

2 Efforts Relating to Global Environmental Issues

Global warming is one of the most serious long-term problems humanity will need to grapple with in the current century. The J-POWER Group regards measures to combat global warming as a top management priority and is pursuing such actions vigorously.

Close-up Development of Low-CO₂-Emission Power Sources

The J-POWER Group is doing its best to curb CO₂ emissions by building low-emission power sources in the form of nuclear power stations and making effective use of such renewable energy as hydro-, wind, biomass, and geothermal power, while also working to perfect gas-turbine combined-cycle generation, which promises high efficiency of energy use.

(For more on nuclear power, see Special Feature 1, "Safe, Sustainable Use of Nuclear Energy," pp. 9–12; for more on coal, see Special Feature 2, "Coal Use and Measures to Counter Global Warming," pp. 13–17.)

J-POWER's Hydroelectric Power Development

Hydropower uses the force of falling water to turn a water turbine and generate electricity. The typical approach is to build a dam on the upper reaches of a river and use the potential energy of the water stored in the dam reservoir to generate power. Power output can easily be adjusted to match demand by altering the amount of water used; when no electricity is needed, the turbine is stopped and the water stored up in the dam reservoir. In this way water is converted to electricity with a minimum of waste.

J-POWER has a half-century of experience developing, building, and operating hydroelectric power stations, from such large-scale facilities as Sakuma Power Station, which began operating in 1956, to our new pumped storage power stations, noted for their superior ability to adjust output to meet peak demand. Today J-POWER operates 59 hydroelectric power stations with a combined capacity of 8.56 GW, almost 20 percent the total installed capacity of Japan's hydropower facilities.

In fiscal 2008, J-POWER sold 8,380 GWh of electricity from these hydropower facilities for a CO₂ emissions reduction benefit of approximately 3.8 million t-CO₂. Today, the pressing need to combat global warming is stimulating renewed interest in hydroelectric power, a renewable resource.

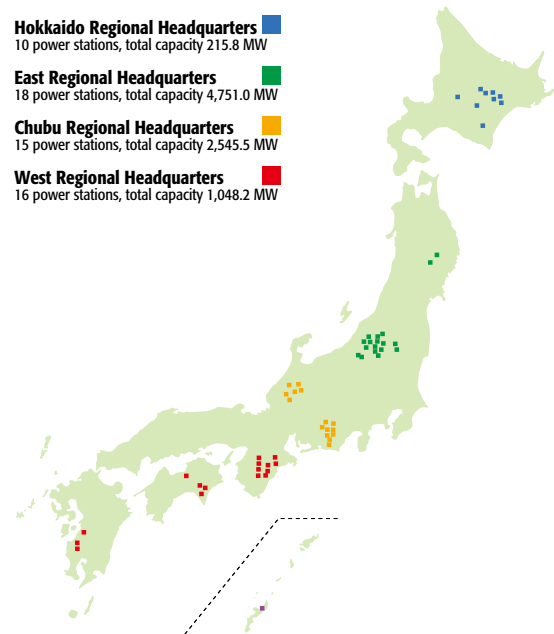
J-POWER is also working to upgrade its aging hydroelectric power facilities using the latest technologies to boost generating efficiency and further reduce the CO₂ intensity of our electric power generation (see p. 52).



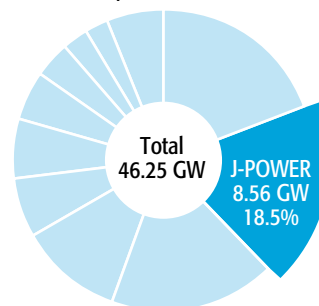
Kurotani Dam (Fukushima Prefecture)

>>> Location of J-POWER Hydropower Stations (Japan)

Hokkaido Regional Headquarters	10 power stations, total capacity 215.8 MW
East Regional Headquarters	18 power stations, total capacity 4,751.0 MW
Chubu Regional Headquarters	15 power stations, total capacity 2,545.5 MW
West Regional Headquarters	16 power stations, total capacity 1,048.2 MW



>>> J-POWER Share of Japan's Installed Hydropower Capacity (as of March 31, 2009)



Note: Excludes home power systems.

Source: Agency for Natural Resources and Energy, Electric Power Statistics.



Motogoya Dam (Hokkaido)

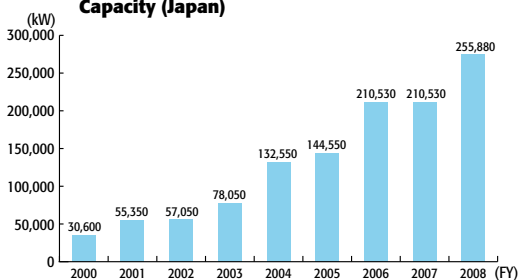
ACTION Wind Power Development

Wind power is a clean, renewable energy source that emits no CO₂ in the electricity generating process. In resource-poor Japan, expectations are high for this valuable, 100 percent domestic energy source.

