Sustainability and Energy

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1. Overview

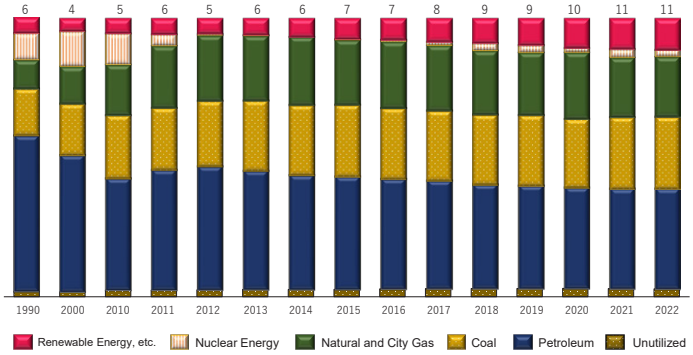
Promoting renewable energy to achieve stable energy self-sufficiency and carbon neutrality

The recent global situation has led to a sharp rise in energy prices. In the first half of 2022, JKM (Asian LNG spot price), TTF (Dutch gas price), and NBP (UK gas price) prices for crude oil, natural gas, etc. reached a global record high of 84.8 USD, 99.5 USD, and 70.4 USD, respectively[1] .

In addition, the global trend towards de-carbonization, including the Paris Agreement, has led to increasing interest in self-sufficient and renewable energy in Japan.

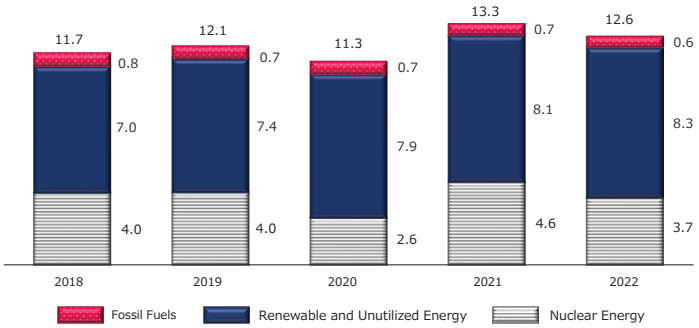
Renewable energy accounted for 11% of domestic energy supply composition in 2022 and it has been increasing steadily (Figure 1). Furthermore, the energy self-sufficiency rate in 2022 was 12.6%, with renewable energy sources accounting for 8.3%, and the proportion is on an increasing trend (Figure 2).

Figure 1 **Trends in source composition of primary energy supply in Japan (%)**



Source: Created by JETRO based on data from ANRE[2]

Figure 2 **Trends in energy self-sufficiency rate and composition of its contribution (%)**

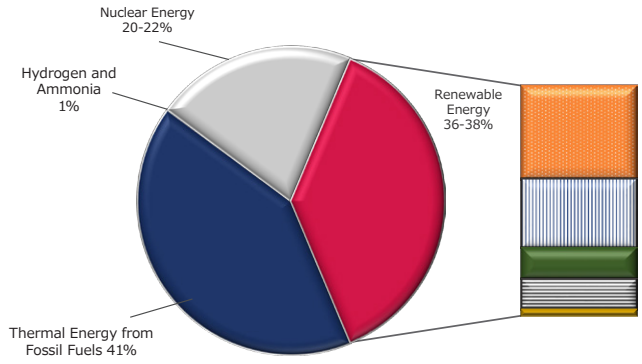


Source: Created by JETRO based on data from ANRE[3]

In 2020, the Japanese government announced Carbon Neutrality, and consequently, the Ministry of Economy, Trade and Industry (METI) formulated the Green Growth Strategy. The strategy identified four energy-related sectors with growth potential: (i) offshore wind energy, solar, and geothermal energy; (ii) hydrogen and fuel ammonia; (iii) next-generation thermal energy; and (iv) nuclear energy[4].

Furthermore, the energy composition target for 2030 aims for a 36–38% share of renewable energy sources, with target figures identified for solar, hydro, wind, biomass, and geothermal (Figure 3).

Figure 3 **Energy composition targets for FY2030**



Source: Created by JETRO based on data from METI[5]

1 Agency for Natural Resources and Energy. *Energy White Paper 2023*, Part 1, Chapter 1, Section 1 (JP).
2 Agency for Natural Resources and Energy. "Primary Energy Supply Rate in Japan," *Comprehensive Energy Statistics* (JP), time-series table (published on November 29, 2023).
3 See Note 2, "Energy Self-Sufficiency Rate."
4 METI. *Green Growth Strategy Through Achieving Carbon Neutrality in 2050*.
5 Agency for Natural Resources and Energy. *Renewable Energy Policies for the Future* (JP), p. 5.

