Kansai Electric Power's

Global Environmental Action Report

A Well-Balanced Environment Today and Tomorrow

September
2000

THE KANSAI ELECTRIC POWER CO.,INC.

2000

A Message from the President

Global environmental problems such as global warming, acid rain and ozone layer depletion have become the focus of international discussions in recent years. To address the issue of global warming, the Framework Convention on Climate Change was concluded at UNCED, the United Nations Conference on Environment and Development, in 1992. An agreement was made on the goals for each advanced nation to reduce greenhouse gases at the Third Session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (COP3), held in Kyoto in December 1997, in which a strict objective was imposed on Japan to reduce overall greenhouse gas emissions by 6% below 1990 levels from 2008 to 2012.

With each country executing its own plan, we can now say that the "age of action" against global environmental problems has begun.

Having recognized early on the importance of environmental protection, the Kansai Electric Power Company has been endeavoring to minimize the environmental impact of its operations. We defined Five Basic Principles of the Action Plan for Global Environmental Considerations in 1990, and have put our best efforts into promoting concrete activities in every sphere of our enterprise. Furthermore, with major changes surrounding our management environment, including the partial liberalization of retail energy sales this year, we feel that we must take on the challenge of environmental problems and other issues that are in the public interest, as we strive to make electricity an ever better product while at the same time gaining the trust of the society we serve. Based on this understanding, we have drawn up our Eco Action 2000, a plan that outlines how we will achieve both business efficiency and public benefit in our stepped-up efforts to protect the Earth's environment.

This report introduces the company's fundamental principles regarding environmental issues and the objectives of related activities. Aiming for sustainable development of the world in the 21st century, we are working to obtain solid results by tackling environmental issues independently and assertively. We would like to receive comments and opinions from all those concerned with protecting the earth's environment. We hope you will assist us in these important endeavors for the future of our planet.

Hiroshi Ishikawa
President
The Kansai Electric Power Co., Inc.

Hiroshi Ishikawa

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Overview of Kansai Electric

Japan has ten major private electric utility companies which operate independently. Each company produces and distributes electricity to a specific geographical region of Japan. Kansai Electric's service area is located in the central part of the main island Honshu and covers 28,681 km^2 (8% of Japan's total land area). This region, generally known as Kansai, includes Osaka, Kyoto, and Kobe and has a population of 21 million, accounting for 16% of the nation's total.

Since its establishment, Kansai Electric has emphasized the development of power sources to meet electricity demand, which has increased with the growth of the Japanese economy. As of March 31, 2000, the company's capacity for hydroelectric power is 8,107 MW, fossil fuel power 19,921 MW, and nuclear power 9,768 MW, making the total capacity 37,796 MW, which is 17 times larger than the initial figure of 2,284 MW in May 1951, when we began operation. Electricity sold in fiscal 1999 amounted to 140,403 million kWh, accounting for 17% of the total power sold in Japan, or the second largest amount in Japan, following the Tokyo Electric Power Co., Inc.

System capacity (as of March 31, 2000)

Fiscal year	Capacity (MW)	Hydro	Fossil fuel	Nuclear
1979	23,115	24%	51%	25%
1989	30,173	20%	55%	25%
1999	37,796	21%	53%	26%

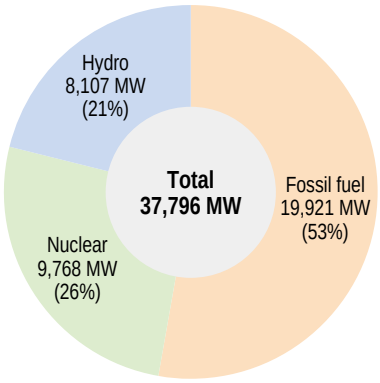
Annual gross output (Fiscal 1999)

Fiscal year	Generation (millions of kWh)	Hydro	Fossil fuel	Nuclear	Purchased power, other
1979	90,217	14%	55%	22%	9%
1989	123,552	12%	44%	37%	7%
1999	153,712	9%	29%	46%	16%

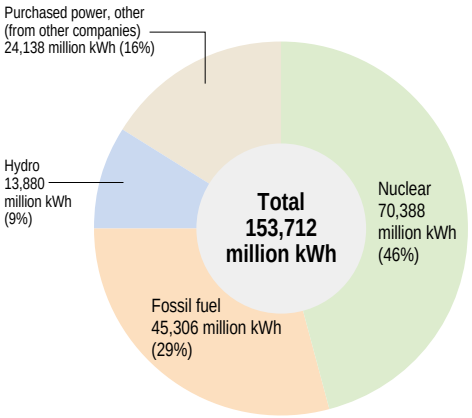
Performance highlights (as of March 31, 2000)

System capacity	37,796 MW
Annual gross output	153,712 million kWh
Annual power sales	140,403 million kWh
Maximum power demand	30,710 MW (Aug. 31, 1999)
Number of customers	12.6 million
Annual revenue from power sales	¥1,959 billion
Capital	¥489 billion
Service area	28,681 km^2 (7 million acres)
Number of employees	26,248

System capacity (as of March 31, 2000)



Annual gross output (Fiscal 1999)



Service areas of Japan's ten electric power companies

Outline of Japan's ten major power companies (as of March 31, 2000)

	Capital (billions of yen)	Number of customers (thousands)	Maximum power demand (MW)	Annual power sales (millions of kWh)	Annual revenue from power sales (billions of yen)	Number of employees	System capacity (MW)			
							Hydro	Fossil	Nuclear	Total
Hokkaido Electric Power Co.	114	3,719	5,112	28,070	486	6,448	1,278	3,500	1,158	5,936
Tohoku Electric Power Co.	251	7,463	14,430	71,804	1,118	14,568	2,431	11,430	1,349	15,209
Tokyo Electric Power Co.	676	26,330	59,250	274,226	4,022	41,882	8,103	32,434	17,308	57,846
Chubu Electric Power Co.	375	9,915	25,806	120,028	1,664	19,788	5,211	22,941	3,617	31,769
Hokuriku Electric Power Co.	118	1,940	5,280	24,853	354	5,683	1,806	3,862	540	6,209
Kansai Electric Power Co.	489	12,625	30,710	140,403	1,959	26,248	8,107	19,921	9,768	37,796
Chugoku Electric Power Co.	186	5,062	10,669	52,914	751	11,243	2,893	7,765	1,280	11,938
Shikoku Electric Power Co.	146	2,804	5,240	25,000	412	6,647	1,123	3,171	2,022	6,316
Kyushu Electric Power Co.	237	7,962	15,120	73,064	1,160	14,428	2,370	11,327	5,258	18,955
Okinawa Electric Power Co.	8	732	1,407	6,558	128	1,553	0	1,445	0	1,445
Total	2,600	78,552	173,024	816,920	12,054	148,488	33,322	117,796	42,300	193,419

Section 1 System of Environmental Measures

1 Environmental Policies and Concrete Action Plans

Kansai Electric's most fundamental management policy has always been to contribute to the development and prosperity of the local communities.

As part of this commitment, we have undertaken a range of measures to address environmental issues in our service area, with particular attention to the needs of each community.

Recently, environmental problems causing worldwide damage—global warming, acid rain, ozone layer depletion, vanishing tropical rain forests, and the spread of deserts—have become a serious concern for everyone, and efforts to combat and solve these threats are being undertaken on a global scale.

These global environmental problems are presenting a new challenge to modern civilization. To effectively address them will require integrated international efforts.

Not only technological measures, but changes in many areas, such as social awareness and consumer lifestyles, need to occur on a global scale. In order to achieve sustainable world development, which will require both economic development and global environmental preservation, it is vital for us as global citizens to "think globally and act locally" in our communities.

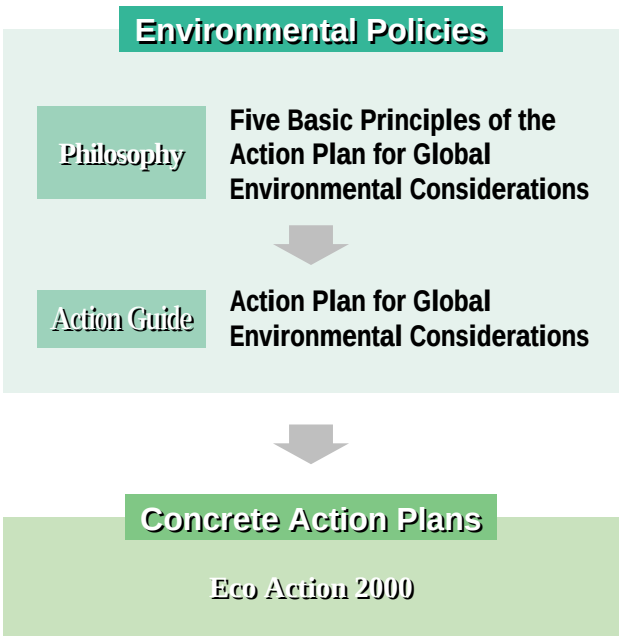
Realizing that it has important responsibility as an electric utility and energy supplier, Kansai Electric is strongly committed to supporting global environmental preservation while working to make people's lives more comfortable. In this respect, we continue to study advanced measures for environmental protection and ways to integrate these into all aspects of our operations.

This action has taken concrete form in efforts such as our Five Basic Principles of the Action Plan for Global Environmental Considerations, which we drew up in April 1990, and the Kansai Electric Power's Action Plan for Global Environmental Considerations of 1991. Both of these outline the environmental protection policies that we follow in all areas of our business.

To further boost our efforts, in 1993 we created the Mid-term Action Plan for Global Environmental Considerations (1993-1995), which outlines concrete action plans based on concrete numerical goals. This plan and the New Mid-term Action Plan for Global Environmental Considerations (1996-1999), created in 1996, have guided our environmental protection efforts to the present.

With major changes surrounding our management environment, such as the partial liberalization of retail energy sales starting in March 2000, we have revised the Kansai Electric Action Plan for Global Environmental Considerations as well as created a new plan of action, Eco Action 2000. Through Eco Action 2000, we are aiming to take on even more environmental challenges so that we may provide benefits for society and earn its trust by making electricity the best and most environmentally friendly energy source available.

System of Environmental Measures



Environmental Policies

Philosophy

Five Basic Principles of the Action Plan for Global Environmental Considerations

1. **Reduction of environmental impact**
2. **Promotion of effective and efficient use of energy and resources**
3. **Development of advanced technologies**
4. **Coordination of efforts throughout the Kansai Electric Group**
5. **Creation of a new corporate culture to support harmonious coexistence with the global environment**

Action Guide

Action Plan for Global Environmental Considerations

Action 1 Consideration for the Environment in All Areas of Our Business

1 Measures to Deal with Global Environmental Problems

a. Measures to Prevent Global Warming (New ERA Strategy)

Efficiency: Efficient utilization of energy by society as a whole
- •Promoting load leveling
- •Promoting the spread of electric vehicles, etc.

Reduction: Reduction of greenhouse gas emissions in electric power supply
- •Promoting nuclear power generation
- •Raising the thermal efficiency of fossil fuel power generation, etc.

Activities Abroad: Activities carried out abroad to prevent global warming
- •International efforts such as expanded use of natural CO_2 absorption mechanism
- •International business that aims to decrease CO_2 emissions

b. Protecting the ozone layer

2 Measures to Deal with Local Environmental Problems

a. Measures to prevent air pollution
- •Reducing sulfur oxides (SOx)
- •Reducing nitrogen oxides (NOx)

b. Measures to prevent water pollution
- •In-plant waste water treatment
- •Thermal discharge impact reduction

c. Measures to deal with chemical matters, etc.
- •PRTR
- •Dioxin

Action 2 Activities Aimed at Building a Metabolic Society

1 Business Activities Geared Towards the Metabolic Society
- •Reducing and Reusing Waste Materials
- •Green Consumerism, etc.

2 Earnest Exchange and Cooperation with External Groups
- •Make public reports on our company's environmental performance, increase opportunities for exchange with external groups
- •Develop grassroots activities in cooperation with external groups, etc.

3 Raising Employee's Awareness of Their Responsibility as Global Citizens
- •Raise awareness among all employees that they are global citizens by carrying out environmental education and consciousness raising activities, etc.

Concrete Action Plans

Eco Action 2000

Concrete Action Plans

Outline of Eco Action 2000 (Companywide action plan)

[Set goals for the next 3 years and revise plans each year so as to stay on target for these goals.]

	Item		
Reduction of greenhouse gas	Reduction of CO_2 emissions per unit of electricity used (sold)		
	Improving capacity factor of nuclear power stations		
	Maintaining and improving thermal efficiency of fossil fuel power stations		
	LNG use		
	Output expansion through hydro power station renovation (Total from fiscal 1989 to present)		
	Reduction in overall loss (losses in generation, transmission and distribution)		
	SF_6 gas exhaust control		
Efficient use of energy	Leveling off peak load	① Increase number of “time-of-use lighting” contracts	
		② Increase number of “load heat storage adjustment” contracts	
		③ Increase peak-shift demand through planned adjustment contracts	
		④ Promotion of peak-cut-type equipment	
	Introduction of electric vehicles		
	Use of untapped energy sources		
	Cooperation in helping spread the use of new energy sources		
	Effective rate of 100,000 People’s Eco-Family Campaign		
Reduction of SOx and NOx emissions per fossil fuel power generation			
Improving recycling of industrial wastes			
Usage rate of 100% recycled copy paper			
Compliance with ISO standards			
Introduction of environmental accounting			

(Fiscal 2000-2002)

Goals			[Reference] Result for fiscal 1999	See page
Fiscal 2000	**Fiscal 2001**	**Fiscal 2002**		
Approx. 0.3kg-CO_2/kWh (forecast)	Approx. 0.3kg-CO_2/kWh (forecast)	Approx. 0.3kg-CO_2/kWh (forecast)	0.28kg-CO_2/kWh	13〜14
[Our goal for fiscal 2010] We aim to reduce emissions to approx. 0.3 kg-CO_2/kWh by 2010 in order to meet the goals that have been set for the electric power industry (emissions unit of CO_2, based on use, to approx. 0.3 kg-CO_2/kWh in fiscal 2010)				
More than 80%	More than 80%	More than 80%	82.0%	19
More than 41%	More than 41%	More than 41%	41.9%	21
More than 5,000,000t	More than 5,000,000t	More than 5,000,000t	5,490,000t	22
29,652kW	30,452kW	33,872kW	27,052kW	22
Reduce as much as possible	Reduce as much as possible	Reduce as much as possible	8.7%	23
Gas reclamation rate during equipment inspection: 90%	90%	90%	83%	25
110,000 contracts	130,000 contracts	150,000 contracts	95,000 contracts	15〜16
3,000 contracts	4,000 contracts	5,000 contracts	2,804 contracts	
500,000kW	530,000 kW	550,000 kW	530,000 kW	
200,000 units	250,000 units	300,000 units	148,000 units	
176 vehicles	We will set goals each year based on market trends and technological innovation		162 vehicles	17
10 districts	11 districts	12 districts	10 districts	17
We will contribute to the spread of new sources of energy by purchasing excess electricity generated by photovoltaic power, wind power, and the burning of waste material			Photovoltaic power generation: 5,800,000kWh Wind power generation: 0kWh Power generation using waste materials: 3,940,000kWh	18
70%	75%	80%	66% (Result for fiscal 1998)	56
SOx: maintaining at current reduced level (Reference: An average of 0.12 g/kWh for the five-year period from fiscal 1995 to 1999)			0.08g/kWh	37〜39
NOx: maintaining at current reduced level (Reference: An average of 0.17 g/kWh for the five-year period from fiscal 1995 to 1999)			0.15g/kWh	
More than 90%	More than 90%	More than 90%	88%	47〜49
Will switch by end of fiscal year	100%	100%	—	50
Will work to increase the number of our business bases that are ISO compliant			18 districts	8
Will do as much as possible to make public the results of our environmental accounting			—	9〜10

2 Environmental Management System

a. Our Environmental Management System (Companywide Efforts)

Environmental management at Kansai Electric is based on the principles of TQM (total quality management) *. This system is outlined below. (See Figures 1 and 2.)

The Nuclear Power and Environmental Committee is chaired by our company president and made up of members of management. Every year, this committee sets concrete action plans for the entire company.

Based on the company's environmental policies and action plans, all divisions, departments, and branches make their own plans and goals that they follow in their environmental improvement activities. They independently check and review the results of these activities.

The Environmental Considerations Department checks and reviews all the various activities carried out throughout the company. When necessary, the Quality and Safety Improvement Audit Department assesses the appropriateness and effectiveness of the environmental management system.

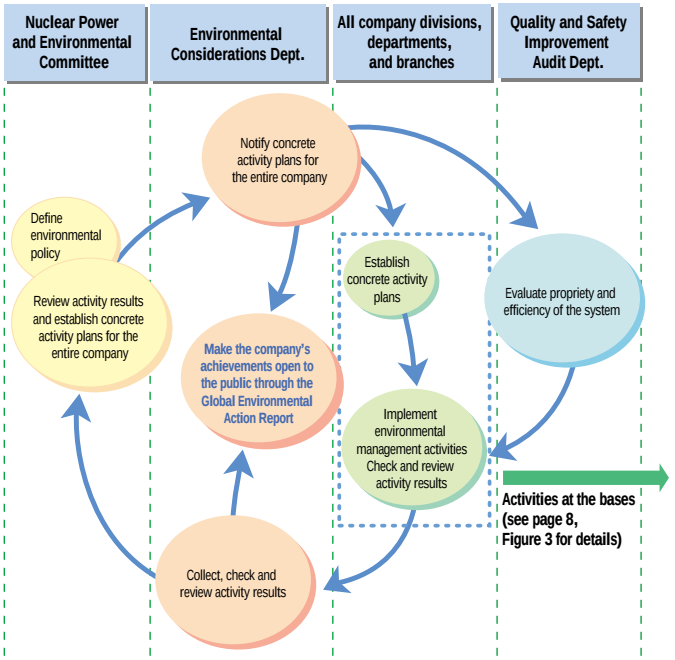
Furthermore, the Environmental Considerations Department reports the results of the check-and-review process to the Nuclear Power and Environmental Committee so that these results can be reflected in the company's concrete action plans for the following year.

The Environmental Considerations Department is the general control center for the operation of the environmental management system. In all divisions, departments, and branches, the Department has set up organizational structures and appointed personnel for the purpose of environmental management.

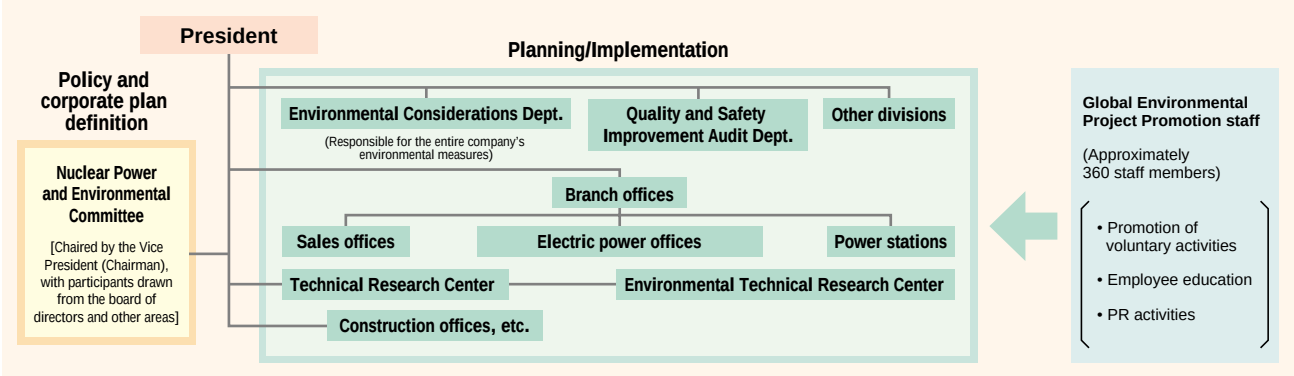
To boost independent efforts in all workplaces throughout the company, we have appointed about 360 environmental project promotion staff members, whose job it is to carry out activities such as internal education and training and external public relations for their own part of the company.

Every year, we publish for the general public the Kansai Electric Power's Global Environmental Action Report, which outlines the state of our environmental management activities.

■PDCA Cycle (Figure 2)

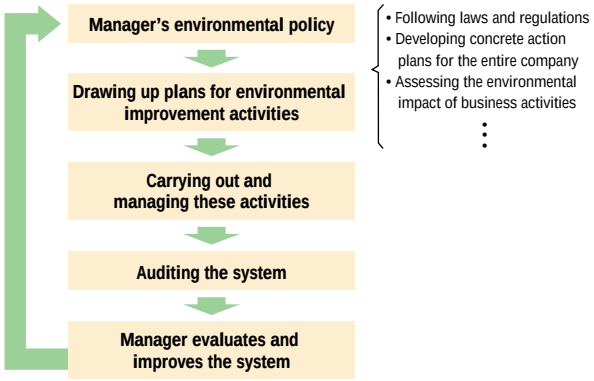


■Organization (Figure 1)



Note: In 1981, we were the first electric power company to introduce a TQC (total quality control) method. In 1984, we received the Deming Prize for contributions to quality and dependability of product. Since then, we have been pursuing consistent and comprehensive activities aimed at improving our environmental performance.

■ISO compliance activities (Figure 3)



b. Environmental Improvement Activities Based on ISO 14001 (Examples from our bases)

Efforts at Bases to Create a Comprehensive Environmental Management System

In order to improve the company's environmental management system, in 1997 we began building an environmental management system compliant with ISO 14001, an international environmental management standard, starting with our fossil fuel power stations (see Figure 3). The result has been a vast improvement in our ability to conserve energy and resources and a higher awareness of these issues among all employees.