Making maximum use of know-how accumulated through decades of experience building, operating, and maintaining hydroelectric and thermal power stations and transmission lines, the J-POWER Group is positioned to handle every phase of a wind power project, from the initial study of wind conditions and project planning to construction, operation, and maintenance. In fiscal 2008, we launched commercial operation of three more wind power facilities in Japan--Sarakitomanai Wind Farm, Yokihi no Sato Wind Park, and Minami Oosumi Wind Farm (a total of 32 generators with a combined capacity of 45.35 MW), for a total of 12 wind farms nationwide (155 generators, 255.88 MW). Altogether, the J-POWER Group's installed wind power capacity (prorated according to ownership share) accounts for approximately 12 percent of Japan's total. Outside of Japan, meanwhile, commercial operation was launched at the new Zajaczkowo Windfarm in Poland (24 generators, 48 MW).

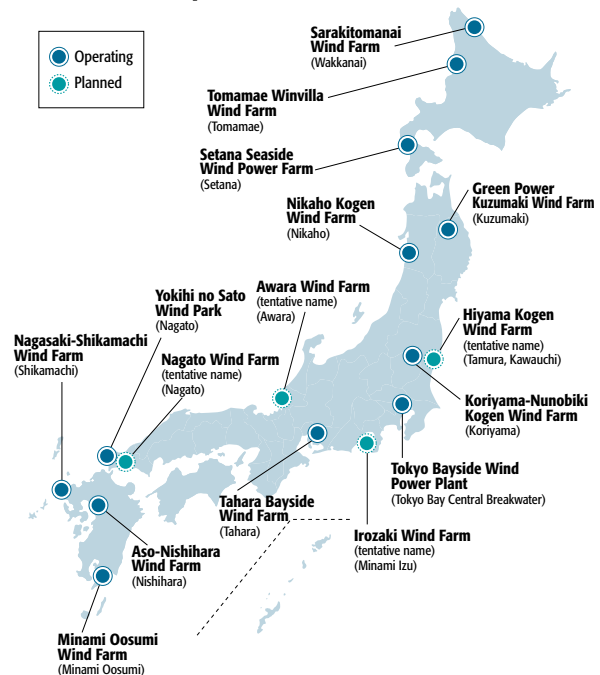
Over the medium term, J-POWER Group is aiming for a wind power capacity of 500 MW each in Japan and overseas. Meanwhile, we are surveying and developing new sites in preparation for additional projects to follow. In addition, we are working constantly to improve operation efficiency and stability for even more effective utilization of wind energy.

Growth in J-POWER Group Installed Wind Power Capacity (Japan)



Note: Figures represent combined installed capacity of facilities in which J-POWER Group has an ownership interest, non-prorated.

Locations of J-POWER Group Wind Power Facilities (Japan)



PERSON Making Wind Power as Green as Possible

Although wind power is clean energy that emits no CO₂ in the electricity generating process, care must be taken to limit the environmental load stemming from construction and operation. In addition to carrying out environmental impact assessments prior to construction (habitat and growth environment of plants and animals, noise, radio interference, etc.), we are at pains to protect the environmental during the actual building and operating processes.

Tadashi Matsumoto
 Wind Power Engineering Group,
 Wind Power Business Office
 Environment & Energy Business
 Department



Close-up Development of Low-CO₂-Emission Power Sources

ACTION Beneficial Use of Biomass

In the J-POWER Group we are actively promoting the beneficial use of such biomass resources as sewage, woody biomass, and non-industrial waste in the belief that co-combustion in coal-fired power stations is the most efficient and economical way to tap these resources on a significant scale.

Utilization of Sewage Sludge (Biosolid Fuel)

Biosolid fuel, produced by heating a mixture of sludge from sewage treatment plants and discarded cooking oil to remove the moisture (oil-heat depressurization drying method is employed), has approximately the same heating properties as coal. In fiscal 2006 we began co-firing biosolid fuel in the commercial facilities at the Matsuura Thermal Power Station (Nagasaki Prefecture) in the first such undertaking in Japan. Working within the constraints of limited fuel production, the facility co-fired about 580 tons of biosolid fuel in fiscal 2008, yielding approximately 1,400 MWh of electric power. We are now working with such entities as the Fukuoka Prefectural Sewage Public Corporation to develop a technique for manufacturing an oil substitute from waste cooking oil with the aim of increasing the volume of biosolid fuel used in co-combustion.



Biosolid fuel

Development of Biosolid Fuel Production Technology (low-temperature carbonization)

Low-temperature (250°C–350°C) carbonization improves the calorific value of biosolid fuel produced from sewage sludge by about 40 percent compared with high-temperature (600°C–800°C) car-

bonization processes, in addition to curtailing the amount of N₂O generated during sludge treatment. By pelletizing the dried sludge and adding steam prior to carbonization, this process also reduces the danger of spontaneous combustion while minimizing odor. By enhancing the value of biosolid fuel as a coal substitute, the technology can make a major contribution to the reduction of greenhouse gases.