2. Government Initiatives

Strengthening market competitiveness in green transformation and energy to achieve de-carbonization, stable energy supply, and economic growth

(1) Establishment of a basic policy for achieving green transformation

In February 2023, the Green Transformation (GX) Promotion Strategy was formulated in response to increased competitiveness of long-term, large-scale investment in green transformation and recognition of challenges in energy security. The strategy consists of two main frameworks: (i) green transformation initiatives based on the basic premise of securing a stable energy supply, such as the use of renewable energy as the main electric power source and energy conservation; (ii) realization and implementation of "growth-oriented carbon pricing concept," etc., including upfront investment in the private sector, etc.[6] (Figure 4).

Prime Minister Kishida has announced his intention to achieve over 999.5 billion USD* (150 trillion JPY) of public and private green transformation investment over the next 10 years [including about 133.2 billion USD* (20 trillion JPY) of upfront investment support from the government], and further expansion of green transformation investment is expected in future[7].

(2) Introduction of FIT and FIP schemes

Feed-in Tariff (FIT) is a scheme under which the Japanese government commits to purchase electricity generated from renewable energy sources at a fixed price for a fixed period of time[8]. The high construction costs incurred by the energy companies for energy generation facilities are also expected to be recovered, thereby promoting the spread of renewable energies.

Business operators are required to develop a business plan that meets the national requirements using one of the eligible energy sources (solar, wind, hydro, geothermal, or biomass). All electricity generated (excluding for personal use) is eligible for purchase[9].

Figure 4 **Overview of the Green Transformation Promotion Strategy**

GX initiatives based on basic premise of securing a stable energy supply	
(1) Promoting intensive energy conservation	• Subsidies and enhanced support for SMEs, etc.
(2) Making renewable energy the main energy source	• System development in approx. 10 years from 2023 on a scale more than 8 times larger than that of the past 10 years • Social implementation of next-generation solar cells and floating-type offshore wind energy
(3) Utilizing nuclear energy	• Rebuilding the next-generation innovative reactor at the decommissioned nuclear plant site • Permit additional extensions for certain periods of suspension, subject to strict safety screening and operating period restrictions
(4) Other important matters	• Support focusing on the price difference between hydrogen/ammonia and existing fuels • Promote R&D, capital investment, and demand creation in the fields of carbon-recycling fuels and storage batteries, etc.
Realization and implementation of "Growth-oriented Carbon Pricing Concept"	
(1) Upfront investment supportthrough GX Economy TransitionBonds	• Supporting upfront investment amounting to 20 trillion JPY by establishing GX Economy Transition Bonds • Developing regulations and regulatory measures in areas that contribute to strxengthening industrial competitiveness and achieving both economic growth and emission reductions
(2) GX investment incentivesthrough Growth-oriented CarbonPricing (CP)	• Full-scale operation of the Emissions Trading Scheme (from FY 2026) • Introduce paid auctions to power generators (from FY 2033) • Introduce levy system for CO2 (from FY 2028) • Establish "GX Promotion Organization "as a single entity to execute the above
(3) Using new financial methods	• Promoting risk compensation measures, sustainable finance, etc.
(4) GX for international strategies, fair transition, SMEs, etc.	• Building the Asia Zero Emission Community (AZEC), etc.
(5) Promoting GX throughout society	• Fair transition, promotion of GX from the demand side, promotion of GX by SMEs

Source: Created by JETRO based on data from the Cabinet Office[6]

6 Cabinet Secretariat. *Outline of the Strategy for Promoting the Transition to a Decarbonized Growth Economy Structure (GX Promotion Strategy).*
7 METI. *Cabinet Decision on the Basic Policy for the Realization of Green Transformation.*
8 Agency for Natural Resources and Energy. *Renewable Energy FIT/FIP Guidebook (2023 Edition)* (JP), p. 4.
9 See Note 8, p. 6.

In addition, the Feed-in-Premium (FIP) scheme was introduced in FY-2022. FIP scheme allows electricity producers to independently sell the electricity they generate on the market and add a premium to the selling price[10]. The difference with the FIT system is that the purchase is carried out at a variable price, which creates an incentive to increase the supply of renewable energy when the demand or the market price rises. Through this, the use of renewable energy is expected to increase, such as through the storage of electricity in batteries.

(3) Implementation of Electricity System Reform

The electricity system reform currently being promoted by METI has three main pillars: (i) expansion of transmission line operation over a wide area; (ii) complete liberalization of retailing; and (iii) further securing the neutrality of the electricity transmission and distribution sector through legal separation[11].

