

# Initiatives for Carbon Neutrality

## Development of Renewable Energy



### Integrated strengths of the J-POWER Group

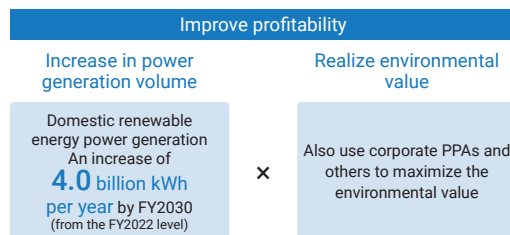
With a history of nearly 70 years in the development of renewable energy, the J-POWER Group boasts a wealth of equipment and human resources, as well as a wide range of expertise in everything from the siting and construction of power plants to maintenance, operation, and sales of electricity. In particular, as a domestic front runner in the fields of hydroelectric and onshore wind power plants in Japan, we have a track record of development of these technologies and has many facilities in promising water and wind-rich areas. Leveraging our advantage as one of Japan's leading renewable energy suppliers, we continuously aim to promote new development of onshore and offshore wind, hydroelectric, geothermal, and solar power, as well as maximize the use of renewable energy through upcycling of existing facilities.

### Strategic investments and development targets

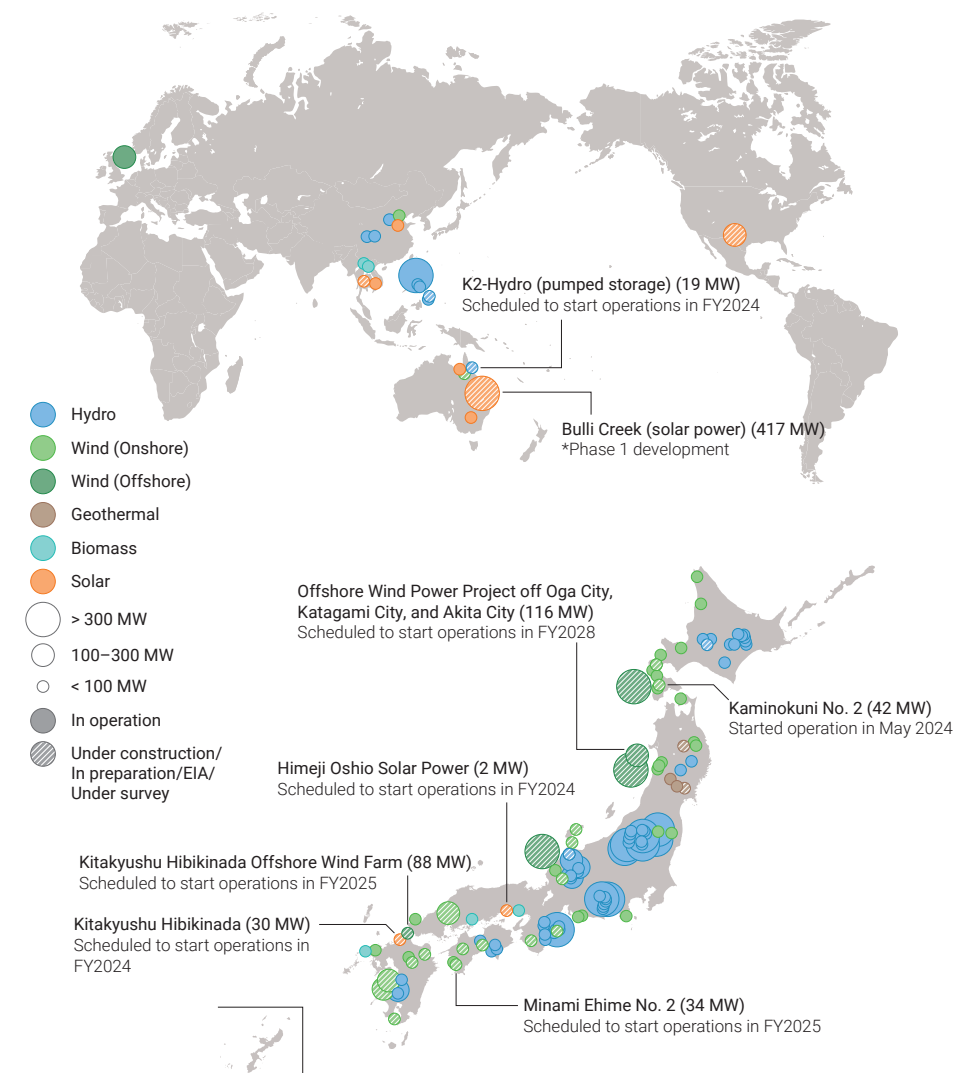
We plan to make strategic investments of 700 billion yen from FY2023 to FY2030. We also plan to invest 200 billion yen in the development of global renewable energy from FY2024 to FY2026 and 60 billion yen in the expansion of the power network, which is essential for the development of renewable energy. We will utilize green bonds and green/transition finance to raise funds. The Medium-Term Management Plan includes a target to increase domestic power generation from renewable energy sources by 4.0 billion kWh per year by FY2030 (from the FY2022 level). To achieve development on a larger scale, at a faster pace, and with higher profitability, we will promote diversification of sales methods as described below and other initiatives using alliances.

### Diversification of sales methods and development of related businesses

In the sale of electricity derived from renewable energy sources (renewable energy), which we are developing as a domestic front runner, we are promoting initiatives for direct sales to consumers, including the use of the FIT and FIP programs and corporate PPAs. In order to implement the sale of renewable energy in a way other than the FIT program, we need to work on our own projections of the power output of renewable energy sources (renewable energy aggregate), whose power generation varies depending on weather. Then, we are also working to accumulate the know-how and provide the renewable energy aggregate service to other power entities (entered into a renewable energy aggregation service agreement through PHOTON CAPITAL LLC in November 2023 and July 2024). Besides these, on behalf of our clients, we also sell and purchase non-fossil certificates, which virtually transform electricity into renewable energy. We also sell tracking information that discloses attribute details like the power source type and power plant location.