Utilization of Woody Biomass

Long-term trials of woody biomass co-firing were begun at Matsuura Thermal Power Station (Nagasaki Prefecture) in fiscal 2008 (scheduled to end in fiscal 2009), in preparation for full-scale generation using woody biomass fuel. In fiscal 2008, the trials co-fired approximately 2,500 tons of woody biomass fuel and confirmed that plant equipment was not affected by co-combustion. In fiscal 2009, the facility will begin long-term trials of simultaneous co-firing of woody biomass and biosolid fuel to verify that the equipment is not affected by simultaneous combustion.



Woody biomass fuel

Testing Carbonized Fuel from Non-industrial Waste

The J-POWER Group is also working to develop technology for producing carbonized fuel from non-industrial waste with biomass content with a view to encouraging use of untapped energy sources (for details, see p. 63).

COLUMN

Turning Sewage Sludge into Fuel in Hiroshima

In April 2012, at the Hiroshima City Seibu Water Resources Reclamation Center, we will be launching Japan's first sewage-sludge recycling operation to produce biosolid fuel using low-temperature carbonization. Under the project, sewage sludge, a biomass resource, will be converted into fuel to be co-fired at J-POWER's Takehara Thermal Power Station (Hiroshima Prefecture). We take an integrated approach in this project, from design, construction, maintenance, and operation of facilities to sales of the fuel produced and use of fuel in boilers at coal-

fired thermal power stations. In recycling an estimated 27,000 tons of sewage sludge each year, 46% of the total amount generated by the city of Hiroshima, the program is expected to aid in the fight against global warming by reducing greenhouse gas emissions equivalent to 15,000 t-CO₂ at the sewage treatment center and the power station combined.

In the years ahead we intend to use mainly our own coal-fired power stations around the country to actively promote expanded recycling of sewage as biosolid fuel.



Exterior view of planned biosolid fuel production facilities (artist's rendering)

ACTION Tapping a Wide Range of Renewable Energy Sources**Geothermal Power**

An unusual number of volcanoes makes Japan a country rich in geothermal resources, with more than 100 hot springs measuring 90°C or higher. Moreover, this 100 percent domestic, renewable energy source is virtually free of CO₂ emissions. We are working hard to ensure the stable operation of our Onikobe Geothermal Power Station (Miyagi Prefecture; 12,500 kW), which puts this precious resource to beneficial use. Meanwhile, we are conducting surveys to lay the groundwork for new geothermal power projects in Japan and overseas. At present we are carrying out a detailed survey, including exploratory drilling, in Akita Prefecture.



Onikobe Geothermal Power Station (Miyagi Prefecture)

Small Hydropower

J-POWER is also moving forward with development of small hydropower to make beneficial use of an important untapped energy source of 100 percent domestic origin. Thus far we have provided design and construction supervision for a power station that makes use of an existing sediment control dam (Oita Prefecture) and a facility that uses the public water supply system (Mie Prefecture) as well as for the redevelopment of a hydropower station damaged by flooding (Mie Prefecture). We also participated in joint development of a micro hydropower system^{*1} ("hydro-agri") using falling water in existing irriga-

tion channels, for which we carried out demonstration testing in Tochigi Prefecture and designed and built commercial facilities.

***1 Micro hydropower**

Hydroelectric power installations with a capacity of 100 kW or less

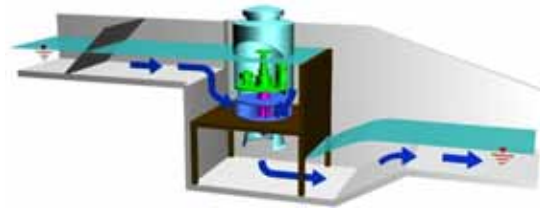


Diagram of micro hydropower system using irrigation channel

Solar Power

In March 2008 operations began at Hibikinada Solar Power Station, which was built on reclaimed land in the Hibikinada district of Kitakyushu's Wakamatsu Ward. This solar power system, approved by the New Energy and Industrial Technology Development Organization (NEDO) in fiscal 2007 as a Field Test Project on New Photovoltaic Power Generation Technology, has an installed capacity of 1,000 kW (1 MW). It consists of 5,600 solar cell modules of the polycrystal silicon type, each measuring 1.29 by 0.99 meters.

The field test is measuring and analyzing various actual-load operating data over a period of four years to evaluate a new type of control system using a high-capacity power conditioner. In one year, the facility generated about 1,100 MWh of electricity, for an emissions reduction benefit of about 500 t-CO₂.



Hibikinada Solar Power Station (Kitakyushu)

COLUMN**High-Efficiency Gas-Turbine Combined-Cycle Generation**

Gas-turbine combined-cycle power generation combines gas turbines and steam turbines to achieve high generation efficiency, in the area of 50 percent.

We established Ichihara Power Co., Ltd. (a joint venture between Mitsui Engineering & Shipbuilding Co., Ltd. and J-POWER) and Bay Side Energy Co., Ltd. to work on gas-turbine combined-cycle power generation using natural gas as fuel. We are also involved in gas-fired power generation overseas, including the Kaeng Khoi 2 gas-fired thermal power station project in Thailand.



