Environmental Action Plan by the Japanese Electric Utility Industry

21 September, 2004

The Federation of Electric Power Companies of Japan

(FEPC)

Contents

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Introduction

The Japanese electric utility industry has recognized environmental protection as one of society's greatest concerns and has worked actively towards its solution. The issue of environmental protection has branched out in many ways to include mitigation of climate change, managing chemical substances and promoting recycling and handling waste as we seek to build a recycling society.

These environmental problems differ from the pollution problems of the past in that each member of society is both responsible for and affected by the problem, and that these problems are closely connected with our lifestyle. Therefore, all parties must voluntarily and proactively work to reduce the burden on the environment. Recognizing this, the twelve electric power-related companies which comprise the Federation of Electric Power Companies (FEPC),[1)] as the ones most knowledgeable about the electric utility industry, have formulated and made public in November 1996 the "Environmental Action Plan by the Japanese Electric Utility Industry." This plan establishes the targets, as well as the measures to achieve them.

The Federation reviews the action plan annually to ensure its transparency and the achievement of its targets, and has recently completed the seventh review.

1. Measures to Mitigate Climate Change

(1) Basic Policy for the Mitigation of Climate Change

Based on the government's Guideline of Measures to Prevent Global Warming ("Guideline"), which sets forth basic measures for meeting the goal of reducing greenhouse gases by 6% as stipulated by the Kyoto Protocol, the government is preceding with individual initiatives, making evaluations of its progress in the first phase (2002 – 2004), and revising its program accordingly. The government plans to draw up a new Guideline in 2005.

Meanwhile, although growth in energy consumption in Japan is expected to structurally slow down because of structural changes in the population, economy and social structure going forward, for the present, consumption is forecast to increase led by the private sector (household, commercial), as the Japanese people seek greater abundance in their lifestyles.

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1) The twelve electric power-related companies affected include ten members of the Federation of Electric Power Companies (Hokkaido Electric Power Co., Tohoku Electric Power Co., Tokyo Electric Power Co., Chubu Electric Power Co., Hokuriku Electric Power Co., Kansai Electric Power Co., Chugoku Electric Power Co., Shikoku Electric Power Co., Kyushu Electric Power Co. and Okinawa Electric Power Co.) as well as Electric Power Development Co. and Japan Atomic Power Co.

At the same time, having experienced two oil crises, manufacturers and other industries in Japan have made great strides in energy conservation, and the country's energy consumption per unit of GDP is already among the lowest in the world.

In light of these various circumstances, achieving the goals set forth in the Kyoto Protocol is expected to be extremely difficult. If we are to meet these targets, greater awareness of the importance of the issue of global warming among all parts of society, as well as continuous and aggressive action to resolve these problems, are essential.

The electric utility industry is seeking to resolve the "three E trilemma" (namely, economic growth, energy security and environmental conservation) and is doing its utmost, based on a fundamental concept of ensuring the stable supply of high-quality inexpensive electricity, to implement measures to reduce greenhouse gas emissions that focus on the promotion of nuclear power.

(2) CO_2 Emissions Reduction Targets and CO_2 Emissions

(i) CO_2 Emissions Reduction Targets

The electric utility industry has set the following CO_2 emissions goal, as measured in kg of CO_2 per kWh of energy used by the end user (this is also known as CO_2 emissions intensity) with respect to the benchmark in fiscal year 1990.

> By fiscal 2010, we aim to further reduce CO_2 emissions intensity (emissions per unit of user end electricity) by approximately 20% from the fiscal 1990 level, to about 0.34 kg of CO_2/kWh.

The amount of CO_2 emissions accompanied by the use of electricity can be calculated by multiplying electric power consumption by the CO_2 emissions intensity. Of these factors, electric power consumption can increase or decrease due to factors that the efforts of electric companies cannot affect, such as the weather and the circumstances for using electricity. For this reason, the electric utility industry adopts goals for consumption units that can reflect their own efforts.

This target was set based on supply and demand forecasts at the time the Environmental Action Plan was drawn up in 1996 and on the anticipated development of nuclear power, among other considerations, and it assumes the industry's highest level of commitment. The electric utility industry recognizes that the target is extremely challenging, but is dedicated to exerting its utmost efforts toward its achievement.

While total electricity consumption is expected to increase 37% over the fiscal 1990 level by fiscal 2010, we calculate that growth in total CO_2 emissions will be held to around 10%.

(ii) CO_2 Emissions in Fiscal 2003

Electric power consumption stood at approximately 834 billion kWh in fiscal 2003, a roughly 7 billion kWh decrease (0.8%) from the fiscal 2002 level due to a drop in demand caused by the cool summer and warm winter.

On the other hand, total CO_2 emissions in fiscal 2003 stood at 363 million tons of CO_2, a 21 million ton CO_2 increase (6.1%) from the fiscal 2002 level.

As a result, the CO_2 emissions intensity for fiscal 2003 was 0.436kg of CO_2/kWh, an increase (7.1%) over the fiscal 2002 figure of 0.029 kg of CO_2/kWh.

Note that electric power consumption is 27% higher than in fiscal 1990 (an annual average increase of 1.8%), and in that period, CO_2 emissions increased by 31%. The result is a 0.015 kg of CO_2/kWh increase in CO_2 emissions intensity.

Item \ Fiscal Year	1990 (results)	2001 (results)	2002 (results)	2003 (results)	2005 (est.)	2010
Electric power consumption (billion kWh)	659	824	841	834	846	(est.) 905
CO_2 emissions (million t-CO_2)	277 [2]	312 [13]	342 [17]	363 [20]	310	(est.) 320
CO_2 emissions intensity (user end electricity) (kg-CO_2/ kWh)	0.421	0.379	0.407	0.436	0.37	(est.) 0.36 Refer to pg. 10 for enhanced measures (Target) 20% reduction vs. FY1990 (about 0.34)

* CO_2 emissions intensity (user end electricity) = CO_2 emissions ÷ energy consumption

* CO_2 emissions is the total of CO_2 emissions for each type of fuel. It is calculated as follows:
CO_2 emissions =Calorific value attending fossil fuel combustion x CO_2 emissions coefficient

* Calorific value uses figures stated in the Agency for Natural Resources and Energy's Fiscal 2004 Fuel Plan for Steam Power Generation, etc. Fuel-specific CO_2 emissions coefficient uses the figures stated in the Ministry of the Environment's Report on Comprehensive Total Greenhouse Gas Emission Estimate Investigation (August 2002).

* Estimates for fiscal 2005 and 2010 are based on fiscal 2004 energy supply plans, which consider GDP indicators, demand trends and other factors.

* Electric power consumption and CO_2 emissions include power purchased from cooperative thermal power plants, IPPs (independent power producers), and household generators, and sold, and CO_2 given off when the purchased power was generated.

* Figures in parentheses represent total CO_2 emissions from the power purchased from IPPs and household generators, and CO_2 reduction efforts are expected from each source. For the purposes of calculation, calorific value is estimated from the amount of power purchased.

(iii) Analysis and Evaluation of CO_2 Emissions

a. Analysis of factors contributing to change in CO_2 emissions intensity

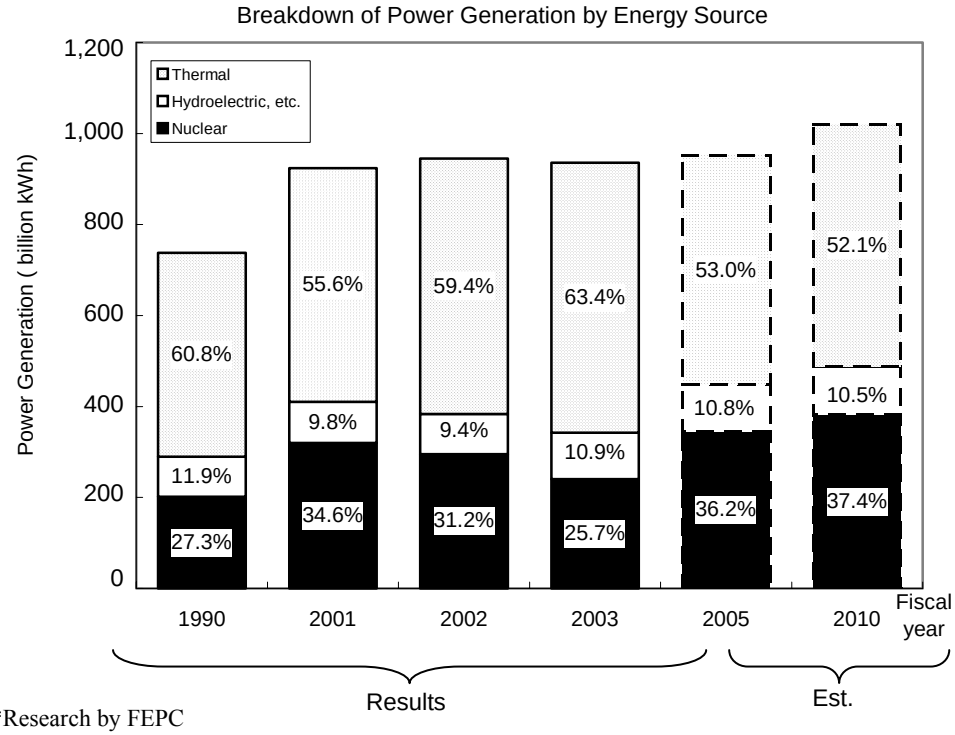
CO_2 emissions intensity (user end electricity) was 0.436 kg of CO_2/kWh in fiscal 2003, which represents an increase from fiscal 2002.

