Environmental Action Plan by the Japanese Electric Utility Industry

16 September, 2005

The Federation of Electric Power Companies of Japan

(FEPC)

Contents

Environmental Action Plan by the Japanese Electric Utility Industry

16 September, 2005

The Federation of Electric Power Companies of Japan

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 eighth review.

1. Measures to Mitigate Climate Change

(1) Basic Policy for the Mitigation of Climate Change

The Japanese government has been working on an analysis of progress of first phase of measures for reducing greenhouse gasses (2002 to 2004). That is based on the Guidelines for Measures to Prevent Global Warming that outlines specific measures to achieve the Kyoto Protocol target of reducing those gasses by 6%.

During that time, the Kyoto Protocol came into force in February 2005. After the government established the Kyoto Protocol Target Attainment Plan that sets down measures necessary to ensure the targets' achievement, the plan earned the cabinet decision in April 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

[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.

(household, commercial), as the Japanese people seek greater abundance in their lifestyles.

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 circumstances, achieving the goals set forth in the Kyoto Protocol targets looks to be extremely difficult. To do that, we must make use of technical innovations and ingenuity under the basic concept of achieving a balance between the environment and economy. At the same time, all involved—government, local authorities, businesses, and citizens—need to be further aware of the importance of the issue of global warming and continuous proactive efforts against global warming are imperative.

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 36% over the fiscal 1990 level by fiscal 2010, we calculate that growth in total CO_2 emissions will be held to around 9%.

(ii) CO_2 Emissions in Fiscal 2004

Electric power consumption stood around 865 billion kWh in fiscal 2004, a roughly 31 billion kWh increase (3.7%) over that for fiscal 2003. That was due to an increase in demand caused by an exceptionally hot summer.

On the other hand, total CO_2 emissions in fiscal 2004 stood at 364 million tons of CO_2, 1 million ton CO_2 increase (0.3%) from the fiscal 2003 level.

As a result, the CO_2 emissions intensity for fiscal 2004 was 0.421 kg of CO_2/kWh, a decrease (3.4%) over the fiscal 2003 figure of 0.015 kg of CO_2/kWh.

Note that electric power consumption is 31% higher than in fiscal 1990 (an annual average increase of 1.9%), and in that period, CO_2 emissions increased by 31%. The result is that CO_2 emissions intensity was the same as in fiscal 1990.

Item \ Fiscal Year	1990 (results)	2002 (results)	2003 (results)	2004 (results)	2005 (est.)	2010
Electric power consumption (billion kWh)	659	841	834	865	854	(est.) 897
CO_2 emissions (million t-CO_2)	277 [2]	342 [17]	363 [20]	364 [26]	330	(est.) 320
CO_2 emissions intensity (user end electricity) (kg-CO_2/ kWh)	0.421	0.407	0.436	0.421	0.39	(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 2005 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 2005 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

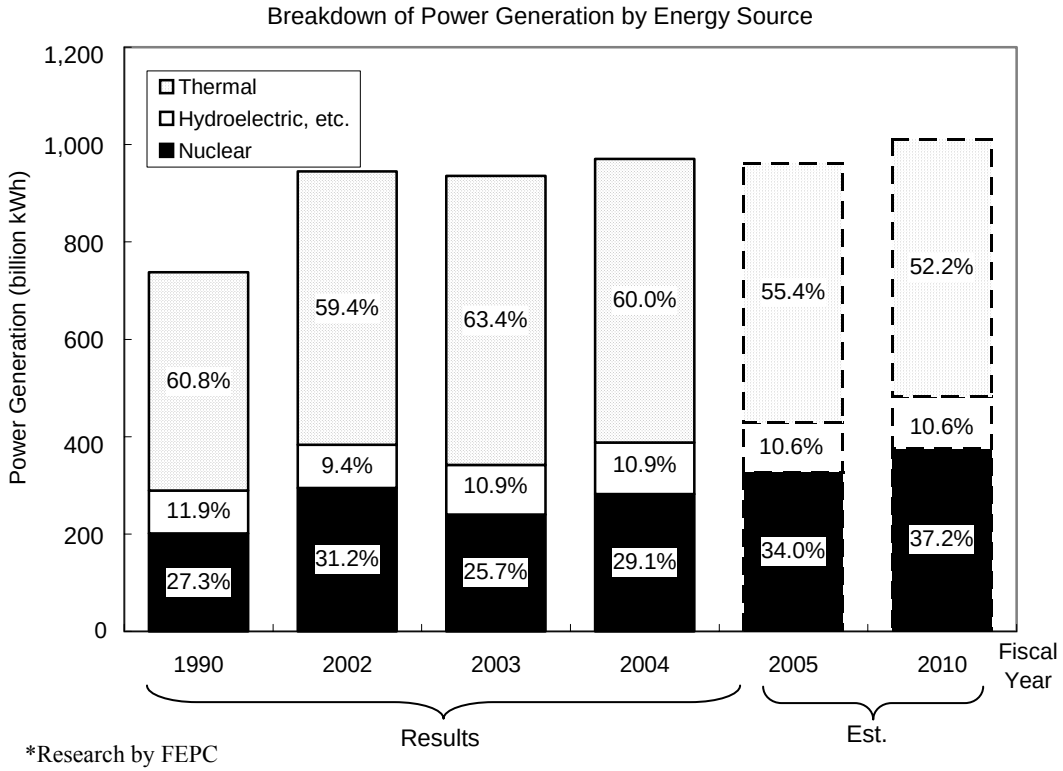
CO_2 emissions intensity (user end electricity) was 0.421 kg of CO_2/kWh in fiscal 2004, which represents a decrease from fiscal 2003.

Despite there were factors for an increase in CO_2 emissions such as an increase in demand for power and shutdowns of nuclear power plants due to problems at those plants, some nuclear power plants that had been shut down for a long time gradually came back on line, resulting in an increase in nuclear power generation over that of fiscal 2003. The amount of thermal power generation was reduced along with the increase, resulting in less consumption of fossil fuel.

<Factors related to CO_2 emissions decrease>

○ Increase in nuclear power generation Figures in parentheses are the ratio of nuclear power to overall power generated
240 billion kWh (25.7%) in fiscal 2003 → 282 billion kWh (29.1%) in fiscal 2004
Capacity factor of 59.7% in fiscal 2003 → Capacity factor of 68.9% in fiscal 2004

○ Reduction in thermal power generation Figures in parentheses are ratio of thermal power to overall power generated
593 billion kWh (63.4%) in fiscal 2003→ 583 billion kWh (60.0%) in fiscal 2004



*Research by FEPC

Supposing the plants were operated in fiscal 2004 at the planned capacity factor of 84.1%[2)] with no impact by the long-term nuclear power plant shutdowns, CO_2 emissions would have decreased approximately 35 million tons to around 329 million tons of CO_2. CO_2 emissions intensity calculates out to 0.380 kg of CO_2/kWh.

