Efforts Relating to Global Environmental Issues

With humanity obliged to continue relying on fossil fuels as its primary energy source through this century, the problem of global warming is the most serious issue to be tackled over the long term. J-POWER Group regards measures to combat global warming as a top management priority and is pursuing such actions vigorously.

CO_2 Emissions from Business Activities

Japan's total annual CO_2 emissions are approximately 1.29 billion t-CO_2 (actual emissions for fiscal 2005), of which about 30% is generated by power stations. Emissions from J-POWER Group companies (in Japan) account for about 4% of Japan's total.

We take this situation seriously, and to respond to it, we have compiled our Action Program (see p. 27), which systematizes our efforts heretofore. Through this program, J-POWER has committed itself to work for around a 10% reduction from the fiscal 2002 level of annual CO_2 emissions per unit of electric power sold by J-POWER Group electric power businesses in Japan and overseas by fiscal 2010.

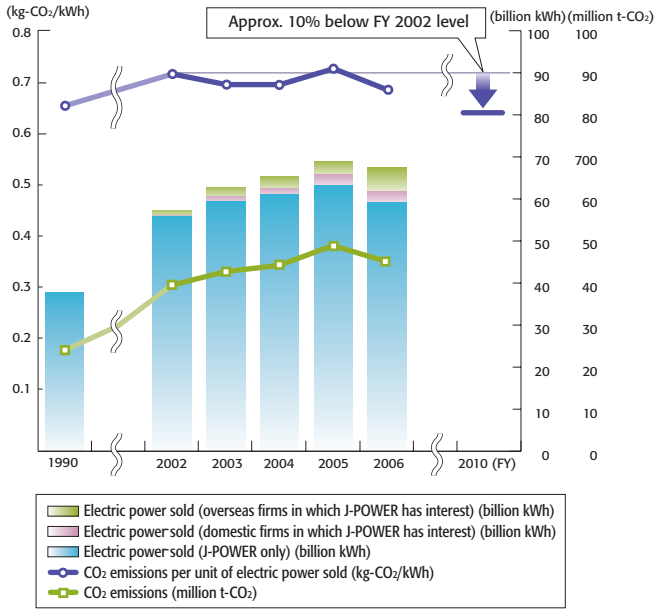
CO_2 Emissions by J-POWER Group Companies (Domestic and Overseas)

In fiscal 2006, electric power sold by the J-POWER Group as a whole—including that of all domestic and overseas subsidiaries and unconsolidated affiliates in which J-POWER has a stake, prorated according to J-POWER's holding ratio—was approximately 66.8 billion kWh, a drop of about 2% from the previous year. CO_2 emissions fell to 45.36 million t-CO_2, a reduction of about 8% from the previous year, owing in part to a lower utilization rate for coal-fired power stations.

At the same time, CO_2 emissions per unit of electric power sold fell approximately 6% from the previous year, to 0.68 kg-CO_2/kWh, thanks to such factors as the drop in the utilization rate of thermal power stations, an increase in the amount of hydroelectric power sold as a result of high precipitation in Japan, and the involvement in a gas cogeneration project overseas. This also represents a drop of about 6% from fiscal 2002, when the level of emissions per unit of electricity sold was 0.72 kg-CO_2/kWh.

We will continue to strive to reach our targets under the J-POWER Group Action Program.

■ **J-POWER Group (Japan and Overseas) CO_2 Emissions**



Scope of Companies Included in the Calculation of CO_2 Emissions and Electric Power Sold

Inasmuch as our focus is on global environmental problems, when calculating CO_2 emissions per unit of electric power sold (CO_2 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 a stake, both domestically and overseas. To this end, we have calculated the electric power sold and the CO_2 emissions of each of the Japanese and overseas companies in which J-POWER has a stake, including non-consolidated affiliates, and prorated their figures in accordance with J-POWER's holding ratio.

In calculating the volume of CO_2 emissions, we have used the emission coefficients established under the greenhouse gas accounting, reporting, and disclosure system instituted under the amended Law Concerning the Promotion of Measures to Cope with Global Warming, to arrive at totals extending back to fiscal 1990.

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CO_2 Reduction Benefit

The 59 hydroelectric power stations that J-POWER operates nationwide represent a total output of 8.56 million kW, almost 20% of the total capacity of Japan's hydropower facilities. In fiscal 2006, the volume of hydroelectric power sold (not including power from pumped storage generation) was 10.63 billion kWh, for a CO_2 emissions reduction benefit* of approximately 4.55 million t-CO_2.

Electric power sold by the Onikobe Geothermal Power Station and J-POWER Group's wind power facilities (domestic) were 94 million kWh and 245 million kWh, respectively, yielding a CO_2 reduction benefit of approximately 150,000 t-CO_2.