Ichihara Power Station (Bay Side Energy Co., Ltd., Chiba Prefecture)

Maintenance and Improvement of Energy-Use Efficiency

The energy-use efficiency of the J-POWER Group's coal-fired power facilities is among the highest in the world, thanks to our ongoing efforts to develop and actively incorporate our own cutting-edge technology. At our hydropower stations, as at other facilities, we strive for stable operations and work to further improve equipment efficiency during upgrades. In addition, the entire Group is working as a team to improve energy conservation.

TOPIC Start-up of Isogo Thermal Power Station New No. 2 Unit

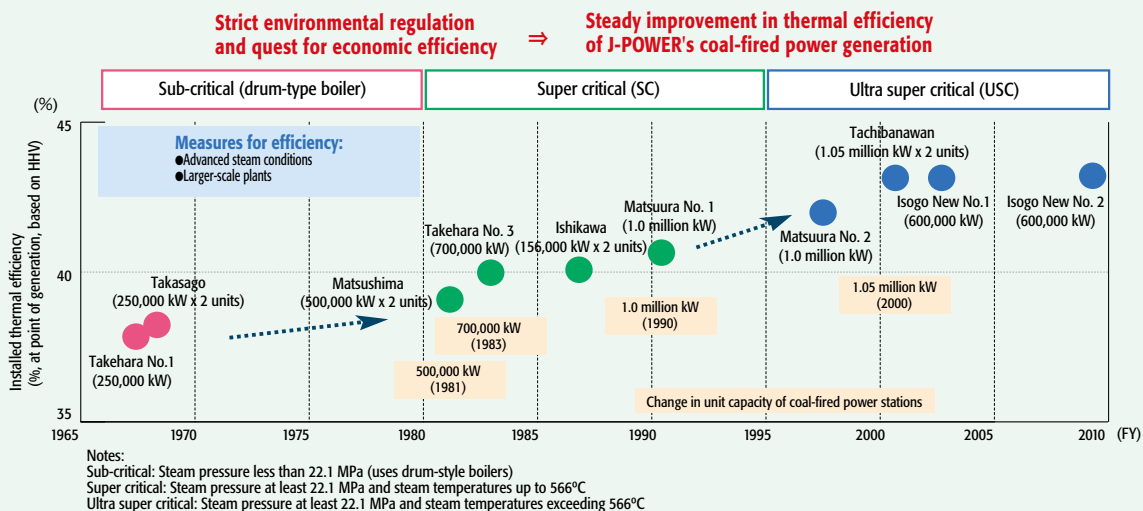
Isogo Thermal Power Station, Pinnacle of Pulverized Coal Technology

The Isogo Thermal Power Station new No. 2 unit (capacity: 600 MW), under construction since October 2005, began operating commercially in July 2009. With the new No. 1 unit up and running as well, this marks the completion of a massive project to replace the generating equipment at Isogo Thermal Power Station. Determined to make Isogo Thermal Power Station a showcase of advanced clean-coal technology, J-POWER boosted the power station's thermal efficiency by applying some of the world's most advanced ultra super critical (USC) technology (main steam at 25 MPa and 600°C). In the new No. 2 unit, moreover, the reheated steam temperature was raised

another 10°C to 620°C, to boost heat efficiency even higher and further reduce CO₂ emissions.

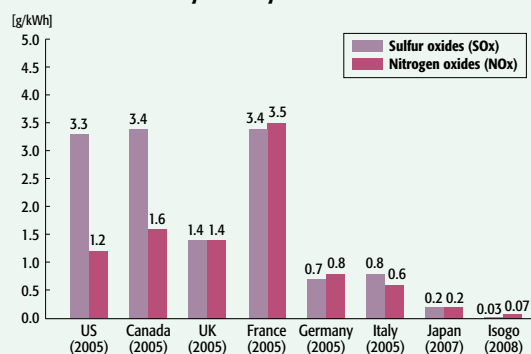
Thanks to the installation of cutting-edge anti-pollution equipment, SO_x and NO_x emissions per unit of electricity generated (intensity) at Isogo Thermal Power Station are extremely low at levels one digit smaller than those of major industrial countries. In this way the Isogo Thermal Power Station has emerged as one of world's most advanced facilities in terms of curbing emissions that impact the environment.

Thermal Efficiency of Coal-Fired Power Generation by J-POWER



Isogo Thermal Power Station (Yokohama)

SO_x and NO_x Emissions Intensity of Thermal Power Generation by Country



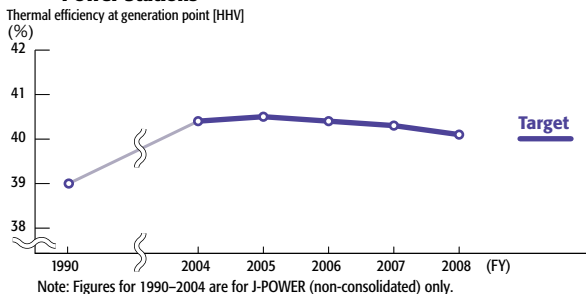
Source: Data compiled by the Federation of Electric Power Companies of Japan.
 Notes: 1. Figure for Japan represents combined data for Japan's 10 regional electric utilities and J-POWER.
 2. Country figures represent combined emissions intensity for coal-, oil-, and gas-fired thermal power.

