

1 Safe and Stable Delivery of Products and Services As Chosen by Customers

MEMO



CSR Action Principles **2**

Proactive Approach with a View to Creating Ever Better Environment

As a provider of energy services that are closely connected with the environment, the Kansai Electric Power Group fully recognizes the scale of impact its business activities have on the global environment and therefore will strive to alleviate the environmental burden and environmental risks accompanying our business activities. Furthermore, we will aspire for creating ever better environment and contribute proactively to the development of a sustainable society through provision of products and services having lesser environmental impact.

Kansai Electric Power Group Environmental Action Policy

Based on our Kansai Electric Power Group CSR Action Charter, as an energy business that has a deep connection to the environment, the Kansai Electric Power Group is taking on the initiatives contributing to the emergence of a low-carbon society and a society that is committed to recycling as well as the promotion of community environmental protection measures. In order to be a corporate group that is trusted by society, we are also striving to promote environmental management and environmental communication.



- Initiatives contributing to the realization of a low-carbon society**

 - Lowering electric power's carbon intensity
 - Technological developments for constructing the Smart Grid
 - Contributing to energy conservation, cost reductions and CO₂ emissions reductions for customers and society
 - Overseas activities
 - Value chain efforts
 - Technical development efforts
 - Efforts to reduce other greenhouse gases in addition to CO₂
- Initiatives contributing to the realization of a recycling-oriented society**

 - Promotion of proactive 3R efforts aimed at zero emissions
 - Promoting safe, reliable, and complete disposal of PCB wastes
 - Promoting green procurement
- Promotion of environmental protection in local communities**

 - Measures to prevent air and water pollution, etc.
 - Efforts to strictly manage and reduce toxic chemicals
 - Considering the preservation of biodiversity
- Promoting environmental management and environmental communication**

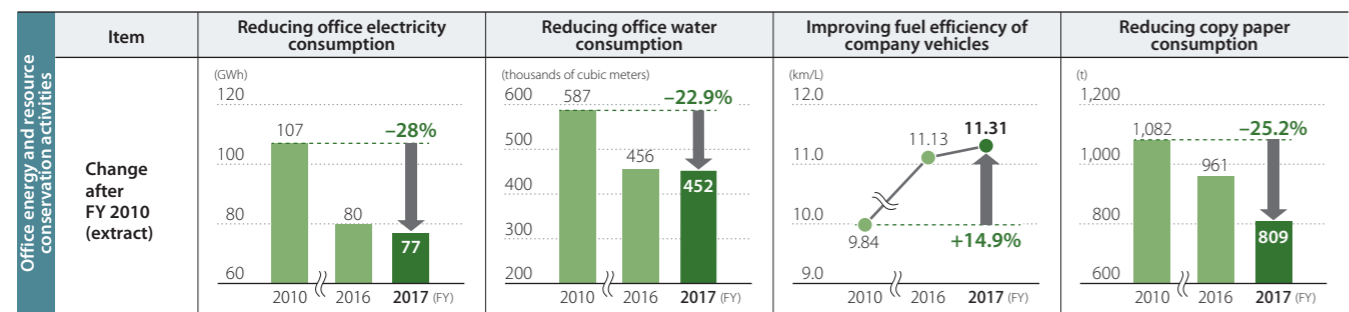
 - Continuous improvement using environmental management systems based on ISO 14001 systems and strict adherence to laws and regulations
 - Active advancement of environmental awareness raising activities with local communities and customers and disclosure of environmental information

2 Proactive Approach with a View to Creating Ever Better Environment

Eco Action (annual targets and results)

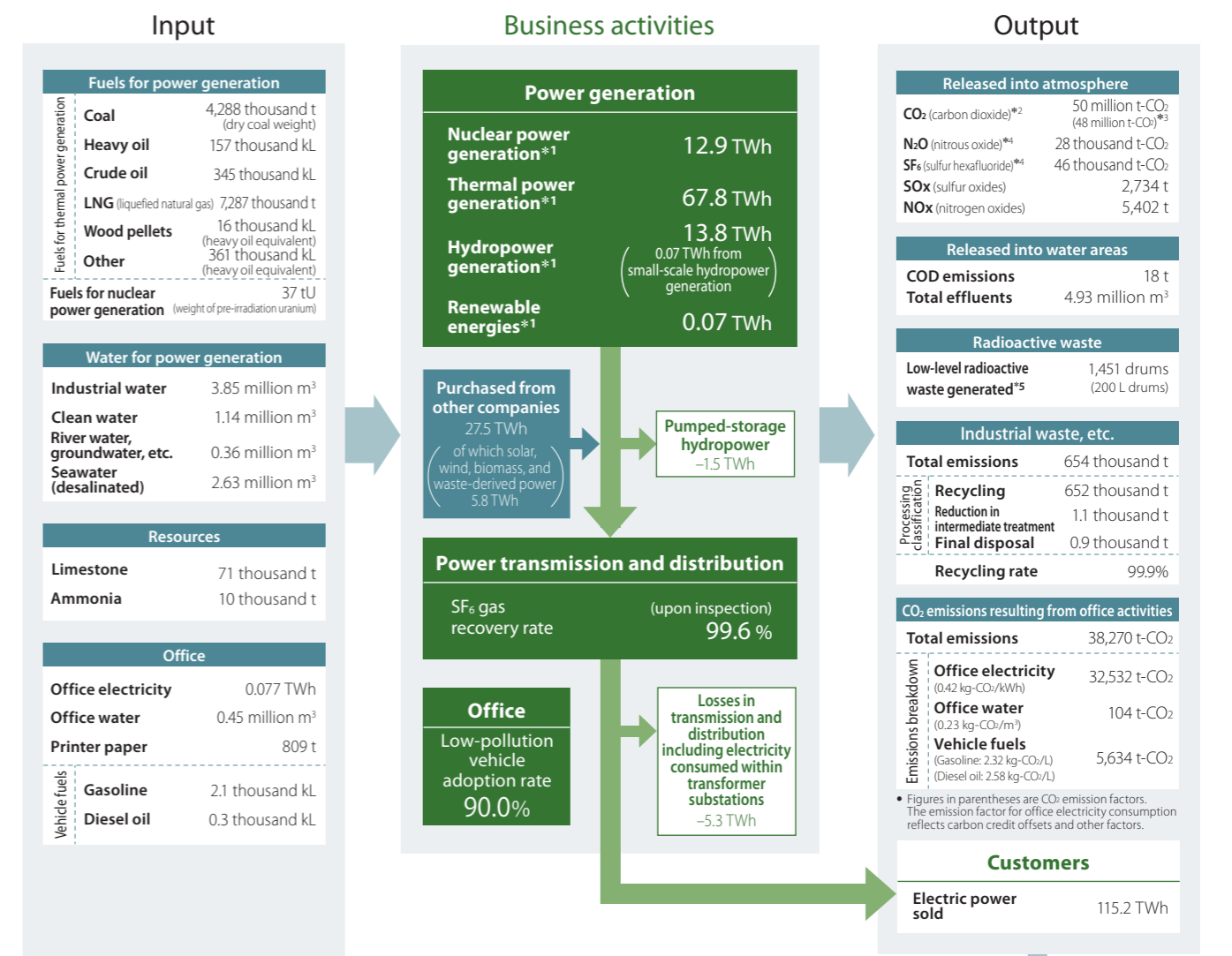
Self-evaluation key ○: Target achieved △: Mostly achieved ×: Not achieved -: No evaluation

