, presenting physical limits and structural inefficiencies, supported by recent data and regional case studies.

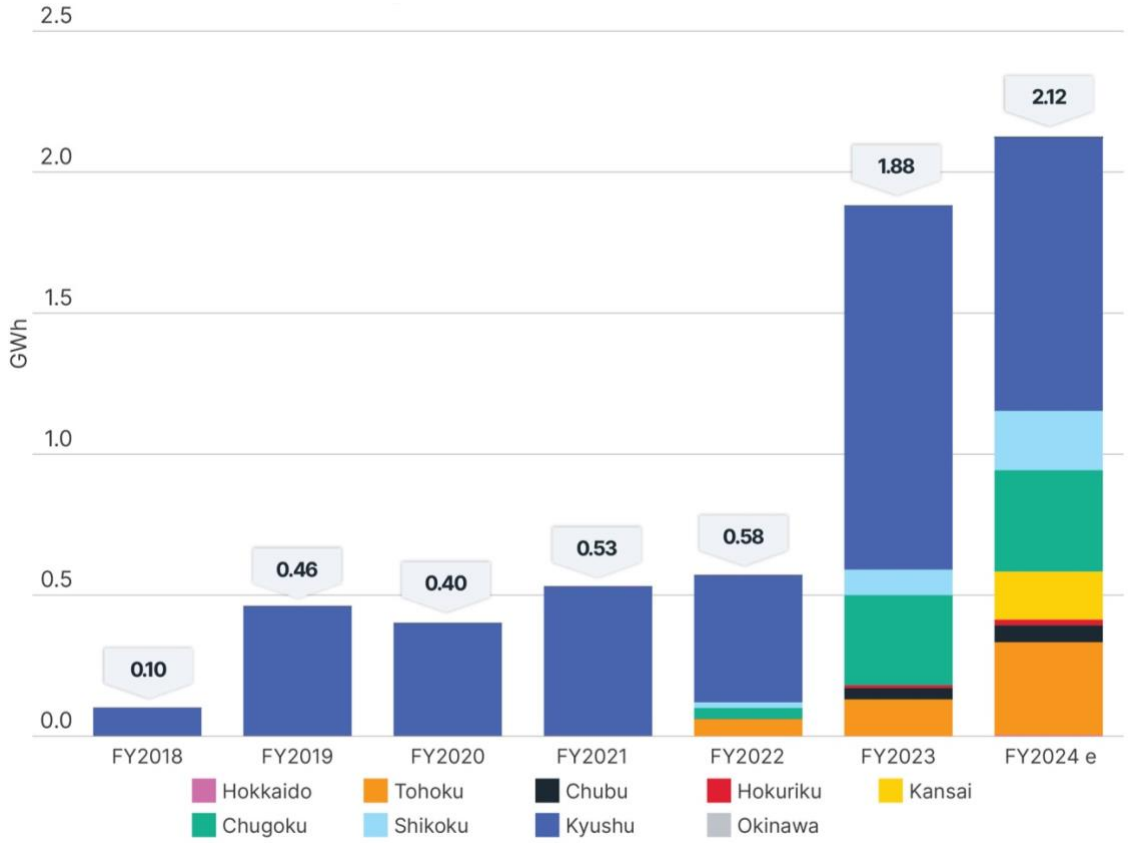
The Japanese government introduced the "Connect & Manage" policy in FY2021 to expand renewable energy integration. This strategy allows conditional grid access, stipulating that output may be curtailed during periods of grid congestion. While the policy has facilitated more renewable project connections, it has also significantly increased the number of restricted generators due to insufficient grid support and expansion. In FY2023, total curtailed electricity reached a record high of 1.88GWh (Figure 11).

Initially limited to the Kyushu area, curtailment became a nationwide issue by FY2023, affecting all regions except Tokyo. In Kyushu, where curtailment has persisted since FY2018, solar and wind power experienced more than 408 curtailment events in FY2023 and around 246 in FY2024.[43] The annual curtailment rate reached 8.3% (equivalent to 12.9 terawatt-hours [TWh]), nearly triple the 3% rate recorded the previous year.[44] The Kyushu Electric Power Transmission and Distribution

[43] Kyushu Electric Power Company. 再エネ事業者様の制御回数実績 (2018 年度～2024 年度). Accessed on: 21 June 2025.
[44] Agency For Natural Resources and Energy. 再生可能エネルギーの出力制御の抑制に向けた取組等について. 18 September 2024.

Company estimates that the curtailment rate for FY2025 remains high at 6.1%[45], far above the 1.5%–4% range in other markets.[46]

Figure 11: Total Curtailed Electricity from Solar and Wind in Japan (2018–2024)



Note: The numbers in FY2024 are based on 10 regional transmission and distribution companies' estimations.
Source: Agency for Natural Resources and Energy.

High curtailment has created a gap between capacity expansion and actual generation. In Kumamoto Prefecture, solar capacity increased by 102% over four years, but generation rose by only 57%. In Miyazaki, wind capacity expanded by 405%, while output increased just 50%, and solar capacity grew by 80% with only a 31% gain in generation.[47]

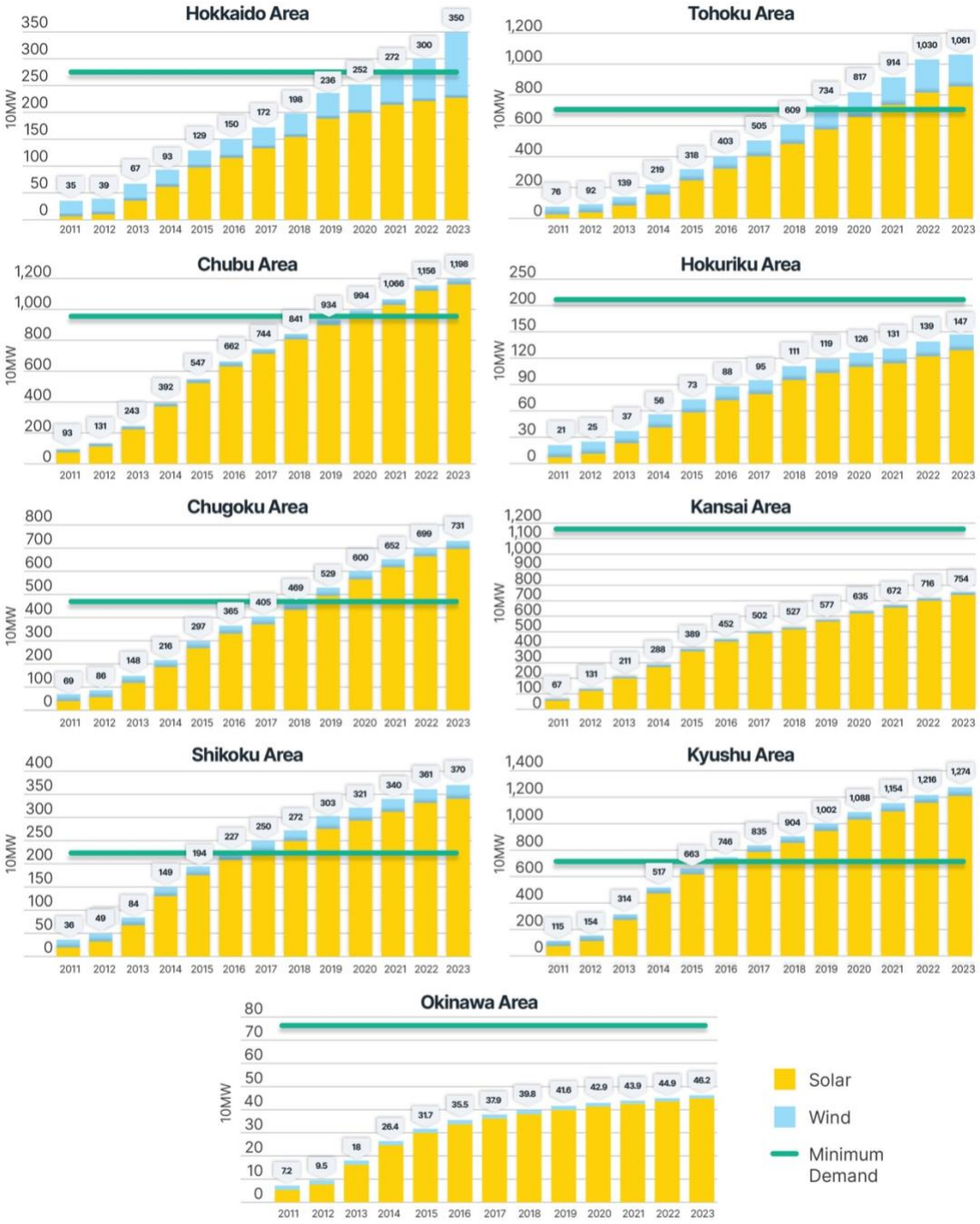
Limited interregional transmission capacity is a significant factor for this trend. Kyushu, which has Japan's highest solar power installation rate, generates more electricity than the region needs and is a supplier for high power demand areas such as Kansai (Figure 12). Its solar capacity exceeded

