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RENEWABLE ENERGY INSTITUTE

Middle East Crisis Highlights Japan's Energy Risk:

Now Is the Time to Accelerate the Transition from Fossil Fuels

Strengthening energy self-sufficiency through renewables, efficiency, and electrification

April 2026

Renewable Energy Institute

Accelerating Energy Transition & Self-Sufficiency

Middle East Crisis and GX Strategy

In response to the current crisis, the Japanese government has taken measures to secure energy supply, including diversifying crude oil procurement, releasing reserves, and providing fuel subsidies. It will also expand the use of inefficient coal-fired power.

While securing supply is essential to protect livelihoods and sustain economic activity, **uniform gasoline subsidies and greater reliance on coal-fired power are inconsistent with the GX strategy, which aims to reduce dependence on fossil fuels.**

Priority on No-regret Measures – Energy Self-Sufficiency

The current crisis has once again exposed Japan's structural vulnerability, with 84% of its energy supply dependent on imported fossil fuels.

The fundamental solution is to increase energy self-sufficiency. Even in emergency situations, public funds should be directed not toward temporary measures, but toward investments that strengthen self-sufficiency.

These are “no-regret” measures that should be prioritized in an increasingly uncertain global environment.

Companies and Local Governments Transitioning Away from Fossil Fuels

Many Japanese companies have already shifted to renewable electricity by participating in RE100 and utilizing PPAs, thereby reducing exposure to rising fossil fuel prices.

Pioneering local governments, such as the Tokyo, have successfully achieved significant reductions in energy consumption while enhancing urban competitiveness through the implementation of climate change measures.

Proposal - Renewables, Efficiency, and Electrification

Renewable Energy Institute proposes **policies to strengthen Japan by increasing energy self-sufficiency through renewable energy, energy efficiency, and electrification.** This proposal consists of seven measures that can deliver results within this year, along with six additional institutional and regulatory reforms.

It is expected that these measures will support national and local government and business efforts and accelerate the transition away from fossil fuels.

The Most Important Priority: Increasing Energy Self-Sufficiency

Japan depends on imported fossil fuels from overseas for 84% of its energy supply

- Rising global crude oil prices directly increase domestic energy costs, while supply disruptions can severely impact economic activity.
- The crisis has underscored the importance of transitioning away from fossil fuels

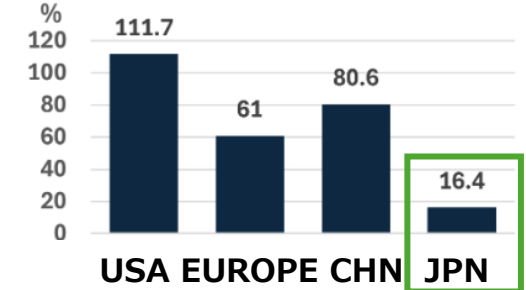
The Most Important Priority: **Increasing Energy Self-Sufficiency**

- ① Maximize abundant domestic renewable energy resources – Particularly solar & wind
- ② Reduce energy demand through efficiency improvements
- ③ Accelerate electrification to reduce dependence on imported fossil fuels

Accelerating **renewable energy, energy efficiency, and electrification** is a **“no-regret” strategy** in an increasingly uncertain global environment

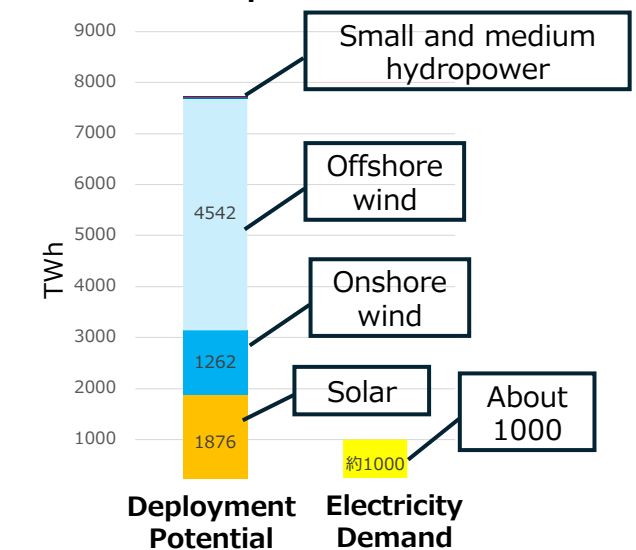
- Increasing energy self-sufficiency **is central to the GX strategy.**
- Priority should be given to no-regret measures
- Delayed demand-side measures risk being ineffective; excessive energy conservation could harm the economy
- Continued gasoline subsidies risk increasing fiscal burden while discouraging necessary demand reduction.

Primary Energy Self-Sufficiency by Country and Region



Source: Compiled by the Renewable Energy Institute based on IEA, *World Energy Balances 2025 Highlights*

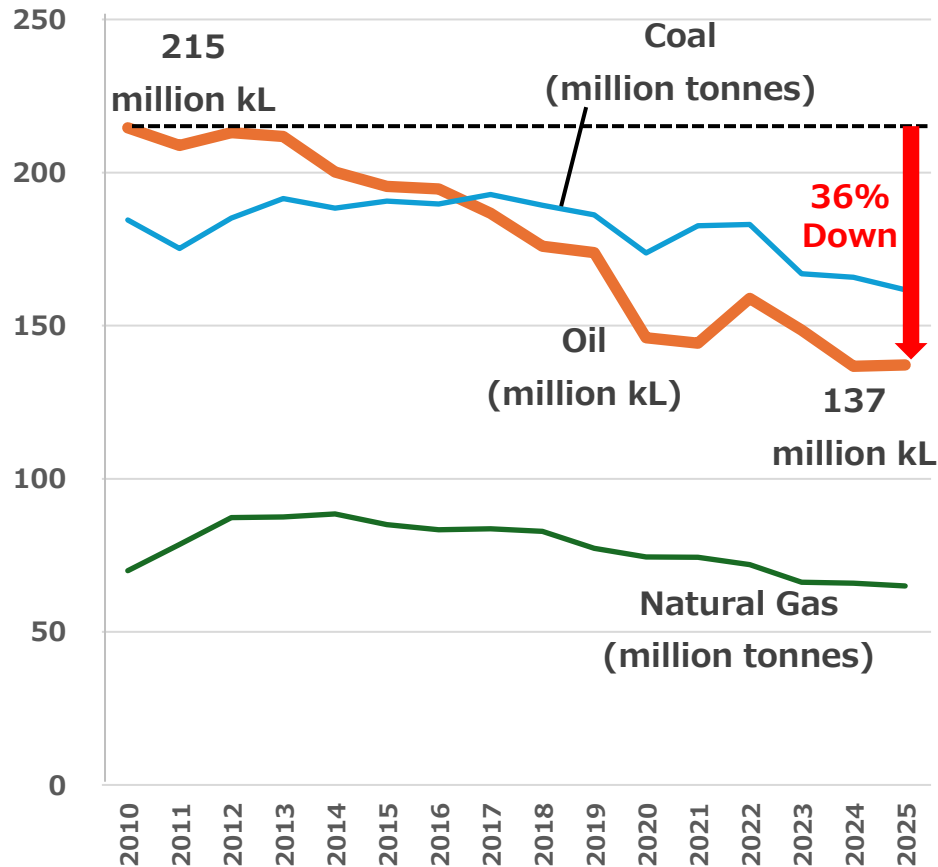
Renewable Energy Deployment Potential in Japan



Source: Compiled by the Renewable Energy Institute based on REPOS (Ministry of the Environment)

Japan's Experience: A 36% Reduction in Crude Oil Imports over 15 Years

Trends in Fossil Fuel Imports



Experience in Addressing Energy Crises through Energy Efficiency Measures

- Japan has overcome multiple energy crises—such as the oil shocks of the 1970s and the power crisis following the Great East Japan Earthquake—by placing energy efficiency at the core of its response.
- Over the past 15 years (2010–2025), Japan's imports of fossil fuels—including oil, coal, and natural gas—have steadily declined.