	CO_2 emissions (million tons of CO_2)	CO2 emissions intensity (kg-CO_2/kWh)	Nuclear power generation (billion kWh)	Nuclear planned capacity factor (%)
Actual figures for fiscal 2004	364	0.421	282	68.9
Assuming no shutdowns	329	0.380	339	84.1
Volume of impact	35	0.041	57	—

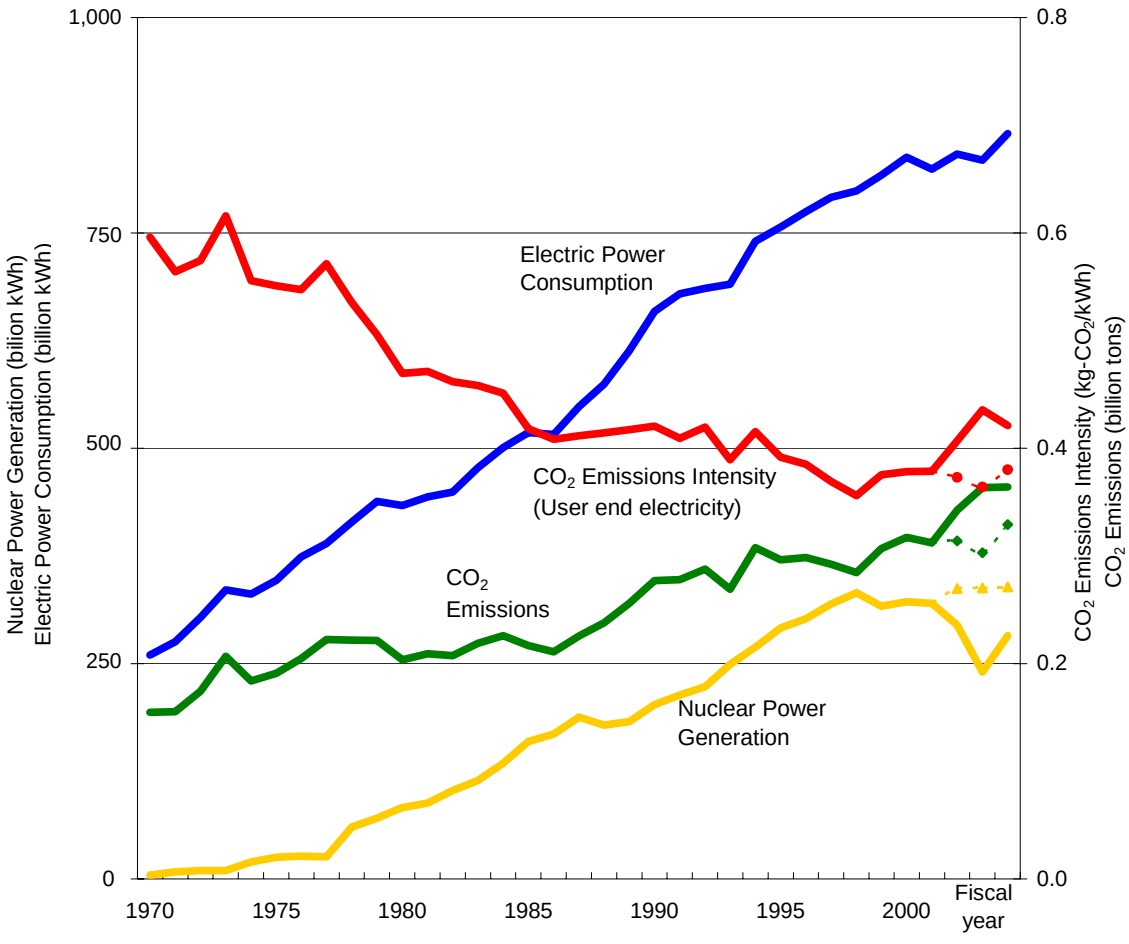
[2)] Planned capacity factor (84.1%) for fiscal 2002 stated in the fiscal 2002 supply plans.

[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 30% 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 through 2004.

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 379 million tons of CO_2, greater than the actual figures for fiscal 2004. The emissions reductions generated by using nuclear power are especially significant: 216 million tons of CO_2. This corresponds to 17% of CO_2 emissions in Japan (1,259 million tons of CO_2) for fiscal 2003. Note that this figure is an 18% increase over the actual result in fiscal 2003 of 183 million tons of CO_2.

(b) Reduction Through Increased Efficiency at Power Plants

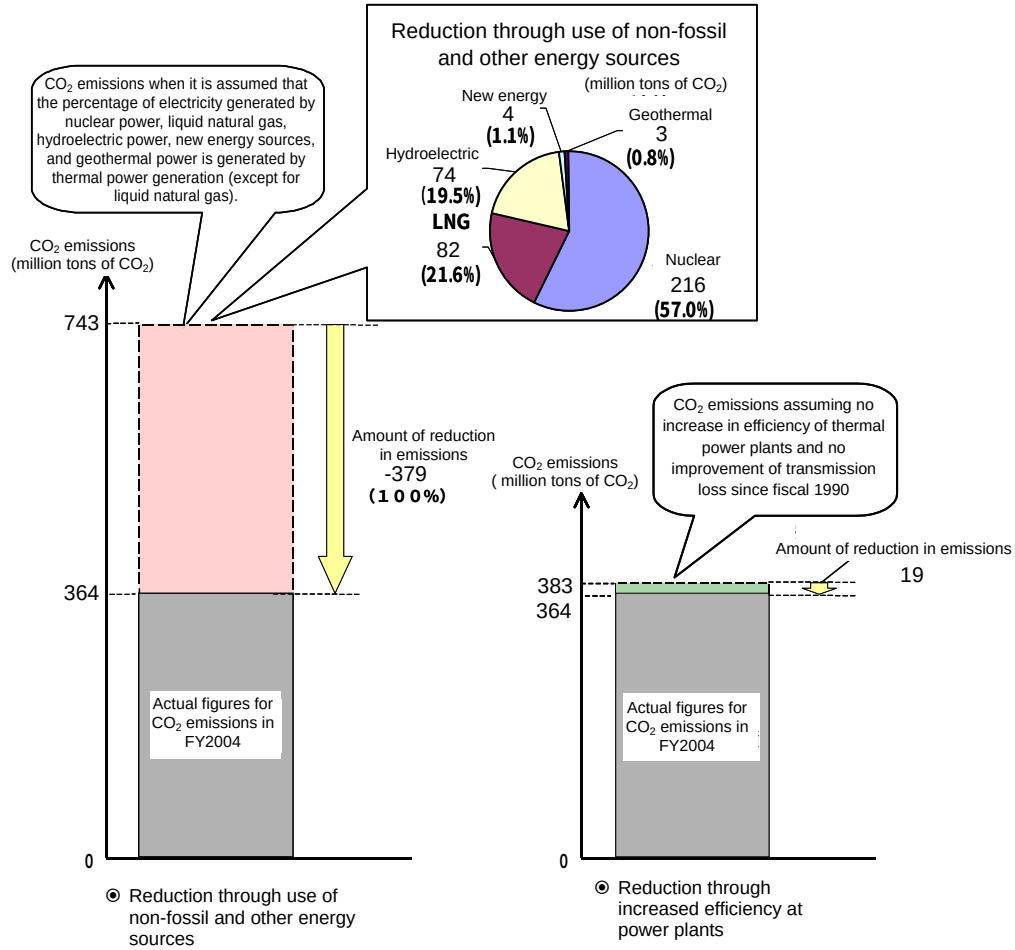
Improving the efficiency of our thermal power plants and improving the rate of transmission loss is provisionally estimated to have prevented 19 million tons of CO_2 emissions.

This corresponds to 5% of actual CO_2 emissions in fiscal 2004.

(c) Fuel Reduction Through Use of Non-Fossil Energy Sources

The electric utility industry is actively taking on reduction of CO2 emissions through investment in nuclear and hydroelectric power facilities. As a result, fiscal 2004 nuclear electric power generation was 81.0 billion kWh more than in fiscal 1990, and hydroelectric 9.0 billion kWh more than fiscal 1990. Assuming the electricity was generated by thermal power, those figures correspond to 21 million kiloliters of crude oil. In effect, 7% reduction in Japan's primary supply of petroleum was achieved.