[45] Kyushu Electric Power Transmission and Distribution Co. 2025 年度出力抑制見通しについて. 23 January 2025.
[46] IEA. Renewable Energy Market Update - June 2023.
[47] Calculated by IEEFA based on the data from the Agency for Natural Resources and Energy. 電力調査統計

12.8GW as of September 2024[48], but transmission capacity to Honshu was restricted to 2.78GW[49] (Figure 13). Moreover, Kyushu is connected only to the Chugoku region. When Chugoku restricts output, Kyushu cannot export surplus electricity, making curtailment unavoidable.

[48] Kyushu Electric Power Transmission and Distribution Co. 2025 年度出力抑制見通しについて. 23 January 2025
[49] OCCTO Secretariat. 中西地域の広域連系系統に係る計画策定プロセス. 08 May 2024

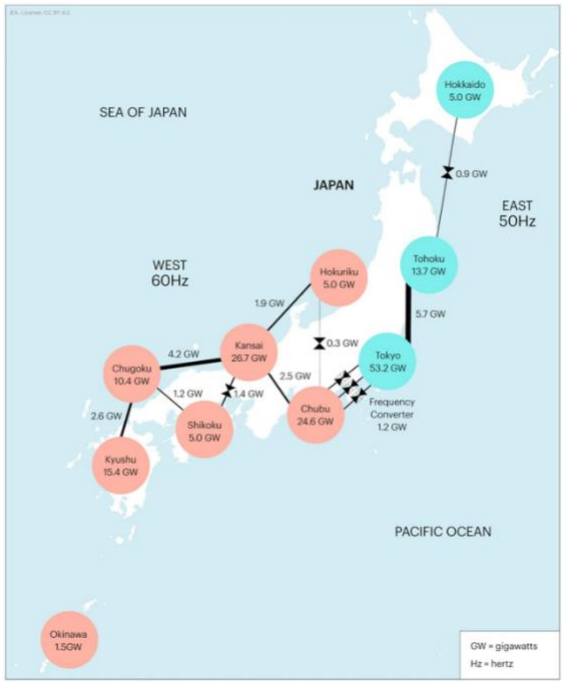
Figure 12: Installed Solar and Wind Capacity by Region



Note: Minimum Demand refers to the demand on the day when the percentage of variable renewable energy (i.e., (solar + wind) / demand) accounts for the largest share of demand during the holidays from April to 7 May 2023 (including Golden Week). For the Okinawa area, this is March.

Source: Transmission and Distribution Companies: Hokkaido Electric Power Network, Tohoku Power Electric Network, Chubu Electric Power Grid, Hokuriku Electric Power Transmission & Distribution Company, Chugoku Electric Power Transmission & Distribution Co., Inc., Kansai Transmission and Distribution, Inc., Shikoku Electric Power Transmission and Distribution Co., Ltd., Kyushu Electric Power, Okinawa Electric Power.

Figure 13: Interregional Transmission Grid Capacity in Japan



Source: IEA as of 2022.

Further complications arise from prioritizing nuclear power in Japan's output control rules. Under the current system, when supply exceeds demand, nuclear output is maintained while solar and wind are curtailed. Kyushu is the only region in Japan that has restarted all four of its commercial nuclear power plants. The operation of Genkai Nuclear Power Plant Units 3 and 4 (1.18GW each) and Sendai Units 1 and 2 (890MW each) increased the Kyushu Electric Power Company's nuclear share to 39% of total power generation in FY2023[50], up from 23% in FY2022.[51] Meanwhile, the share of renewables remained at just 4% in both years, exacerbating curtailment.

Although fossil fuel generation, such as LNG and coal, is also reduced when supply exceeds demand, thermal plants typically reduce output to only 30%–50% of capacity[52], while renewable generation is curtailed completely. Consequently, fossil generation continues to operate and occupy grid capacity, limiting the system's ability to integrate more renewables.

The restart of nuclear reactors in the Kansai area, which has the highest power demand in western Japan, had similar effects. Kansai Electric Power Company's nuclear share rose from 31% in FY2022[53] to 44.4% in FY2023[54], increasing regional self-sufficiency and reducing the need for

[50] Kyushu Electric Power Company. 当社の電源構成 (2023 年度実績)
[51] Kyushu Electric Power Company. 当社の電源構成（2022 年度実績）
[52] Agency for Natural Resources and Energy. 再生可能エネルギーの出力制御の抑制に向けた取組等について. 11 March 2024. Pages 20-21.
[53] Kansai Electric Power Company. 2022 年度決算説明資料. 05 April 2023. Page 20.
[54] Kansai Electric Power Company. POWER BOOK 2024. Page 11.

electricity imports. As a result, the Shikoku and Chugoku utilities, which supply electricity to the Kansai area, lost export opportunities and were forced to curtail renewable output.

To address this issue, the Japanese government has started promoting the creation of new electricity demand in geographically remote locations with abundant renewable energy resources. A key example is the effort to attract data center investments to the Kyushu and Hokkaido areas.[55] These regions generate significant solar and wind power but face limited capacity for interregional power transmission.

In 2024, METI launched a subsidy program covering up to 50% of setup costs for companies building data centers in Kyushu and Hokkaido, aiming to ease supply-demand imbalances and spread electricity demand more evenly across regions.[56] As of FY2023, Japan had 510 data centers, with over 80% located in the Tokyo metropolitan area (64%) and Osaka (24%). In contrast, Hokkaido and Kyushu — key regions for renewable energy generation — accounted for only 1% and 3% of national data center capacity, respectively.

Although the policy has triggered some interest in regional sites, most data center projects proposed since 2024 remain concentrated in Tokyo and Osaka. Regional examples include IDC Frontier's investment of more than JPY65 billion (USD420 million) in Hokkaido[57], Asia Pacific Land's JPY300 billion (USD2 billion) project in Fukuoka[58], and GCI Data Centers' planned Fukuoka facility.[59] Nevertheless, digital infrastructure remains concentrated in metropolitan regions[60], and Japan continues to face challenges in diversifying its data center locations.

The economic impact of curtailment is significant. Under the FIT scheme, where power is purchased at a fixed price, reduced generation decreases revenue. For example, a 1MW solar plant with an 8.7% curtailment rate and a sale price of JPY10/kWh would lose approximately JPY1.32 million (USD8,938) in annual revenue. In high-curtailment regions such as Kagoshima and Miyazaki, the increasing number of solar power plants listed for sale[61] suggests that profitability concerns are causing operators to exit the market.