This is because the factors reducing CO_2 emissions, namely, decreased power demand and increased hydroelectric power generation, were outweighed by the impact of long-term shutdowns of nuclear power plants due to problems recording independent inspections.

Despite the electric utility industry's efforts to improve the efficiency of thermal power plants and to increase the capacity factor at nuclear power plants, the shutdown of some nuclear power plants in fiscal 2003 was one full year, so the impact was greater than in fiscal 2002 when the plants were shutdown for only around half a year. Nuclear generated power for the industry as a whole decreased substantially, from 294.9 billion kWh in fiscal 2002 to 240.0 billion kWh in fiscal 2003, and the capacity factor decreased from 73.4% in fiscal 2002 to 59.7% in fiscal 2003. (The historic high was 84.2% in fiscal 1998.)

As a result, as shown in the diagram below, nuclear power as a percentage of total power generation was 25.7%, for a decrease greater than that in fiscal 2002. Compensating for this reduction, the proportion of oil-fired and coal-fired thermal power generation to the whole increased 4.0%. For this reason, consumption of the fossil fuels used in thermal power generation increased, which led to increases in CO_2 emissions and emissions intensity.

Supposing the planned capacity factor of 84.1%[2)] had not been impacted by the long-term nuclear power plant shutdowns and the plants had operated in fiscal 2003, nuclear generated power would have increased roughly 98.0 billion kWh, which would have reduced CO_2 emissions approximately 60 million tons to around 303 million tons of CO_2. CO_2 emissions intensity also would have been 0.364 kg of CO_2/kWh, a 0.072 kg of CO_2/kWh decrease compared to the actual figures.



*Research by FEPC

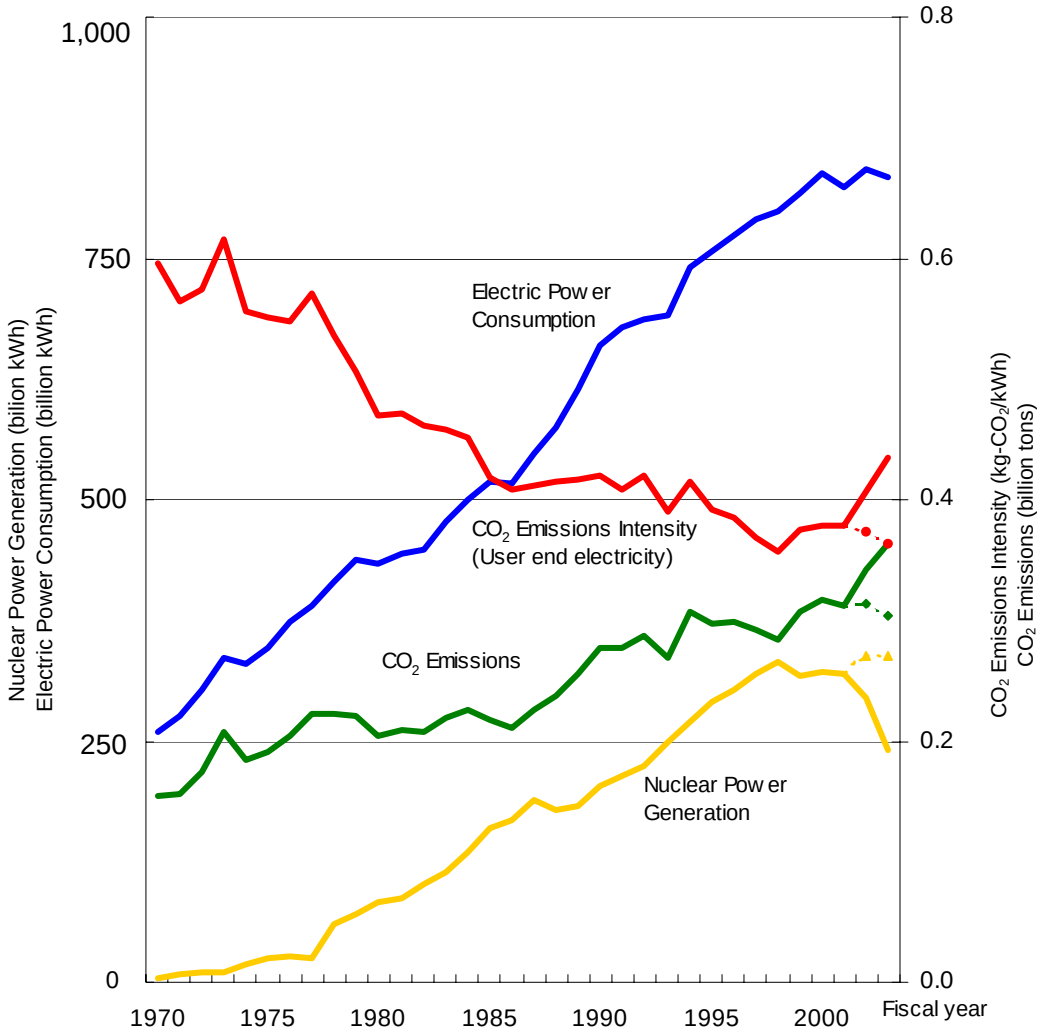
2) Planned capacity factor (84.1%) for fiscal 2002 stated in the fiscal 2002 supply plans.

[Reference: Trends in CO_2 Emissions, etc. by the Electric Utility Industry]

Since the oil crises of the 1970s, power consumption in Japan has increased approximately three point two times, but CO_2 emissions have increased only two point four times. This is because CO_2 emissions per kWh (CO_2 emissions intensity) has decreased to about three-fourths of the previous figure.

This improvement is largely the result of expanded use of nuclear power which emits no CO_2 to generate power, and of liquefied natural gas (LNG) which emits comparatively little CO_2, as well as the improved efficiency of thermal power generation.

CO_2 Emissions by the Electric Utility Industry



* The marked dotted lines indicate estimates supposing no impact was exerted by the long-term shutdown of nuclear power plants in fiscal 2002 and 2003.

b. Results of Efforts to Reduce CO_2 Emissions

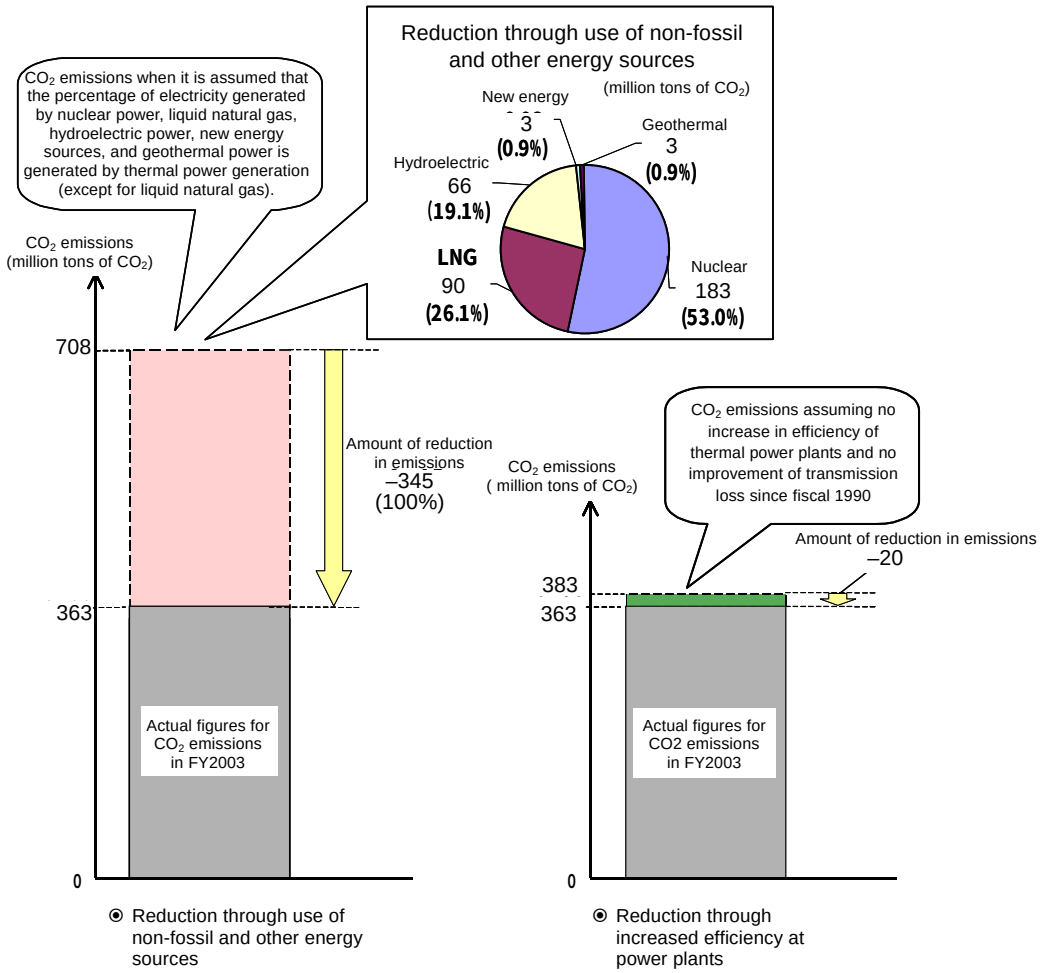
(a) Reduction Through Use of Non-Fossil and Other Energy Sources

The result of reducing CO_2 emissions through the use of nuclear power, liquid natural gas, hydroelectric power and other energy sources is provisionally estimated by assuming electric power was not generated by these sources but the same amount was generated by thermal power generation other than liquid natural gas. As a result, the amount reduced was calculated at 345 million tons of CO_2, which is close to the same level as the actual figures for fiscal 2003. The emissions reductions generated by using nuclear power are especially significant: 183 million tons of CO_2. This corresponds to 15% of CO_2 emissions in Japan (1,248 million tons of CO_2) for fiscal 2002. Under the impact of the long-term shutdown of nuclear power plants, this figure represents a decrease of 19% over the actual result in fiscal 2002 of 225 million tons of CO_2.