Based on the above-mentioned electricity system reform, four market systems have been established to ensure a fair access environment to energy sources (Figure 5). By transferring energy management, which was previously handled by government organizations, to the market, efforts are being made to achieve more affordable and effective electricity distribution. Through these initiatives, electricity trading and supply-demand adjustment at private sector level are expected to increase.

(4) Initiatives by local government agencies (Zero Carbon Cities)

The Japanese government is promoting the increase of "Zero Carbon Cities," where local governments aim to achieve net zero greenhouse gas or carbon dioxide emissions by 2050[13]. Prefectures and municipalities are committed to formulating and implementing comprehensive and systematic measures to reduce greenhouse gas emissions, etc., in accordance with the natural and social conditions of the region[14]. As of December 2023, more than 1,000 municipalities have declared themselves to move towards zero-carbon, with effective and innovative initiatives and ordinances being implemented or enforced.

Figure 5 **Overview of the four market systems based on Electricity System Reform**

Capacity Market	• Auctions are held to secure future supply capacity. • The market was established in 2020, with trading to commence in FY 2024.
Baseload Market	• Auctions are held four times a year to improve access to low-cost and stablesources for electricity generation (thermal energy from coal or nuclear energy). • The market opened in 2019.
Supply/Demand Adjustment Market	• General transmission and distribution companies can procure regulated energy(e.g., generators with regulatable energy output, re-chargeable and dis-chargeable storage batteries, load regulation for factories, and otherconsumers) across areas. • The market opened in 2021.
Non-fossil Value Trading Market	• Trade in "non-fossil certificates," which separate the "environmental value"from the electricity generated from non-fossil sources. • The market opened in 2018.

Source: Created by JETRO based on data from METI[12]

10 See Note 8, p. 4.
11 Agency for Natural Resources and Energy. *About Electricity System Reform* (JP).
12 Agency for Natural Resources and Energy. *Challenges regarding Further Review of the Electricity System* (JP), pp. 13-24.
13 Ministry of the Environment. *Toward Achieving Carbon Neutrality by 2050* (JP).
14 Ministry of the Environment. *Status of Local Governments Announcing Zero Carbon Dioxide Emissions by 2050.*

3. Attractive Markets

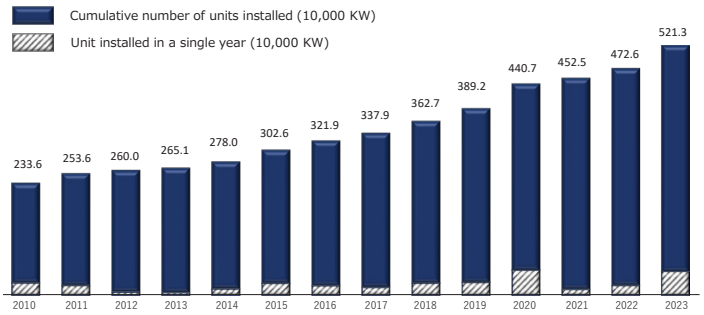
We focus on following five attractive markets with growth potential in the Environment & Energy industry.

(1) Offshore wind energy: Active market entry by foreign companies
(2) Biomass: Advancing institutional development in terms of costs
(3) Solar energy: The largest renewable energy source in Japan
(4) Hydrogen: World-leading R&D and implementation
(5) Storage batteries (lithium-ion): Diverse commercialization and international collaboration

(1) Offshore wind energy: Active market entry by foreign companies

The overall market size of wind energy generation in Japan is growing. The cumulative power generation capacity from wind energy was 5,213,000 kW at the end of 2023, with 2,626 installed units. The new installed capacity during 2023 (487,000 kW) is approximately 2.4 times greater than that in 2022 (200,000 kW), representing steady increase (Figure 6).

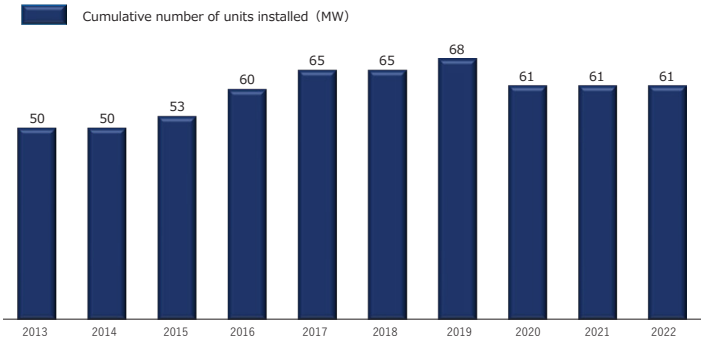
Figure 6 Trends in capacity of wind energy plant in Japan



Source: Created by JETRO based on data from Japan Wind Power Association[15]

In particular, the Japanese government has emphasized the importance of offshore wind energy generation in its "Basic Policy for Green Transformation" and "The 6th Strategic Energy Plan" and is actively promoting these initiatives.