Item	Targets	FY 2017 results	Self-evaluation	Future efforts	Related page
Initiatives contributing to the realization of a low-carbon society					
Advancement of efforts to control CO₂ emissions	About 0.37 kg-CO ₂ /kWh*1 for the entire electric power business by fiscal 2030	Electric Power Council for a Low Carbon Society (FY 2016): 0.516 kg-CO ₂ /kWh*1	-	● In addition to making efforts for the operation of nuclear power plants with safety as the first priority, the maintenance and improvement of the thermal efficiency of thermal power plants, and the development and popularization of renewable energies, lead efforts to reduce carbon intensity in the energy field by promoting a higher ratio of electricity use in society as a whole.	51
		Our company (FY 2017) 0.418 kg-CO ₂ /kWh*1,*2			52
					53
Operating nuclear power plants that make safety the top priority	Advance efforts to operate nuclear power plants that make safety the top priority	We worked for the safe and stable operation of plants that had resumed operating. We implemented safety improvement measures that conform to new regulatory requirements and independently and continuously advanced various other safety measures.	○	● Work for the safe and stable operation of plants that have resumed operating. ● Continue to implement safety improvement measures that conform to new regulatory requirements and independently and continuously advance various other safety measures.	51 52
Maintaining and improving the thermal efficiency of thermal power plants (lower heating value base)	Maintain and improve thermal efficiency	Thermal efficiency 48.3%	○	● Steadily maintain and improve thermal efficiency through appropriate facility management and highly-efficient facility operation.	52
Making efforts for renewable energy development	Development and promotion of renewable energy (Development goal: about 500,000 kW by 2030)	● Renewable energy development: 1 location, 500 kW*3 (Cumulative total: 107,934 kW, progress rate: about 22%)	○	● Contribute to the promotion and increase of renewable energy sources through active efforts for their development and by steadily enabling their incorporation into power grids	52
		● Renewable energy purchased: 5.85 TWh			53
Promoting use of innovative forms of energy among customers and communities	Contribute to making energy use by customers and society more sophisticated	We worked to promote devices and services that contribute to making energy use by customers and society more sophisticated. ● Smart meters deployed: 1.82 million/year (Cumulative total: 9.32 million, progress rate: about 72%) ● Number of Hapi e-Miruden subscribers: about 1.96 million/year (Cumulative total: about 3.988 million)	○	● Promote the adoption of smart meters and share information that contributes to reducing energy, costs and CO ₂ in order to contribute to increasing customer energy conservation awareness and meet a wide range of needs.	54 55
Contribute to the realization of low carbon societies through overseas power generation businesses*4	Increase low carbon power supplies through overseas power generation businesses	● Hydroelectric power cases: 2*5 ● Renewable energy cases: 1*6 ● Developing country support efforts under GSEP*7 framework: 2	-	● Continue to contribute to the realization of low carbon societies by steadily advancing hydroelectric power projects and investigating participation in renewable energy projects overseas. Continue to support efforts for developing countries under the GSEP framework.	56
Limiting SF₆ emissions (calendar year basis) (gas recovery rate upon inspection/removal of equipment)	97% (upon inspection) 99% (upon removal)	99.6% (upon inspection) 99.3% (upon removal)	○	● Implement steady SF ₆ gas recovery through the appropriate operation of recovery equipment, etc.	-
Initiatives contributing to the realization of a recycling-oriented society					
Maintaining industrial waste recycling rate	99.5%	99.9%	○	● Toward the goal of achieving zero emissions, advance efforts related to maintaining the industrial waste recycling rate, for example.	57
Proper processing of PCB wastes	Process the entire amount within the legal time limit	Amount of high-concentration PCB processed: 239 units*8 (Cumulative total: 5,073 units, progress rate: about 96%)	○	● Process the entire amount reliably and safely within the legal time limit based on appropriate management of PCB waste.	57
Promotion of environmental protection in local communities					
Maintaining sulfur oxide (SO_x) and nitrogen oxide (NO_x) emission factors	SO _x	Maintain the lowest levels in the world	○	● Seek to maintain one of the world's lowest emission levels (emission factors) through the appropriate operation of sulfur scrubbers and nitrogen scrubbers, etc.	58
	NO _x				
	Overall: 0.028 g/kWh Thermal: 0.039 g/kWh Overall: 0.055 g/kWh Thermal: 0.077 g/kWh				



*1 Amount of CO₂ emissions per unit of electricity use (sales)
 *2 This value is provisional. Based on the Act on Promotion of Global Warming Countermeasures and other factors, the actual value of the CO₂ emission factor will be officially announced by the country.
 *3 Kurobegawa No. 2 Hydropower Plant 1 (500 kW, began operation in May)
 *4 Added from fiscal 2018 plan
 *5 Rajamandala Hydroelectric Power Project in Indonesia (47 MW), Nam Ngiep 1 Hydropower Project in Laos (291 MW)
 *6 Wind power generation project in Ireland (178 MW)
 *7 Global Sustainable Electricity Partnership
 *8 Number of high-voltage transformers, condensers and other electrical equipment that were subcontracted to the Japan Environmental Storage & Safety Corporation (JESCO).

Status overview of our business activities and environmental load (FY 2017)



Note 1: This table contains non-consolidated figures for Kansai Electric Power Co., Inc. only.
 Note 2: Totals may not sum due to rounding.
 Note 3: Thermal power generation figures do not include biomass power generation.

*1 Includes amounts of power for inside power plants
 *2 Includes CO₂ originating from electricity purchased from other electric power companies
 *3 Emissions taking carbon credits into account
 *4 CO₂ conversion
 *5 Net generation (generated amount - reduced amount)

Environmental efficiency (FY 1990 = 100)	Electric power sold 146	Electric power sold 85
	Composite index*		CO ₂ emissions	

* Composite index = $\frac{\text{Environmental load caused by CO}_2, \text{SO}_x, \text{NO}_x, \text{and landfill disposal of industrial waste}}{\text{Resources consumed (Oil, coal, LNG)}}$
 • In calculations starting in FY 2007, we are using the LIME2 integrated coefficient developed by the National Institute of Advanced Industrial Science and Technology.
 • The amount of CO₂ emissions shown takes carbon credits into account.