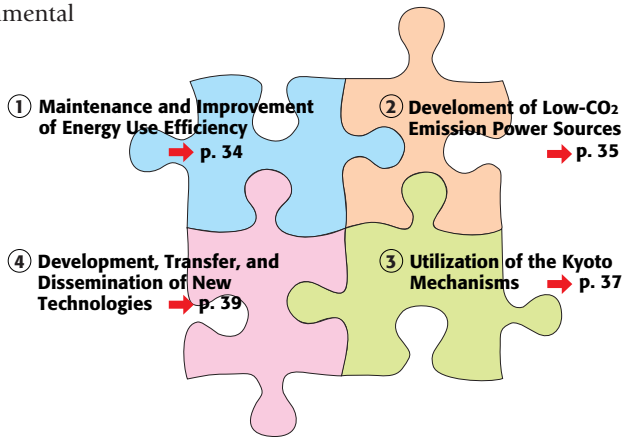

Tagokura Dam and Tagokura Power Station (Fukushima Prefecture)


Tomamae Winvilla Wind Farm (Hokkaido)

Four Measures for Achieving Emissions Reduction Targets

The J-POWER Group has been addressing global environmental problems by taking the following four measures.

- Maintenance and Improvement of Energy Use Efficiency
- Develoment of Low-CO_2 Emission Power Sources
- Utilization of the Kyoto Mechanisms
- Development, Transfer, and Dissemination of New Technologies



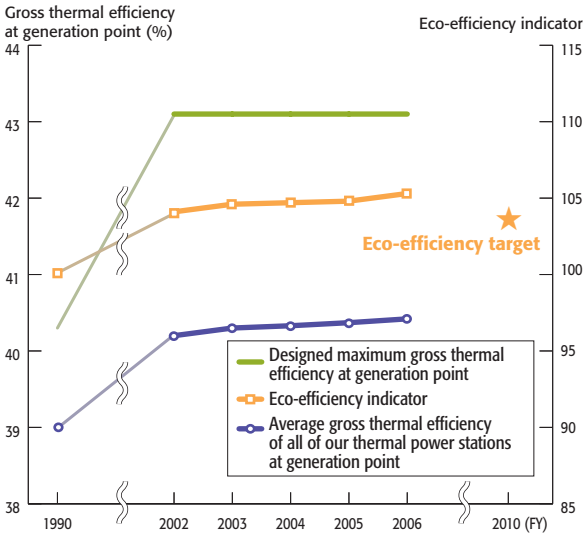
Maintenance and Improvement of Energy Use Efficiency

The energy-use efficiency of J-POWER's coal-fired power facilities is among the highest in the world, thanks to the company's efforts to develop and actively incorporate its own cutting-edge technology. In its hydropower and other facilities as well, J-POWER strives for stable operations and works to further improve equipment efficiency during upgrades. In addition, the Group as a whole is continually working to devise energy-saving measures.

Maintaining Efficient Operation of Coal-Fired Power Stations

J-POWER is taking measures to reduce auxiliary power for operations in its coal-fired power stations, while working to maintain high-efficiency operation through the introduction of new technologies, such as ultra super critical (USC) technology. In fiscal 2006, the average thermal efficiency of all of our thermal power stations (at point of generation) was 40.3% (as compared with 40.5% in fiscal 2005). Although thermal efficiency of coal-fired power generation equipment declines with age, we slow the aging process and stem the decline in thermal efficiency by installing high-efficiency equipment in our new facilities and conducting regular equipment inspections. By stemming the decline in thermal efficiency, it is possible to reduce the amount of fuel used and ultimately cut CO_2 emissions. J-POWER will continue these efforts to maintain and improve the efficiency of energy use in its coal-fired thermal power stations.

■ **J-POWER Coal-Fired Power Stations: Thermal Efficiency and Eco-efficiency**



Note: Eco-efficiency indicator: 100 = FY 1990 eco-efficiency (electric power sold ÷ energy input)

Measures to Maintain and Improve Hydropower Facilities (renewal)

J-POWER is carrying out a total replacement of the aging main generating facilities at the Tagokura Power Station to prolong the life of the facility and improve the reliability of its equipment, while adopting the latest technology to improve power generation efficiency. The plan should boost output by an estimated 5%.

We are also carrying out a total upgrade at Nukabira Power Station. In this way we are working to ensure stable operation of our hydroelectric power stations through improvements in equipment efficiency, as well as proper maintenance and operation of facilities.

Through these efforts, the power generation capacity of Tagokura Power Station is expected to gradually increase from the current 380,000 kW to 400,000 kW by 2012 (reaching 385,000 kW in 2006, 390,000 kW in 2008, and 395,000 kWh in 2010), while the output of Nukabira Power Station is planned to rise from 42,000 kW to 44,000 kW after 2010.

Total upgrade of main equipment at Nukabira Power Station (Hokkaido)

* For purposes of this report, CO_2 emissions-reduction benefit is calculated by comparing the emissions intensity for nuclear power, hydropower, geothermal power, or wind power with the average emissions intensity for electricity from all power sources in Japan (kg-CO_2 ÷ kWh).

Development of Low-CO_2-Emission Power Sources

As one important low-CO_2-emission power source, the J-POWER Group is moving forward with the construction of nuclear power stations. We are also at work on gas-turbine combined-cycle power generation, which can achieve high efficiency of energy use. In addition, while promoting the uses of wind power, biomass, and other alternative energy sources, we are working to develop micro-hydropower, one of the few natural resources remaining in Japan.