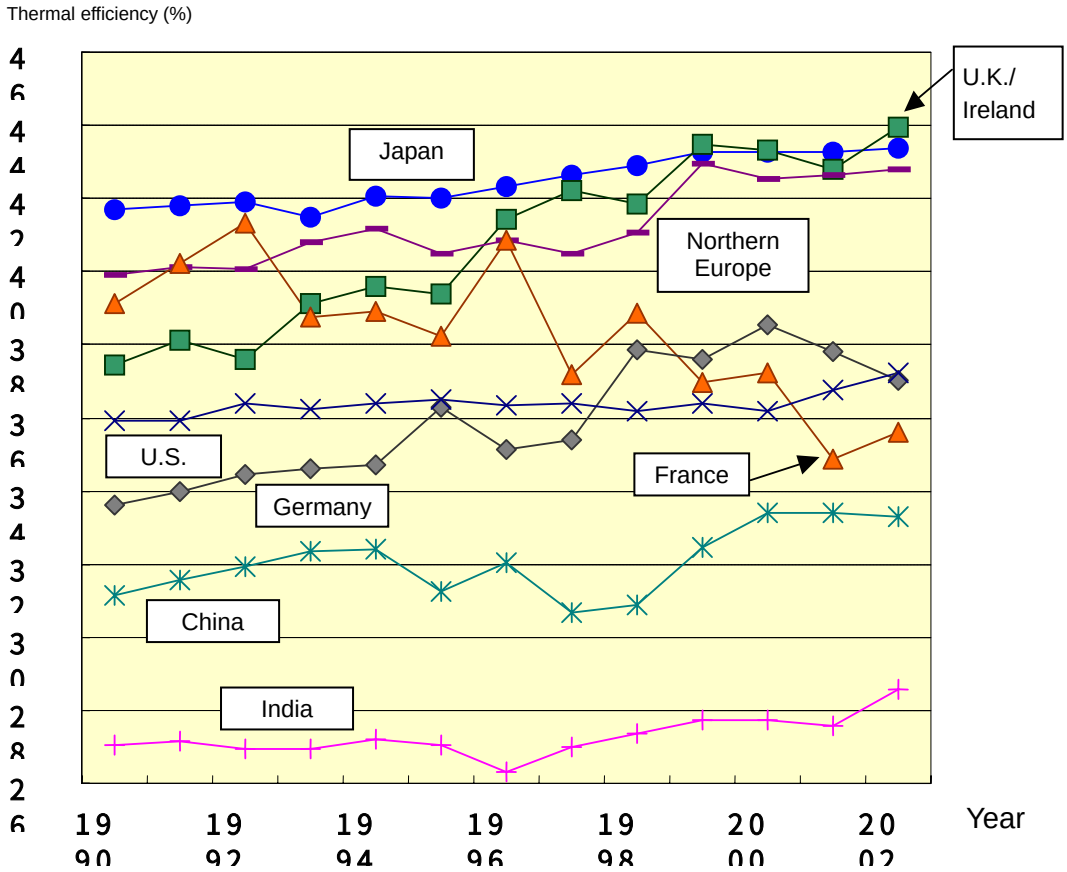
CO_2 Emissions and Reduction of Potential CO_2 Emissions in Fiscal 2004
Preliminary calculation by FEPC



[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: Updated Comparison of Power Efficiency on Grid Level, 2005 (Ecofys)

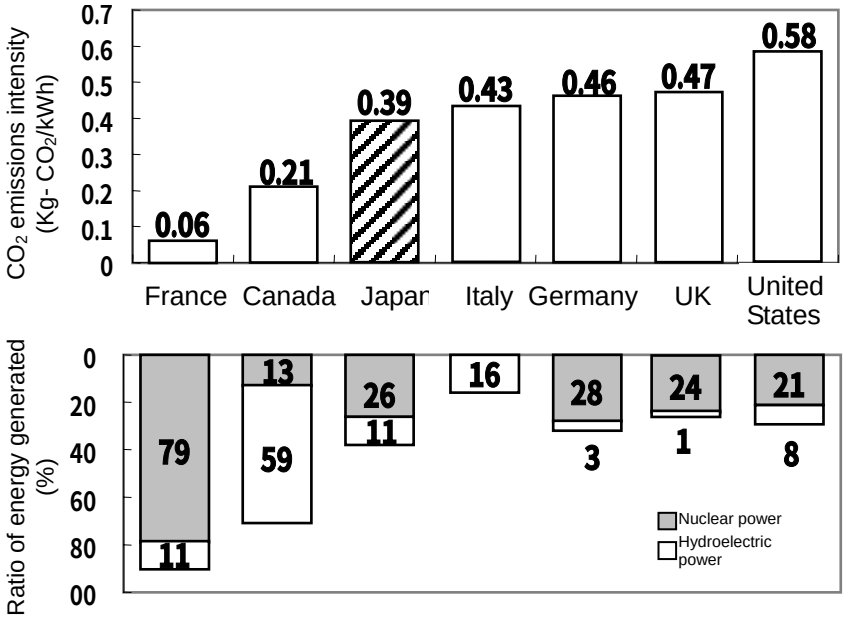
[Reference: Country-to-Country Comparison of CO_2 Emissions Intensity (per unit of energy generated)]

CO_2 emissions from Japan's electric utilities accounts for approximately 1.4% of the world total in fiscal 2002 and for about 29% of Japan's total CO_2 emissions in fiscal 2003.

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 2003 figures
*Source: Energy Balances of OECD Countries 2002-2003
*Figures for Japan from FEPC

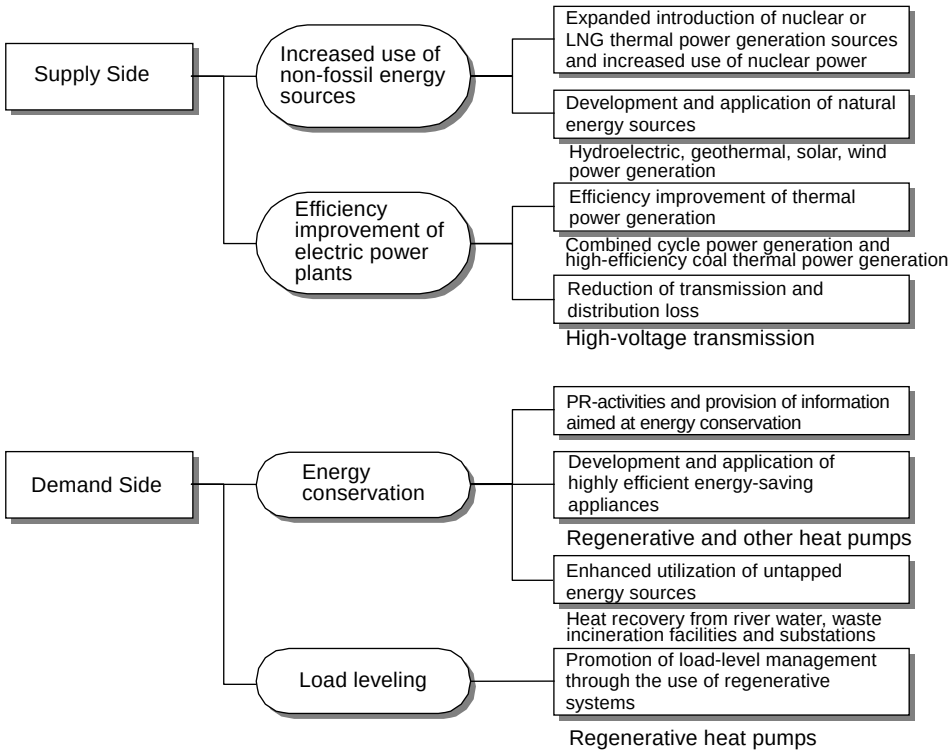
(3) Future Efforts and Issues for Reducing CO_2 Emissions

(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 it has become extremely difficult to achieve this target with revisions in energy development plans due to phased expansion of areas for liberalization and stagnating growth in power demand and with ongoing delays in locating sites for nuclear power plants.