Eco Action: Kansai Electric Power Group Company Concrete Action Plans

Item	FY 2016 results*	FY 2017		Evaluation (Reasons for increase/reduction)
		Targets	Results*	
Reducing office electricity consumption	60.5 GWh	Reduce as much as possible	62.1 GWh (2.7% increase)	At every company, we made efforts to conserve energy in offices, but the total amount used grew over the previous fiscal year due to office expansion, increased operation of factories and equipment, growth of work volume and other factors.
Reducing office water consumption	248,400 m ³	Reduce as much as possible	246,400 m ³ (0.8% reduction)	Even though some companies had increased usage due to greater use for melting snow in the winter, for example, we were able to reduce the amount of use from the previous fiscal year thanks to efforts at every company to conserve water in offices.
Improving fuel efficiency of company vehicles	9.26 km/L	Increase as much as possible	9.38 km/L (1.4% increase)	Our fuel efficiency improved compared to the previous fiscal year because each company has strictly enforced the practices of "eco" driving and stopping the engine when idling, as well as adopted vehicles with high fuel economy, for example.
Reducing printer paper consumption	902.6 t	Reduce as much as possible	867.8 t (3.9% reduction)	Even though some companies used more because their work volume increased, the amount decreased compared to the previous fiscal year as a result of thorough efforts at each company, including the use of double-sided copies and other paper reduction efforts.

* The calculation of results covers 42 companies in FY 2016 and FY 2017. Parentheses () show comparisons with the previous fiscal year.

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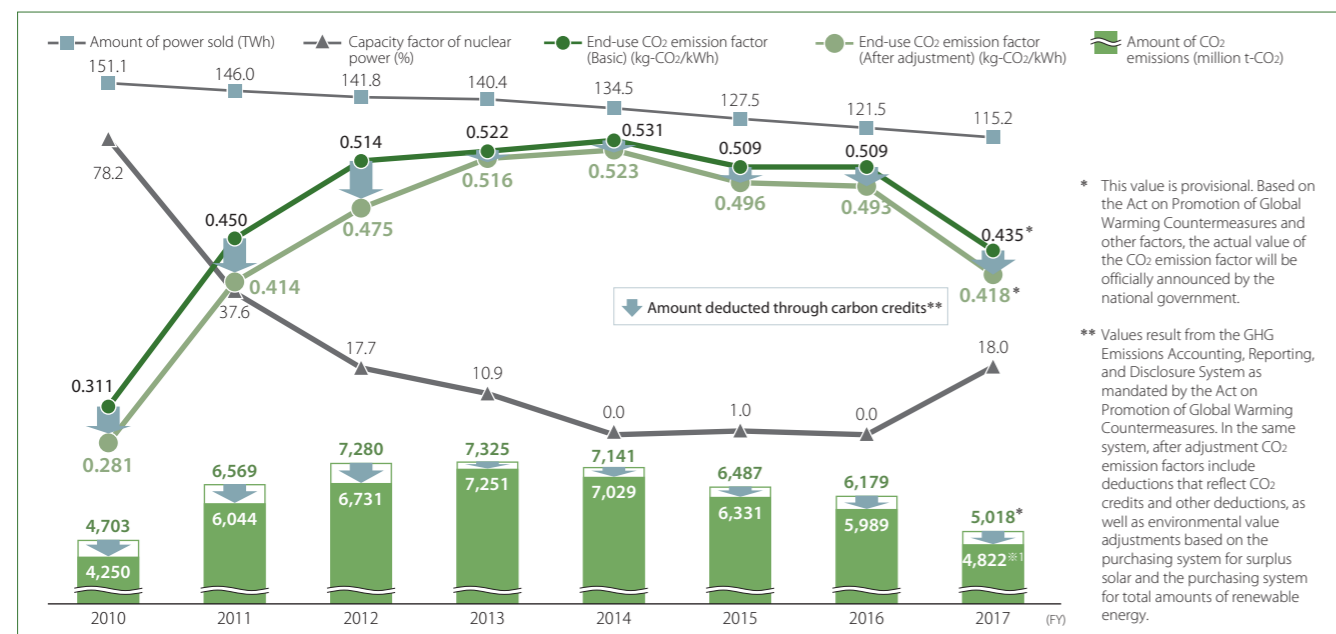
Initiatives contributing to the realization of a low-carbon society

Efforts to reduce CO₂ emissions

Our company joined the Electric Power Council for a Low Carbon Society, and the industry as a whole is seeking to achieve an emission factor of about 0.37 kg-CO₂/kWh (user-end) by fiscal 2030. We will continue to advance efforts to suppress CO₂ emissions, including the utilization of nuclear power generation with the most emphasis on safety, the maintenance and improvement of the thermal efficiency of thermal power plants, and the development of renewable energies. In addition, with a long-term perspective, we will contribute to the realization of a low carbon society by promoting electrification in society.

Our CO₂ emission factor for fiscal 2017 was about 0.42 kg-CO₂/kWh* (after adjustment), and we expect great improvement compared to the previous fiscal year. Main factors that we can give are our efforts toward carbon reduction through increased utilization rates for nuclear power, hydroelectric power and, at our Himeji No. 2 Power Station, high-efficiency natural gas power generation facilities.

Changes in CO₂ emission factor, etc.



Effect of nuclear power generation on CO₂ emission reduction

Nuclear power can greatly contribute to CO₂ emission reduction because it does not emit CO₂ during the generation unlike fuel power which uses fossil fuels such as coal, oil and natural gas.

After the Great East Japan Earthquake (in fiscal 2010), the amount of CO₂ emission and CO₂ emission factor of our company increased significantly due to the increased fuel power generation caused by drastic decline of the capacity factor of nuclear power. CO₂ emission factor has a strong correlation with the capacity factor of nuclear power, which means that CO₂ emission factor increases when capacity factor of nuclear power decreases.

In fiscal 2017, the CO₂ emission factor decreased compared to fiscal 2016 with the resumption of nuclear power plant operation. This indicates how great the effectiveness of nuclear power generation is.

We believe that nuclear power generation putting the most emphasis on safety will continue to be an extremely important from the point of view of energy security, economy, and

environment including global warming.

Comparisons with values before the Great East Japan Earthquake

	FY 2010	FY 2016	FY 2017
Ratio of nuclear power generation (%)	78.2	0.0	18.0
Amount of power from thermal power generation (TWh)	76.6	114.4	89.6
CO ₂ emissions (after adjustment) (10,000 t-CO ₂ units)	4,250	5,989	4,822
CO ₂ emission factor (after adjustment) (kg-CO ₂ /kWh)	0.281	0.493	0.418*

* This value is provisional. Based on the Act on Promotion of Global Warming Countermeasures and other factors, the actual value of the CO₂ emission factor will be officially announced by the national government.

Lowering electric power's carbon intensity

We are working to reduce the carbon impacts of electricity that we provide to customers, starting with efforts for the operation of nuclear power plants with safety as the first priority. Our efforts also include the maintenance and improvement of the thermal efficiency of thermal power plants as well as the development and popularization of renewable energies

Nuclear power generation prioritizing safety

Since nuclear power generation emits no CO₂, it is an important source of energy that prevents global warming. With understanding of residents of local communities, we continue the safe and stable operation of plants that have resumed operation and restart plants as soon as the safety is confirmed by appropriately responding to examinations of the Nuclear Regulation Authority. We will also keep independently and continuously promoting safety measures that exceed regulatory requirements.

Maintaining and improving the thermal efficiency of thermal power plants and further increasing natural gas use

We continuously undertake measures related to facilities and operation, working to reduce the amount of fuel used and suppress the amount of CO₂ emissions by maintaining and increasing thermal efficiency.

