

J-POWER Group Materials of Environmental Initiatives 2020

Electric Power Development Co.,Ltd.



The Materials of Environmental Initiatives 2020 attached to J-POWER Group Integrated Report 2020 .

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Scope of Environmental Related Data

The scope of applicability includes J-POWER and its 25 consolidated domestic subsidiaries, which are engaged in the electric power business, electric power related business, and other business. The amounts attributed to consolidated subsidiaries are based on percentages corresponding to J-POWER's equity share. For information on the companies included, please refer to the list of section 4-3.

Reporting period

From April,1 2019 to March 31,2020

Publication of the report

August,2020

1. J-POWER Group Environmental Management Vision



1-1. J-POWER Group Environmental Management Vision



Based on our Corporate Philosophy—“We will meet people’s needs for energy without fail, and play our part for the sustainable development of Japan and the rest of the world”—the J-POWER Group engages in business conduct aimed at harmonizing energy supply and the environment.

The J-POWER Group Environmental Management Vision consists of the J-POWER Group Environmental Management Vision Basic Policy and Action Programs. Under our Corporate Conduct Rules and the J-POWER Group Environmental Management Vision, we address global environmental issues such as climate change and seek to operate in harmony with local environments.

J-POWER Group Environmental Management Vision

J-POWER Group Environmental Management Vision Basic Policy

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Action Programs

Corporate Targets

Targets addressed by the entire Group that lay out medium-term issues to be addressed, targets, and means

Segment Targets

Targets established and addressed by each relevant department and subsidiary

J-POWER Group Environmental Action Guidelines

Issues to be addressed in the fiscal year

Basic Stance

As an energy supplier, we will contribute to the sustainable development of Japan and the rest of the world by harmonizing our operations with the environment and ensuring the constant supply of energy essential to human life and economic activity.

Addressing Global Environmental Issues

In addition to doing our utmost to ensure a stable energy supply, we will steadily advance initiatives toward the realization of zero emissions power supply both domestically and internationally and will contribute to the reduction of CO₂ emissions on a global scale.

To that end, aiming to expand CO₂-free power sources and achieve zero emissions from fossil fuel power generation by such means as the capture, utilization, and storage of CO₂ emitted from the combustion of fossil fuels, we will work from medium- and long-term perspectives, with technology as our central focus, to realize a stable energy supply and reduction in CO₂ emissions domestically and internationally.

Addressing Local Environmental Issues

We will seek to operate in harmony with local environments by adopting measures to reduce the environmental impact of our operations while working to save, recycle, and reuse resources in order to limit waste.

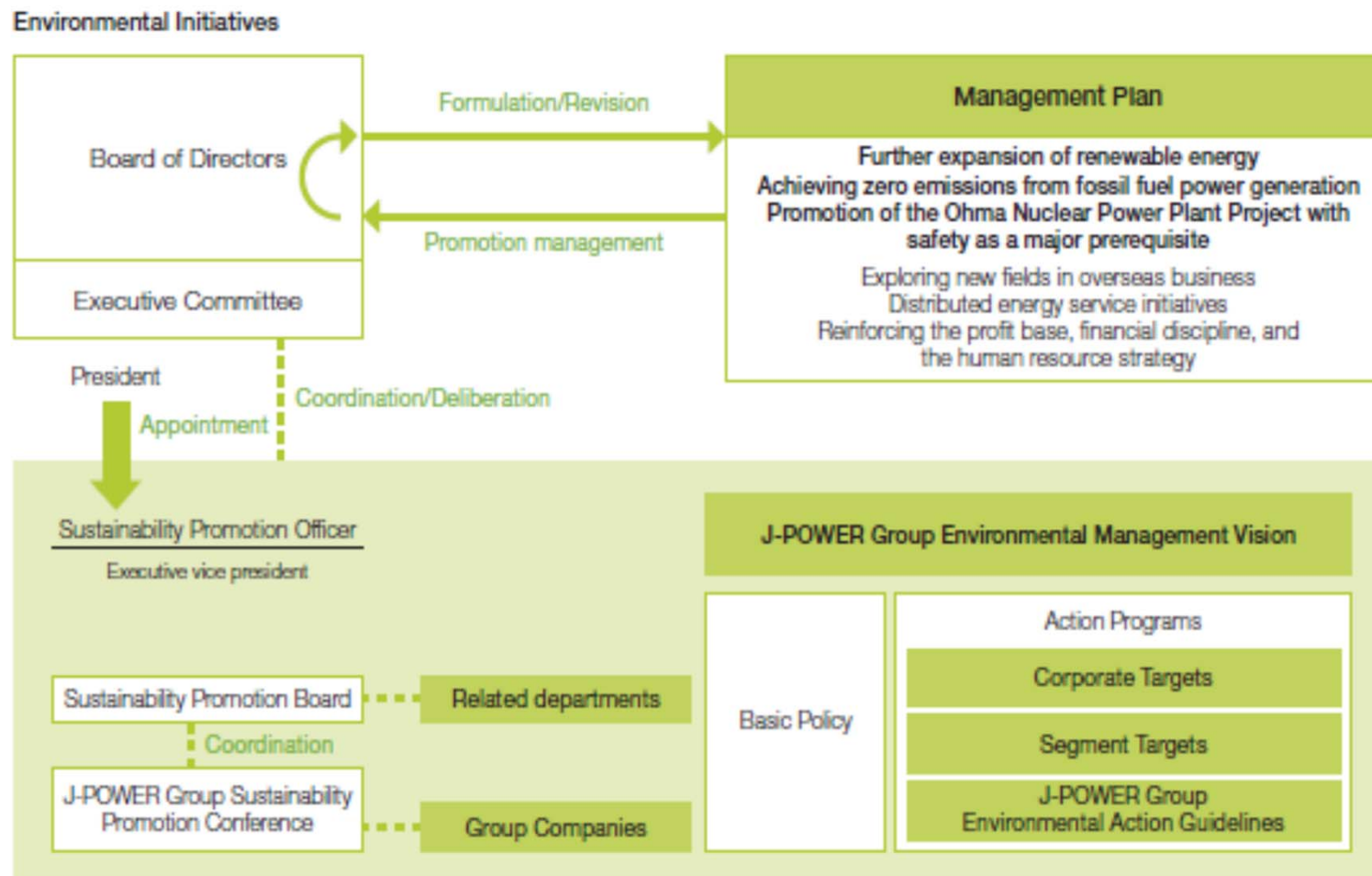
Ensuring Transparency and Reliability

We will ensure that our business activities comply with all applicable laws and regulations, disclose a wide range of environmental information, and enhance communication with stakeholders.

1-3. J-POWER Sustainability Promotion Structures



Appointed by the president, the Executive Vice President in charge of sustainability is responsible for environmental initiatives. We have established the Sustainability Promotion Board and the J-POWER Group Sustainability Promotion Conference to promote sustainability, including environmental initiatives.



1-4. Corporate Targets and Achievements (1)



The Action Programs for the J-POWER Group Environmental Management Vision set Corporate Targets, which are medium-term targets to be addressed by the Group as a whole. Actual performance versus the fiscal 2019 Corporate Targets is shown below. In fiscal 2019, all Corporate Targets were achieved.







Addressing Global Environmental Issues

Item	FY2019		FY2020 Target
	Target (🏠)	Performance and Initiatives (🏠)	
Promoting technological development to reduce carbon emissions and achieve zero emissions from power generation	Steadily implement the following measures aimed at realizing a low-carbon society as well as contribute to the stable supply of energy and reduction of CO ₂ emissions in Japan and around the world by achieving the targets of the Electric Power Council for a Low Carbon Society's Action Plan for Achieving a Low-Carbon Society.		Continuance
	1. Expansion of renewable energy		Continuance
	🏠	Advance the new installation, upgrading, and equipment replacement of hydroelectric power plants in order to expand the use of hydroelectric power.	Continuance
	🏠	With regard to the expansion of hydroelectric power utilization, we began construction on the Shinkatsurazawa Hydroelectric Power Plant Project and the Ashoro Hydroelectric Power Plant Repowering Project in April 2019.	
🏠	Work to significantly expand wind power facilities, including offshore wind power generation.	Continuance	
🏠	In onshore wind power, in January 2020 we started operations at the Setana-Osato Wind Farm and Nikaho No. 2 Wind Farm. In addition, we advanced construction of the Kuzumaki No. 2 Wind Farm and Kaminokuni No. 2 Wind Farm as well as construction preparations for the Tomamae and Shimamaki replacement projects and the Minami Ehime No. 2 project. In offshore wind power, we are advancing business studies related to the Hibikinada Offshore Wind Farm. We also started development surveys for the Hiyama, Awara, and Saikai projects. In the overseas wind power business, in August 2018, we acquired a stake in the Triton Knoll Offshore Wind Power Project in the U.K., and construction of this project advanced.		

1-4. Corporate Targets and Achievements (2)



Addressing Global Environmental

Item	FY2019		FY2020 Target
	Target ()	Performance and Initiatives ()	
Promoting technological development to reduce carbon emissions and achieve zero emissions from power generation	 Work to develop new geothermal power projects in Japan.	 Looking at the development of new geothermal power projects in Japan, we started operations of the Wasabizawa Geothermal Power Plant in May 2019. We also started construction of the Appi Geothermal Power Plant in August 2019. In addition, at the Takahinatayama site in Osaki City, Miyagi Prefecture, in July 2019 we began small caliber well drilling surveys aimed at future geothermal power plant development. Furthermore, having shut down the Onikobe Geothermal Power Plant's existing facilities in April 2017, we began the construction of facility replacement in April 2019.	Continuance
	2 Strive toward carbon reduction and decarbonization in coal use		Strive toward Carbon Reduction and Zero Emissions in Coal Use
	 Advance the development of high-efficiency integrated coal gasification combined cycle (IGCC) technology with the aim of bringing it to practical use. Advance research and development of CO₂ capture, utilization and storage (CCUS) technology.	 At the Osaki CoolGen Project, we completed demonstration tests of oxygen-blown IGCC (Phase 1) in February 2019 and began demonstration tests of oxygen-blown IGCC with CO ₂ separation and capture (Phase 2) in December 2019. We also started construction preparations for demonstration tests of IGFC with CO ₂ separation and capture (Phase 3).	Continuance

1-4. Corporate Targets and Achievements (3)



Addressing Global Environmental

Item	FY2019		FY2020 Target	
	Target (🚩)	Performance and Initiatives (📊)		
Promoting technological development to reduce carbon emissions and achieve zero emissions from power generation	<p>🚩 Work to replace aging coal-fired thermal power plants with the world's leading high-efficiency coal-fired thermal power plants.</p> <p>📊 Construction of the Takehara Thermal Power Plant Replacement Project progressed toward its June 2020 start of operations.</p>		Continuance	
	<p>🚩 Promote the mixed combustion of biomass fuels in coal-fired thermal power plants (effective exploitation of untapped resources).</p> <p>📊 At the Matsuura Thermal Power Plant, Takehara Thermal Power Plant, and Takasago Thermal Power Plant, we implemented mixed combustion using domestically-sourced biomass fuels (such as wood pellets and dried sewage sludge). To make effective use of unused wood and other materials from wooded areas in Japan, we advanced preparations toward 2021 for commercialization of wood pellets manufacturing and sales through SJ Wood Pellet Co. Ltd., which was jointly established with another company.</p>		Continuance	
	<p>🚩 Contribute to the reduction of global CO₂ emissions and the adoption of advanced technologies by expanding the coal-fired thermal power generation business using J-POWER's advanced, high-efficiency power generation technologies, especially in Asia.</p> <p>📊 In Indonesia, we advanced the construction of the Central Java Project toward a planned start of operations in fiscal 2020.</p>		Continuance	
	3 Promotion of the Ohma Nuclear Power Plant Project, with safety as a major prerequisite			Continuance
	<p>🚩 Advance construction of the Ohma Nuclear Power Plant, giving highest priority to safety and working to ensure the trust of the local community.</p> <p>📊 For the Ohma Nuclear Power Plant Project, we carried out studies for safety enhancement measures and responded to the review of compliance with the new safety standards. We also implemented initiatives to gain the understanding and trust of local residents.</p>		Continuance	