(b) Reduction Through Increased Efficiency at Power Plants

Improving the efficiency of our thermal power plants and improving the rate of transmission loss is provisionally estimated to have prevented 20 million tons of CO_2 emissions.

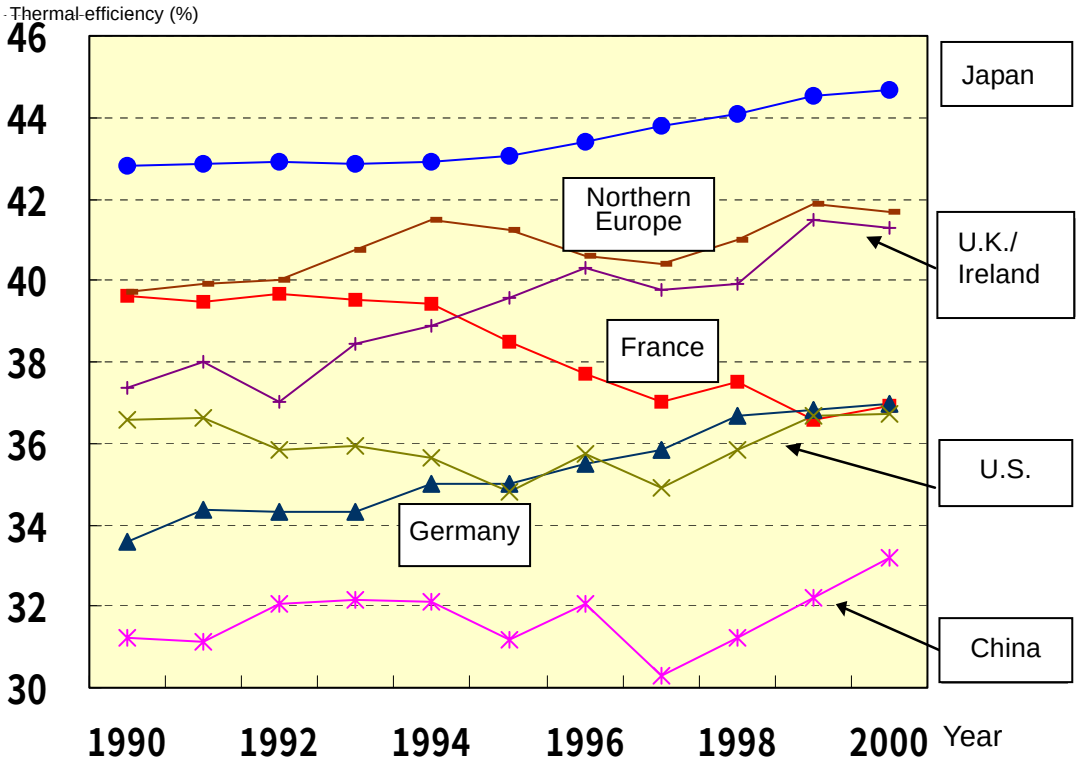
CO_2 Emissions and Reduction of Potential CO_2 Emissions in Fiscal 2003
Preliminary calculation by FEPC



[Reference: Country-by-Country Comparison of Thermal Power Generating Efficiency]

Japan's electric utilities worked to maintain thermal efficiency through thermal efficiency management and efforts to further raise efficiency including increasing the combustion temperatures of gas turbines used in LNG combined cycle power generation and raising the temperature and pressure of steam in boiler and turbines. As a result, the thermal efficiency of Japan's thermal power plants is at the highest level in the world.

Comparison of thermal power plant efficiency in Japan with other countries



* Thermal efficiency is the gross generating efficiency based on the weighted averages of efficiencies for coal, petroleum and gas (low heat value standard).

* Comparisons are made after converting Japanese data (high heating value standard) to low heat value standard, which is generally used overseas. Low heat value figures are around 5 - 10% higher than high heat value figures.

* Private power generation facilities, etc. not covered.

Sources: Overseas data: Comparison of Power Efficiency on Grid Level, 2004 (Ecofys)
Domestic data: Overview of Electric Power Supply and Demand, 2002 (Agency for Natural Resources and Energy)

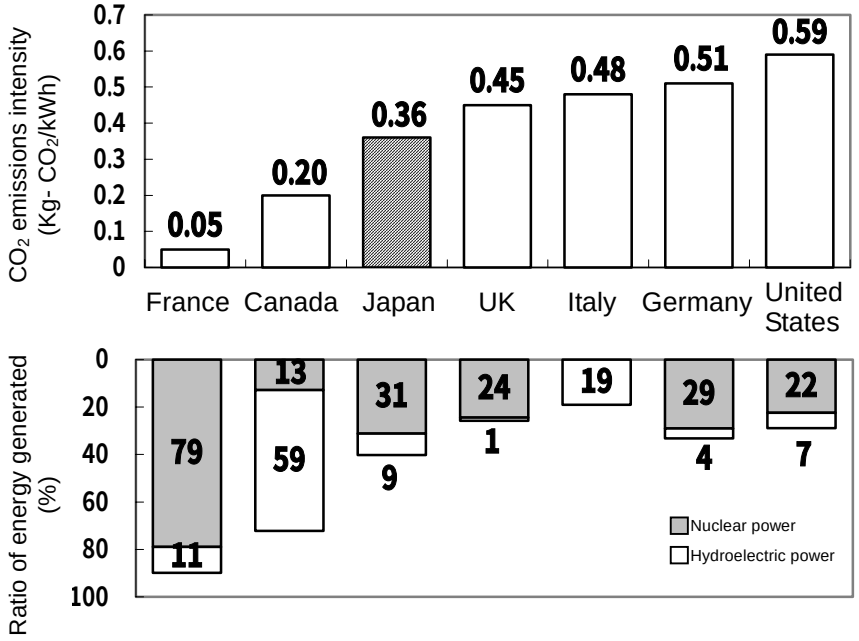
[Reference: Country-to-Country Comparison of CO_2 Emissions Intensity (per unit of energy generated)]

CO_2 emissions from Japan's electric utilities accounts for approximately 1.3% of the world total in fiscal 2001 and for about 27% of Japan's total CO_2 emissions in fiscal 2002.

However, CO_2 emissions intensity (per unit of energy generated) in Japan is low in comparison with major European and North American countries, although not as low as Canada (which has a high ratio of hydroelectric power generation) and France (a high ratio of nuclear power generation).

Thus, it can be said that the electric utility industry of Japan has sought to implement the "best mix" of power sources, centering on nuclear power with the optimal ratio of thermal, hydroelectric and other power sources.

Country-by-country Comparison of CO_2 Emissions Intensity (per unit of energy generated)
Preliminary calculation by FEPC



*Fiscal 2002 figures
*Source: Energy Balances of OECD Countries 2001-2002
*Figures for Japan from FEPC

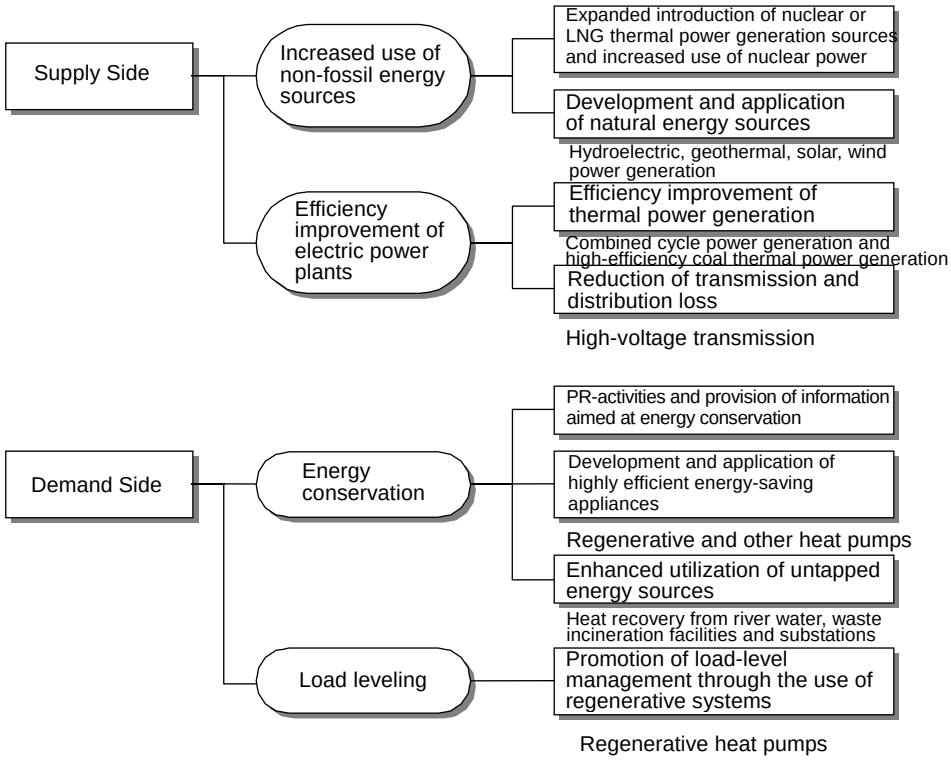
(3) Future Efforts and Issues for Reducing CO_2 Emissions

(i) Summary of Measures to Reduce CO_2 Emissions

Measures by the electric utility industry to suppress CO_2 emissions can be broadly classified into "supply side" and "demand side" measures. Following is a summary of each.