Crude Oil Imports Fell by 36% over 15 Years

- Approx. 215 million kL in 2010 to about 137 million kL in 2025.
- This corresponds to a reduction of about 1.34 million barrels per day—equivalent to Japan's total crude oil imports in 2025 from the UAE, Kuwait, Qatar, and the United States

The Growing Role of Renewable Energy

- Since 2011, the expansion of solar power—alongside energy efficiency—has contributed to reducing fossil fuel imports.
- Further electrification and renewable energy expansion will play an increasingly important role in reducing oil demand.

Source: Compiled by Renewable Energy Institute based on Trade Statistics of the Ministry of Finance

Corporate Experience: Managing Price Risk through Renewable Energy PPAs

Growth of Corporate PPAs

- Japanese companies have rapidly expanded corporate PPAs (long-term renewable power purchase agreements) over the past five years.
- The number of contracts has been doubling each year and continues to grow strongly in 2026.

20-Year Solar PPAs Shield Against Price Volatility

- Electricity from new solar projects is cheaper than standard electricity rates.
- It offers stable, long-term pricing—typically over 20 years—shielding companies from rising energy costs.

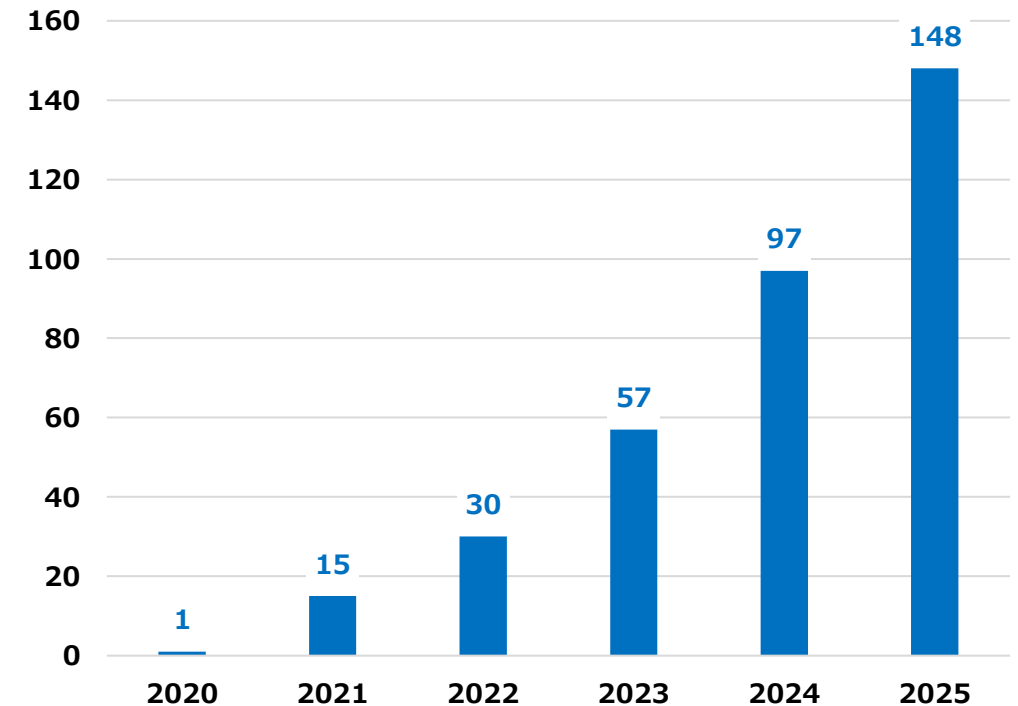
Fossil-Free Transition Drives Future Cost Competitiveness

- Companies that have transitioned to renewables are more resilient to price shocks, making fossil-free operations a key factor in future cost competitiveness.

Now is the time for all companies to accelerate efforts to expand renewable electricity, including corporate PPAs.

Number of Off-site PPA Projects (Publicly Announced)

Includes only projects with disclosed offtakers. Classified by the year of announcement, not necessarily the year the contract started.



Source: Renewable Energy Institute

Local Government Experience: Advanced Energy Efficiency and Renewable Energy Measures

Mandatory Solar Installation for Buildings

- The Tokyo Metropolitan Government and Kawasaki City mandate solar installation on new homes from April 2025. Sendai City has announced plans to introduce the requirement from 2027.
- Kyoto City, Kyoto Prefecture, and Gunma Prefecture already require solar installation for large-scale buildings.
- Nagano Prefecture plans to mandate solar installation for new buildings over 300m².

Introduction of Cap-and-Trade System

Japan introduced its GX-ETS (emissions trading scheme) in April 2026.

The Tokyo Metropolitan Government introduced a cap-and-trade system for large facilities in April 2010. With 15 years of experience, combined with other measures, it has reduced energy consumption in Tokyo by about 30%.

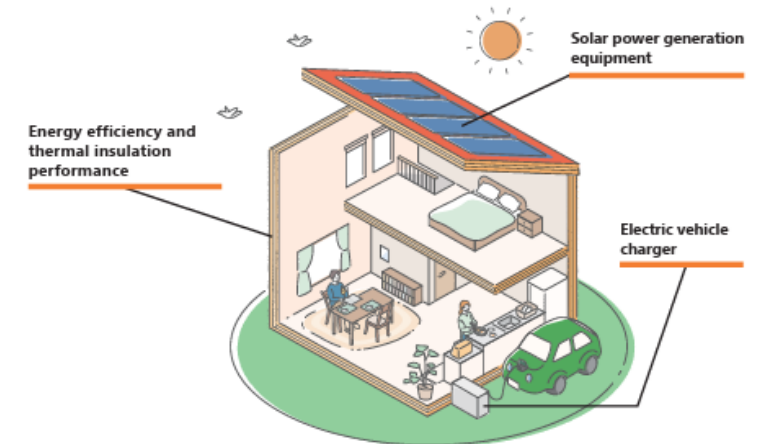
Entities responsible for installing solar power generation equipment

- Major house builders and other businesses* that supply a total floor area of 20,000 m² or more annually in Tokyo
- New buildings with a total floor area of less than 2,000 m² subject to the program

* Businesses that have made application and been approved by the governor will also be able to participate in the program.

Obligations

- ① Installation of solar power generation equipment
- ② Ensuring thermal insulation and energy efficiency performance
- ③ A mechanism to mandate or encourage the installation of electric vehicle chargers and other equipment



Source: Tokyo Metropolitan Government
"Zero Emission Tokyo Strategy Beyond Carbon Half"

Germany's Experience: Renewable Expansion Stabilizes Electricity Prices

Gas Prices Surge, Power Prices Decline

- Following U.S. and Israeli attacks on Iran, **gas prices in Germany have risen by about 45–50%.**
- **Electricity prices** increased by only 3% in March compared to February and **fell by 30% in early April.**