Figure 7 Trends in capacity of offshore wind energy plant in Japan



Source: Created by JETRO based on data from IRENA[16]

As result of these factors, offshore wind energy generation has been steadily increasing (Figure 7). Similar to onshore wind energy, the majority of high-potential areas for offshore wind energy are in the northern part of Japan (Hokkaido and Tohoku region)[17] , with continuous development of these areas expected in the future. At the end of December 2023, there were 57 offshore wind energy generation plants at 10 sites, out of which six were full-scale offshore wind energy and four were semi-offshore wind energy (offshore wind energy accessible from coastal areas) [18]. The majority of newly introduced plants in Japan are by foreign manufacturers, including Vestas (Denmark) and Siemens (Germany)[19], and it is expected that wind turbines will increase in size, resulting in a significant increase in cumulative energy output.

15 Japan Wind Power Association. *[Preliminary] Installed capacity of wind power in 2023 Japan* (JP), p. 2.
16 International Renewable Energy Agency (IRENA). *Renewable Capacity Statistics 2023,* p. 32.
17 Ministry of the Environment. "wind power," *Renewable Energy Potential System (REPOS)* (JP) (as of February 29, 2024).
18 Japan Wind Power Association. *Cumulative installed capacity of wind power in 2023 Japan: 5,213.4 MW 2,626 Units.*
19 See Note 15, p. 3.

The government has set a goal of offshore wind power projects of 10 million kW by 2030 and 30 to 45 million kW by 2040. Additionally, in 2020, under its first offshore wind energy industry vision, the government announced a policy of designating zones of around 1 million KW per year for a period of 10 years[20]. In this manner, the government has designated renewable energy promotion zones to form offshore wind energy generation projects and has issued a public call for offshore wind farm operators to participate. In the same year, the first round of public calls for operators in three promising zones was held[21]. In 2023, a second call for applications was made in four new potential zones, and a joint consortium comprising of RWE Offshore Wind Japan Murakami-Tainai K.K. (with German offshore wind manufacturer RWE as the parent company), Mitsui & Co., Ltd., and Osaka Gas Co., Ltd., was selected as an implantable offshore wind energy producer in Niigata Prefecture[22].

As a result of the above-mentioned, government support for private companies has led to increased cooperation between European and Japanese companies and growing momentum for collaboration, with more companies entering the Japanese market. (Figure 8).

Figure 8 **Examples of foreign offshore wind energy companies in Japan**

Company Name	Head Office	Entry Type
BW Ideol	France	Established a Japanese subsidiary
wpd	Germany	Established a Japanese subsidiary
Vector Renewables	Spain	Formed a dedicated team for offshore wind energy generation
Vena Energy	Singapore	Established a Japanese subsidiary
Van Oord	Netherlands	Joint participation in energy generation projects
Equinor	Norway	Established a Japanese subsidiary
Xodus Group	U.K.	Established a Japanese subsidiary
Vestas	Denmark	Established a Japanese subsidiary
RWE Renewables	Germany	Established a Japanese subsidiary
Orsted	Denmark	Established a Japanese subsidiary

Source: Created by JETRO based on companies' websites[23]

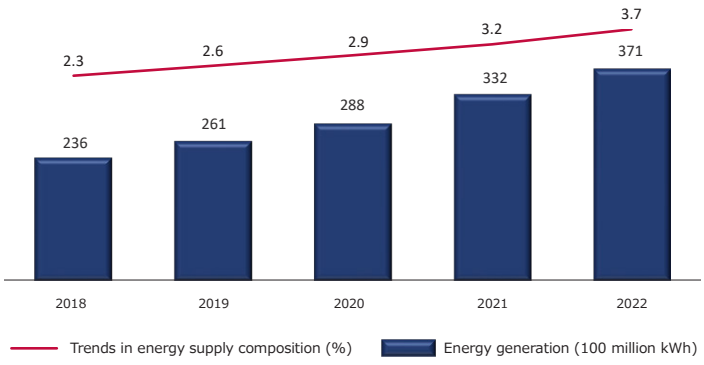
In addition, the 6th Strategic Energy Plan mentions the development of direct current (DC) transmission system to transmit electricity from high-potential areas such as Hokkaido, Tohoku, and Kyushu regions to large consumption areas as a policy to promote offshore wind energy[24].