- **Supply-side measures**
  - Expanded introduction of nuclear power generation, which emits no CO_2 to generate power, and of liquefied natural gas (LNG), which emits comparatively little CO_2; increased use of nuclear power generation
  - Development and application of natural energy sources such as hydroelectric, geothermal, solar and wind power
  - Enhancing the efficiency of thermal power generation by introducing combined-cycle systems and high-efficiency coal-fired thermal power generation, as well as improving the efficiency of power facilities by reducing transmission/distribution power losses

- **Demand-side measures**
  - PR activities and provision of information on energy conservation measures for customers, development and application of highly efficient, energy-conserving appliances like heat pumps, and using untapped energy sources
  - Promotion of load leveling by the use of regenerative heat systems, etc.



(ii) Future Efforts and Issues

The electric utility industry will continue to aggressively push forward with both supply-side and demand-side initiatives to achieve its CO_2 emissions reduction target. However, with plans to develop power sources being revisited due to expanded liberalization and stagnating growth in power demand and with ongoing delays in locating sites for nuclear power plants, it is becoming exceedingly difficult to meet this target.

The industry plans to commit its full efforts to achieve its objective by continuing to steadily implement existing measures and by strengthening the following initiatives[3] in order to further improve effectiveness.

- Promotion of nuclear power on the precondition of ensuring safety and restoring trust
- Further improvement of the efficiency of thermal power generation and review of methods for managing thermal power sources
- Active utilization of the Kyoto Mechanisms, etc.

a. Promotion of Nuclear Power on the Precondition of Ensuring Safety and Restoring Trust

Continuing on from fiscal 2002, the influence of long-term shutdowns of nuclear power plants led to a substantial increase in CO_2 emissions intensity in fiscal 2003. Nuclear power, which does not emit CO_2 in the course of generating electricity, is extremely important to the electric utility industry, and we believe that it will play a major role in Japan's efforts against global warming in the future.

Additionally, the promotion of nuclear power is positioned as one of the principal measures in the government's Guideline of Measures to Prevent Global Warming. It is also positioned as the nation's core energy source in the government's Basic Energy Plan. This indicates the importance of the private sector and the government working together to promote nuclear power.

That is why the electric utility industry is making every effort to restore confidence in nuclear power and has made promotion of nuclear power its most important management issue. We will cooperate with the government to gain the understanding of local communities, local governments, and the Japanese people based on a policy of ensuring safety guarantees, and pour our greatest efforts into promoting sites for nuclear power plants, raising the capacity factor, establishing a nuclear fuel cycle, and setting up back-end measures.

Furthermore, with respect to increasing the capacity factor, we will work to expand implementation of rated thermal power operation[4] (implementation is already complete at 90% of the nuclear power plants nationwide), and while making reference to the achievements of other countries,[5] we will further raise the factor through scientific, rational operations management.

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[3] The Energy Supply and Demand Subcommittee of the Advisory Committee for Energy in June 2004 and the Global Environment Subcommittee of the Environment Committee of the Industrial Structure Council in August 2004 made clear that additional response measures are necessary in order to achieve the targets of the voluntary action plan of the electric power industry, and that the government will review the efforts of the industry to meet the targets by increasing capacity factor of nuclear power, improving thermal power plant efficiencies, considering methods for managing thermal power sources and utilizing the Kyoto Mechanisms.

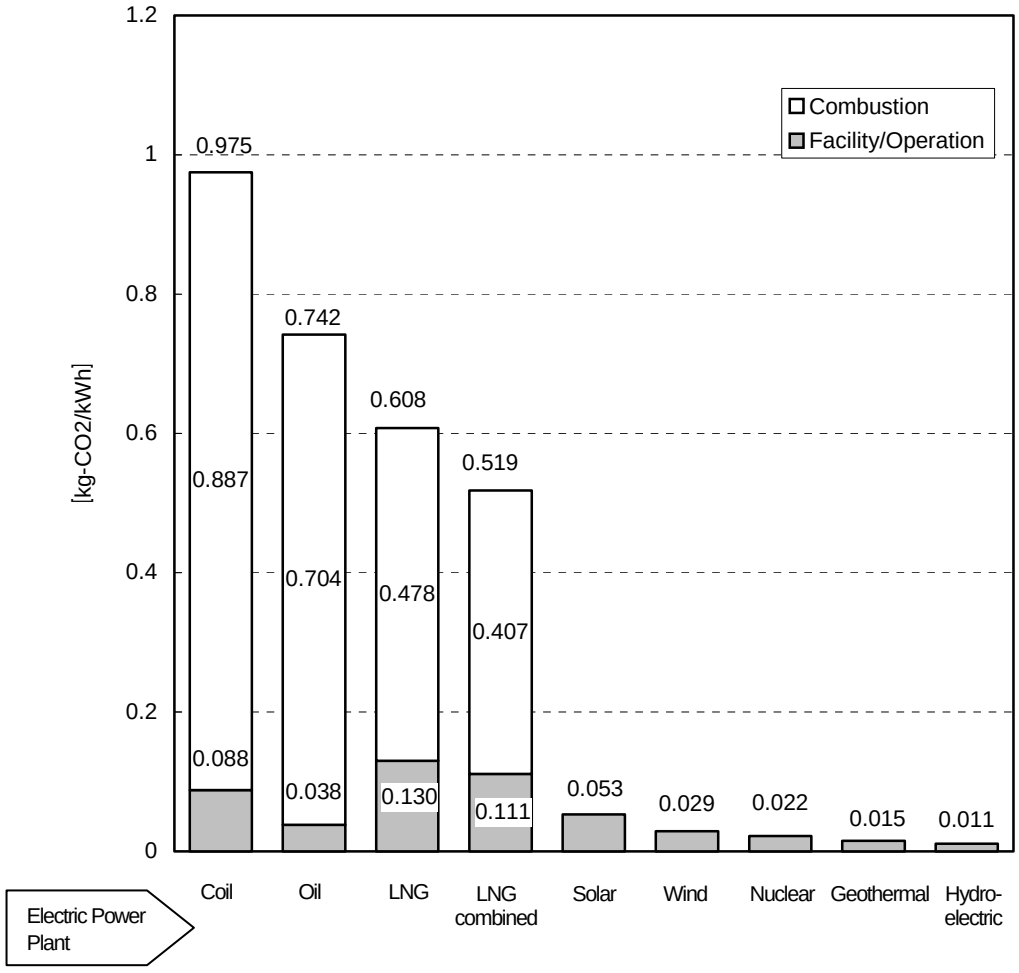
[4] A method of operation that keeps the thermal output of a nuclear reactor uniform through rating. The efficiency of the turbine increases when the temperature of the seawater is low, making it possible to produce more electricity. Formerly, plants were operated at lower thermal output when the temperature of the seawater was low, in order to keep electrical output uniform.

[5] The capacity factors for selected other countries in 2002 were 89.1 % for the U.S., 92.4% for South Korea, 91.7% for Spain and 92.2% for Switzerland (from Japan Atomic Industrial Forum research)

[Reference: Lifecycle Assessment CO_2 Emissions Intensity for Japan's Energy Sources]

A comparison of CO_2 emissions over the entire life cycle of different energy sources, including the stages of energy extraction, plant construction, transportation, refining, plant operation and maintenance, shows that CO_2 emissions from nuclear power are as low as those from solar and wind power, and that nuclear power is an ideal source of energy for mitigating climate change.

Lifecycle Assessment CO_2 Emissions Intensity for Japan's Energy Sources



* Based on total CO_2 emissions from all energy consumed in energy extraction, plant construction, transportation, refining, plant operation and maintenance, etc. in addition to burning of the fuel.

* Data for nuclear power includes reprocessing of spent fuel in Japan (now in the planning stages), use of Plu-thermal technology (assumes recycling once) and disposal of high level radioactive waste.

* CO_2 emissions from the uranium enrichment process are calculated according to the ratio of uranium enriched in Japan. If it is assumed that all uranium is enriched domestically, the figure for nuclear power would be 0.010kg-CO_2/kWh.

* In some cases, the sum of "fuel" and "equipment/operation" do not correspond exactly with the total values listed due to the rounding up of numerical data.

(Source: Report of the Central Research Institute of Electric Power Industry)

b. Further Increase in the Efficiency of Thermal Power, and Reviewing Thermal Power Plant Operating Methods

The electric utility industry has endeavored to improve the efficiency of thermal power.

A balanced ratio of energy sources (LNG, coal and oil) needs to be developed and used that takes into account the supply stability and economic advantage and environmental impacts of each fuel.