After Ukraine Invasion, Both Gas and Power Prices Surged

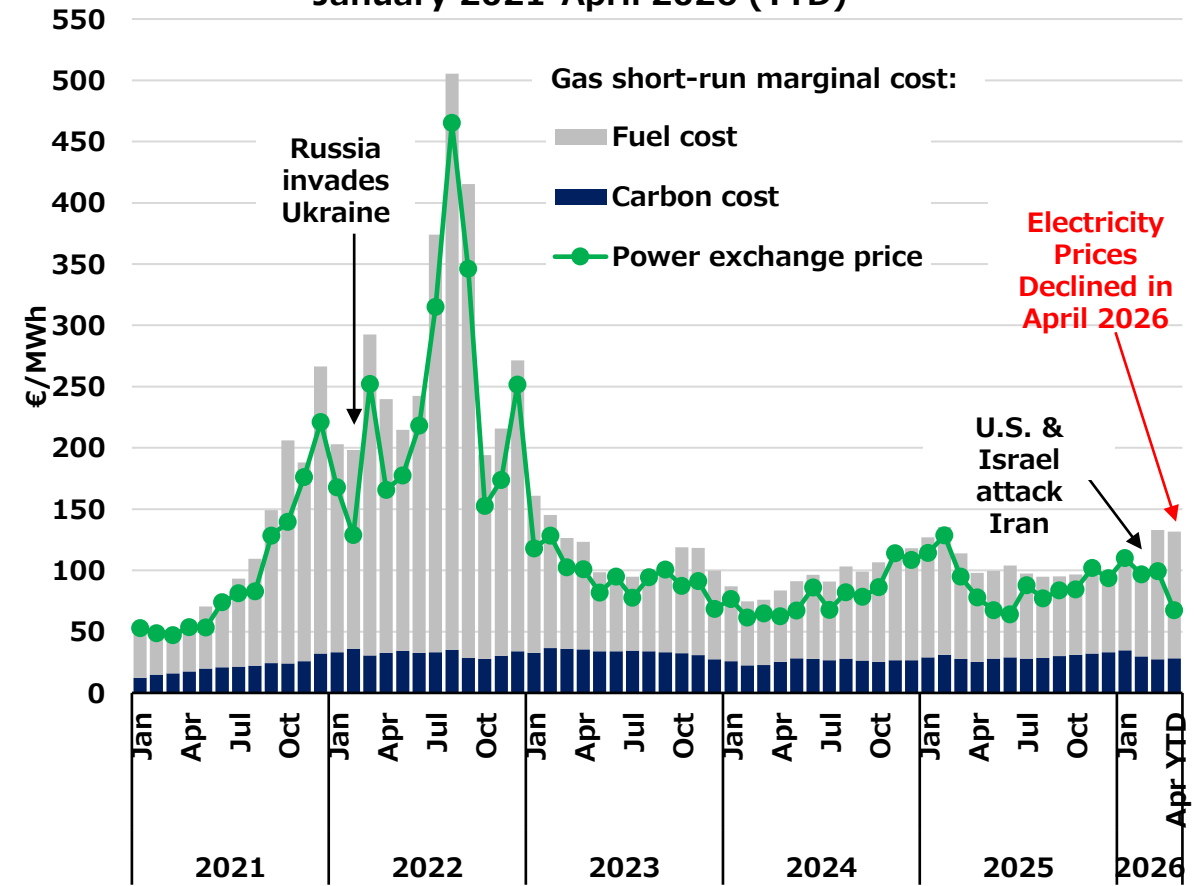
- Following Russia's invasion of Ukraine in late February 2022, gas prices in Germany rose by about 60% in March.
- Electricity prices also surged, nearly doubling during the same period.

Renewables Expansion Lowers Power Prices

- Renewable energy was 41% of Germany's electricity consumption in March 2022, rising to 73% in early April 2026.
- Gas generation in March 2026 was 34% lower than in March 2022.
- Two benefits: lower gas demand and a reduced role of gas in setting electricity prices.


Germany's experience clearly demonstrates that renewable energy expansion can stabilize electricity prices even amid fossil fuel price shocks.


Germany Monthly Power Exchange Price
VS. Gas Short-Run Marginal Cost
January 2021–April 2026 (YTD)





Source: Renewable Energy Institute, based on Fraunhofer ISE, *Energy Charts: Average Spot Market Prices* (accessed April 8, 2026)


Seven High-Impact Measures for Immediate Implementation


1 Lower daytime electricity prices to maximize solar use 


2 Deploy off-grid solar for self-consumption within months 

3 Accelerate on-site and off-site PPAs 

4 Expand high-impact energy retrofits for existing homes 

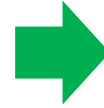
5 Promote replacement with high-efficiency ACs and refrigerators 

6 Enhance energy efficiency in offices and factories with AI and SaaS 

7 Maximize use of heat pumps using ambient heat 

1. Maximize Solar Use by Lowering Daytime Electricity Prices

Significant solar power is wasted particularly during daytime hours.



Electricity pricing structures—often higher during the day—discourage consumption when solar supply is abundant.

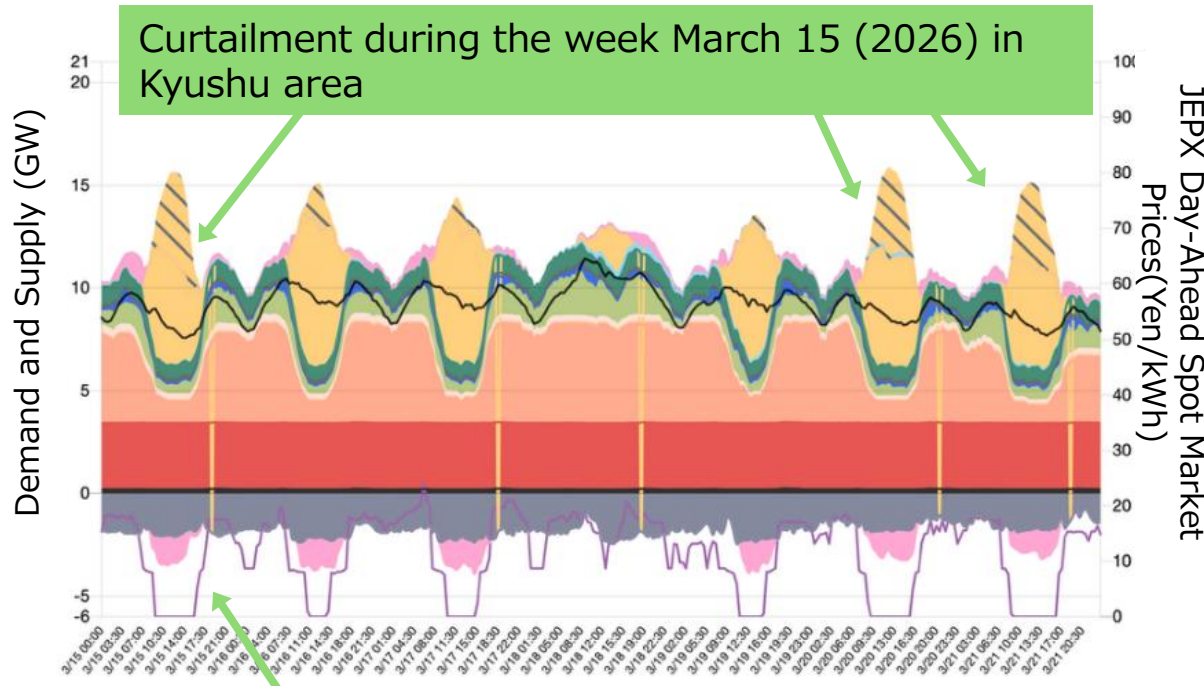


[Australia Policy]
Electricity is free for households during three daytime hours with abundant solar power (from July this year).

Introducing pricing schemes that encourage daytime use can reduce fossil fuel imports.



Halving curtailment could **save about ¥100 billion annually in Japan**



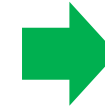
Wholesale electricity prices hit the floor (¥0.01/kWh) during the daytime

Source: Renewable Energy Institute, Power Supply-Demand Chart

Curtailment reached approximately 2 billion kWh in FY2025—equivalent to **around ¥200 billion in lost value** (at ¥10/kWh)

2. Rapid Deployment of Off-Grid Solar for Self-Consumption

Off-grid solar systems for self-consumption can be deployed within about three months. By avoiding reverse power flow, grid coordination requirements are minimized, enabling faster installation.