Japanese offshore wind market is expected to continue to expand in future due to initiatives by public and private sectors, such as the opening of specific regions to offshore wind energy, active collaboration and participation of private companies, and development of transmission systems.

(2) Biomass: Advancing institutional development in terms of costs

The biomass energy generation market in Japan is in the growth phase. Prior to the introduction of FIT in 2012, the cumulative amount of biomass energy generation was 2.3 million kW; however, as of June 2021, the cumulative amount of biomass energy generation, including the amount certified under the FIT, was 10.36 million kW, and this figure is on an increasing trend[25]. Furthermore, although biomass accounted for only 3.7% of the overall energy source composition in 2022, its share has been increasing every year and is expected to continue to grow (Figure 9).

Figure 9 **Trends in share of biomass energy generation in energy supply composition and volume**



Source: Created by JETRO based on data from ANRE[26]

20 Public-Private Council on Enhancement of Industrial Competitiveness for Offshore Wind Power Generation, Agency for Natural Resources and Energy. *Overview of the Vision for Offshore Wind Power Industry (1st)* , p. 6.

21 METI. *Regarding the selection of offshore wind power generators in "Noshiro City, Mitane Town and Oga City, Akita Prefecture," "Yurihonjo City, Akita Prefecture" and "Choshi City, Chiba Prefecture* (JP).

22 METI. *About the selection of offshore wind power generators in "Oga City, Katagami City and Akita City, Akita Prefecture", "Murakami City and Tainai City, Niigata Prefecture" and the "Saikai City, Eshima, Nagasaki Prefecture"* (JP).

23 JETRO. *Leader in the floating offshore wind industry, IDEOL SA, establishes a Japanese subsidiary.*
JETRO. *German offshore wind power giant wpd establishes subsidiary in Tokyo.*
JETRO. *UK-based energy consultancy Xodus Group establishes a Japanese subsidiary in Tokyo.*
JETRO. *Danish wind power plant manufacturer MHI Vestas Offshore Wind establishes company in Tokyo.*
JETRO. *Major European energy producer RWE Renewables establishes limited liability company in Tokyo.*
WIND JOURNAL. *Vector Renewables Japan establishes a team specializing in offshore wind power! Supporting your business even before development.*
Vena Energy. Official website.
Kajima Corporation. *Participation in the construction of two offshore wind power projects in Akita Prefecture and one in Chiba Prefecture.*
Equinor. Official website.
Orsted. Official website.

24 METI. *6th Strategic Energy Plan* (JP), p. 35.

25 Agency for Natural Resources and Energy. *Regarding Biomass Power Generation (January 2022)* (JP), p. 6.

26 Agency for Natural Resources and Energy. "Electrical power composition (power generation)," *Comprehensive Energy Statistics* (JP), time-series table (published on November 29, 2023).

As for the prospects of introducing biomass energy generation in 2030, a large share is expected to come from wood-based sources, with 6.26 GW coming from wood-based sources and 0.21–0.24 GW from methane-fermentation gas-based sources[27]. Biomass is attracting attention as a regionally distributed energy source with significant ripple effects on improving disaster resilience, economy, and employment.

On the other hand, biomass is an energy source that requires fuel, and fuel costs account for the majority of energy generation costs. For this reason, the Japanese government has introduced a policy to promote the implementation of FIT and FIP for biomass from the perspective of cost recovery and to promote initiatives to stimulate market trading. Some examples are the selection of suitable tree species as fuel wood by relevant authorities, demonstration testing of forestry methods suitable for the region, and development of quality standards for wood biomass fuels, aiming at increasing the supply of domestic wood biomass fuels[28].

The Japanese biomass energy market is at a growing stage compared to other energy markets, and with expansion over the long term, it is expected that foreign companies will enter this market, which will accelerate the market's growth. (Figure 10).