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. Supply-Side Measures for Reaching Voluntary Targets

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

Nuclear power, which does not emit CO_2 in the course of generating electricity, is extremely important to the electric utility industry. We believe that it will play a central role in Japan's efforts against global warming in the future.

Additionally, nuclear power is strategically positioned in the government's Kyoto Protocol Target Attainment Plan for promoting measures to prevent global warming. It is positioned as a core energy source that the public and private sectors are cooperating in promoting and as the nation's core energy source in the Basic Energy Plan. Thus, active use of nuclear power, including building new plants and use of existing facilities, holds an important position in Japan's promotion of measures to prevent global warming.

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). At the same time, we will aim for intensive[5] use by means such as condition-monitoring maintenance, online maintenance, flexible operating cycles, and increased rated output. Those are actively implemented in other countries, and we are gaining the understanding of related authorities. That way we can take on improving maintenance and management technology, inspection technology, and safety assessment technology, thus further increasing the capacity factor.

---

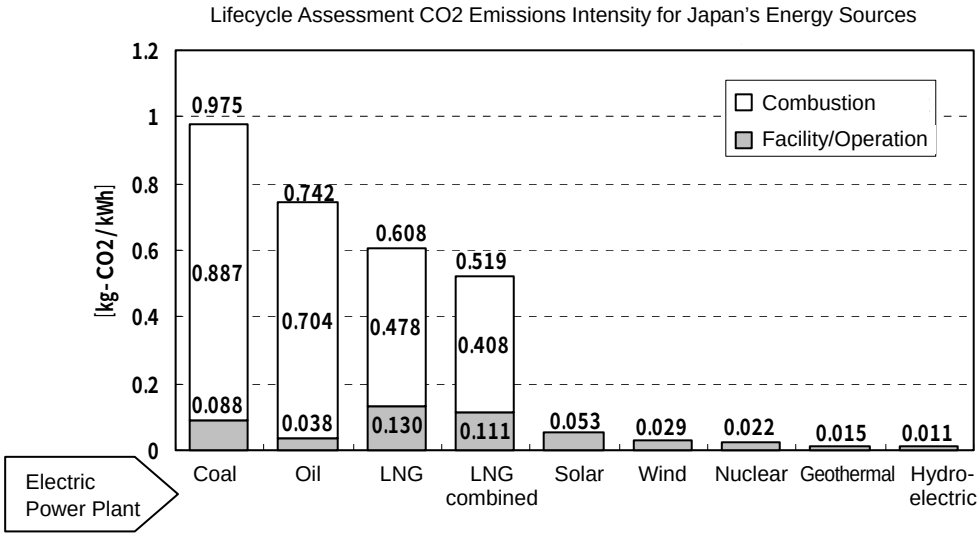
3) The Kyoto Protocol Target Attainment Plan (approved by cabinet on April 28, 2005) notes the following.
"Electric utility sector CO_2 emissions intensity reduction: Follow up on voluntary target achievement through the following approaches by the industry
   - Increase of capacity factor of nuclear power facilities through scientific, rational operations management.
   - Further improve thermal efficiency in thermal power generation and arrangement of thermal power source operation methods, taking into account environmental characteristics into account.
   - Gain credit (emissions reductions) in the Kyoto Protocol by the industry's use of 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) Other countries are moving from time-planned maintenance methods where machinery is disassembled and inspected at regular intervals to condition-monitoring maintenance methods where machinery operation data is monitored to find signs of trouble before disassembling and inspecting. Also, online maintenance where backup machinery is maintained during operations has been introduced, and operation cycles of 18 to 24 months of continuous operations are being flexibly employed. Increasing rated output for existing nuclear power plants is also being actively promoted. The result of achieving such intensive use has been high levels with capacity factors of 88.7% in the USA, 94.5% in S. Korea, 91.7% in Spain, and 91.9% in Switzerland (2003 figures).
(Source: Japan Nuclear Energy Safety Organization "Status of Nuclear Facilities in Japan")

[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.



* 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.

(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 (coal, LNG, 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 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. Through the Green Power Fund, a cumulative 1.5 billion yen in subsidies has been provided for 514 cases of aid for new-energy generation facilities as of the end of fiscal 2004.

In addition, the Special Measures Law Concerning the Use of New Energy by Electric Utilities (RPS Law) mandates use of electricity such as that from new energy. The mandated volume of new energy in fiscal 2004 was greater than that for fiscal 2003, and the ten public electric utilities put great effort into securing use of the mandated volume of new energy. We intend to continue to promote the spread of natural energy in the future.

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.

b. Efforts in Emissions Reduction in Civil and Transport Sectors

(a) Development and promotion of energy-conserving equipment

The electric utility industry has been actively working to develop and promote popularization of thermal storage systems, CO_2 refrigerant heat pump water heaters, and high efficiency commercial air conditioners that use heat pump technology. These technologies contribute to CO_2 emissions reduction by helping to save energy on the customer side and also by leveling the load on the supply side.[6)]

The industry has also been engaged in verification tests on home energy management systems (HEMS) which support household energy conservation activities through means such as optimum operation of household appliances.

The industry also plans to actively roll out 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.

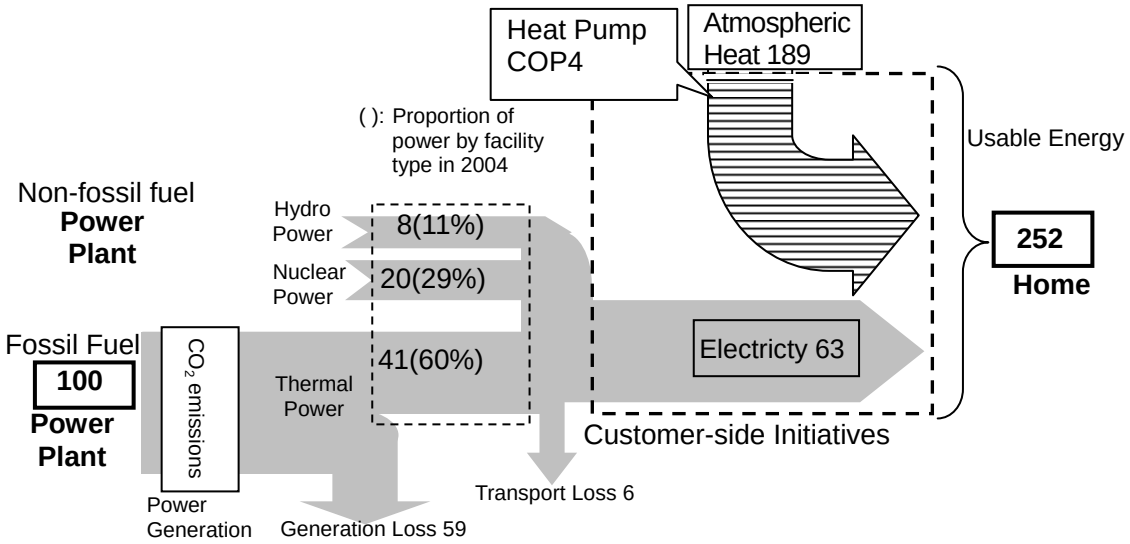
6) The Kyoto Protocol Target Attainment Plan (approved by cabinet on April 28, 2005) notes the following target quantity. Introduction of CO_2 refrigerant heat pump water heaters: approx. 5.2 million units. Introduction of high efficiency commercial air conditioners: approx. 12,000 units.