Maintaining and Improving Efficiency of Thermal Power Stations

When the thermal efficiency of a thermal power station declines, it means that more fossil fuel is consumed to generate the same amount of power, resulting in an increase in CO₂ emissions. We work hard to keep thermal efficiency high through conscientious maintenance of our generating facilities. Equipment that has aged from years of use is replaced and upgraded to restore or improve operational efficiency.

At Matsuura Thermal Power Station, the high- and intermediate-pressure rotors of the steam turbine that powers the generator will be replaced during fiscal 2009 and 2010 to restore generating efficiency. In the process, we will adopt the latest technology to maintain and improve thermal efficiency, including high-performance blades optimally designed with the help of computer simulation and an improved packing structure that prevents steam from escaping.

>>> Change in Thermal Efficiency of J-POWER Group Thermal Power Stations



High- and intermediate-pressure turbine rotors at Matsuura Thermal Power Station (Nagasaki Prefecture)

Equipment Replacement at Hydropower Facilities

At hydropower facilities with aging equipment, we have undertaken the total replacement of key system components. The purpose is to prolong the life of the facility and improve the reliability of its equipment, while boosting power generation efficiency and capacity by incorporating the latest advances in design engineering.

At Tagokura Power Station (Fukushima Prefecture), work has been ongoing since fiscal 2004 under an eight-year plan to replace four water turbine generators and increase the facility's capacity from 380,000 kW to 400,000 kW. To date, the no. 4 and no. 2 generators have been replaced and are operating commercially.

At Nukabira Power Station (Hokkaido), where a four-year project to replace two water turbine generators was launched in fiscal 2006, the no. 2 generator has been replaced and is operating commercially. Large-scale renovation is under consideration for other sites as well.



Replacement of key system components at Nukabira Power Station (Hokkaido)

PERSON

Mitsuo Miyahara Planning & Management Group, Thermal Power Engineering Department

Royal Purple

RP-LUCID is a high-performance lubricant perfected by the US firm Royal Purple using advanced additive technology centered on the proprietary additive Synerlec. This unique product achieves the ideal that has eluded previous lubricants by combining film strength, oxidation resistance, and excellent separation from water in one product. At J-POWER we use RP-LUCID to lubricate much of our rotary equipment, and the result has been fewer equipment failures, longer intervals between oil changes, and energy savings.



RP-LUCID high-performance synthetic lubricant

At our wind power facilities, use of the lubricant in recent years has led to improved output performance, and we intend to expand its use over time.

Note: The original name of the lubricant is Royal Purple.



Utilization of the Kyoto Mechanisms and Other Measures

The J-POWER Group has been moving forward with application of the Kyoto Mechanisms, with an emphasis on CDM Project development. The CDM (Clean Development Mechanism; see chart below) and JI (Joint Implementation)^{*1} are essential mechanisms for minimizing Japan's economic burden and keeping Japanese industry internationally competitive, and the J-POWER Group is actively involved in efforts to earn and make use of carbon credits through these programs.

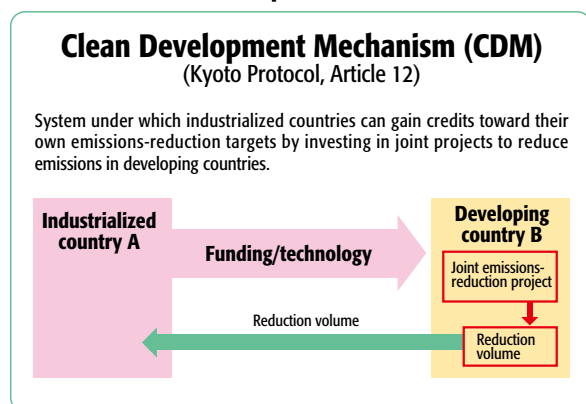
Overview of CDM Project Development

The Kyoto Protocol sets numerical targets to reduce greenhouse gas emissions for industrialized nations. Under the protocol, the Kyoto Mechanisms (JI, CDM, and emissions trading) have been established as tools by which industrial nations can achieve their targets in an economically rational manner while providing technical and financial support for emissions reduction in developing countries.

The J-POWER Group began moving proactively to take advantage of the CDM even before the Kyoto Protocol went into effect in February 2005. The reason for the focus on CDM was that, unlike JI and emissions trading, for which carbon credits were not to be issued until 2008, the CDM applied to activities undertaken from 2000 on, making it possible to earn credits even before 2008.

In order to accumulate experience, we began by participating in a large number of small-scale projects. Focusing on Central and South American countries that have actively embraced the CDM, we assisted in a broad range of activities required for official CDM registration. As the date of the protocol's enforcement neared, we broadened our focus to include Asia and began to participate in large-scale projects as well. Of the CDM-related projects in which we have been involved, six had been registered with the CDM Executive Board^{*2} as of the end of March 2008.