1-4. Corporate Targets and Achievements (4)



Addressing Global Environmental

The ★ marks denote data that are the subject of third-party assurance.
(Please refer to section 4-2「Third-Party Assurance Regarding Environment-Related Information」)

Item	FY2019		FY2020 Target
	Target	Performance and Initiatives	
Maintaining and improving thermal efficiency for thermal power (higher heating value (HHV) basis)	Maintain current level [about 40%]	40.8%★ (Reference: LHV* = 41.9%) <Fiscal 2018 Performance 40.6%、LHV : 41.6%> The J-POWER Group met its target for total thermal efficiency for thermal power thanks to efforts at existing thermal power plants to maintain high-efficiency operations and to adopt high-efficiency technologies when renovating facilities	Continuance
Reduction of sulfur hexafluoride (SF ₆) emissions; gas recovery rate during inspection and retirement of equipment	Inspection: at least 97% Retirement: at least 99%	Inspection: 99.9% Retirement: 99.3%★ <Fiscal 2018 Performance Inspection: 99.1% Retirement: 99.3%> The target was met, with a recovery rate of 99.9% during inspections and 99.3% at retirement, thanks to efforts to curb emissions during equipment inspection through sound recovery and reuse.	Continuance

* LHV (lower heating value) is estimated from actual HHV (higher heating value) using conversion coefficients supplied in the Agency of Natural Resources and Energy's Comprehensive Energy Statistics (Fiscal 2004 edition)

Addressing Local Environmental Issues

Item	FY2019		FY2020 Target
	Target	Performance and Initiatives	
Reducing sulfur oxide (SOx) emissions per unit of electric power generated by thermal power	Maintain current level [about 0.2 g/kWh]	0.22g/kWh★ <Fiscal 2018 Performance 0.21g/kWh> As a result of efforts including fuel management and the appropriate operation of flue gas desulfurization systems, we curbed our SOx emissions and achieved our target for emissions per unit of electric power generated	Continuance
Reducing nitrogen oxide (NOx) emissions per unit of electric power generated by thermal power	Maintain current level [about 0.5 g/kWh]	0.50g/kWh★ <Fiscal 2018 Performance 0.51g/kWh> As a result of efforts including fuel management, combustion management and the appropriate operation of flue gas denitrification systems, we curbed our NOx emissions and achieved our target for emissions per unit of electric power generated.	Continuance

1-4. Corporate Targets and Achievements (5)



Addressing Local Environmental Issues

The ★ marks denote data that are the subject of third-party assurance.
(Please refer to section 4-2「Third-Party Assurance Regarding Environment-Related Information」)

Item	FY2019		FY2020 Target
	Target	Performance and Initiatives	
Increasing the recycling rate for industrial waste	Maintain current level [about 97%]	99.3% ★ <Fiscal 2018 Performance 98.8%> We achieved our targets through efforts to promote the recycling of coal ash and to reduce industrial waste generated by the maintenance and operation of power plants.	Continuance
Preservation of aquatic environments	Consider the protection of river and ocean environments in business activities	At operating power generation facilities that are involved with rivers, we implemented measures for the protection of the river environment appropriate to the conditions at each location. These included the implementation of sedimentation disposal measures and measures to mitigate the long-term persistence of turbidity. At operating power generation facilities that adjoin the ocean, we implemented precise control over effluent in compliance with environmental protection agreements and other such arrangements.	Continuance
Preservation of biodiversity	Consider the protection of biodiversity in business activities	We showed consideration for the protection of ecosystems and the diversity of species in conducting our business activities and worked to protect rare animal and plant species and their habitats.	Continuance

Ensuring Transparency and Reliability

Item	FY2019		FY2020 Target
	Target	Performance and Initiatives	
Improvement of environment management level	Continual improvement of EMS	We implemented the PDCA cycle consistently and worked to raise the level of environmental management	Continuance

1. Addressing Global Environmental Issues

Expansion of Renewable Energy

- Maintain stable operations at existing hydroelectric, geothermal, wind, and biomass power stations
 - Maintain stable operations at existing hydroelectric, geothermal, wind, and biomass power stations
 - Improve efficiency through the replacement of existing hydroelectric power facilities
 - Advance the development of new hydroelectric, geothermal, and wind power projects
 - Advance the development of new hydroelectric, geothermal, and wind power projects; particularly in the case of wind power, in addition to proceeding with development aimed at significantly expanding power generation capacity, advance efforts to realize offshore wind power projects
 - Advance the development of renewable energy and support thereof in developing countries

Strive toward Carbon Reduction and Zero Emissions in Coal Use

- Proceed with large-scale demonstration tests of oxygen-blown integrated coal gasification combined cycle (IGCC) generation
 - Proceed with the Osaki CoolGen Project to develop high-efficiency IGCC generation technologies
- Proceed with development of CO₂ capture, utilization and storage (CCUS) technologies
 - Steadily proceed with Phase 2 of the Osaki CoolGen Project, making use of the results of pre-combustion CO₂ capture technology developed in the EAGLE Project
 - Advance basic research aimed at evaluating the technical risks and economic efficiency of CO₂ transportation and storage. Promote fundamental research of CCUS.

- Advance brown coal hydrogen pilot testing project in Australia
- Maintain high-efficiency operations at existing thermal power stations
- Promote biomass fuel mixed combustion at existing thermal power stations
- Move forward with a replacement project for an existing thermal power station
 - Replace the Takehara Thermal Power Station Units No. 1 and 2 with the latest USC plants to greatly improve efficiency
- Transfer high-efficiency coal-fired thermal power generation technologies overseas and promote their diffusion
 - Contribute to the reduction of global CO₂ emissions and adoption of advanced technologies by expanding the high-efficiency coal-fired thermal power generation business using J-POWER's advanced, high-efficiency power generation technologies, especially in Asia

Promotion of the Ohma Nuclear Power Plant Project, with Safety as a Major Prerequisite

- Respond appropriately to the review of compliance with new safety standards conducted by the Nuclear Regulation Authority
- Based on serious consideration of the accident at Tokyo Electric Power Company's Fukushima Daiichi Nuclear Power Station, implement voluntary initiatives to further enhance safety and advance the construction of a nuclear power plant that will be trusted by the local community

1. Addressing Global Environmental Issues

Other

- Promote energy saving
 - Promote the reduction of the internal consumption rate at power stations
 - Take the initiative in energy conservation in offices throughout the Group
 - Promote energy conservation measures in offices, giving consideration to the criteria for judgment stipulated for businesses by the Energy Conservation Act
 - Work to conserve energy at our Headquarters to ensure compliance with the Tokyo Metropolitan Ordinance on Environmental Protection
 - Reduce the environmental burden by promoting such initiatives as the improvement of efficiency when transporting raw materials, etc.
 - Reduce the environmental burden through measures including the use of public transportation, improvement of company vehicles' operational efficiency, and promotion of eco driving
 - Promote energy and resource-conserving measures in employees' households, such as the use of the Household Eco-Account Book
 - Support measures to promote the spread of energy conservation
- Utilization and promotion of the offset credit mechanism
- Reduce emissions of GHGs other than CO₂
 - Curtail emissions of greenhouse gases other than CO₂, such as SF₆ (sulfur hexafluoride), CFCs (chlorofluorocarbons), HCFCs (hydrochloro-fluorocarbons), HFCs (hydrofluorocarbons), and N₂O (nitrous oxide)

2. Addressing Local Environmental Issues

Reduction of Emissions of Environmentally Harmful Substances

- Continue to reduce emissions
 - Properly manage combustion conditions and environmental equipment in order to reduce emissions of SOx, NOx, soot, dust, etc.
 - Properly manage wastewater treatment facilities to reduce the discharge of water pollutants
 - Properly manage facilities to reduce noise, vibration, and odors
 - Properly manage facilities to prevent the pollution of soil and groundwater
- Strengthen measures to prevent oil spills from equipment, etc., and be prepared so that emergencies can be dealt with in an appropriate and timely manner
- Design and introduce highly efficient environmental equipment when newly installing or renovating facilities

Promotion of the 3Rs (Reduce, Reuse, and Recycle waste) and Proper Disposal of Waste

- Make efforts toward the reduction of waste, the reuse and recycling of recyclable resources and achievement of zero waste emissions
 - Promote the reduction of waste as well as the reuse and recycling of materials and equipment during the new installation, upgrading, and demolition of facilities
 - Promote the separation, prevention, reuse and recycle of waste plastics.

2. Addressing Local Environmental Issues

- Work to reduce consumption of water, chemicals, lubricating oil, etc.
- Work to curb volume of office waste (copy paper, etc.) and promote reuse
- Rigorously collect and separate paper, bottles, cans, plastic, and other waste, and promote reuse and recycling
- Maintain and continue green purchasing efforts in line with the J-POWER Group Green Purchasing Guidelines
 - Maintain and continue the green purchasing of office goods
 - Maintain and continue the use of low-pollution vehicles, etc.
- Properly implement maintenance, management, and closing procedures for final disposal sites
- Properly dispose of waste
 - Dispose of waste properly and completely in accordance with the Waste Disposal and Public Cleansing Act

Management of Chemical Substances

- Fully comply with the Act on Confirmation, etc. of Release Amounts of Specific Chemical Substances in the Environment and Promotion of Improvements to the Management Thereof (commonly known as the Pollutant Release and Transfer Register, or PRTR, Act)
 - Survey and manage the amounts of chemical substances subject to the PRTR Act that are emitted and transferred, notify the appropriate authorities, and publicly disclose this information
- Take appropriate measures to deal with dioxins
 - Appropriately manage waste incinerators, and survey and report on exhaust gases and ash in accordance with the Act on Special Measures against Dioxins
 - Observe the stipulations of the Waste Disposal and Public Cleansing Act and the Act on Special Measures against Dioxins when waste incinerators are scrapped

- Manage and treat PCB waste and products containing PCBs
 - Appropriately store and manage PCB waste and products containing PCBs based on the stipulations of the Waste Disposal and Public Cleansing Act, the Act on Special Measures concerning Promotion of Proper Treatment of PCB Wastes, the Electricity Business Act, and the Fire Service Act
 - Steadily treat PCB waste and products containing PCBs in accordance with the J-POWER Group's Basic Policy for the Treatment of PCBs
- Strive to reduce volumes of toxic chemicals handled
- Respond appropriately to asbestos-related issues
 - Adopt appropriate measures to manage asbestos, including the prevention of dispersion, while systematically removing asbestos and replacing it with alternative substances based on the J-POWER Group's Basic Policy concerning Asbestos

Measures to Protect the Natural Environment and biodiversity

- Take the natural environment into account at the various stages of business
 - Recognizing that the blessings of the natural environment support rich and secure living, conduct surveys, estimates, and assessments as necessary of the impact of business activities on the natural environment and biodiversity, and work to protect and sustain the natural environment and biodiversity at each stage of the business process, including the planning, design, construction, and operation of facilities.
- Consideration for aquatic environments
 - In operating power generation facilities that are involved with rivers, steadily promote measures for the protection of the river environment appropriate to conditions at each location, including the implementation of sedimentation control measures and measures to mitigate the long-term persistence of turbidity
 - In operating power generation facilities that adjoin the ocean, implement precise control over effluent in compliance with environmental protection agreements and other such arrangements

2. Addressing Local Environmental Issues

- Addressing biodiversity
 - Show consideration for the protection of ecosystems and the diversity of species in conducting our business activities and strive to protect rare animal and plant species and their habitats
 - Strive to raise awareness of biodiversity through participation in environmental education and conservation activities inside and outside the company.
- Implement forest protection initiatives
 - Institute appropriate protections for company-owned forests based on the J-POWER Group Forest Protection Guidelines
 - Promote the use of unexploited offcuts in forests

Environmental Conservation Initiatives in Overseas Projects

- Promote the overseas transfer of environmental protection technologies
 - Promote the transfer of environmental protection technologies for thermal and hydroelectric power generation
- Incorporate environment-conscious initiatives when formulating development plans and considering investment in projects, and ensure that such initiatives are carried out