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

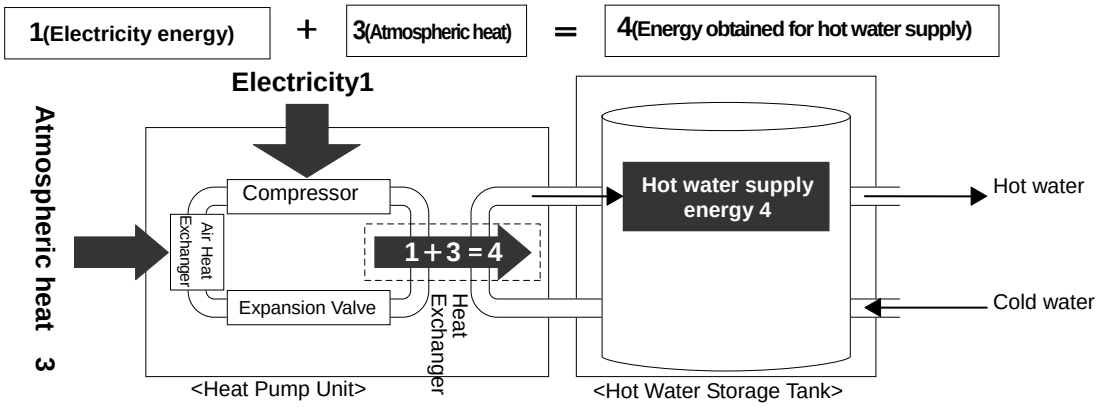
For example, 252 units of energy can be used with 100 units of fossil fuels (energy) by utilizing unused energy from atmospheric heat and other sources with a heat pump COP[7]4. (Sample provisional calculation)



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 4.0, so it is extremely effective at conserving energy. CO_2 emissions are also reduced by roughly 60% compared to conventional combustion-based hot water heaters. The cumulative number of EcoCute systems introduced as of the end of 2004 has reached 250,000 units. That calculates out to 200,000 tons of CO_2 reduced. If the 5.20 million units by 2010 targeted for in the Kyoto Protocol Target Attainment Plan are introduced, that calculates out to 4.0 million tons of CO_2 reduced[8]. That reduction corresponds to 1% drop in CO_2 emissions intensity.

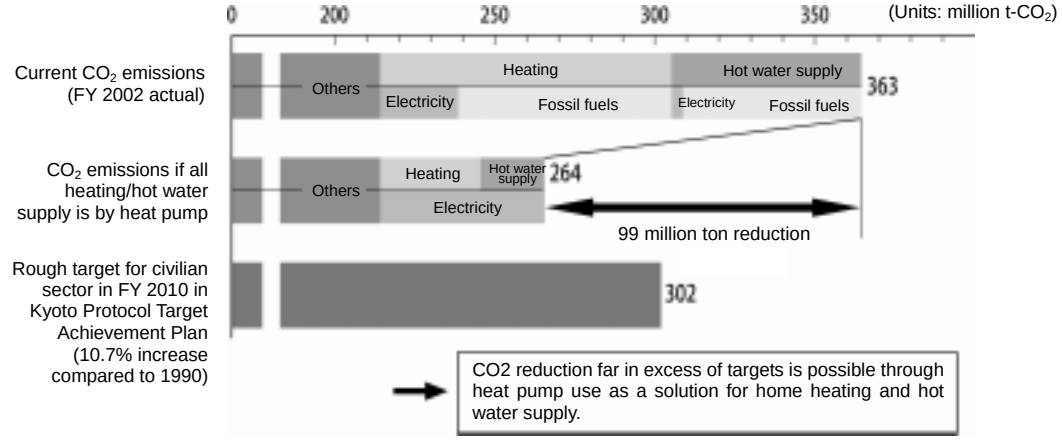


[7] $COP = \frac{\text{Cooling or Heating Capacity (kw)}}{\text{Heat Pump Power Consumption (kw)}}$ (COP=Co-efficiency of Performance)

[8] Reduction effect by unit is calculated by weighted average estimating diffusion rate for gas, oil, and electric hot water heaters from past shipments. Annual COP of CO_2 refrigerant heat pump hot water heaters is calculated as 4.0.

Possibility for home and business CO_2 reduction through heat pump use

Air conditioning and hot water supply make up more than 50% of energy consumption in Japan by the civilian sector—homes and businesses. A complete switch from traditional fuel combustion to highly efficient heat pump use for those would allow a CO_2 reduction of approx. 100 million t-CO_2 per year. (Calculations by The Heat Pump & Thermal Storage Technology Center of Japan)



Examples of CO_2 Reduction and Energy Savings Through Implementation of High Efficiency Heat Pump Systems

Implementation example	Overview
Implementation of high efficiency heat pump / heat storage system in new office building	Energy consumption reduced approx. 30% over no measures taken by implementing daylight use and solar shielding, high efficiency heat pump / heat storage air conditioning, and Building and Energy Management System (BEMS).
Implementation of high efficiency heat pump system in shopping centers	Controlling and conserving energy so air conditioner is operated at optimum efficiency according to the annual cooling load. High efficiency equipment at about COP 7.4 each is employed.
Implementation of high efficiency heat pump / heat storage system in district heating and cooling systems	CO_2 emissions intensity reduces approx. 60% by implementing heat pump and heat storage system that utilizes atmospheric heat and building exhaust heat.
Implementation of high efficiency heat pump in hotels	Annual reduction of 1,500 tons of CO_2, 12% of energy consumption, and more than 100 million yen in energy costs by implementing high efficiency heat pump for hotel air conditioning.
Implementation of high efficiency heat pump / heat storage system in semiconductor plants	Shift from cogeneration to high efficiency heat pump/ heat storage system, resulting in 32% reduction in CO_2 emissions over before implementation.

Efforts in providing information on energy saving and CO_2 reduction to employees and customers

- Environmental education for employees through Environmental Trainer System and e-Learning
- Environmental education through Environment and Energy Classes for schools and the community, and afforestation activities such as distributing seedlings
- Introduction of usage of air conditioners, refrigerators, and other home electronics that leads to energy savings on website

(b) Efforts in Office Use and Own Distribution & Transport

CO_2 emissions from the civil and transport sectors are on the rise, requiring immediate measures. The electric utility industry is implementing the following measures to reduce consumption of electricity for offices (classified as civil business sector) and of fuel in for its own distribution and transport (classified as transport sector) that it intentionally is involved in. In that way, it is making efforts in CO_2 emissions reduction. The industry is also working to grasp the volume of CO_2 emitted.