>>> Outline of Clean Development Mechanism



Major Activity in FY 2008

● JI and CDM Projects

In January 2009, the Sichuan Erdaoqiao Hydropower Project to develop renewable hydroelectric power was registered as an approved CDM project.

The J-POWER Group has been involved in a variety of other JI- and CDM-related projects as well, not only in Central and South America but also in Eastern Europe, China, and Southeast Asia, providing development support for projects involving the use of such renewable energy sources as biomass and hydropower, as well as projects to recover biogas with methane content from landfills and effluent treatment facilities and burn it as fuel.



Landfill in Brazil



Landfill gas^{*3} recovery well

>>> CDM Executive Board-Registered Projects Developed with J-POWER Participation

Country	Project name	Description
Chile	Nestle Graneros Plant Fuel-Switching Project	Switch to natural gas in conjunction with renovation of facilities
Chile	Metrogas Package Cogeneration Project	Introduction of cogeneration for improved energy-use efficiency
Colombia	La Vuelta and La Herradura Hydroelectric Projects	Use of renewable energy sources
Brazil	Aquarius Hydroelectric Project	Use of renewable energy sources
Brazil	Caieiras Landfill Gas Emission-Reduction Project	Combustion of landfill gas to reduce greenhouse gases
China	Sichuan Erdaoqiao Hydropower Project	Use of renewable energy sources

● Participation in Carbon Funds

As part of our ongoing effort to secure emissions credits efficiently through CDM and JI, J-POWER contributes to the following carbon funds:

- Japan Greenhouse Gas Reduction Fund (JGRF)
- Dexia-FondElec Energy Efficiency and Emissions Reduction Fund

key word

^{*1} Joint implementation (JI)
Mechanism whereby industrialized countries can carry out joint emissions-reduction projects and apply the resulting reductions toward their own emissions-reduction targets.

^{*2} CDM Executive Board
Body charged with oversight of CDM projects. Responsible for accrediting designated operational entities (DOEs), registering CDM projects, and issuing certified emission reductions (CERs).

^{*3} Landfill gas
Biogas generated from waste in landfills. A major component of landfill gas is methane, generated during the anaerobic fermentation of organic matter. Methane is a greenhouse gas with a warming effect 21 times that of CO₂.

CDM Project Close-up

● Small-scale CDM Project at Aquarius Hydroelectric Power Station in Brazil

One small-scale CDM project in which J-POWER has been involved is the Aquarius Hydroelectric Project in Brazil. The United Nations CDM Executive Board approved the project's registration on December 15, 2006, and the Aquarius Hydroelectric Power Station has been operating successfully. In December 2008, the board approved issuance of the first certified emission reductions, or CERs,^{*4} from this project.

The project's objective was to avoid greenhouse gas emissions from fossil-fuel-fired power by supplying clean electricity from the Aquarius Hydroelectric Power Station (capacity 4,200 kW), built and operated in Rua da Cana, Municipio Sonora, Mato Grosso do Sul, by Brazilian wholesale power supplier Aquarius Energetica S.A. J-POWER worked with the project owner to draft the project design document (PDD) and complete other CDM procedural requirements. The CO₂ emissions reduction volume anticipated from the project is 284,000 t-CO₂ over the 21-year period from 2006 through 2026.



Aquarius Hydroelectric Power Station, Brazil

>>> Project History

April 24, 2006	Approved by Japanese government
Sept. 19, 2006	Approved by government of host country, Brazil
Dec. 15, 2006	CDM registration approved by CDM Executive Board
Dec. 19, 2008	CERs issued by CDM Executive Board (19,024 CERs)

The Kyoto Mechanisms and the J-POWER Group's CO₂ Intensity Target

Such Kyoto Mechanisms as CDM and JI allow industrially developed nations to earn carbon credits to offset their own emissions by taking part in emissions reduction projects in other countries. CDM and JI were adopted under the Kyoto Protocol to help achieve the emissions reduction targets at the lowest possible cost. By implementing programs to reduce CO₂ emissions in developing countries and elsewhere, a country like Japan, whose energy conservation measures have progressed to the point where further reductions in greenhouse gas emissions can only come at considerable cost, to pursue more cost-effective CO₂ emissions at the global level, while encouraging emissions reduction in developing countries.

With this in mind, we have been working actively to earn and use credits via CDM and JI. To give due consideration to these efforts, when calculating the J-POWER Group's progress toward its CO₂ intensity reduction target, we offset our CO₂ emissions from power generation with the carbon credits transferred to Japan through our CDM and JI projects.

PERSON

Taichi Hirose Carbon Credit Group, Climate Change Office, Corporate Planning & Administration Department

Ensuring the Success of Our CDM and JI Projects

For a CDM or JI project to succeed, thorough preparations must be carried out in close contact with personnel on the ground, so as to build an effective team. One must also be diligent in obtaining project approval from the UNFCCC^{*5} organization and each government involved. It must be remembered that the systems and procedures governing CDM and JI are still evolving and can change from

one day to the next. Staying alert at all times to any new information from the UNFCCC, government, or DOE,^{*6} as well as from consultants and others involved in the program, we work with local personnel on a daily basis to respond nimbly to procedural changes and ensure the success of the project.