Meanwhile, Hokkaido, which has the highest potential for solar and wind power generation[62], faces severe grid constraints even before projects are connected. Approximately 80% of high-voltage transmission lines (157 kilovolts [kV] or more) have no available capacity[63], and only 20% of the

[55] Ministry of Internal Affairs and Communications. デジタル田園都市国家インフラ整備計画（改訂版）. 25 April 2023. Page 19.
[56] Nikkei. データセンター、電力豊富な北海道と九州に　半額補助. 28 May 2023.
[57] Nikkei XTECH. ソフトバンクが地方データセンターの整備事業者に採択、経産省から 300 億円補助. 07 November 2023.
[58] Nikkei. 米 APL、福岡･糸島に 3000 億円データセンター　25 年着工. 05 December 2024.
[59] Global Compute Infrastructure. Asia Pacific Land (APL) Group and Global Compute Infrastructure (GCI) Announce Joint Venture to Develop a Data Center Campus in Kyushu, Japan. 20 January 2025.
[60] Fuji Chimera Research Institute, Inc. 国内データセンター市場における AI 需要/地方分散/再エネ電源. 30 May 2024. Page 10.
[61] Goodfellows, inc. 出力抑制で売却依頼が 2 倍で加速！太陽光発電所の売却市場データ. 03 July 2023
[62] Ministry of the Environment Government of Japan. REPOS. 再エネ導入ポテンシャル（推計値）.
[63] Hokkaido Electric Power Company. 187kV 以上系統　混雑状況マップ.

regional grid can accommodate new large-scale projects. These limitations have delayed or halted several developments, including renewable-powered data centers.[64]

Despite its extensive renewable resources, grid expansion in Hokkaido has been slow due to structural challenges. Local electricity demand is far lower than installed wind and solar power capacity (Figure 12), making large-scale grid investments economically unattractive.[65] Upgrading existing lines is often insufficient. New transmission infrastructure is needed across wider areas to support renewable energy development.[66] Addressing congestion node by node can shift bottlenecks downstream, ultimately increasing the scope and cost of reinforcement.[67]

Lack of Financial and Regulatory Transmission Frameworks

Japan lacks a robust national planning and cost-sharing system for interregional grid development. There has been limited progress in strengthening interregional transmission links between Hokkaido and consumers in Honshu, particularly in the Tokyo metropolitan area. The current interconnection capacity between the two locations is limited to 900MW, consisting of the Hakodate-Aomori (600MW) and the Shin-Hokuhon (300MW) links. Notably, the region's wind generation potential from available resources exceeds 226GW, equivalent to about two-thirds of Japan's total installed generation capacity from all sources.[68]

While Hokkaido Electric Power Company has implemented some measures, such as increasing capacity on the existing interconnection line to Honshu, the investment required outstrips the financial capacity of a single utility.

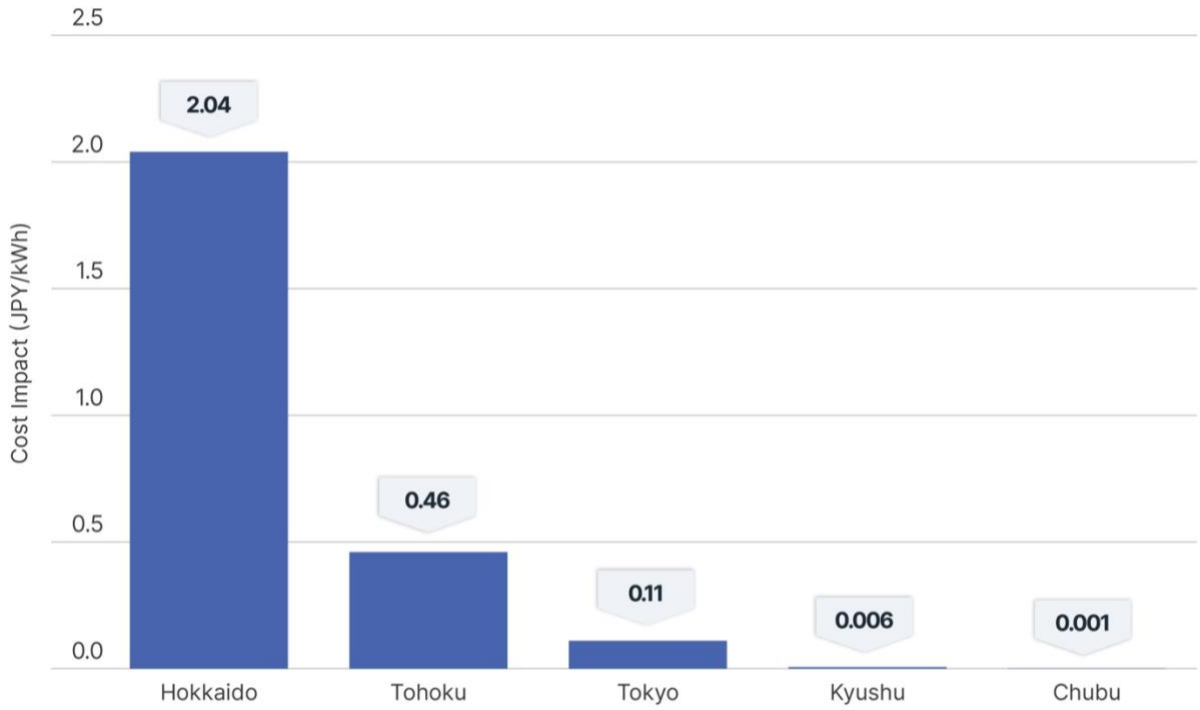
Japan's current grid cost framework creates a dual financial burden for renewable energy deployment. Power producers often bear project-specific grid upgrades required for connecting renewable energy facilities, especially in regions with limited hosting capacity. Simultaneously, transmission and distribution operators plan broader intra-regional transmission investments, such as backbone upgrades, and recover them through local transmission tariffs paid by electricity consumers.

This cost-recovery structure disproportionately burdens renewable-rich but demand-poor areas like Hokkaido. For example, the estimated cost of reinforcing Hokkaido's internal transmission network exceeds JPY1.1 trillion (approximately USD7.6 billion), far higher than in other regions[69] (Table 3). If

[64] Nikkei. 北海道、再生エネ利用データセンター集積　送電網に課題. 15 April 2025
[65] Hokkaido Prefecture. 北海道のバックアップ機能の検証. Page 4.
[66] OCCTO. 広域系統長期方針（広域連系系統のマスタープラン）＜別冊（資料編）＞. March 2023. Page 52.
[67] OCCTO. マスタープラン策定に向けた検討状況について. 01 November 2022. Page 28.
[68] Renewable Energy Institute. Japan's offshore wind power potential. November 2023.
[69] OCCTO. 広域系統長期方針（広域連系系統のマスタープラン）. 29 March 2023. Page 20. The costs in other areas to increase the existing internal network are: Tohoku Area - JPY650 billion, Tokyo Area - JPY670 billion, Chubu Area - JPY52 billion, Kyushu Area - JPY10 billion.

this cost were to be recovered over 20 years[70] through local transmission charges, Hokkaido would have the highest price of approximately JPY2.04/kWh (USD0.014/kWh) (Figure 14), highlighting the structural imbalance of the current cost allocation system.

Figure 14: Additional Electricity Price Impact of Transmission Upgrades by Region



Source: Calculated by IEEFA based on OCCTO Master Plan.