We undertook to convert the Himeji No. 2 Power Station, one of our largest natural gas-fired thermal power plants, to a combined-cycle power plant* with advanced 1,600°C class gas turbines. We are working to suppress the amount of CO₂ emissions by increasing thermal efficiency to about 60%, which is the highest global standard, and reducing the amount of fuel used.

Moreover, at Units 1 and 3 of the Aoi Power Station, in addition to the heavy oil and crude oil we had been using thus far, we began using natural gas, which is less expensive and better for the environment. Unit 1 began in May and Unit 2 began in August 2016.

* Combined cycle power generation: Power is generated by using both gas turbines and steam turbines capturing exhaust heat from the gas turbine with high thermal efficiency.

Development and promotion of renewable energy

Like nuclear power, renewable forms of energy such as hydropower, solar power, and wind power emit no CO₂ when generating power, making them effective energy sources for preventing global warming. As a unified group, we are accelerating efforts toward the target of incorporating 500,000 kW of renewable energy in Japan by 2030.

We have been working to increase the output of existing hydropower plants and to develop power generation using renewable energy sources, including land-based wind, solar and biomass. As of March 2018, we had announced the start of operation for about 110,000 kW of generation capacity. We will continue to work for the development of diverse renewable energy sources, including offshore wind farms and geothermal power plants with a broad view that includes all of Japan as well

as overseas locations.

On the other hand, solar and wind power generation are easily affected by the weather, and power generated in excess of demand can have an effect on the quality of electricity. Furthermore, power generation costs become high because energy densities and usage rates of power generation facilities are low. We are working to overcome these issues related to supply stability and generation costs and seeking to expand the utilization of renewable energy sources. We will continue advancing carbon intensity reduction for electricity further by utilizing various energy sources in a well-balanced manner.

Solar power development

In June 2018, Kanden Energy Solution Co., Inc. (Kenes) began operation of the Ako Nishihama Solar Power Station (1,990 kW output) in Ako City, Hyogo Prefecture. Our corporate group has solar power generation plants in a total of ten locations. They effectively reduce CO₂ emissions by a total of about 27,000 tonnes per year.



Ako Nishihama Solar Power Station

Solar power stations (10 locations)
Reduction in CO₂ emissions
About 27,000 tonnes/year

Development of hydropower plants

At our existing hydropower plants, we are systematically updating facilities by replacing water turbines and generators with ones that have better generation efficiency as we seek to increase maximum outputs and generated power quantities. At the Kurobegawa No. 2 Hydropower Plant in Kurobe City, Toyama Prefecture, we upgraded the facilities of water turbine generator unit 1 in May 2017, increasing maximum output from 72,000 kW to 72,500 kW. The ten hydropower generation cases* that are subjects of our corporate development goals account for a CO₂ emission reduction of about 19,000 tonnes per year.

* These cases are from among those since November 2012 that had begun operation by the end of fiscal 2017.



Kurobegawa No. 2 Hydropower Plant

Hydropower plants (10 cases)
Reduction in CO₂ emissions
About 19,000 tonnes/year

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Wind power development

In the city of Tahara, Aichi Prefecture, Kenes' Tahara No. 4 Wind Power Station (6,000 kW [2,000 kW x 3 units]) has been in continuous operation since May 2014. Together with the Awaji Wind Power Station (12,000 kW), our Group operates wind power stations in two locations, which reduce our CO₂ emissions by about 18,000 tonnes/year in total.



Tahara No. 4 Wind Power Station

**Wind power station (2 locations)
Reduction in CO₂ emissions**
About **18,000**
tonnes/year

Development of biomass power generation

In December 2016, Kenes began operation of the Asago Biomass Power Plant (5,600 kW output) in Asago City, Hyogo Prefecture. This plant generates power using the biomass of domestic unused wood as a fuel. With the cooperation of the Hyogo Forest

Public Service Corporation, the Hyogo Prefectural Federation of Forest Owners Cooperative Associations manufactures the fuel chips and Kenes generates power from these chips. This business scheme conducted with cooperation between government and private interests is the first of its kind in Japan.

In addition, we are planning the construction of a biomass power plant (75,000 kW output) that utilizes materials from overseas in order to advance a biomass power generation project in the town of Kanda in Miyako, Fukuoka. With the intention to start commercial operation in October 2021, we established Biopower Kanda LLC as a new company on November 9, 2017 for the construction of this power plant.

The realization of this biomass project would indicate that our group has the second biomass-fired power plant and it would be our first biomass power plant outside the Kansai area.



**Asago Biomass Power Plant
Reduction in CO₂ emissions**
About **19,000**
tonnes/year

Technical development efforts

By making use of our specialized technical capabilities as an electric company, we are contributing to the emergence of a low-carbon society using our technological breakthroughs.

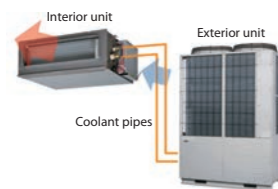
Joint development of hot wind generator using high-efficiency air to air heat pump

To respond to the needs for the promotion of energy saving in drying processes in industrial fields, we jointly developed* "Neppu-ton," a hot wind generator using a high-efficiency air-source heat pump. Mitsubishi Heavy Industries Thermal Systems, Ltd. started sales of it in June 2017.

As with general air conditioners, it has a separate-type configuration comprised of an outdoor unit that takes in heat from the atmosphere and an indoor unit that can directly generate hot wind. It generates hot wind of 90°C, which is the highest-temperature hot wind provided by an air-source heat pump in Japan, and has achieved a high-efficiency of a COP of 3.5**, realizing great reductions in energy use, cost and CO₂ emissions.

* Joint development partners: Mitsubishi Heavy Industries Thermal Systems, Ltd., Tokyo Electric Power Company Holdings, Inc., and Chubu Electric Power Co., Inc.
** Coefficient Of Performance (COP) indicates the energy consumption efficiency of a heat generator

Neppu-ton appearance and Energy Conservation Grand Prize trophy

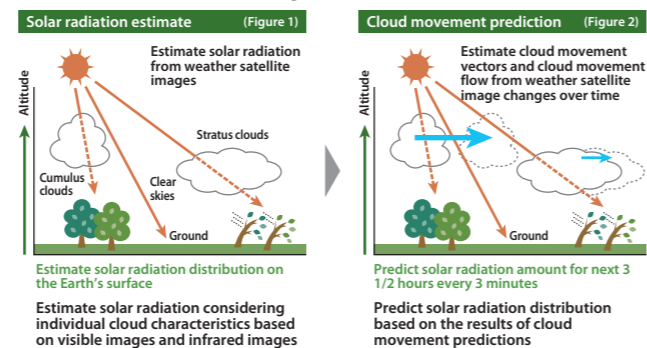


We received the Energy Conservation Center Chairman's Award of the Energy Conservation Grand Prizes (products and business models division) for fiscal 2017.