Improving the efficiency of thermal power directly helps to decrease CO_2 emissions intensity, so the industry is proceeding with deliberations on stepping up implementation of high efficiency facilities such as LNG combined-cycle plants. It is also working to raise the combustion temperature and to develop technology for integrated coal gasification combined-cycle (IGCC) power generation.

The industry is also reviewing ways of managing thermal power sources that give consideration to the environment, based on fuel procurement and facilities operation restrictions and the need to ensure energy security.

c. Efforts for Helping to Spread the Use of Natural Energy

The electric utility industry has been cooperating with the Green Power Fund (a program for individual consumers), and the Green Power Certificate System (for corporate users) as part of a long-term effort to promote the use of natural energy.

In addition, the Special Measures Law Concerning the Use of New Energy by Electric Utilities (RPS Law) went into effect in April 2003, and in fiscal 2003 the ten public electric utilities secured use of the mandated volume of new energy. The industry intends to continue to promote the spread of natural energy resources.

Note that natural energy sources have low power density, are easily influenced by weather and require high initial costs. Issues remain in connection with wind power, such as the need to set up systematic links, so we have to move toward solving these problems as well.

d. Promotion of Energy Conservation

The electric utility industry has been actively working to promote the development and popularization of regenerative heat systems, CO_2 heat pump water heaters, and high efficiency commercial air conditioners that use heat pump technology. These technologies limit CO_2 emissions by helping to save energy on the customer side and also by leveling the load on the supply side. The industry has also been engaged in verification tests on home energy management systems, which support household energy conservation activities by optimizing the operation of household appliances and other means.

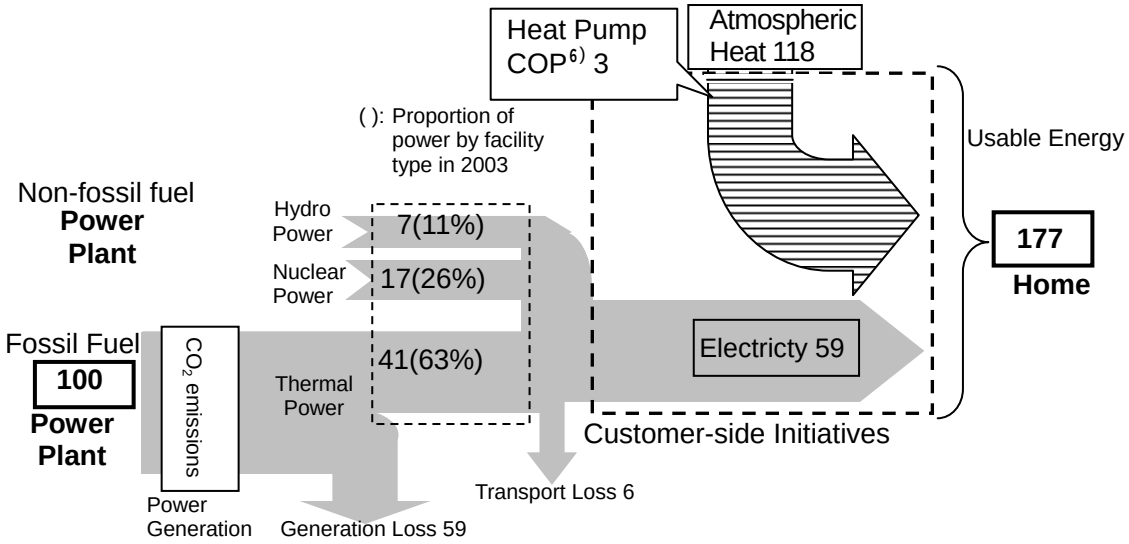
The industry also plans to actively develop initiatives that contribute to the promotion of energy conservation on the customer side. These include providing information that helps customers in energy saving activities and proposing measures via energy diagnoses.

Electric Power Initiatives Directed at CO_2 Reduction on the Customer-Side

Perspectives and evaluations that follow the flow of energy from power plants to customer usage are effective in supporting the more efficient use of electrical energy. Given this perspective, promoting the popularization of high efficiency, energy-saving devices is an important customer-side initiative.

Electricity: From the Power Plant to the Home

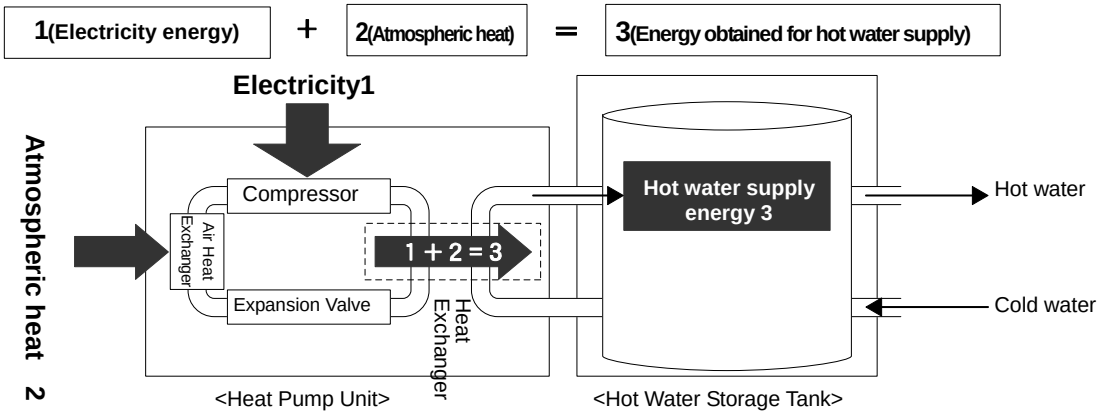
For example, 177 units of energy can be used with 100 units of fossil fuels (energy) by utilizing unused energy from atmospheric heat and other sources with a heat pump. (Sample provisional calculation)



EcoCute Hot Water Supply System: CO_2 Refrigerant Heat Pump Hot Water Heater

EcoCute is a hot water supply system that uses a CO_2 refrigerant heat pump to effectively incorporate heat from the air and use it as energy to heat water. Compared to conventional freon refrigerant, CO_2 refrigerant heat pumps have superior heating properties, so work is being done to extend their usage to hot water heaters. In addition, compared to freon refrigerant, CO_2 refrigerant's impact on global warming is extremely small, meaning that heat pumps that use this coolant are environmentally friendly.

The EcoCute's average annual COP is above 3.0, so it is extremely effective at conserving energy. CO_2 emissions are also reduced by roughly 50% compared to conventional combustion-based hot water heaters.



6) $\text{COP} = \dfrac{\text{Cooling or Heating Capacity (kw)}}{\text{Heat Pump Power Consumption (kw)}}$

(COP=Co-efficiency of Performance)

e. Efforts for Using the Kyoto Mechanisms[7)]

The electric utility industry recognizes the importance of the Kyoto Mechanisms as measures that complement domestic policy because of their contribution to preventing global warming and their cost effectiveness in reducing CO_2 emissions.

The industry is promoting activities overseas that help reduce CO_2 emissions, including biomass power generation, thermal efficiency improvement projects and afforestation projects. Such projects are in anticipation of the Joint Implementation and Clean Development Mechanisms stipulated in the Kyoto Protocol. The industry also provides investment to the World Bank's Carbon Fund and is otherwise actively involved in projects to prevent global warming.

Along with continuing to promote projects that utilize the Kyoto Mechanisms, the industry will review its utilization policies to meet its targets while assessing trends in detailed designs for both domestic and overseas systems.

f. Technological Developments Connected with Global Warming

In response to the problem of global warming, the industry recognizes the necessity of promoting technology research and development from a medium- to long-term perspective. Specifically, we intend to research and develop technologies that help customers conserve energy, technologies for the recovery and processing of CO_2 contained in the gases emitted by thermal power plants, nuclear power related technologies,[8)] and technology for using forests as carbon sinks.

In addition, the industry has trees on their plant sites, including water conservation forests. These help to absorb CO_2, and electric utility industry intend to maintain these forests.

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7) Refers to emissions trading (ET), joint implementation (JI) and the clean development mechanism (CDM) stipulated in the Kyoto Protocol.

8) Technology directed at the establishment of a nuclear fuel cycle, technology to develop next-generation light water reactors, etc.