Currently, users within the same area bear the intra-regional grid investment costs, regardless of the national benefits. Therefore, Hokkaido — despite its abundant renewable energy resources — may face higher electricity prices than other regions, potentially discouraging investment by electricity-intensive industries such as data centers. Addressing this inequity through national cost-sharing mechanisms is essential to unlock Hokkaido's full renewable potential.

The Japanese government has acknowledged this structural issue and launched discussions on cost-sharing reforms. However, these remain at the consultation stage, and no concrete institutional mechanism has been implemented to redistribute the grid reinforcement burden across regions.[71] Consequently, large-scale projects in areas like Hokkaido continue to face delays.

[70] In Japan, the statutory service life for transmission infrastructure is typically 15–20 years (e.g., 20 years for overhead lines and towers, 15 years for underground cables), as defined in Appendix Table II of the Ordinance for Enforcement of the Corporation Tax Act. This is commonly used as the basis for cost recovery in the transmission tariff system.
[71] Agency for Natural Resources and Energy: 電力ネットワークの次世代化について. 23 May 2025.

National grid connection data underscores these structural barriers. In FY2023, 25,829 preliminary consultations were held between electric utilities and power generators to discuss conditions for connecting facilities to the grid. After transmission operators provide a "feasible" outcome, a more detailed grid connection study is conducted to assess scenarios and costs based on specific information about the generation facility. These connection studies have increased since FY2020, reaching 6,725 cases in FY2023. However, only 1,780 projects progressed to the formal application stage (Figure 15). The conversion rate was just 6%, and in Kyushu, it was even lower at 2.3%. These figures imply that the lack of national transmission prioritization, including capacity shortages, procedural complexity, and uncertain returns, discourages developers.

Figure 15: Consultation, Business Consideration, and Connection Application Cases (2017–2023)

Source: OCCTO.

Japan's Organization for Cross-regional Coordination of Transmission Operators (OCCTO) released a nationwide grid Master Plan in 2023 to remove bottlenecks and enhance interregional transmission. The plan outlined ten transmission reinforcement projects, including capacity expansion between Chugoku and Kansai, and a significant upgrade to the Hokkaido-Honshu and Tohoku interconnections (Table 3). The planned projects aimed to increase cross-regional transmission capacity by approximately 10GW by the early 2030s. The estimated investment cost is

around JPY2.8 trillion (USD19billion). These projects would facilitate wider renewable integration by enabling electricity transmission from regions with a surplus, like Kyushu and Hokkaido, to high-demand locations, like the Kansai and Tokyo metropolitan areas, thereby reducing curtailment.

Table 3: Projects Summary of OCCTO Master Plan

Region	Project Name	Outline	Start Period	Investment Amount (JPY)
Hokkaido	Reinforcement of regional grid	Strengthening intra-regional grid to accommodate large-scale renewables	From 2023	Approx. JPY 1.1 trillion
Tohoku–Tokyo	New HVDC interconnection line	New subsea HVDC link from Hokkaido to Tokyo with 6–8 GW capacity	Planning since July 2022, completion by FY2030	Approx. JPY 2.5–3.4 trillion
Tohoku	Reinforcement of regional grid	Grid upgrades to accommodate large-scale renewable energy	From 2023	Approx. JPY 650 billion
Tokyo	Reinforcement of regional grid	Upgrades to ensure stability and integration of renewables in metro area	From around 2023	Approx. JPY 670 billion
Chubu	(OPTION) Reinforcement of regional grid	Upgrades to support increased renewables integration	–	Approx. JPY 3 billion
Chugoku	(OPTION) Reinforcement of regional grid	Grid enhancement for renewable integration and stability	–	Approx. JPY 100 billion
Shikoku	(OPTION) Reinforcement of regional grid	Grid upgrades for renewable energy and local stability	–	Approx. JPY 160 billion
Kyushu	Reinforcement of regional grid	Network expansion for increased renewable capacity	–	Approx. JPY 10 billion
Kyushu–Shikoku	(OPTION) New interconnection line	New transmission line linking Kyushu and Shikoku	–	Approx. JPY 480–540 billion
Kyushu–Chugoku	Reinforcement of interconnection	Increased transmission capacity between Kyushu and Chugoku	(OPTION) 2.6GW→ 5.4GW	Approx. JPY 420 billion
Frequency Converter Area	New/expanded facilities + grid upgrades	Frequency converter upgrades and regional grid reinforcement	1.2 GW→ 3.9 GW	Approx. JPY 400–430 billion
Nationwide	Total Master Plan Investment	Comprehensive national grid enhancement plan including all above	Sequential from 2023	Approx. JPY 6–7 trillion

Note: Options are still at the proposal stage and should not be regarded as finalized projects.
Source: OCCTO.

However, Japan's current level of transmission investment remains below what is needed to achieve its 2040 offshore wind deployment target of 30GW–45GW. Updated estimates by OCCTO indicate that JPY6.0 trillion to JPY7.9 trillion (approximately USD45–60 billion) in nationwide transmission

upgrades are required — more than double the 2021 projections. These costs include significant interregional reinforcement, such as 6GW of new capacity from Hokkaido to Tohoku and 8GW from Tohoku to the Tokyo metropolitan area. Upgrades to Japan's east-west frequency converter systems (from 3GW to 5.7GW) are also needed.

Currently, committed investment remains low, estimated at only JPY2–3 trillion (USD13.5-20.3 billion) by the early 2030s. Ongoing upgrades include expanding the Hokkaido-Honshu high-voltage direct current (HVDC) line and a new 2.8GW link between Kyushu and Honshu. However, a multi-trillion-yen funding gap remains. Without accelerated and coordinated investment, high-quality offshore wind resources, particularly in northern Japan, risk being underutilized due to continued grid constraints.

Japan's 2023 OCCTO Master Plan aims to address this challenge through a phased, national approach to grid enhancement designed to reduce renewable curtailment (which could reach 39% in certain scenarios) and support a 47% renewable share in the power mix by 2050 (Table 4). However, achieving these targets will depend on technical planning and resolving institutional and financial bottlenecks.

Table 4: Estimated Cost of OCCTO Master Plan

Total Investment Cost	JPY 6-7 trillion
Benefit-Cost Ratio	0.7-1.5
Annual Cost	JPY 550-640 billion per year
Annual Benefit (Gross)	JPY 420-730 billion per year
Ratio of Renewables	47%
Output Curtailment	12%

Note: Base scenario.
Source: OCCTO.

Concerns are growing over the cost and feasibility of key projects, including the proposed "Sea of Japan Route" transmission line, connecting Hokkaido to Tohoku through an 800-kilometer subsea cable. With a transmission capacity of 2GW, making it the largest in Japan, the estimated cost has risen sharply due to inflation to between JPY1.5 trillion and JPY1.8 trillion (approximately USD9.7–11.6 billion). A consortium of four regional utilities, namely Hokkaido Electric Power, Tohoku Electric Power, TEPCO Power Grid Company, and Chubu Electric Power, has led project development. The group cautioned that rising costs and extended timelines could prompt withdrawals unless the government establishes risk-sharing mechanisms.[72]

[72] Nikkei. 送電網計画、東電などが異例の撤退示唆　再エネ普及に壁. 16 January 2025.

This hesitation highlights a broader issue: unlike past large-scale infrastructure projects such as the high-speed rail network, Japan's interregional transmission development does not have a stable financing framework. While the government is exploring options like project finance, the current structure substantially burdens private transmission operators. With continuing profitability challenges from unbundling and regulatory pressures, securing investment for grid expansion remains a significant barrier to scaling up renewable energy.

Transmission investment should be a national priority, matching the public financial support allocated to Green Transformation (GX) projects for hydrogen and ammonia, which are projected to receive several trillion yen. Unlike GX-backed technologies, which remain mostly unproven and high-risk for energy security and decarbonization, wind and solar technologies are scalable and well-established. A nationally coordinated, long-term investment and financing framework is essential to unlock their potential.