Implementation of Accurate Environmental Impact Assessments

- Accurately conduct surveys, estimates, and assessments of the environmental impact of business activities in accordance with the applicable laws and regulations, reflect the results in the details of business activities, and give due consideration to environmental protection

3. Ensuring Transparency and Reliability

1. Continual Improvement of Environmental Management (Greater Reliability)

Improvement of Environmental Management Level

- Continue to improve the operation of the environmental management system (EMS) at each J-POWER Group company
 - Assess the actual status of environmental burden and set targets and formulate plans for the protection of the environment
 - Systematically conduct internal environmental audits and periodically evaluate and improve details of environmental activities in order to meet targets
 - Take measures to enhance check functions with the aim of maintaining and improving internal environmental audits
 - Make improvements through activities concerning ISO 14001 at certified business sites
 - Promotion of rationalization of environmental management system.
 - Promote rationalization of environmental management system.
- Raise employee awareness of environmental issues
 - Systematically conduct education and training programs regarding environmental laws and regulations applicable to business activities
 - Promote environmental education using e-learning, etc.
- Request that business partners, including contractors, cooperate in environmentally friendly business operations
- Strengthen risk management
 - Work to prevent environmentally harmful incidents and ensure essential communication and appropriate responses in an emergency

3. Ensuring Transparency and Reliability

Full Compliance with Laws, Regulations, Agreements, and Other Rules

- Identify applicable laws, regulations, agreements, and other rules, and ensure that they are recognized and complied with in business operations
 - Accurately identify laws and regulations, agreements, etc., applicable to business activities, and work to ensure appropriate responses, their widespread recognition, and application, while verifying compliance
- Fully comply with environment-related laws, regulations, agreements, and other rules
 - Make precise improvements to equipment and operations in order to prevent pollution of the surrounding environment
 - Conduct risk diagnoses in relation to waste and education programs for employees engaged in waste disposal in order to ensure the appropriate disposal of waste. In addition, promote the application of the J-POWER Group Guidelines for Deciding Industrial Waste Disposal Contractors and the expansion of use of electronic manifests

2. Communication with Society (Greater Transparency)

Disclosure of Environmental Information

- Formulate environmental reports
 - In disclosing environmental information via the environmental report, we refer to such guidelines as the Environmental Reporting Guidelines of the Ministry of the Environment and carry out reporting in consideration of social demands
 - With regard to the content of the environmental report, work to increase reliability and transparency by such means as reviews by third parties

Increased Engagement in Environmental Communication

- Carry out environmental communication
 - Conduct publicity programs via websites, internal Group publications, etc.
 - Conduct publicity programs targeting visitors to offices, PR centers, etc.
 - Communicate with experts and other third parties
 - Receive external assessments, such as environmental ratings
 - Conduct environment-related social contribution activities, such as providing support for environmental education
- Carry out regional environmental protection activities
 - Independently implement regional environmental protection activities
 - Participate in cleanup events, beautification activities, tree planting events, and similar activities organized by cities, towns, villages, neighborhoods, etc.

2. Business Activities, INPUT·OUTPUT

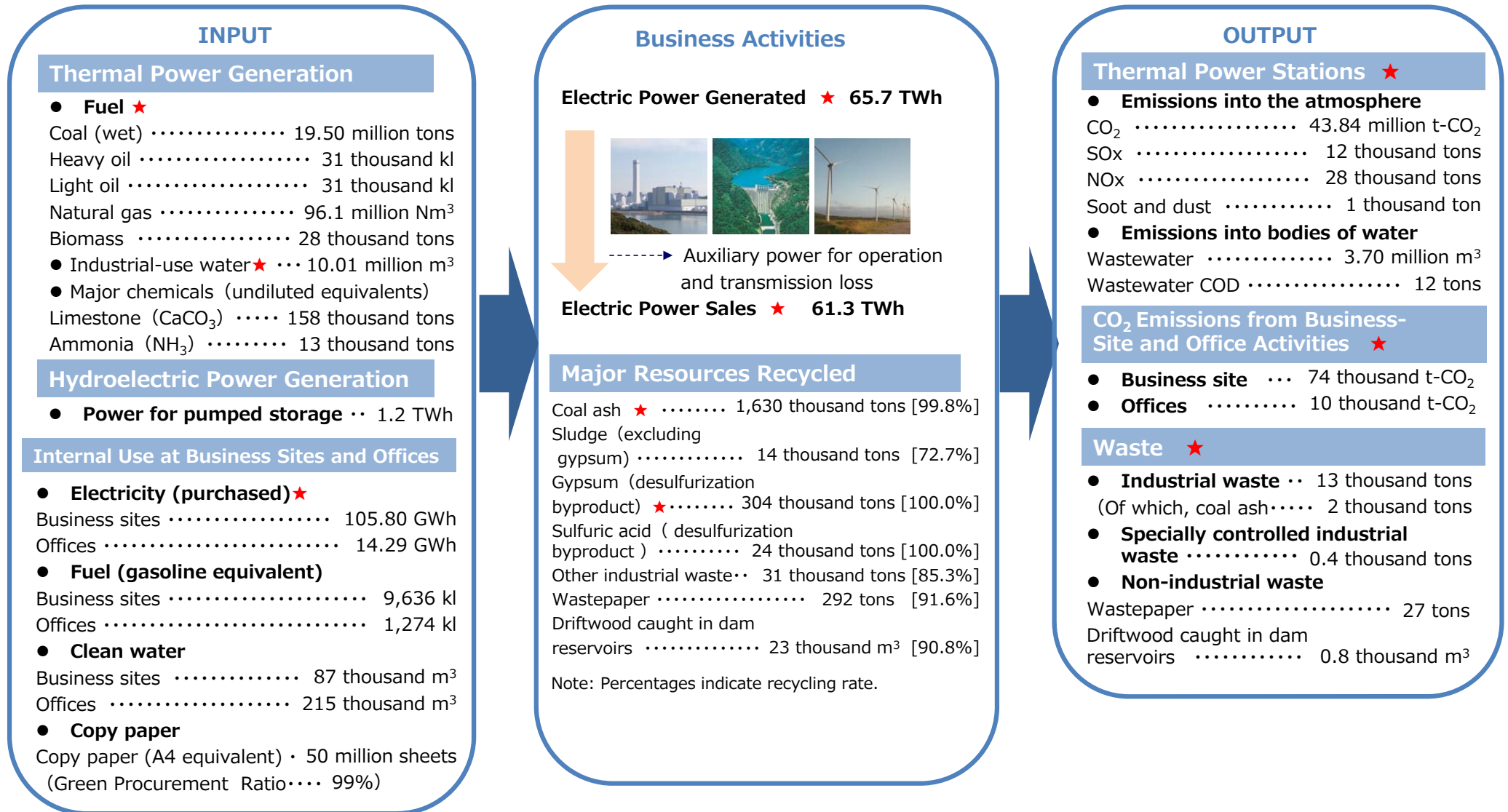
2. Business Activities and the Environment



The charts below detail the resource consumption and environmental load of the fiscal 2019 J-POWER Group operations within Japan.

The ★ marks denote data that are the subject of third-party assurance. (Please refer to section 4-2 [Third-Party Assurance Regarding Environment-Related Information].)

Note: The scope of applicability includes J-POWER and its 25 consolidated domestic subsidiaries, which are engaged in the electric power business, electric power related business, and other business. The amounts attributed to consolidated subsidiaries are based on percentages corresponding to J-POWER's equity share. Note that equity method affiliates (one company in Japan) are included in the calculation of CO₂ emissions from thermal power stations.



Notes:1. Other than that discharged as wastewater, almost all industrial-use water used in thermal power stations is released into the atmosphere as steam.

2. River water used in hydroelectric power stations is not included in the input figures, as all such water is returned to the river after power generation.

3. Environmental Initiatives

3-1. Addressing Global Environmental Issues

Hydroelectric Power

The J-POWER Group boasts a track record in the building and operation of hydroelectric power plants that extends back more than half a century. Beginning in the mid-1950s, in a bid to solve postwar power shortages, the Company developed many large-scale conventional hydroelectric power plants. Subsequently, from the 1970s onward, the Company developed largescale pumped storage hydroelectric power.

J-POWER currently has about 60 domestic hydroelectric power facilities with a combined capacity of approximately 8.6 GW, accounting for almost 20% of hydroelectric power generation in Japan.

Repowering of Hydroelectric Power

At J-POWER, we strive to maximize the reliability and efficiency of our hydroelectric power stations by refurbishing all major electro-mechanical installations as they age and by providing proper maintenance and management of existing facilities.

The Company is also undertaking the development of small- to medium-scale hydroelectric power plants that utilize untapped hydroelectric resources in order to effectively utilize this precious resource to the maximum extent possible.



Sakuma Dam (Shizuoka)



Installing a waterwheel casing for construction of Shin-Katsurazawa Power Station

3-1-1. Expansion of Renewable Energy (2)

Geothermal Power Plant

Geothermal energy is a renewable and purely domestic energy source that promises steady output throughout the year, regardless of weather conditions. J-POWER operated Onikobe Geothermal Power Station (14.9 MW), for more than 40 years since 1975. As of the end of March 2017, the Onikobe Geothermal Power Station ceased operation, and from April 2019, the renewal construction has been carried out with the latest units.

Large scale geothermal power Station

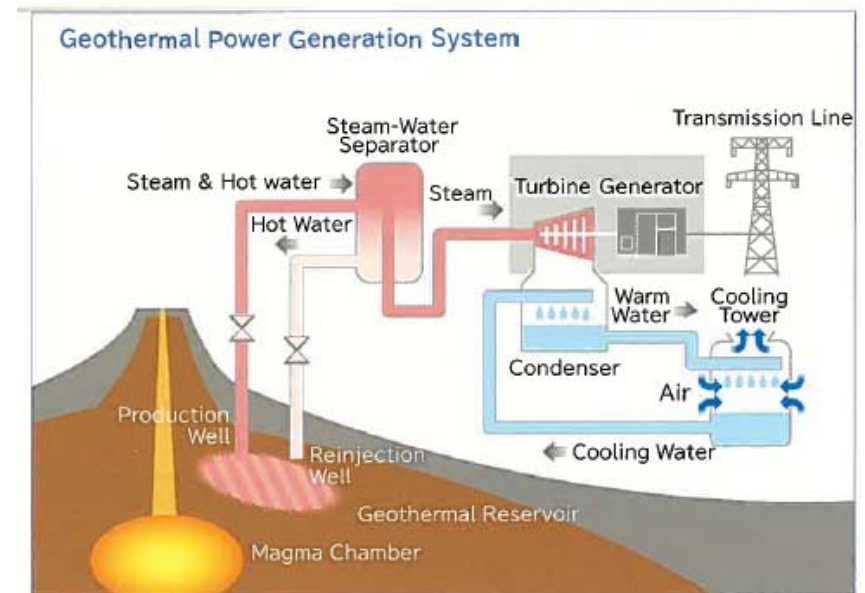
J-POWER is currently working to develop a brand-new large scale geothermal power plant.

【Wasabisawa Geothermal Power Plant】

J-POWER has established Yuzawa Geothermal Power Generation Corporation together with Mitsubishi Materials Corporation and Mitsubishi Gas Chemical Company, Inc. It commenced operation at Wasabizawa Geothermal Power Plant from May 2019. It generates a power output of 46,199 kW. This is the first large-scale geothermal power station operation in Japan for 23 years with an output over of 10,000 kW.

【Appi Geothermal Power Plant】

In a Joint project with Mitsubishi Materials Corporation and Mitsubishi Gas Chemical Company, Inc. J-POWER is participating in the construction of Appi geothermal power station (14.9MW). (Scheduled to commence operation from 2023)



Wasabizawa Geothermal Power Plant commenced operation

3-1-1. Expansion of Renewable Energy (3)



Wind Power

The J-POWER Group is a pioneer in the wind power generation business, having commenced operations at its first wind farm in 2000 and steadily expanded this business since then. J-POWER is the second-largest provider of wind power in Japan, operating 24 wind farms with a combined capacity of 531MW, as of March, 2020. Drawing on its many years of experience, expertise, and technologies in the building, operation, and maintenance of power plants and transmission lines, the Company has created a system that covers the full gamut of the wind power business, from surveys of wind conditions to wind farm design, construction, and operation and maintenance (O&M).