Construction of Ohma Nuclear Power Station

Nuclear power accounts for approximately one-third of Japan's total electric power generating capacity. In addition to benefiting from stable fuel supplies and prices, nuclear generation offers the environmental advantage of almost no CO_2 emission. For this reason, we believe it has a key role to play in efforts to combat global warming.

We are currently working on the construction of a nuclear power station (full MOX-ABWR; 1.383 million kW) in Ohma-machi, Aomori Prefecture, designed to use MOX fuel for the entire reactor core (scheduled to start operation in March 2012). We are carrying out this construction plan based on coexistence with local communities, with close attention to rigorous safety measures and environmental conservation. Ohma Nuclear Power Station is expected to yield an annual emission-reduction benefit of approximately 3.2 million t-CO_2 (assuming utilization rate of 80%).

Artist's rendering of completed Ohma Nuclear Power Station (Aomori Prefecture)

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%.

We have 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.

Overseas as well, the J-POWER Group is involved in such IPP undertakings as the Kaeng Khoi 2 gas-fired thermal power station project in Thailand, which is expected to contribute to reductions in CO_2 emissions intensity once the facility begins operation.

Wind Power Generation

In fiscal 2006, commercial operation was launched at Koriyama Nunobiki Kogen Wind Farm (Fukushima Prefecture; total output 65,980 kW), Japan's largest wind power facility. With this, the total output of

Koriyama-Nunobiki Kogen Wind Farm (Fukushima Prefecture)

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Wind Power Stabilization Technology Development Project

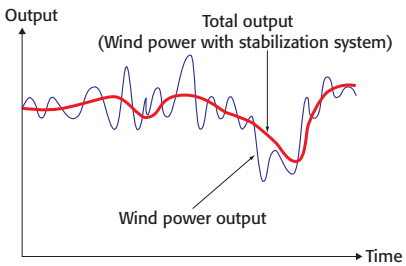
Wind power is a renewable energy source that has raised hopes from the standpoint of combating global warming. At Tomamae Winvilla Wind Farm, demonstration trials began in January 2005 for new control technology to stabilize the natural fluctuations in wind-generated power output using a power stabilizer (energy storage system) and to make wind power compatible with the existing electric power system. The trials, which make use of a stabilizer in combination with the Vanadium Redox-Flow Storage Battery, are scheduled to continue until the end of fiscal 2007.

Through this project, we are demonstrating the following newly developed control technologies:

1. Stabilization control: stabilizing output power from wind generation
2. State of charge feedback control: utilization of batteries' power capacity
3. Battery bank control system: control technology to reduce energy losses
4. Time constant shift control: control technology to sustain stabilizing effect

In addition, with the model program validated through our demonstration test data, we are carrying out simulations using data from other wind farms (measurements from a total of five sites other than Tomamae) to study the stabilizers at these wind farms.

■ Ilustration of Stabilization System



Note: This development has been carried out as part of the Wind Power Stabilization Technology Development Project commissioned by the New Energy and Industrial Technology Development Organization (NEDO) and carried out jointly by J-POWER, the Central Research Institute of Electric Power Industry, and the Institute of Applied Energy since fiscal 2003; it is scheduled to run through fiscal 2007.

all wind power facilities currently operating in Japan reached approximately 210,000 kW.

Overseas, we participated in a wind power project in Poland in fiscal 2006.

Power Generation Using Biomass Fuel

● Utilization of Woody Biomass (Co-firing with Coal)

From fiscal 2001 to fiscal 2004, we carried out a joint project with the Research Institute of Innovative Technology for the Earth (RITE). The aim of the project was to develop a technology for co-firing of woody biomass chips, which were derived from forest thinnings and construction wastes, in a coal-fired power station. In the final year of the project, fiscal 2004, a co-firing test was carried out in the No. 2 Unit of Matsuura Thermal Power Station (Nagasaki Prefecture), and it was verified that the co-firing of woody biomass was technically feasible.

Encouraged by the result, we have been working on feasibility studies of co-firing biomass fuels in our power stations for their future commercial operation.

Woody biomass chips

● Utilization of Sewage Sludge (Biosolid) Fuel (Co-firing with Coal)

A biosolid fuel is produced by heating a mixture of sewage sludge from sewage treatment plants and discarded cooking oil, in order to remove the moisture. For heating, the oil-heat depressurization drying method is employed. The resulting fuel has approximately the same heating properties as typical coal. From August 2003 to March 2006, as the first such attempt in Japan, we conducted a test of co-firing biosolid fuels with coal in the Matsuura Thermal Power Station (Nagasaki Prefecture), and it was verified that biosolid fuels could be co-fired at the maximum co-firing ratio of 1%. In fiscal 2006 we began commercial operation in the Matsuura Thermal Power Station and are currently co-firing 1,800 tons of biosolid fuels annually.

Matsuura Thermal Power Station is the first commercial thermal power generation facility in Japan to be certified as a new energy facility under the Renewable Portfolio Standard (RPS) system (certification was received February 16, 2005).