These developments illustrate how physical transmission constraints, institutional inflexibility, and rigid power supply structures limit effective renewable energy integration. Expanding interregional transmission, reforming grid access rules, and enhancing system flexibility will be vital to overcoming these challenges. The absence of transmission routes may delay or prevent development even where new demand, such as renewable-powered data centers, exists.

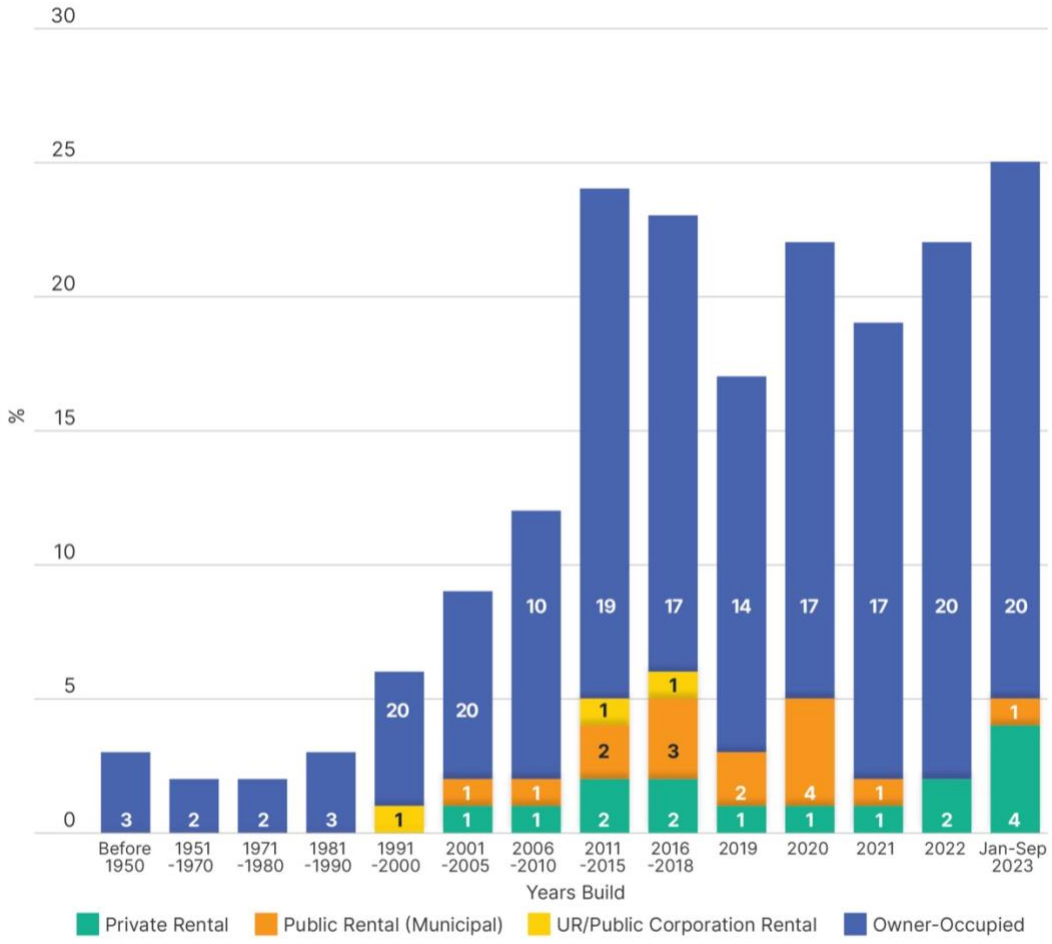
Urban versus Rural Renewable Energy Development

While solar PV projects have primarily driven Japan's renewable energy growth, urban areas lag significantly in deployment. For example, Tokyo, one of the country's largest energy-consuming regions, has among the lowest renewable energy adoption rates. In FY2023, it generated only 80,490 megawatt-hours (MWh) from renewables[73] or just 0.1% of its total electricity output — the lowest share across all prefectures. Residential solar penetration is also limited, with only 1.6% of households having rooftop systems, compared to the national average of 4.4%.[74]

Solar deployment in Japan is concentrated in detached, owner-occupied homes (Figure 16). Rental properties — private and public — have installation rates below 2%. Most solar systems are installed during construction. Since the 2010s, rooftop solar has become common in new single-family homes, reaching 30%–40% installation rates in some regions by 2023.[75]

[73] Agency for Natural Resources and Energy. 電力調査統計. 2023 年度（令和 5 年度）2-(2)都道府県別発電実績.
[74] Calculated by IEEFA based on data from the Ministry of Internal Affairs and Communications. 住宅・土地統計調査 住宅の種類(2 区分)、住宅の所有の関係(5 区分)、建て方(4 区分)、構造(3 区分)、省エネルギー設備等(7 区分)別住宅数－全国、都道府県、21 大都市.
[75] Calculated by IEEFA based on data from the Ministry of Internal Affairs and Communications. 住宅・土地統計調査

Figure 16: Solar Power Installation Rate by Year Build and Housing Ownership Type



Source: Statistics Bureau of Japan.

Approximately 49% of urban households live in rental properties and face inherent structural disadvantages.[76] A "split incentive" problem arises in these situations. Landlords bear the upfront solar installation costs but do not benefit from electricity bill savings, which are advantageous to tenants. Conversely, tenants cannot alter the rented property. These factors discourage solar investment, even when such upgrades could improve asset value and advance energy transition goals.

Consequently, solar uptake in urban areas remains far below its potential, further entrenching geographic disparities in clean energy access. Without targeted policy tools, such as green leases[77],

[76] Calculated by IEEFA based on data from the Ministry of Internal Affairs and Communications. 住宅・土地統計調査

[77] Green leases: Lease agreements that include provisions for energy efficiency or sustainability, aligning landlord–tenant incentives to reduce emissions (e.g., sharing savings from LED lighting or improved insulation).

shared-benefit mechanisms[78], or financial incentives for landlords[79], solar deployment in urban rental housing will remain constrained.

The Tokyo Metropolitan Government requires rooftop solar systems on new residential buildings from April 2025.[80] While this measure may help increase baseline solar deployment, its impact on the rental sector will likely remain limited for four reasons:

1. The mandate applies only to new constructions, whereas most rental properties are part of the existing building stock and fall outside its scope.
2. The regulation does not resolve the core economic misalignment: landlords bear the capital costs, while tenants benefit from lower utility bills.
3. The regulation requires installation but does not mandate utilization or benefit sharing — raising the risk of underuse.
4. Conventional rental arrangements, where tenants pay utility bills independent of rent, reinforce the split incentive and discourage owner investment.

Tokyo's solar mandate is an important first step. However, structural barriers to solar deployment in rental housing will persist without additional reforms, such as green lease frameworks or financial co-benefit mechanisms.

In contrast, stricter regulations on solar development have been introduced in rural areas in response to environmental and community concerns. Many local governments have recently tightened rules on mega-solar power projects due to risks from natural disasters, landscape degradation, and residents' opposition. To date, 403 renewable energy ordinances have been enacted, with 72% involving regulatory restrictions.[81] 290 municipalities have imposed restrictions on solar development to curb excessive expansion and prevent disputes between developers and communities.

As a part of these regulations, some prefectures, like Miyagi and Aomori, have actively expanded wind and solar deployment by introducing new taxation schemes. These taxes discourage poor planning and ensure that renewable energy expansion is controlled and sustainable.

While environmental damage mitigation and community conflict resolution are necessary, excessive or poorly designed regulations slow the pace of renewable energy deployment. If this trend continues, it could become increasingly challenging for Japan to meet its national renewable energy targets.