Nikaho No.2 (Akita Prefecture) commenced operation in January 2020

New development of wind power

In terms of onshore wind power, we are steadily advancing new development and replacement projects. As of July 2020, two projects are under construction, and 20 projects are in the construction preparation or assessment stages of development. The Company will continuously seek locations that possess wind conditions suitable for new facilities and steadily develop new projects in the years to come.

With regard to offshore wind power, we will be conducting surveys on the wind conditions and marine areas toward the commercialization in Hibikinada. We are also focusing efforts on the commercialization of offshore wind power in Japan through such efforts as conducting sea area surveys aimed at open-water development in the Hiyama offshore area in Hokkaido, the Awara area in Fukui, and in the Saikai Sea area in Nagasaki. Furthermore, J-POWER acquired a 25% stake in the Triton Knoll offshore wind project in the United Kingdom.



Artist's rendering of Hibikinada Offshore Wind Farm (Fukuoka Prefecture)

3-1-2. Zero Emission Technology for Fossil Fuel Power Generation (1)

Efficiency improvement and CO₂ reduction

Thanks to abundant reserves distributed widely around the globe, coal will be able to support long-term electric power demand in Japan and worldwide.

Japan is almost entirely dependent on imports to meet the demand for energy and so coal is an important resource in terms of ensuring a well-balanced energy mix in terms of energy security, stable power supply and cost.

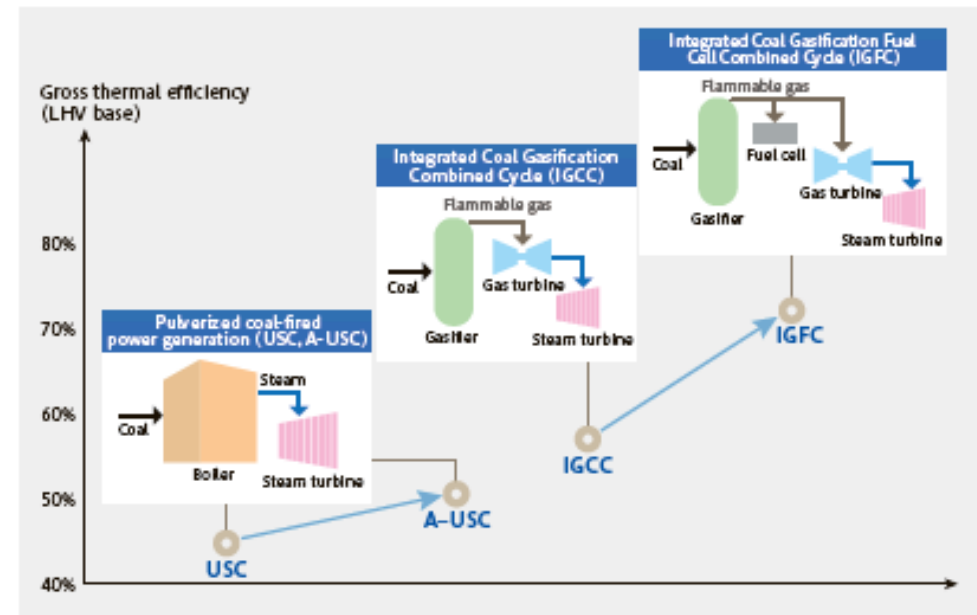
As coal serves in this role, in order to continue its use, it will be essential to greatly reduce CO₂ emissions by ensuring higher efficiency and more advanced systems.

The J-POWER Group is promoting renewable energy and nuclear power plant. In addition we are developing CO₂ separation, capture, utilization, and storage (CCUS) technologies to achieve zero CO₂ emissions from power generation using fossil fuels.

The J-POWER Group is implementing initiatives aimed at the commercialization of oxygen-blown integrated coal gasification combined cycle (IGCC) ※¹, having further high thermal efficiency, ability of quick load change, and high affinity with CCUS, is also developing integrated coal gasification fuel cell combined cycle (IGFC) ※².

※¹ IGCC: Integrated Coal Gasification Combined Cycle

※² IGFC: Integrated Coal Gasification Fuel Cell Combined Cycle



Gross Thermal Efficiency of IGCC and IGFC (Prospect)

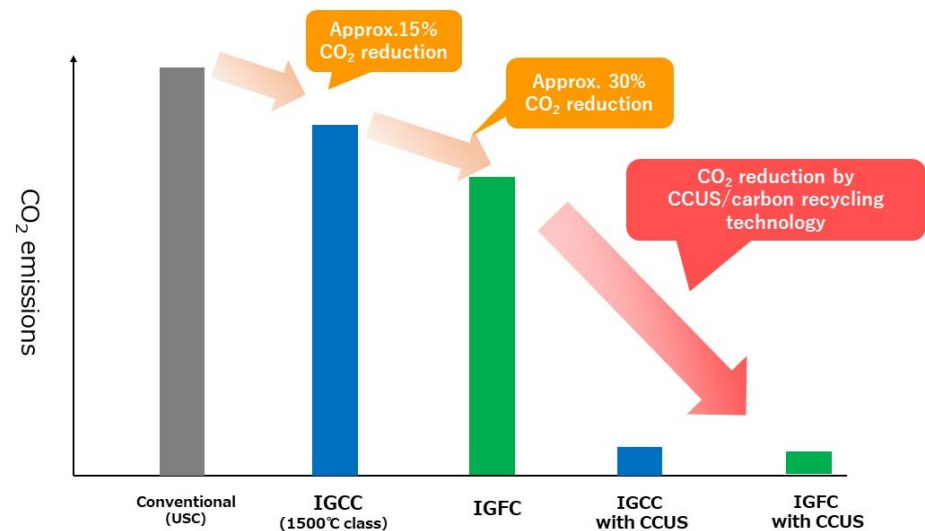


Image of CO₂ emission reduction

3-1-2. Zero Emission Technology for Fossil Fuel Power Generation (2)

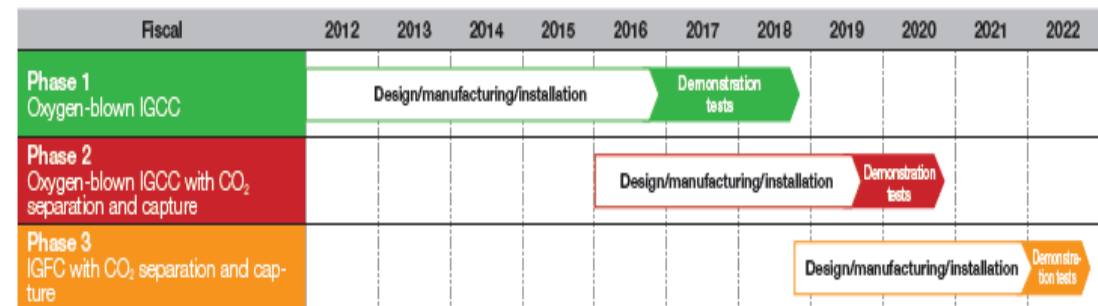
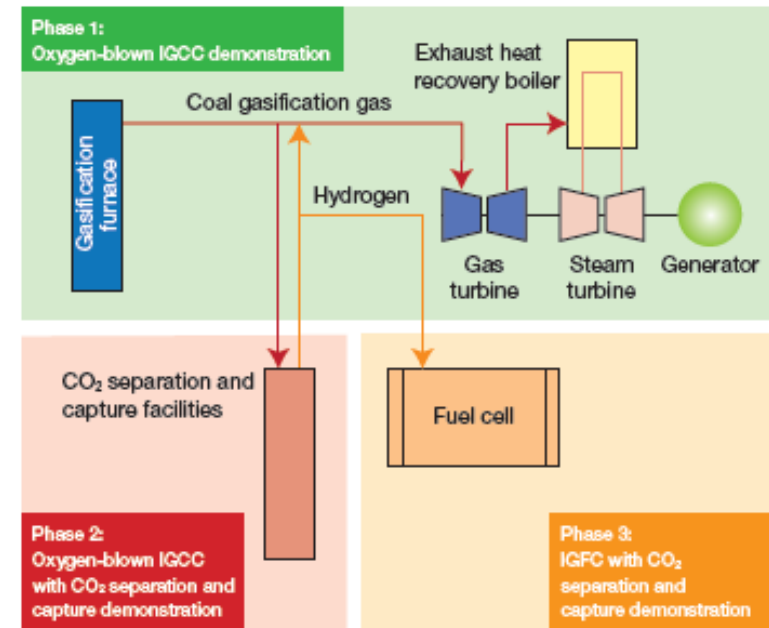
Osaki CoolGen Project

Beginning in fiscal 2002, J-POWER was engaged in the EAGLE ※1 Project in collaboration with the New Energy and Industrial Technology Development Organization (NEDO), a national research and development body. This project was aimed at establishing technologies for realizing oxygen-blown IGCC.

Employing insights and results gleaned from the EAGLE Project, the Company has since been engaged in the Osaki CoolGen Project, with support from NEDO and in collaboration with The Chugoku Electric Power Co., Inc. Phase 1 of this project, a demonstration test of oxygen-blown IGCC (166 MW capacity, with a coal consumption volume of 1,180 tons per day), was completed in February 2019. In Phase 2, we plan to add CO₂ separation and capture facilities to conduct demonstration testing of IGCC with CO₂ separation and capture. Then, in Phase 3, we will use fuel cells to conduct further demonstration testing of IGFC with CO₂ separation and capture.

1. EAGLE: An oxygen-blown coal gasification project that was conducted at the Wakamatsu Research Institute. The name EAGLE is an acronym for coal Energy Application for Gas, Liquid & Electricity.

- [Phase 2 Target]
- Gather data needed to design a new commercial plant (1,500°Cclass IGCC) that achieves 90% CO₂ capture while maintaining approximately 52% net thermal efficiency (LHV).*
 - Capture rate of CO₂ at separation and capture equipment: Over 90%
 - Purity of captured CO₂: Over 99%



3-1-2. Zero Emission Technology for Fossil Fuel Power Generation (3)

Research and development of carbon capture and storage (CCS) technology

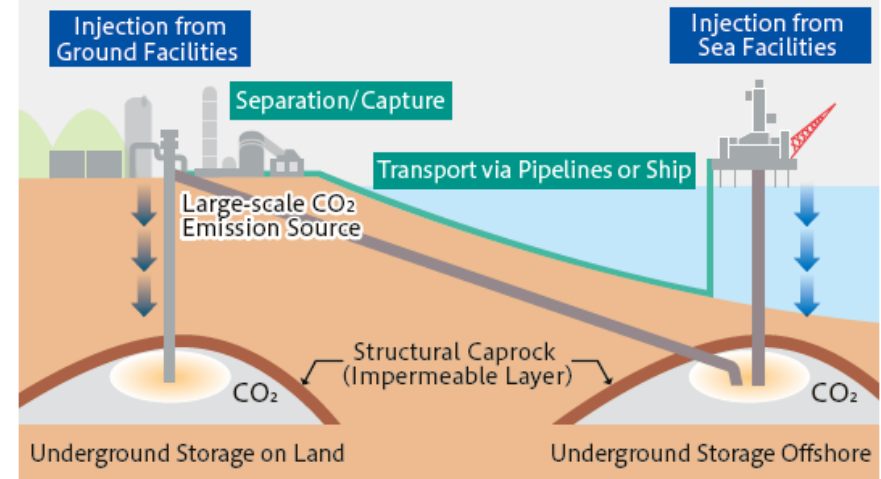
CO₂ capture and storage, or CCS*¹ is technology for collecting the CO₂ produced in the process of power generation and storing it deep underground. J-POWER participated in a large-scale demonstration project being implement at Tomakomai, Hokkaido Prefecture held by Japan CSS Co, Ltd. In this demonstration project in November 2019 they achieved a CO₂ injection volume of 300,000 tons, the target aimed for. Currently monitoring is continuing.