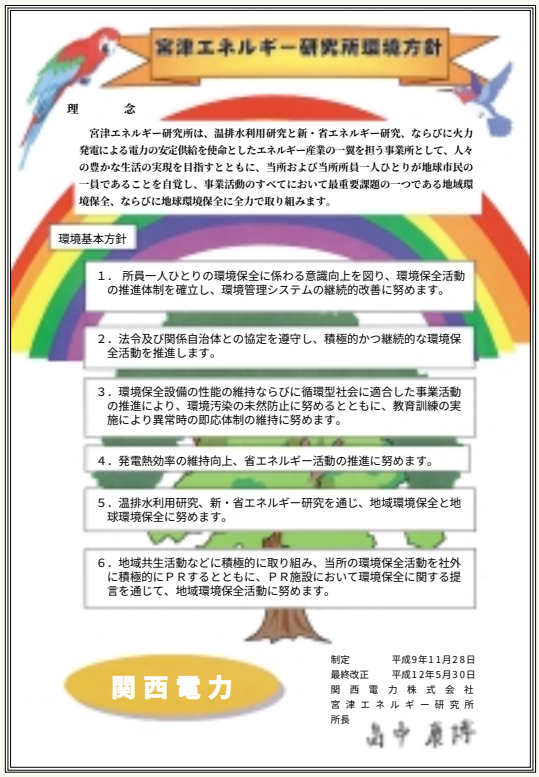
Based on these results, we began environmentally-oriented activities at our Mihama Power Station (nuclear) in fiscal 1999 and at our electric power offices and sales offices in fiscal 2000.

Acquiring External Certification

Internal auditors who have been trained at official external institutions carry out our company's system auditing process, which follows ISO 14001 standards. We have worked to make this auditing as fair and objective as possible.

In fiscal 1999, the Miyazu Energy Research Center and Himeji No. 1 Power Station (both fossil fuel power) achieved ISO 14001 certification from third party institutions. This will ensure even more objective assessment of our activities.

In fiscal 2000, we will continue our efforts by working to make several more fossil fuel power stations ISO 14001 compliant.


宮津エネルギー研究所環境方針

理　念

宮津エネルギー研究所は、温排水利用研究と新・省エネルギー研究、ならびに火力発電による電力の安定供給を使命としたエネルギー産業の一翼を担う事業所として、人々の豊かな生活の実現を目指すとともに、当所および当所所員一人ひとりが地球市民の一員であることを自覚し、事業活動のすべてにおいて最重要課題の一つである地域環境保全、ならびに地球環境保全に全力で取り組みます。

環境基本方針

1．所員一人ひとりの環境保全に係わる意識向上を図り、環境保全活動の推進体制を確立し、環境管理システムの継続的改善に努めます。

2．法令及び関係自治体との協定を遵守し、積極的かつ継続的な環境保全活動を推進します。

3．環境保全設備の性能の維持ならびに循環型社会に適合した事業活動の推進により、環境汚染の未然防止に努めるとともに、教育訓練の実施により異常時の即応体制の維持に努めます。

4．発電熱効率の維持向上、省エネルギー活動の推進に努めます。

5．温排水利用研究、新・省エネルギー研究を通じ、地域環境保全と地球環境保全に努めます。

6．地域共生活動などに積極的に取り組み、当所の環境保全活動を社外に積極的にＰＲするとともに、ＰＲ施設において環境保全に関する提言を通じて、地域環境保全活動に努めます。

関西電力

制定　平成9年11月28日
最終改正　平成12年5月30日
関西電力株式会社
宮津エネルギー研究所
所長　高中康博

Miyazu Energy Research Center Environmental Policy Leaflet

Environmental Management System at the Miyazu Energy Research Center

The Miyazu Energy Research Center (fossil fuel power) works to protect the environment, following all laws and regulations and preventing pollution before it happens. It also carries out research into new sources of energy.

Topics

By doing away with a special bus that used to take employees to work and having them instead take public transportation, the Miyazu Energy Research Center has cut costs and taken a contributor of exhaust fumes off the road.

This has allowed the public bus system, which used to operate in the red, to increase the number of buses and lengthen routes. Public transportation now takes people as far as our office and the Tango Watch-Kan, a public exhibit which houses an aquarium.

This expansion of the bus system has meant more convenience for local senior citizens and students traveling to school. The local municipality no longer has to subsidize underused bus routes, the bus companies have more passengers to keep them in business, and there are fewer cars on the road. Locals have praised the Miyazu Energy Research Center for energizing public transportation and creating convenience in the local community.

The Miyazu City Eco Network, formed by the city and major local groups, has called for companies in the area to be ISO 14001 compliant. By being the first company to do so, the Miyazu Energy Research Center has made itself the city's leading corporate citizen.

Miyazu Energy Research Center

3 Environmental Accounting

Environmental accounting is a method for quantitatively calculating, analyzing, and publicizing the costs related to environmental protection (investment and expenses) and the effects of these investments and expenses. Kansai Electric began working towards introducing environmental accounting in fiscal 1999. Using the publication "Towards Establishing an Environmental Accounting System (Fiscal 2000 Report)", a guideline put out by the Environment Agency in May 2000, we carried out a solidly grounded trial accounting of as much of the entire company's environmental costs and effectiveness as was possible.

Range of total: Entire company
Period: April 1, 1999-March 31, 2000

Environmental protection costs

Units: 100 million yen

Field		Main items	Amount invested	Expenses
(1) Environmental protection costs to control the environmental burdens from manufacturing and servicing activities that arise within the business areas (costs within business areas)			76.7	337.9
Details	①Pollution prevention costs	Air pollution prevention measures (eliminating sulfur and nitric acid) Water pollution prevention measures	44.0	286.8
	②Environmental protection costs	Measures to improve the thermal efficiency of existing thermal power stations; purchasing excess power from new energy sources	31.8	37.7
	③Cost of recycling resources	Recycling industrial waste	0.9	13.4
(2) Costs to control the environmental burdens that arise upstream or downstream as a result of manufacturing and servicing activities (upstream/downstream costs)		Introducing electric vehicles	0.0	0.7
(3) Environmental protection costs incurred in management activities (management activities costs)		Environmental concentration measurement surveys, in-house education, ISO 14001 certification by third party certification bodies	0.6	14.3
(4) Environmental protection costs incurred in research and development activities (R&D costs)		Absorbing CO_2, fixing CO_2 levels, recycling waste, superconductivity research	0.7	29.0
(5) Environmental protection costs incurred during social activities (social activities costs)		Underground line construction, afforestation work, making environmental reports public	420.8	511.4
(6) Costs to deal with environmental damage (environmental damage costs)		Levies on pollution	0.0	12.3
Total			**498.8**	**905.6**

* Amount invested: The cost of plant and equipment incurred in construction
Expenses: Cost of maintaining and operating plant and equipment, cost of in-house education, other costs

Reference

Units: 100 million yen

	Main items	Total amount
Total investment during the related period	Construction of power stations	6,122.9
Total R&D expenses during the related period	R&D to streamline operation of power stations	276.3

Effect of environmental protection activities

Field	Items	Unit	Compared to fiscal 1990	Details
(1) Effect of environmental protection in business areas (effect within business areas)	SOx	0.08g/kWh	△0.09g/kWh	Total emissions: 3,808 t
	NOx	0.15g/kWh	△0.09g/kWh	Total emissions: 6,626 t
	CO_2	0.28kg-CO_2/kWh	△0.07kg-CO_2/kWh	Total emissions: 39,260,000 t-CO_2
	Industrial waste, etc.	Recycling rate: 88%		Total emissions: 101,000 t
(2) Effect of environmental protection upstream or downstream (upstream/downstream effects)	Items	Results for each year		Total results
	Introducing electric vehicles	162 vehicles (Total at end of fiscal 1999)		—
(3) Other effects	Total cable length for underground electrical wiring routes	339km		12,064km
	Green zoning area	5,000 m^2		4,089,000 m^2
	Tree planting	33,000 trees		235,000 trees (Total since fiscal 1993)
	Community beautification	801 times		2,753 times (Total since fiscal 1996)

Economic effect of environmental protection measures

Units: 100 million yen

Field	Main items	Total amount
Income from recycling	**Flue gas desulfurization plaster**	0.4
Costs saved from energy conservation	**Measures to improve the thermal efficiency of existing thermal power stations**	3.6
Costs saved from things like reuse and recycling	**Reuse of things like transformers**	33.3
Total		**37.3**

(*) The economic effects of environmental protection do not include estimates based on hypothetical calculations.

Future Environmental Efforts

It is not possible to take compound costs that consist of environmental costs among many others and isolate in detail only those costs that are related to environmental protection.

A typical example of a compound cost is nuclear power stations, which are an effective way of contributing to the reduction of global warming but are also an important source of secure energy. However, since there are so many ways we could separate the environmental protection costs from the overall cost of nuclear power stations, we have left this area out of our environmental accounting in this report.

But if we were to calculate things like the cost of waste material disposal at nuclear power stations as environmental protection costs, it would total investments of about ¥60 billion and expenses of about ¥170 billion.

Depending on the method of calculation, environmental protection costs vary greatly. Since there are risks involved in such calculation, we did not sum up environmental cost in this report. We will, however, consider it for future reports.

We are also carrying out solidly grounded trial accounting of economic effects.

We will continue to work to achieve a more accurate idea of our environmental protection costs and effectiveness in order to make environmental accounting a more powerful tool for creating and carrying out effective environmental protection measures.

Section 2 Consideration for the Environment in All Areas of Our Business

1 Measures to Prevent Global Warming

① CO_2 Emissions Worldwide and in Japan

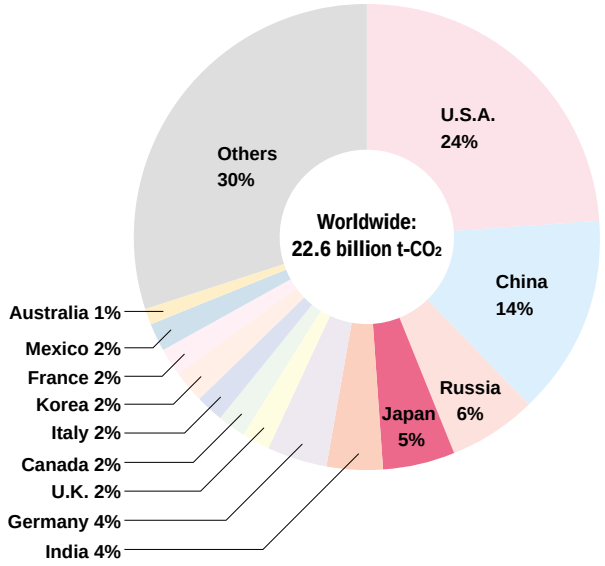
CO_2 emissions from fossil fuel combustion, the basis of much of our social and economic activity, are considered a major cause of global warming.

Worldwide CO_2 emissions amounted to approximately 22.6 billion t-CO_2 (result for 1997), with Japan accounting for 5% of the total (see Figure 4).

Looking at CO_2 emissions in Japan by sector, the industry sector accounted for 40%, the domestic sector (households) 13%, the commercial sector 12%, and the transportation sector 21% (see Figure 5).

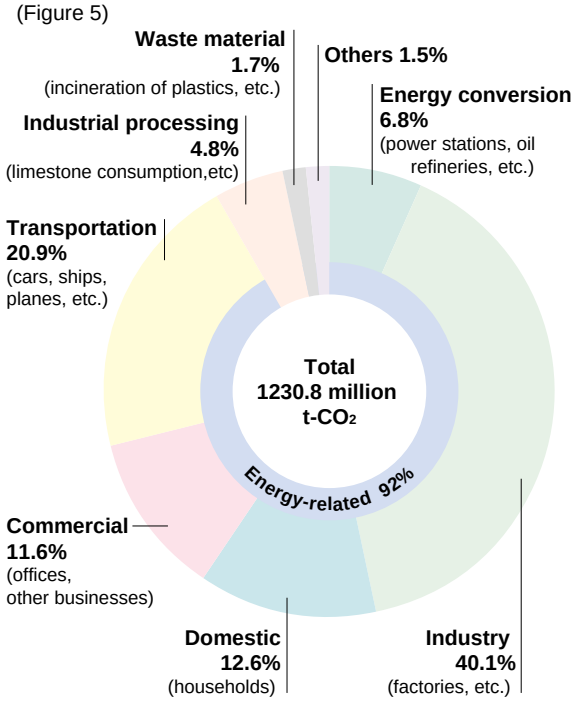
Of the increase in CO_2 emissions caused by energy generation in each sector since fiscal 1990, sharp increases were attained of 13% in the commercial sector and 21% in the transportation sector, while the industry sector almost maintained its current levels (see Figure 6). This is mainly due to the increase of energy consumed with the growth of amenities in the commercial sector, as well as the increase in number and size of private cars in the transportation sector.

■World CO_2 emissions from fossil fuel combustion (1997) (Figure 4)



Source: Outline of Energy and Economic Statistics 2000
Japan Energy and Economic Research Institute

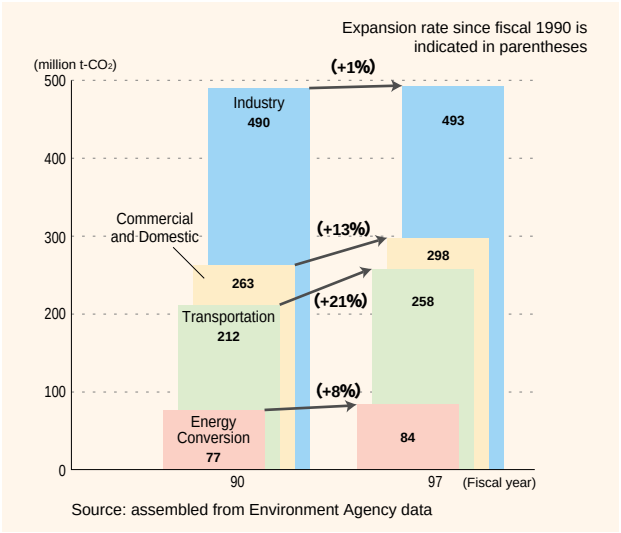
■Japan's CO_2 emissions by sector (Fiscal 1997) (Figure 5)



(Note)
- Figures indicate percentage of total emissions by power plants allotted to various sectors by their final demand in proportion to their power usage.
- Figures in this graph indicate percentage of total emissions.
- "Others" includes statistical errors as well as the consumption of lubricants.

Source: assembled from Environment Agency data

■Japan's CO_2 emission trend by sector (Figure 6)



Source: assembled from Environment Agency data

② Measures to Reduce CO_2 Emissions in the Electric Power Industry

Japan's electric utility companies strive to reduce CO_2 emissions voluntarily.

To reduce CO_2 emissions resulting from power generation, we must attack the problem from both the supply side and the demand side.

CO_2 emissions ($kg\text{-}CO_2$)	=	Power consumption (kWh) Quantity of electricity consumed	×	CO_2 emissions per unit of power generated ($kg\text{-}CO_2/kWh$) CO_2 emissions unit

In order to achieve this, electric utility companies have taken a number of measures to reduce CO_2 emissions per kWh, by working to achieve the optimum generation capacity mix with a focus on nuclear power and improve the efficiency of facilities at fossil fuel power stations.

We are also promoting load leveling to achieve efficient energy use by developing and popularizing equipment that has high energy efficiency.

The Electric Power Industry's Environmental Plan of Action

The Federation of Electric Power Companies of Japan published the Environmental Plan of Action for the Electric Power Industry in November 1996, in order to step up voluntary efforts to solve problems such as global warming. The second review was conducted in September 1999.

The plan outlines the goal for the electric industry to strive to reduce CO_2 emissions units (amount of emission per 1kWh of electric power consumed by customers) in fiscal 2010 by around 20% (approximately $0.3kg\text{-}CO_2/kWh$) of fiscal 1990 levels by promoting nuclear power development and improving the nuclear power utilization factor.

Accordingly, even though gross electric power output is expected to increase by 150% by 2010, CO_2 emissions are expected to increase by around 120%, based on 1990 levels.

CO_2 emissions approx. 340 million $t\text{-}CO_2$ (1.2×1990 levels)	=	Power consumption approx. 1 trillion kWh (1.5 times)	×	CO_2 emissions per unit of power consumed approx. $0.3kg\text{-}CO_2/kWh$ (20% reduction)

Third Session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (COP3)

Approximately 10,000 people from fields such as government, NGOs, and media in 161 countries participated in the Third Session of the Conference of the Parties to the UNFCCC (COP3) held in Kyoto, December 1-11, 1997.

Although assertions from each country were strongly divided over the goals for greenhouse gas reduction, the conference ended by adopting the Kyoto Protocol to determine concrete numerical goals for advanced nations. The Kyoto Mechanism and observance systems will be decided in detail at COP6 which will be held in the Netherlands in November 2000.

■Main Contents of the Kyoto Protocol

Target Period		Five years between 2008 and 2012 (First Phase)	
Target Gas		CO_2, methane, nitrous oxide, HFC, PFC, SF_6 (note 1)	
Base Year		1990 (1995 may also be selected for HFC, PFC, SF_6)	
Emission Reduction Target		At least 5% reduced from the base year by advanced nations (note 2) as a whole EU 8%, U.S.A. 7%, Japan 6%, Russia 0%, Australia +8%, etc.	
Sinks		Resulting from land use change and forestry activities, limited to afforestation, reforestation and deforestation since 1990, were considered. Although implementation was decided, details will be determined at a later date.	"Buenos Aires Plan of Action" adopted at COP4. Rules of mechanism will be determined before COP6.
Kyoto Mechanism	Emissions Trading	The difference between numerical goals and actual emission can be traded as an "emission right."	
	Joint Implementation	If the greenhouse gas reduction project is performed among advanced nations, emission reductions from the project can be transferred and/or obtained.	
	Clean Development Mechanism (between advanced nations and developing nations)	The greenhouse gas reduction project will be performed between advanced nations and developing nations. Advanced nations can obtain their reduced amount through a certain authentication procedure. Developing nations also receive profit from the project activities.	

(note 1) HFC (hydrofluorocarbons) and PFC (perfluorocarbons) are substitution gases for specific chlorofluorocarbons. SF_6 (sixth fluoridation sulfur) is insulation gas.
(note 2) Advanced nations: Annex B countries to the Kyoto Protocol (OECD member nations as well as the former Soviet republics and Eastern European nations); 38 countries, 1 international organization (EU)

③ Kansai Electric's Measures to Prevent Global Warming - New ERA Strategy

Kansai Electric attacks the global warming problem with its New ERA Strategy.

Kansai Electric is actively developing its New ERA Strategy, a comprehensive policy on the further reduction of greenhouse gas. We will continue to explore new possibilities that can be integrated in this strategy.

"ERA" is an acronym for

Efficiency:

efficient utilization of energy by society as a whole

Reduction:

reduction of greenhouse gas emissions in electric power supply

Activities Abroad:

activities carried out abroad to prevent global warming.

The initials "ERA" also represent our commitment to cultivate a new era in environmental protection (see Figure 7).

A report of the IPCC (Intergovernmental Panel on Climate Changes) states that the impact of global warming on nature and society will appear over a long-term period, and areas affected will increase throughout the whole world.

In order to solve the global warming problem, not only is it vital to take immediate action but also to face the problem with a medium/long-term and global view.

Kansai Electric will continue endeavoring to maintain sustainable development by simultaneously achieving its goals - the 3Es, which are:

Economical Growth

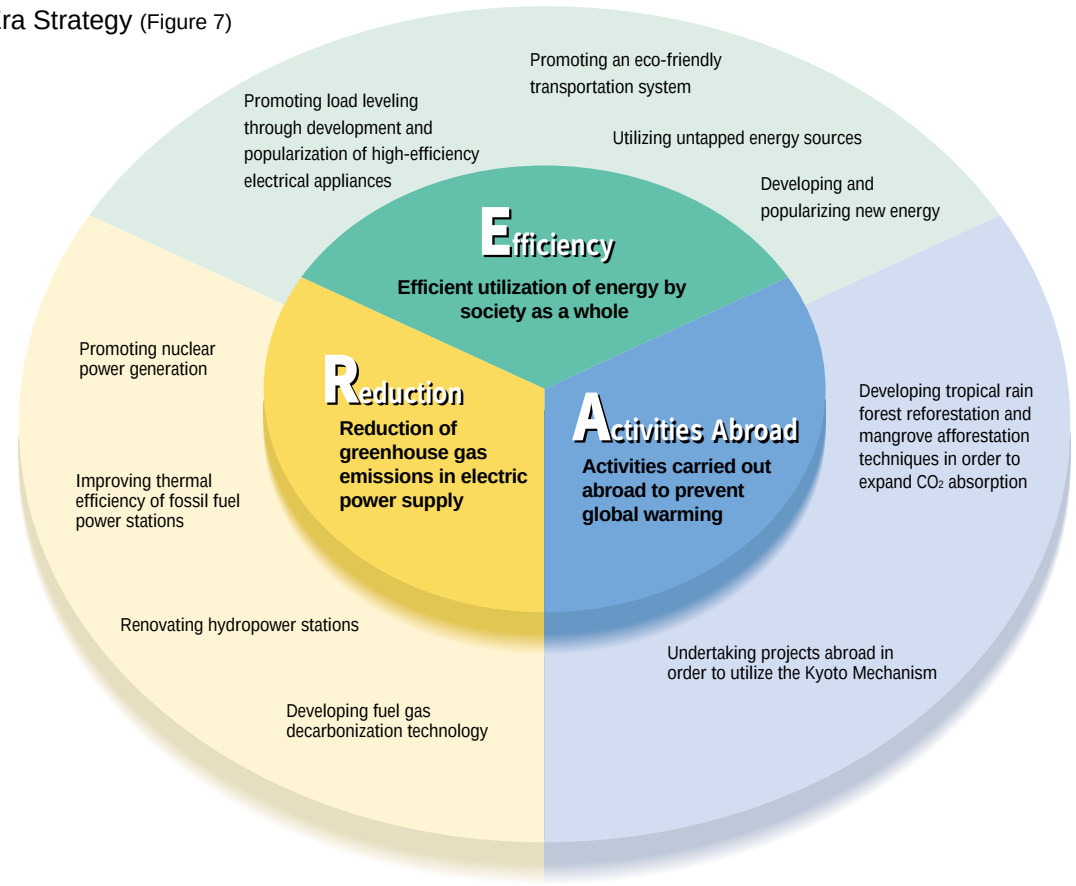
Energy Security

Environmental Preservation

We are working to balance the "E," "R," and "A" of our New ERA Strategy in order to propel our long-term endeavor to preserve the global environment.

The various measures included in the New ERA Strategy are described from page 14 onwards.