[78] Shared-benefit mechanisms: Arrangements where landlords and tenants share the gains from efficiency measures (e.g., splitting revenue from onsite solar generation or energy cost savings).
[79] Financial incentives for landlords: Public subsidies, grants, or tax benefits that encourage building owners to make low-carbon upgrades (e.g., government rebates for installing high-efficiency boilers or heat pumps).
[80] Tokyo Metropolitan Government News. 広報東京都 2023 年 1 月号. 01 January 2023.
[81] Ministry of the Environment. 地方公共団体の脱炭素関係予算 及び再エネに関する条例の推移. 01 August 2024. Page 4.

Key Opportunities and Policy Recommendations

While structural obstacles constrain renewable energy deployment across most of Japan, favorable conditions can enable faster, more effective development.

Reform Transmission Regulation and Financing

Grid connection limitations and output curtailment are significant barriers to renewable energy development. Japan's "Connect and Manage" approach allows non-firm grid access without guaranteed transmission, leading to frequent curtailment, particularly in renewable-rich areas such as Kyushu and Hokkaido.

Solar PV plants face curtailment in some regions, reducing profitability and investment. In Kagoshima and Miyazaki, revenue losses have reached several hundred thousand yen per megawatt annually, contributing to bankruptcies and asset sales.

Japan should introduce firm, guaranteed grid connections and cost-sharing frameworks to improve investor confidence. Akita and Fukushima Prefectures offer critical case studies for effective grid reform development.

Box 1: Case Studies of Akita and Fukushima

Akita and Fukushima illustrate how localized transmission planning approaches can unlock renewable energy opportunities more effectively than a standardized national strategy.

Akita Prefecture has strong offshore wind, onshore wind, and solar energy potential, but experiences a "no-exit power" bottleneck, where electricity generation exceeds local demand. In some months, Akita's output surpasses 150% of its consumption[82], with insufficient capacity to export to other regions.

To address this, the Tohoku Electric Power Network began developing the Dewa Line, a new 500kV transmission line between Akita and Yamagata, allowing up to 3.9GW of new renewable capacity to be connected to the grid. The project adopted an innovative bidding process in which renewable energy developers submit connection requests and commit to sharing construction costs.

This cost-sharing and connection-priority model differs from conventional grid expansion practices, where utilities bear the full cost and approve connections sequentially. In Akita's case, grid expansion could be scaled flexibly based on developer interest and financial commitment, making it a leading example of proactive, market-aligned transmission planning.

Meanwhile, Fukushima Prefecture took a different but equally innovative path. When nuclear plants shut down after the 2011 accident, high-voltage transmission capacity became available. The prefecture used this opportunity to rapidly expand solar and wind projects. Between 2012 and 2023, Fukushima increased its large-scale solar capacity to over 1,300 MW[83], becoming one of Japan's leading renewable energy producers.

The Fukushima New Energy Society Vision was launched to support this growth, aiming to power the region through renewables entirely. The Fukushima Power Transmission Company, a public-private joint venture, was established to build a shared transmission network dedicated to renewables as part of the strategy. Around 86 kilometers of new lines were constructed to connect multiple solar and wind projects, enabling efficient delivery of clean electricity to demand centers like Tokyo.[84]

In Fukushima, an independent, non-utility entity developed the transmission infrastructure. The funding comprised national and local subsidies, regional bank loans, and developer contributions. This financially circular and regionally anchored model enabled large-scale renewable deployment and supported local economic revitalization.

Akita's cost-sharing, developer-driven model illustrates how utilities and project developers can align incentives to accelerate grid expansion. Fukushima's integrated, publicly-supported transmission model highlights how existing infrastructure and regional financing can be leveraged.

To enable equitable and scalable renewable energy growth across Japan, national policy should facilitate more flexible, region-specific transmission strategies, including mechanisms for cost allocation, priority connection rights, and independent infrastructure development. Replicating these innovative approaches in a localized way for other regions will help accelerate the transition to a resilient, renewable-powered future.

Support Local Governments in Zoning, Planning, and Community Engagement

Support from local and national governments is vital for accelerating renewable energy development across Japan. Recognizing this, the Ministry of the Environment has launched several initiatives to support municipalities in renewable energy zoning and planning. These include the Zoning Support Project, the Regional Decarbonization Transition Grant, and the Leading Decarbonization Areas program. These efforts have enabled pioneering prefectures such as Fukushima and Akita to identify suitable project locations, coordinate with stakeholders, and avoid land-use conflicts. Consequently, these regions have more streamlined permitting processes and quicker solar and offshore wind project deployment.

However, participation in these programs remains limited to a few proactive municipalities. Many smaller or rural local governments lack the technical capacity or resources for long-term planning or community coordination. National support should be expanded and institutionalized to ensure broader, more equitable renewable energy deployment. This includes increasing access to existing funding programs, developing standardized toolkits for land-use coordination, and environmental screening. Additionally, the Leading Decarbonization Areas program, which currently supports only 100 municipalities, should be expanded to include other untapped regions. Strengthening local government capacity is essential to accelerating renewable deployment while minimizing opposition and delays.

Proactive land use planning and close collaboration with local communities are crucial for boosting renewable energy mobilization. Early local initiatives, such as Fukushima Prefecture's pioneering zoning efforts, helped the Japanese government introduce a national promotion zone system in 2021.[85] This system assigns pre-screened areas for smoother development by new energy companies. Meanwhile, the government further centralized procedures by conducting environmental impact assessments and preliminary surveys on behalf of offshore wind project developers to lower barriers to entry.[86]

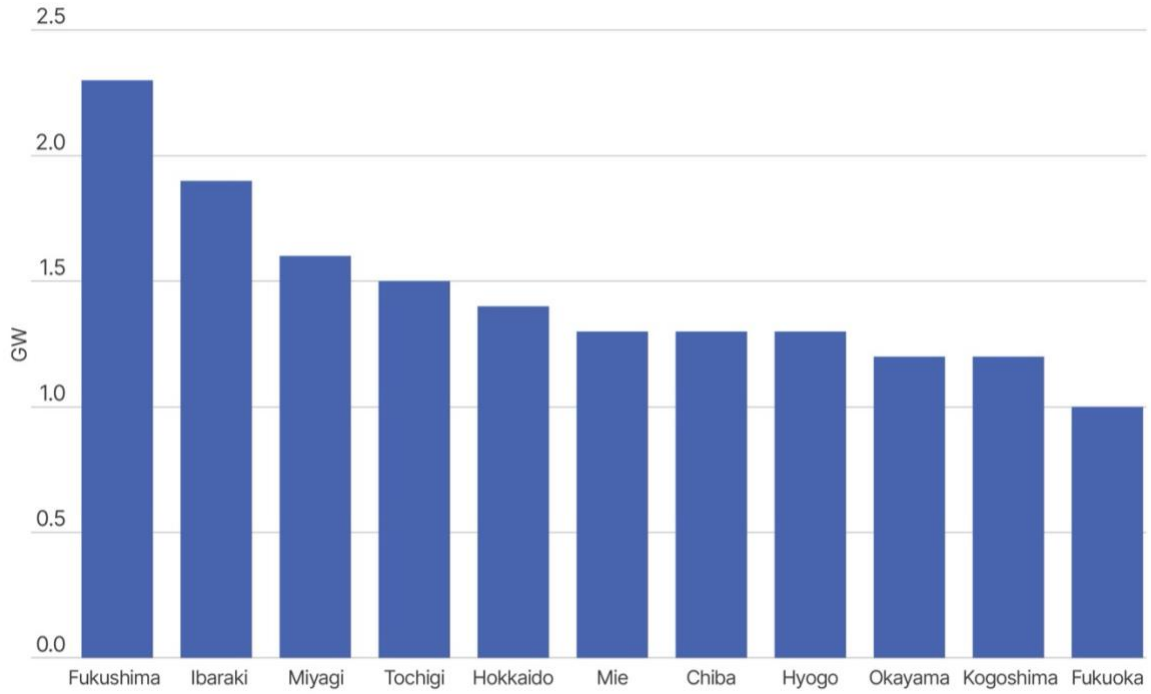
Many mega solar developments are in Fukushima Prefecture (Figure 17), where a local zoning initiative was launched in 2013. Suitable land for renewable energy projects was mapped out, and consultations were held with residents and agricultural groups, promoting a harmonized approach to development. The Prefecture's "Action Plan for Renewable Energy Pioneering Lands (Phase 5)" integrates support for community-led projects in collaboration with local businesses, and