^{*4} Certified emission reductions (CERs)
Emission reduction credits issued by the CDM Executive Board for a CDM project in accordance with its outcomes.

^{*5} UNFCCC (United Nations Framework Convention on Climate Change)
Treaty establishing an international framework for averting the environmental effects of global warming, with the ultimate aim of at stabilizing greenhouse gas concentrations in the atmosphere. The treaty came into force in March 1994.

^{*6} Designated operational entity (DOE)
An independent body that verifies and certifies the amount of greenhouse gas emissions reduction from a CDM project.

Efforts to Curb Greenhouse Gas Emissions

In the J-POWER Group we are taking appropriate steps to control CO₂ and other greenhouse gases (SF₆, HFC, PFC, N₂O, and CH₄) to minimize emissions. We are also taking the necessary steps to control emissions of specified CFCs and halons that deplete the ozone layer.

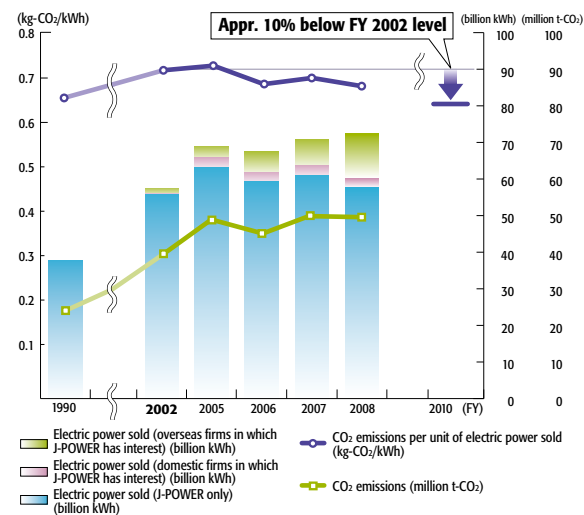
CO₂ Emissions in Fiscal 2008

In fiscal 2008, electric power sold by the J-POWER Group as a whole, calculated by pro-rating sales according to J-POWER's ownership share in each subsidiary and unconsolidated affiliate in Japan (20 companies) and overseas (21 companies), was 72,200 GWh, representing an annual increase of about 1 percent. During the same time CO₂ emissions decreased approximately 2 percent, to 49.38 million t-CO₂.

CO₂ emissions per unit of electric power sold fell 2 percent, to 0.68 kg/t-CO₂, the result of a slight increase in electricity sold from hydropower facilities and a drop in electricity sold from thermal power stations, reflecting a decline operating rate. This figure is 5 percent below the baseline fiscal 2002 level of 0.72 kg-CO₂/kWh. We will continue working to reach our target through such strategies as the development of low-CO₂-emission power sources* and utilization of the Kyoto Mechanisms.

* CO₂ emissions reduction benefit of wind power and other alternative energy sources (estimated using average CO₂ intensity of all energy sources in Japan): Electricity sold from wind power and geothermal generation in FY 2008 was approximately 300 GWh and 70 GWh respectively, yielding a combined emissions reduction benefit of approximately 170,000 t-CO₂. (For hydropower, see p. 47.) The annual emissions reduction benefit from Ohma Nuclear Power Station since its completion is estimated at around 3.2 million t-CO₂ (based on an 80 percent utilization rate).

>>> J-POWER Group (Japan and Overseas) CO₂ Emissions



* Scope of Data Included in Calculation of CO₂ Emissions and Electric Power Sold
 Inasmuch as our focus is on global environmental problems, when calculating CO₂ emissions per unit of electric power sold (CO₂ intensity)—the measure on which our corporate targets are based—we have made an effort to include in our aggregate all energy-producing businesses in which J-POWER has an investment, both domestically and overseas. To this end, we have calculated the electric power sold and the CO₂ emissions of each of the Japanese and overseas companies in which J-POWER has a stake, including unconsolidated affiliates, and prorated their figures in accordance with J-POWER's ownership share.
 To calculate the volume of CO₂ emissions, we have used the emission coefficients set by the greenhouse-gas accounting, reporting, and disclosure system instituted under the amended Law Concerning the Promotion of Measures to Cope with Global Warming.

Measures to Curb Greenhouse Gases Other than CO₂

The Kyoto Protocol covers five greenhouse gases in addition to CO₂. Where emissions by the electric utility industry are concerned, the contribution of these other gases to global warming is about 1/480 that of CO₂.* With regard to SF₆, the J-POWER Group has established as its targets a 97 percent recovery rate during equipment inspection and a 99 percent rate when equipment is retired and are working to minimize emissions through careful and consistent recovery and reuse. In 2008, our recovery rate during inspections was 99 percent.

* Federation of Electric Power Companies of Japan, Environmental Action Plan by the Japanese Electric Utility Industry (September 2008).