Biosolid fuel

● Development of Biomass Fuel Production Technology

As well as biomass co-firing technologies at coal-fired power stations, we are developing technologies to produce a variety of biomass fuels. For biosolid fuels, we are currently developing a method of production of fuels from sewage sludge using low-temperature carbonization technology. Compared to conventional carbonization processes, the low-temperature method was successful in upgrading the heating value of the fuel by about 40%. We carried out demonstration tests in fiscal 2006, and in 2007 we expect to receive a technical certification for the application of this technology in the sewage industry.

Stable Operation of Geothermal Power Facilities

Geothermal power, which makes effective use of Japan's precious volcanic resources, is another energy source that emits almost no CO_2. We are working to ensure the stable operation of our Onikobe Geothermal Power Station (Miyagi Prefecture; 12,500 kW).

Onikobe Geothermal Power Station (Miyagi Prefecture)

Micro-Hydropower Generation

J-POWER is working on utilizing the untapped energy potential of micro-hydropower generation in a number of areas. Thus far we have provided design and construction supervision for a power station that makes use of an existing sediment control dam (Oita Prefecture), facilities that use irrigation channels (Tochigi Prefecture and Yamanashi Prefecture), and one that uses the public water supply system (Mie Prefecture).

Yokkaichi Bureau of Waterworks hydroelectric power station (Mie Prefecture, 320 kW), for which KDC Engineering Co., Ltd. provided design and construction supervision.

Utilization of the Kyoto Mechanisms

The J-POWER Group has been making proactive use of the Kyoto Mechanisms, particularly the development of CDM projects that can generate emissions credits before the first commitment period (2008–12) of the Kyoto Protocol. In addition, we are actively supporting other companies' efforts to utilize the Kyoto Mechanisms.

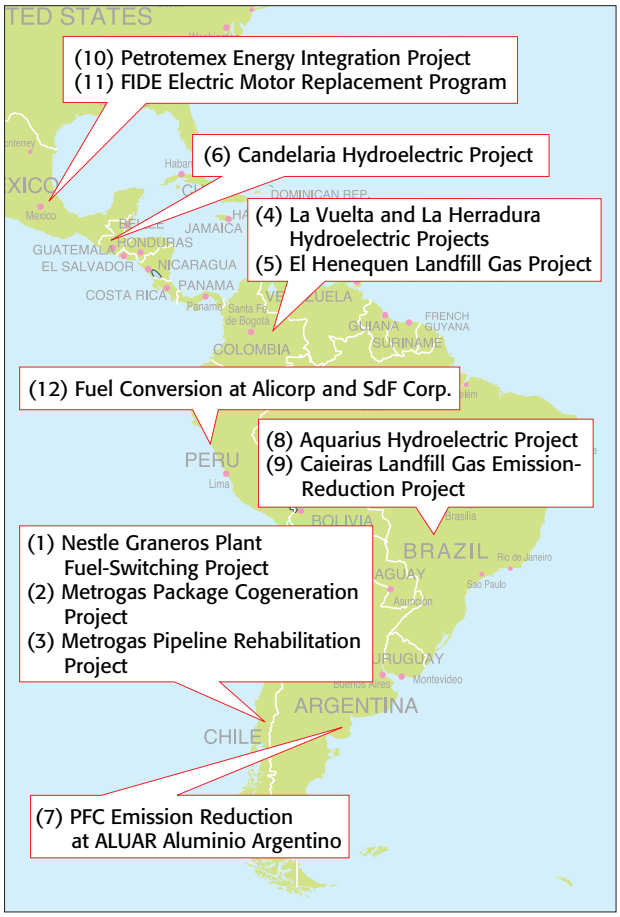
Overview of CDM Project Development

The Kyoto Protocol went into effect in February 2005, and detailed rules governing application of the Kyoto Mechanisms were formally adopted at the COP 11 and COP/MOP 1 meetings held in Montreal in November and December 2005. Even before the Kyoto Protocol went into effect, however, the J-POWER Group began moving proactively to take advantage of the Clean Development Mechanism (CDM). The reason for the focus on CDM is that while carbon credits will not be issued until 2008 under the other two Kyoto Mechanisms—Joint Implementation (JI) and emissions trading—credits can be issued before then under the CDM, which applies to activities undertaken from 2000 on.

In order to accumulate experience, we began by participating in a large number of small projects and assisting in activities that need to be carried out in order for a project to be registered as a CDM project, focusing on receptive Central and South American countries. As the date of the protocol's enforcement neared, we began to participate in large-scale projects as well.