※ 1 CCS : Carbon (Dioxide) Capture and Storage

Australian Brown Coal Hydrogen Pilot Test Project

Hydrogen produces no CO₂ when combusted, can be manufactured from a variety of energy sources, and can be stored and transported. By employing CCS technology at the manufacturing stage, hydrogen can be used as a CO₂-free form of energy. Therefore, for Japan, a nation poor in mineral resources, hydrogen technologies are promising as a means of promoting energy security and combating global warming. J-POWER is handling the gasification of the brown coal (sponsored by NEDO) and purification facilities for the hydrogen gas produced. The pilot test is scheduled to be carried out in 2020. When this supply chain is commercialized, plans call for utilizing CCS to store the CO₂ produced during the manufacture of hydrogen from brown coal, avoiding its release to the atmosphere and thus achieving CO₂-free operations

CCS Technology Overview



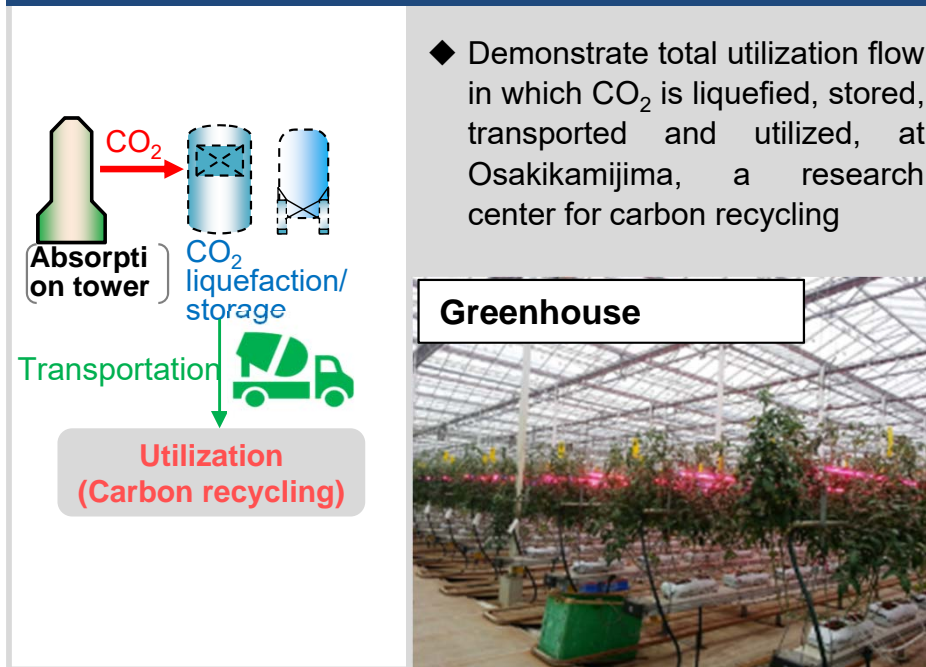
A brown coal gasification furnace and hydrogen production test equipment being constructed in Australia (Photo courtesy of HySTRA)

3-1-2. Zero Emission Technology for Fossil Fuel Power Generation (4)

Considering CO₂ as a resource, separating and recovering it, and reusing it as a material and fuel through mineralization, artificial photosynthesis, and methanation to reduce CO₂ emissions into the atmosphere called “Carbon Recycling” which is one of the key to accelerate energy transition and decarbonization.

J-POWER is promoting technological development for social implementation of carbon recycling.

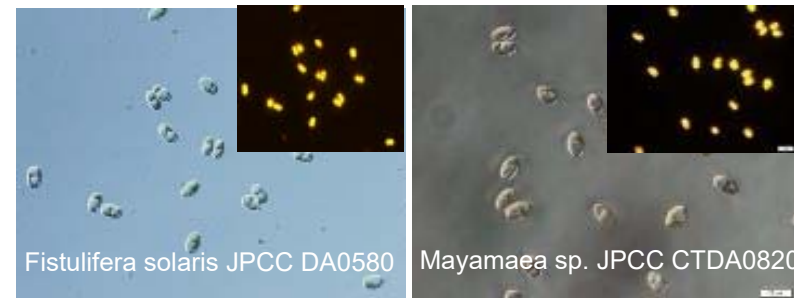
Technology development for Carbon recycling



Technology development for Carbon recycling

Production of Bio-fuels from marine microalgae

- ◆ We aim to put the technologies into practical use by around 2030.(Integrated production process for 5 ha area)



Development of Blue Carbon Coal ash Weight Blok

- ◆ We aim to develop a block material emits less CO₂ during manufacturing and is expected to have a higher seaweed bed creation effect than normal concrete materials.



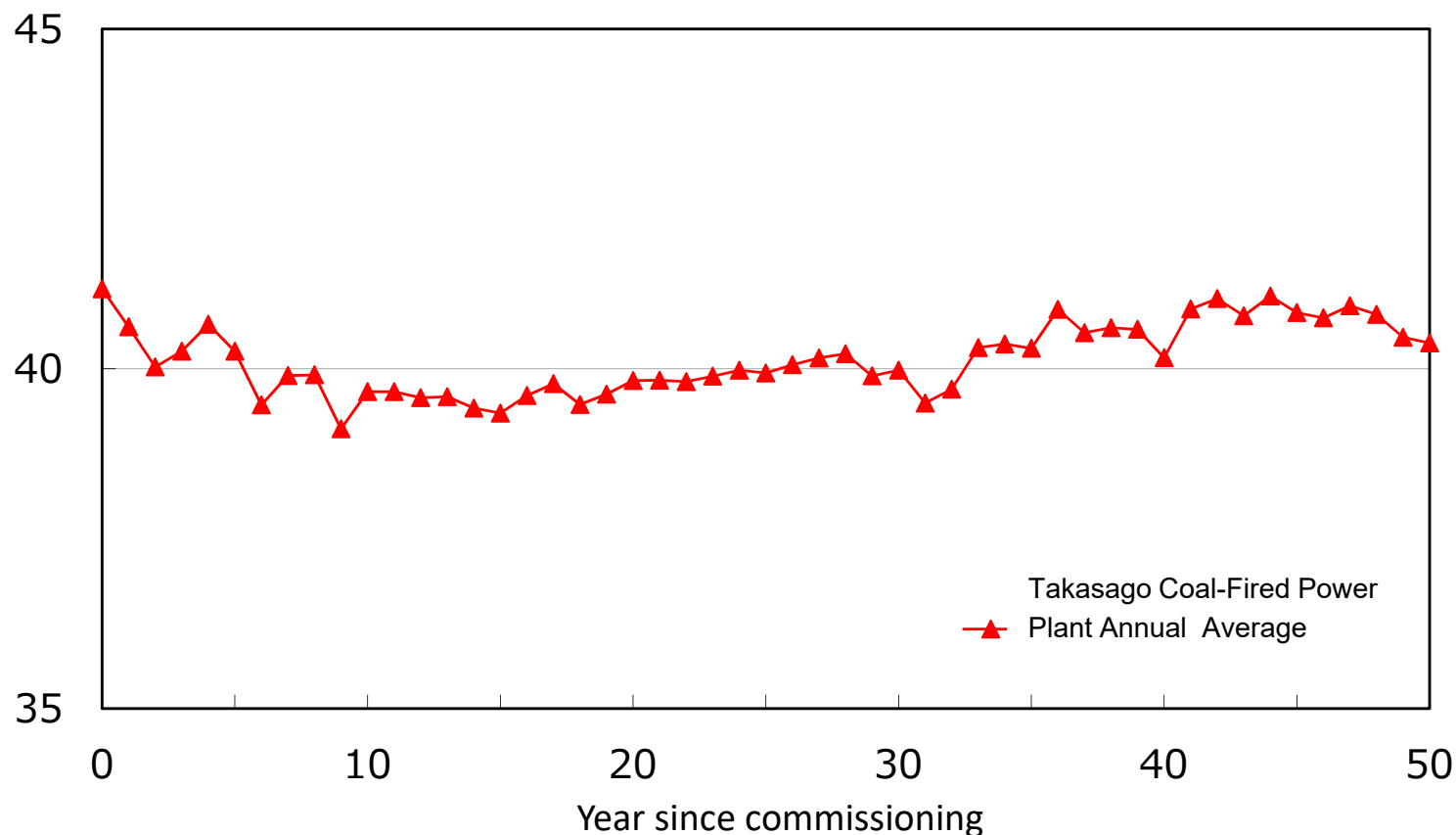
3-1-3. High-Efficiency Coal-Fired Power Generation



In pursuit of high-efficiency power generation, J-POWER's coal-fired thermal power stations were among the first to adopt high-temperature and high-pressure ultra super critical (USC) steam technology. By always adopting the newest technology available, our coal-fired power stations are achieving the world's highest thermal efficiency. Higher efficiency contributes to lower CO₂ emissions per unit of electricity generated.

As thermal power facilities deteriorate with age, their thermal efficiency declines, resulting in greater fuel consumption. J-POWER also takes proactive steps to maintain optimum efficiency through proper refurbishment and maintenance. By preventing a drop in thermal efficiency, we avoid increased fuel consumption and thereby curb CO₂ emissions.

Net thermal efficiency (LHV,%)



J-POWER Takasago Power Plant

Takasago Power Plant was given award by the Asia-Pacific Partnership in 2007 as a case of proper operation management for over 40 years operation.

3-1-4. Replacement and New Projects of Coal-Fired Power Plants



To contribute to the stable supply of electricity in Japan over the medium-to-long term, the J-POWER Group is promoting new coal-fired thermal power projects to replace aging thermal power plants and develop new power plants.

Takehara Thermal Power Station New Unit No. 1 commenced operation in June 2020, and under this project, old Units No.1 and No.2, of which total capacity was 600MW, were replaced with New Unit No.1 with the same capacity. New Unit No.1 has achieved thermal efficiency of approximately 48% (LHV). (Old Units No.1 :41%, Old Units No.2:38%)

Furthermore, the new unit not only reduces CO₂ intensity by around 20%, but also aims at 10% of biomass fuel mixed combustion ratio to reduce coal consumption and realize lower carbon emission.

Kashima Power Co., Ltd., which was jointly established by NIPPON STEEL CORPORATION and J-POWER, has promoted construction works of Kashima Thermal Power Plant Unit No.2 since November 1, 2016, July 1, this plant commenced commercial operation.



Panoramic view of Takehara Thermal Power Station



Panoramic view of Kashima Thermal Power Plant Unit No.2

Replacement projects

Power station name	Capacity	Commercial startup
Takehara Thermal Power Station, New Unit 1 (Hiroshima Prefecture)	600MW	June 2020

New projects

Power station name	Capacity	Commercial Operation	Planned Commercial startup
Kashima Thermal Power Station, Unit 2 (Ibaraki Prefecture)	645MW	Nippon Steel Corporation	July 2020
Nishiokinoyama Power Station (provisional name) (Yamaguchi Prefecture)	At planning stage	Ube Industries Ltd.	Changes in plan under review

3-1-5. Effective Use of Biomass Fuel in Coal-Fired Power Plants



J-POWER is reducing the emission of CO₂ by employing mixed combustion using biomass fuel in coal-fired thermal power stations. Takehara Thermal Power Station New Unit No. 1 is seeking to attain 10% mixed combustion with biomass fuel.

In Fukuoka Prefecture J-POWER operates a Solidified Sewage Sludge Fuel Production facility, the largest class in the Kyushu Region. Also, in a joint project with Sumitomo Forestry Co., Ltd., J-POWER seeks to establish Japan's largest scale wood pellet supply system utilizing unused wood of afforested areas in Japan.

Also, in addition to mixing with coal, in Omuta City, Fukuoka Prefecture J-POWER is part of an initiative involving highefficiency power generation from combustion of Refuse-Derived Fuel (RDF) made by compressing and pelletizing municipal solid waste.

※RDF: Refuse Derived Fuel

Biomass Fuel examples



Wood pellet



Low-temperature carbonized sewage sludge fuel



Carbonized fuel produced from municipal solid waste

3-1-6. Transfer High-Efficiency Coal-Fired Power Plant Technologies Overseas



J-POWER is engaged in the Central Java coal-fired power plant in Batang Regency, Central Java, Indonesia with a capacity of 2 GW. (This is a joint project of J-POWER, PT ADARO POWER of Indonesia and ITOCHU Corporation).