[82] Bank of Japan Akita Branch. 秋田県で進む再エネ発電の体系的理解～県経済における需要創出に貢献～.21 March 2024.
[83] Calculated by IEEFA based on data from the Agency for Natural Resources and Energy's FIT Portal.
[84] Fukushima Power Transmission Company. Root Map.
[85] Ministry of the Environment. 「地域脱炭素化促進事業」制度. Page 25-38.
[86] Ports and Harbours Bureau of the Ministry of Land, Infrastructure, Transport and Tourism. 洋上風力発電に係るセントラル方式の運用方針. 24 April 2024.

consolidates environmental and land use coordination.[87] By pre-emptively zoning suitable land, Fukushima avoided conflicts and facilitated developer entry, contributing significantly to renewable energy expansion.

In Akita Prefecture, offshore wind development progressed efficiently through early negotiations with local fisheries cooperatives. Local governments played a key role in securing community support, which paved the way for nationally designated promotion zones. This model — early local engagement with national-level streamlining — has also been adopted in Aomori and Hokkaido Prefectures, where offshore wind projects have progressed similarly. Akita provides a national model for community-integrated offshore wind energy development.

Figure 17: Installed Large-Scale Solar Power Capacity Under FIT/FIP in the Top 10 Prefectures



Note: Data as of September 2024.
Source: Agency for Natural Resources and Energy.

Address Urban-Rural Disparities through Structural Reforms

Japan's renewable deployment has been highly uneven between rural and urban areas. In cities like Tokyo, rooftop solar penetration is just 1.6%, mainly due to the "split incentive" problem in rental housing, where landlords bear solar installation costs while tenants benefit from electricity savings.

To address this issue, Japan should develop green lease frameworks that equitably distribute costs and benefits between landlords and tenants. Subsidies or tax incentives aimed at building owners,

[87] Fukushima Prefecture. 令和 6 年度　福島県再生可能エネルギー・水素等関連産業に係る事業紹介及び成果報告パンフレット.

rather than residents, could also accelerate adoption. Tokyo's regulation mandating rooftop solar systems for new homes is a positive step. However, national policies must also target existing buildings, multi-unit rentals, and commercial rooftops.

Promising models are emerging from the private sector. Third-party ownership schemes — such as zero-upfront-cost solar installations through power purchase agreements (PPAs) — are being applied to existing rental apartment buildings across several regions in Japan.[88, 89] Landlords provide rooftop access without paying installation costs, while energy service companies install, own, and operate the solar systems. Tenants benefit from reduced electricity bills, and landlords earn roof lease income or increase property value. These initiatives offer scalable, low-risk solutions to overcome structural barriers in Japan's dense rental housing market. Greater policy support and national coordination could accelerate adoption.

Japan should also revise its tax incentive frameworks to include rental properties, which are ineligible for most renovation benefits. Currently, income tax deductions for energy-efficient renovations (such as insulation upgrades and solar installations)[90], mortgage tax credits for renovation loans[91], and fixed asset tax reductions[92] following improvements apply only to owner-occupied homes.

Rental housing is excluded, leaving a significant portion of Japan's building stock unsupported in the energy transition. Expanding eligibility to rental units — with simplified documentation and clearer qualifications — would provide landlords with financial incentives to install solar systems and improve insulation. Combined with PPA-based approaches that reduce upfront costs, such reforms could drive widespread solar adoption in urban multi-unit rental buildings.

These policy and market-based interventions can narrow the urban-rural deployment gap and assimilate Japan's rental housing in the energy transition.

Promote Corporate and Community PPAs through Regulatory and Financial Support

PPAs are emerging as a crucial mechanism for expanding renewable energy beyond government subsidies. They enable direct, long-term contracts between power producers and corporate or public-sector consumers seeking clean electricity. In Japan, interest in PPAs is growing, particularly among RE100 member companies and large manufacturers[93] who aim to meet all their operating needs with renewable energy by 2050. There are over 220 RE100 members in Japan, with over 90

[88] RTS Corporation. 屋根置き太陽光の国内外の動向. 02 July 2024. Page 38.
[89] PVeye. UR 都市機構、PPA 実証開始へ. January 2022
[90] National Tax Agency. No.1219　省エネ改修工事をした場合（住宅特定改修特別税額控除）.
[91] The Ministry of Land, Infrastructure, Transport and Tourism. 住宅ローン減税.
[92] Tokyo Metropolitan Government. 省エネ改修工事をした住宅に対する固定資産税の減額.
[93] RE100. Japan policy recommendations.

headquartered there.[94] These companies cannot fulfill their renewable mandates due to the lack of clean energy connections and supply.

Japan's corporate PPA market remains underdeveloped due to structural barriers. These include complex grid access and wheeling procedures, limited creditworthiness among SMEs and municipal buyers, and a shortage of aggregation models enabling smaller consumers to enter joint contracts. Wholesale electricity price volatility under the FIP scheme also increases long-term contracting risks for buyers and sellers.

Targeted support measures could address these challenges: public credit guarantees or risk-sharing mechanisms for smaller buyers, reduced legal costs, and stronger policy incentives for public institutions to purchase renewable electricity. Platform-based aggregation models — allowing multiple smaller consumers to combine demand — could increase market accessibility, while expanding existing financial[95] and advisory programs[96] could lower entry barriers. These reforms could accelerate renewable deployment and stabilize revenues for independent producers.

Establish a Specific Target to Triple Renewable Energy Capacity through Auctions and Procurement Mandates

At the 28th COP in December 2023, 133 countries, including Japan, pledged to triple renewable energy capacity by 2030.[97] However, Japan's official target for renewable energy in the 7th SEP is a percentage of the electricity mix rather than a capacity figure. The country should define targets to increase renewable energy capacity from 120GW in 2023 to 360GW by 2030, in line with global obligations.

To achieve these commitments, the government can establish binding renewable energy obligations for major utilities and expand renewable energy auctions to support price discovery, developer participation, and project financing.

First, Japan's major utilities — including JERA and J-POWER — own less than 0.3% renewable capacity (excluding hydro), despite controlling nearly 75% of national generation capability. Their portfolios remain dominated by fossil fuels and nuclear, while new entrants account for nearly all solar and wind growth.

To correct this imbalance, Japan should reintroduce legally binding RPS for incumbent utilities — which were in place before the introduction of the FIT scheme — along with obligations for long-term renewable energy procurement through mechanisms like Contracts for Difference (CfD). These

[94] RE100. Our work in Japan.
[95] Ministry of the Environment. 脱炭素化支援事業 事業概要（合本版）.
[96] Ministry of the Environment. 脱炭素まちづくりアドバイザー制度.
[97] COP 28. Global renewables and energy efficiency pledge. 2 December 2023.

reforms would ensure that large utilities take active responsibility for the national decarbonization effort.