■New Era Strategy (Figure 7)



Kansai Electric's CO_2 reduction target

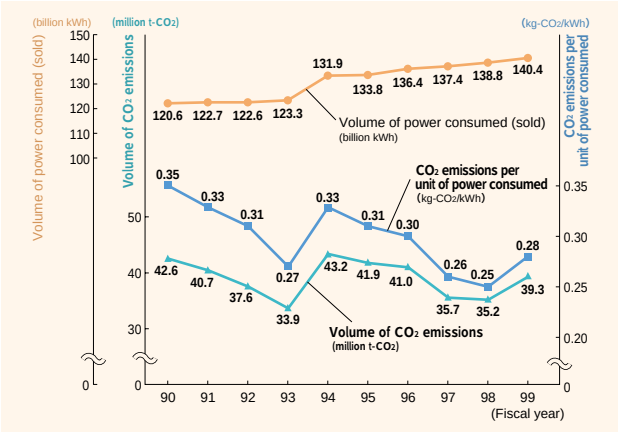
Endeavoring to reduce CO_2 emissions per unit of power consumed.

Under the New ERA Strategy, we have set a number of numerical goals to reduce CO_2 emissions per kWh (emissions per unit of power consumed) utilized (sold) in fiscal 2010 to 0.3kg-CO_2/kWh, in accordance with the targets of the electric power industry (see page 12).

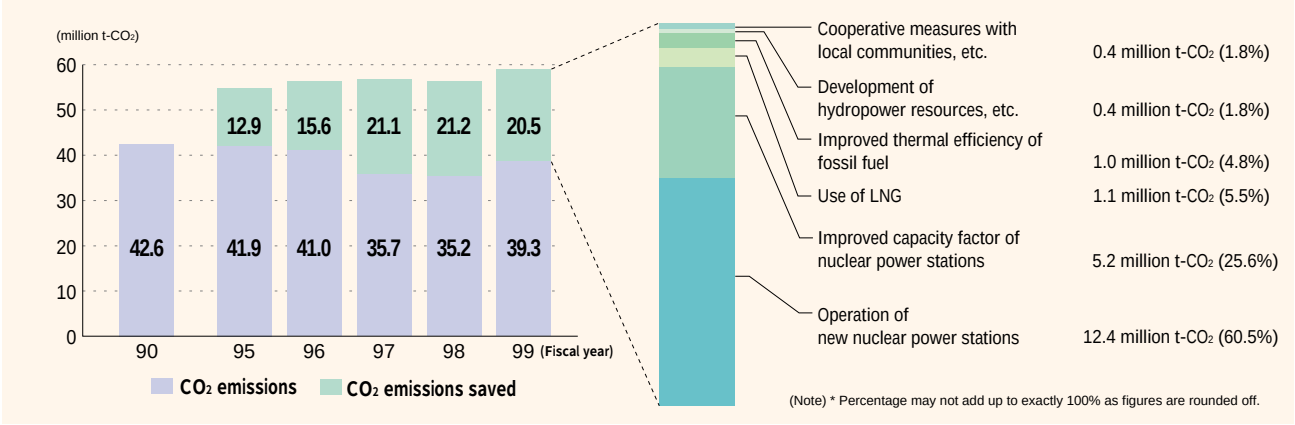
As a result of the New ERA Strategy, CO_2 emissions utilized in fiscal 1999 amounted to 0.28kg-CO_2/kWh, a reduction of approximately 8% over fiscal 1990 despite the 16% increase of electrical power consumed (sold). (see Figure 8.)

Kansai Electric's CO_2 emissions per kWh are lower than those of major Western nations, just above France with its high nuclear power ratio and Canada with its high hydropower ratio. We will continue in our efforts to voluntarily and assertively reduce CO_2 emissions based on the New ERA Strategy (see Figure 9).

■Trend of CO_2 emissions per unit of electric power consumed (Figure 8)

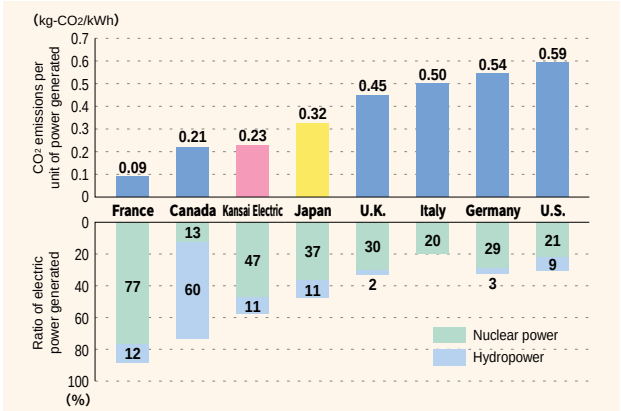


■CO_2 emissions saved by New ERA Strategy (Figure 10)



(Note) * Percentage may not add up to exactly 100% as figures are rounded off.

■CO_2 emissions per unit of power generated and nuclear/hydropower ratio (1998) (Figure 9)



Source for foreign countries: Energy Balances of OECD Countries 1997-1998
Source for Japan: survey by the Federation of Electric Power Companies

Note: Kansai Electric's emissions per unit of CO_2 are just above those of France (high nuclear ratio) and Canada (high hydropower ratio)

The effect of CO_2 reduction through the New ERA Strategy

Promoting nuclear power is the key to reduction of CO_2 emissions

As a result of our efforts, CO_2 emissions saved were approximately 20.5 million t-CO_2 less in fiscal 1999 as compared to fiscal 1990 levels. This is equivalent to approximately 2% of Japan's total CO_2 emissions – 1.23 billion t-CO_2 – in fiscal 1997. Converted into the petroleum equivalent, this amounted to an estimated saving of approximately 7.4 million $k\ell$ of oil (equivalent to about 70% of our annual fuel consumption).

Nuclear power generation accounted for approximately 90% of the total reduction, primarily due to the start-up of Units 3 and 4 at the Ohi Power Station (nuclear) after 1990 and the increased generation of CO_2-free nuclear power owing to the improved capacity utilization factor at nuclear power stations.

Other measures to reduce CO_2 emissions include improved thermal efficiency at fossil fuel power stations, use of LNG, and development of hydropower resources (see Figure 10).

Efficiency

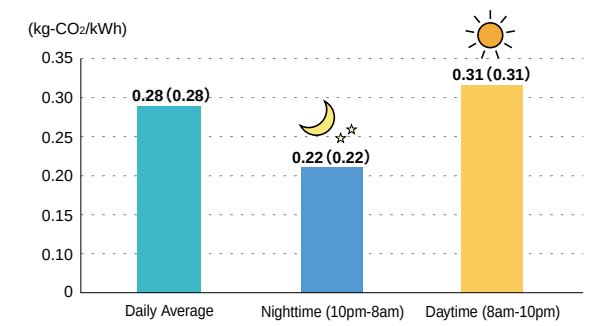
(Efficient utilization of energy by society as a whole)

Promoting Load Leveling

Kansai Electric promotes the use of off-peak nighttime electricity which emits less CO_2.

In recent years, the increasing demand for electricity to power air conditioners in the daytime has created a large gap between daytime and nighttime electricity use. Kansai Electric Power has been trying to narrow this gap (load leveling) and thus achieve effective use of energy and facilities. As well, we have been pushing for more use of nighttime electricity, which results in less CO_2 emissions and thus less contribution to global warming (Figure 11).

■Kansai Electric's CO_2 emissions per electricity sold (Estimates) (Figure 11)



(Average demand over five years from 1995 to 1999. Figures in parentheses are for 1999 only.)

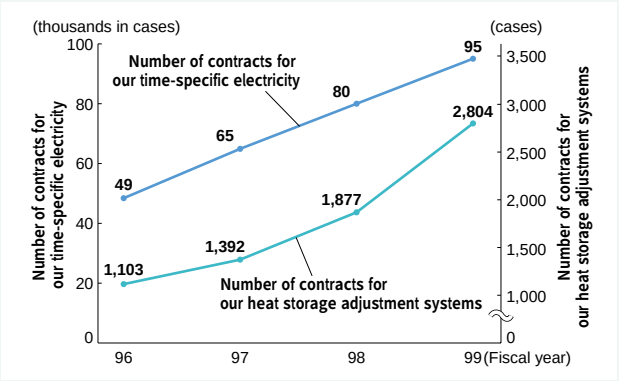
To achieve this, we have been striving to spread the use of our ice (water) storage air-conditioning systems and electric water heaters. In addition, we introduced a system of cheaper electricity rates in the evenings in an attempt to shift some of the use from the peak daytime period and thus lessen the above-mentioned electricity gap between day and night.

These are some of the benefits of our nighttime electricity use devices and system:

1 Customers achieve substantial savings by using cheaper nighttime electricity.
2 We can improve our operation efficiency by reducing power generation costs because the gap between daytime and nighttime demand can be leveled off.
3 Through the use of nighttime power, with its high nuclear power generation ratio and low CO_2 emissions, we are contributing less to global warming.

As a result of our promotion of these programs, there has been a steady increase in the number of contracts for our "load heat storage adjustment" and "time-of-use lighting" (see Figure 12).

■Number of contracts for our heat storage adjustment systems and time-specific electricity (Figure 12)



Apart from these, we have had great success in shifting use away from peak periods with our systematic adjustment contracts and through the introduction of the Eco-Vender, a peak-cut-type soft drink vending machine.

In November 1999, to celebrate reaching 2000 contract customers for our load heat storage adjustment systems, we held the Kanden (Kansai Electric) Customer Forum 2000, at which participants vowed to spread the word and the use of load heat storage adjustment systems.

Furthermore, starting in March 2000, we introduced plans including our "Happy Time" initiative (customers sign up for electric supply that varies depending on the season and time of day), which lowers electricity costs during the morning, evenings, and holidays, times when the whole family is often together at home.

Such are the electricity fee systems we are introducing in order to level the electricity load. The public and private sectors are also working together to promote more effective and efficient use of electricity by offering tax incentives, preferential financing, and government subsidies. As well, every July, the Heat Pump/Energy Storage Center sponsors Energy Storage Month, during which time, the Get-together for Energy Storage events bring together 10 power company presidents, related companies and groups, building owners, and representatives from public agencies. Kansai Electric Power also joins in, cooperating with the public and private sectors in presenting events like the Energy Storage Fair and the Eco Ice Campaign, held twice a year in summer and winter.

Promoting and expanding load leveling apparatus and systems

Kansai Electric is promoting the use of energy storage air-conditioning systems which store energy as ice or cold water by utilizing less expensive off-peak nighttime electricity. The space requirements for the Eco-Ice (ice-storage air-conditioning system) are even less than those for the cold water system, adding to its increasing popularity.

In October 1998, in collaboration with electric power companies and manufacturers, we developed the Eco-Ice Mini for use in offices and shops with an area of 50-200 square meters. We are also promoting our energy storage air-conditioning systems to a wide spectrum of customers.

TV commercial for Kansai Electric's Eco-Ice Mini

Since 1999, Kansai Electric has been endeavoring to promote the Ice-Storage Freezing Water Condensing System throughjoint development with manufacturers. This system freezes drainage water at night to reduce the volume of drainage water by making pure ice. It also makes other uses of water such as storing ice as an energy source for air conditioning or sprinkling melted water.

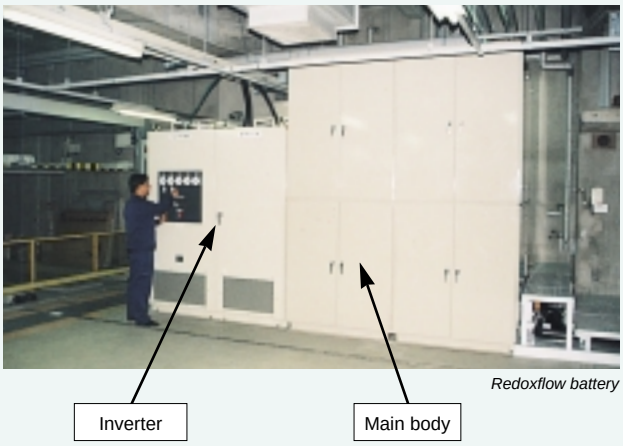
Furthermore, we are promoting the installation of the Eco-Vendor, a peak-cut-type soft drink vending machine, as well as electric vehicles and electric water heaters, that draw minimal electricity during peak-load times.

Ice-Storage Freezing Water Condensing System

Developing Technology for Highly Efficient Energy Use

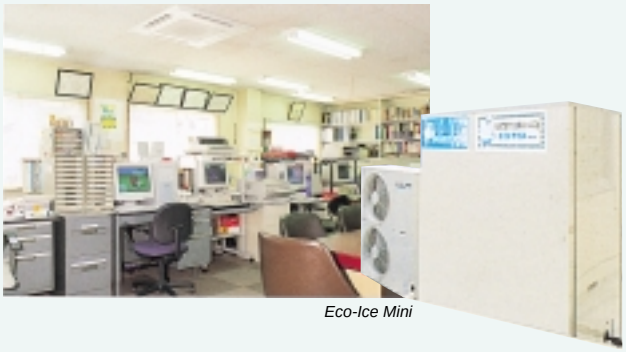
Generating constant output is more energy-efficient and economical than starting up and shutting down the power station to adjust to fluctuations between nighttime and daytime demand.

Accordingly, Kansai Electric is researching and studying power storage batteries such as redoxflow battery which will enable nighttime power to be stored during the nighttime and then put to use during the daytime.



Redoxflow battery

We are also conducting technological development on high efficiency power equipment aimed at leveling off the peak load. By examining ways to increase the efficiency and operation methods of heat pumps and heat storage systems, we developed appliances that make highly effective use of electricity, such as the Small Eco-Ice (ice-storage air-conditioning system) with home water-heater, and the Eco-Ice Mini, a small ice-storage air-conditioning package. We also developed the Air-Conditioning System with Thermal Storage in Slabs which utilizes nighttime electricity and uses stored heat from the building structure by blowing cold and hot air against large heat capacity concrete slabs.



Eco-Ice Mini

Efficiency

(Efficient utilization of energy by society as a whole)

Promoting an Eco-Friendly Transportation System

Electric vehicles lead to reduction of CO_2 emissions for society as a whole.

Electric vehicles are more energy-efficient than gasoline vehicles, as they emit some 60% less CO_2 even when taking into consideration the loss in generation (from the 1997 edition of the Environmental White Paper). CO_2 emissions are further reduced when electricity is charged at night.

At present, Kansai Electric is aggressively promoting the use of electric vehicles within the company. We have also placed 162 electric vehicles (as of March 2000, excluding vehicles solely for use on the premises) mainly at five sales offices located in major cities, and are using them on a daily basis. We plan to further increase the number of electric vehicles introduced as a replacement for gasoline and diesel vehicles.

Recently, electric scooters which can be recharged at 100V have become popular. These scooters contribute to reducing CO_2 emissions if they are recharged at night.

Electric scooter

Kobe Eco-Car Co., Inc.

Kobe Eco-Car Co., Inc., a subsidiary of Kansai Electric, commenced business in April 1998. Kobe Eco-Car is the first car-rental agent in Japan to rent out "eco-cars" (low pollution vehicles) such as electric vehicles and currently it has 53 eco-cars.

As well as installing electricity supply stands for electric cars at 28 locations in Kobe City, Kobe Eco-Car has set up a service system to accommodate both tourism and business operations. Promoting the eco-car is expected to raise citizens' environmental awareness and upgrade Kobe's image as a "clean sightseeing city."

Electric vehicle

Utilizing Untapped Energy Sources

Kansai Electric contributes to environmental preservation by converting untapped energy into useful energy

A large amount of energy in municipal areas disappears without being used.

Recycle-type regional heating services which make effective use of such untapped energy contribute to environmental preservation.

We are making efforts to convert untapped energy from sources such as steam from fossil fuel power stations, waste heat exhausted from office buildings and computers, and the regional heat supply, by taking advantage of the differences between river or seawater temperatures and atmospheric temperatures.

As part of our efforts to promote regional heating and cooling systems, we have established 10 regional heating services throughout Kansai (see Table 1).

We are also considering introducing a regional heat supply that makes use of river water in the Osaka Konohana Rinkai districts and Nakanoshima 3-chome.

Cosmo Square, Osaka Nanko

■Projects for Practical Use of Untapped Energy (Table 1)

Area	Osaka Nishi Umeda	Osaka Honjo Higashi	Nakanoshima 6-chome Nishi	Osaka Nanko Cosmo Square	Kansai International Airport	Wakayama Marina City	Kobe Research Park Kanoko-dai	Tenmabashi 1-chome	Rinku Town Area	Sannomiya Station
Started	Apr. 1991	Jan. 1992	Nov. 1992	Apr. 1994	Apr. 1994	Jul. 1994	Nov. 1994	Jan. 1996	Sep. 1996	Apr. 1999
Service area (ha)	11	6	2	21	511	49	15	5	49	1
Energy source	Waste heat from cogeneration	Waste heat from computers and buildings	Waste heat from buildings	Sea water temperature, waste heat from cogeneration and buildings	Waste heat from power stations	Extracted steam from power stations	Waste heat from computers and buildings	River water temperature, waste heat from cogeneration	Waste heat from substations	Waste heat from buildings and cogeneration
Facility capacity: Low temperature heat (RT)	3,217	3,041	2,740	17,700	26,380	5,050	10,460	6,600	5,550	2,150
Facility capacity: High temperature heat (Gcal/h)	9.0	5.1	5.2	49.5	77.1	18.0	6.6	25.1	25.8	5.5

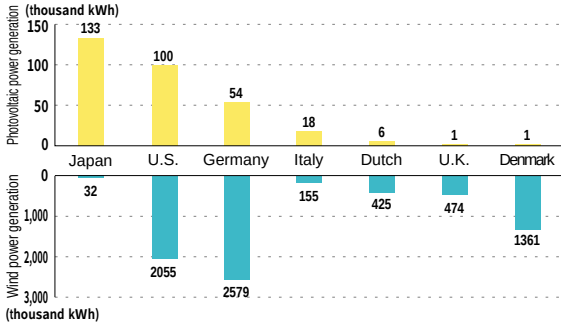
Developing New Energy Sources

Kansai Electric also endeavors to use natural energy, etc.

Photovoltaic and wind power generation

Although natural energy sources such as photovoltaic and wind power are CO_2-free, energy density is low, power generation is unstable due to changeable weather conditions, and the generation cost is higher than for traditional forms of energy. However, in Japan, which lacks natural resources, these new energy sources are being developed assertively, and the volume of photovoltaic power generation introduced is the highest in the world. Meanwhile, Japan's wind power installations fall below international levels, with only 1% of available land area used compared with Denmark which uses approximately 50% (see Figure 13).

■Photovoltaic and wind power introduced (1998) (Figure 13)



Source: Assembled by Kansai Electric from General Energy Chosakai's New Energy Meeting and NEDO data.
Note: Solar power figures are for end of fiscal 1998. Wind power figures are for end of 1998.

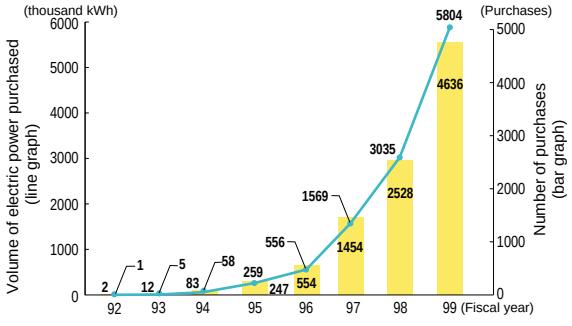
Under the auspices of NEDO (New Energy Development Organization, the Ministry of International Trade and Industry), our Rokko Test Center has installed equipment for photovoltaic power generation (500 kW) and wind power generation (33 kW). Trial tests are being conducted on the effect of photovoltaic generation on power quality and safety when numerous photovoltaic power systems are connected to our power grid, as well as countermeasures and technology to improve utilization merit.

Photovoltaic cells are expected to become an important auxiliary energy source in years to come. Therefore, we install more photovoltaic facilities when building or renovating our buildings. As of the end of fiscal 1999, 740kW of photovoltaic power generation systems have been installed, moving us closer to the fiscal 2000 target of 765kW.

Kansai Electric has also installed a low wind velocity power generator to conduct verification tests and deepen our knowledge of actual operation. At the end of fiscal 1999, equipment with a combined capacity of 159kW had been installed.

We have been promoting an institutional program for new energy sources such as photovoltaic power since April 1992. Customers who install power generation equipment for new energy sources to produce household electricity and hope to sell surplus power can have their equipment linked to our power grid (see Figure 14). To encourage the early development and use of this new technology, the purchase price of such surplus power is set equivalent to the ordinary sales price.

■Purchase of surplus power from photovoltaic generation (Figure 14)



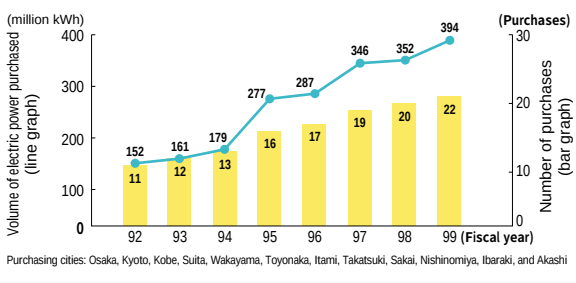
Note: There are no records for surplus power purchased from wind power generation.

Furthermore, we are planning to implement a Green Electric Power System for large-scale wind power generation and photovoltaic power generation for public use through cooperation between Kansai Electric and our customers.

Power Generation Using Waste materials

Electric power from waste is generated by using combustion heat from waste as a heat source. Since there is no additional burden on the environment from this system, Kansai Electric purchases waste-generated power at a higher price than surplus power from other independent power producers and at a similar price to Kansai Electric's unit selling price. We also provide consulting services to local governments on matters such as effective patterns of generation. In 1999, Kansai Electric purchased 394 million kWh of electricity generated by the municipal waste incineration from 12 cities (22 purchases). (see Figure 15)

■Purchase of surplus power from waste generation (Figure 15)



Purchasing cities: Osaka, Kyoto, Kobe, Suita, Wakayama, Toyonaka, Itami, Takatsuki, Sakai, Nishinomiya, Ibaraki, and Akashi

Reduction

(Reduction of greenhouse gas emissions in electric power supply)

Promoting Nuclear Power Generation

Kansai Electric promotes nuclear power generation which does not emit CO_2.

Improving capacity factor of nuclear power stations

Kansai Electric plans to increase electrical power generation using nuclear energy, a power source that does not emit CO_2, while making every possible effort to improve the reliability and capacity factor of our nuclear power stations.