Today the J-POWER Group is participating in 12 CDM projects in Central and South America. As the number of CDM projects registered with the CDM Executive Board has mounted—from four at the end of March 2005 to 146 a year later and 576 as of the end of March 2007—we have been applying ourselves diligently to the registration process. For six of the 12 projects, it was necessary to begin

■ **CDM Projects Involving the J-POWER Group**



■ **CDM Projects that J-POWER Group Helped Develop**

Country	Project name	Description	Notes
Chile	(1) Nestle Graneros Plant Fuel-Switching Project	Switch to natural gas in conjunction with renovation of facilities	Registered with CDM Exec. Board
	(2) Metrogas Package Cogeneration Project	Introduction of cogeneration for improved energy-use efficiency	
	(3) Metrogas Pipeline Rehabilitation	Rehabilitation of facilities for improved energy-use efficiency	
Columbia	(4) La Vuelta and La Herradura Hydroelectric Projects	Use of renewable energy sources	Registered with CDM Exec. Board
	(5) El Henequen Landfill Gas Project	Combustion of landfill gas to reduce greenhouse gases	
Guatemala	(6) Candelaria Hydroelectric Project	Use of renewable energy sources	Registered with CDM Exec. Board
Argentina	(7) PFC[a] Emissions Reduction at ALUAR Aluminio Argentino	PFC emissions reduction through improved aluminum production methods	
Brazil	(8) Aquarius Hydroelectric Project	Use of renewable energy sources	Registered with CDM Exec. Board
	(9) Caieiras Landfill Gas Emission-Reduction Project	Combustion of landfill gas to reduce greenhouse gases	Registered with CDM Exec. Board
Mexico	(10) Petrotemex Energy Integration Project	Improving energy-use efficiency through energy conservation, etc.	
	(11) FIDE[b] Electric Motor Replacement Program	Switch to high-efficiency motor for energy conservation	
Peru	(12) Fuel Conversion at Alicorp and SdF Corp.	Switch to natural gas in conjunction with renovation of facilities	

a. PFC: Perfluorocarbon, a type of CFC gas
b. FIDE: Mexico's Trust for Electric Energy Saving

by developing methodologies,* and four of these methodologies have been successfully registered with the CDM Executive Board. As of the end of March 2007, five J-POWER Group projects had been registered.

* The baseline methodology and monitoring methodology used in the Project Design Document (PDD) for CDM projects must be methodologies approved by the CDM Executive Board. For new kinds of projects, therefore, it is only possible to apply for registration after first developing a methodology and having it approved by the CDM Executive Board.

Major Fiscal 2006 Activities

CDM Projects

In fiscal 2006, two CDM projects were registered by the CDM Executive Board: the Aquarius Hydroelectric Project at the Aquarius Hydroelectric Power Station (4.2 MW) in Brazil and the La Vuelta and La Herradura Hydroelectric Project at the La Vuelta hydroelectric power station (11.7 MW) and La Herradura hydroelectric power station (19.8 MW) in Colombia.

Participation in Carbon Funds

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

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

Feasibility Studies

With a view to identifying new JI and CDM projects, we carried out feasibility studies for landfill gas emissions reduction projects and projects to reduce methane emissions from livestock manure, both in China.

International Conferences

The J-POWER Group provided simultaneous Japanese interpreting as a language sponsor of Carbon Market Insights, an international conference on emissions trading held by Point Carbon, a Norway-based consultancy (March 2007).

In addition, we participated as an exhibitor in the Carbon Expo held by the International Emissions Trading Association (IETA) in May 2006.

Activities to Support Utilization of the Kyoto Mechanisms

The J-POWER Group is engaged in various activities to support utilization of the Kyoto Mechanisms by other Japanese businesses. For example, as the exclusive agent in Japan for the Norwegian firm Point Carbon, a world leader in information, analysis, and forecasts concerning the emissions trading market, we offer information services targeted to specialists. We also operate a Web-based service called GHG Solutions, which offers information and solutions targeted to Japanese businesses interested in global warming issues.

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The Kyoto Mechanisms and J-POWER's CO_2 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 by the Kyoto Protocol as a way of achieving the emissions reduction targets at the lowest possible cost. This makes it possible for a country like Japan, which has already pushed energy conservation to the point where further reductions in greenhouse gas emissions can only come at considerable cost, to pursue CO_2 emissions reductions more cost-effectively, at the global level, by implementing programs to reduce CO_2 emissions in developing countries and elsewhere. These mechanisms are crucial to minimize the economic burden on Japan and keep domestic industry internationally competitive.

With this in mind, J-POWER has been working actively to earn and use credits via CDM and JI. In evaluating the J-POWER Group's progress toward its CO_2 intensity reduction target, we give J-POWER's overseas CDM and JI projects the weight they deserve by applying the credits earned to offset J-POWER Group CO_2 emissions.

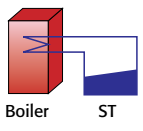
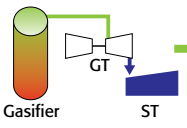
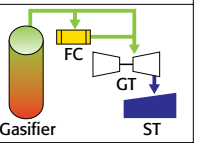
Development, Transfer, and Dissemination of New Technologies

Aiming for significant improvement in the efficiency of coal use, the J-POWER Group is pushing forward with the development of oxygen-blown coal gasification technology, which can be effectively combined with CO_2 capture technology. We are also testing technology for capture of CO_2 from pulverized-coal thermal power stations and conducting research into geological storage of CO_2.