>>> Measures for Reducing Emissions of Other Greenhouse Gases

Gas	Applications and measures for reducing emissions
Sulfur hexafluoride (SF ₆)	Used for insulation in gas insulation equipment. The J-POWER Group works to reduce emissions through rigorous recovery and reuse during inspection and disposal. In 2008, our rate of recovery and reuse was 99 percent.
Hydrofluorocarbons (HFCs)	Used as refrigerant in air-conditioning equipment, etc. Their use is expected to increase as they are adopted to replace government regulated CFCs. The J-POWER Group works to reduce emissions through cooperative efforts to recover and reuse such gases, as well as preventing leaks during installation and repair.
Perfluorocarbons (PFCs)	Not stocked by J-POWER Group Companies.
Nitrous oxide (N ₂ O)	The J-POWER Group is working to keep emissions to a minimum by improving thermal efficiency of thermal power stations. (In fiscal 2008, emissions totaled approximately 1,660 t.)
Methane (CH ₄)	As CH ₄ concentrations in flue gases from thermal power stations are below average atmospheric concentrations, emissions are effectively zero.

Protecting the Ozone Layer

The ozone layer in the upper stratosphere (about 20 km–40 km above the earth) plays an important role in protecting life by absorbing harmful ultraviolet rays. There are concerns that specified chlorofluorocarbons (CFCs) and halons can destroy the ozone layer, resulting in serious damage to human health and to the ecosystem. In the J-POWER Group we periodically monitor our stocks and consumption of these substances and are working to limit their emissions through proper management and control (see p. 76).

Stepping Up Energy Conservation

●Larger Coal Carriers for a Lighter Environmental Load

In the J-POWER Group we are working to reduce our environmental load by moving in the direction of larger Panamax^{*1} coal carriers (approximately 90,000 tons) when contracting with shipping companies.

In fiscal 2008, we imported approximately 20 million tons of coal from Australia, China, Indonesia, and other countries to our power stations.

The use of larger bulk carriers makes it possible to cut back on the amount of shipping fuel consumed per ton of coal transported, which in turn reduces the environmental load from shipping (emissions of CO₂, sulfur oxides, and nitrogen oxides).



The *Southern Cross*, a dedicated coal carrier

●Marine Transport of Coal Ash

Coal ash is the residue generated when coal is burned in coal-fired thermal power stations.

In fiscal 2008, approximately 1.75 million tons of coal ash was generated and shipped from power stations to cement plants and other locations around the country to be recycled as raw material for cement or land reclamation material.

In the J-POWER Group, we use dedicated carriers and other marine transport for 90 percent of the coal ash we ship to reduce CO₂ emissions per unit transported. Greater reliance on maritime transport also helps mitigate congestion on our roads.

With respect to the Isogo new No. 2 unit, which began commercial operation in July 2009, plans are now under way to secure carriers and build the necessary loading facilities, so that the coal ash generated there can be shipped by marine transport as well.

●Environmental Infrastructure Operations

J-POWER has become the first Japanese power company to take part in a district cooling project in the Middle East by teaming with the United Arab Emirates company Tabreed and Sumitomo Corporation to establish Sahara Cooling Limited. J-POWER has already provided consulting services for district heating and cooling projects in Japan and overseas, and we are building on that experience, together with our know-how in the design, management, maintenance, and operation of hydroelectric and thermal power stations, to improve the operating stability and increased efficiency of the system's cooling plants.

The UAE district cooling project involves six cooling plants with a total capacity of 54,500 RTs.^{*2} District cooling helps save energy by centralizing the thermal energy source for higher efficiency and by permitting load leveling among multiple users. Tabreed has estimated that by shifting to a district cooling system the UAE could cut energy consumption by 55 percent compared with the use of individual cooling units.

With demand growing in the UAE and neighboring countries for environmentally friendly, energy-saving district cooling systems, J-POWER plans to expand its Middle East operations and continue taking part in projects designed to lighten the environmental load.



District cooling project, United Arab Emirates

●Curbing Energy Use at the Office and at Home

As part of our effort to stem global warming, the J-POWER Group's business sites follow such energy-saving policies as lights off during lunch break, reduced power supply to equipment on standby, and environmentally-friendly driving. In addition, we make a point of selecting equipment meeting strict specifications for energy efficiency whenever we build new office buildings or replace company vehicles.

One critical component of Japan's overall effort to combat global warming is stepped-up energy-conservation efforts in the commercial sector, which includes offices. To this end the J-POWER Group has adopted corporate targets to step up energy-conservation efforts in our offices. Through Group-wide initiatives, our employees are working as a team to meet those targets (see p. 44).

We have also launched an initiative to encourage employees to aid in the fight against global warming by conserving energy in their own homes with the help of the "Household Eco-Account Book" available on the Ministry of the Environment's "Eco-family" website.^{*3}

*1 Panamax

The largest category of ship that can transit the Panama Canal. For bulk carriers, this usually means a cargo capacity of 60,000 to 90,000 tons.

*2 RT (refrigeration ton)

A unit used to measure refrigerating capacity. 1 RT is the thermal energy necessary to freeze a ton of water at 0°C in 24 hours. 1 RT is also about the capacity needed to cool the average Japanese house.

*3 Ministry of the Environment Eco-family

web <http://www.eco-family.go.jp/index.html>
(Japanese only)