We have taken specific steps at our nuclear power stations to improve reliability and safety, such as replacing steam generators and top lids of nuclear reactors, as part of our regular preventive measures. We completed all the necessary steam generator replacements in fiscal 1997.

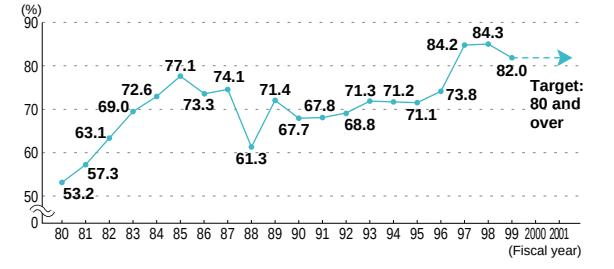
By continuing to improve detailed process management and operation efficiency, we plan to achieve short periodic inspections around 40 days constantly, on condition that we ensure safety and reliability. By doing so, we aim to upgrade the efficiency of maintenance work and set the capacity factor of our nuclear power stations at above 80% (see Figure 16).

Control of radioactive waste

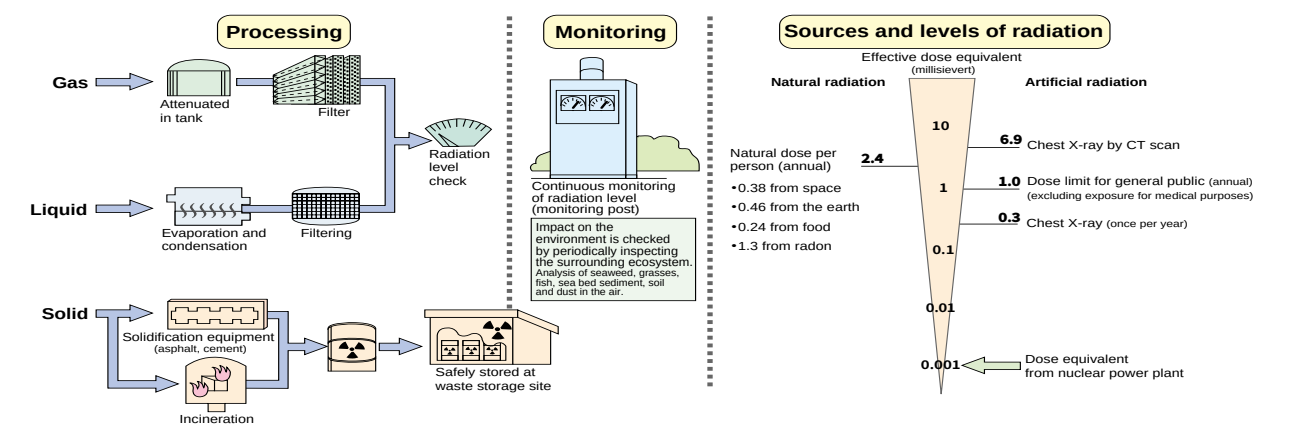
Radioactive waste generated by our nuclear power stations is handled through a rigorous and precise control system to minimize impact on the environment. Radiation impact to the surrounding area is kept to an extremely low level, less than 1/1000 of the annual radiation dose from natural sources, about 1 millisievert (see Figure 17).

After separating valuable substances such as uranium through reprocessing of spent fuel from nuclear power stations, remained high-level radioactive waste is stored safely for approximately 30-50 years for cooling and disposed of several hundred meters underground. Based on the Principles of Fair Burden Between Generations, expenditure for future disposal is to be secured as funds during operation at power stations. Nuclear power is operated with reliable disposal of waste in consideration of future generations (see Figure 18).

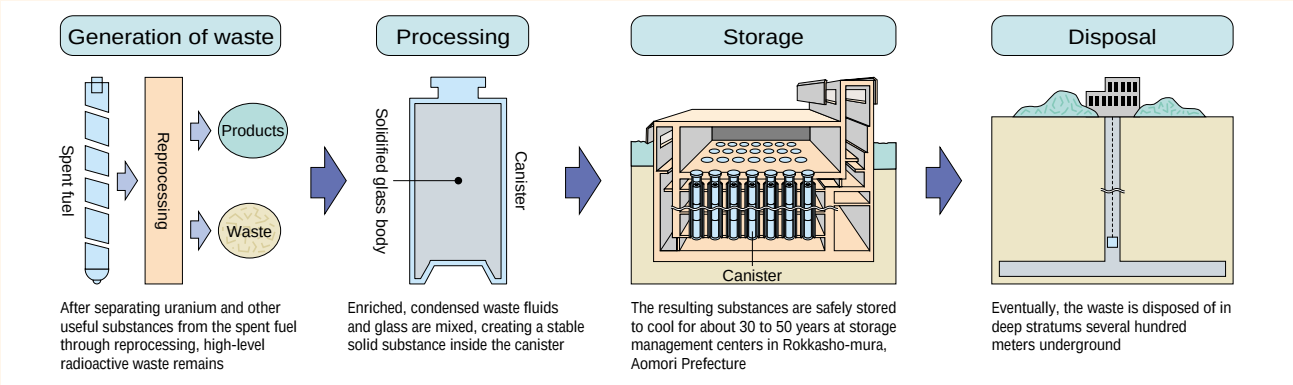
■Nuclear power generation capacity factor (Figure 16)



■Control of radioactive waste (Figure 17)



■Processing and Disposal of High-Level Radioactive Waste (figure 18)



Pluthermal Plan

Under the Pluthermal Plan, plutonium which has been collected by reprocessing spent fuel is mixed with uranium to form MOX fuel (mixed oxide fuels) and then reused in nuclear reactors (light-water reactor; thermal reactor). (The word "pluthermal" comes from the "plu" of plutonium and the "thermal" of "thermal reactor.") Countries such as Germany, France, and the United States have reported successful results with this program.

With limited natural resources, Japan's basic energy policy is to recycle any spent fuel that can possibly be reused. In line with this policy, Kansai Electric is proceeding with its own Pluthermal Plan.

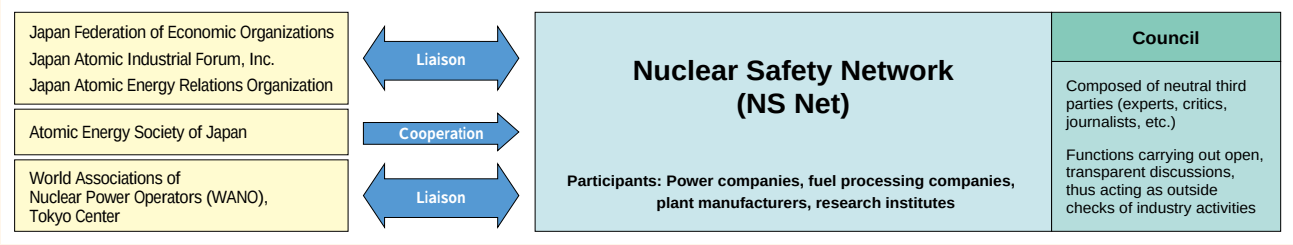
Regarding the problem last year with MOX fuel produced at BNFL (British Nuclear Fuels Ltd.), our BNFL MOX Fuel Issue Investigation and Examination Committee, with the help of outside experts, is thoroughly investigating the causes of the problems and creating measures to prevent recurrence. In June 2000, the Committee presented its final report to the related organizations including the Ministry of International Trade and Industry and the Fukui Prefectural Government. As a result of discussions with BNFL, it was agreed that BNFL would recall the eight assemblies of MOX fuel currently stored at the Takahama Power Station and compensate Kansai Electric for its damages. We have to do our utmost to gain the understanding of local public and private groups affected by our operations.

Activities Aimed at Gaining Trust

Recent incidents in the nuclear power industry, such as the criticality accident at the JCO uranium processing plant and erroneous data on MOX fuel at BNFL, have raised calls for more thorough quality control, safety management, and an increased sense of responsibility among workers in the nuclear power industry. This is why we at Kansai Electric are working to gain the trust of society by creating measures to ensure safe nuclear power and peace of mind for the general public.

The September 1999 criticality accident at JCO, the first ever such accident in Japan, had huge social and economic effects: three workers, two of whom died, were seriously exposed to radiation and local residents were ordered to evacuate or stay indoors for a period of time. Up until the accident, workers in the nuclear power companies had been working to improve safety through activities such as exchange inspections among different plants and facilities. However, the JCO accident provided the impetus for the creation of the Nuclear Safety Network (NS Net), which works to promote mutual safety among not only power companies but also 35 companies and groups including fuel processing plants and manufacturers. Currently, we are carrying out support activities including information exchange and safety education and training. The focus of activities is safety-oriented peer review among members of the nuclear power industry (see Figure 19).

■Nuclear Safety Network (Figure 19)



Reduction

(Reduction of greenhouse gas emissions in electric power supply)

Improving and Maintaining Thermal Efficiency of Fossil Fuel Power Stations

Kansai Electric strives to conserve fossil fuel by improving thermal efficiency of fossil fuel power generation.

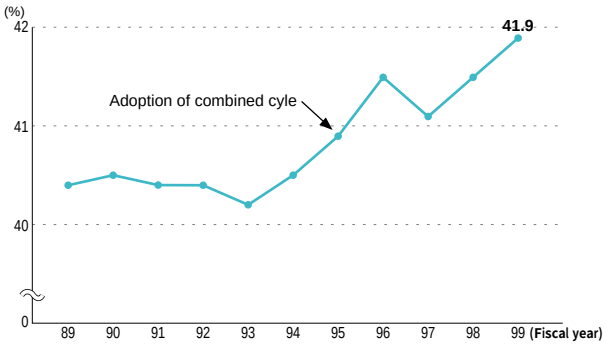
Measures to improve thermal efficiency using combined cycle generation

By improving thermal efficiency at fossil fuel power stations, we are able to conserve fossil fuel which enables us to control CO_2 emissions. We have introduced highly efficient combined recyle generation (thermal efficiency 54%) at our Himeji No. 1 Power Station. As a result, we have raised the total thermal efficiency for fossil fuel power stations by maintaining a high utilization factor.

In combined cycle power generation, hot exhaust from a gas turbine is routed to a heat recovery steam generator, where it is used to generate steam to run a steam turbine. Effective combination of these two generation cycles can improve the thermal efficiency of the entire generation facility.

We are also working to maintain and improve thermal efficiency by adopting improvement measures for both equipment and operation at steam turbine plants, an existing generation method.

■Kansai Electric's fossil fuel power gross transmission thermal efficiency (Figure 20)



In recent years, we have introduced highly efficient combined cycle power generation with thermal efficiency of 54%.
By operating existing equipment, gross thermal efficiency is approximately 41% at all fossil fuel power stations.

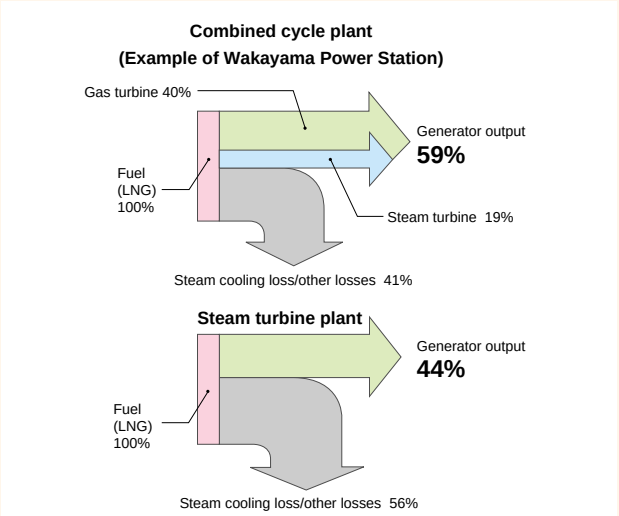
Combined cycle generating system with state-of-the-art gas turbines

We are planning to adopt a combined cycle power generation at Wakayama Power Station, which is in the construction planning stages, incorporating state-of-the-art 1500˚C-class (combustor exit temperature) gas turbines.

We expect that this will raise the gross thermal efficiency to the world's highest level, about 59%, and will reduce CO_2 emissions from electricity generation by about 25% compared to conventional LNG power generation (see Figure 21).

Thermal efficiency is shown at a lower heating value.

■Gross thermal efficiency of combined cycle generating system (Figure 21)



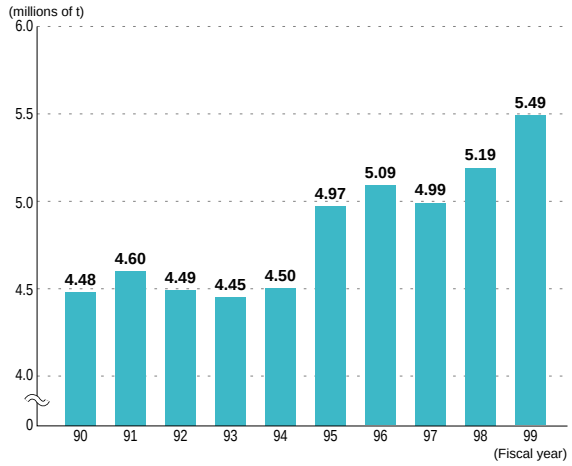
Using LNG

Using LNG, a superb environmentally-friendly fuel

Since carrying out trials with LNG in 1973, we started importing this fuel, first from Indonesia in 1977, then from Western Australia in 1989, from Malaysia in 1995, and from Qatar in 1999. In 1999, we used a total of 5.49 million tons of LNG. (See Figure 22.) This accounts for approximately 72% of fuel used for thermal reactors (heavy oil conversion ratio), making it the major source of fuel for our company. LNG has minimal impact on the environment: it contains almost no sulfur or nitrogen, and it emits far less CO_2 than fossil fuels like oil and coal. We plan to continue making LNG our main fuel for our fossil fuel power stations.

Ship carrying LNG from Qatar

■Amount of LNG consumed (Figure 22)



Renovating Hydropower Stations

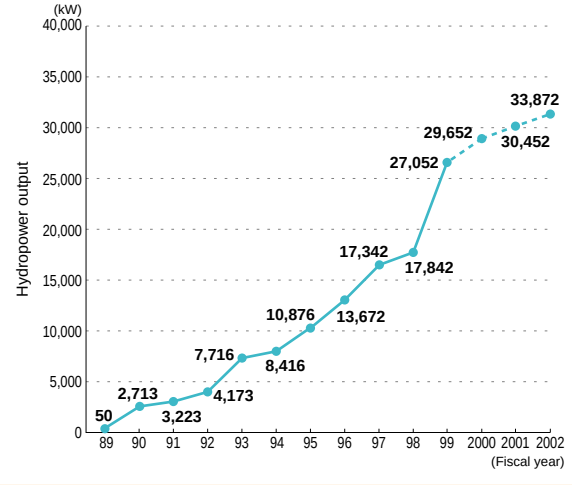
Kansai Electric endeavors to produce pure domestic energy with zero CO_2 emissions.

It has become increasingly difficult to conduct large-scale hydropower development, since undeveloped areas are mainly small in scale. However, because hydropower is a clean energy resource that is purely domestic, we are developing this power source as much as possible.

When we replace obsolete facilities in already-existing power stations, we use more efficient water turbines. In rivers with an ample amount of water, we strive to produce as much electricity as possible by using the maximum amount of water for power generation. From 1989 through fiscal 1999, output had increased to 27,052 kW at hydropower stations as a result of plant renovation.

We plan to further increase output by 6,820 kW, or seven more units, from fiscal 2000 through fiscal 2002 (see Figure 23).

■Increase in hydropower output from facility renovation (Figure 23)



Reduction

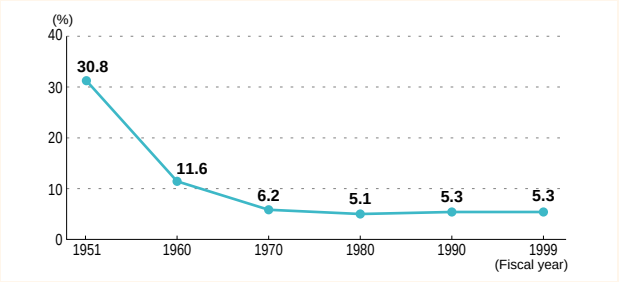
(Reduction of greenhouse gas emissions in electric power supply)

Reducing Transmission and Distribution Losses

Striving to use energy more efficiently by reducing transmission and distribution losses

We have managed to reduce and maintain a low loss ratio for many years now at transmission and distribution facilities by developing and introducing technology such as higher transmission voltage and greater volumes of power transmitted and distributed. (See Figure 24.) We will continue to work to ensure that distribution facilities are structured so as to ensure low transmission and distribution losses and that we operate facilities with the same goals.

■Ratio of transmission and distribution losses (Figure 24)



Technological development with the goal of reducing CO_2 emissions

Kansai Electric is conducting cutting-edge R&D in order to reduce CO_2 emissions

Developing Flue Gas Decarbonization Technology

With the goal of eliminating CO_2 from flue gas at fossil fuel power stations, we have been researching chemical absorption methods since 1991, by operating a flue gas CO_2 recovery pilot plant at Nanko Power Station (see photo right and Figure 25).

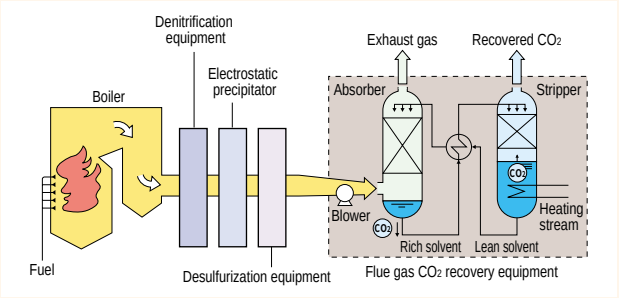
We have succeeded in reducing the amount of energy required to recover CO_2 by using newly developed absorbent liquids, and we are evaluating the optimum system configuration based on these results. We are working to solve problems such as the large amounts of energy still needed to recover CO_2 and the environmental impact from disposal of recovered CO_2.

We have applied for a patent for the results of our research so far in Japan, the United States, Europe and Asia, and many countries have recognized the patent. Using these results, highly efficient CO_2 recovery equipment has been adopted at Malaysian companies.

Also, we are conducting comprehensive CO_2 recycling studies, such as synthesizing methanol and dimethyl ether from CO_2 and using water electrolysis with solar batteries to produce the hydrogen necessary for synthesis.

Flue gas CO_2 recovery pilot plant at Nanko Power Station

■Mechanism of flue gas CO_2 recovery equipment (chemical absorption method) (Figure 25)



Developing Advanced Energy Supply Technology for the Future

Kansai Electric considers future energy.

Achieving Sustainable Energy

Renewable energy sources like solar and wind power exist in much greater abundance than the energy consumed by the human race and they can be considered in practically unlimited supply. However, these energy sources have their setbacks: a low energy concentration, inconsistent output, and high costs. Conversely, while nonrenewable energy sources like oil have a high energy concentration and are inexpensive, they are in limited supply.

Consequently, before the nonrenewable energy sources are depleted, we must create a society that can continue to function using the renewable energy sources. Furthermore, the current pace of global warming will make it a major threat to the human race even before we run out of natural resources in the latter half of the 21st century. It is therefore urgent that we secure sustainable energy sources as soon as possible.

This century we must introduce renewable energy sources that are economical, while at the same time making the most efficient use of fossil fuels and developing advanced technology aimed at supplying the next generation of energy. We at Kansai Electric vow to work earnestly toward achieving these goals.

Research on electric power applied superconductivity technology

Superconductivity technology could potentially bring about a revolution in all areas of future society. Superconducting generators improve efficiency over traditional generators and also improve power system stability. Accordingly, incorporating superconducting generators leads to resource conservation by reducing the use of fossil fuels and contributes to energy conservation through improved stability of electric power systems, thereby enhancing transmission capacity.

Kansai Electric is also engaged in basic research to determine the possibility of applying superconductivity technology in power generation apparatus, in preparation for a superconduction power generation system in the 21st century, and participating in the government's superconductivity development project for the purpose of finding solutions to utilize superconducting generators.

R&D on next-generation fuel batteries

Fuel cells, a system which generates electricity directly through a hydrogen and oxygen chemical reaction, are expected to develop into a new power generation system. This is an efficient method of low energy conversion loss, enabling fuel diversification using fuels such as natural gas, methanol, and coal.

Kansai Electric is conducting an elementary technical development of the Molten Carbonate Fuel Cell and the Solid Oxide Fuel Cell, two next-generation fuel cells with high power-generation capacity and superior utilization of exhausted waste heat. Our goal is to apply these cells to be used in the electric power sources of the future.

Toward joint R&D on nuclear fusion

Nuclear fusion is the use of energy generated when plural nucleuses fuse into one, as opposed to nuclear fission. It is expected to become a permanent source of energy due to its superior features - it provides a stable supply of fuel resources (its fuel - heavy hydrogen - is contained richly in the sea), a fundamentally high safety level (reaction terminates immediately by stopping the fuel supply), and advantages to environmental preservation (reaction does not emit CO_2 or SOx). In Japan, R&D on nuclear fusion is underway at institutions such as the International Thermal Nuclear Fusion Experimental Reactor (ITER), the Japan Atomic Energy Research Institute, the National Institute for Fusion Science, and Osaka University (see Table 2).

Designating nuclear fusion as one of the energy supplying methods for the next generation, Kansai Electric is cooperating with research at the Japan Atomic Energy Research Institute, the National Institute for Fusion Science, Institute of Advanced Energy Kyoto University, and Osaka University Nuclear Fusion Center.