High-Efficiency Coal Gasification Power Generation (IGCC, IGFC)

By converting coal to gas and combining different methods of power generation, it is possible to achieve far greater generation efficiency than conventional thermal power generation using pulverized coal, and this in turn leads to lower CO_2 emissions per unit of electricity generated. In pulverized-coal-fired power stations, electricity is generated by steam turbines alone. But an integrated coal gasification combined cycle (IGCC) system uses two forms of power generation, gas turbines and steam turbines, while an integrated coal gasification fuel cell combined cycled (IGFC) system adds a fuel cell to this mix to yield triple combined cycle generation. IGFC is considered the ultimate high-efficiency coal use technology, and the J-POWER Group is leading the world in its development. When these efforts bear fruit, it should be possible to improve generation efficiency to be approximately 60% and reduce CO_2 emissions by approximately 30% compared with conventional pulverized coal-fired power generation. With this goal in mind, the J-POWER Group is currently involved in the Multi-Purpose Coal Gasification Technology Development (EAGLE) project, as well as in research and development of a solid oxide fuel cell (SOFC).

■ **Next-Generation Coal-Fired Thermal Power Generation Technologies**

Latest pulverized-coal-fired thermal power (USC)	Integrated coal gasification combined cycle (IGCC at 1,500°C)	Integrated coal gasification fuel cell combined cycle (IGFC)
		
Gross thermal efficiency: 42% Net thermal efficiency: 40% (Comparative basis)	Gross thermal efficiency: 51–53% Net thermal efficiency: 46–48% CO_2 reduction: -15%	Gross thermal efficiency: more than 60% Net thermal efficiency: more than 55% CO_2 reduction: -30%

ST: steam turbine GT: gas turbine FC: fuel cell

Multi-Purpose Coal Gasification Technology Development (EAGLE)

To make technologies like IGCC and IGFC a practical reality, coal must be efficiently converted to gas, and the gas must be thoroughly cleansed of such matter as dust and sulfur.

Through the EAGLE pilot test (fiscal 2002 through fiscal 2006), which was carried out under a joint research project with the New Energy and Industry Development Organization (NEDO), we verified the basic performance and long-term reliability of such technology and obtained the data required to build a larger scale plant. For the next three years, beginning in fiscal 2007, we will be carrying out EAGLE Step II with a view to improving the performance of our gasification technology and verifying the applicability of the technology for separating CO_2 from synthesis gas as a way of countering global warming.

EAGLE Pilot Test Facility (J-POWER Wakamatsu Research Institute)

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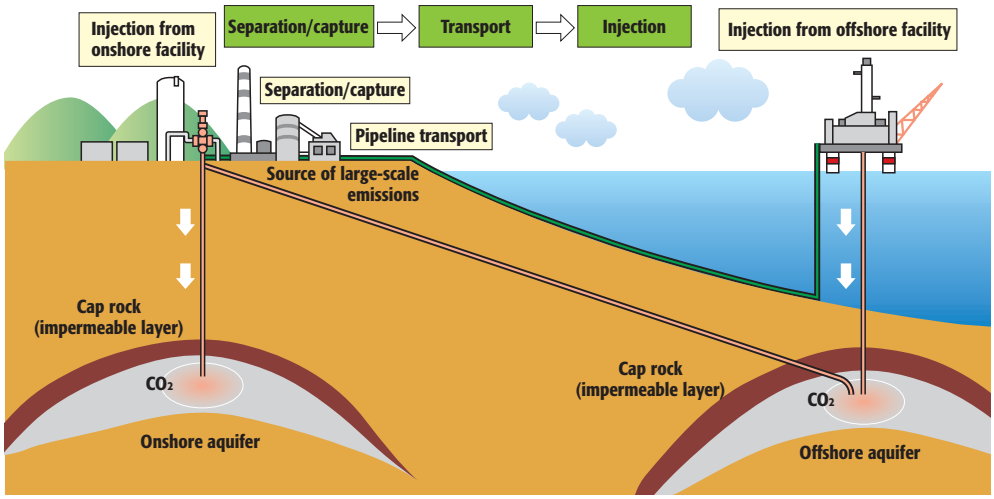
Solid Oxide Fuel Cells (SOFC)

In fuel cell power generation, hydrogen produced from gasified fuel reacts electrochemically with the oxygen in the air to produce electricity. Unlike power generation processes in which the heat generated by burning fuel is converted to electrical energy, this process generates electrical energy directly from the feedstock, resulting in low energy loss and high generation efficiency.

The SOFC under development by the J-POWER Group is made of an ion-conductive ceramic and produces high heat of 900°C–1,000°C during the electrochemical reaction. By using the hot exhaust in combination with gas turbines in a hybrid system, it is possible to achieve higher generation efficiency than with other types of fuel cells.

Testing of one of the world's largest capacity atmospheric-pressure SOFC systems, with an output of around 150 kW, is now under way at the Chigasaki Research Institute.

■ Illustration of CO_2 Storage Technology



Source:
Reference material for March 14, 2006, meeting, Global Environment Commitee, Central Environment Council.