### Development Status of Renewable Energy (As of March 31, 2024)



- Generation capacity is calculated on owned capacity and, if capacity is not yet decided, on estimated maximum owned capacity.
- Wind power generation during the survey and construction phase includes replacement without an increase in generation output.
- In addition to the above, studies on the development of wind power in Japan's general offshore areas are in progress (for offshore wind power in general offshore areas, the operator is selected through bidding after designating the promotion area).

## Initiatives for Carbon Neutrality

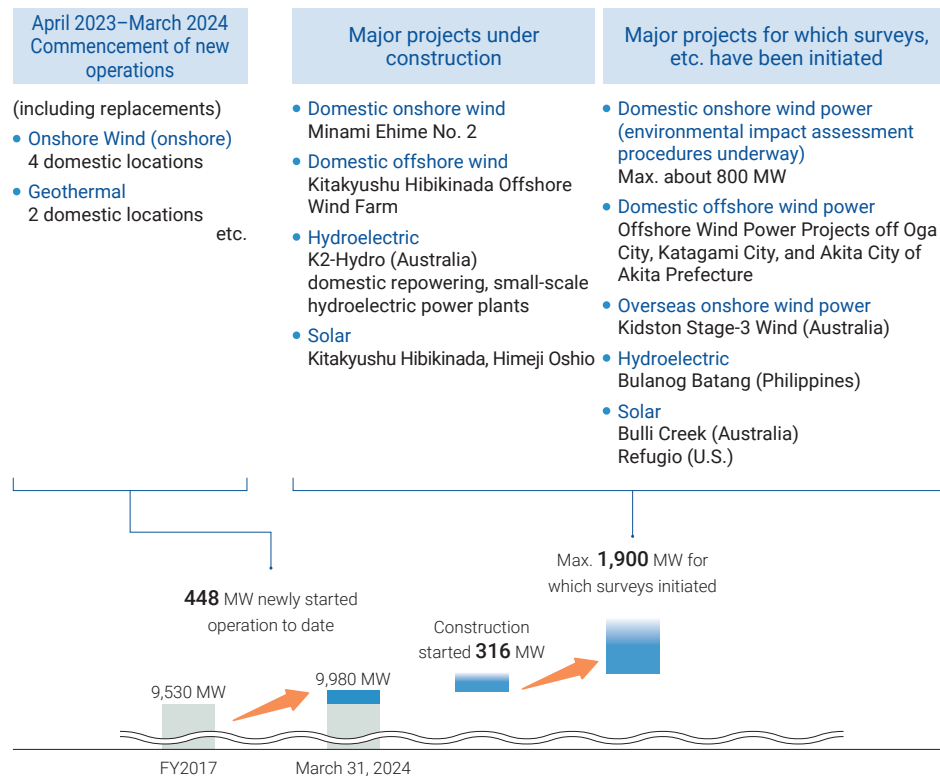
## Development of Renewable Energy



### Development results and expansion status

J-POWER has been steadily promoting the development of new renewable energy plants, starting operations of four onshore wind power plants and two geothermal power plants in Japan during FY2023. As a result, operating renewable energy capacity is approximately 448 MW higher than the FY2017 level (as of March 31, 2024). Several projects focusing on construction and replacement of domestic onshore wind power plants are currently in progress, including the installation of offshore wind power, the repowering of small-scale hydroelectric power and existing hydroelectric power, and the installation of solar power. In the U.S., Australia, and the Philippines, J-POWER is working with local partners with local expertise to rapidly promote the development of renewable energy with its domestically accumulated technical capabilities. Currently, the overall quantity of renewable energy projects in development is up to approximately 1,850 MW, including domestic onshore wind sites undergoing environmental impact assessment procedures (up to about 800 MW) and overseas projects in the planning stage.

### Renewable Energy Development Goals and Progress



### NEXUS® Sakuma Project

The Sakuma Power Station, which has contributed to a reliable supply of electricity for more than 60 years, is being renovated as part of the NEXUS Sakuma Project to make it a next-generation hydroelectric power plant. By bringing together hydroelectric generation, local community/basins, and people, we are trying to produce new value and energy in addition to repowering older facilities. This power station, which can supply power to both 50 Hz and 60 Hz areas, is scheduled to increase its maximum capacity from 350 MW to 400 MW through a two-stage renovation construction from FY2026 to FY2035.

#### Next-generation hydroelectric power plant to create new value and energy

##### Hydroelectric Generation

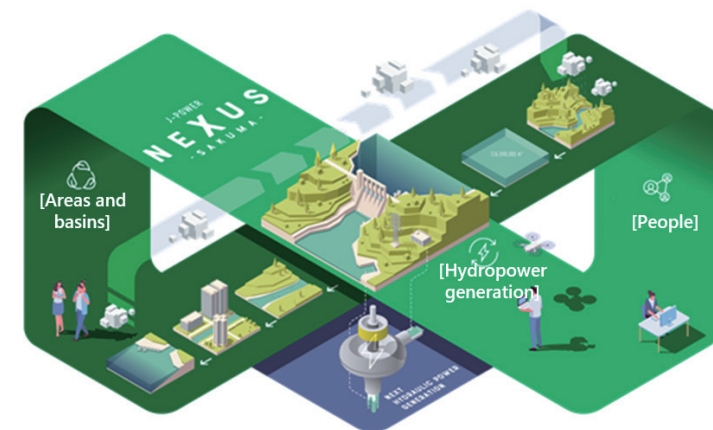
By applying modern technologies to renovate aged facilities, we aim to further increase both output and the amount of electricity to be generated, as well as to drastically solve issues in the existing facilities.