■Research activities by main research agents (Table 2)

Research agent	Main theme	
	Reactor core plasma technology	Reactor engineering technology Technologies relating to other areas
Japan Atomic Energy Research Institute*	Magnetic Confinement Fusion (Tokamak)	Designing of Tokamak reactor, reactor materials, superconduction magnet, tritium, measuring, theory
Electrotechnical Laboratory	Pinch Method Inertial Confinement Fusion	Superconduction magnet, laser
National Institute for Fusion Science*	Magnetic Confinement Fusion (Helical)	Measuring, theory, reactor materials, superconduction magnet, heating apparatuses
Institute of Advanced Energy Kyoto University	Magnetic Confinement Fusion (Helical)	Measuring, heating
Tsukuba University Plasma Research Center	Mirror Method	Measuring, heating
Osaka University Institute of Laser Engineering*	Inertial Confinement Fusion	Measuring, fuel pellet, laser, theory
Kyushu University Research Institute for Applied Mechanics	Magnetic Confinement Fusion (Tokamak) (superconduction)	Measuring, heating
National Reseach Institute for metals	——	Reactor materials, superconduction magnet materials
Other Universities	——	Basic research

Source: Nuclear White Paper 1998 *Research in which Kansai Electric is participating

Reduction

(Reduction of greenhouse gas emissions in electric power supply)

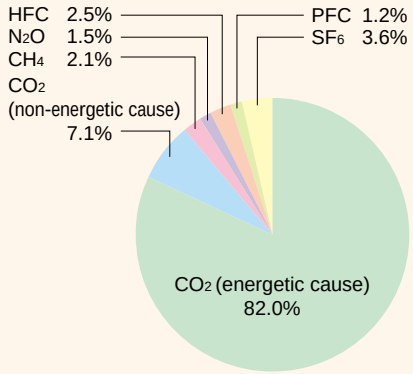
Reducing Emissions of Greenhouse Gases Other Than CO_2

Kansai Electric strives to reduce emissions of greenhouse gases other than CO_2.

At COP3 in Kyoto in December 1997, reduction goals were determined for greenhouse gases including carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbon (HFC), perfluorocarbon (PFC), and sixth fluoridation sulfur (SF_6).

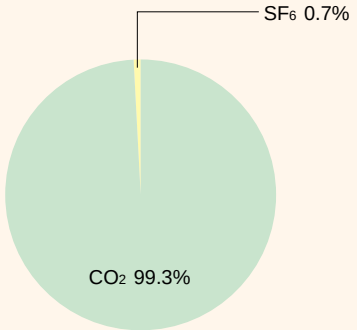
CO_2 has more emissions than other greenhouse gases, more than 90% of Japan's total, and over 99% of Kansai Electric's total (see Figures 26 and 27). Apart from CO_2, SF_6 is relevant to Kansai Electric as we use it in gas insulators.

■Emission rate of greenhouse gases in Japan (Fiscal 1997) (Figure 26)



Note: Emission rate was calculated as carbon dioxide equivalent, using global warming coefficient
Source: assembled from Environment Agency data

■Emission rate of greenhouse gases at Kansai Electric (Fiscal 1999) (Figure 27)



Note: Emission rate was calculated as carbon dioxide equivalent, using global warming coefficient.

Reducing emissions of SF_6

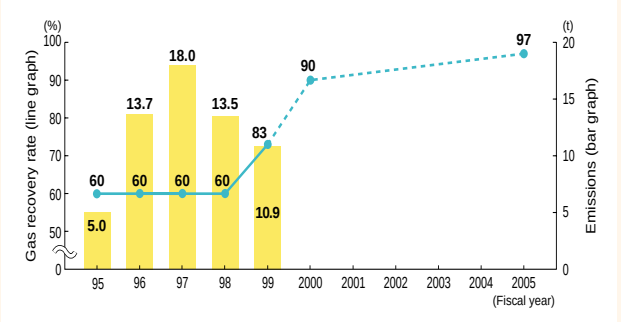
SF_6 is widely used in electric apparatus, namely gas circuit breakers and gas-insulated switchgears, because it is a highly efficient insulation gas which helps to make the electric apparatus lightweight and compact, and does not cause harm to human health. The SF_6 gas insulator has been indispensable to electric enterprises because, (1) the substation sites can be greatly reduced, (2) it is harmonious with the environment as it does not require a large site and (3) it enables construction of underground substations in urban areas.

SF_6 gas, such as that used for electric insulators, is normally used hermetically and there is almost no leakage while the apparatus is in operation. However, SF_6 gas is known to have been emitted during complete inspections of the insulating parts, which are required every 12 years.

We will continue to use SF_6 in the future since currently there is no other alternative in terms of performance, handling, safety and economy. However, we are endeavoring to control emissions during use. We were able to recover 83% of the SF_6 during inspection in fiscal 1999, but we will work to attain 90% in fiscal 2000 and 97% by fiscal 2005 (see Figure 28).

SF_6 gas recovery equipment

■SF_6 gas recovery rate during apparatus inspection (Figure 28)



Activities Abroad

(Activities carried out abroad to prevent global warming)

International R&D and projects aimed at preventing global warming

The United Nations Framework Convention on Climate Change (FCCC) is emphasizing international cooperation in the fields of technology, funding, and research into climatic change. At the third session, COP3, in 1997 in Kyoto, members agreed to introduce the mechanisms of the convention—Emissions Trading, Joint Implementation, and the Clean Development Mechanism—to complement the goals each of them set for reduction of greenhouse gasses in their own countries. (See page 12)

We believe that by applying the objectives of the Kyoto Protocol, we can contribute to solving the social problem of global warming while at the same time carrying out our business in an environmentally-friendly manner.

It is to this end that we are developing our international business with the aim of applying the Kyoto Mechanisms. We are using our advanced technology built up over many years and our know-how gained through dedicated survey and research in order to invest in and start business on a global scale.

Activities Abroad Activities carried out abroad to prevent global warming

R&D on expanded use of natural absorption mechanism	
Developing technology to restore tropical rain forests	Indonesia
Research into CO_2 absorption and fixation through the use of coastal ecosystem	Australia, Thailand
Developing afforestation technology to restore the mangrove ecosystems	Thailand
Activities aimed at applying the Kyoto Mechanisms and surveys into their feasibility for business	
Attaining better thermal efficiency at existing fossil fuel power stations by improving station operation	Thailand
Project to bring power to outlying areas	Indonesia
Basic study on combined cycle generation at the Konakovo Power Station	Russia
Basic study on replacement of Symferopoloskaya Thermal Electric Power Station	Ukraine
District Heating Plant in Tbilisi Improvement Study	Georgia
Rehabilitation plan for the Ambuklao Hydro Electric Plant	Philippines
Business feasibility study on CO_2 fixation afforestation using carbonization	Malaysia
International business developments to contribute to the decrease of global warming	
Hydroelectric wholesale power station project	Philippines
Investment fund to support energy conservation businesses among the countries of Eastern Europe	Eastern Europe
Domestic Efforts that Consider International Business	
Development of technology for creating compound environmental measures such as preventing global warming through the carbonization of things like trees	Japan

Activities Abroad

(Activities carried out abroad to prevent global warming)

Research and Development to Expand Natural Resources

Increasing the scale of nature's CO_2 absorbing capacity, such as the tropical rainforests, is an important and cost-effective way to achieve reduction of greenhouse gases. That's why, from early 1990s, we have been carrying out research and development on technology that can fully apply the principles of the Kyoto Mechanisms such as the Joint Implementation, and the Clean Development Mechanism projects.

Developing technology to restore the rainforests through large-scale afforestation

Every year, 12.6 million hectares of tropical rainforest—an area roughly one-third the size of Japan—disappear.

Although we tend to think that tropical rainforests can replenish themselves quickly, this is unfortunately not the case. Because the temperature in the tropics is high, organic matter dissolves quickly and is dispersed into the air as substances such as CO_2 and CH_4 (methane). This means there is only a thin layer of soil with few nutrients. For example, the lauan only bears fruit once every three to five years since doing so every year would drain its nutrients and cause it to die. Accordingly, restoration of the rainforests requires the help and guidance of people.

Against this background, Kansai Electric and Gadjah Mada University in Indonesia have been carrying out international joint research since 1992 under the Tropical Rainforest Restoration Technology Development Project.

Under this project, researchers make use of the symbiotic relationship between lauan and micrrhizal mushrooms in order to raise the number and growth rate of the seedlings. So far, they have selected certain micrrhizal mushrooms beneficial to the growth of lauan saplings and developed a method of inoculating large numbers of lauan saplings with these micrrhizal mushroom fungi. As well, they have found that the fungi have been effective in doubling tree size growth and in increasing the number of trees by five times.

In 1998, the experimental forest area was increased to 60 hectares, and in this forest researchers have been testing technology for improved afforestation, developing afforestation support technology such as agroforestry (a method of afforestation in which the forest is managed while planting and harvesting agricultural crops so as to eliminate the necessity of slash and burn farming), and attempting to improve soil by confining CO_2 using charcoal.

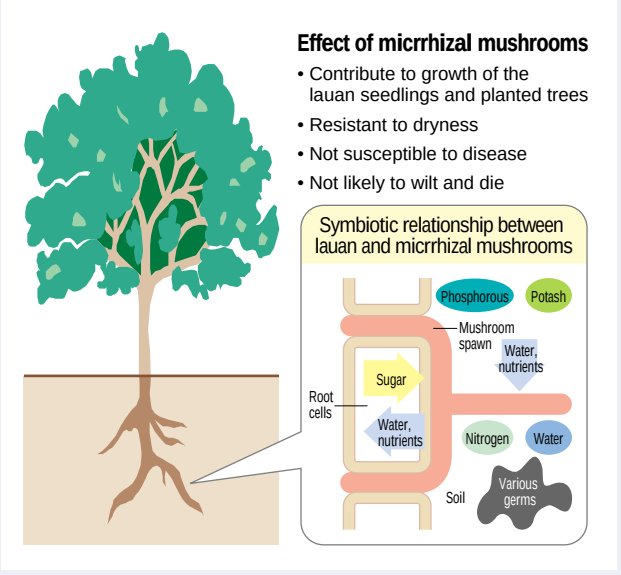
Four-month-old saplings (left) have been treated with fungi and grow at twice the rate of untreated ones (right).

Afforestation field test (Sumatra, Indonesia)

■Outline of joint project with Indonesia's Gadjah Mada University

	Contents
Project name	Tropical Rainforest Restoration Technology Development Project
Participating Japanese companies	Kansai Electric Kansai Environmental Engineering Center Co., Ltd.
Cooperative body	Gadjah Mada University
Project content	Develop technology for reforestation of lauan, a native tree, in order to restore the tropical rainforests, which act to absorb CO_2
Site	Java and Sumatra, Indonesia
Duration of the project	1992—2001

■Symbiotic relationship between lauan and micrrhizal mushrooms



Developing technology for planting mangroves in devastated lands for the sake of local improvement

Mangrove is a general term for the tropical region vegetation that exists in the coastal regions where sea water and fresh water meet and mix. Mangrove forests provide an ideal habitat for marine life, and also play an important role in providing local residents with food and wood resources.

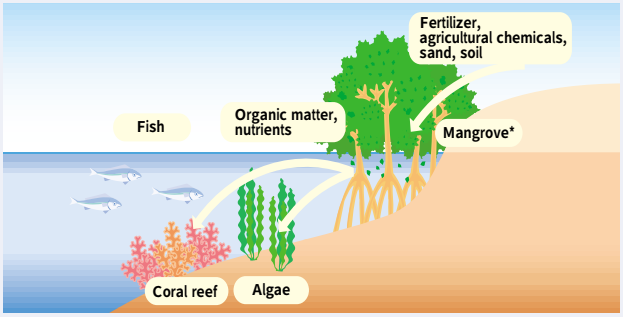
However, mangrove forests have been rapidly disappearing in Southeast Asia due to expanded shrimp cultivation and tin mining.

For four years from 1996 to 1999, the Kansai Electric Group and the Australian Institute of Marine Science carried out joint research into CO_2 absorption and fixation of mangrove forests in Australia and Thailand. This research revealed that mangrove forests are better at absorbing and fixing CO_2 than tropical rainforests. As well, it was discovered that the areas where sea and fresh water meet contain very little oxygen and thus things like falling leaves are not broken down but rather accumulate as organic carbon. This means that these coastal areas hold promise as storage areas for carbon.

The Kansai Electric Group will look to build on these results in the Mangrove Ecosystem Restoration Reforestation Technology Development Project, a joint effort with the Royal Forest Department in Thailand starting in 2000.

The aim of this research is to restore the mangrove forests, which have been devastated by industries like shrimp cultivation, and develop reforestation technology that can sustain the mangrove forests and thus contribute to the local improvement in a sustainable way.

Mangrove forest in Thailand



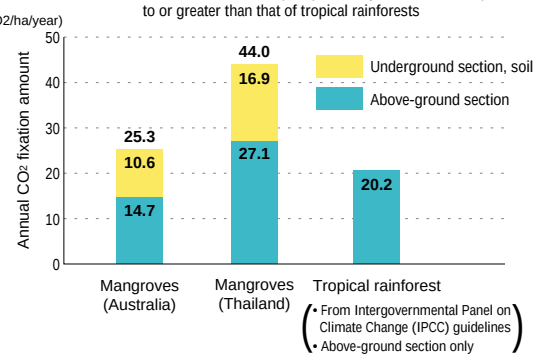
** "Mangrove" is the general term for thickets of salt-resistant plants distributed throughout tropical and subtropical regions in the brackish waters of coastal and estuarial intertidal regions. In these swamps, leaves and twigs fall continuously from plants, then decay and are consumed by plankton, which are in turn eaten by fish. Thus, a mangrove swamp plays an important role, forming the center of an entire food chain.*

■Outline of project with the Australian Institute of Marine Science

	Contents
Project name	CO_2 Absorption and Fixation Research Through the Use of Coastal Ecosystems
Participating Japanese companies	Kansai Electric Kansai Environmental Engineering Center Co., Ltd.
Cooperative body	Australian Institute of Marine Science
Project content	Because the coastal areas are highly effective in absorbing and fixing CO_2, propose measures to protect coastal ecosystems and promote effective CO_2 absorption and fixation by developing mangrove forest restoration technology
Site	Hinchinbrook, Australia; Chumpon, Thailand
Duration of the project	1996—1999

Research results

The carbon fixation capacity of mangrove forests is equal to or greater than that of tropical rainforests



■Outline of project with Thailand Royal Forest Department

	Contents
Project name	Tropical Rainforest Restoration Technology Development Project
Participating Japanese companies	Kansai Electric Kansai Environmental Engineering Center Co., Ltd.
Cooperative body	Royal Forest Department in Thailand
Project content	Development of technology to plant trees in a devastated mangrove forest, which is a promising CO_2 pool
Site	Samuth Songkram, Surattani, and other locations in Thailand
Duration of the project	2000–2004

Activities Abroad

(Activities carried out abroad to prevent global warming)

Activities and Business Feasibility Studies for the Future Utilization of the Kyoto Mechanisms

Activities in the electric power field

The idea of Joint Implementation by several nations to counteract greenhouse gas emissions was an important concept emerging from the Framework Convention on Climate Change. Wanting to be involved in promoting AIJ (Activities Implemented Jointly), Japan created a basic framework called the AIJ Japan Program. As part of our efforts to promote international cooperation, Kansai Electric is involved in two of these projects: Power Plant Thermal Efficiency Improvement/Recovery Through Enhanced Operational Management in Thailand, and Renewable Energy Supply Systems in Indonesia.

■Outline of the project with the Electricity Generating Authority of Thailand (EGAT)

	Contents
Project name	Power Plant Thermal Efficiency Improvement/Recovery Through Enhanced Operational Management
Participating Japanese companies	Kansai Electric, Electric Power Development, Chubu Electric
Cooperative body	Electricity Generating Authority of Thailand (EGAT)
Project contents	The four companies named above ("the parties") have been promoting improvement of their power plants' thermal efficiency, and have developed various energy-saving techniques. Based on this technical experience and expertise, the parties jointly and cooperatively implement the project to improve/recover the power plant thermal efficiency.
Site	South Bangkok Power Station
Duration of the project	1996-2000 (including monitoring)
Expected effect	CO_2 emission reduction: 14,000 t- CO_2/year

South Bangkok Power Station

■Outline of the project in Indonesia

	Contents
Project name	Renewable Energy Supply Systems in Indonesia
Participating Japanese companies	Kansai Electric, Tokyo Electric *
Cooperative body	The Directorate General of Electricity and Energy Development of the Ministry of Mines and Energy of the Republic of Indonesia (DGEED)
Project contents	To cooperate in ways contributing to sustainable energy supply through renewable energy supply systems including the implementation of solar home systems, microhydropower and hybrid system (photovoltaic and wind power) in rural areas in Indonesia.
Site	Rural areas in Indonesia
Duration of the project	1996-2000 (including monitoring)
Expected effect	CO_2 emission reduction: 1,200 t- CO_2/year

** This project will be implemented in the name of "E7."*
"E7" is a group consisting of some of the world's major producers and distributors of electricity (See page 31).

Solar home system

In order to develop new projects in compliance with the Kyoto Mechanism, Kansai Electric implemented the Basic Survey Project for Joint Implementation, under a publicly recruited project organized by NEDO (the New Energy and Industrial Technology Development Organization), to replace the generation system at Konakovo Thermal Power Station in Russia in fiscal 1998, and at Symferopoloskaya Thermal Power Station in the Ukraine in fiscal 1999.

Konakovo Thermal Power Station (Moscow)

Symferopoloskaya Thermal Power Station (Crimea)

District Heating Plant in Tbilisi, Georgia

Ambuklao Hydro Electric Plant (Benguet Province, Luzon Island)

Under this scheme, it was decided in fiscal 2000 to participate in the Feasibility Study on Renovation and Rehabilitation of District Heat Supply System in Tbilisi, Georgia. Furthermore, it was also decided to conduct Ambuklao Hydro Electric Plant Rehabilitation Project in the Philippines under a publicly recruited project called the Study for Environment and Plant Revival Projects, organized by JETRO (the Japan External Trade Organization).

■Outline of the business feasibility study with Russia (Fiscal 1998)

	Contents
Project name	Konakovo Thermal Power Station Upgrading Project
Participating Japanese companies	Kansai Electric, Mitsubishi Corp.
Cooperative body	United Power System of Russia
Project contents	The project would improve the total plant thermal efficiency of Konakovo Thermal Power Station by introducing a modern gas turbine combined cycle power plant which would substantially reduce the plant's CO_2 gas emissions.
Site	Konakovo Thermal Power Station (suburb of Moscow)
Expected effect	CO_2 emission reduction: 2.3 million t-CO_2 / year

■Outline of the business feasibility study with Ukraine (Fiscal 1999)

	Contents
Project name	Basic Study on Replacement of Symferopoloskaya Thermal Power Station
Implementing corporation	Kansai Electric, Sumitomo Shoji
Cooperative body	Krymenergo
Project contents	The project would improve the total plant thermal efficiency of Symferopoloskaya Thermal Power Station by introducing a modern gas turbine combined cycle power plant which would substantially reduce the plant's CO_2 gas emissions.
Site	Symferopoloskaya Thermal Power Station (Crimea)
Expected effect	CO_2 emission reduction: 0.7 million t-CO_2/year

■Outline of the business feasibility study with Georgia (Fiscal 2000)

	Contents
Project name	Renovation and Rehabilitation of District Heat Supply
Participating Japanese companies	Kansai Electric, Shimizu Corp.
Cooperative body	Ministry of Fuel and Energy, Tbilisi
Project contents	To improve regional heating plant through restoration of existing hot water boilers and construction of new gas turbines for power plants.
Site	District Heating Plants in Tbilisi

■Outline of business feasibility study with the Philippines (Fiscal 2000)

	Contents
Project name	Ambuklao Hydro Electric Plant Rehabilitation Plan
Participating Japanese companies	Kansai Electric
Cooperative body	Philippine National Power Company (NPC)
Project contents	In addition to using Japan's experience and technology in repairing stalled hydroelectric power facilities, plan and carry out measures to quickly get the facilities back up and running. Diagnose the facilities and repair and replace intake mechanisms and deteriorated machinery
Site	Ambuklao Hydroelectric Power Plant (Benguet Province, Luzon Island)
Expected effect	CO_2 reductions: 0.3 million t-CO_2/year

Activities Abroad

(Activities carried out abroad to prevent global warming)

Afforestation Efforts

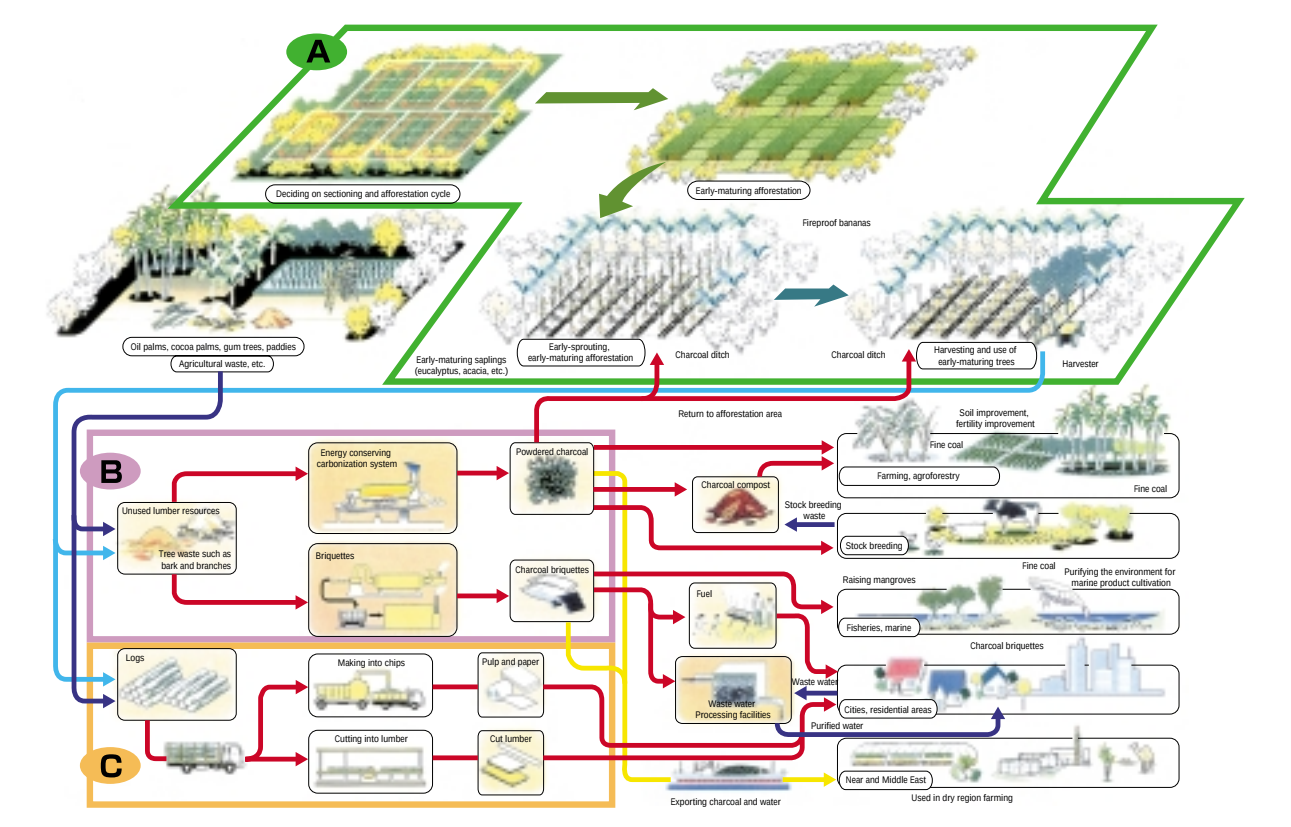
In 1999, Kansai Electric embarked on its business feasibility study on CO_2 fixation afforestation that makes possible sustainable manufacturing using carbonization in Malaysia as part of the Environment Agency's Business Feasibility Study of Clean Development Mechanism to Prevent Global Warming.