<Examples of CO_2 Reduction and Absorption by Electric Utilities Overseas>

Project	Outline	Period, etc.
A.T. Biopower rice husk power project in Pichit, Thailand	Japanese government approved CDM project to effectively use rice husks that are disposed of through combustion as fuel for power generation.	2003.12～
Yale rubber wood residue biomass project	Japanese government approved CDM project to effectively use rubber tree scrap wood as fuel for biomass power generation.	2004.3～
e7 Bhutan micro hydro power CDM project	Japanese government approved CDM project to provide electricity to a region without it by constructing a micro hydro power plant.	2003.6～
Methane capture and combustion from swine manure treatment in Chile	CDM project that collects and combusts methane released in the air from state-of-the-art animal waste facilities (Japanese government approval pending)	2004.1 ～2012.12
Technical cooperation in China to improve thermal efficiency of an existing thermal power plants	Project to improve the thermal efficiency of an existing thermal power plant of the electric company, Zhongguo Shandong Dianli	1998.6 ～2001.3
Development of afforestation technology for reviving mangrove ecosystems by the Thai Office of Marine and Coastal Resources	Experimental afforestation project in damaged mangrove forests (such as former sites of shrimp-raising ponds), seeking to restore these potentially effective carbon sinks	2000.10～
Afforestation business projects in Australia	Afforestation projects designed to preserve the world's forest resources and fix atmospheric CO_2	Implemented multiple times
Joint research on afforestation in Australia	An afforestation project to examine the effects of environmental tree planting on coal mine sites.	2004.5 ～2008.3
	Afforestation experiment to improve the soil with gypsum from the desulfurization process of coal-fired thermal power plants	2000.4 ～2006.3
Participation in the World Bank Prototype Carbon Fund and the European Bank for Reconstruction and Development (EBRD) Fund	Prototype Carbon Fund established and operated by the World Bank and other institutions designed to provide accommodate for and invest in projects to reduce greenhouse gases in developing countries ・ World Bank Carbon Fund (PCF) ・ World Bank Community Development Carbon Fund (CDCF) ・ World Bank's BioCarbon Fund (BioCF) ・ Eastern Europe Energy Efficiency Reserve Fund (EEERF) ・ Greenhouse Gas-Credit Aggregation Pool (GG-CAP) ・ Global Asia Clean Energy Service Fund (FEGACE)	PCF: 2000.4～ CDCF: 2003.7～ BioCF: 2004.6～ EEERF: 2000.1～ GG-CAP 2004.12～ FEGACE 2004 .5～

[Reference: CO_2 Emissions from Office Usage and from the Company Fleet]

CO_2 emissions from the services and transportation sectors are increasing and the need for countermeasures is urgent. The electric utility industry itself is promoting initiatives aimed at assessing amounts of CO_2 emitted and curtailing emissions both for electricity consumption in the offices of industry members (services sector) and fuel use by company fleets (transportation sector).

(i) CO_2 emissions from office usage

The amount of power that the electric utility industry used in its offices (head offices, branch offices, sales offices, and rooms in various divisions) was about 900 million kWh in fiscal 2003.

This corresponds to about 0.4 million tons of CO_2 emissions, or approximately 0.11% of the CO_2 emissions (363 million tons of CO_2) from production activities (combustion of fossil fuels).

In its role as a consumer of power, the electric utility industry is engaged in the following efforts to reduce CO_2 emissions from office use.

- Efficient use of air conditioning (appropriate control of room temperature, reducing usage times, etc.)
- Making it a habit to turn off lights during lunch hours and other non-working hours to reduce the number of lights in use
- Encouraging use of the stairs rather than elevators
- Modifying office automation equipment and lighting devices to make them more energy efficient and turning off the power when they are not in use.
- Introducing regenerative cooling systems and solar-powered facilities in company-owned buildings

(ii) CO_2 emissions from the company fleet

The amount of fuel (gasoline and light oil) used by the industry in its own fleet of vehicles totaled about 30,000 kl in fiscal 2003. This corresponds to 70,000 tons of CO_2 emissions, or 0.02% of the CO_2 emissions (363 million tons of CO_2) created by production activities (combustion of fossil fuels).

The industry is engaged in the following efforts to reduce CO_2 emissions resulting from vehicle use.

- Encouraging safe energy-conserving driving habits, such as shutting off engines when idling and avoiding harsh acceleration and deceleration
- Introducing and giving priority use to energy-efficient and electric-powered vehicles
- Operating vehicles at appropriate tire pressures
- Training of staff concerned with vehicles on how to conserve energy
- Efficient operation of vehicles (checking your route ahead of time, carpooling)

(4) Measures to Reduce Greenhouse Gas Emissions Other than CO_2

The combined effect on the climate of five greenhouse gases other than CO_2 emitted by the electric utility industry is about 1/600 of that of CO_2.

The industry has been putting great effort into limiting emissions of these gases through the measures described next.

(i) Sulfur Hexafluoride (SF_6)

Since no effective alternative gas is known at this stage, SF_6, a gas with superior insulation properties, is essential for a stable electric power supply as an insulation medium for gas-insulated devices. Although the electric utility industry must continue to use it, the industry adopted the Voluntary Action Plan of the Japanese Electric Utility Industry to Reduce SF_6 Emissions in April 1998. Under this plan, the industry has worked to reduce emissions by 2005 to 3% of SF_6 contained when devices are inspected, and to 1% when they are disposed of. By aggressively applying gas recovery systems and working to recycle the recovered gas, the industry has made substantial progress in containing emissions. Emission ratios in 2003 have already been reduced to 3% during mechanical inspections and 2% during disposal, and the industry aims to meet its targets by continuing its efforts in this area.

(ii) Hydrofluorocarbon (HFC)

HFC is principally used as a refrigerant for air-conditioning equipment. The industry foresees a continuing shift from CFCs, whose use is restricted by law, to HFC substitutes. The industry will make the utmost effort to prevent leakage during device installation and repair and to recover and recycle the gas.

(iii) Perfluorocarbon (PFC)

Liquid PFC is used as a refrigerant and an insulating medium for certain types of transformers. Since it is used in liquid form, it is easy to recover and recycle, and there is no fear of leakage to the environment, either during normal operation or upon disposal.

(iv) Nitrous Oxide (N_2O)

N_2O emissions occur at thermal power plants due to the combustion of fuels. N_2O emissions by the electric power industry account for about 1% of total N_2O emissions in Japan. The industry is making the utmost effort to reduce its emissions, primarily by improving thermal efficiency.

(v) Methane (CH_4)

The concentration of CH_4 in flue gases emitted in the burning of fuel at thermal power plants is less than the concentration in the atmosphere, meaning emissions are essentially zero.

(5) Response to the Problem of Global Warming from a Long-term Perspective

In responding to global warming, a long-term perspective and global initiatives are essential. International discussions on a post-Kyoto Protocol framework for the future (from 2013 onward) are scheduled to begin in 2005. In Japan as well, deliberations are being conducted on energy and environmental policy in view of the year 2030 and on future international frameworks.[9)]

At the same time, electricity is an important means for realizing the development of a sustainable society and economy and will be an effective energy into the future with respect to environmental measures, including those to prevent global warming. The rate of electrification is expected to increase as the country develops into an information-based society with an aging population, so the stable supply of high-quality electricity will become even more important.

From 2010 as well, the electric utility industry will continue to exert maximum effort at preventing global warming and constructing a sustainable society. We consider this our social responsibility as corporations.

Under a framework in which all countries are active participants, the industry therefore plans, for the future, to advance an aggressive response with a view to 2030 centered on the following four initiatives, which leverage the characteristics of the industry.

a. Promotion and Effective Use of Nuclear Power
   - Nuclear power is the key for solving the triple-pronged problem of simultaneously achieving economic growth, energy security and environmental conservation, and we will work to promote it along with the nuclear fuel cycle.
   - We will utilize new and existing facilities to maximum effect by raising the capacity factor.

b. Development of Innovative Technologies
   - We will contribute to the development and realization of technologies that include clean coal technology, CO_2 separation technology, and hydrogen manufacturing technology that utilizes nuclear power.

c. Active Assistance Overseas
   - In order to contribute to global warming prevention on a worldwide scale, we will support technology transfers and capacity development for developing countries and otherwise promote international partnerships.

d. Active Contribution to Household and Commercial Sectors
   - We will contribute to the energy conservation activities of our customers by working to develop and promote the popularization of EcoCute, high efficiency heat pumps and other devices.

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9) The Industrial Structure Council and Advisory Committee for Energy's Joint Committee on Energy and the Environment, the Advisory Committee for Energy's Supply and Demand Committee, the Global Environment Subcommittee of the Environment Committee of the Industrial Structure Council's Expert Committee to Study Future Frameworks, and the Global Environment Subcommittee of the Central Environmental Council's Special Committee on International Climate Change Strategy, etc.

2. Establishing a Recycling-based Society

Contemporary Japan is breaking away from its previous socioeconomic attitude of "mass production, mass consumption, and mass disposal" and promoting "reduction, reuse, and recycling" in order to achieve a recycling-oriented society. In March 2003, the Cabinet decided to enact the Basic Plan for Promoting the Creation of a Recycling-Oriented Society, a comprehensive and systematic set of measures for the formation of a sustainable society.

The electric utility industry has been voluntarily working toward the realization of such a recycling-based society, and continues to promote the effective use of resources by producing renewed resources from waste products[10] and other materials and by establishing nuclear fuel cycles.

(1) Measures for Waste Reduction and Recycling

Waste produced by the electric utility industry includes coal ash from thermal plants, construction waste materials like discarded concrete poles from power distribution works, and scrap metal such as electric cable. There are also byproducts, an example of which is gypsum produced by thermal power generation facilities.

Total waste volume has been increasing as the total amount of power generated has risen with the growth in energy consumption. This figure of the volume is expected to climb to 9 million tons in fiscal 2010, almost twice the level produced in fiscal 1990.

The electric utility industry considers the reduction of waste volume ultimately disposed of an important issue in responding to the increase in waste volumes and is increasing efforts to curtail generation increase and promote the production of reutilized resources.

(i) Reductions Target for Waste Disposal

The electric utility industry uses the amount of final waste processed as an indicator for setting waste reduction targets, and is currently making efforts in the area of waste reduction. Previous efforts to reduce, reuse, and recycle and future trends in demand will serve as the basis for further reduction in the amount of final waste processed as we move toward realizing a recycling-based society. The following goals have been set based on fiscal 1990 levels.