Figure 10 **Examples of foreign biomass energy companies in Japan**

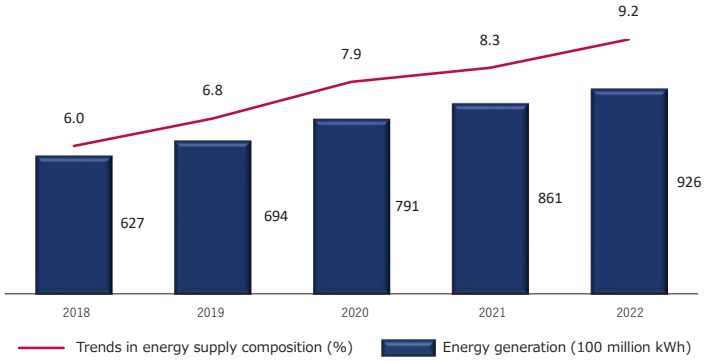
Company Name	Head Office	Businesses in Japan
Enviva Partners	U.S.	Joint review of supply chain for energy generation using woody biomass with J Power
Peterson and Control Union Group	Netherlands	Third-party certification of biomass, fiber, food, etc.
WegscheidEntrenco	Germany	Provision of solutions for electricity, heating, and cooling using wood biomass fuels
Veolia	France	Operation and maintenance wood biomass and biogas energy plants that utilize digester gas generated in the sewage sludge treatment process

Source: Created by JETRO based on companies' websites[29]

(3) Solar energy: The largest renewable energy source in Japan

Solar energy accounted for 9.2% of energy source composition in 2022, the highest share among all renewable energies, and the amount of electricity generated was 92.6 billion kWh in the same year, representing a continuously increasing trend (Figure 11).

Figure 11 **Trends in share of solar energy generation in energy supply composition and volume**



Source: Created by JETRO based on data from ANRE[30]

The potential in terms of volume of solar energy generation facilities is assumed to be 455,205 MW for "building systems (government offices, public facilities, housing, etc.)" and 1,009,836 MW for "land systems (disposal sites, agricultural land, degraded agricultural land, water, etc.)". In addition, it is estimated that the Kanto region, Aichi, Osaka, and other urban areas have the highest potential for building systems, while Hokkaido, with its large land area, is considered to be the highest potential area for land systems[31]. The number of solar energy projects, particularly in residential applications below 10 kW, has been increasing in recent years in response to surging fuel and electricity prices[32].

In the 6th Strategic Energy Plan, future policies on solar energy include the use of energy management systems (HEMS/BEMS) in homes and buildings, practical application of next-generation solar cells such as perovskite solar cells that can be installed on walls, and the development of basic technologies to improve performance of next-generation solar cells through collaboration between industry, academia, and government[33].

Meanwhile, reducing the cost of energy generation is a challenge, and foreign companies with cost advantage are expected to continue dominating the Japanese solar energy generation market (Figure 12).

27 Japan Organics Recycling Association and Japan Woody Bioenergy Association. *Prospects for Introducing Biomass Power Generation in Japan* (JP), p. 2.
28 METI. *6th Strategic Energy Plan* (JP), p. 65.
29 Enviva. *Enviva and J-Power Join Efforts to Decarbonize Power Generation in Japan.*
City of Kobe. *Control Union Japan opens Kobe branch.*
Wegscheid Entrenco. Official website.
Veolia. Official website.
30 Agency for Natural Resources and Energy. "Electrical power composition (power generation)," *Comprehensive Energy Statistics* (JP), time-series table (published on November 29, 2023).
31 Ministry of the Environment. "Solar power," *Renewable Energy Potential System (REPOS)* (JP) (as of February 29, 2024).
32 Japan Photovoltaic Energy Association (JPEA). *Current Status of Solar Power Generation and Challenges in Becoming Self-Sustaining and Mainstream* (JP), p. 21.
33 See Note 28, pp. 112, 116.

Figure 12 Examples of foreign solar energy companies in Japan

Company Name	Head Office	Businesses in Japan
Vena Energy	Singapore	Establishment of 31 MW-scale solar energy generation plants
Canadian Solar	Canada	Sale of household and industrial solar energy generation systems
Hanwha	Korea	Sale of solar energy cell modules

Source: Created by JETRO based on companies' websites[34]

(4) Hydrogen: World-leading R&D and implementation

Japan is a pioneer in acquiring knowledge of hydrogen and ammonia energy generation and in the development of infrastructure in marine transport technology. It is working to establish and expand the commercial supply chain with the aim of establishing its presence in the global market. In particular, efforts are being made to strengthen industrial competitiveness by identifying nine fields in five categories, including hydrogen supply, fuel cells, and use of hydrogen compounds, as priority areas where the market is large and Japanese companies are considered to have a technological advantage[35].

From the 2017 Basic Hydrogen Strategy to the 2020 Green Growth Strategy and the 6th Strategic Energy Plan in 2021, the position of hydrogen is becoming increasingly important in Japan. The target for the introduction of hydrogen in the Green Growth Strategy is up to 3 million metric tons by 2030 and around 20 million metric tons by 2050[36]. In addition, the Basic Hydrogen Strategy revised in 2023 added a new target of 12 million metric tons of hydrogen (including ammonia) for 2040[37].