Apollon solar power short-time forecasting system

In preparation for the high-volume adoption of solar power generation, which varies in output according to the weather, we developed the Apollon solar power short-time forecasting system together with the Meteorological Engineering Center, Inc. from fiscal 2012–2014. The Apollon system analyzes the characteristics of clouds from cloud images captured by weather satellites and estimates the solar radiation strength on the Earth's surface (Figure 1). In addition, it predicts the movement of clouds by analyzing changes in clouds over time shown in weather satellite images (Figure 2) and predicts the amount solar radiation in three-minute intervals for 1 km grid units up to 3 1/2 hours ahead. By utilizing predicted solar radiation amounts, fluctuations in solar power generation output can be predicted in advance, allowing stable control of supply and demand. In this way, our company is contributing to the popularization of solar power, and seeking to build a low-carbon society.

Predicting solar radiation for 3 1/2 hours (in 3-minute intervals) from a weather satellite image



Contributing to energy conservation, cost reductions and CO₂ emissions reductions for customers and society

By enabling customers to use energy efficiently and comfortably, we are contributing to increased energy efficiency, lower costs, and reduced CO₂ emissions for customers and society. We are also promoting energy conservation and CO₂ emissions reductions at our workplaces.

Encouraging efficient energy use

With the goals of realizing energy conservation, cost cutting and CO₂ reduction for our customers and society, we are offering high-efficiency systems that utilize renewable energy sources and heat pump technologies, as well as proposing effective operation procedures, for example. In addition, we are providing total support for energy management to customers and other members of society and undertaking activities that serve these purposes, including the services that allow customers to see energy use.

Serving residential customers

For our residential customers we are proposing "complete electrical conversions" that realize more effective use of energy and comfortable and convenient lifestyles. This is achieved by combining electrical appliances, particularly our EcoCute energy-efficient hot water supplies and "IH cooking heaters" that are safe comfortable and convenient, with our Hapi e-Time discount electricity rate options and Hapi e-Miruden web service that makes electricity use visible.

Moreover, with our Internet-based Hapi e-Miruden service, we have established "environmental household account books" in which users can input kerosene charges along with electricity and gas to check their total household CO₂ emissions. On this service we also provide "energy conservation advice" with useful information related to energy conservation. In these ways, we are advancing a variety of efforts that contribute to helping customers conserve energy, cut costs and reduce CO₂ emissions.

Providing information related to energy conservation through Hapi e-Miruden



Serving corporate customers

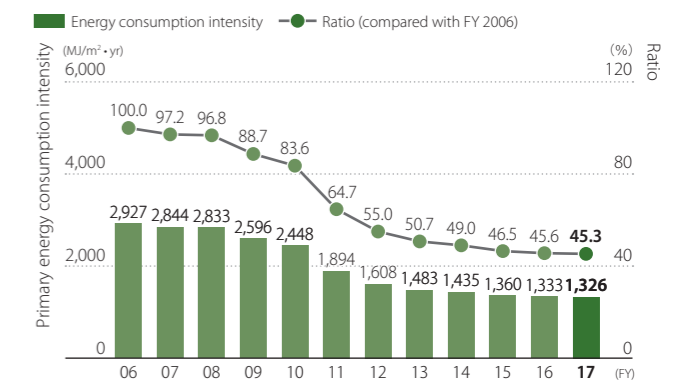
We provide our customers with support for total energy management according to customer needs and offer advice regarding optimal energy systems and their application. In addition, we work with other Group companies to offer a range of services including energy conservation diagnoses and energy management support appropriate to the customer's facility usage patterns. We remain committed to helping our customers minimize their energy consumption, achieve cost savings, and reduce their CO₂ emissions.

Energy management at business branches

We have been employing energy management measures at business locations since fiscal 2007. In our efforts, we measure the amount of electricity used by application and by time period for buildings in order to investigate and implement effective energy conservation means.

Through energy management at business locations, we achieved a 55% reduction compared to fiscal 2006

Primary energy consumption intensity at business branches employing energy management system



Notes:
• Electricity consumption is corrected for air temperature.
• From FY 2011 to 2015, the reduction achieved through energy conservation is included.
• 20 business locations employing energy management, as of March 2018

Kansai Electric Power Company Minami Osaka Sales Branch Office Received 31st Technology Encouragement Award from the Society of Heating, Air-Conditioning and Sanitary Engineers of Japan

The Minami Osaka Sales Branch Office received this award in May 2017, having been highly evaluated for its continuous energy conservation efforts through very efficient air-conditioning operation as a result of realizing its own control system and conducting performance evaluation meetings. They were able to reduce primary energy consumption intensity by about 52% compared to the target at the time of design, realizing environmental performance appropriate for a "next-generation sales office that is good for the environment and people." Furthermore, this office also received a 6th Carbon Neutral Award Branch Honorable Mention in May 2018.



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Technological developments for constructing the Smart Grid

The Kansai Electric Power Group aims for the realization of a low-carbon society and better usability for customers through the construction of a smart grid (next-generation electricity transmission and distribution network).

What is the "Smart Grid"?

Our Group has positioned the smart grid as a key to achieving an efficient, high quality, reliable electricity transmission and distribution system, employing advanced information, telecommunications, and storage battery technologies to achieve a low-carbon society and a better energy environment for customers without sacrificing the stability of the basic power grid.

Meeting the challenges of large-scale renewable energy use

With large-scale or focused introduction of renewable energy, including solar power, into the electric power grid, the stability of the power grid can be compromised.

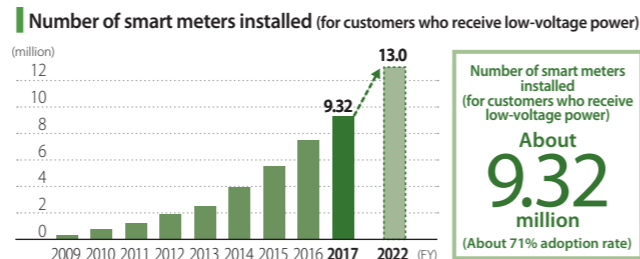
For this reason, as technology measures for grid facilities, we are advancing systems to evaluate these impacts and research for the development of supply and demand control technologies using advanced voltage control and power storage.

Furthermore, we are undertaking a virtual power plant demonstration project that applies the supply and demand management functionality of a power plant (virtual power plant) to numerous customer devices, including storage batteries and electric vehicles, connected to the power grid by using IoT technologies and controlling them collectively through the Internet. By doing so, we are seeking to optimize energy use and further increase the adoption of renewable energy sources.