The project is characterized in using locally produced sub bituminous coal as fuel for power generation and in introducing to Indonesia the first two large boilers with a capacity of 1,000MW each, using the ultra super critical (USC) technology to minimize the environmental impact. The project is also in line with the initiative of the Japanese government for Deployment of Integrated Infrastructure Systems Overseas.



Artist's rendering Central Java coal-fired IPP project (Indonesia)

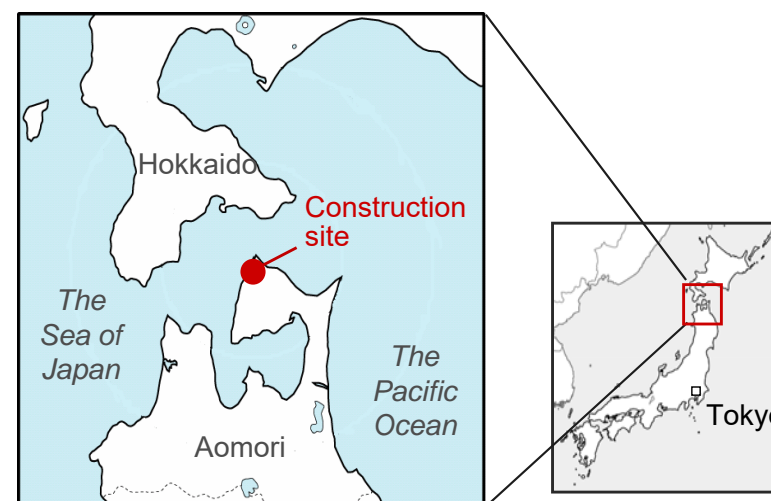
3-1-7. Promotion of the Ohma Nuclear Power Plant Project, with Safety as a Major Prerequisite



From the perspective of steady energy supply, nuclear power is an essential and indispensable source of energy for Japan, an island country with limited natural resources. It is also a source of energy that provides an effective countermeasure to global warming.

Since May 2008, J-POWER has been engaged in construction of the Ohma Nuclear Power Plant. On December 16, 2014, J-POWER submitted an application requesting permission for alteration of the reactor installation license to the Nuclear Regulation Authority (NRA) in order to comply with new safety standards adopted in the wake of the accident at the Fukushima Daiichi Nuclear Power Station.

At J-POWER, we will not be content simply to comply with regulatory requirements but will undertake voluntary safety measures and strive tirelessly to enhance safety as we exert every effort to build safe nuclear power plants.



Plan Overview	
Location	Ohma-machi, Shimokita-gun, Aomori Prefecture
Output	1.383 GW
Site area	130 ha
Reactor type	Advanced Boiling Water Reactor (ABWR)
Start of construction	May 2008
Start of commercial operations	To be determined
Fuel	Enriched uranium and uranium-plutonium Mixed Oxide (MOX)

※1 MOX: Mixed Oxide



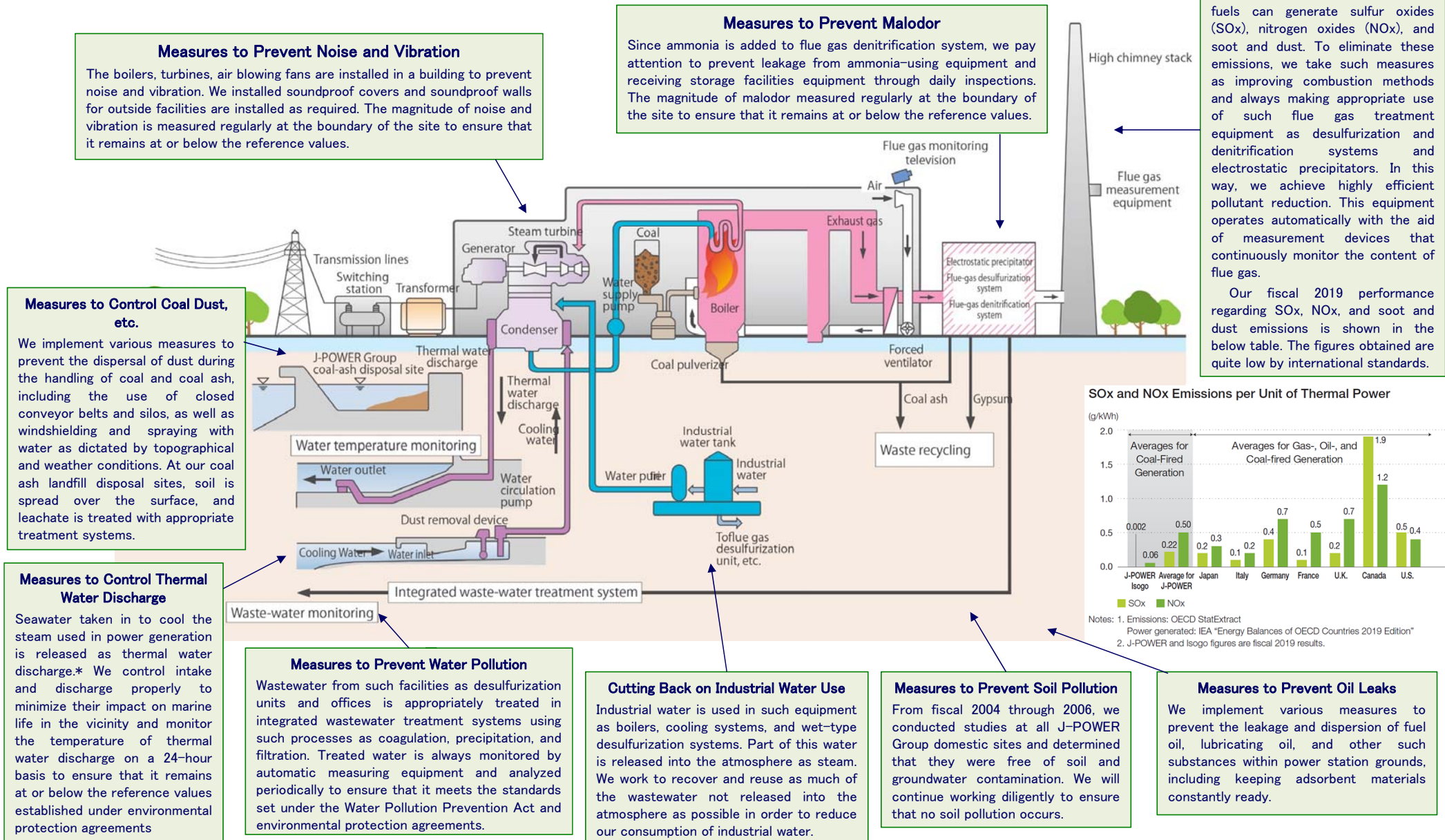
3. Environmental Initiatives

3-2. Addressing Local Environmental Issues

3-2-1. Reducing Emissions of Environmentally Harmful Substances



The J-POWER Group undertakes environmental preservation initiatives using the latest technologies and knowledge to reduce the environmental burden caused by its domestic and overseas electric power businesses.



* Thermal water discharge:

In thermal power generation, the steam that drives the turbine is sent through a condenser for cooling, returning to its liquid state for reuse in the boiler. In almost all power stations in Japan, seawater is used for cooling in the condensers. As the seawater cools the steam passing through the condenser, its temperature rises. It is then returned to the ocean through the discharge outlet, at which point it is referred to as thermal water discharge.

3-2-2. Promotion of the 3Rs (Reduce, Reuse, and Recycle) and Proper Disposal of Waste



Maintaining and Improving the Industrial Waste Recycling Rate

The J-POWER Group's target industrial waste recycling rate is 97%. The total amount of industrial waste we generated in fiscal 2019 was 2.00 million tons, and we achieved a recycling rate of 99.3%.

Making Effective Use of Coal Ash and Gypsum

The J-POWER Group's industrial waste consists of 97% coal ash and gypsum from thermal power stations.

We recycle 99.8% of coal ash produced in coal-fired thermal power generation, mainly as material for making cement and for land reclamation, as well as 100% of the gypsum and sulfuric acid produced as byproducts of emissions desulfurization.

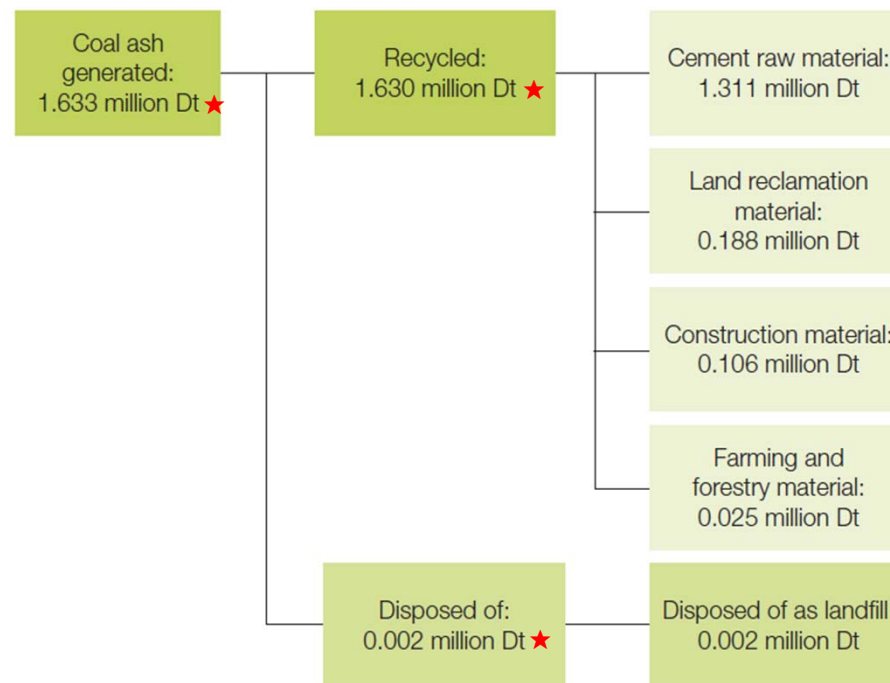
Information on Maintenance and Management of Industrial Waste Final Disposal Sites

The J-POWER Group discloses on its website maintenance and management information for its industrial waste final disposal sites, including the maintenance and management plan, the results of groundwater and discharge water quality analyses, inspection results, and the volume of landfill waste.

<http://www.jpowers.co.jp/bs/karyoku/maintenance.html>

(Japanese Only)

Breakdown of Coal Ash Recycling (displacement tons)



Note: Sums of figures may not equal totals due to rounding.

The ★ marks denote data that are the subject of third-party assurance.
(Please refer to section 4-2「Third-Party Assurance Regarding Environment-Related Information」.)

3-2-3. Management of Chemical Substances



The J-POWER Group complies with applicable laws and regulations and properly uses, stores, manages, and treats chemical substances regulated by the PRTR Act, dioxins, PCB waste material (including equipment that contains trace amounts of PCB), materials that contain asbestos, and other substances that are used in power plants or are included in equipment or machinery.

PRTR Substance Release and Transfer Volumes (Fiscal 2019)

Substance	Use	Volume handled	Volume released	Volume transferred as waste
33: Asbestos	Insulation for equipment	6.3 t/y	–	6,290 kg/y
71: Ferric chloride	Wastewater treatment agents	5.2 t/y	–	–
80: Xylene	Coating for machinery	2.3 t/y	2,322 kg/y	–
240: Styrene	Coating for machinery	2.1 t/y	2.156 kg/y	–
300: Toluene	Fuel for power generation (coal)	16.4 t/y	16,394 kg/y	–
333 : Hydrazine	Boiler water treatment agent	1.0 t/y	0.2 kg/y	–
405: Boron compounds	Manure additives	14.1 t/y	0.4 kg/y	–
406:PCB	Fluorescent lamp ballast.	1.3 t/y	–	1,300 kg/y

Note: Figures represent the total release and transfer volumes for all business sites handling 1 ton or more per year of a Class 1 designated chemical substance or 0.5 ton or more per year of a Specific Class 1 designated chemical substance.