Development trend in hydrogen includes initiatives in power-to-gas technology, which absorbs fluctuations in the energy output of natural variable power sources such as solar energy and converts it into hydrogen for storage. A demonstration project for hydrogen production using a 10,000-kW alkaline water electrolyser, one of the world's largest, is also underway[38].

Regarding hydrogen mobility, fuel cell buses and fuel cell forklift trucks were launched in market in 2016. In addition, technological development of large fuel cell trucks began in 2020, and several automobile and transportation companies began demonstration operations in the Kanto and Chukyo regions in FY-2022, and mass production is scheduled to begin after FY-2025. Moreover, the advanced development of hydrogen stations started in 2013, and 181 hydrogen stations (including those under construction) were opened by the end of May 2023[39].

In hydrogen energy generation, the development of technology to control the high combustion rate of hydrogen is progressing, and in 2018, the world's first 100% hydrogen-fuelled gas turbine energy generation (1 MW) to supply heat and power to a city block was achieved[40]. In this manner, a wide range of research and demonstration projects have been carried out (Figure 13).

Figure 13 Development of major hydrogen and ammonia technologies in Japan (as of January 2023)

Technology	Status
FC Bus	Commercialized
FCTruck	Under practical demonstration (in 2020s)
Hydrogen Burner	Technology established
Hydrogen Boiler	Commercialized
Ammonia Burner	Under development and demonstration (- FY 2027)
Pure Hydrogen Fuel Cell	Commercialized
Small-sized Hydrogen Turbine (Dedicated)	Commercialized
Large-sized Hydrogen Turbine (Co-fired)	Scheduled for practical demonstration (around 2025)
Ammonia 20% Co-fired	Under practical demonstration (1 million kW; until FY 2024)
High Ammonia Co-fired Burner (50% Or More)/Dedicated Burner	Under development and demonstration (- FY 2028)
Fuel-cell Powered Ships	System under development and demonstration (- FY 2028)
Hydrogen And Ammonia-fueled Ships	Engine under development (- FY 2030)
Using Ammonia in Naphtha Cracking Furnaces	Development of technology (in 2030s)
MTO (methanol To Olefin)	Scheduled for large-scale demonstration (-2030)
Hydrogen-based Reduction Ironmaking	Development of elemental technologies (in 2040s)

Source: Created by JETRO based on data from ANRE[41]

34 Vena Energy. Official website (JP).
Canadian Solar. Official website.
Hanwha. Official website (JP).
35 Agency for Natural Resources and Energy. *Overview of Basic Hydrogen Strategy* (JP), p. 7.
36 METI. *Green Growth Strategy (Hydrogen/Ammonia)* (JP).
37 Cabinet Secretariat. *Basic Hydrogen Strategy* (JP), p. 12.
38 Agency for Natural Resources and Energy. *Energy White Paper 2023*, Part 3, Chapter 8, Section 1 (JP).
39 Agency for Natural Resources and Energy. *Interim summary on the promotion of hydrogen in the field of mobility* (JP), pp. 22, 24, 36.
40 See Note 38.
41 Agency for Natural Resources and Energy. *Interim meeting of the Subcommittee on Hydrogen Policy/Subcommittee on Decarbonized Fuels such as Ammonia* (JP), pp. 6, 14.

Japan has the second-highest number of hydrogen-related patents after the European Union (EU), accounting for 24% of the total number of hydrogen-related International Patent Family (IPF) inventions published as of 2023[42].

Future technological developments are expected to effectively utilize fossil fuels in clean form by producing hydrogen and ammonia from surplus renewable energy sources such as electricity and by combining them with CCUS (Carbon Capture, Utilization, and Storage) technology[43].

Hydrogen-related businesses are still in the technology development and demonstration stage worldwide, and more foreign companies are expected to enter the market in the future. (Figure 14). The Japanese government is planning to promote legislation, including the establishment of a hydrogen-related safety regulation system, along with support for the development of supply infrastructure such as tanks and pipelines and large-scale investment aid using blended finance[44], making the market more active in the future.