##### Local Communities and Basins

To deploy our sustainable hydroelectric business under the understanding and cooperation by those who are living in the involving areas, we live together with them in the basins around our facilities and take efforts to create together new values.

##### People

With a fusion of the local employees' force (people) and digital technologies, we realize highly-advanced, highly efficient maintenance services, as well as we create time and motivation for new challenges.



#### Final Conceptual Image

The image of hydroelectricity, community and watershed, and people working together around a power plant is expressed based on atmospheric and water circulation systems and the infinity symbol (∞).

## Initiatives for Carbon Neutrality

### Development of Renewable Energy



#### Strengths in offshore wind power

Since 2011, J-POWER has been promoting an offshore wind power demonstration research project\*, including construction, operation, and removal, off the coast of Kitakyushu City. We intend to generate additional offshore wind power while leveraging our experience in construction and project management through initiatives such as the Kitakyushu-Hibikinada Offshore Wind Farm and the Triton Knoll Offshore Wind Farm in the United Kingdom, both of which we participate in. In December 2023, the consortium in which we participate was selected as the operator of an offshore wind power project off the coast of Oga City, Katagami City, and Akita City, Akita Prefecture. This project is scheduled to begin operations in June 2028, contributing to the early expansion of renewable energy adoption in Japan.

In order to lower prices and hasten the adoption of floating offshore wind power generation, we are also collaborating with related manufacturers and electric power businesses in the creation of technologies. We are also working with other companies to develop domestically produced floating-axis wind turbines for the purpose of reducing the cost of offshore wind power generation.

\*Conducted jointly with the New Energy and Industrial Technology Development Organization (NEDO) from FY2011 to FY2016, and solely by J-POWER in FY2017 and beyond.

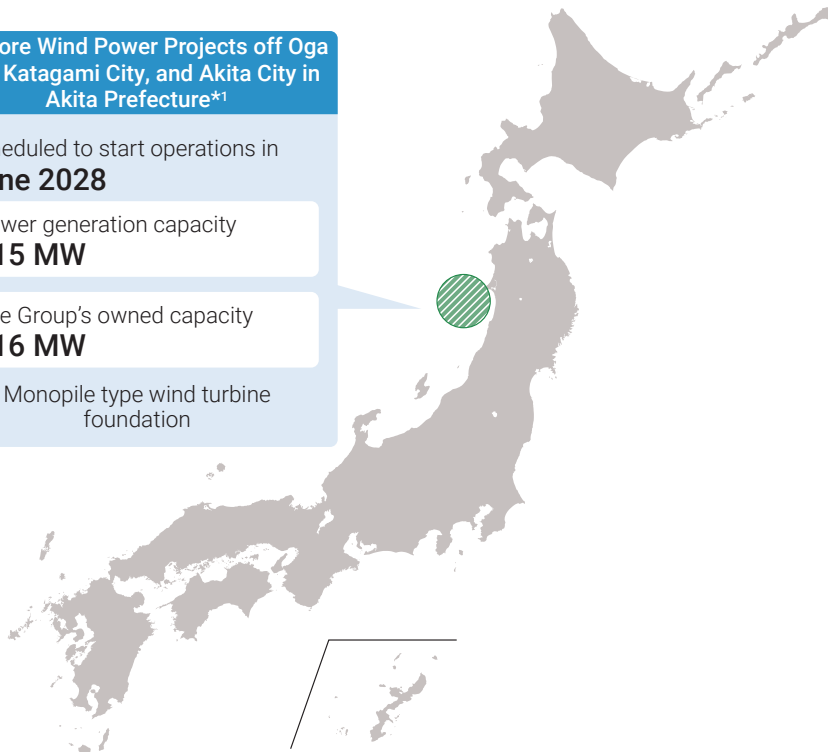
#### Offshore Wind Power Projects off Oga City, Katagami City, and Akita City in Akita Prefecture\*<sup>1</sup>

Scheduled to start operations in  
**June 2028**

Power generation capacity  
**315 MW**

The Group's owned capacity  
**116 MW**

Monopile type wind turbine  
foundation



#### Domestic onshore wind power: 24 locations (Hokkaido through Kyushu)

- The 2nd share in Japan
- A track record of development since the early 2000s
- Installation and replacement throughout Japan

#### NEDO's demonstration test of bottom-mounted offshore wind turbines (Fukuoka Prefecture)

- Long-term demonstration test from FY2011 to FY2015
- Obtain **expertise in the stages of survey, construction, and removal**
- Hybrid gravity type wind turbine foundation



#### Triton Knoll Offshore Wind Farm (UK)\*<sup>2</sup>

- One of the world's largest offshore wind turbines in the UK, leading the way in the field
- J-POWER has been **involved and provided engineers since the development stage**
- Gained expertise in operations as a commercial machine

#### Kitakyushu Hibikinada Offshore Wind Farm (Fukuoka Prefecture)\*<sup>3</sup>

- Japan's largest class of offshore wind farm located in a port area
- Jacket-type wind turbine foundation
- **Under construction**, scheduled to start operations in FY2025



\*<sup>1</sup> Conducted jointly with JERA Co., Inc., Tohoku Electric Power Co., Inc., and ITOCHU Corporation

\*<sup>2</sup> Conducted jointly with RWE AG and The Kansai Electric Power Co., Inc.

\*<sup>3</sup> Conducted jointly with Kyuden Mirai Energy Company, Incorporated, Hokutaku Co., LTD, Saibu Gas Co. Ltd., and Kyudenko Corporation.

## Initiatives for Carbon Neutrality

### Construction of nuclear power plants



## The Ohma Nuclear Power Plant Project

### Plan overview and significance

The Ohma Nuclear Power Project will be a CO<sub>2</sub>-free energy source capable of steadily providing substantial amounts of electricity once it is operational. In addition, it will be the only power plant in Japan capable of using MOX fuel, made by recycling spent fuel, for the entire core.