Preservation of Aquatic Environments

From fiscal 2013 onward, the preservation of aquatic environments has been designated as one of the Corporate Targets under the J-POWER Group Environmental Management Vision with the aim of reinforcing our environmental preservation initiatives regarding rivers and the seas.

We undertake environmental preservation measures based on the specific regional environment and characteristics of each business site. For example, near hydroelectric power stations, we take measures regarding water quality and the accumulation of silt in dam lakes and downstream area, while near thermal power stations we manage effluent emitted into nearby oceans in accordance with applicable laws and regulations.

Preservation of Forests

J-POWER owns forests in areas near its hydroelectric power facilities throughout Japan. We appropriately maintain these valuable forests in accordance with the Forest Protection Guidelines (formulated in 2007).

The J-POWER Group is contributing to forest preservation as well as the reduction of CO₂ emissions through efforts to combust biomass fuel pellets made from forestry offcuts and other materials along with coal at coal-fired thermal power stations.

Preservation of Biodiversity

To reinforce our measures in light of the Basic Act on Biodiversity, from fiscal 2011 onward, the preservation of biodiversity has been one of the Corporate Targets under the J-POWER Group Environmental Management Vision.

During the planning and design stages of power generation facilities, we incorporate environmental preservation measures to mitigate the impact on habitats, breeding environments and ecological systems as determined through environmental impact assessments that look at the wildlife and ecological systems of the surrounding land and marine areas. We strive to preserve wildlife living in the vicinity of operating power plants, particularly rare species, and their habitats.

These measures are tailored to local environments and characteristics. For example, every effort is made to avoid outdoor work during the nesting season of the Japanese golden eagle and other endangered birds that live in the vicinity of the Okutadami Dam and Otori Dam. Another example is the restoration, maintenance, and management of marshes that became landfill areas when the Okutadami Dam was expanded.



Okutadami dam downstream Yazaki Wetland (Niigata)

3-2-5. Implementation of Accurate Environmental Impact Assessments



Environmental Impact Assessment

Before building or expanding power plants, we conduct environmental impact assessments in accordance with applicable laws and regulations and implement adequate environmental preservation measures, taking the opinions of local residents into consideration. After a power plant becomes operational, we carry out ongoing monitoring in accordance with environmental protection agreements entered into with related local governments to ensure that our environmental preservation measures are effective. Currently, 21 projects are in the process of environmental impact assessment (as of July,2020).

Project (tentative name)	Area	Project (tentative name)	Area
Minami Ehime No.2 Wind Farm	Ehime Prefecture	Naka-Noto Wind Farm	Ishikawa Prefecture
Sarakitomanai Wind Farm (Replacement)	Hokkaido Prefecture	Fukui Ono Ikeda Wind Farm	Fukui Prefecture
Tomamae Wind Farm (Replacement)	Hokkaido Prefecture	Kichu Wind Farm	Wakayama Prefecture
Aso Nishihara Wind Farm (Replacement)	Kumamoto Prefecture	Hisatsu Wind Farm	Kumamoto Prefecture
Minamiosumi Wind Farm (Replacement)	Kagoshima Prefecture	Hiroshim-Nishi Wind Farm	Hiroshima Prefecture
Tahara Seaside Wind Farm (Replacement)	Aichi Prefecture	Fukui Prefecture Awara offshore wind power generation	Fukui Prefecture
Kita-Kagoshima Wind Farm	Kagoshima Prefecture	Hiyama area offshore wind power generation	Hokkaido Prefecture
Seiyo Yusuhara Wind Farm	Ehime Prefecture	Hibikinada Offshore Wind Farm	Fukuoka Prefecture
Wajima Wind Farm	Ishikawa Prefecture	Saikai offshore wind power generation	Nagasaki Prefecture
Youra Wind Farm	Oita Prefecture	Uprating project of Sakuma East-West Interconnection Facilities	Yamanashi Prefecture
Reihoku Kunimiyama Wind Farm	Kochi Prefecture		

※ Assessments listed include those carried under not only J-POWER but also J-POWER Group Companies

3. Environmental Initiatives

3-3. Ensuring Transparency and Reliability

3-3-1. Improvement of Environmental Management Level



The J-POWER Group conducts environmental preservation activities in accordance with its corporate philosophy. To this end, the Group utilizes environmental management systems (EMSs) at all its business sites in order to advance measures to enhance environmental management and to ensure thoroughgoing compliance with all applicable laws, regulations, and agreements.

Furthermore, we proactively engage in environmental communication activities.

Improvement of Environmental Management Level

On the basis of the J-POWER Group Environmental Action Guidelines, reviewed annually by management, each executive unit draws up its own Environmental Action Plan. Each executive unit periodically reviews and evaluates its initiatives and revises the measures to be taken, following the PDCA cycle. In this way, we work to constantly enhance environmental management.

In addition, the J-POWER Group plans and implements environmental education, using such means as group classes and e-learning, to foster a deeper awareness of environmental issues and sense of personal responsibility among employees.

Fiscal 2019 In-House Environmental Training

Media	Type	Training category	Results	Main content
General training	General environmental management	Environmental management briefing	Approximately 730 Participants	Information regarding group environmental management initiatives and information of energy policy etc.
	E-learning	Basic knowledge regarding Environmental issues	88.8%	Energy and environmental policy trends
Advanced and specialized training	EMS implementation	Internal environmental auditor training	40 Participants	Knowledge necessary to conduct internal audits under EMSs
		Follow-up training for internal environmental auditors	23 Participants	Knowledge necessary to oversee audit teams conducting internal audits under EMSs
	Environmental laws and Regulations	Skill enhancement training for wasteprocessing operations	80 Participants	Explanation of the key points of the Waste Disposal Act
		Wasteprocessing risk assessment	Four locations Assessed	Checking provisions of agreements and manifests specified by law
		Training on environmental laws and Regulations	173 Participants	Explanation of environmental laws and regulations
	E-learning	EMS course	63 Participants	Basic knowledge of EMSs

Full Compliance with Laws, Regulations, Agreements, and Other Rules

In order to reduce the impact of business activities on the surrounding environment, we take appropriate steps to implement the laws, regulations, agreements, and other such rules applicable to our business activities and make them widely known. We are also engaged in ongoing efforts to improve our facilities and operations.

In order to dispose of waste properly, we take measures to maintain and improve the disposal capabilities of waste disposal operators, employing waste disposal consulting firms to directly confirm the status of waste disposal by local organizations.

Responding to Environmental Incidents

We make every effort to prevent environmental incidents before they occur. When problems arise that require emergency handling, however, we promptly take whatever measures are required to contain the damage and notify the local agencies concerned as well as the J-POWER Headquarters Emergency Response Team and related departments.

The J-POWER Headquarters Emergency Response Team promptly notifies top management and, in the interests of information disclosure, provides information for publication on the emergency to the media and other relevant parties. We also devise measures to prevent recurrences. Of the incidents impacting the environment that occurred in fiscal 2019, no incident was reported through the mass media.

Status of Environmental Incidents

Fiscal year 2017 : One incident

Fiscal year 2018 : One incident

Fiscal year 2019 : No incident

4. Environment-Related Data

4-1. Environment-Related Data (1)



The following data represent year-end values for each fiscal year. Unless specifically noted, includes data for Group companies. ※1

1. The scope of applicability includes J-POWER and its 25 consolidated domestic subsidiaries, which are engaged in the electric power business, electric power related business, and other business. The amounts attributed to consolidated subsidiaries are based on percentages corresponding to J-POWER's equity share. Please refer to section 4-3「Major Group Companies」for the covered data in the Environment-Related data .(However, the figures under Usage of Specified CFCs and for SF₆ emissions and handled amount under Greenhouse Gas Emissions are calculated based on the total amounts from consolidated subsidiaries.)

Note: The sums of individual figures may not equal the corresponding totals due to rounding.

The ★ marks denote data that are the subject of third-party assurance. (Please refer to section 4-2「Third-Party Assurance Regarding Environment-Related Information」)

Fuel Consumption

	Unit	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019 ★
Coal (dry coal 28 MJ/kg equivalent)	million t	18.83	17.73	18.87	18.09	16.98
Use intensity (coal-fired thermal power)	t/GWh	342	340	340	338	334
Natural gas	million m ³ N	116	160	164	130	96
Heavy oil	million kl	0.05	0.04	0.04	0.03	0.03
Diesel	million kl	0.02	0.02	0.02	0.02	0.03
Biomass	million t	0.03	0.02	0.03	0.02	0.03

Note: Denominators for use intensity represent electric power sold by coal-fired thermal power stations

4-1. Environment-Related Data (2)



Greenhouse Gas Emissions²

	Unit	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019 ★
CO ₂ emissions (domestic and overseas power generation) ³	million t-CO ₂	59.11	55.24	57.02	53.53	52.15
CO ₂ emission intensity	kg-CO ₂ /kWh	0.64	0.65	0.66	0.66	0.64
CO ₂ emissions (domestic power generation)	million t-CO ₂	48.20	45.52	48.42	46.73	43.84
CO ₂ emission intensity	kg-CO ₂ /kWh	0.72	0.73	0.73	0.72	0.71
SF ₆	Emissions	t	0.1	0.1	0.0	0.0
	Handled	t	11.0	10.2	6.7	2.3
	Recovery rate	%	99	99	99	99
HFC emissions ⁵	t	0.1	0.1	0.1	0.2	0.2
N ₂ O emissions	t	1,715	1,107	1,780	1,618	610

- CO₂ emissions comprise emissions from fuel combustion for power generation. Emissions of other greenhouse gases (PFC, CH₄, and NF₃) are effectively zero. The calculation of CO₂ emissions from both operations in Japan and those overseas is performed in accordance with the Act on Promotion of Global Warming Countermeasures.
- This covers J-POWER as well as consolidated subsidiaries and equity method affiliates, which are engaged in the electric power business and overseas business (10 domestic and 32 overseas companies). The amounts attributed to consolidated subsidiaries and equity method affiliates are based on the percentages of J-POWER's equity share. Please refer to section 4-3「Major Group Companies」for the covered data in the calculation of CO₂ emissions.
- Calculated using the same tabulation method as that employed for Usage of Specified CFCs.

Note: Denominators for emission intensity represent electric power sold.

4-1. Environment-Related Data (3)



J-POWER Group Total Thermal Efficiency for Thermal Power Generation (Gross Efficiency)

	Unit	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019 ★
Total thermal efficiency (gross efficiency, HHV)	%	40.4	40.3	40.4	40.6	40.8

Usage of Specified CFCs

		Unit	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Specified CFCs	Inventory	t	1.0	1.0	1.0	1.0	0.0
	Emissions	t	0.0	0.0	0.0	0.0	0.0
Halons	Inventory	t	4.7	4.7	4.5	4.8	4.7
	Emissions	t	0.0	0.0	0.0	0.0	0.0
Other CFCs	Inventory	t	6.2	5.8	5.0	4.7	4.4
	Emissions	t	0.1	0.0	0.0	0.0	0.0
HFCs (CFC alternatives)	Inventory	t	15.2	20.0	20.8	21.1	21.3
	Emissions	t	0.1	0.1	0.1	0.2	0.2 ★

4-1. Environment-Related Data (4)



SOx, NOx, and Soot and Dust Emissions

		Unit	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019 ★
SOx	Emissions	thousand t	10.7	10.2	11.4	12.4	11.9
	Intensity	g/kWh	0.18	0.18	0.19	0.21	0.22
NOx	Emissions	thousand t	29.8	27.8	29.6	29.4	27.5
	Intensity	g/kWh	0.50	0.50	0.49	0.51	0.50
Soot and dust	Emissions	thousand t	0.8	1.0	0.9	0.9	0.6
	Intensity	g/kWh	0.01	0.02	0.02	0.02	0.01

Notes: 1. Soot and dust emissions are calculated from monthly measurements.

2. Denominators for intensity represent the electricity generated in thermal power stations (excluding geothermal power stations).