> By fiscal 2010, we aim to reduce the amount of final waste disposal to 1.5 million tons, less than the 2.4 million tons of fiscal 1990. (Viewed in terms of reutilization of resources, the reutilization rate in fiscal 2010 will be 83%, compared to an actual 52% in fiscal 1990.)

With regard to coal ash, the most commonly produced of the different kinds of waste products, and we will treat promotion of recycling as a major issue.

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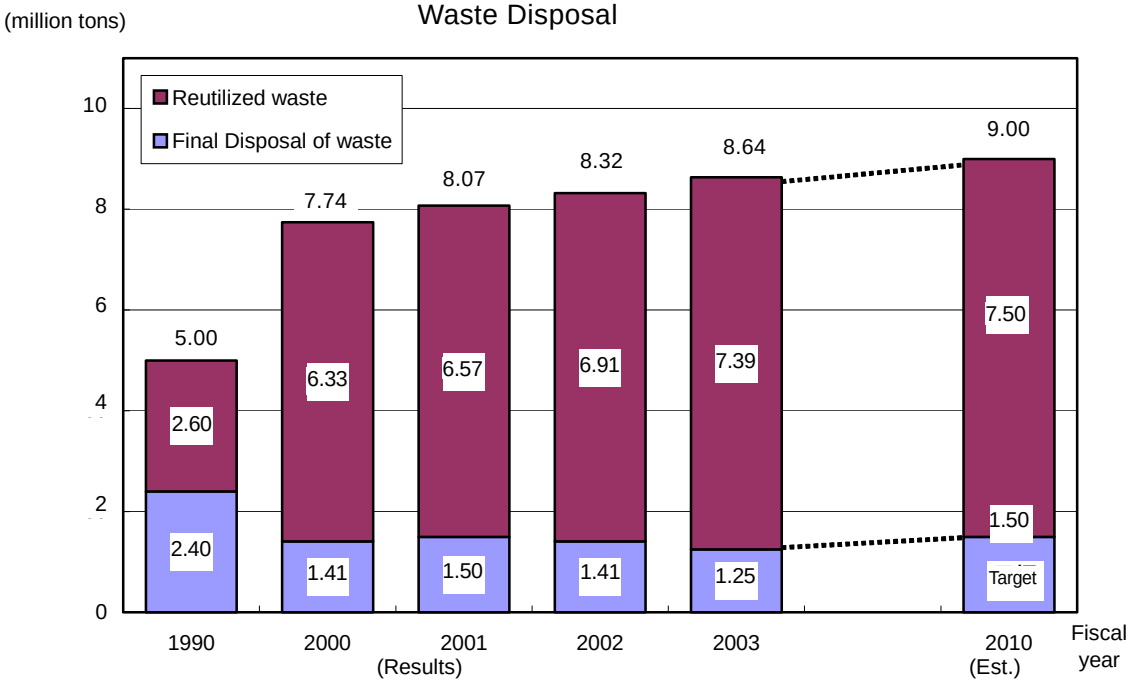
[10] Waste products include those defined as industrial waste (defined under the Law Concerning the Processing and Cleaning of Waste Products, including certain products of value) and those generated secondarily through production activities (byproducts). Radioactive waste is not included in the definition of waste products. It is handled in a separate, more appropriate manner.

Electric Utility Industry Target for Reducing Final Waste Disposal

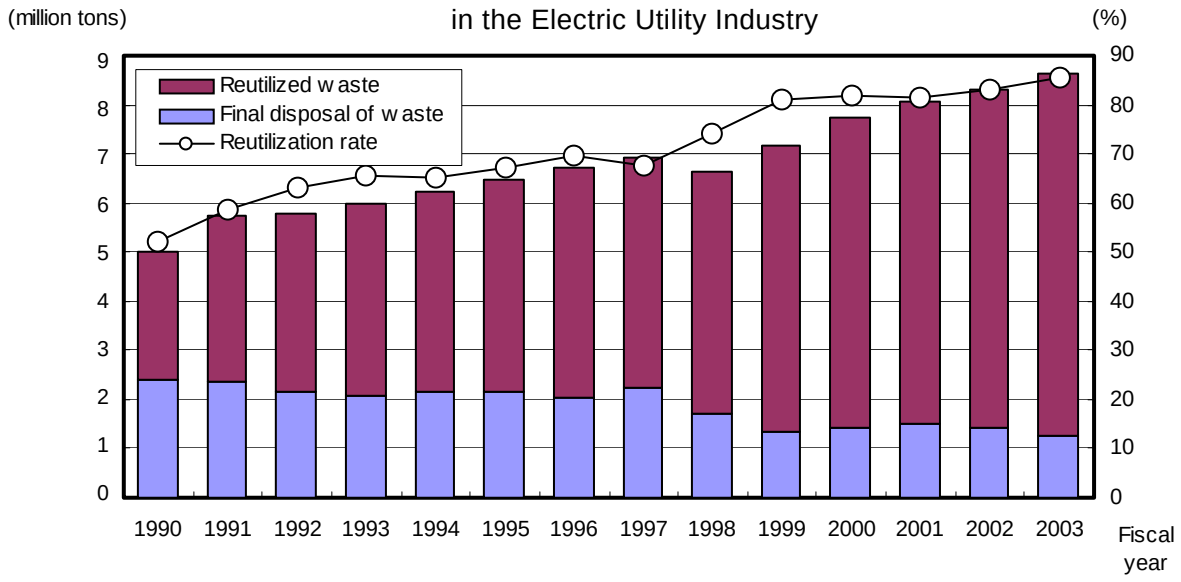


* The fiscal 1990 level includes some estimates.

(ii) Disposal of Waste in Fiscal 2003

Waste generated by the industry amounted to 8.64 million tons in fiscal 2003, an increase of 0.32 million tons from the fiscal 2002 level. The reason for this increase was a rise in coal ash generation accompanying the increase in total coal fired power generation due to the impact of long-term shutdowns at certain nuclear power plants. On the other hand, the recycled volume has increased by 0.48 million tons from the previous year to 7.39 million tons. The result is that final disposal of waste in fiscal 2003 was 1.25 million tons, a decline of 0.16 million tons over fiscal 2002.

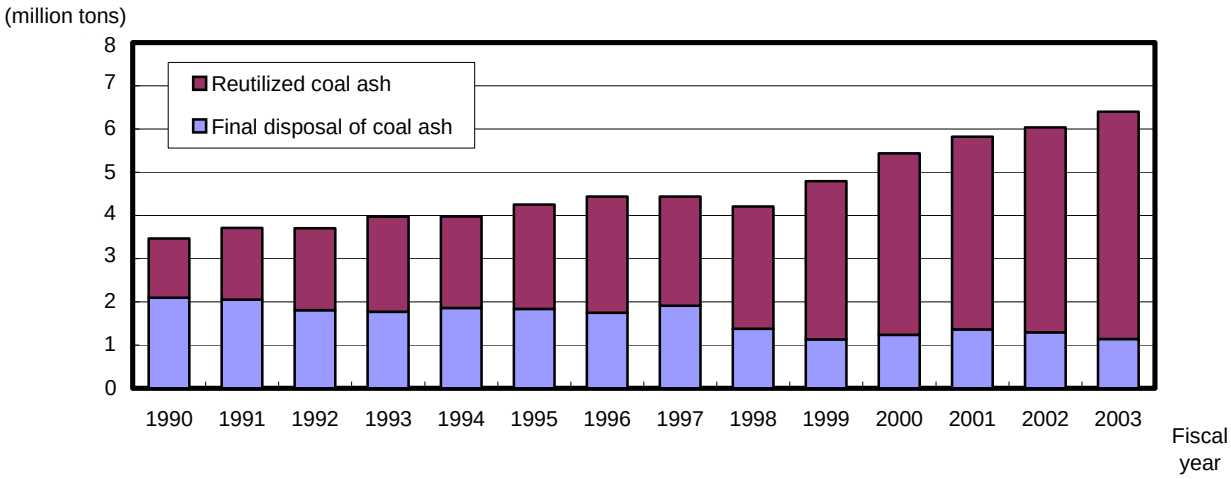
Trends in Amounts of Waste Reutilized and Undergoing Final Disposal in the Electric Utility Industry



Coal ash makes up the greatest part of the waste, accounting for 6.4 million tons, of which 5.26 million tons is reutilized, mostly as a raw material for cement or as an admixture for concrete.

Renewed resources are produced from nearly all of the total scrap metal and the construction waste material generated, and every possible effort is made to produce renewed resources from other waste products as well. All gypsum, which is a byproduct of the desulfurization process, is used to produce renewed resources such as gypsum boards and as an ingredient for cement.

Trends in Amounts of Coal Ash Reutilized and Undergoing Final Disposal by the Electric Utility Industry



* After coal ash has been buried, its final disposal sites are used as construction sites for new power plants and other industrial facilities.