By making afforested tree into charcoal, which is semi-permanently deactivated the CO_2, and by using charcoal as medium to improve the soil and to purify water, we can make lumber industry being more sustainable. The Kansai Electric Group have determined that this research can be put to practical business use and have therefore decided to start a more detailed survey in fiscal 2000 (see Figure 29).

■Outline of business feasibility study in Malaysia

	Contents
Project name	Business feasibility study on CO_2 fixation afforestation that makes possible sustainable manufacturing using carbonization
Participating Japanese companies	Kansai Environmental Engineering Center Co., Ltd.
Cooperative body	Ta-Ann Group, Malaysia
Project contents	Feasibility study of afforestation business, which makes possible a sustainable lumber industry and CO_2 fixation by making afforested tree into charcoal, which is semi-permanently deactivated the CO_2, and by using charcoal as medium to improve the soil and to purify water.
Site	Sarawak Province, Malaysia
Duration of the project	1999–2000

■Conceptual illustration of CO_2 fixation afforestation business that makes possible sustainable manufacturing using carbonization (Figure 29)



Explanation

A Afforestation of acacia and other early-maturing trees

- Decide on the sectioning of afforestation areas in devastated regions and on the afforestation cycle
- Each year, plant early-maturing saplings in one section
- Place charcoal in the sapling holes at the time of planting to improve the soil
- After planting is completed, harvest the first section and make the trees into pulp and lumber. Plant a new batch of saplings in that section.
- Repeat this cycle to create a sustainable early-maturing afforestation process.

B Using waste such as unused wood and bark

- Unused parts of trees such as bark and wood waste generated during the processes A and C, as well as agricultural waste products that are currently disposed of by burning, are carbonized and used in the following ways:

①As soil improvement in afforestation and farming areas (CO2 fixation)
②As fuel
③In waste water processing facilities

C Using lumber

- Harvested early-maturing trees are cut down and processed into pulp and paper or processed lumber

Developing International Business that Contributes to the Decrease of Global Warming

Kansai Electric decided in April 1998 to participate in planning a hydropower generation project in the Philippines. This is the first time for a Japanese utility to invest and participate in an electric power generation project abroad. This project is called the San Roque Multipurpose Project, supposed to be one of the biggest hydropower generation projects in the Philippines, and we are jointly investing and participating in the project with Marubeni Corp. and Sithe Energies, Inc. We consider it a significant step to participate in hydropower development abroad, a renewable energy, from the viewpoint of preventing global warming.

Furthermore, in January 2000, our company made the decision to participate in the "Dexia-Fond Elec Energy Efficiency and Emissions Reduction Fund, L.P.," an environmental fund put together by the European Bank for Reconstruction and Development (investment: 10 million euros). The purpose of this fund is to invest in energy businesses involved in such areas as electricity, heat supply, and gas in the 26 Eastern European countries which are candidates for loans from the European Reconstruction and Development Bank, thereby containing the emission of greenhouse gases at the same time as increasing revenues through improved efficiency, while aiming for the eventual acquisition of emission reduction credits of greenhouse gases.

■Outline of the project in the Philippines

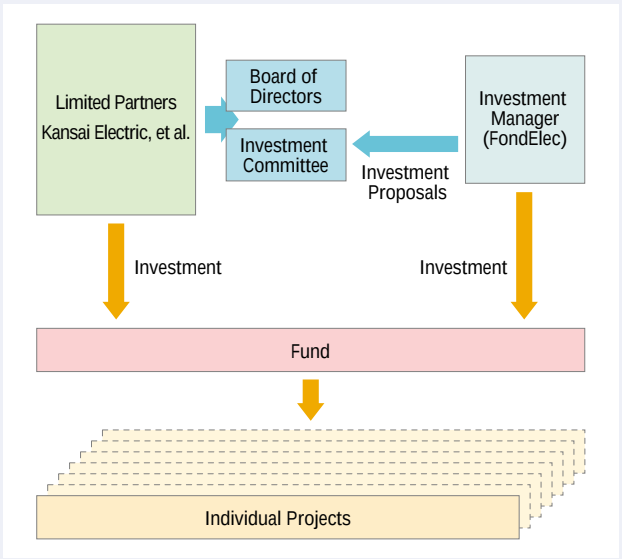
	Contents
Project name	San Roque Multipurpose Project (115MW X 3 units)
Implementing corporation	San Roque Power Corporation *
Project contents	Construct a hydropower plant, and hand over the ownership of the plant to the Philippines National Power Plant after 25 years of operation.
Site	Agno River (northern part of Luzon Island, Philippines)
Expected effect	CO_2 emission reduction: 0.7 million t-CO_2/year

** Kansai Electric will begin by establishing wholly owned company Kanden International Co., Ltd., then establish subsidiary KPIC Singapore Ltd. in Singapore. KPIC Singapore will invest in San Roque Power Co., Ltd.*

Construction site for San Roque Project

■Outline of the investment fund in Eastern Europe

	Contents
Name	Dexia-FondElec Energy Efficiency and Emissions Reduction Fund, L.P.
Investor	European Bank for Reconstruction and Development (project planner), Kansai Electric, Dexint, Marubeni Corporation, Mitsui & Co., Ltd.
Investment Manager	FondElec (Connecticut, USA)
Description of Business	To invest in energy businesses involved in electricity, heat supply, and gas in Eastern European countries, thereby containing the emission of greenhouse gases while at the same time increasing revenues through improvement of efficiency, eventually aiming for the acquisition of emission reduction credits of greenhouse gases.
Size of fund	Established at 60 million euros. Additional fundraising to a maximum of 150 million euros
Duration	2000-2009 (extended a maximum of two years)
Anticipated Effects	Amount of CO_2 reduction: 0.9 million t-CO_2/year



Scheme for the Investment Fund for Energy-Conserving Businesses in Eastern Europe

Activities Abroad

(Activities carried out abroad to prevent global warming)

Domestic Efforts that Consider International Business

In August 2000, the Kansai Electric Group sent researchers to the Research Institute of Innovative Technology for the Earth (RITE), which is conducting Development of Technology for Creating Compound Environment Measures such as Preventing Global Warming Through the Carbonization of Things like Trees under the framework on guidance research related to environmental industry technology, which is run by the New Energy and Industrial Technology Development Organization (NEDO). Among the responsibilities of our members are selecting carbon fixing plants and developing effective charcoal compost manufacturing methods.

■Outline of project to create anti-warming measures through carbonization of things like trees

	Contents
Project name	Development of Technology for Creating Compound Environmental Measures such as Preventing Global Warming Through the Carbonization of Things like Trees
Implementing organization	Research Institute of Innovative Technology for the Earth (RITE)
Participating companies, etc.	Kansai Environmental Engineering Center Co., Ltd. Wood Research Institute, Kyoto University Ebara Corporation
Project content	In order to gather, fix, and deactivate large amounts of CO_2, confine carbon long-term by carbonizing the carbon fixed within plants, and develop effective uses for charcoal such as purifying water and improving soil. In addition to this long-term deactivation of CO_2, carry out basic research that will be useful in creating measures for things like preventing pollution and protecting the environment
Duration of the project	2000–2004 (planned)

International Group Activities Aimed at Sustainable Development

To solve the problem of global warming, industries must reach beyond the borders of their own countries and cooperate on a worldwide scale. Kansai Electric has been a member of groups such as the E7 (a conference of major electric utilities companies in the G7 countries) and the World Business Council for Sustainable Development (WBCSD) since foundation, working in earnest making proposals for environmental problems and offering developing countries advanced support related to environmental technology. We announce the fruits of such activities in the form of opinions and suggestions from the private sector at conferences such as the Conference of the Parties (COP) of the United Nations Framework Convention on Climate Change (FCCC).

■E7 (a conference of major electric utilities companies in the G7 countries)

Established	1992
Purpose	To play an aggressive role in dealing with worldwide energy problems and to promote sustainable development
Contents of activities	• Draw up proposals for the energy industry with the aim of ensuring sustainable development and preventing global warming • Provide technological support to developing countries (e.g. providing solar powered electricity to outlying areas in Indonesia, providing environmental technology to countries like Thailand and Laos, etc.)
Members	Kansai Electric Power (Japan), Edison International (US), EdF (France), ENEL (Italy), Hydro Quebec (Canada), Ontario Power Generation (Canada), RWE-EAG (Germany), Tokyo Electric Power (Japan)

■World Business Council for Sustainable Development (WBCSD)

Established	1995
Establishment history, purpose	The World Industry Council for Environment (WICE; established in 1993) and the Business Council for Sustainable Development (BSCD; established in 1990) merged in 1995 to form the WBCSD, which takes the lead in advocating measures to deal with matters related to the environment and sustainable development
Contents of activities	The group takes up various themes related to sustainable development, such as climate and energy, eco-efficiency, and trust in society, exchanging information, holding seminars, and publishing reports
Members	About 130 companies and organizations, including Kansai Electric, from more than 30 countries

④ Protecting the Ozone Layer

Kansai Electric works to protect the earth from ultraviolet rays.

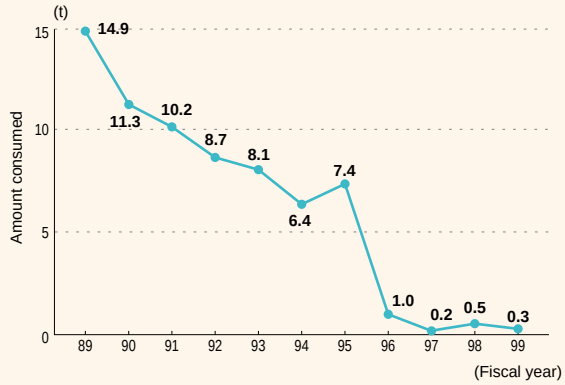
CFCs and halon gas destroy the ozone layer in the stratosphere, causing an increased amount of ultraviolet rays to reach the earth's surface. Since ultraviolet rays are harmful to humans and animals, the destruction of the ozone layer has a significantly negative impact on ecological systems. For this reason, production limits on these materials are being set under international control.

Although not regulated directly, Kansai Electric is taking every possible measure to abolish the use of specified CFCs with the aim of aggressively promoting the Japanese government's measures to protect the ozone layer.

CFCs have mainly been used as air conditioning coolants. However, all new air conditioners installed after 1996 have been using CFC substitutes. Existing air conditioners are being replaced as necessary with new models using CFC substitutes. During inspection of air conditioners, recovery equipment is being used to keep CFCs from escaping into the air (see Figure 30).

In the past, fire-extinguishing equipment at power stations (fossil fuel and nuclear) were designed to use halon gas. However, fire-extinguishing equipment at new facilities now uses CO_2 or powder extinguishing material instead of halon gas. Existing extinguishers will be replaced by those using halon substitutes as soon as regulations allowing their use are approved, as they are only used in fire emergencies.

■Consumption of CFCs (Figure 30)



2 Working to Protect the Environment

① Environmental Assessment for Power Station Construction

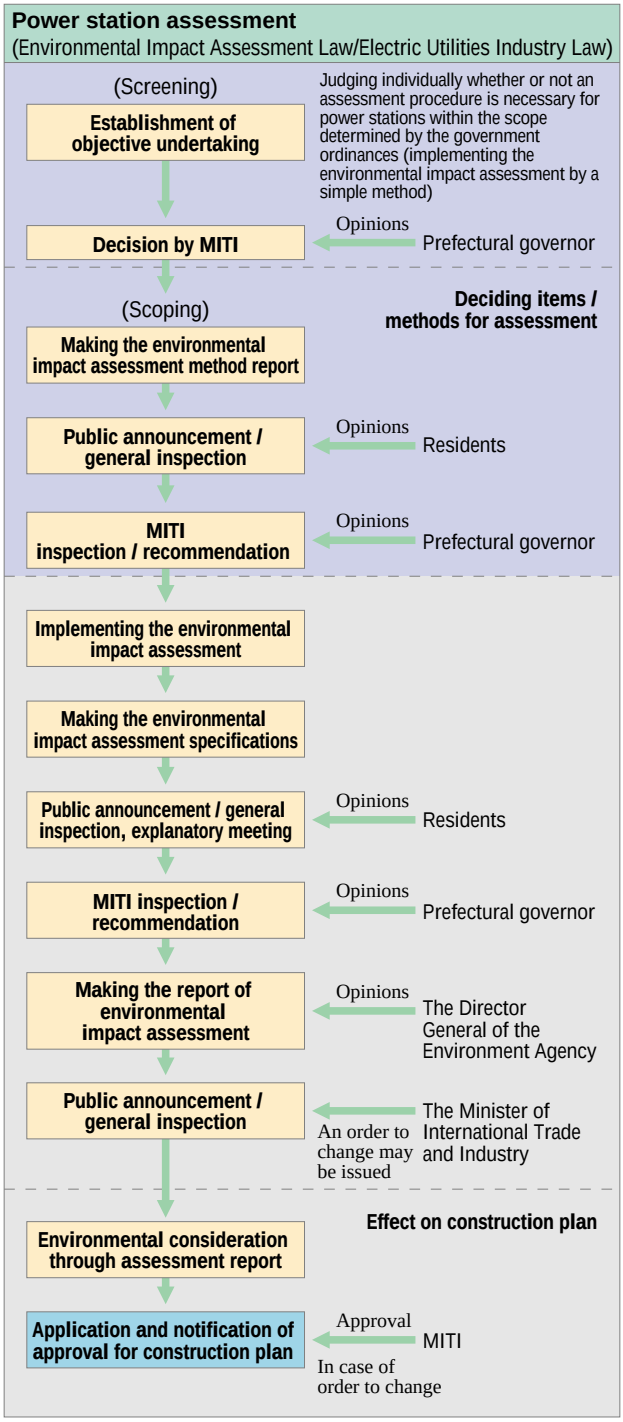
Since 1973, the Ministry of International Trade and Industry (MITI) has required that an environmental impact assessment be conducted when a power station is constructed. In accordance with the ministerial council's 1977 document entitled "Strengthening of Environmental Impact Reviews in Power Plant Siting," we have carried out 16 environmental assessments to date in order to contribute to environmental protection.

In 1997, the new Environmental Impact Assessment Law was passed, and revisions of the Electric Utilities Industry Law were implemented in June 1999. Under the Environmental Impact Assessment Law, before implementing large-scale development projects, corporations conduct their own environmental impact assessment to determine the procedures for implementing environmental assessment with consideration to environmental preservation. Specific procedures for power stations have been determined additionally under the Electric Utilities Industry Law.

Under the new system, environmental consideration is required from the early stages of the project, and procedures to judge whether assessment is necessary or not and determine contents and method of the assessment have been added. For the construction of power stations, the result of the assessment becomes the requirement for the approval of the construction plan (see Figure 31).

Based on this new environmental assessment system, Kansai Electric will endeavor to construct and operate power plants with consideration to the environment.

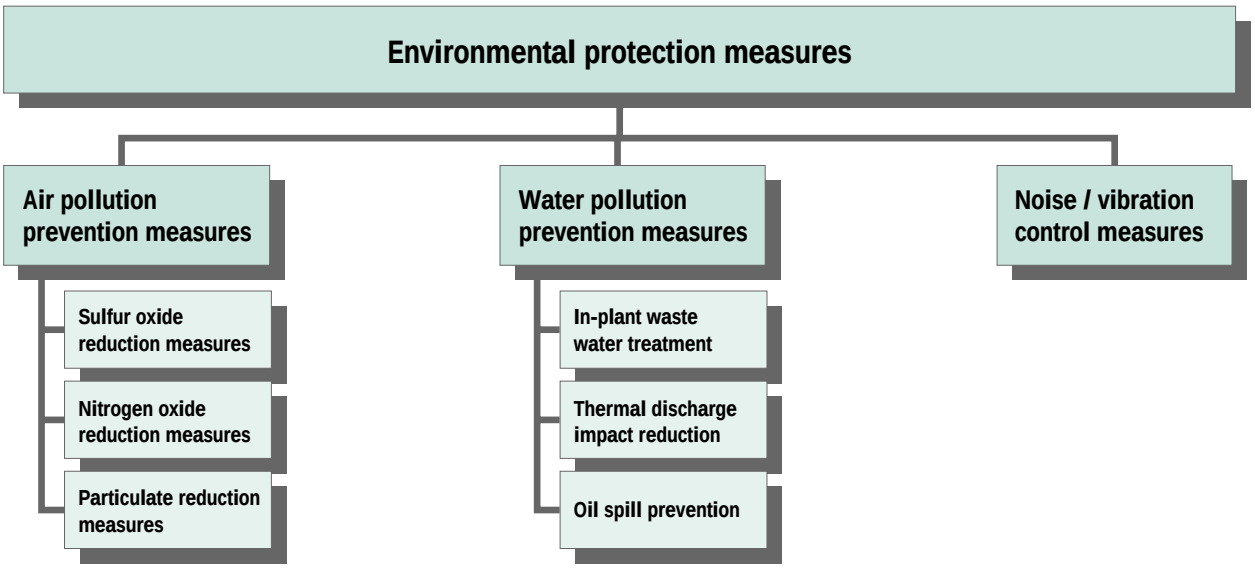
■Power station assessment system in accordance with the law (Figure 31)



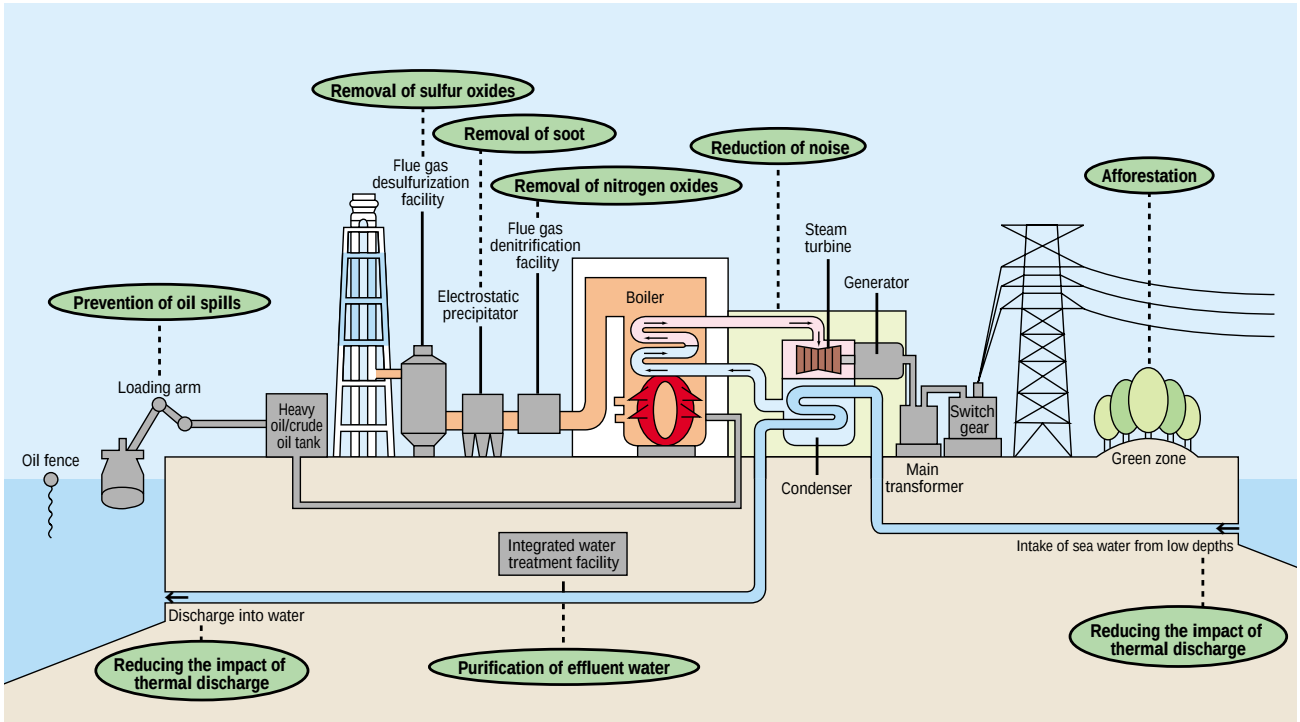
(note) Procedures which have been added in accordance with the enactment or amendment of a law.
Clauses complying with assessment report have been added to approval conditions for construction plans.