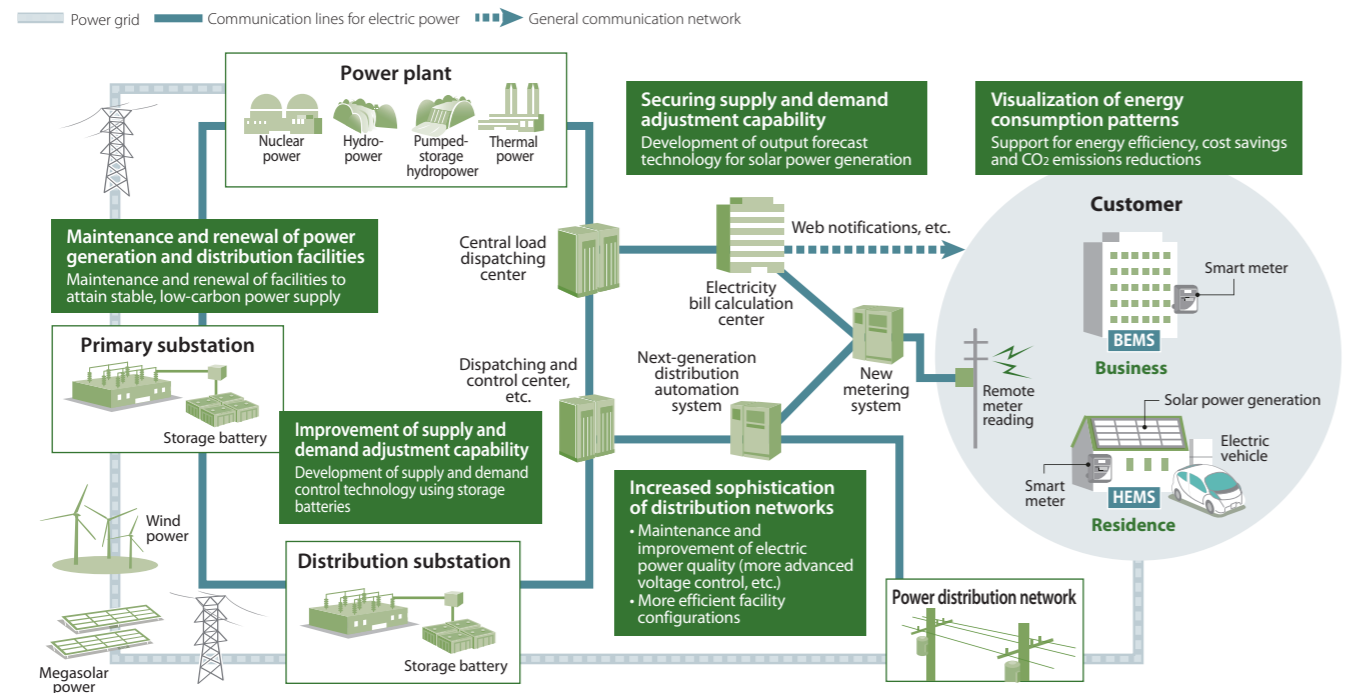
Usability improvements for customers

We have completed installing smart meters, which have communication functions and can measure and record the amount of electricity a customer uses every 30 minutes, in factories, office buildings and other customers that receive high-voltage and extra-high-voltage electricity. In addition, we had incorporated 9.32 million units for households and other customers that receive low-voltage electricity by the end of fiscal 2017. We will complete installation for all customers by the end of fiscal 2022 and also continue converting to remote automatic meter reading.

Among the many benefits, installing smart meters contributes to the energy conservation of society as a whole, enables flexible handling of various rate options, makes meter reading work more efficient, and enables formation of efficient facilities according to the conditions of electricity use. Through this endeavor, which leads the nation, we are improving usability for customers by promoting measures that allow them to see their energy use. We are supporting their efforts to conserve energy, cut costs and reduce CO₂ emissions with services such as the Hapi e-Miruden Service (residential), which allows people to see the status of their electricity use, and the Electricity Usage Notification service (business).



Constructing the Smart Grid



Overseas activities

We are implementing a wide range of initiatives outside Japan in an effort to devise solutions to global environmental issues and other global problems by applying the technical capabilities, knowledge, and expertise we have gained through our years of operation as an electric power supplier.

**Republic of Indonesia
Rajamandala Hydroelectric Power Project**

We are constructing a run-of-river hydroelectric power plant with a capacity of 47 MW, located on the Citarum River, in Java Island, the Republic of Indonesia (commercial operation scheduled in 2019). This is a BOT* project which will sell electricity to the PT Perusahaan Listrik Negara (state electricity company of Indonesia) utilizing the water released from an upstream hydroelectric power plant** operated by a local power company.

While this project is designed to make profit for Kansai Electric Power, it is also supposed to contribute to the development of Indonesia where power demand is growing remarkably. We will be able to supply affordable and low carbon electricity in a stable manner over the long term.

* Build-operate-transfer (BOT) is a type of project arrangement whereby a project company builds a facility and manages and operates it for a certain period to recover its investment, after which it transfers ownership of the facility to the public sector / authority.
** Saguling Hydroelectric Power Plant (700 MW) owned by PT Indonesia Power (100% subsidiary of PLN)



Power plants area overview

Workshops held in Pacific island nations

As part of GSEP*, we have been holding 14 workshops since 2005 for the Pacific Power Association. The past topics are "Grid interconnection of renewable energies," "Tariff Structure" and so on.

In 2017, we offered lectures titled "Renewable energy grid connections" in Fiji (March) and in Guam (June) respectively. In addition to explaining issues related to the massive installation of renewable energy sources and the measures for handling them, we also introduced our latest efforts and countermeasures of our company such as the "Apollon" solar power short-term forecasting system, smart grids and demand side management etc.

In these ways, our company is contributing to the resolution of global environmental problems through technology transfers and personnel cultivation programs related to the various issues faced by island nations.

* GSEP stands for "Global Sustainable Electricity Partnership." Comprised of nine major electric power companies from seven countries, including Japan, the USA and France, in this organization leaders from each company exchange ideas about the development of sustainable energy sources, climate change problems and other global issues related to the electric power business as a whole.



All participants visited a solar power plant on Guam.

Our employees enthusiastically answered questions from each of the participants.

Value chain efforts

We are working to introduce and utilize high-efficiency LNG ships.

Fuel value chain

We are advancing the introduction of LNG ships with excellent energy conservation performance. Following the LNG EBISU, the LNG JUROJIN, and the LNG FUKUROKUJU, which are already in service, we completed the LNG SAKURA in fiscal 2017. These ships have Dual Fuel Diesel Engine system for power. We hope to achieve outstanding fuel economy compared to conventional steam turbine systems.

In addition, by utilizing the latest thermal insulation systems,

they achieve an LNG evaporation rate of 0.08% per day, which is the lowest level in the world, making them outstanding in terms of both environmental and economic performance.



LNG SAKURA

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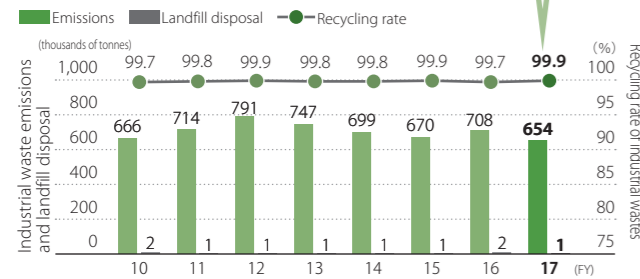
Initiatives contributing to the realization of a recycling-oriented society

Efforts to achieve zero emissions

The principal types of industrial waste generated by Kansai Electric Power include coal ash from coal-fired thermal power plants and concrete pole fragments remaining from power grid construction. We have targeted an industrial waste recycling rate of at least 99.5% with the goal of achieving zero emissions. We achieved a 99.9% recycling rate in fiscal 2017, which marks the eighth consecutive year that we have reached our target. We are also working to reduce and recycle general waste, such as printer paper, produced by our offices.