Second, expanding renewable energy auctions is an opportunity to build on past successes. For example, competitive auction systems[98] have significantly catalyzed Japan's offshore wind power expansion. Previously, development remained limited due to unclear regulations and high project risks. The new framework provided long-term visibility, reduced entry barriers, and attracted large-scale investments.

The sharp decline in offshore wind power prices in Japan has resulted from competitive auction systems. The country's first auction round in 2021 awarded 1.69GW across three sites in Akita and Chiba Prefectures. These projects were developed under the FIT scheme, with awarded prices ranging from JPY12/kWh to JPY16.5/kWh — less than half the JPY36/kWh offered for earlier projects.[99]

Subsequently, in the second auction round conducted between 2022 and 2023, the policy framework transitioned from a FIT to a FIP scheme, further intensifying price competition.[100] Under this system, developers bid the premium (in JPY/kWh) they would require on top of the wholesale electricity market price. With greater emphasis on price in the evaluation process, bidding competition intensified. In three of the four auctioned sites (Yurihonjo North, Yurihonjo South, and Kujukuri Offshore), multiple developers submitted the minimum possible premium of JPY3/kWh.[101]

Moreover, the government revised auction guidelines between the first and second auctions to improve transparency and attract international developers. Major Japanese trading houses and utilities formed strategic alliances with experienced European offshore wind developers, combining local knowledge with global technical expertise. For example, Mitsui & Co. partnered with RWE (from Germany), JERA partnered with Northland Power (from Canada), and Japan Renewable Energy (JRE) partnered with Iberdrola (from Spain).

These partnerships allowed consortia to offer technically robust proposals while enhancing their scores in both price and non-price categories. The increased competition led many groups to submit the minimum premium of JPY3/kWh, pushing the economic floor of the FIP auctions. This demonstrated that competition is key to lowering costs.

The presence of international developers also contributed to the transfer of best practices, including advanced design, construction, and risk management approaches drawn from European offshore

[98] Under the 2019 Act on Promoting Utilization of Sea Areas for the Development of Marine Renewable Energy Power Generation Facilities.
[99] European Commission. Sectoral Study: Analysis of the offshore wind tender results in Japan. October 2022. Page 4.
[100] White & Case. Japan Offshore Wind Update – Round 2 Auction Results. 14 December 2023
[101] Nikkei Energy Next. 早くも体力勝負に突入した洋上風力、ラウンド2公募結果を読み解く. 26 December 2023.

wind markets. This shift increased competition and improved the quality and bankability of project proposals.

Japan's auction prices are now approaching levels seen in mature European markets. However, recent global cost inflation (resulting in rising material costs and supply chain issues) is increasing cost pressures. The Japanese government is discussing changing auction terms such as extending project operating periods to 40 years and switching earlier FIT-awarded projects to FIP so developers can benefit from market prices.[102] These adjustments aim to keep developers engaged despite global offshore wind cost challenges.

The third auction round in 2024 demonstrated further progress, awarding projects for Aomori south side offshore (600MW) and Yamagata offshore (450MW), reaching an additional 1.05GW. These projects are currently targeting commercial operation dates between 2028 and 2030.

Japan aims to reduce offshore wind power costs for bottom-fixed projects to between JPY8/kWh and JPY9/kWh by 2030–2035. Meeting this goal will require sustained competition and policy support to counteract rising interest rates and commodity prices. The recent auctions have only secured about 4.6GW of capacity — roughly one-tenth of the 45GW targeted by 2040.[103] This slow start implies the need for more frequent and larger auctions, and enhanced rules to attract more bidders.

Moreover, without significant government efforts to address transmission issues, developers will likely remain concerned about grid access and offtake risks in future bids (Table 5). In summary, Japan's auction mechanism has effectively reduced offered prices. However, ensuring projects reach operation on schedule (some Round 1 projects are already delayed beyond 2028) will be crucial to realizing low-cost generation.

Japan's recent auctions have proven the viability of offshore wind projects and established a replicable framework for rapid scaling. The country can attract domestic and global capital into a previously dormant sector, utilizing clear regulation, robust competition, and designated infrastructure. This momentum, combined with legal reforms to expand development into the Exclusive Economic Zone (EEZ), opens vast new deployment areas. Furthermore, international developer participation ensures a competitive market with advanced technology and project execution expertise. If grid connection and supply chain constraints are addressed, Japan could become Asia's leading offshore wind hub.

[102] Ministry of Economics, Trade and Industry. 公募占用指針改訂案について. 03 June 2025.
[103] Reuters. Japan poised to sweeten offshore wind rules as players get cold feet. 27 May 2025.

Conclusion

Japan's renewable energy deployment has slowed, fueling an unsubstantiated narrative that renewables cannot ensure a stable supply. Fossil fuel proponents support calls for continued reliance on non-renewables — particularly LNG — as a "necessary risk management strategy." This narrative is reflected in government policy: the 7th SEP includes a scenario in which LNG imports would be increased if renewable expansion falls short.

Yet, the core challenges are not technological or economic, but structural and institutional bottlenecks — including grid congestion, market inflexibility, output curtailment, and major utility inaction.

In regions like Fukushima, Akita, Saga, and Hokkaido, proactive local leadership, early zoning, transmission investment, and engagement with local finance have enabled tangible renewable energy growth. These regions are models for what can be accomplished through localized strategies.

Japan must prioritize scaling these successful approaches rather than relying on fossil fuels. Solutions should include reforming grid access, modernizing market design, and enabling deployment pathways such as PPAs that give consumers and communities a more active role.

Energy security and renewable expansion are not mutually exclusive. With the appropriate policies, investments, and political resolve, renewables can become Japan's primary power source — and a foundation for climate and economic resilience.

Table 5: Challenges and Policy Recommendations for Expanding Renewable Energy in Japa

Challenges & Barriers to Renewable Energy Deployment	Recommendations
Reluctance of electric utilities toward renewables • Major utilities control 75% of installed capacity • Renewables represent only 0-2% of major utility generation portfolios • Utilities prioritize fossil fuel and nuclear assets over domestic renewables	The government should strengthen the enforcement of the 44% non-fossil fuel obligation by introducing penalties or binding compliance mechanisms Require major utilities to increase their domestic renewable generation capacity
Underutilization of Non-Fossil Certificates (NFCs) • Low purchase rates by major utilities • Renewable-designated NFCs remain limited	The government should encourage higher NFC uptake by major utilities through stronger guidance from the Ministry of Economy, Trade and Industry (METI) and disclosure of non-compliance
Grid connection constraints and curtailment • Widespread curtailment in renewable-rich regions (such as Kyushu, Hokkaido) • Thermal power plants receive dispatch priority over renewables • Limited long-distance transmission connecting rural generation to urban demand • High grid access costs and lengthy connection delays	National policy should facilitate more flexible, region-specific transmission strategies, including mechanisms for cost allocation, priority connection rights, and independent infrastructure development
Lack of financial and regulatory frameworks for transmission • Inadequate cost-sharing mechanisms for grid infrastructure • Transmission investments are currently borne primarily by developers, making it financially challenging for projects in renewable-rich regions	Establish a national cost-sharing mechanism to reduce the financial burden on developers in renewable-rich regions Prioritize transmission investment equal to Green Transformation (GX) subsidies to ensure timely grid development
Urban-rural renewable energy gap • Urban rooftop solar adoption remains low (Tokyo: 1.6%) • Split incentives in rental housing	Japan should develop green lease frameworks that equitably distribute costs and benefits between landlords and tenants Third-party ownership schemes (such as PPAs and tax incentives targeting building owners, rather than residents) could also accelerate adoption
Overregulation in rural areas • 72% of 403 local ordinances restrict renewables development • Community opposition is increasing	Proactive land use planning and close collaboration with local communities have proven essential for accelerating deployment

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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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