For energy resource-scarce Japan, nuclear power is a power source that excels in terms of largescale CO<sub>2</sub>-free power, stable procurement and storage of fuel. The operation of the Ohma Nuclear Power Plant will promote the reprocessing of spent fuel in Japan, contributing to the stable operation of other nuclear power plants nationwide, which are CO<sub>2</sub>-free power sources, helping to improve the energy self-sufficiency of Japan. The J-POWER Group is implementing the Ohma Nuclear Power Plant Project by ensuring safety as its top priority.

### Overview of the Ohma Nuclear Power Plant Construction Plans

Location	Ohma-machi, Shimokita-gun, Aomori Prefecture
Capacity	1,383 MW
Type of nuclear reactor	Advanced boiling water reactor (ABWR)
Fuel	Enriched uranium and uranium-plutonium mixed oxide
Start of construction	May 2008
Start of operations	To be determined



### Ohma's position in the pluthermal program

In July 2018, the Japanese government issued The Basic Principles on Japan's Utilization of Plutonium, a new policy paper published by Japan's Atomic Energy Commission (JAEC), which stated that Japan will reduce the size of its plutonium stockpile. The Federation of Electric Power Companies of Japan (FEPC) unveiled in December 2020 its Pluthermal Program and a new plan for the utilization of plutonium in February 2023. J-POWER also released its MOX Fuel Utilization Plan at the Ohma Nuclear Power Plant in February 2023. Approximately 1.7 tons\* of plutonium can be used annually at the stage of loading MOX fuel into all reactor cores, thereby helping to reduce the size of plutonium stockpiles.

\*This had been set to the amount of fissile plutonium (about 1.1 tons). However, since July 2018, when the Japan Atomic Energy Commission set "The Basic Principles on Japan's Utilization of Plutonium," which indicates the total amount of plutonium, we have used this basis (about 1.7 tons).

### Use of the Long-Term Decarbonization Power Source Auction system

The J-POWER Group will also consider to apply the Long-Term Decarbonization Power Source Auction system, which was introduced in FY2023, to the Ohma Nuclear Power Plant.

### Ohma Nuclear Power Plant Safety Reinforcement Measures

In the wake of the accident at the Fukushima Daiichi Nuclear Power Station, the new regulatory standards established by the Nuclear Regulation Authority are now thought to be the strictest safety standards in the world. At the Ohma Nuclear Power Plant, we are learning the lessons from the accident at the Fukushima Daiichi Nuclear Power Plant and incorporating measures to strengthen safety based on these new regulatory standards.

Examples include strengthening design standards to protect the functions of power plant safety equipment from natural disasters such as tsunamis and earthquakes, measures to respond promptly in the event of a severe accident, and measures to prevent serious accidents caused by terrorism and other causes. Furthermore, by not limiting ourselves to these measures and voluntarily and consistently improving safety based on the latest knowledge, we will continue to strive to make the Ohma Nuclear Power Plant the world's safest power plant so that we can contribute to the local community and Japan.

For details of safety enhancement measures, please refer to the J-POWER website. (Japanese only)

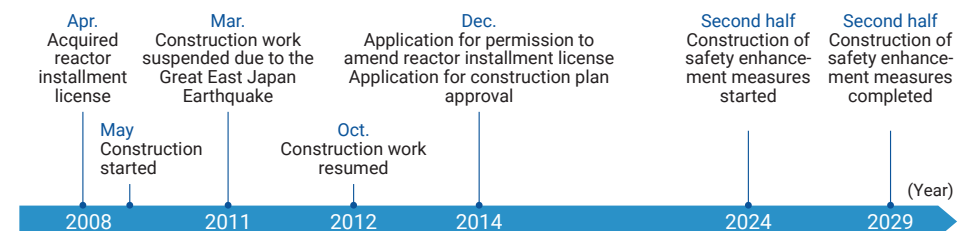
[https://www.jpowers.co.jp/bs/nuclear/safety\\_measure/index.html](https://www.jpowers.co.jp/bs/nuclear/safety_measure/index.html)

### Status of Ohma Nuclear Power Plant review

The Nuclear Regulation Authority is currently reviewing the Ohma Nuclear Power Plant's compliance with the New Safety Standards for Nuclear Power Stations. Sixty-four review meetings have been held as of the end of April, 2024. We will respond sincerely to the review so that our explanation can be understood by the authority.

Standard seismic motion and standard tsunamis are currently the main topic of discussion. As the business operator, we are unable to predict the progress of the compliance review. However, once the review has been passed, we will begin construction on facility safety reinforcement in the latter half of 2024 based on the review findings, with the aim of completion in the latter half of 2029. To gain the community's understanding and trust, we shall keep working toward providing more detailed information and communication.

### Process (actual results and outlook)





## Initiatives for Carbon Neutrality

### Creating a zero-emission power supply



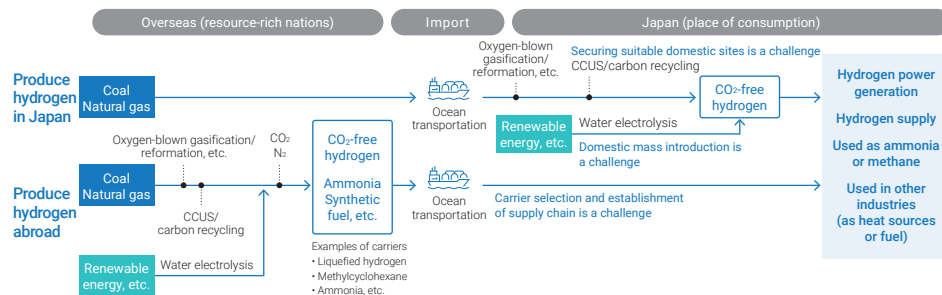
### Thermal power transition strategy

In order to achieve both stable power supply and carbon neutrality in Japan, it is necessary to utilize thermal power sources that can provide supply regulation, in addition to renewable energy and nuclear power, while reducing or eliminating their carbon content.