Changes in emissions and recycling rates for industrial wastes



Note: Industrial waste recycling rate (%) = (industrial waste emissions - landfill disposal amount) / industrial waste emissions × 100

Main applications of recycled industrial waste, etc.

Type of industrial waste	Recycling rate	Main recycling applications
Metal scraps	99.4%	Metal recovery
Demolition debris (Waste concrete utility poles, etc.)	99.8%	Roadbed materials
Soot (Coal ash, heavy oil ash, etc.)	100%	Cement raw materials
Sludge (Desulfogypsum, wastewater processing sludge, etc.)	99.9%	Construction materials
Cinders (Coal ash, heavy oil ash, etc.)	100%	Rare metal recovery
Waste oil	100%	Fuel

Recycling of coal ash

We are recycling all the coal ash emitted by the Maizuru Power Station as raw material for cement and roadbed material, for example. The minute spherical particles found in coal ash are called "fly ash" when in their modified form and, when mixed with concrete, add strength. Fly ash is used as concrete admixture for engineering and construction projects for bridges and the like. Kanden Power-Tech Corporation is promoting sales of this material.

Polychlorinated biphenyl (PCB) waste processing

Kansai Electric Power complies strictly with the Law Concerning Special Measures Against PCB* Waste and related laws, and promotes safe, reliable disposal based on the special characteristics of the PCB waste involved. Kansai Electric Power uses a range of methods for dealing with the disposal of electrical equipment containing minute amounts of PCBs. We established the Recycling Center for Utility Pole Transformers to render insulating oil and transformer cases harmless and suitable for recycling. At the end of July 2015, we completed processing of stored insulating oil and transformer cases. For other equipment, we are promoting effective processing using technologies from our Group companies. In keeping with government plans, we have commissioned Japan Environmental Storage & Safety Corporation (JESCO) to process waste containing high concentrations of PCB insulating oil.

* PCB: Initialism for polychlorinated biphenyl. It is a strong electrical insulator and has been used as an insulating oil in electrical transformers. Because it has an adverse environmental impact, its production and use have been prohibited in principle.

Initiatives of our group companies

The Kanden L & A Co., Ltd. developed a technology to recycle used insulators into stone materials for gardening, for example, by rounding corners with grinding machines. At the FY 2015 Awards for Resources Recirculation Technologies and Systems, this technology received the Award of the Director-General of the Industrial Science and Technology Policy and Environment Bureau. Furthermore, together with a road company this company has developed an environmentally-friendly paving material that suppresses road surface temperature increases. This is done by injecting and filling the fine powder from the grinding into gaps in the asphalt mixture. They received a patent in July 2016. Moreover, Kanden Engineering Corporation received the first permit in Japan from the Minister of the Environment in May 2014 for disposal treatment of low-concentration PCBs in discarded electrical equipment by using mobile solvent-based cleaning equipment. It has been conducting safe and economical decontamination treatments that do not require moving or dismantling contaminated equipment. In the future, our corporate group will continue contributing to the realization of a recycling-oriented society.



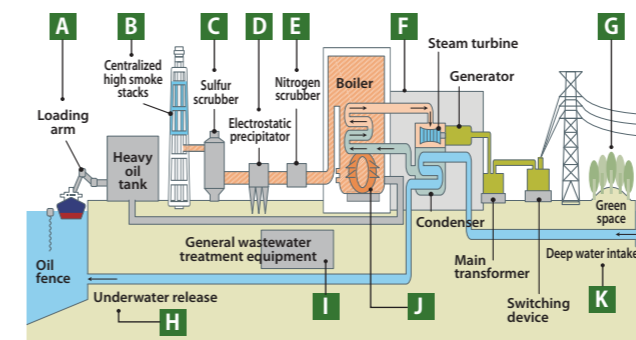
Kanden Engineering Corporation PCB cleaning equipment

Promotion of environmental protection in local communities

Environmental protection measures at power plants

At our power plants, we undertake measures based on laws, local regulations, environmental protection agreements and other rules to reduce air pollution, water contamination, noise, vibrations, and other problems. In addition, we monitor and measure the air and ocean around our power plants and carefully evaluate the environmental effects of our operations on the regional environment to ensure that no problems occur.

Environmental measures adopted at thermal power stations

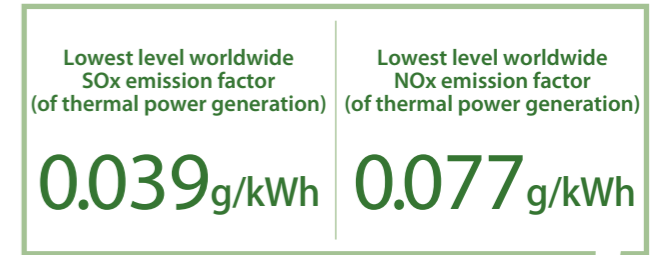
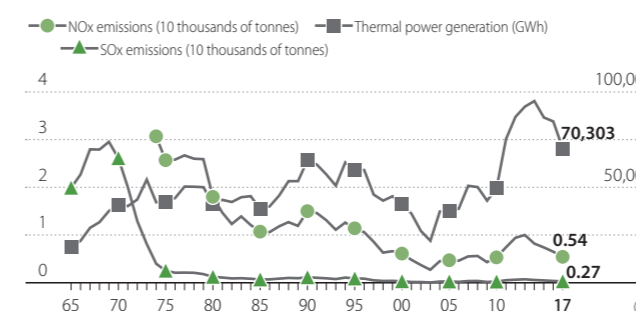


- A** Oil leakage prevention
- B** Ground-level density reduction measures
- C** Removal of sulfur oxides
- D** Removal of dust
- E** Removal of nitrogen oxides
- F** Noise prevention
- G** Afforestation
- H** Heated water discharge measures
- I** Drainage treatment
- J** Low-sulfur fuel
- K** Heated water discharge measures

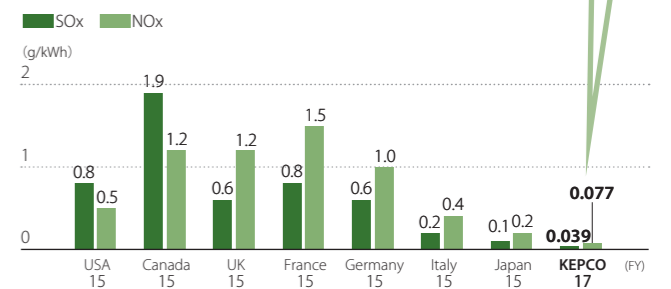
Air pollution prevention measures (SOx, NOx, soot)

Kansai Electric Power has implemented measures aimed at reducing the volume of SOx (sulfur oxides) emitted by our thermal power plants by using low-sulfur fuels, installing sulfur scrubbers, and other measures. To address the issue of NOx (nitrogen oxides), we are taking steps to lower emission levels, such as improving combustion methods and installing nitrogen scrubbers. As a result, our SOx and NOx emissions per unit of electric power generated are significantly lower than those of the major countries of Europe and North America, remaining among the lowest in the world. In addition, we have installed high-performance electrostatic precipitators that dramatically cut soot emissions.