As the next step toward development of a commercially viable system, study has begun on a large-scale demonstration trial of oxygen-blown coal gasification. We see this as an important step toward a further improvement in efficiency, which will enable the development of IGFC power generation, and a solution to global warming.

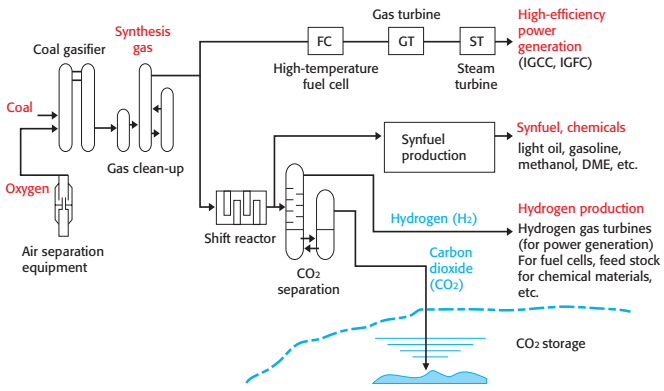
CO_2 Capture and Storage (CCS) Technology

● Capture from Synthesis Gas Derived from Oxygen-Blown Coal Gasification

In the EAGLE Pilot Test, due to the use of the oxygen-blown method, the derived gas produced by coal gasification has low nitrogen content and consists primarily of carbon monoxide (CO) and hydrogen (H_2). By converting the CO to CO_2 using the shift reaction ($CO + H_2O \rightarrow CO_2 + H_2$) and increasing the concentration further, the CO_2 can be captured efficiently, which offers an advantageous in terms of working toward zero CO_2 emissions. Taking advantage of this feature, we intend to build a CO_2 capture test facility at the EAGLE Pilot Test plant and carry out verification tests.

After CO_2 separation, the synthesis gas, having a high concentration of hydrogen, is suitable for use in clean fuel-cell power generation or as feedstock for the chemical industry. In addition, it is possible to produce synthetic fuels such as methanol or dimethyl ether (DME) from the derived gas. In this way, coal gasification technology can contribute to the stabilization of Japan's energy supply through expanded use of coal as well as helping protect the global environment.

■ Possibilities for Oxygen-Blown Gasification Technology



● Capture from Pulverized-Coal-Fired Power Stations

At present, pulverized-coal thermal power is widely employed as a coal-fired power generation system, and separation and capture of the CO_2 in the flue gas after combustion could become an important method for reducing CO_2 emissions in the future.

At Matsushima Thermal Power Station, we have been collaborating with Mitsubishi Heavy Industries Ltd. in demonstration trials using the chemical absorption method. Through operating trials carried out in fiscal 2006, we verified the applicability of this technology to existing pulverized-coal thermal power facilities by examining the influence of trace substances in the flue gas on the test facilities.

In addition, we are currently involved in preparatory study to develop oxyfuel technology, in which oxygen instead of air is supplied to boilers for combustion, in connection with a project being planned in Australia to demonstrate an integrated system encompassing CO_2 separation, capture, and geological storage.

CO_2 separation and capture demonstration test equipment at the Matsushima Thermal Power Station No. 2 unit

● Research on Geologic Storage of CO_2

J-POWER is involved in a three-year project beginning in fiscal 2005 to study the geological structure of an area near a source of large-scale CO_2 emissions in order to design survey and assessment methods to estimate the amount of CO_2 that can be geologically stored there (commissioned by the Engineering Advancement Association of Japan). We are also participating in the project "Development of Technology for CO_2 Georeactor Sequestration of Flue-Gas CO_2" from 2007 by performing chemical reaction simulation as part of the study on CO_2 mineral trapping at the Ogachi geothermal field (commissioned by the Research Institute of Innovative Technology for the Earth).

In addition, working with the National Institute of Advanced Industrial Science and Technology, we are developing a reservoir simulator for supercritical CO_2 behavior and a simulation analysis method incorporating geophysical monitoring techniques.

Note: For data on the number of patents that J-POWER owns, including those relating to research on global environmental issues, see page 78 in the Materials section.

Reduction of Emissions of Greenhouse Gases Other Than CO_2

The Kyoto Protocol of the Framework Convention on Climate Change covers six types of greenhouse gases. The J-POWER Group is working to ensure adequate control not only of CO_2 but also of other greenhouse gases (SF_6, HFC, PFC, N_2O, and CH_4) and is doing its utmost to reduce emissions of these gases. We are also taking appropriate steps to control specified CFCs and halons that deplete the ozone layer.

Measures for Reducing Emissions of Other Greenhouse Gases

The greenhouse gases covered by the Kyoto Protocol include five types in addition to CO_2. With respect to emissions by the electric utility industry, the contribution of these gases to global warming is about 1/400 that of CO_2.*

Sulfur hexafluoride (SF_6) is used in a confined state and is therefore not released into the atmosphere during use. However, partial release can occur when equipment is inspected or discarded. We are working to minimize such emissions through consistent recovery and reuse. In fiscal 2006, our recovery rate for SF_6 was 99%.