	Examples of companies' efforts in CO_2 emissions reduction (reference)
Efforts in offices	○ Participation as all 12 companies of the Federation of Electric Power Companies of Japan in the national campaign to prevent global warming, Team Minus 6% ○ We are carrying out the following efforts to reduce volumes consumed for electricity and water used in offices. ・ Use the company Intranet to raise employee awareness and to share information. ・ Efficient operation of air conditioning (thorough temperature control, reduced usage time, etc.) ・ Turning off lights at lunch and after hours, less use of lighting ・ Reduced usage of elevator use (promotion of using stairways) and other measures ○ We are carrying out casual wear campaigns such as implementing "Cool-Biz" with no neckties or jackets worn in the summer and wearing *Kariyushi wear* that combines energy savings with promotion of Okinawa.
Efforts in own distribution and transport	○ Establishing a logistics company for all group companies, and optimizing distribution through joint delivery ○ We are implementing the following economical driving measures such as setting reduction targets for business vehicles fuel economy (fuel consumption by distance traveled. e.g. 20% reduction over fiscal 2000 by fiscal 2005). ・Promoting fuel-efficient driving through efforts such as no unnecessary idling taking safety into account and avoiding sudden acceleration and braking ・Introducing and giving priority to use of electric vehicles, clean energy vehicles, and fuel-efficient vehicles. ・Efficient vehicle use (confirming route beforehand, implementation of carpool) ・Driving at optimal tire pressure ○ Making logistics more efficient through concentrating coal centers and using larger coal transport vessels. ○ A system where external power source supplements truck air conditioning for parked or stopped trucks was developed, and its promotion in underway (if implemented nationwide, the effect will be 125,000 tons of CO_2/year reduction).

<Actual CO_2 emissions from office use>

Total electricity used in company facilities such as head offices, branches, and sales offices was 910 million kWh in the whole electric utility industry in fiscal 2004. That comes out to 0.38 million tons of CO_2 when converted to CO_2 emissions, a figure corresponding to 0.11% of the 364 million tons of CO_2 emissions from productive activities (combustion of fossil fuels).

<Actual CO_2 emissions from household transport>

Total use of fuel (gasoline, diesel) for company-owned vehicles in fiscal 2004 was 310,000 kl in the whole electric utility industry. That comes out to 0.07 million tons of CO_2 when converted to CO_2 emissions, a figure corresponding to 0.02% of the 364 million tons of CO_2 emissions from productive activities (combustion of fossil fuels).

c. International Efforts

(a) Efforts for Using the Kyoto Mechanisms[9)]

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.

In the Kyoto Protocol Target Achievement Plan, promoting and utilizing Kyoto Mechanisms holds an important position from the standpoint of Japan's contributions to preventing global warming.

The electric utility industry is conducting feasibility studies and projects overseas that help reduce CO_2 emissions, including biomass power generation, thermal efficiency improvement projects and afforestation projects. Such projects are targets of the Joint Implementation and Clean Development Mechanisms stipulated in the Kyoto Protocol. The industry also provides investment to such entities as the World Bank's Carbon Fund and the Japan Greenhouse Gas Reduction Fund (JGRF) that Japanese industry participates in as one, and it is also actively involved in other projects to prevent global warming. Of the investment in those activities, total investment in the Carbon Fund is expected to be approximately 18.0 billion yen.

The contribution in CO_2 reduction through effort such as the Kyoto Mechanism is affected by approval of the United Nations and host countries. However, it is forecasted to come to become around 15.0 million tons of CO_2 by 2010.

We will continue to promote projects that utilize such efforts as the Kyoto Mechanism. and will utilize CO_2 reduction contributions by global warming prevention projects such as the Kyoto Mechanism in achieving our targets, while identifying trends in detailed system design in Japan and abroad. Furthermore, we will study its measures.

Investments to major carbon funds

Fund	Expected investment
World Bank Prototype Carbon Fund (PCF) World Bank Community Development Carbon Fund (CDCF) World Bank BioCarbon Fund (BioCF)	60.5 million dollars (6.7 billion yen)
Japan Greenhouse Gas Reduction Fund (JGRF)	52.0 million dollars (5.7 billion yen)
Greenhouse Gas Credit Aggregation Pool（GG-CAP）	22.0 million euro (3.1 billion yen)

Calculated as 1 USD=110Yen, 1 Euro=140Yen

(b) Efforts in Energy Saving Technology Guidance for Developing Nations

The electric utility industry has been actively involved in technology transfer to developing nations by guidance on energy saving technologies, and seminars on improving and managing thermal efficiency though projects for preventing global warming and for afforestation. Global warming prevention activities will continue effectively in the future on a global scale utilizing the top-class technologies accumulated by the industry.

---

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

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

Project	Outline	Start period
e7 Bhutan micro hydro power CDM project	UN CDM Executive Board approved CDM project to provide electricity to a region without it by constructing a micro hydro power plant.	2003.6~
Fuel switch project in Chile	CDM project approved by the United Nations CDM Executive Board for switching fuel from coal and petroleum to natural gas at food production plants.	2003.12~
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~
Methane capture and combustion from swine manure treatment in Chile	Japanese government approved CDM project to collect and combust methane released in the air from state-of-the-art animal waste facilities.	2004.1~
Electric generation operation in Honduras using sugar cane residue	Biomass electric generation project using as fuel sugar cane residue (bagasse) generated in the sugar production process	2005.2~
Afforestation business projects in Australia	Afforestation projects designed to preserve the world's forest resources and fix atmospheric CO_2	Implemented multiple times
Participation in the various Carbon 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 ・ Japan GHG Reduction Fund (JGRF) ・ 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)	JGRF: 2004.12~ PCF: 2000.4~ CDCF: 2003.7~ BioCF: 2004.6~ EEERF: 2000.1~ GG-CAP 2005.2~ FEGACE 2004.5~

<Example of involvement in instruction on energy conservation technology in developing nations>

Project	Outline	Period, etc
Technical cooperation in thermal efficiency improvement at thermal power plants in China	Operation improvement training, equipment improvement proposals and other activities at the Huangtai thermal power plant of China's Shandong Electric Power Company resulted in improved thermal efficiency. That, in turn, caused an 88,000 ton reduction in coal used and 210,000 tons less CO_2 emissions per year.	1996.4~ 2000.3
Thermal efficiency recovery project through improvement of thermal power plant operations in Thailand	Providing operation management and technical knowledge to the Energy Generating Authority of Thailand (EGAT) South Bangkok Power Plant resulted in an approx. 5,000 ton reduction in fuel oil use and 16,000 ton reduction in CO_2 emissions.	1999.9~ 2002.7
Model operation for thermal power plant thermal efficiency improvement in Indonesia	Equipment improvement and thermal efficiency management training held at Java-Bali Power Company's Muara Karang power plant resulted in an approx 6,000 ton reduction in fuel oil use and 15,000 ton reduction in CO_2 emissions per year.	1998.6~ 2001.3

d. Efforts in Research and Development

(a) Technical Development Related to the Global Warming Problem

In response to the problem of global warming, the industry recognizes the necessity of a mid- to long-term vision, and is working on development of supply- and demand-side technologies as well as environmental protection technologies. Specifically, we are working on R&D for technologies, which help customers conserve energy, recover and process of CO_2 contained in the gases emitted by thermal power plants, and are related to nuclear power and for using forests as carbon sinks.

In addition, the power plants possess forests in their plant sites, including water conservation forests. These forests help to absorb CO_2, and the electric utility industry intends to maintain them.

[Examples of Efforts in Technical Development to Solve the Global Warming Problem]

① Technologies to allow efficient use of electricity

We are supporting and promoting technical development of CO_2 refrigerant heat pumps that contribute to energy conservation and reduction of CO_2 emissions. That development centers on aspects such as further increases in efficiency, technology imporvement in order to promote its usage in cold districts, and size reduction, towards achiving a government target of 5.2 million devices installed by fiscal 2010.