Introduce a support scheme in which the government and grid operators assist consumers, including support for installing batteries and RPRs (reverse power relays)

Schedule Comparison Until Operation Start

Example: 50 kW self-consumption system installed on a factory folded-plate roof



 **Eliminating the grid interconnection process connects directly to shorter construction time and reduced costs!**

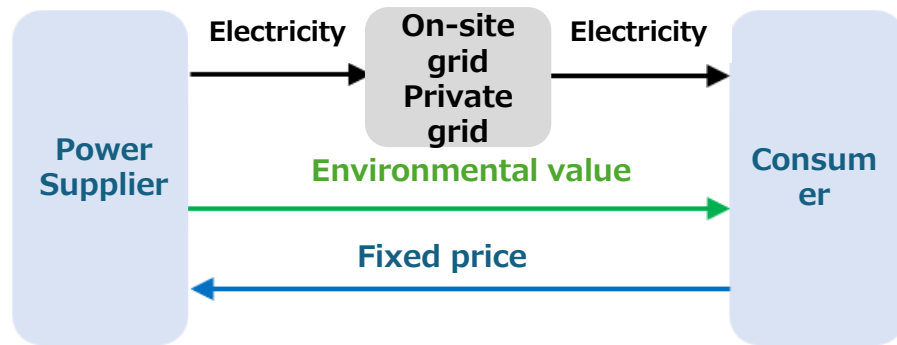
Source: Chart recreated using AI by Renewable Energy Institute, based on excerpts from the Next Energy & Resources Co., Ltd. Website

3. Accelerate On-site and Off-site PPAs

Accelerate on-site PPA deployment by prioritizing FIT (rooftop) and grid connection, and providing financial support to developers with limited funding

On-site PPA Structure

The generator and consumer enter into a direct contract. The consumer provides the site and purchases electricity and environmental value at a fixed price

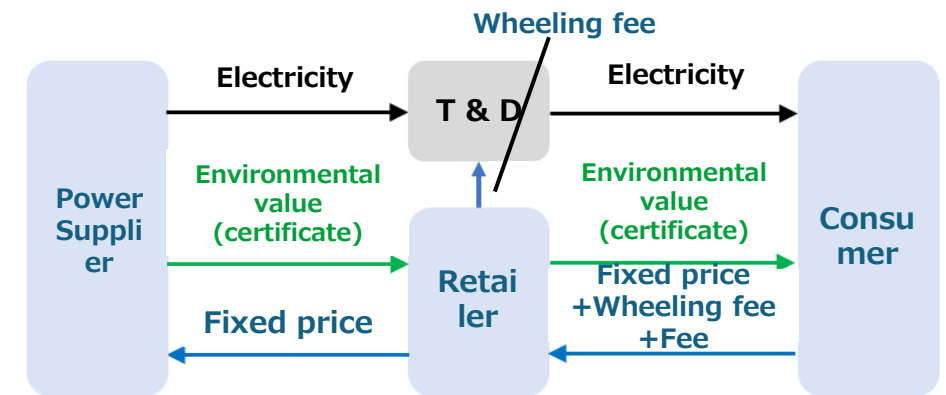


Per kWh	On-site PPA (solar, rooftop, high-voltage)	Standard electricity price (high-voltage)
Consumer cost (national average)	14~17 yen	22 yen + Renewable energy surcharge

Accelerate off-site PPA deployment by introducing tax credits based on contract value

Off-site PPA (Physical) Structure

The consumer purchases electricity and environmental value from generation facilities located off-site



Per kWh	Off-site PPA (solar, physical, high-voltage)	Standard electricity price (high-voltage)
Consumer cost (national average)	20~23 yen + Renewable energy surcharge	22 yen + Renewable energy surcharge

Corporate PPAs enable companies to procure renewable electricity at stable, long-term prices, reducing exposure to fossil fuel price volatility.

4. Accelerate Energy Efficiency Retrofits for Existing Homes

Energy Efficiency Renovations Improve Comfort

- Energy efficiency retrofits deliver immediate energy savings while significantly improving living comfort.
- A wide range of options is available, from whole-home insulation and airtightness upgrades to partial improvements such as windows, ceilings, and floors.

Prioritize Public Funding for Energy Efficiency Renovations

- Subsidy programs, such as the national Housing Energy Efficiency 2026 campaign and Tokyo's HTT campaign, have been launched.
- Strong support for rental housing, as well as for elderly and low-income households, and leadership in public housing are essential.
- **Focus public spending on these lasting efficiency measures rather than temporary subsidies such as gasoline support.**

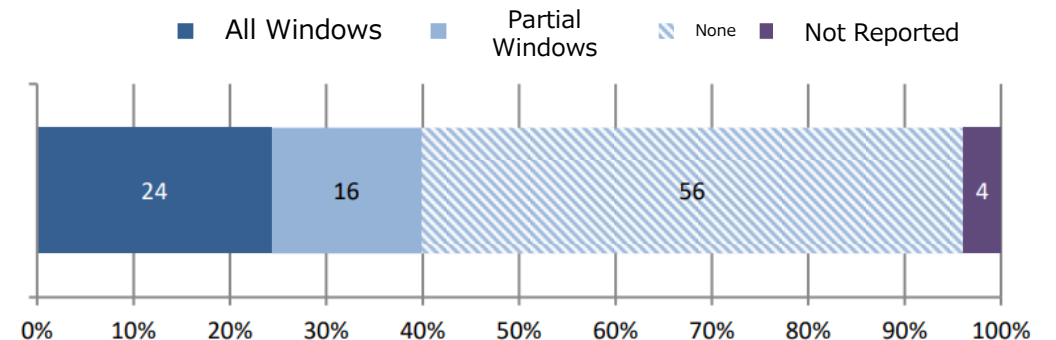
High-Impact Window Renovations

- **Windows account for 60–70% of heat loss**, yet high-performance glazing remains underutilized, with adoption rates around 30% outside Hokkaido and Tohoku.
- The role of subsidies for window renovations should be further strengthened as part of the response to the Middle East crisis.

Logos of the Housing Energy Efficiency 2026 Campaign and Tokyo's HTT Campaign



Adoption rate of double glazing or multi-pane windows



Source: Ministry of the Environment, FY2023 Survey on CO₂ Emissions in the Household Sector (Statistical Report, Final Figures)

5. Promote Replacement with High-Efficiency Home Appliances

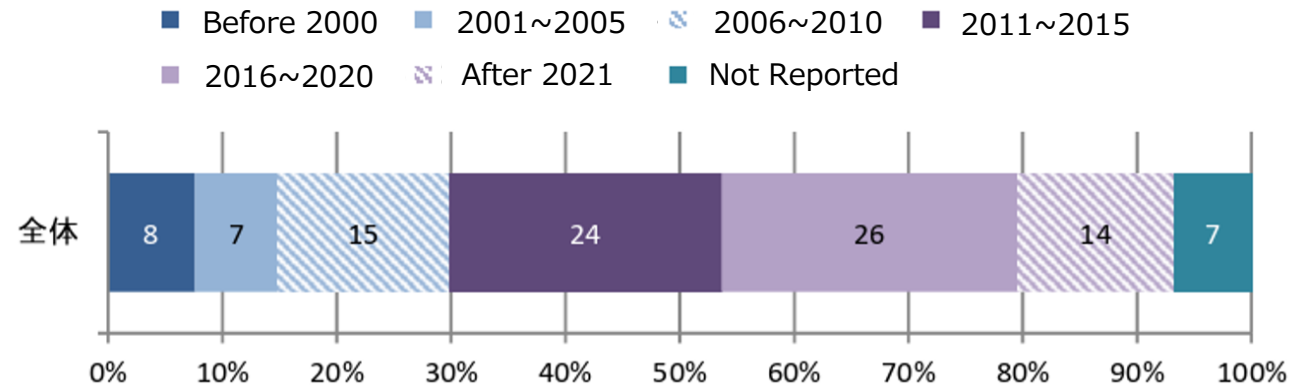
Many households still use outdated air conditioners and refrigerators, with over half of refrigerators manufactured before 2015 - according to a 2023 survey by the Ministry of the Environment.

Replacing these with high-efficiency models can reduce energy use by about 21–30% for refrigerators and about 14% for air conditioners.