The J-POWER Group has announced the direction of coal-fired power plants at eight locations (15 plants) to achieve zero-emission thermal power in the Medium-Term Management Plan 2024–2026. By using hydrogen, ammonia, and biomass, the Group aims to gradually achieve zero-emission thermal power, taking into account plant characteristics.

The Group will also secure a variety of decarbonization technologies from the upstream to downstream in the supply chain, including hydrogen/ammonia production and CCS, with the goal of achieving a reliable transition from thermal power.

[P.23 Medium-Term Management Plan](#) [P.63 Direction for thermal power transition](#)



### Government Policy Trends

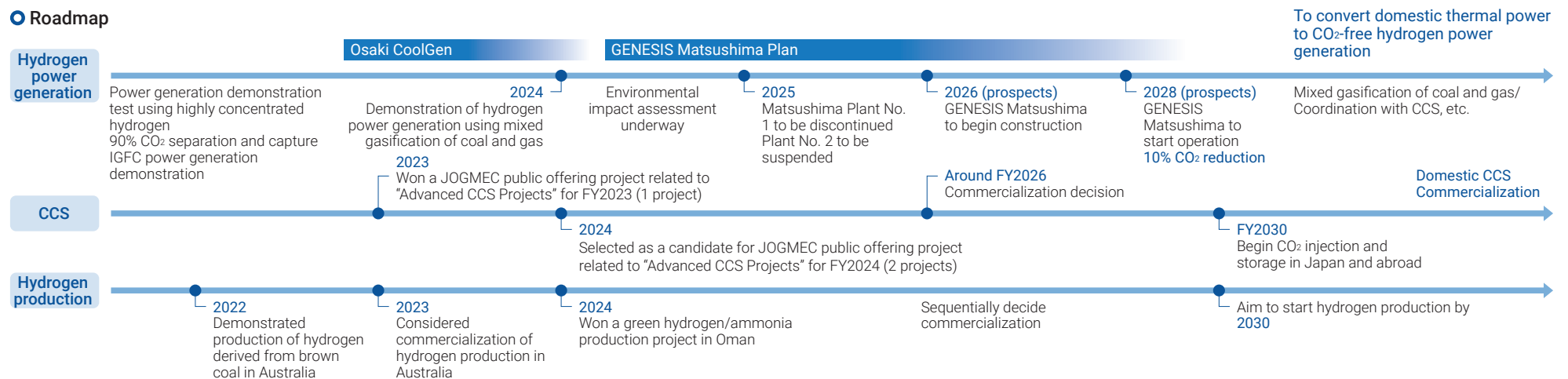
Hydrogen and ammonia are expected to contribute to carbon neutrality not only in the power generation sector, but also in various other industries. Since they can also be produced from various energy sources, hydrogen and ammonia are also important from the perspective of Japan's energy security. The Japanese government has announced its Basic Hydrogen Strategy and enacted the Hydrogen Society Promotion Act in 2024, which provided for support for the supply chain by compensating for the price difference between hydrogen and ammonia and support for site development.

Regarding CCS, the government aims to launch CCS projects by 2030 and expects to invest approximately 4 trillion yen in the public and private sectors over the next 10 years to establish an advanced CCUS value chain. The CCS Business Law enacted in 2024 provided for a licensing system for exploratory drilling and storage projects necessary for commercialization, as well as the regulations for storage business operators.

### Strengths of the J-POWER Group

J-POWER has already demonstrated hydrogen production and power generation using oxygen-blown coal gasification and CO<sub>2</sub> separation and capture technologies in Japan and abroad. By combining these with CCS, it aims to realize CO<sub>2</sub>-free hydrogen. In addition, we have renewable energy facilities and a wealth of expertise in their operation that can be used for green hydrogen production.

### Roadmap



## Initiatives for Carbon Neutrality

### Creating a zero-emission power supply



### Hydrogen/ammonia power generation

#### Osaki CoolGen Project

The Osaki CoolGen Project\*<sup>1</sup> has demonstrated the CO<sub>2</sub> separation and capture oxygen-blown IGCC\*<sup>2</sup> for power generation performance, including the production of highly concentrated hydrogen gas, a CO<sub>2</sub> capture rate of 90% or more, and operation with a hydrogen concentration of around 40% at the gas turbine inlet. With its excellent load flexibility, this generation method is expected to play the role of providing the regulatory power in response to output fluctuations of renewable energy.

In addition, with efficient CO<sub>2</sub> capture and compatibility with low-grade coal, the generation system is also expected to help reduce power generation costs for commercialization.

\*<sup>1</sup> Joint project between J-POWER and the Chugoku Electric Power Co., Inc. (NEDO subsidized project)