Trends in Reutilizing Major Types of Waste and Byproducts

(1,000 tons)

Type			Fiscal 1990	Fiscal 2001	Fiscal 2002	Fiscal 2003
Waste	Combustion residue Dust and soot Coal ash	Volume generated	3,470	5,820	6,050	6,400
		Reutilized volume	1,370	4,460	4,740	5,260
		(Reutilization rate)	(39%)	(77%)	(78%)	(82%)
	Construction waste material	Volume generated	400	390	330	300
		Reutilized volume	210	340	310	290
		(Reutilization rate)	(53%)	(87%)	(94%)	(96%)
	Scrap metal	Volume generated	140	150	170	160
		Reutilized volume	130	140	160	150
		(Reutilization rate)	(93%)	(94%)	(96%)	(97%)
Byproducts	Gypsum from desulfurization process	Volume generated	850	1,530	1,600	1,610
		Reutilized volume	850	1,530	1,600	1,610
		(Reutilization rate)	(100%)	(100%)	(100%)	(100%)

*Waste includes products of value.
*Figures for construction waste material and scrap metal in fiscal 1990 are estimates.
*Gypsum from desulfurization process is all sold.
*Reutilization rates are calculated on an actual volume basis. (Figures for the volume generated and recycled volume are rounded to the nearest 1,000 tons.)

(iii) Future Efforts to Reduce and Reutilize Wastes

To maintain the best mix of power-generating sources, the electric utility industry regards coal as the second most important fuel for baseload power after nuclear power. In the long term, coal-fired thermal power plants will supply the base and middle load demands. Reutilizing wastes such as coal ash will be an important issue in this respect.

The industry, therefore, is working on new applications for further efficiency improvements in thermal power generation, greater reduction of wastes such as coal ash and the development of applications and technology to handle large volumes of coal ash in a stable manner over time.

The industry intends to maintain complete utilization of the desulfurizing byproduct gypsum. Efforts to reduce, reuse and recycle other wastes will continue to be made in order to reduce the amount undergoing final disposal.

<Examples of Recycling>

Major type of waste or byproduct		Major recycling applications
Combustion residue, dust and soot	Coal ash	Raw material for cement, fertilizer, construction materials (soil enhancement and sand replacement)
	Heavy Crude oil ash	Vanadium recovery and combustion enhancement
Sludge		Raw material for cement
Construction waste material		Structural material for new construction, roadbed material and recycled asphalt
Scrap metal		Recycled distribution lines and ingredient for metal products
Scrap glass and scrap ceramics		Tile and block material, structural material for new construction and roadbed material
Gypsum from desulfurization process (byproduct)		Gypsum board material and raw material for cement

*For details, refer to Examples of Recycling Applications for Waste Materials by the Electric Utility Industry

(iv) Increased Utilization of Reused and Recycled Products

Recognizing that recycling resources and the use of environmentally friendly products are critical to forming a recycling-based society, the electric utility industry has been promoting green purchasing and expanding the use of reused and recycled products.

(2) Recycling by the Nuclear Industry

(i) Establishment of the Nuclear Fuel Cycle as Part of the Recycling-based Society

The nuclear fuel cycle makes it possible to recycle uranium and plutonium recovered from spent fuel. For Japan, which depends on imports for about 80% of its primary energy supply, this could be a very effective method for assuring a stable supply of energy. It would enhance the properties of generated nuclear power, which provides superior supply stability and is also consistent with the concept of a recycling-based society.

A spent fuel reprocessing plant is currently under construction in Aomori Prefecture to help establish the nuclear fuel cycle, and it is scheduled to enter operation in 2006. Due to the current energy policy in Japan which dictates that there should be no surplus plutonium, the industry is promoting its "Plu-thermal" plan. This technology enables the plutonium recovered from spent fuel to be used as MOX fuel (Mixed Oxide Fuel – pellets of uranium mixed with plutonium) in existing light-water reactors. The industry will work to gain public understanding of this plan to enable its progress. In the future, the most effective scenario will be to use fast-breeder reactors currently under development. If this technology is realized in the future, it could dramatically improve the availability factor of the uranium resource.

(ii) Effective Utilization of Recyclable Resources from Nuclear Facilities.

The Nuclear Safety Commission of Japan in March 1999 established clearance-level standards for nuclear power plant scrap metal and waste concrete classified as "not requiring handling as radioactive materials."

The legal revision for handling such waste is currently under review by the government. When the legal system has been determined, the industry will work towards the effective use of these recyclable resources.

3. Management of Chemical Substances

(1) PRTR System

The electric utility industry has carried out independent PRTR (Pollutant Release and Transfer Register) studies since 1997, even before the relevant laws were enacted, in an effort to precisely monitor release and transfer volumes at power generators and other facilities as the amount of special chemical substances gradually increase.

A system for reporting emission volumes and other factors was introduced in April 2002 and was based on the Law Concerning the Reporting, etc. of Releases to the Environment of Specific Chemical Substances and Promoting Improvements in Their Management (the PRTR Law). Under this system, electric utility companies gather information on the release and transfer volumes for specific chemical substances at each of their facilities and report their findings to the national government.

The release and transfer volumes in the electric utility industry for fiscal 2003 are illustrated in the table below. The period of preparatory measures set forth in the PRTR Law has ended, and starting this fiscal year the reporting requirement for establishments that handle specified Type I chemical substances (excluding special specified Type I chemical substances) has changed from five tons or more to one ton or more, but the industry has already been inspecting and compiling information on substances in volumes of one ton or more since beginning voluntary inspections.

The majority of emissions into the environment are emissions into the air from painting, while the majority of transported waste is processed waste oil from replacing turbine control oil and removing fuel oil tanks.

Total Release and Transfer of Chemical Substances (Results for fiscal 2003)

Chemical codes	Chemical	Volume released to the environment (kg/year)				Volume transferred (kg/year)		Applications, etc.
		Air	Water	Soil	Landfill	Sewer	Other	
16	2-Amino ethanol	0	0	0	0	0	3,500	Feed water-processing agent
30	Bisphenol A type epoxy resin	43	0	0	0	0	0	Used in painting
40	Ethylbenzene	32,000	0	0	0	0	100	Used in painting
43	Ethylene glycol	18	0	0	0	0	1,400	Coolant Antifreeze
63	Xylene	150,000	0	0	0	0	7,800	Used in painting, power-generation fuel
85	Chlorodifluoromethane (HCFC-22)	14	0	0	0	0	0	Air conditioning refrigerant
121	Dichlorodifluoro-methane (CFC-12)	540	0	0	0	0	0	Air conditioning refrigerant
124	2,2-dichlo-1,1,1 Trifluoromethane (HCFC-123)	1,000	0	0	0	0	140	Air conditioning refrigerant
144	Dichloropentafluoro-propane (HCFC-225)	21,000	0	0	0	0	0	To launder clothing
177	Styrene	22,000	0	0	0	0	0	Used in painting
179	Dioxins	150	0.012	0	0.50	0	14	Waste incinerators
227	Toluene	20,000	0	0	0	0	5,600	Used in painting, power-generation fuel
253	Hydrazine	31	1,800	0	0	6.9	19	Feed water-processing agent
299	Benzene	170	0	0	0	0	1,600	Power-generation fuel
353	Tris phosphate (dimethyl phenyl)	0	0	0	0	0	28,000	Turbine control oil

* Chemical codes represent the number assigned to each chemical under the PRTR Law.
* Units in this table for release and transfer volumes for dioxin substances are measured as [kg/year → mg-TEQ/year].
* Figures for dioxin substances represent sum totals that include release and transfer volumes from those establishments designated in the Law Concerning Special Measures against Dioxins.
Figures for all other substances represent sum totals that include release and transfer volumes from each establishment that handles at least one ton of the Type I chemical substances specified in the PRTR Law or at least half a ton of the special Type I chemical substances specified by this law.
* It has been confirmed that the volume of dioxin released or transferred is within the emission limits stipulated in the Law Concerning Special Measures against Dioxins.

(2) Efforts to Manage Chemical Substances

The electric utility industry continues to make the following efforts to properly manage chemical substances and reduce emissions.

- ○ By following management documentations such as control manuals, the industry performs proper control of substances, covered by law, such as those found in turbine control oil and boiler feed water processing agents, and it endeavors to reduce the amount used by improving operating methods.
- ○ The industry is taking appropriate steps to reduce emissions of ozone-depleting chemicals used as refrigerants, cleaners, etc. These steps include reducing the amount used through proper usage, leakage prevention, recovery and recycling and replacement with alternatives.
- ○ Efforts are also being made to reduce emissions of regulated chemical substances from painting instruments, piping and other materials by reducing painting frequency, shifting to paints with lower proportions of such substances and other measures.
- ○ The industry throughly controls the combustion waste incinerators to minimize the amount of dioxins emitted from them. Dioxin emissions have also been limited by reusing waste in order to limit the use of incinerators or to shut them down to the extent possible.

4. Promotion of Environmental Management

Members of the electric utility industry have been among the first to create environmental departments and set up in-house environmental management systems. They have reported on their environmental protection efforts through environmental action reports.

According to each member's policy, the industry has voluntarily and actively worked to improve in-house environmental management systems in line with the international standards of the ISO14000 series, and to earn ISO14001 certification at their representative sites. The industry has also paid close attention to other societal trends, such as environmental accounting and environmental auditing.

These efforts will continue in the future to ensure that we place even less burden on the environment.

5. Environmental Considerations in Overseas Projects

The electric utility industry has long trained personnel in environmental fields by accepting trainees from developing countries and providing technical assistance by dispatching specialists from Japan. With regard to participation in projects overseas and technology collaborations, the industry has conducted initiatives in consideration of local environmental issues and global-scale environmental preservation. These include biomass power generation, reforestation and measures to reduce the environmental impact of thermal power plants.

The electric utility industry plans to continue to aggressively promote these kinds of initiatives that give adequate consideration to the environment.