Tokyo introduced **a subsidy program** from summer 2025, **offering up to ¥80,000** for switching to energy-efficient appliances

The government should launch a nationwide campaign, in collaboration with manufacturers, retailers, and local governments to accelerate replacements with a focus on supporting elderly and low-income households

Year of manufacture of refrigerators



(If a household owns multiple refrigerators, the one with the largest storage capacity is used as the reference)

Source: Ministry of the Environment, *FY2023 Survey on CO₂ Emissions in the Household Sector (Statistical Report, Final Figures)*

6. Enhance Energy Efficiency with AI and SaaS

Quick Efficiency Gains from Equipment Optimization

In offices and factories, significant energy savings can be achieved in the short term by upgrading to high-efficiency equipment, introducing inverters, and optimizing operations based on building performance, usage patterns, and weather conditions. However, many small and medium-sized enterprises lack the manpower to fully implement these measures.

Enhancing Efficiency with AI and SaaS

Energy efficiency can be significantly improved by applying AI and SaaS to optimize operations. These solutions enable real-time monitoring and control, reducing both energy use and operational costs, making them accessible even for SMEs. Support should be provided to accelerate such operational efficiency measures as an immediate action.

AI-Based Prediction Using Diverse Data

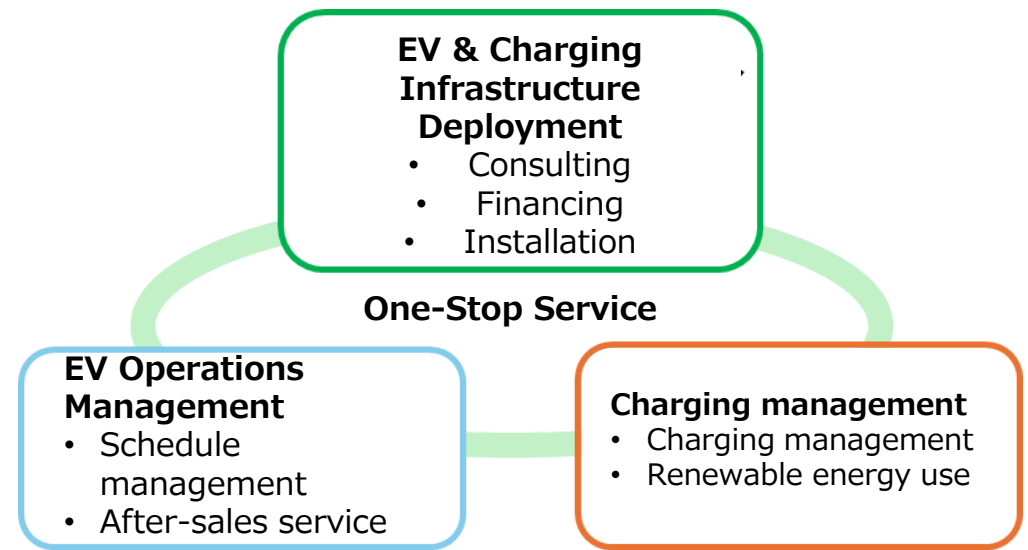
By integrating diverse data and applying AI, predictive management becomes possible. Building heat loads can be forecast using environmental data such as weather, along with internal heat load and equipment operation data.

Equipment Control Using SaaS

SaaS enables easier control and monitoring of HVAC and other equipment through remote operation and centralized management. Automated control and monitoring services are also advancing.

One-Stop EV Services / EaaS

EV adoption is an effective energy-saving measure and offers lower total cost of ownership. However, high upfront costs have limited adoption. Recently, one-stop services (EaaS) have emerged, providing integrated solutions for EV deployment and operation, including fleet management, charging optimization, and energy management.



7. Maximize the Use of Heat Pumps

Heat Pumps: Using Ambient Heat Instead of Fossil Fuels

- Heat pumps use heat from the air for heating and hot water instead of fossil fuels. They require only electricity, such as for compressors. **Energy consumption can be reduced to less than one-third.**
- They can be used in homes and offices, as well as for low-temperature industrial processes such as food processing, cleaning, and drying.

Low Adoption in Heating and Hot Water

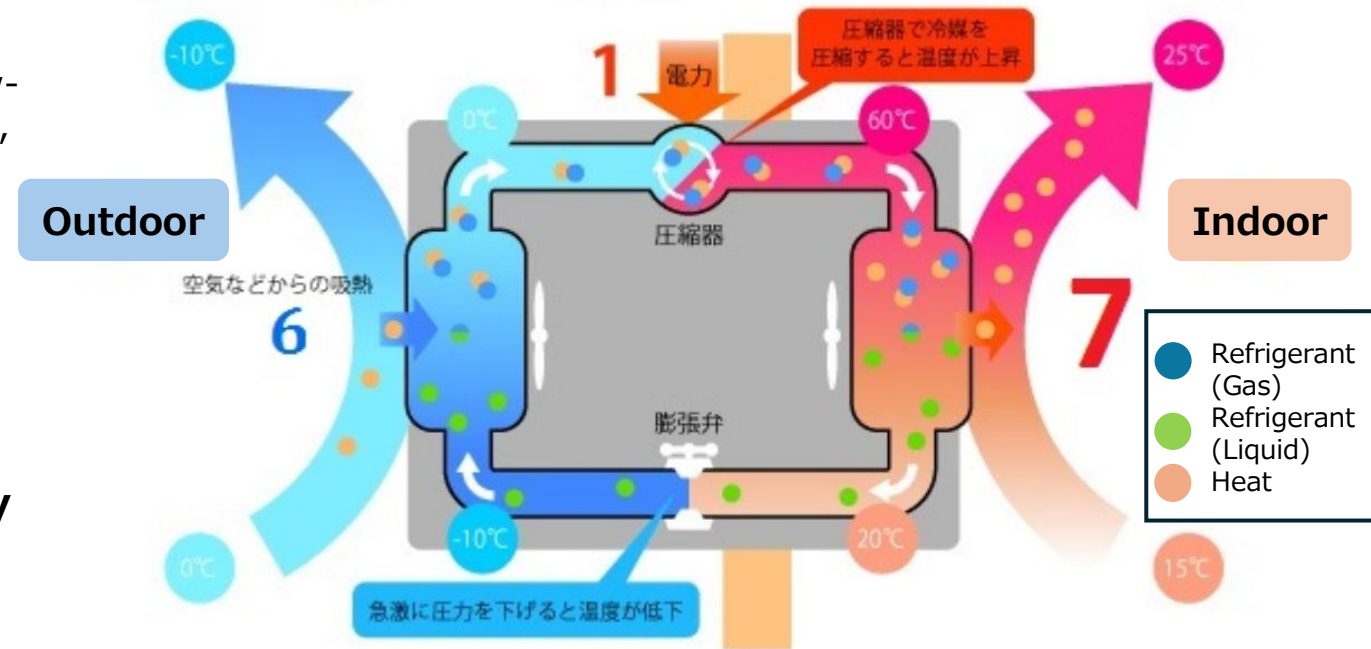
- About 30% of households use heat pumps for heating, and only about 10% for hot water.
- Industrial use has not yet scaled up.

Heat Pumps: A Strength of Japanese Industry

- Japan has strong global competitiveness in heat pump technology.
- Expanding deployment strengthens energy security and supports overseas growth, particularly in Southeast Asia.

Air conditioners deliver up to seven times more energy than they consume

1 Electricity + 6 Ambient Heat → 7 Thermal Energy ※Example of residential air conditioner heating



Source: Translated by Renewable Energy Institute from the Heat Pump & Thermal Storage Technology Center of Japan (website)

Strengthen support measures such as energy audits and subsidies to promote electrification through heat pump adoption

Six Structural Reforms to Strengthen Energy Self-Sufficiency



1

Accelerate solar deployment



- a | Promote agrivoltaics
- b | Enable plug-in solar systems
- c | Mandatory solar PV for buildings

2

Accelerate onshore and offshore wind development



3

Develop geothermal as a national strategic resource



4

Expand grids and storage to maximize renewables



5

Standardize GX ZEH for resilient, efficient housing



6

Strengthen GX-ETS benchmarks for power and industry



1. Regulatory Reform to Accelerate Solar Deployment

Agrivoltaics: Boosting Agriculture and Regional Revitalization

- There are over 6,000 cases nationwide (as of FY2023).
- Large-scale solar (2,500 kW) is combined with rice cultivation in Miyagi.
- Coffee is grown under 51% shading in Okinawa.
 - **Avoid unnecessary regulations on shading rates.**
 - Simplify procedures for temporary conversion of farmland.
 - Promote databases on cultivation performance.