Thermal power generation and SOx and NOx emissions



SOx and NOx emission factors for thermal power generation of major countries and Kansai Electric Power



Source: Overseas data: OECD StatExtracts, IEA ENERGY BALANCES 2017
Japan figures: Federation of Electrical Power Companies of Japan (10 electric power companies and Electric Power Development Co., Ltd.)

Handling chemicals

We regularly monitor the status of buildings and equipment that contain asbestos and systematically advance the removal of asbestos and replacement with non-asbestos products. In these ways, we are managing asbestos suitably as we strictly abide by related laws, regulations and other rules.

Moreover, in addition to abiding by the PRTR (Pollutant Release and Transfer Register) Law, we are working to manage toxic chemicals strictly and to reduce them based on our "Guidelines for Managing Chemicals Subject to PRTR."

Scope of use (buildings and facilities) of asbestos (at March 31, 2018)

Blown-in materials containing asbestos	Acoustic insulation, thermal insulation, and fireproofing materials in company buildings; acoustic insulation for transformers
Building materials	Fireproofing panels, roofing materials, and flooring for buildings
Asbestos-cement pipes	Duct lining for underground lines (transmission, distribution, and communications facilities)
Thermal insulation	Power generation facilities (thermal power facility, nuclear power facility)
Sealing materials, gaskets	Power generation facilities (thermal power facility, nuclear power facility)
Buffers	Suspension insulators for transmission facilities and the like
Thickeners	Electric wire for the overhead transmission lines, hydroelectric dams

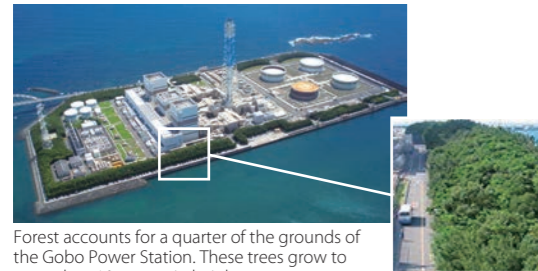
2 Proactive Approach with a View to Creating Ever Better Environment

Conservation of biodiversity

The promotion of business activities that consider the preservation of biodiversity is part of the Kansai Electric Power Group Environmental Action Plan. In accordance with this, in carrying out our business, we are steadily implementing efforts for this purpose, including conducting environmental assessments and undertaking environmental preservation measures that suit local characteristics.

Natural forest creation

In order to make forests that are similar to nature at power plants in short amounts of time, we are trying to create environments that protect the original biodiversity of the region by selecting cultivated tree saplings that are suited to the region, and planting different species densely in close proximity.



Forest accounts for a quarter of the grounds of the Gobo Power Station. These trees grow to more than 10 meters in height.



Stork building nest on utility pole

Protecting oriental white storks

In Toyooka City, Hyogo Prefecture, released oriental white storks, which are designated a Special Natural Treasure in Japan, sometimes make their nests on utility poles and steel towers. Not only are there concerns about accidents, but there are also fears that storks could be electrocuted. For these reasons, we patrol carefully, removing nests as quickly as possible and conducting measures to discourage them from coming near utility poles in cooperation with the University of Hyogo and the Hyogo Park of the Oriental White Stork. In these ways, we are both protecting the storks and maintaining the safety and stability of the power supply.

Promoting environmental management and environmental communication

Promoting environmental management

Promoting environmental management on a Group-wide basis

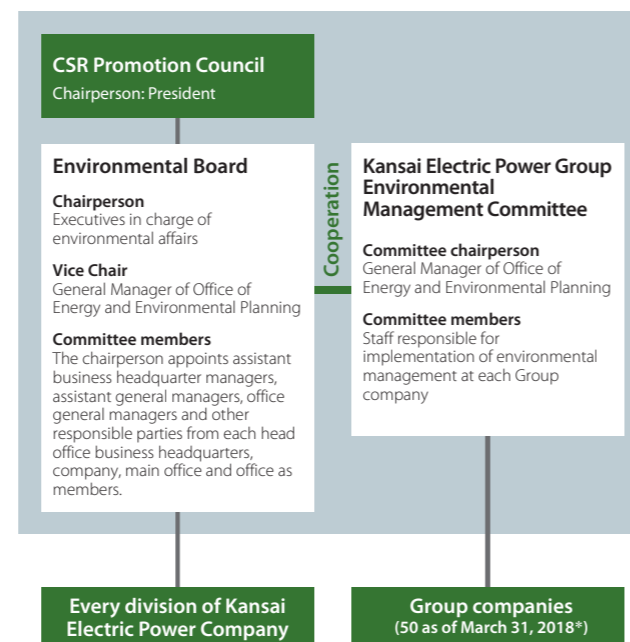
In our corporate group, our company and our group companies have been unified in efforts to reduce environmental impacts and environmental risks, and we have built environmental management systems that incorporate the approaches of ISO 14001. Kansai Electric Power has established an Environmental Board within its CSR Promotion Council. For the Group, we have established the Kansai Electric Power Group Environmental Management Committee, and are working to develop Eco Action measures and implement Check and Review, as well as comply with environmental law and other regulations. The Office of Energy and Environmental Planning communicates with every division and group company about the state of environmental management, providing advice or guidance as necessary.

Strict adherence to laws, regulations and other rules

We endeavor to adhere to laws and regulations with restrictions related to the environment.

In addition, we have sought to adhere unflinchingly to "environmental protection agreements" made with local governments near our power plants, and we had no violations of such agreements. In fiscal 2017, there were no cases in which we received guidance, recommendations or orders from the national or local governments about these laws, regulations and agreements related to the environment.

Environmental management promotion system of the Kansai Electric Power Group



* The 50 companies, which are selected from 69 consolidated subsidiaries and 4 equity method affiliates, exclude those that have low environmental impacts.

Promoting environmental communication

Community environmental initiatives undertaken in cooperation with local governments

We consider the environment together with the community residents through environmental events hosted by the local government, cleaning campaigns, and environmental education at local schools. We emphasize environmental communication by seeking out residents' opinions about our initiatives. June is Environment Month at Kansai Electric Power Group, a time when our entire Group engages in activities such as community cleanups, tree planting, exhibiting at environmental events, and conducting on-site environmental classes at schools.



Planting activity with local elementary school students (Higashi Osaka City, Osaka Prefecture)

Some initiatives of the Kansai Electric Power Group

Our Group has undertaken a variety of environmental initiatives by combining the technological capabilities of individual companies and the management resources of our entire Group.

Kanden Realty & Development Co., Ltd.

Akasaka Center Building receives the Organization for Landscape and Urban Green Infrastructure Chairman's Award

In December 2017, the landscaping (completed January 2013) of the Akasaka Center Building received the Chairman's Award in the 16th Rooftop and Wall Green Technology Competition held by the Organization for Landscape and Urban Green Infrastructure.

According to the commendation received, "In the wall plantings of this multipurpose building, which combines offices and condominiums, nearby a verdant area that symbolizes local history and culture, vegetation was actively incorporated into an exterior design that has a softness unlike stone walls, creating an urban environment where people can enjoy strolling."



Akasaka Center Building that received the Organization for Landscape and Urban Green Infrastructure Chairman's Award