② Technical development for safe and stable operation of nuclear power plants

We are making efforts in upgrading private-sector standards such as alligning domestic and international standards and utilizing private-sector technologies related to soundness assessment standards and judgment criteria. With that, we will be able to implement scientific, and rational operational management for increasing capacity factors of the facilities upon rounding out a self-imposed system for maintenance.

③CO_2 recovery and processing technologies

Since a perspective for practical application of CO_2 recovery technologies has been gained, we will continue to work on its improvement and development. As for CO_2 processing technology, we are taking a long-term view to proceed with surveying and evaluating technical trends in Japan and abroad.

(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 1/400 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 2004 have already been reduced to 3% during mechanical inspections and 1% 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 1.5% 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 planned to start at COP/MOP 1, which will be held in November 2005. Japan, as well, has demonstrated modalities for energy and environmental policy looking towards the year 2030 and for future frameworks[10]. The government has also made a cabinet decision on the Kyoto Protocol Target Achievement Plan to meet CO_2 reduction targets in the Kyoto Protocol. At the same time, electricity is an important means for achieving the sustainable development of society and the economy and will be an effective energy into the future with respect to environmental measures, including those to prevent global warming. Nuclear power, especially, shows promise for playing a major role in the future in forming a zero-CO_2 emissions society that utilizes hydrogen produced using nuclear power. On top of that, nuclear power emits no CO_2 in generating electricity. 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 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 achievement of technologies including clean coal technology and CO_2 separation technology.

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.

---

[10] 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 Changes 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" to form a recycling-oriented society with less burden on the environment. The Basic Plan for Promoting the Creation of a Recycling-Oriented Society, a comprehensive and systematic set of measures for the formation of a recycling-based society, underwent its first revision in February this year.

The electric utility industry has been voluntarily working toward the achievement of such a recycling-based society and following up on that. It will continue in efforts to promote the effective use of resources by recycling waste products[11] 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) Waste Recycling Rate Targets

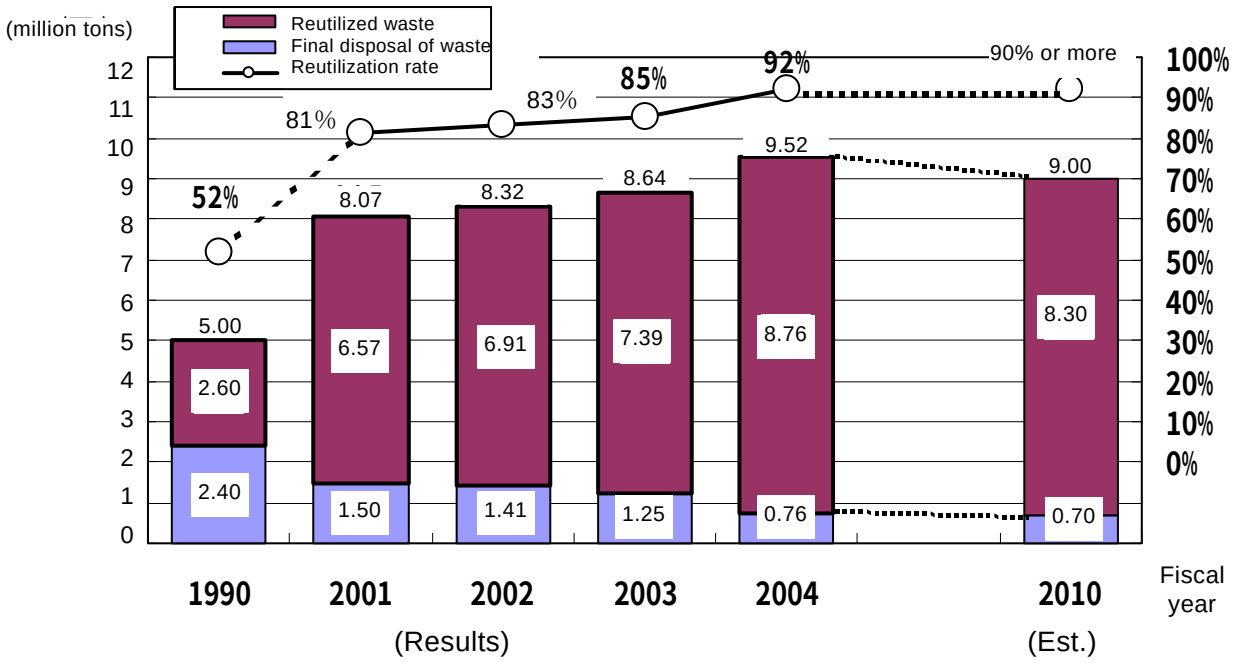
The electric utility industry has up to now used the amount of final waste processed as an indicator for setting waste reduction targets. It has been working on waste reduction with a target of keeping that to 1.5 million tons, or less than fiscal 1990 levels. Now we will use recycling of waste as a target, as that is not influenced significantly by fluctuations in demand. The following is how we will take this on.

> Work to raise waste recycling rates in fiscal 2010 from the fiscal 1990 level of 52% to 90% or more. (The forecast amount of final waste processed in fiscal 2010 is expected to be around 0.7 million tons considering the current state of recycling.)

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.

[11] 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.

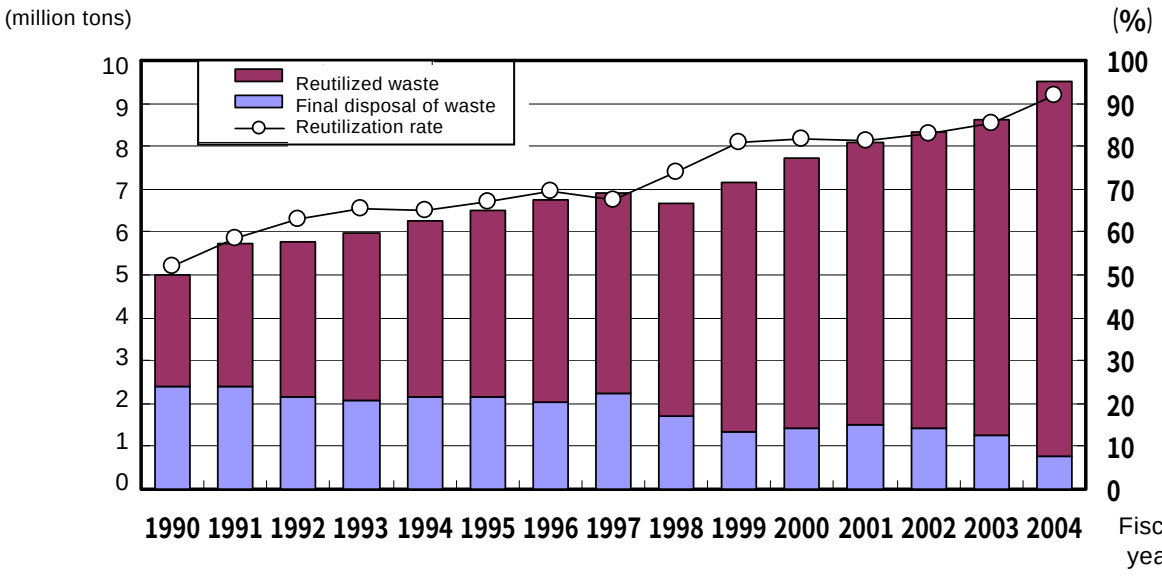
Waste Recycling Rate Targets for the Electric Utility Industry



(ii) Fiscal 2004 Waste Recycling Results

Waste generated by the industry amounted to 9.52 million tons in fiscal 2004, an increase of 0.88 million tons from the fiscal 2003 level. The generated amounts was increased because of the rise in demand for electricity. On the other hand, the recycled volume has increased by 1.37 million tons from the previous year to 8.76 million tons. The result is that the recycling rate in fiscal 2004 was 92%, 7% increase over fiscal 2003.