Enable Plug-in Solar for Everyone

- Easy to install on balconies of apartments and condominiums.
- 1.2 million units registered in Germany with actual numbers estimated to be 3–4 times higher.
- **The UK to enable this within a few months as part of its response to the Middle East crisis.**

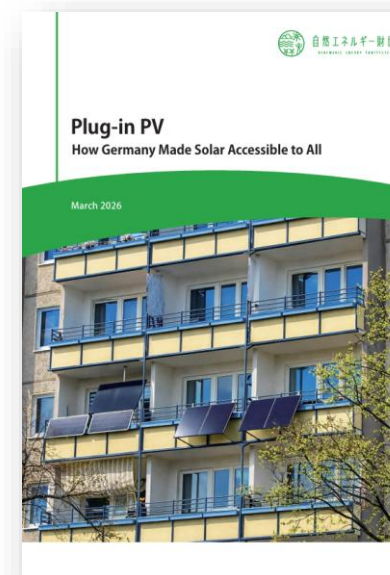
Nationwide Mandates for Solar Installation on Buildings

- Tokyo and Kawasaki and others have already introduced requirements.
- Current national measures are limited to reporting under the Energy Conservation Act and voluntary efforts under the Top Runner Program for housing.
- Introduce mandatory requirements nationwide.

Agrivoltaics using vertical solar panels



Photo: Renewable Energy Institute



Renewable Energy Institute "Plug-in PV How Germany Made Solar Accessible to All" 25 March 2026

Target: 10 GW by FY2026 and 70 GW by FY2030

2. Accelerate Onshore and Offshore Wind Development

Streamline Procedures to Unlock Its Large Potential

- The government handle grid connections in a centralized manner.
- Introduce preferential interest rates and credit guarantees.
- Shift toward broader cost sharing for grid construction.

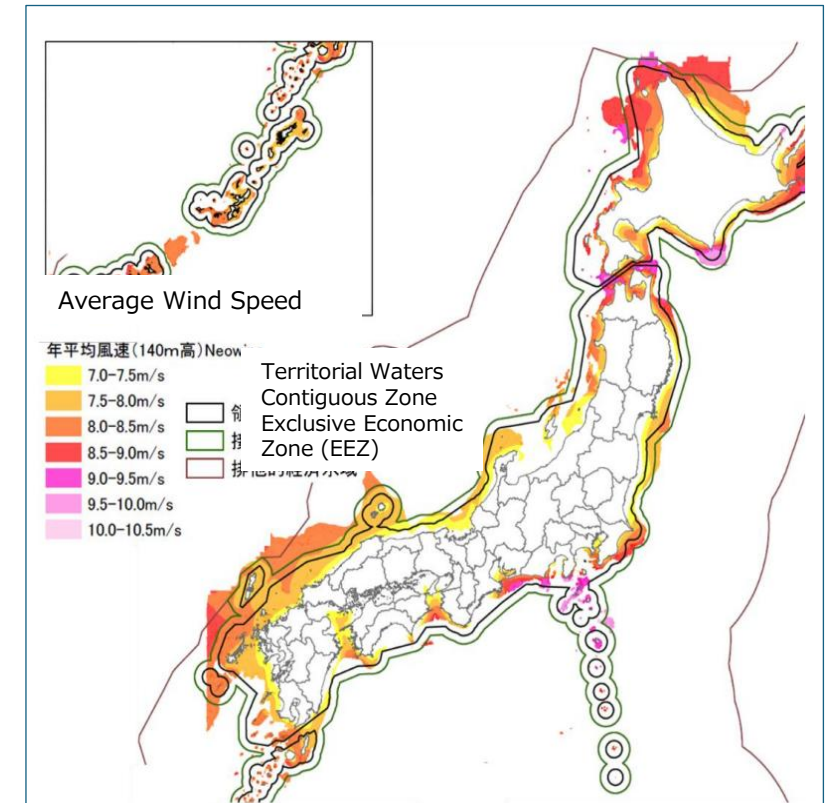
Onshore Wind Power

- Accelerate procedures for projects under environmental assessment.
- Repower aging turbines with larger, more efficient models.

Offshore Wind Power

- About 4.6 GW is expected by the early 2030s.
- Set clear annual auction volumes to ensure a steady pipeline.
- Maximize the use of international standards for technical requirements and certification.
- Support financing through dedicated frameworks and green investment schemes.

Offshore Wind Power: 1,128 GW Potential in Territorial Waters and EEZ



Source: Renewable Energy Institute, *Offshore Wind Power Potential in Japan* (November 2023)

Target: Over 10 GW of New Capacity by 2030

3. Develop Geothermal as a National Strategic Resource

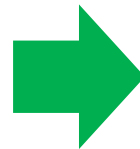
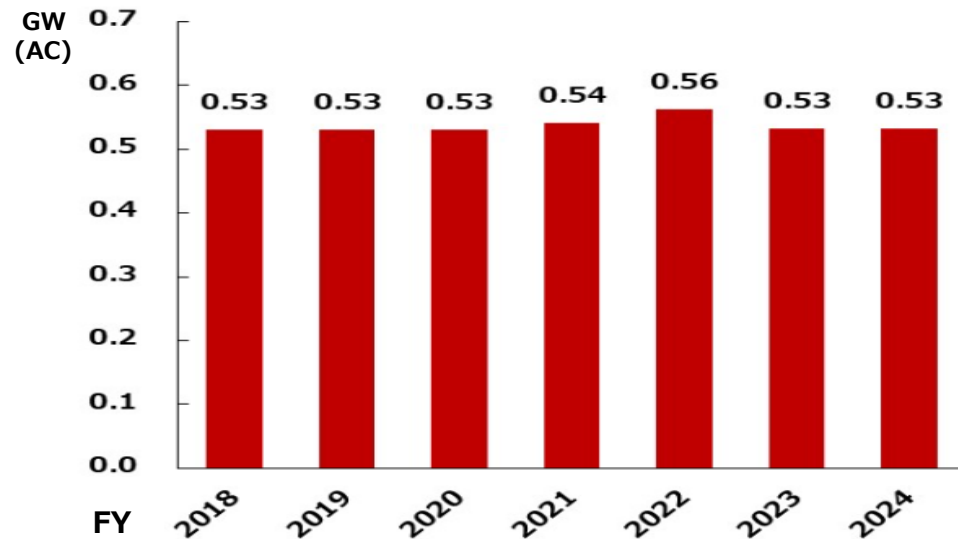
Japan has the world's third-largest geothermal resources (23 GW)

It is a stable energy source not affected by weather.

Three Japanese companies hold about 70% of the global geothermal turbine market.



However, only 0.53 GW is in operation in Japan.



Maximize Use of Domestic Geothermal Resources

- Enact a “**Geothermal Resource Development Promotion Act**” and designate geothermal as a national strategic resource.
- Establish a one-stop system for geothermal policy.
- Conduct drilling surveys and resource zoning under government leadership to manage total potential.
- Organize development rights through auctions and clarify usage periods.
- Establish systems for environmental impact assessment and monitoring.

Source: Renewable Energy Institute, based on “Status of Renewable Energy Grid Connection and Applications” (General Transmission and Distribution Utilities website)

4. Expand Grids and Storage to Maximize Renewable Energy

Unlock Nationwide Renewable Energy Potential

- Expand interregional transmission lines (OCCTO Master Plan) to deliver power from resource-rich regions (Hokkaido, Tohoku, Kyushu) to major demand centers (Tokyo, Chubu, Kansai).
- Strengthen support to address challenges in large-scale transmission development, including assessments, stakeholder coordination, and financing.