\*<sup>2</sup> IGCC: Integrated gasification combined cycle



#### GENESIS Matsushima Plan

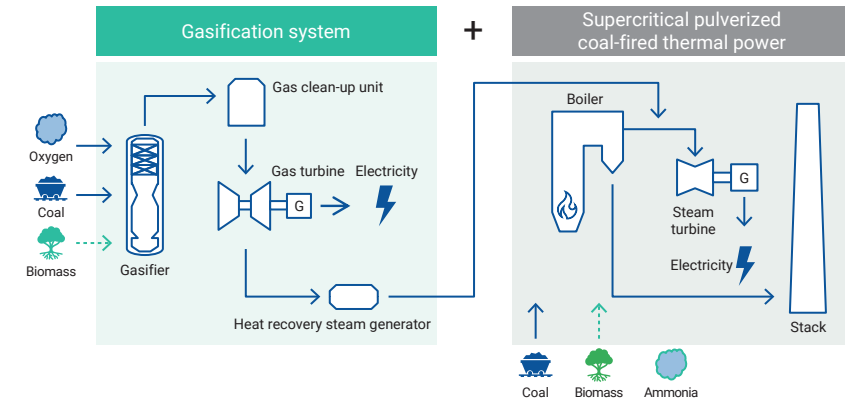
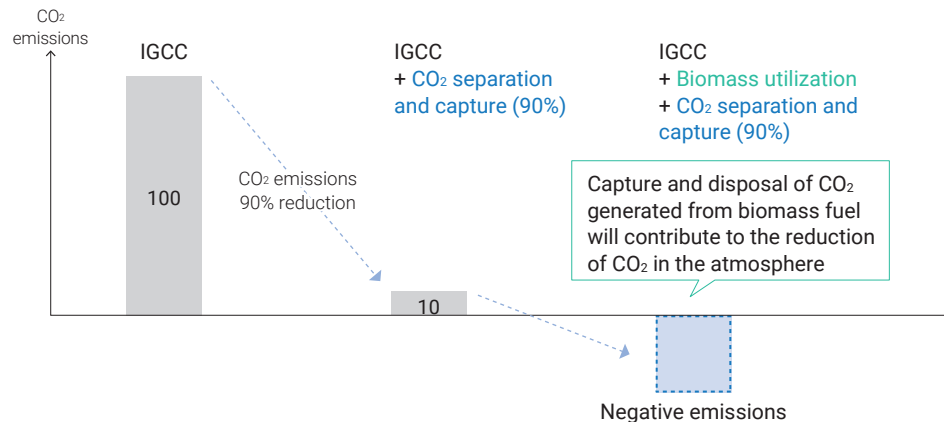
We are promoting the GENESIS Matsushima Plan to commercialize the technology demonstrated in the Osaki CoolGen Project at the Matsushima Thermal Power Plant No. 2, which will be shut down at the end of FY2024. The plant No. 2 will reduce its CO<sub>2</sub> emissions by approximately 10% due to its higher efficiency.

In the future, we will adopt CO<sub>2</sub> separation and capture and combine it with CCS, etc., with a view to realizing CO<sub>2</sub>-free hydrogen power generation and even providing hydrogen to other industries. In this way, we aim to create an advanced carbon-neutral site.



#### Negative Emissions

The Osaki CoolGen Project involves demonstration tests of mixed gasification of biomass and coal during FY2023–2024. The gasification technology would further contribute to CO<sub>2</sub> reduction if successfully commercialized. In addition, the storage and recycling of captured CO<sub>2</sub> will realize “negative emissions” and contribute to the reduction of CO<sub>2</sub> in the atmosphere.



#### Ammonia power generation

We are considering transitioning to ammonia-based power generation at our thermal sites. In this consideration, sites will be selected taking into account the conditions of plant equipment and port facilities as well as the surrounding environment. In addition, we will work with various stakeholders to establish a stable ammonia supply chain in Japan, as large-scale mixed/mono combustion requires bulk procurement of ammonia.

## Initiatives for Carbon Neutrality

### Creating a zero-emission power supply



### Promotion of CCS

#### Initiatives of J-POWER

J-POWER established a joint venture, West Japan Carbon dioxide Storage Survey Co., Ltd., with ENEOS Corporation and JX Nippon Oil & Gas Exploration Corporation, with the aim of starting a CO<sub>2</sub> separation, capture, transportation, and storage project in western Japan by FY2030. This project has been selected as a candidate for JOGMEC\* public offering project related to "Advanced CCS Projects." We are now preparing for commercialization, including exploration and evaluation of the selection of candidate storage sites.

In addition, the Southern Offshore of Peninsular Malaysia CCS project in Malaysia, in which several companies including J-POWER participate, has been selected as a candidate for JOGMEC public offering project related to "Advanced CCS Projects."

\*JOGMEC: Japan Organization for Metals and Energy Security

[P.41 Research & development \(CO<sub>2</sub> hydrates\)](#)

#### Overview of the project in western Japan

Proposer	J-POWER, ENEOS, JX Nippon Oil & Gas Exploration, West Japan Carbon dioxide Storage Survey
Emission sources	Oil refineries and thermal power plants in Setouchi and Kyushu regions
Transport method	Vessels and pipelines
Candidate sites for CO <sub>2</sub> storage	Off the western Kyushu (offshore saline aquifers)
Storage volume	Approx. 1.7 million tons/year
Feature of the project	The project will promote hub-and-cluster CO <sub>2</sub> storage that links multiple CO <sub>2</sub> emission sources and offshore storage sites, targeting emissions from oil refineries and power plants in a wide area of western Japan, including Setouchi region.

#### Overview of the project in Malaysia

Proposer	J-POWER, Mitsui & Co., Chugoku Electric Power, The Kansai Electric Power, Cosmo Oil, Kyushu Electric Power, Resonac, Mitsubishi UBE Cement
Emission sources	Multiple industries including power generation, chemical, cement, and oil refining in the Kinki, Chugoku, and Kyushu regions, among others
Transport method	Vessels and pipelines
Candidate sites for CO <sub>2</sub> storage	Off the east coast of Malay Peninsula in Malaysia (offshore depleted oil and gas fields, aquifers)
Storage volume	Approx. 5 million tons/year
Feature of the project	The project will promote large-scale CO <sub>2</sub> capture from multiple scalable CO <sub>2</sub> clusters across industries in a wide area of western Japan, and then transport the captured CO <sub>2</sub> overseas to a hub to be developed off the east coast of Peninsular Malaysia for storage in partnership with Petronas (Malaysia) and TotalEnergies (France).

### Hydrogen/ammonia power generation

The Group has demonstrated the production of high-purity hydrogen using brown coal, which is still abundant and unused in Australia. Based on this experience, the Group also aims to expand its business line to achieve the production and supply of clean hydrogen that has been subjected to CO<sub>2</sub> processing.