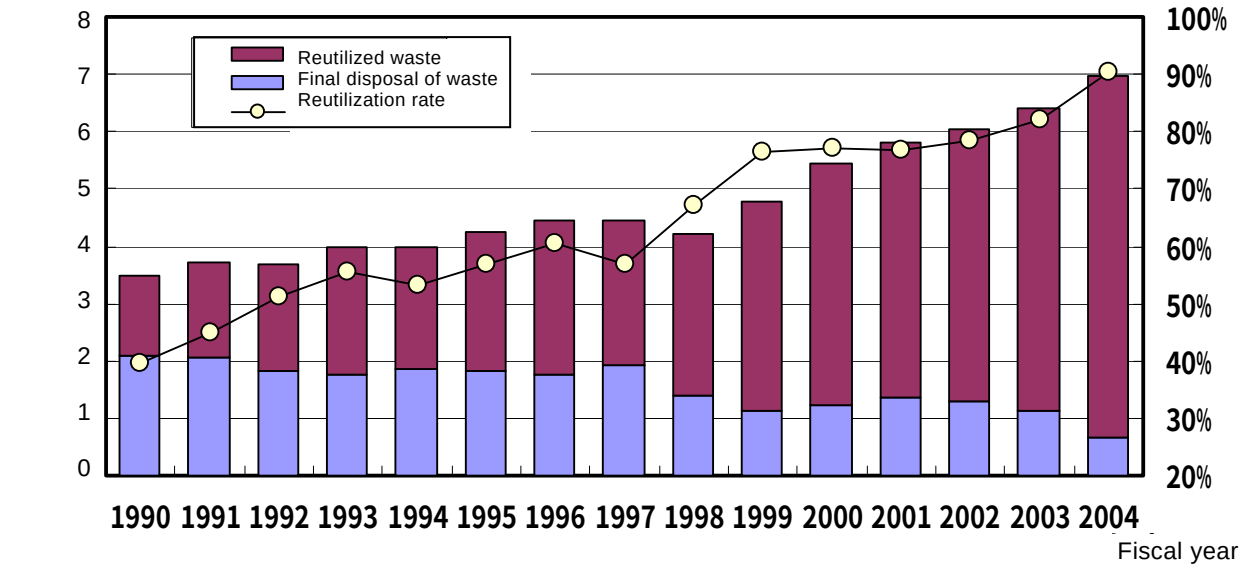
Trends in Recycling Waste by the Electric Utility Industry



Coal ash makes up the greatest part of the waste, accounting for 6.97 million tons. Of that, 6.31 million tons are recycled, mainly as raw material for cement and admixture for concrete, or as land development material.

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 Recycling Coal Ash by the Electric Utility Industry



* The place of disposal after final disposal (disposal in landfills) is utilized as land for power generation facility expansions or other industrial land uses. Some of the coal ash used there is counted from fiscal 2004 as recycled as land development material according to government interpretation.

Trends in Reutilizing Major Types of Waste and Byproducts

(1,000 tons)

Type			Fiscal 1990	Fiscal 2002	Fiscal 2003	Fiscal 2004
Waste	Combustion residue Dust and soot Coal ash	Volume generated	3,470	6,050	6,400	6,970
		Reutilized volume	1,370	4,740	5,260	6,310
		(Reutilization rate)	(39%)	(78%)	(82%)	(91%)
	Construction waste material	Volume generated	400	330	300	360
		Reutilized volume	210	310	290	350
		(Reutilization rate)	(53%)	(94%)	(96%)	(98%)
	Scrap metal	Volume generated	140	170	160	170
		Reutilized volume	130	160	150	160
		(Reutilization rate)	(93%)	(96%)	(97%)	(98%)
Byproducts	Gypsum from desulfurization process	Volume generated	850	1,600	1,610	1,830
		Reutilized volume	850	1,600	1,610	1,830
		(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 2007. 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 Power Facilities.

The Nuclear Reactor Regulation Law was revised in the 2005 ordinary session of the Diet. Under that revision, waste from nuclear facility demolition and operation that has extremely low levels of radiation and of which the effects on humans can be disregarded can be classified as "that which does not need to be treated as radioactive waste" (hereafter, "cleared substances"), upon receiving strict governmental confirmation of measurement and judgment results. It can then be treated the same as normal valuable resources or waste.

The electric utility industry will actively make use of scrap metal and waste concrete from nuclear facilities as recyclable resources that have been confirmed by authorities to be cleared substances in line with the revised law.

Until the system for cleared substances takes firm hold in society, the electric utility industry will transport such waste to disposal companies and disposal facilities only upon their understanding that it came from nuclear facilities. Furthermore, we will take the initiative ourselves in reuse of that material.

3. Management of Chemical Substances

(1) Volume of Chemical Substance Release

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 2004 are illustrated in the table below. The period of preparatory measures set forth in the PRTR Law has ended, and starting previous 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.

Total Release and Transfer of Chemical Substances (Results for fiscal 2004)

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	3,700	Feed water-processing agent
30	Bisphenol A type epoxy resin	64	0	0	0	0	0	Used in painting
40	Ethylbenzene	35,000	0	0	0	0	300	Used in painting
43	Ethylene glycol	1,400	0	0	0	0	0	Heat-source water for heat supply equipment
63	Xylene	140,000	0	0	0	0	920	Used in painting, power-generation fuel
124	2,2-dichlo-1,1,1 Trifluoromethane (HCFC-123)	1,800	0	0	0	0	0	Air conditioning refrigerant
144	Dichloropentafluoro-propane (HCFC-225)	12,000	0	0	0	0	0	To launder clothing
177	Styrene	14,000	0	0	0	0	5,700	Used in painting, Plastic fixation agent
179	Dioxins	100	0.037	0	1.2	0	36	Waste incinerators
227	Toluene	30,000	0	0	0	0	0	Used in painting, power-generation fuel
253	Hydrazine	11	2,400	0	0	7.0	1,400	Feed water-processing agent
299	Benzene	250	0	0	0	0	0	Power-generation fuel, Painting
307	Polyalkylether	1.1	0	0	0	0	0	Dust-prevention agent for stored coal
353	Tris phosphate (dimethyl phenyl)	0	0	0	0	0	43,000	Turbine control oil

* Chemical codes represent the number assigned to each chemical under the PRTR Law.
* Volume transferred is the amount transferred from the plant for processing as waste, etc.
* 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 Reduce Chemical Substance Release

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 reduced 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.

The Federation of Electric Power Companies

Keidanren Bldg., 1-9-4 Otemachi, Chiyoda-ku, Tokyo 100-8118, Japan Tel.03-3279-2180 http://www.fepc.or.jp/

The paper used in this Energy and Environment 2004-2005 is “thinnings paper”, made from 10% domestic thinnings pulp and 90% market collected waste paper. The use of thinnings paper helps to stimulate the domestic forestry industry. It also contributes to “forest management” for CO_2 reduction as cited in the Kyoto Protocol, and promises effects in mitigating global warming.

The printing is done with soy-based inks, which contain fewer petroleum-based solvents than conventional ink. Use of soy-based inks can limit the consumption of finite petroleum resources and can greatly reduce the emission of volatile organic carbons (VOC), air pollutants that generated in the printing process.

Nov. 2005