Connect Distributed Renewable Energy

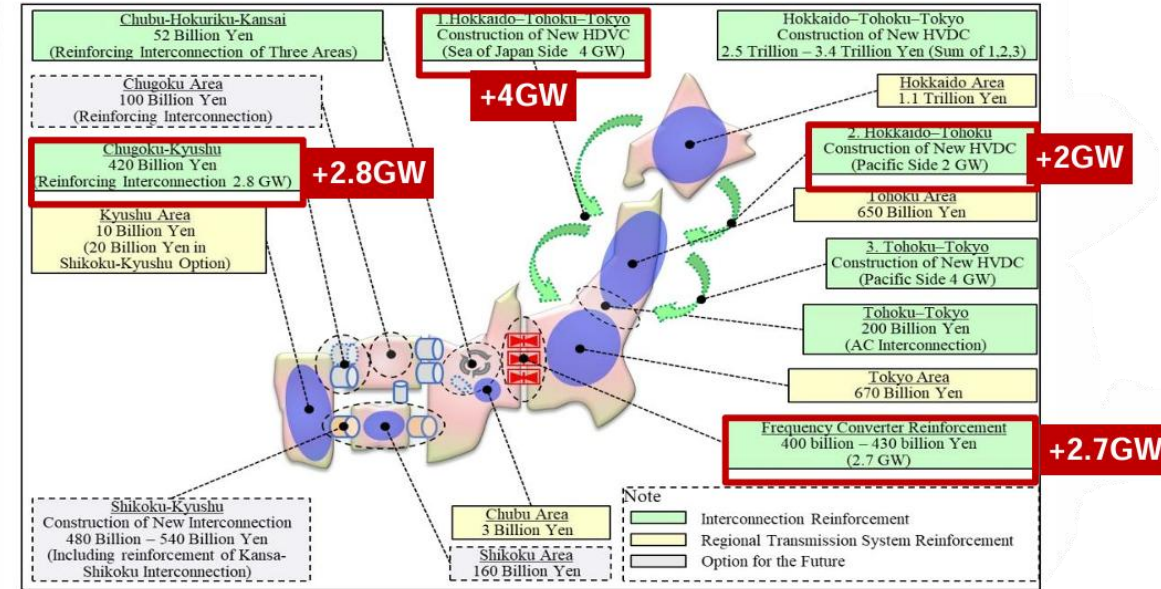
- Support transmission expansion planning by utilities.
- Design incentives under the revenue cap system to promote grid reinforcement.*

*Under the revenue cap system, fixed revenues incentivize asset utilization over new investment, limiting transmission expansion.

Accelerate Battery Deployment to Enhance Grid Flexibility

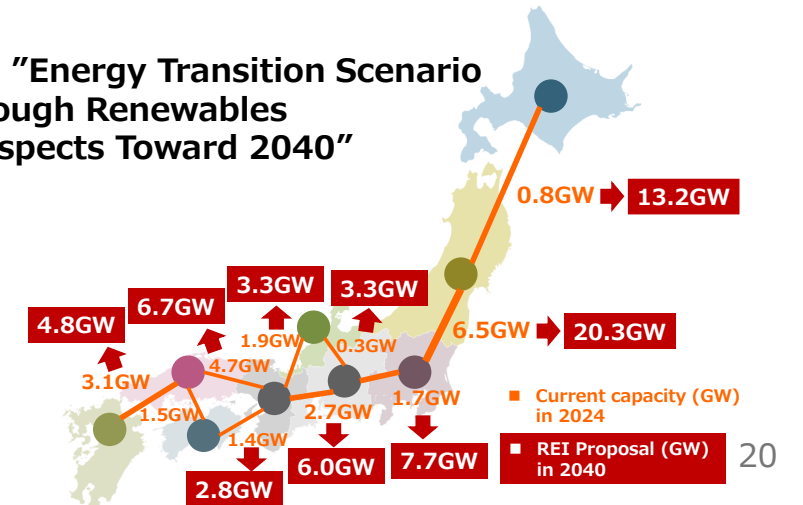
- Expand subsidies to promote battery installation in homes, factories, public facilities (e.g., hospitals), and infrastructure (e.g., water systems).
- Streamline grid connection procedures for utility-scale batteries.
- Identify locations where batteries can avoid grid upgrades and guide deployment.
- Develop market mechanisms where batteries support supply-demand balance and grid stability (e.g., negative pricing).

OCCTO Master Plan



Source: OCCTO presentation at CIGRE Conference in Paris in August 2024

REI "Energy Transition Scenario through Renewables Prospects Toward 2040"



5. Standardize GX ZEH for Resilient and Comfortable Housing

Improving housing energy performance enables safe, comfortable living even during energy crises.

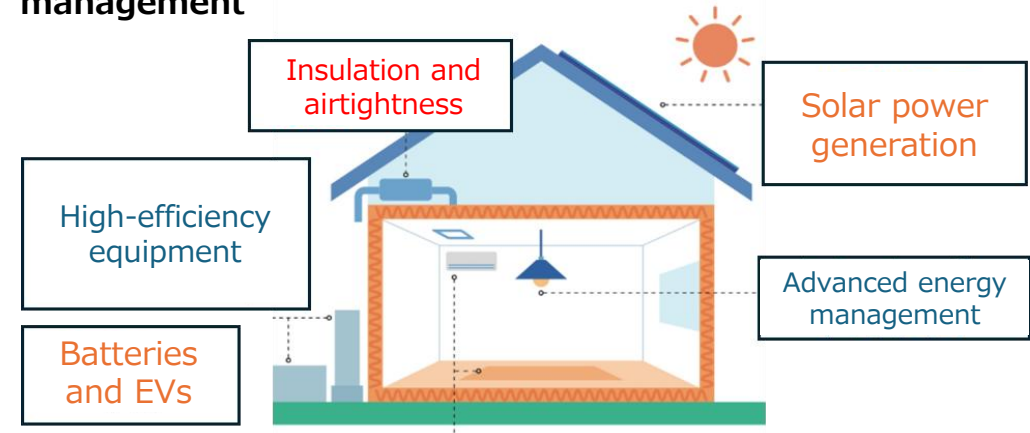
- By 2030, ZEH (net zero energy housing) standards will become mandatory in Japan.
- In 2025, GX ZEH—defined as a “true” net zero energy home—was introduced, with certification starting in FY2027.
- Conventional ZEH has relied heavily on solar and lacked sufficient insulation and efficiency standards.
- GX ZEH requires 100% of annual energy use to be covered by on-site generation, while GX ZEH+ raises this to 115%, extending coverage to appliances.
- A key challenge is the lack of airtightness standards, which should be established and widely adopted.

Standardize GX ZEH and GX ZEH Apartments

- GX-oriented housing has been eligible for subsidies since FY2025, with ¥1.1 million per unit in FY2026 under the “Future Eco Housing 2026” program, totaling about ¥205 billion.
- GX ZEH and GX ZEH apartments should be prioritized and standardized for new construction.

GX ZEH

Power generation with solar, combined with insulation and high-efficiency equipment, and smart use of generated electricity through batteries, EVs, and advanced energy management



Source: Renewable Energy Institute, based on figures from the Ministry of Land, Infrastructure, Transport and Tourism website



Tottori Prefecture introduced its own energy-efficient housing standard (NE-ST) in 2020, including insulation and airtightness requirements.

Through outreach to builders and real estate stakeholders, over half of new wooden houses now meet this standard.

6. Strengthening GX-ETS for Power and Industry

Reform GX-ETS to Achieve Power Sector Decarbonization by 2040

- Revise GX-ETS to align with the 2040 power sector decarbonization target.
- The current plan—fuel-specific benchmarks for the first 3 years and thermal averages from FY2029—is too slow.
- Shift to an all-power-source average benchmark by FY2030 at the latest and bring forward paid auctions in the power sector.