The Group has also formed a consortium with Yamna (UK) and EDF (France) and won the right to implement a large-scale green hydrogen/ammonia production project in the Sultanate of Oman.



#### Topics

##### Economic efficiency of zero-emission thermal power generation

We will actively utilize the Japanese government's economic support programs to achieve cost reduction. It is possible to use the "Long-Term Decarbonized Power Source Auction system" for investment in upcycling existing coal-fired thermal power plants to mixed/mono hydrogen combustion facilities. In addition, CCS would be supported by the "Advanced CCS Project" for costs in the development and construction phase and for maintenance costs in the operation phase.

The carbon pricing system is scheduled to be implemented in FY2028. We will be able to commercialize hydrogen power generation and CCS if they can be implemented at costs below carbon pricing.

[P.43 Government Policy Trends](#) [P.65 Disclosure Based on TCFD Recommendations](#)

##### Carbon reduction and blue carbon initiatives using concrete substitutes

J-POWER has developed "J Blue Concrete," a concrete substitute material made mainly from coal ash and copper slag, which are industrial by-products, and used it at its sites. Compared with ordinary concrete, J Blue Concrete is more resistant to sea waves (heavier) and has a lower carbon content (less CO<sub>2</sub> emissions from the material).

We have also worked on the research and development of blue carbon, which uses J Blue Concrete to help seaweed absorb and fix CO<sub>2</sub> from the atmosphere. We then became the first company in the private sector to obtain certification for J Blue Credits\*.

J-POWER will continue its initiatives for further CO<sub>2</sub> reduction and absorption, thus contributing to carbon neutrality.

\*A system whereby the Japan Blue Economy Association (JBE), which was established and approved by the Ministry of Land, Infrastructure, Transport and Tourism, certifies and issues the credits



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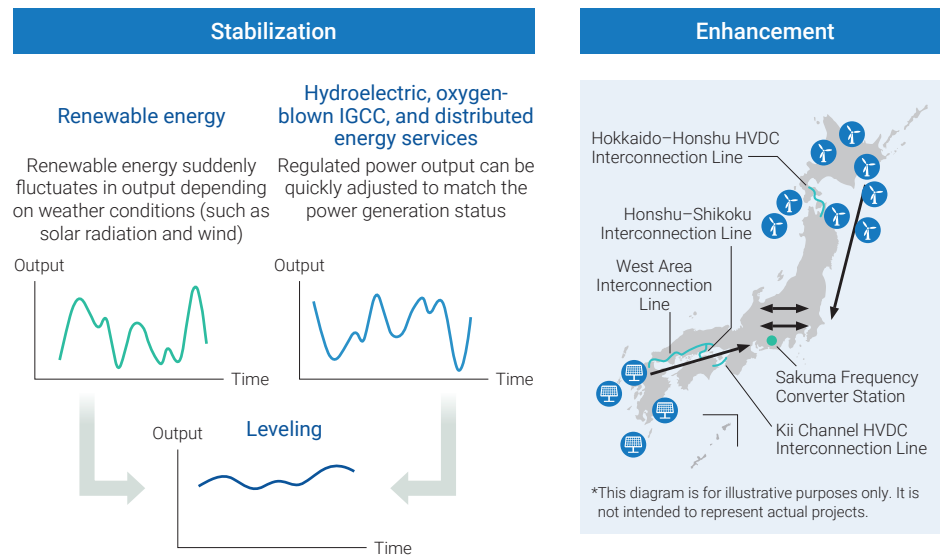
### Power network stabilization and enhancement



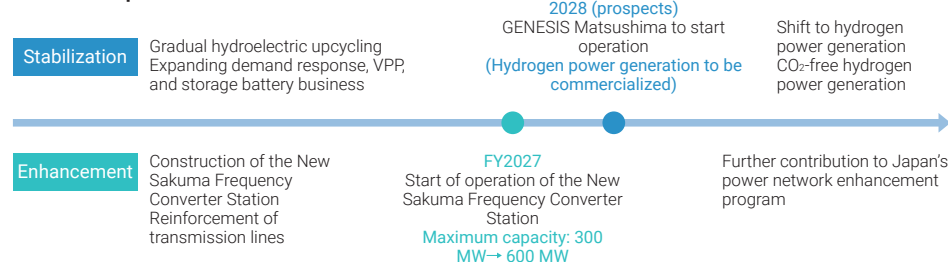
#### Supporting Mass Introduction of Renewable Energies

Renewable energies like solar and wind power are vulnerable to sudden fluctuations in output depending on weather conditions. When they are introduced in large amounts, the need to be able to adjust to control the supply-demand balance becomes even more critical. In addition, the power network must be strengthened to deliver electricity from renewable energy-rich power production sites (such as Hokkaido, Tohoku, and Kyushu) to distant consumption areas.

The Group plans to aid in the widespread use of renewable energy by stabilizing and enhancing the power grid.



#### ● Roadmap



\*Strengthening the power network is an initiative of J-POWER Transmission Network Co., Ltd.

#### Stabilization

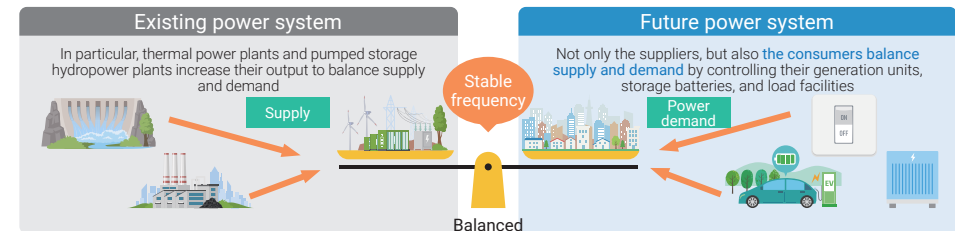
##### Hydroelectric power and hydrogen power generation

J-POWER has large-scale general hydroelectric power plants and pumped storage hydropower plants to generate power according to seasons and time frames and to absorb surplus power. It also aims to realize hydrogen power generation, which enables flexible load adjustment. By using these as regulated power sources, we contribute to the stabilization of the power network.