Figure 14 Examples of the entry of hydrogen-related foreign companies

Company Name	Head Office	Businesses in Japan
Siemens Energy	Germany	Selected for "Hydrogen Production through Water Electrolysis Using Power from Renewables Project" by NEDO
Air Liquide	France	Production of hydrogen from low-carbon or renewable energy sources and the construction of hydrogen stations

Source: Created by JETRO based on companies' websites[45]

(5) Storage batteries (lithium-ion): Diverse commercialization and international collaboration

In the "Basic Policy for the Realization of Green Transformation," the storage battery industry was identified as one of 16 priority areas for promoting green transformation investment, and the direction of green transformation and measures to promote investment were summarized[46]. The demand for storage batteries is expected to grow for both in-station and in-vehicle applications. The Storage Battery Industry Strategy, formulated in August 2022, sets the targets of establishing a domestic manufacturing base of 150 GWh/year by 2030, securing a global manufacturing capacity of 600 GWh/year, and the full-scale commercialization of all-solid-state batteries. Liquid-based lithium-ion batteries are currently the mainstream; however, considering safety, operating range, and recharging time, the development of all-solid-state lithium-ion batteries is expected to lead as the next generation storage batteries[47].

As of April 2023, Japan's current storage battery production capacity is around 20 GWh[48]. Earlier, the Japanese companies held the top global share in the lithium-ion market; however, in recent years, they have faced a decline in market share due to the expansion of Chinese and South Korean manufacturers[49]. In order to overcome the situation, the Japanese government is promoting investment support measures related to storage batteries. In the future, the government plans to invest approximately 3 billion USD* (450 billion JPY) from the public and private sectors to support the target of securing a domestic manufacturing base of 150 GWh/year.

In addition, the "partnership in critical minerals" (October 2022) with Australia and the "agreement on strengthening the supply chain for critical minerals" (March 2023) with the United States have been signed so far. In the future, the government will continue to promote global cooperation and initiatives to secure stable supplies of the resources needed for storage batteries, such as by strengthening cooperation in the supply chain with Canada[50].

In the 6th Strategic Energy Plan, target price has been set for FY-2030 to increase storage batteries for commercial and industrial use as well as for grids. The target price at which the investment can be recovered through revenue generated from energy storage system is around 466 USD* (70,000 JPY) per kWh for household energy storage systems and 399 USD* (60,000 JPY) per kWh for commercial and industrial energy storage systems[51].

42 International Energy Agency (IEA). *Hydrogen patents for a clean energy future,* p. 10.
43 METI. *6th Strategic Energy Plan* (JP), pp. 38, 39.
44 Agency for Natural Resources and Energy. *Overview of Basic Hydrogen Strategy* (JP), pp. 6, 9.
45 JETRO. *Siemens Energy K.K. selected for Green Innovation Fund project.*
Air Liquide. Official website (JP).
46 METI. *"Sector-specific Investment Strategies" Compiled as Effort for Specifying Investment Promotion Measures for the Realization of Green Transformation.*
47 METI. *Storage Battery Industry Strategy* (JP) by the Public-Private Council for Strategic Review of Storage Battery Industry, pp. 4, 5, 12, 25.
48 Public-Private Council for Strategic Review of Storage Battery Industry, METI. *Progress and Immediate Steps Taken in Relation to the Storage Battery Industry Strategy* (JP), p. 9.
49 See Note 47.
50 See Note 48, p. 9.
51 See Note 43, pp. 48, 49.

In addition, regarding lithium-ion batteries, some examples of foreign companies entering the market for R&D and collaboration with Japanese companies are observed (Figure 15).

Figure 15 Examples of foreign lithium-ion battery companies in Japan

Company Name	Head Office	Businesses entered in the Japan
SVOLT Energy Technology	China	Established a Japanese corporation for the purpose of R&D on lithium-ion powered batteries and related anode materials, as well as storage batteries and related integration products
Formosa Plastics Group	Taiwan	Joint entry with Sojitz into the sale of household energy storage systems in Japan
BASF	Germany	Established a joint venture with Toda Industries to increase the production capacity of high-nickel cathode materials for LiB used in EVs
QuantumScape	U.S.	Established an office in the Kyoto Research Park to expand business in the development of next-generation solid-state lithium metal batteries

Source: Created by JETRO based on companies' website[52]

*Calculated based on the Bank of Japan exchange rate of 1 USD at 150.07 JPY (as of March 1, 2024)

Japan External Trade Organization (JETRO)

https://www.jetro.go.jp/en/invest/

52 JETRO. *SVOLT Energy Technology Co, Ltd., a Chinese battery manufacturer, establishes a Japanese subsidiary in Yokohama City, Kanagawa Prefecture.*
JETRO. *JETRO supports QuantumScape Corporation (NYSE: QS) with opening an office in Kyoto City (Kyoto Research Park; KRP).*
Sojitz. *Sojitz and Taiwan's Formosa Plastics Group Jointly Begin Sales of Household Energy Storage Systems in Japan.*
BASF. *BASF and TODA to further expand their Japanese joint venture's capacity for high nickel cathode active materials.*