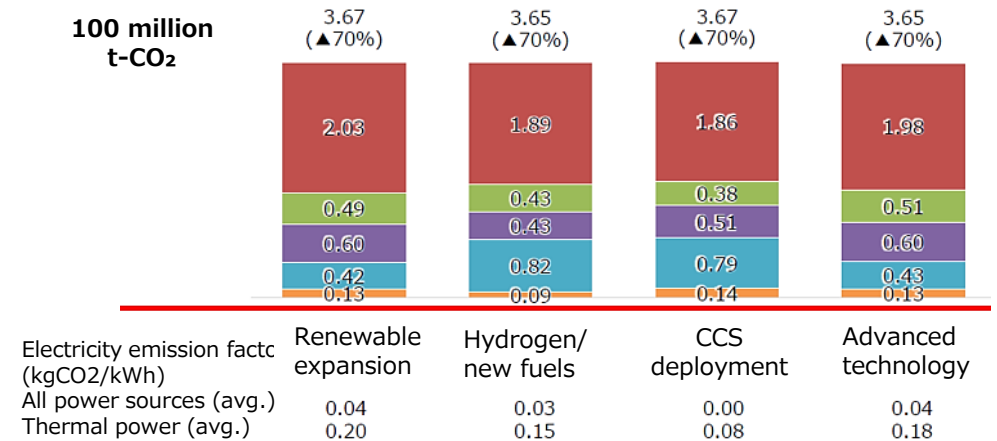
Strengthen Industrial Benchmarks

- Raise industrial benchmarks to the top 15% by FY2030 and align with NDC targets for 2035 and 2040.
- The current plan—starting from the top 50% and reaching 32.5% by FY2030—is insufficient.

Set Cap Prices to Enable Decarbonization Investment

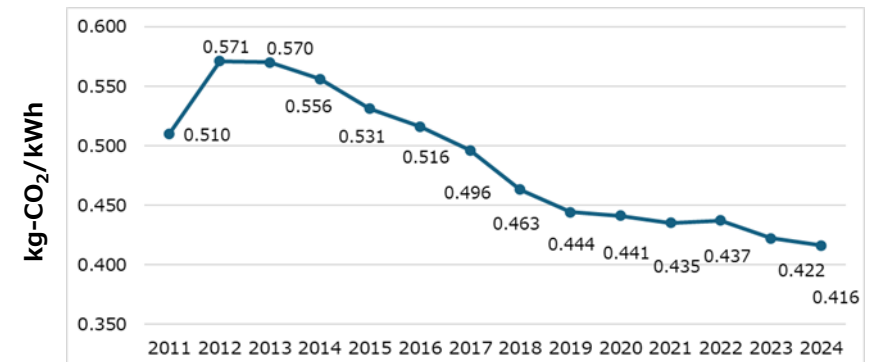
- Raise the cap price to a level that enables investment in decarbonization.
- Current price levels are too low to support such investments, according to industry.

Energy-Related CO₂ Emissions by Government Scenario (FY2040)



Source: Renewable Energy Institute, based on Agency for Natural Resources and Energy, *Outlook for Energy Supply and Demand in FY2040 (Related Materials)* (February 2025)

Trend in End-Use CO₂ Emission Intensity (FY2011–2024)

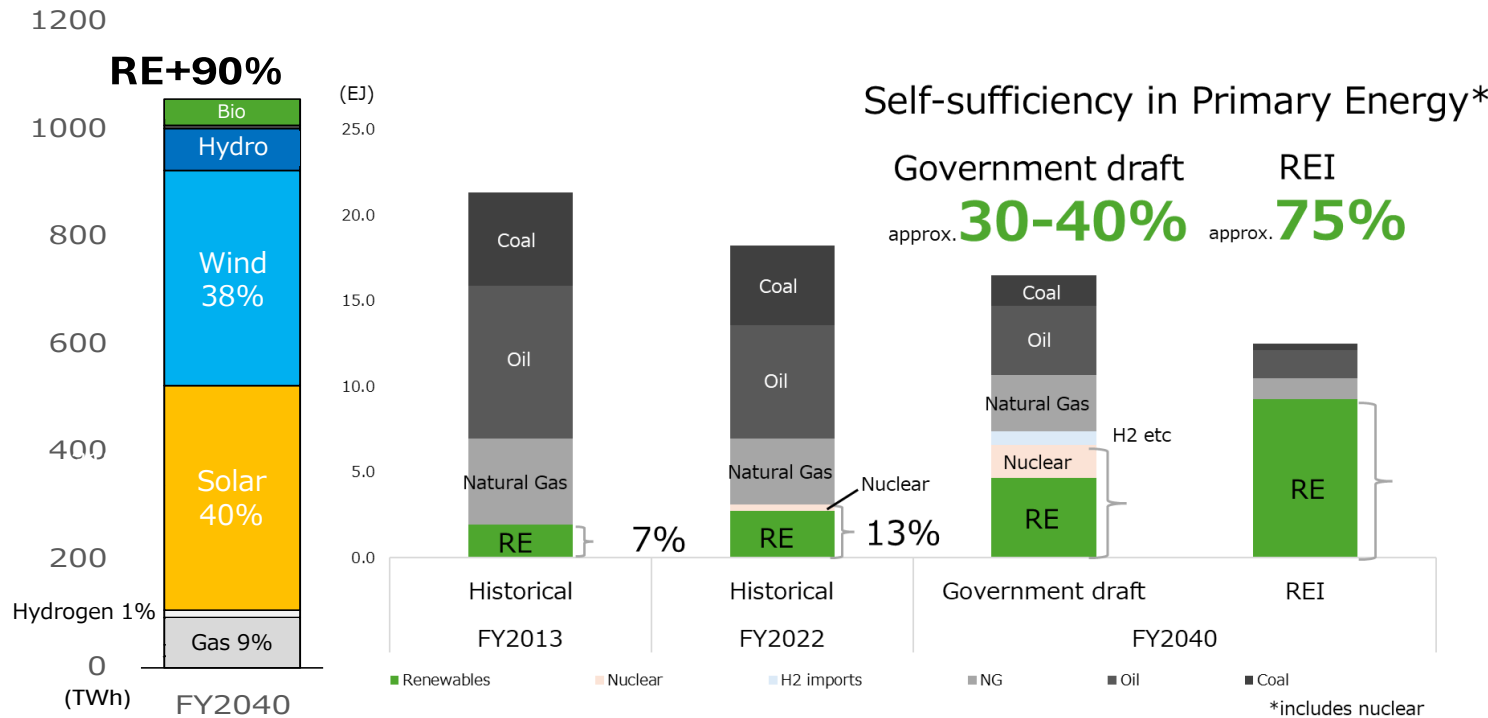


Source: Prepared by Renewable Energy Institute based on "Japan's Greenhouse Gas Emissions and Removals in FY2024 (Detailed)" (Ministry of the Environment, April 14, 2026), p.15

REI Scenario: 75% Energy Self-Sufficiency by 2040

- **By expanding renewable energy, improving energy efficiency, and accelerating electrification**, Japan can achieve around 75% energy self-sufficiency by 2040. Renewable energy could supply over 90% of electricity, significantly reducing reliance on fossil fuel imports (REI Scenario).
- In contrast, the government’s current plan reaches only 30–40% self-sufficiency, maintaining high dependence on imported fossil fuels.

Primary Energy Supply Mix and Self-Sufficiency: 7th Strategic Energy Plan vs. Renewable Energy Institute Scenario



Fossil Fuel Reduction by FY2040 (vs. FY2022)

- Oil demand: **-76%** (to 40 million kL)
- Natural gas demand: **-70%** (to 21 million t)
- Coal demand: **-92%** (to 14 million t)

Note: Government scenario values are shown as ranges, calculated from upper and lower bounds of capacity and share estimates.

Source: Renewable Energy Institute, based on Agency for Natural Resources and Energy, *Outlook for Energy Supply and Demand in FY2040 (Related Materials)*, and Takase et al., *“Energy Scenario Centered on Efficiency and Renewables: Achieving 75% Energy Self-Sufficiency by 2040,”* Energy and Resources, Vol. 46, No. 3 (2025)