##### Distribution network system

J-POWER uses its expertise in supply and demand forecasting to act as an intermediary between electric power companies and consumers, providing services to manage the supply-demand balance. For instance, we are developing Demand Response and VPPs, which balance supply and demand by combining customer-owned demand facilities, requiring power conservation to avoid power outages, and methodically managing the recharge/discharge of storage batteries.

#### ● Overview of demand response



#### Enhancement

##### Expansion of trunk transmission lines and inter-regional connection lines

The Group has trunk transmission lines and inter-regional connection lines that enable flexible transmission between regions. In order to enhance the capability to interchange electric power between 50Hz in eastern Japan and 60Hz in western Japan, the Group is promoting the new construction of the New Sakuma Frequency Converter Station and the replacement/expansion of related transmission lines. (Scheduled to start operations in FY2027)

##### Expansion of submarine DC interconnection facilities

Efficient long-distance transmission requires the use of submarine ultra-high-voltage DC transmission facilities using submarine cables. The Group successfully built the ultra-high-voltage DC power transmission facilities and developed the ultra-high-voltage DC CV cable for the first time in Japan. It also owns and maintains cross-regional interconnection facilities, contributing to the development of Japan's enhanced power network.



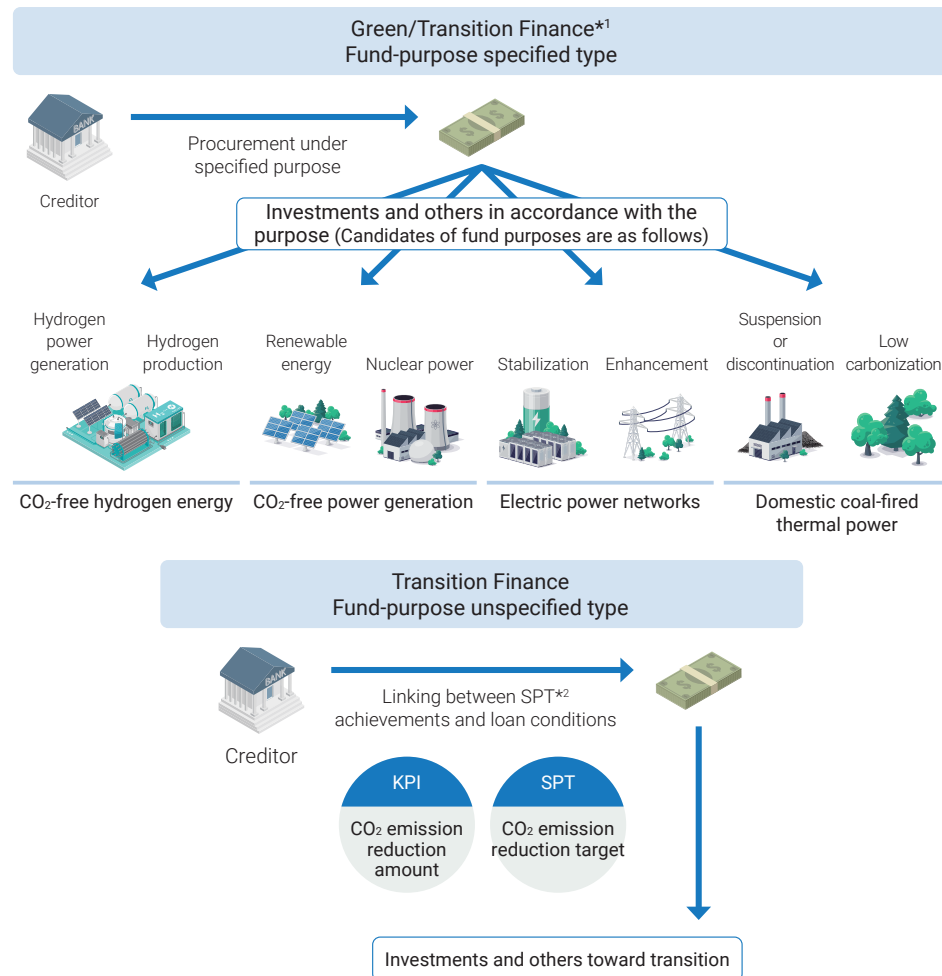
## Initiatives for Carbon Neutrality

### Financial Initiatives



### Diversifying Methods of Fundraising Toward Transition

We have formulated a new framework called “Green/Transition Finance Framework” for fundraising toward transition to a carbon-neutral society. This framework has been evaluated for its eligibility to various finance standards by a third-party evaluation organization called DNV BUSINESS ASSURANCE JAPAN.



\*1 Green Finance only applies to those accepted as eligible green projects

\*2 An abbreviation of Sustainability Performance Target, representing a target that should be achieved to fulfill KPI

#### Examples of transition-linked loan financing

Date borrowed	Sept. 29, 2023	Sept. 29, 2023	Feb. 29, 2024
Borrowed amount of money	¥10.0 billion	¥10.0 billion	¥10.0 billion
Borrowing period	7 years	10 years	7 years
Creditor	Domestic financial institutions (joint financing)	Domestic financial institutions (joint financing)	Domestic financial institutions (joint financing)

#### Examples of green bond fundraising

The 87th issuance of unsecured corporate bonds of J-POWER (with inter-bond pari passu clause) (Green Bonds)

Date issued	Feb. 16, 2024
Amount issued	¥20.0 billion
Period	10 years
Interest rate	1.106%

The fund-purpose, reporting, and environmental improvement effects related to Green Bonds issued in the past are posted on the Company's website:

<https://www.jpower.co.jp/sustainability/finance/> (available only in Japanese)