* Federation of Electric Power Companies of Japan, Environmental Action Plan by the Japanese Electric Utility Industry (September 2006).

■ **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 fiscal 2006, our rate of recovery and reuse was 99%
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_2O)	The J-POWER Group is working to keep emissions to a minimum by improving thermal efficiency of coal-fired power stations. (In fiscal 2006, emissions of N_2O totaled approximately 1,580 t.)
Methane (CH_4)	As CH_4 concentrations in flue gases from coal-fired 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. For this reason reductions in the production and consumption of these substances have been mandated internationally.

As a user of these substances, we are not subject to direct regulation. Nevertheless, we periodically monitor our stocks and consumption and work hard to maintain appropriate controls and to limit emissions.

■ **Stocks and Consumption of Specified CFCs and Halons**

Category	As of year-end, fiscal 2006 (tons)				Application
Specified CFCs	Stock	1.8	Consumption	0.0	Refrigerant
Halons	Stock	4.3	Consumption	0.0	Fire extinguisher
Other CFCs, etc	Stock	9.9	Consumption	0.3	Refrigerant
Total	Stock	16.0	Consumption	0.3	
CFC substitutes (HFCs)	Stock	8.4	Consumption	0.0	Refrigerant

About Specified CFCs and Halons

Ozone-depleting substances, such as specified CFCs and halons, are chemically stable compounds that contain chlorine or bromine. Like HFCs, PFCs, and SF_6, they also have a powerful greenhouse effect.

Under the Ozone Layer Protection Law (Law Concerning the Protection of the Ozone Layer through the Control of Specified Substances and Other Measures), the production and consumption of substances targeted for regulation under the Montreal Protocol, referred to as "specified substances," is being phased out according to a regulatory schedule. As a result, halon production had completely halted by the end of 1993, and production of specified CFCs had stopped by the end of 1995. The production of other ozone-depleting substances is also being phased out.

Efforts to Reduce Environmental Load during Distribution

Reducing Environmental Load Using Larger Coal Carriers

In fiscal 2006, approximately 19 million tons of coal were imported to Japan from overseas (Australia, China, Indonesia, etc.). We have contracted with shipping companies to use larger dedicated bulk carriers (approximately 90,000–150,000 t), and three new coal carriers were completed in fiscal 2006.

The use of larger coal carriers cuts back on the amount of fuel oil consumed per unit of coal transported and reduces the environmental load of transport (emissions of CO_2, sulfur oxides, nitrogen oxides, etc.).

Reducing Environmental Load by Marine Transport of Coal Ash

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

In fiscal 2006, J-POWER used marine transport to ship some 1.31 million tons of coal ash from its power stations to cement plants or other locations around the country, so that it could be put to use as a raw material for cement, concrete admixture, land reclamation material, and so on.

Approximately 90% of the coal ash we ship is transported by dedicated carriers and other ships. The use of maritime transport reduces the environmental load of shipping, such as CO_2 emissions, as compared with truck or train transport.

Dedicated coal-ash carrier Shoyo-maru

Energy Conservation at Our Offices

Energy Conservation Activities

As part of our effort to prevent global warming, we implement rigorous energy-saving policies at all our business sites, including lights off during lunch break and reduced power supply to equipment on standby. In addition, we are actively installing energy-saving equipment in every new office we build.

In terms of Japan's overall efforts to combat global warming, more intensive energy conservation is required not only of the industrial sector but of the consumer and transportation sectors as well. To do its part, the J-POWER Group has adopted the group-wide goal of reducing office electricity use and office fuel use by at least 4% from the fiscal 2006 levels by fiscal 2010 in order to take our office energy conservation efforts to the next level. By adding this target, we intend to promote new efforts in addition to the initiatives already in place.

Energy Conservation at J-POWER's Head Office

J-POWER's Head Office building consumes the most energy of any office in the J-POWER Group. For this reason we have developed an energy conservation policy for the head office that includes use of exhaust heat from air conditioners and recovery of exhaust heat from computer rooms, installation of regenerative heat pumps, and strict enforcement of a "lights off when not in use" policy. As a result of these and other energy-conservation efforts, 1.78 million kWh of electricity were consumed for lighting purposes at the head office in fiscal 2006.

column

Energy Conservation Services

Our activities center on electricity supply-side measures, and we are also keenly aware of the importance of demand-side management. For this reason we offer energy auditing and consulting services, as well as sales and installation of energy-saving equipment, both domestically and overseas.

Domestically, we have offered energy audits and carried out energy-saving conversions for national and local governments, universities, elementary, middle, and high schools, hospitals, office buildings, shopping centers, and so on. As of the end of fiscal 2006, we had performed about 77 energy audits. We also implemented an energy-saving conversion of air-conditioning at a university (designed by J-POWER, installed by JP Hytec) that reduced the air-conditioning load by more than 30%. We also carry out technical evaluation and sales support for excellent energy-saving products (including the "EcoSylphi" for mitigating imbalance of indoor temperatures, high-efficiency ballast and fluorescent lamps, etc.).