② Environmental Protection Measures

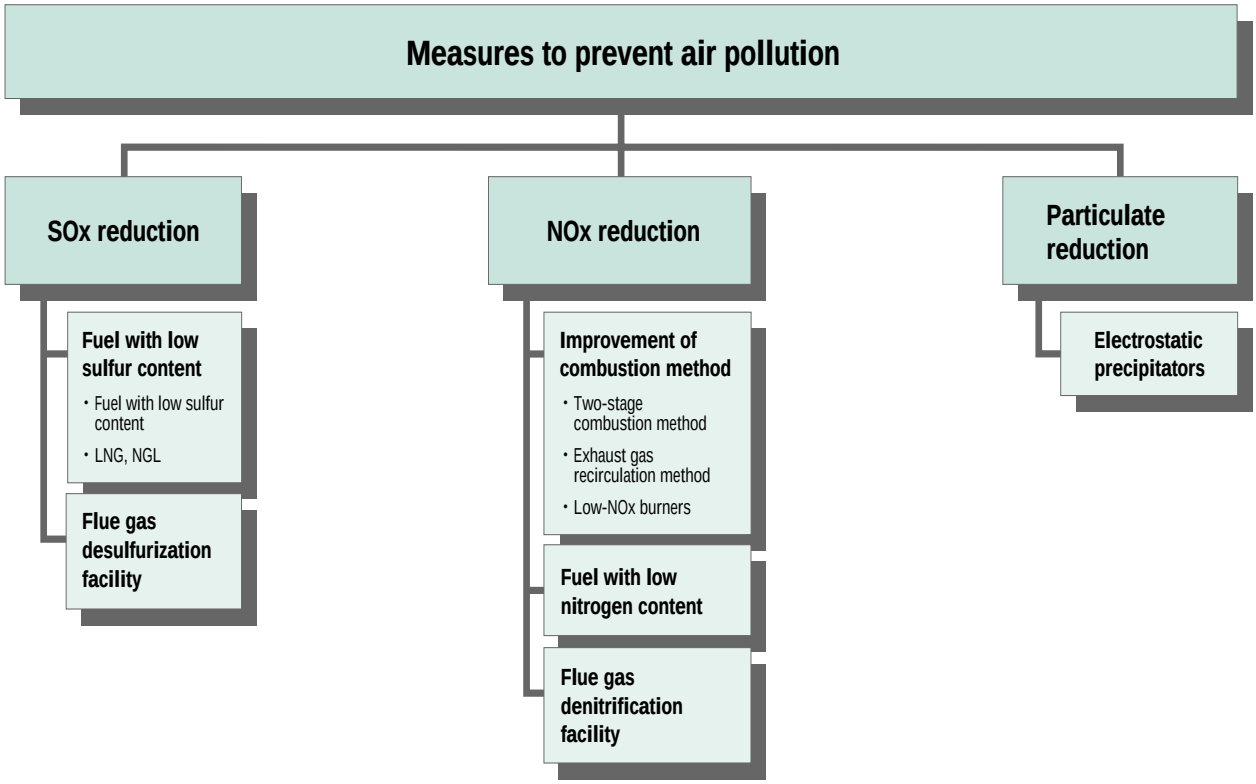
In accordance with the Environmental Protection Agreement, thorough care is taken at fossil fuel power stations in implementing countermeasures against air pollution, water pollution, noise and vibration, and also in supervising and observing whether or not these measures are actually effective (see Figure 32).



■Environmental protection system in a fossil fuel power station (Figure 32)



a. Measures to prevent air pollution



Reducing sulfur oxides (SOx)

To reduce SOx emissions, Kansai Electric has promoted the following methods:

* Use of heavy/crude oils with low sulfur content
* Use of LNG (liquefied natural gas) and NGL (natural gas liquids)

We have also adopted flue gas desulfurization facilities to remove SOx from flue gas, thus reducing SOx emissions with both fuel- and facility-related measures.

Use of heavy / crude oil with a low sulfur content

SOx is generated when fuel is combusted and the sulfur content comes into contact with oxygen. Therefore, reducing the sulfur content in fuel leads to SOx reduction. For this reason, Kansai Electric uses heavy oil or crude oil low in sulfur content, which is an important anti-sulfur oxide measure.

Use of LNG (liquefied natural gas) and NGL (natural gas liquids)

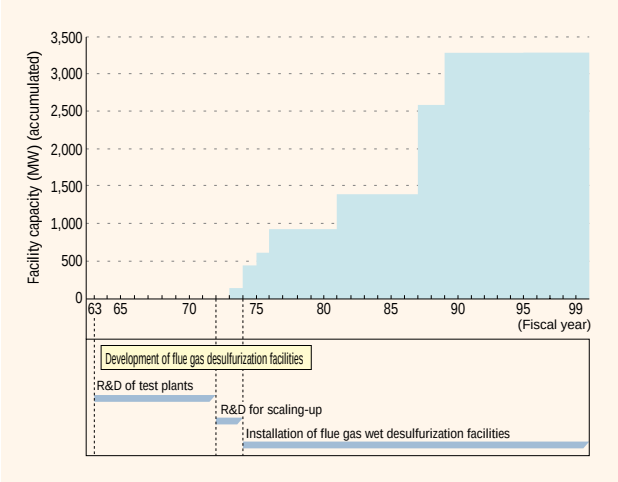
Kansai Electric uses clean LNG and NGL, which are completely sulfur-free. LNG consumption in fiscal 1999 totaled approximately 5.49 million tons, accounting for 72% of the total fossil fuel power generation.

Installation of flue gas desulfurization facilities

Kansai Electric has conducted extensive research and development on flue gas desulfurization facilities to reduce SOx emissions.

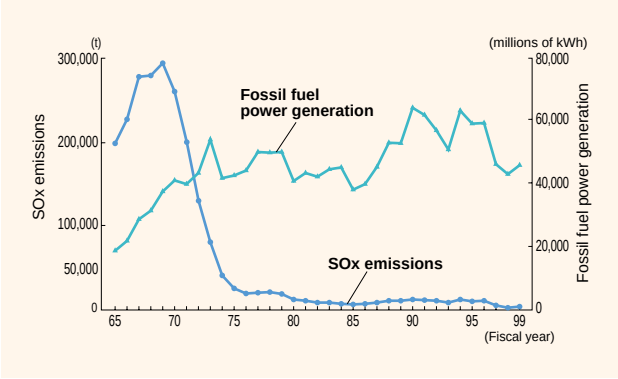
As of the end of fiscal 1999, we have installed a total of 10 flue gas desulfurization facilities at power stations with a total generating capacity of 3,330 MW. Together with the use of low sulfur content fuel, these facilities are contributing greatly to the reduction of SOx emissions (see Figure 33).

■Installation of flue gas desulfurization facilities (Figure 33)



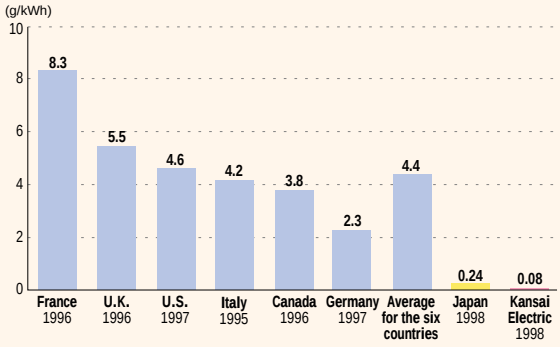
By implementing the above measures, the annual SOx emissions in fiscal 1999 have been reduced to approximately 1.9% compared to fiscal 1965, despite the increase of fossil fuel power generation (see Figure 34).

■SOx emissions and fossil fuel power generation (Figure 34)



The rate of SOx emissions per unit of fossil fuel power generation achieved by Japanese power companies is considerably lower than that of major Western countries (USA, Germany, UK, France, Canada and Italy). The Japanese average is 0.24g/kWh as opposed to their combined average of 4.4g/kWh. Kansai Electric's level is even lower than the Japanese average (see Figure 35).

■SOx emissions per kWh from fossil fuel power generation (Figure 35)



Source for foreign countries: OECD Environmental Data Compendium/1999, Energy Balances of OECD Countries 1996-1997
Sources for Japan: survey by the Federation of Electric Power Companies

Reducing nitrogen oxides (NOx)

NOx is generated when nitrogen in fuel and in the air react chemically with oxygen in the air. It is said that the higher the combustion temperature becomes, the more NOx is generated. To reduce NOx emissions, our fossil fuel power stations are implementing the following measures.

Improving the combustion system

To reduce NOx emissions through the improvement of the boiler combustion system, three methods are available - the two-stage combustion method, the exhaust gas recirculation combustion method, and the use of low-NOx burners.

Kansai Electric has made improvements on boilers to enable them to simultaneously use both the two-stage combustion method and the exhaust gas recirculation combustion method. For an even greater reduction in NOx emissions, we have also installed low-NOx burners, which have been developed based on the principles of these methods.

Use of fuels with low nitrogen content

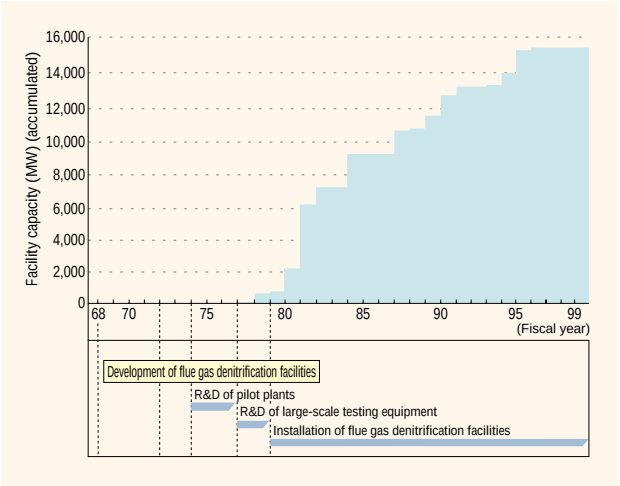
As of the end of fiscal 1999, Kansai Electric has converted the boilers at 14 out of 17 existing fossil fuel power stations to use LNG or high quality oils such as NGL, which contain little nitrogen.

Installation of flue gas denitrification facilities

Kansai Electric has focused much effort on the research and development of flue gas denitrification facilities to reduce NOx emissions and on their introduction to plants.

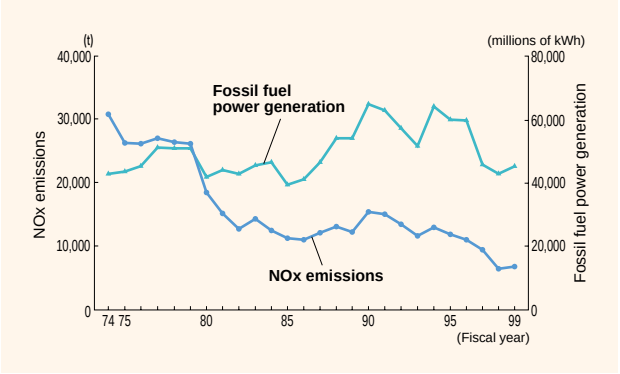
As of the end of fiscal 1999, we have 46 denitrification facilities with a total capacity of 15,380 MW (see Figure 36).

■Installation of flue gas denitrification facilities (Figure 36)



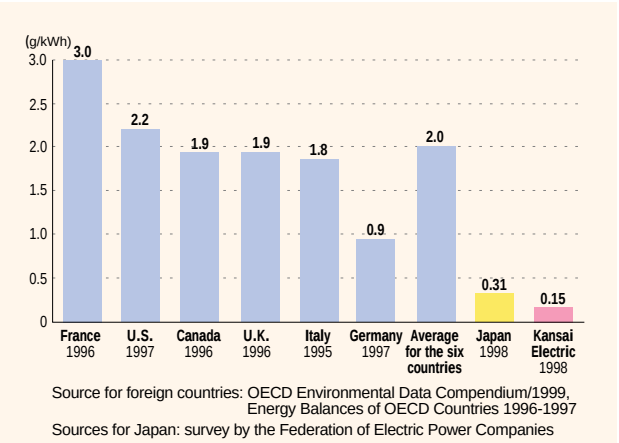
By implementing the above measures, the annual NOx emissions in fiscal 1999 have been reduced to approximately 22% compared to fiscal 1974, despite the increase of fossil fuel power generation (see Figure 37).

■NOx emissions and fossil fuel power generation (Figure 37)



In addition, average NOx emissions per unit of fossil fuel power generation in Japan is 0.31g/kWh, a figure considerably lower than the 2.0g/kWh combined average of the USA, Germany, the UK, France, Canada and Italy. Kansai Electric's level is even lower than that of the Japanese average (see Figure 38).

■NOx emissions per kWh from fossil fuel power generation (Figure 38)



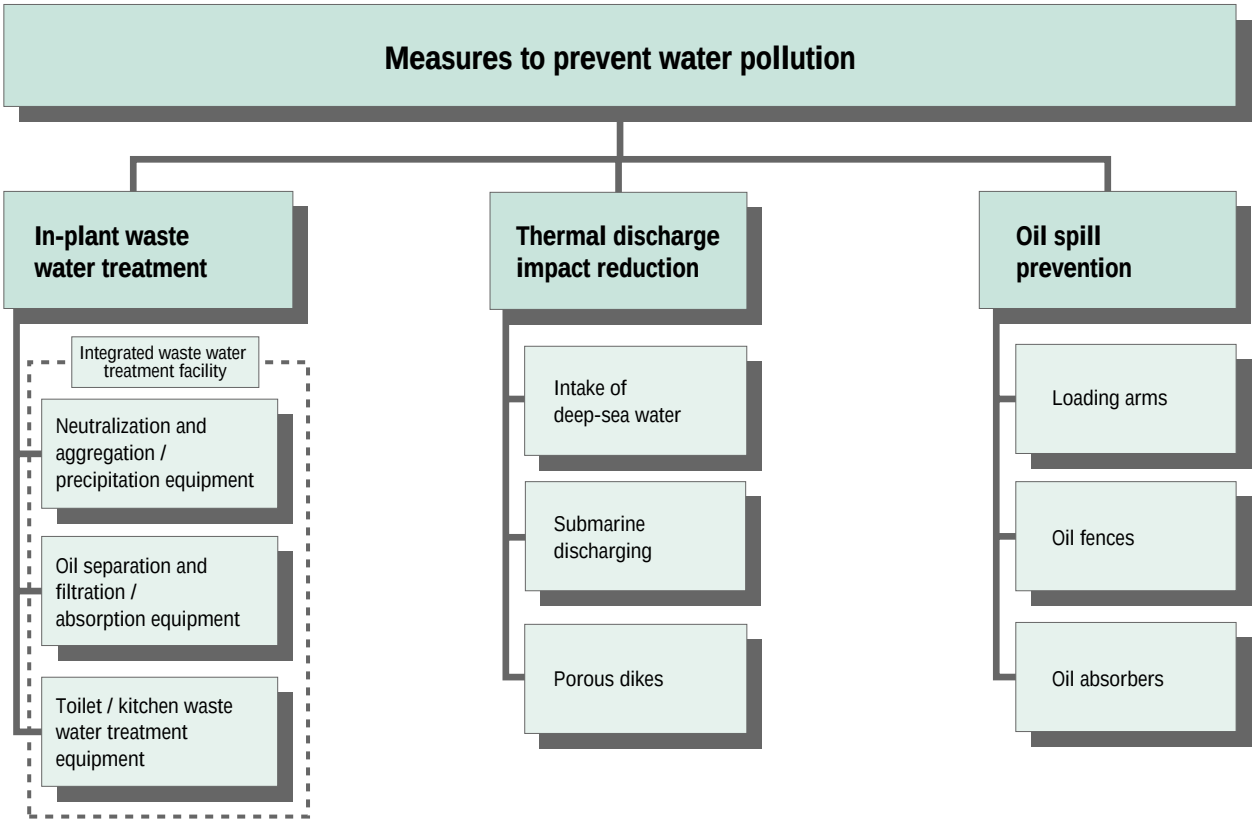
Source for foreign countries: OECD Environmental Data Compendium/1999, Energy Balances of OECD Countries 1996-1997
Sources for Japan: survey by the Federation of Electric Power Companies

Reducing particulates

All boilers for crude and heavy oil are equipped with high efficiency electrostatic precipitators in order to achieve the lowest possible level of particulates.

Electrostatic precipitator (Kainan Power Station)

b. Measures to prevent water pollution



In-plant waste water treatment

In-plant waste water produced from operations at fossil fuel power stations contains small amounts of acid, alkali, suspended solids, oil and other substances. Machine cleaning during annual boiler and turbine overhaul inspections also produces waste water. All the waste water is specifically treated based on its respective condition by using neutralization and aggregation/precipitation equipment and oil separation equipment for purification. It is then purified using filtering and adsorption treatment facilities.

Even toilet/kitchen waste water from employee facilities is purified using specifically designed treatment facilities before being discharged.

Thermal discharge impact reduction

At fossil fuel and nuclear power stations, turbine generators are driven by high-pressure, high-temperature steam which is cooled by seawater in a condenser in order to return it to a liquid state. The temperature rise (thermal discharge) of the seawater is kept at 7°C or less.

In order not to affect sea life, deep-sea intake and submarine discharge is used, and their locations are carefully selected by the characteristics of each station's location in order to minimize the area in which heated water is dispersed.

Oil spill prevention

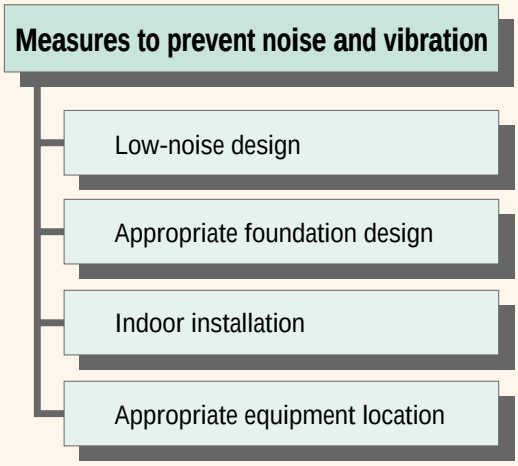
Oil brought in by tankers is unloaded at docking facilities on power station sites. To avoid oil spills, we use a loading arm, which directly and firmly connects an intake valve on the pier with an outlet valve on the tanker.

During the unloading of oil, absorbers are kept on hand, and an oil fence is in place to prevent oil from spreading in the rare case that a spill occurs.

When the loading arm is in operation, the area is under intense surveillance by trained staff. Oil retaining dikes are also installed around fuel tanks to prevent any spilled oil from spreading.

Oil fence at unloading dock

c. Measures to prevent noise and vibration



Noise prevention

In power stations and substations, various devices such as draft fans, transformers, turbine generators, and pumps are usually in operation. To prevent noise, we generally place these facilities inside buildings. When they must be built outdoors, these facilities are specially equipped with silencers and soundproof walls to minimize noise and are located in isolated places in order not to disturb residential areas.

Vibration prevention

Facilities that may cause vibrations at power stations and substations are installed on a solid strong base. They are also located as far as possible from the station's outer boundaries in order to minimize vibration levels outside the power stations.

③ Measures to Deal with Chemical Matters

a. Pollutant Release and Transfer Register (PRTR)

The Pollutant Release and Transfer Register is a system which states that a company must notify the government of the amount of potentially poisonous chemical matter it emits into the environment and the amount of waste material that it transfers. The government will then make this information public. The purpose of the system is to improve the independent management of chemical matters by companies, decrease the amount of emissions, and control the amount of waste.

Companies in Europe and North America, where PRTR is now law, have already introduced the system. The PRTR system was enacted as the Bill Concerning Reporting, etc. of Release to the Environment of Specific Chemical Substances and Promoting of the Improvements in Their Management (Japan's PRTR Law) in July 1999 in Japan, and in March 2000, the government instituted a list of the chemical matters and the types and scale of businesses to which the law would apply. Since April 2000, companies have been obligated to report emissions data based on the law.

Even before this, Kansai Electric has been independently monitoring emission of chemical matters into the environment and we have determined that emission amounts are extremely small (see Table 3).

■Kansai Electric's data related to the Pollutant Release and Transfer Register (fiscal 1999) (Table 3)

Chemicals	Use	Amount handled (t/year)	Amount emitted (t/year)	Where emitted	Amount transferred as waste (t/year)
2-aminoethanol	Water supply processing agent	25.9	0	—	0
Toluene	Power generation fuel (contained in naphtha and NGL)	361.2	0	—	0
Benzene	Power generation fuel (contained in naphtha)	36.5	0	—	0
Xylene	Power generation fuel (contained in NGL)	429.5	0	—	0
Hydrazine	Water supply processing agent	97.1	0	—	0
Boron and boron compounds	Reactor reaction control rod material	7.8	0	—	0
HCFC-22	Coolant	3.3	3.3	Into the atmosphere	0
HCFC-225	Cleaner	10.3	10.3	Into the atmosphere	0
Asbestos	Heat insulating material	23.8	0	—	23.8

b. Dioxins

Dioxins have conventionally been dealt with through restrictions on incinerators (incinerating capacity: 200 kg/h and above) as stipulated in the Waste Management Law and Air Pollution Control Law. But with increasing concerns about environmental pollution and the affects on people's health, the Law Concerning Special Measures Against Dioxins, dealing with small waste incinerators (incinerating capacity: 50–200 kg/h) not previously covered by law, was established in July 1999 and went into effect in January 2000.

In addition to abiding by laws related to incineration, Kansai Electric is striving to control the amount of waste material incinerated by decreasing the amounts we incinerate or recycling it instead.

④ Exchanges with the Community Through Environmental Preservation Measures

Kansai Electric contributes to the local community through environmental preservation measures.

a. Green zoning measures

Kansai Electric aims to grow forests at our business locations which are as close to nature as possible and which are highly beneficial in preserving the local environment. To do this as quickly as possible, we are creating and managing green zones based on an ecological system that enables forests to grow quickly by laying good quality soil and grow dense and mixed vegetation using saplings of natural trees to adapt to the local environment.

As a result, the green zones at many of our power stations, including the Himeji No. 2 Power Station (fossil fuel), are inhabited by birds, insects and small animals.

While emphasizing ecological green zoning as a fundamental principle, we also make efforts to provide an aesthetically pleasing environment for local residents by planting the official trees and flowers of the cities where our power stations are located.

These efforts have been highly appreciated, and in June 1992, the Himeji No. 2 Power Station (see photo above right) received the Prime Minister's Award and in September 1995, the Kainan Power Station (fossil fuel) received the Ministry of International Trade and Industry Award for excellent green zoning activities.

In the green zones of our power stations, we are creating a natural environment that local residents can enjoy complete with insects such as dragonflies and fireflies (see Table 4, photos center right and below right).

As of the end of fiscal 1999, green zone areas totaled 409 hectares. With the addition of the natural forests around our hydropower stations, the total green zone area is 7,851 hectares.