Industrial Waste Recycling

	Unit	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019 ★
Volume generated	million t	2.25	2.10	2.32	2.30	2.00
Volume recycled	million t	2.22	2.07	2.29	2.27	1.98
Recycle rate	%	99	99	99	99	99

Coal Ash and Gypsum Recycling

	Unit	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019 ★
Coal ash	Volume generated	thousand t	1,852	1,719	1,939	1,899
	Volume recycled	thousand t	1,839	1,708	1,929	1,893
	Recycle rate	%	99.3	99.4	99.5	99.7
Gypsum	Volume generated	thousand t	318	310	329	318
	Recycle rate	%	100	100	100	100

4-1. Environment-Related Data (5)



Electricity (Purchased)

	Unit	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019 ★
Business sites	GWh	41.63	69.66	65.25	87.48	105.80
Office	GWh	15.60	17.31	15.96	15.55	14.29

Fuel(Gasoline equivalent)

	Unit	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Business sites	kℓ	7,971	8,961	9,173	9,020	9,636
Office	Kℓ	1,196	1,230	1,324	1,341	1,274

Industrial-use water・Clean Water

	Unit	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	
Industrial-use water※5	million m ³	9.22	10.87	11.02	10.05	10.01 ★	
Clean Water	Business sites	thousand m ³	66	68	102	75	87
	Office	thousand m ³	216	185	189	177	215

※5 Almost all industrial-use water used in thermal power stations

4-1. Environment-Related Data (6)



Office Power Consumption

		Unit	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Power consumed by offices (company total)		GWh	19.61	20.83	19.37	18.80	17.66
Head office	Power consumption	GWh	6.41	6.37	6.25	6.15	5.75
	Lighting/power sockets	GWh	1.25	1.22	1.18	1.24	1.20

(The data is modified according to the aggregable range)

Rate of Green Procurement of Copy paper (Recycled copy paper ratio)

		Unit	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Copy Paper ※6	Purchased	million sheets	55.30	54.81	55.14	53.70	49.98
	Green Procurement	million sheets	54.76	54.58	54.63	52.96	49.49
	(Green Procurement Rate)	%	99	100	99	99	99

※6 A4 paper-size equivalent

4-2 Third-Party Assurance Regarding Environment-Related Information



The environmental information and performance data (hereinafter “sustainability information”) contained in the “J-POWER Group Materials of Environmental Initiatives 2020” have been reviewed by Ernst & Young ShinNihon LLC, from the point of view of accuracy and comprehensiveness for important sustainability information as determined by the Japanese Association of Assurance Organizations for Sustainability Information (J-SUS). As a result of this review, said sustainability information has received an Independent Assurance Report. The data that were calculated in accordance with the specified calculation standards and are covered by this assurance are indicated by stars (★).



The following is an English translation of an independent assurance report prepared in Japanese and is for information and reference purposes only. In the event of a discrepancy between the Japanese and English versions, the Japanese version will prevail.

August 13, 2020

Translation

Independent Assurance Report

TO:
Mr. Toshifumi Watanabe
Representative Director President and Chief Executive Officer
Electric Power Development Co., Ltd.

Kenji Sawami
Engagement Partner
Ernst & Young ShinNihon LLC Tokyo

We, Ernst & Young ShinNihon LLC, have been commissioned by Electric Power Development Co., Ltd. (hereafter the “Company”) and have carried out a limited assurance engagement on the Key Environmental Performance Indicators (hereafter the “Indicators”) of the Company and its major subsidiaries for the year ended March 31, 2020 as included in Materials of Environmental Initiatives attached to J-POWER Group Integrated Report 2020 (hereafter the “Report”). The scope of our assurance procedures was limited to the Indicators marked with the symbol “★” in the Report.

1. The Company's Responsibilities

The Company is responsible for preparing the Indicators in accordance with the Company's own criteria, which it determined with consideration of Japanese environmental regulations as presented in the Investor Relations, IR Library, Integrated Reports, Calculation Standards of Environmental Information of the Company's website. Greenhouse gas (GHG) emissions are estimated using emissions factors, which are subject to scientific and estimation uncertainties, given instruments for measuring GHG emissions may vary in characteristics, in terms of functions and assumed parameters.

2. Our Independence and Quality Control

We have met the independence requirements of the Code of Ethics for Professional Accountants issued by the International Ethics Standards Board for Accountants, which is based on the fundamental principles of integrity, objectiveness, professional competence and due care, confidentiality, and professional behavior. In addition, we maintain a comprehensive quality control system, including documented policies and procedures for compliance with ethical rules, professional standards, and applicable laws and regulations in accordance with the International Standard on Quality Control 1 issued by the International Auditing and Assurance Standards Board.

3. Our responsibilities

Our responsibility is to express a limited assurance conclusion on the Indicators included in the Report based on the procedures we have performed and the evidence we have obtained.

We conducted our limited assurance engagement in accordance with the International Standard on Assurance Engagements: Assurance Engagements Other than Audits or Reviews of Historical Financial Information - (“ISAE 3000”) (Revised), and with respect to GHG emissions, the International Standard on Assurance Engagements: Assurance Engagements on Greenhouse Gas Statements (“ISAE 3410”), issued by the International Auditing and Assurance Standards Board. The procedures, which we have performed according to our professional judgment, include inquiries, document inspection, analytical procedures, reconciliation between source documents and Indicators in the Report and the following:

- Making inquiries regarding the Company's own criteria that it determined with consideration of Japanese environmental regulations, and evaluating the appropriateness thereof;
- Inspecting relevant documents with regard to the design of the Company's internal controls related to the Indicators, and inquiring of personnel responsible thereof at the headquarters and one power station;
- Performing analytical procedures concerning the Indicators at the headquarters and one power station; and
- Testing, on a sample basis, underlying source information and conducting relevant re-calculations at the headquarters and one power station.

The procedures performed in a limited assurance engagement are more limited in nature, timing and extent than a reasonable assurance engagement. As a result, the level of assurance obtained in a limited assurance engagement is lower than would have been obtained if we had performed a reasonable assurance engagement.

4. Conclusion

Based on the procedures performed and evidence obtained, nothing has come to our attention that causes us to believe that the Indicators included in the Report have not been measured and reported in accordance with the Company's own criteria that it determined with consideration of Japanese environmental regulations.

4-2 Third-Party Assurance Regarding Environment-Related Information (2)



List of Sustainability Information Calculation Standards

Primary information	Definition, calculation method, etc.
Fuel Consumption Electricity (purchased)	Calculated in Accordance with the Provisions of the Energy Use Law.
Industrial-use water	Automated measurement data is collected by measuring instruments. Measuring instruments are calibrated in accordance with legal requirements.
CO ₂ emissions, HFC emissions, N ₂ O emissions	The volume is calculated by multiplying the volume of each type of energy used by the relevant energy conversion factor according to the method specified in the Act on Promotion of Global Warming Countermeasures.
SO _x , NO _x , and Soot and Dust Emissions	Automated measurement data is collected by measuring instruments in accordance with the Air Pollution Prevention Act. Measuring instruments are calibrated in accordance with legal requirements.
waste water	Measurements are taken using measuring instruments and the volume is totaled.
Wastewater COD	The volume is calculated by multiplying the concentration of waste water (measured by a measurement certification business) by the volume of waste water in accordance with the method specified in the Water Pollution Prevention Act.
Volume of waste generated	The volume is totaled using the values indicated in manifests* specified in the Waste Disposal Act. Driftwood in dam reservoirs is determined by calculating the volume of driftwood that is removed from the reservoirs. * Manifest: A management form that must be issued under the Waste Disposal Act when transportation and disposal of waste is outsourced to an outside service provider. The manifest indicates the weight of waste, the method of disposal, and other information.
Volume of waste recycled	The volume of waste material that is reused or recycled and the volume of valuable material that is sold to outside service providers is totaled in accordance with the Waste Disposal Act and related notices.
Volume of SF ₆ handled and Emissions	Volume handled: The volume of SF ₆ gas in possession is totaled. Volume released: The volume is calculated by multiplying the volume that leaked (the annual SF ₆ refilling volume to related equipment) by the relevant release coefficient in accordance with the method specified in the Act on Promotion of Global Warming Countermeasures.
Electric power generated, amount of electric power sales	Automated measurement data is collected by measuring instruments. Measuring instruments are calibrated in accordance with legal requirements.
Total thermal power efficiency (gross efficiency, HHV)	Calculated using the following formula: Amount of electric power generated (MWh) × 3,600 ÷ Total heat input (excluding reheating and denitrification) (GJ) ÷ 1,000 × 100

4-3. Major Group Companies



Environment Related Data calculations

Calculation of CO₂ emissions for domestic and overseas power generation

J-POWER and 25 domestic consolidated subsidiaries

J-POWER, 10 electric power business companies and 32 overseas business companies

※Equity Stake [%]

Electric Power-Related Business

- JPHYTEC Co., Ltd. [100%]
- JPec Co., Ltd. [100%]
- KEC Corporation [100%]
- JP Design Co., Ltd. [100%]
- J-POWER Business Service Corporation [100%]
- JP Enterprise Co., Ltd. [100%]
- J-POWER EnTech Co., Inc. [100%]
- JM Activated Coke, Inc. [90%]
- PLANT-GIKEN Co.,Ltd. [100%]
- J-POWER RESOURCES Co., Ltd. [100%]
- J-Wind Service Co., Ltd. [100%]
- Miyazaki Wood Pellet Co., Ltd. [98.33%]

Electric Power Business

- J-POWER SUPPLY & TRADING Co., Ltd. [100%]
 - Mihama Seaside Power Co., Ltd. [100%]
 - ITOIGAWA POWER Inc. [64%]
 - J-Wind Co., Ltd. [100%]
 - J-Wind SETANA Co., Ltd. [100%]
 - J-Wind NIKAHO Co., Ltd. [100%]
 - J-Wind KUZUMAKI Co., Ltd. [100%]
 - Nagasaki-Shikamachi Wind Power Co., Ltd. [70%]
-
- TOSA POWER Inc. [45%]
 - Yuzawa Geothermal Power Generation Corporation [50%]

Other Business

- Kaihatsu Hiryou Co., Ltd. [100%]
- Japan Network Engineering Co., Ltd. [100%]
- Omuta Plant Service Co., Ltd. [60%]
- Biocoal Osaka-Hirano Co., Ltd. [60%]
- Green Coal Saikai Co., Ltd. [60%]
- Biocoal Yokohama-South Co., Ltd. [60%]

Overseas Business

- CBK Power Co.,Ltd.
 - Shaanxi Hanjiang Investment & Development Co., Ltd.
 - Roi-Et Green Co.,Ltd.
 - Gulf Yala Green Co.,Ltd.
 - Gulf JP UT Co.,Ltd.
 - Gulf JP NS Co.,Ltd.
 - Gulf JP NNK Co.,Ltd.
 - Gulf JP CRN Co.,Ltd.
 - Gulf JP NK2 Co.,Ltd.
 - Gulf JP TLC Co.,Ltd.
 - Gulf JP KP1 Co.,Ltd.
- Gulf JP KP2 Co.,Ltd.
 - Gulf JP NLL Co.,Ltd.
 - Gulf Cogeneration Co.,Ltd.
 - Gulf Power Generation Co.,Ltd
 - Nong Khae Cogeneration Co.,Ltd.
 - Samutprakarn Cogeneration Co.,Ltd
 - EGCO Cogeneration Co.,Ltd.
 - Chiahui Power Corporation
 - China Resources Power (Hezhou) Co., Ltd.
 - Tenaska Frontier Partners,Ltd
 - Elwood Energy, LLC
- Green Country Energy,LLC
 - Birchwood Power Partners, L.P.
 - Pinelawn Power LLC
 - Equus Power I, L.P.
 - Tenaska Virginia Partners, L.P.
 - Edgewood Energy, LLC
 - Shoreham Energy, LLC
 - Orange Grove Energy,L.P.
 - Tenaska Pennsylvania Partners, LLC
 - Zajaczkowo Windfarm Sp. z o.o ※1

※1 Zajaczkowo Windfarm Sp. z o.o. data is covered for the period from April,2019 to November,2019.