■Locations of pond habitats for dragonflies and stream habitats for fireflies (Table 4)

	Power Stations, etc.
Pond habitats for dragonflies	Sakaiko Power Station (Fossil fuel) Osaka Power Station (Fossil fuel) Amagasaki No. 3 Power Station (Fossil fuel) Himeji No. 1 Power Station (Fossil fuel) Takasago Power Station (Fossil fuel) Himeji LNG Terminal Takahama Power Station (Nuclear) Ohi Power Station (Nuclear)
Stream habitats for fireflies	Himeji No.1 Power Station (Fossil fuel)

Green zone at the Himeji No. 2 Power Station

Pond habitats for dragonflies at the Osaka Power Station

Stream habitats for fireflies at the Himeji No.1 Power Station

Genji fireflies which have grown larger at the Himeji No.1 Power Station

b. Electric power facilities in harmony with the environment

When we plan to build and maintain an electric power facility, we take municipal and regional development plans into consideration. We thoroughly examine the surrounding area and choose an appropriate facility design that blends in with the landscape and is harmonious with the local environment.

By thoroughly understanding the importance of blending in with the local environment, it is our top management priority to achieve mutual understanding and a harmonious coexistence with the regions where we operate.

Power stations representing local areas

Before constructing a power station, we thoroughly investigate the condition of the surrounding area and receive advice from experts in many fields in order to make facilities into symbolic images of the region and in harmony with the local environment.

When constructing Nanko Power Station (fossil fuel) in Suminoe-ku, Osaka, for example, which began operation in 1991, we placed great emphasis on a design compatible with the urban surroundings. In particular, the stack was designed to be a local landmark shaped like a monument. At night it is illuminated by solar power, with the colors changing from season to season. Well-integrated into its environment, Nanko Power Station received the Color Prize for Public Utilities from the Japan Color Laboratory and an International Illumination Design Award (Lighting Section Award) from the North American Illumination Institute. It was also selected as a Good Design Institution (normally called G Mark) by the Ministry of International Trade and Industry (see photo above right).

The stacks of Himeji No. 1 Power Station Units No. 5 and No. 6, which commenced operation in April 1995 and May 1996 respectively, are also illuminated at night. Changing lighting effects and a flashing strobe light create a seasonal atmosphere, and even provide information on the tide position, air temperature, and time of day. These stacks are enjoyed as a symbol of the waterfront area and received the Urban Spectacle Award from Himeji City (see photo center right).

The Sakaigawa Power Station (hydro) which commenced operation in 1993, located in Kamitaira in Toyama Prefecture, was modeled after a house in the gassho-zukuri style, with a steep roof and prominent top beam. Kamitaira is located near a village noted for its many gassho-zukuri houses which are recognized as a UNESCO World Heritage Site. The power station blends well with the beautiful surroundings (see photo below).

Nanko Power Station

Himeji No. 1 Power Station

Sakaigawa Power Station

Substation designs in harmony with surrounding city buildings

At substations, radiators and other equipment are hidden from view and trees are planted to enhance the landscape. The design and color of the buildings are also coordinated with surroundings.

For example, the Hoshida Substation (Katano City, Osaka), which is in a residential area, has been designed as a low building with the external appearance of a residential house in order to blend in with the local environment .

Hoshida Substation

Power distribution methods to upgrade local amenities

We intend to contribute to the overall upgrading of amenities in the areas where our distribution facilities are located by designing them to match the shapes and colors of city buildings and their surroundings.

With this in mind, while assuring a stable power supply, we plan to improve both the quality and look of power distribution facilities by using an effective power distribution method that conforms to the way electricity is used and by choosing designs that conform to city planning concepts. We determine the shape of buildings and their color schemes by considering the size of the roadside buildings and various city design regulations.

One method of improving scenery in a city is burying power distribution lines underground. We use an underground power distribution system in areas already developed with no plan for future development and which have a stable, high demand for electricity (see photo below left).

In cases where maintaining scenic beauty has top priority, for example around national treasures, UNESCO world heritage sites, or areas such as historic boulevards, we promote utilization of underground power lines as long as the technical requirements can be met.

In many cases even the steel towers that support transmission lines have been designed so that their shape and color blend in with the surroundings (see photo below).

The area around Osaka International Conference Center (underground power lines)

The electric transmission tower of the Himeji Power Station (fossil fuel)

c. Efficient utilization of thermal discharge

Using thermal discharge from fossil fuel and nuclear power stations, the company has been cultivating fish and young shellfish with regional characteristics and conducting research on their growth. By releasing cultivated fish and shellfish into the ocean, we help promote local fishery industries.

We are cultivating abalone and top shell and conducting research on their growth at Takahama Power Station (nuclear), shrimp at Tanagawa No. 2 Power Station (fossil fuel), and shrimp and abalone at Miyazu Energy Research Laboratory (fossil fuel).

We are also carrying out agricultural cultivation research using thermal discharge. We have been growing orchids in a greenhouse at Takahama Power Station using a heat pump with heated water as the heat source. Miyazu Energy Research Laboratory has been conducting test operations of greenhouse cultivation which uses thermal discharge as a heat source and different heat-exchange methods.

A prawn raised in a tank (Tanagawa No. 2 Power Station)

Orchids in a greenhouse (Takahama Power Station)

Greenhouse cultivation application tests (Miyazu Energy Research Laboratory)

Section 3 Activities Aimed at Building a Metabolic Society

1 Business Activities Geared Towards the Metabolic Society

① Reducing and Reusing Waste Materials

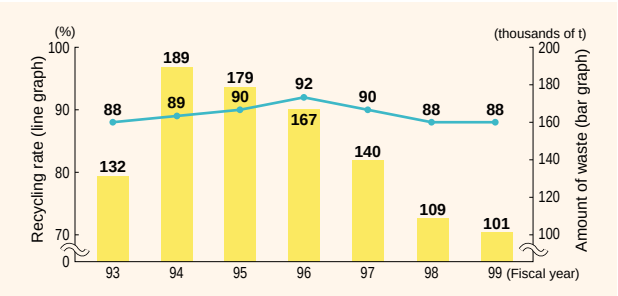
Promoting the control of emissions and the reuse and recycling of waste, and properly disposing of what we cannot use

Kansai Electric has been promoting a program for waste management, from generation to disposal. As well as strictly observing all legal requirements, we are working to promote "precycling" so that less waste will be generated, and we are actively promoting the recycling of waste materials (see Figure 39).

■Industrial waste measures (Figure 39)

We have an extremely high recycling rate for industrial waste—approximately 90%. As well, we reduced our emissions from 1998 to 1999 by approximately 8,000 tons. The main reason for this was the reduction in emissions of gypsum plaster and soot due to a drop in operations at fossil fuel power stations (see Figure 40, Table 5).

■Industrial waste recycling (Figure 40)



Precycling

We are striving to generate less waste and preserve the environment by using block-type insulation. Previously we replaced the insulation during each periodic inspection of turbines and valves at power stations. We also use the foundations of old machinery as replacements rather than reconstructing them.

Recycling

Gypsum plaster is generated by desulfurization facilities at fossil fuel power plants. In 1999, all of the plaster generated - approximately 44,000 tons - was recycled for use in cement and plasterboard.

We are also actively involved in reusing other waste materials, such as utilizing old electric poles made of concrete in road foundations and recycling sludge from wastewater disposal for use in cement.

Furthermore, we are experimenting with the Life Cycle Assessment (LCA) standard, which determines the environmental effect that products have throughout their life cycle, and promoting green purchasing. Other efforts towards the building of a metabolic society include using recycled products such as recycled paper and other office supplies, plant and building inspection route staircases made out of recycled copper wire and plastic, and water permeable pavement materials made of insulator scraps.

■Industrial waste recycling at Kansai Electric (Fiscal 1999) (Table 5)

Waste	Description	Amount (1000 tons) (A)	Recycled amount (1000 tons) (B)	Recycling rate (B/A) (%)	Recycled to:
Sludge	Plaster sludge, waste water treatment sludge and other	46.50	45.49	98	Construction materials, cement materials
Metal scraps	Scrap iron and other	17.84	16.71	94	Metal recovery
Rubble	Waste concrete poles and scraps, and others	16.73	15.91	95	Road materials, metal recovery
Soot and dust	Heavy/crude oil ashes	6.53	6.53	100	Cement materials, fuel
Glass, ceramic chips	Insulator scraps, glass wool and other	5.08	0.56	11	Metal recovery, roadbed materials
Waste oil	Waste lubricants, oil waste, oil sludge and other	4.82	2.98	62	Fuel, other
Waste plastics	Ion exchange resin, polyethylene insulation tubing and other	1.64	0.13	8	Location survey poles, other
Soot and dust	Ash from furnaces and flues, and other	0.81	0.27	33	Rare metals recovery
Others	Slag, waste acid, waste alkali and other	1.07	0	0	
Total		101.02	88.58	88	

Examples of Recycled Resources

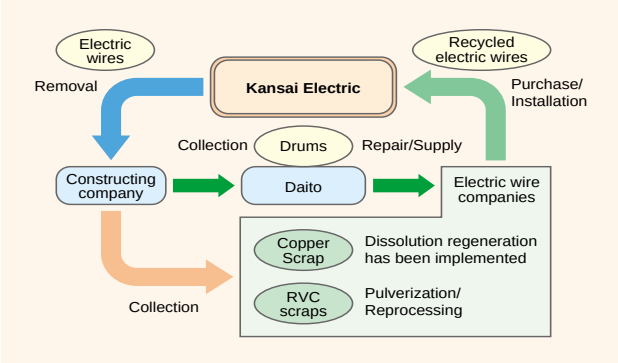
Utilizing recycled low-voltage wires

When removing low-voltage wires, the PVC (polyvinyl chloride) used for coating electric wires was previously processed as industrial waste and disposed of by incinerating at high temperature or burying in the ground, while the copper scraps were recycled. But since 1998, the coating materials from removed electric wires have been pulverized, reprocessed and used along with the copper scraps as recycled wires (see Figure 41).

We are also incorporating lightweight resin drums in cooperation with an affiliated company (Daito Co., Ltd.), who uses them to coil round electric wires.

In this way, by complying with the Life Cycle Assessment method, which scientifically analyses and assesses the environmental effect related to product life cycles (from the material procurement stage to final waste disposal), Kansai Electric contributes to reducing costs related to things like raw materials and industrial waste disposal.

■Recycling system of low-voltage electric wires
(Figure 41)



Using insulation material scraps (Osaka Power Station)

Waste materials generated during power station maintenance—such as scraps from insulating material and fireproof material—are mixed with a special hardening agent to make interlocking blocks and planters that are used for environment repair work. Thus, materials that were previously buried in garbage dumps are recycled in efforts to protect the environment.

Flower planter at an office entrance (Osaka Power Station)

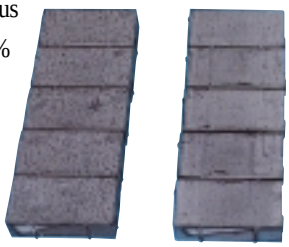
We are determined to continue studying ways to make lighter products, reducing manufacturing costs, and making new and improved products.

Brick manufacturing using coal ash

Maizuru Power Station (fossil fuel), which is presently under construction, will use coal for fuel, and generate coal ashes in the future.

For this reason we are looking into using this coal ash to make bricks as a way to make the best use of resources. In 1999, with the cooperation of the Hyogo Prefectural Institute of Industrial Research, we used this research as a basis for trial manufacturing of bricks using a production line at a roof tile plant. Careful management of the burning temperature allowed us to make bricks containing up to 50% coal ash.

We hope that further research will allow us to make a business out of making and selling these bricks.



Oxidized baked bricks containing coal ash

Making unbaked bricks

Unbaked bricks are made from more than 80% waste materials, including incinerator ash from burnt sewage sludge, coal ash, quarry waste dirt, steel slag, and glass scraps. Using a special hardening technology patented by Kamei Pottery Manufacture Co., Ltd. (located in Kasahara Town, Toki, Gifu Prefecture), the materials are molded and hardened without baking into products that meet standards for product hardness and standards for product safety set by the Environment Agency.

Currently, the Kansai Environmental Engineering Center is working with Kinki Concrete Industries and Kamei Pottery, carrying out experiments to develop technology for making blocks out of sludge accumulated at hydroelectric dams, shells from fossil fuel and nuclear power stations, and things like insulator scraps from the Kansai Electric Group's waste materials. The goal is to create a business manufacturing and selling these blocks.

We are also developing a network of companies and local governments that must dispose of waste, the Kansai Electric Group, which takes this waste and processes it, and companies and local governments who can use the products we make from the waste.

Unbaked bricks

Making water-permeable and other pavement materials from insulator scraps

As a result of our research and development on practical uses for insulator scraps, in 1993 we developed a commercial water-permeable pavement material made with an energy-efficient manufacturing process. This material can mitigate the heat island effect in densely populated urban areas by maintaining the ambient temperature at a comparatively low level. In 1995, we also began to provide a light-colored asphalt pavement material that keeps pavement temperatures low in the summer and is resistant to damage from tire chains in the winter.

Water-permeable pavement from insulator scraps (Amagasaki Techno-land)

Aiming for a power station with zero waste (Kasugade Power Plant)

Many of our offices and plants are tackling recycling, efficiently utilizing resources by sorting waste such as paper and cans. Since 1998, under the "Zero Waste Campaign," the Kasugade Power Station (fossil fuel) has been endeavoring to reduce waste and expand the use of sorted waste, recycling it as fertilizer and solid fuel.

Using the slogan "Waste is a Great Resource," we promote waste sorting in the work place, setting up "sorted waste collection corners" rather than trash cans. Every employee is cooperating by depositing their waste at the collection corners which are decorated with white-cloth-covered tables and flowers, instead of throwing it away.

We also promote the recycling campaign by investigating what other businesses with advanced recycling campaigns are doing and collecting ideas through slogans and posters.

Sorted waste collection corner

In the future, we will work to spread our efforts to other business locations.

Recycling insulating oil

Due to its high toxic content, polychlorinated biphenyl (PCB), which was being used as insulating oil for electrical apparatus such as transformers, was banned from both use and production under administrative guidance in 1972. Furthermore, in 1974, when the Law Concerning the Examination and Regulation of Manufacture, etc. of Chemical Substances was enforced, PCB manufacture, importation and use became illegal in principle, and it was mandatory for manufacturers and enterprises to keep it under strict control. Kansai Electric has kept PCB in exclusive storage under close surveillance.

PCB disposal methods were limited, and although high temperature incineration was acceptable, scarcely more than a partial experimental disposal treatment was carried out domestically, and keeping it under strict watch had become the long-term procedure for handling PCB. There has been a demand for the establishment of a new disposal technique which would replace the incineration method.

Kansai Electric and Kansai Tech Corp. have jointly developed a new chemical treatment disposal technique to replace high temperature incineration disposal (see photo below). The government has recognized the practicality of the technique which generates no combustion gas and basically completes the reaction process in a closed cycle.

Along with enforcement of disposal standards, our chemical disposal technique was sanctioned as an approved method to dispose of PCB when the ministerial ordinance of the Law Concerning Waste Treatment was amended (June 1998). Utilizing the technique developed by our company, we are investigating concrete disposal plans in order to start actual disposal at the earliest possible time, and aim to be actively engaged in efficient use of the insulating oil that we have retained.

Sorted waste collection corner

② Promoting Green Purchasing

The term “green purchasing” means that consumers and businesses purchase products and services based not only on price and quality, but on the impact they have on the environment.

Kansai Electric has for some years now been practicing green purchasing by actively purchasing (and leasing) energy-conserving equipment such as superbly power efficient electric vehicles and various eco-label products. We drew up our Green Purchasing Promotion Policy in 1999 and have been earnestly striving to “purchase green” in all areas of the company.

We currently use 100% recycled copy paper in the company and soon employees will be wearing work clothes made from recycled PET bottles.

Work clothes made from recycled PET bottles

Eco-friendly *Recycled paper* *Global energy logo*

Eco-labels

③ Promoting Eco-Business Throughout the Kansai Electric Group

Kansai Electric develops innovative eco-business throughout the group

In recent years eco-businesses (environment-related industries), which provide recycling equipment and technology, low-pollution vehicles, and eco-friendly products, have been the object of public attention. As well as being a major contributor towards creating a sustainable society with lower environmental impact, eco-businesses are expected to become the driving force for economic development and innovation. We anticipate much growth in this area.

Our goal is to establish a groupwide eco-business strategy that will contribute to environmental conservation by mobilizing the diverse technological expertise of the Kansai Electric Group to promote and support eco-business efforts in various ways, such as providing market information through a regular newsletter Eco-Business News (see photo below). Several of Kansai Electric’s affiliated companies which are currently in the process of developing innovative eco-business products and services are introduced on pages 51 and 52.

Eco-Business News

KANSAI ENVIRONMENT ENGINEERING CENTER CO., LTD.
Dioxin research and analysis

The Kansai Environmental Engineering Center Co. is involved in dioxin research and analysis, one of today's major issues.

To respond to the demand for control of the precision and quality of toxic dioxins analysis, and to obtain accurate data, the Analysis Center in Higashi-Osaka City has installed the latest high-precision, high-sensitivity analysis system which received ISO 14001 certification and is based on our great wealth of experience and advanced technology.

In answer to requests from local authorities, we actively engage in research and analysis of dioxins (including Co-planar PCBs), environmental hormones, heavy metals found in soils, exhaust fumes, and waste water.

Gas Chromatograph Mass Spectrometer (GC-MS)

KANSAI TECH CORP.
Using PCB disposal technology for analysis

Kansai Tech carries out analysis of environmental elements such as air, gas, and soil, and also diagnoses the remaining life span of existing transformers.

Kansai Tech was also engaged in the recent dioxin problem, and has started measuring and analyzing dioxin at the Technical Research Center in Fukuzaki, Minato Ward, Osaka City, which is equipped with the highly sensitive GC-MS (Gas Chromatograph Mass Spectrometer).

An additional merit of the company's analysis technology lies in the safe disposal of the samples received from customers after analysis through disassimilation and nontoxic disposal technology. This technology was developed in collaboration with Kansai Electric, using the potassium tertiary butoxide method, a PCB chemical processing technology sanctioned by the Law Concerning Waste Treatment amendment in 1998.

Kansai Tech aims to be an electric and communication construction company with superior environmental technology and to continue promoting eco-businesses.

Technical Research Center (Analysis Preparation Room)

TOKO SEIKI INC.
Selling simple electricity volume display devices

In February 1999, Toko Seiki released the Ecowatt, a simple electricity volume display device that encourages consumers to be energy-conscious by allowing them to see how much power their home appliances are using.

The Ecowatt shows the accumulated electricity costs, electricity consumed, and amount of time used for each appliance in the home, making it easy for anyone to see the amount of electricity and electricity costs of their home appliances.

For example, you can raise or lower the temperature on your air conditioner or heater and see, in actual electricity costs, how much you will save by doing so. This makes it possible to save energy and electricity costs and see just how much they are contributing to protecting the Earth's environment.

Ecowatt

KANDEN L-HEART CO., LTD.
Floriculture

Kanden L-Heart works with the mentally challenged in floriculture and flower garden maintenance businesses, helping to bring flowers and plants to more areas and brightening up people's days by offering them something beautiful to look at.

The workers do everything they can do make the gardening environmentally friendly; they recycle the soil and use organic fertilizer and biodegradable flower pots.

Currently, the company plants flowers at Kansai Electric locations and holds various flower exhibitions and sales. It has just started selling flowers to large supermarkets and has started a flower arrangement service, both of which are winning repeat customers.

We offer our support to Kanden L-Heart in its continuing work with its numerous physically and mentally challenged employees as being a pioneer in gardening and landscaping.

Making a flower garden

KINDEN
Recycling coal ash as filler for propulsion pipes for underground electric lines

Kinden has taken the coal ash generated at coal-powered fossil fuel power stations and is using it to fill the propulsion pipes that are used to run electric wires underground.

Previously, companies made underground electrical pipe lines using non-cut-and-cover conduit excavation technology, placing many porous electrical pipes inside the propulsion pipe and then securing this by filling the pipe with a hardening agent such as mortar. However, with the increasing congestion of facilities underground, demand arose for a filler that generated little heat and that had high fluidity in order to make effective use of the propulsion pipes and cope with the long distances to be filled.

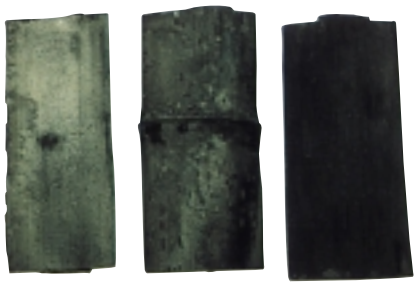
In addition to generating little heat and having high fluidity, the newly developed filler makes good use of coal ash, a designated by-product of coal-powered electricity.

Filling work

TOKAI DENGYO
Manufacture and sale of bamboo charcoal

As one way to make efficient and environmentally friendly use of the bamboo trees that are cut down to make way for electrical power lines, between October 1998 and December 1999 Kansai Electric contracted Tokai Dengyo to carry out research on carbonizing bamboo to create a new kind of charcoal called "bamboo charcoal."

The research revealed the possibility of manufacturing this superb bamboo charcoal, which boasts the same quality as the extremely popular Bincho charcoal. In 2000, the company began full-fledged manufacture and sale of the product, called Chikutan, which comes in two types: one for cooking and another for bath freshening and deodorizing. The company hopes that its bamboo charcoal can contribute to saving the earth by effectively reusing valuable resources.



Bamboo charcoal

NIHON ARM
Manufacture and sale of steel pipe pillars for soft underground construction

Nihon Arm builds steel pipe pillars with built-in cables for high and low tension power lines. The company has built these all over Japan, in city centers, residential areas, and in historical and tourist sites, always ensuring that their products match the particular needs and scenery of each location.

The company used its experience to develop a steel pipe pillar suitable for use in the type of "soft underground construction" based on the New Power Line Underground Plan, which was created by various government agencies and ministries at the end of fiscal 1998.

Soft underground construction is a flexible underground wiring method in which various types of wiring can be combined, such as joining overhead lines with back street power lines and incoming lines. The goal is to match the wiring and power lines to the specific situation of the location.

Nihon Arm will manufacture and sell low-cost, compact steel pipe pillars for soft underground construction that blend in with outdoor lighting and match the surrounding environment.

Steel pipe pillar in Kobe's Chinatown

KANDEN L-FARM
Making effective use of dam driftwood

Established as the first start-up company under Kansai Electric Entrepreneurial Opportunity System, Kanden L-Farm takes unused natural wood, such as that trapped by dams at hydroelectric power stations, and disposes of it using the environmentally friendly bioregion method.

Bioregions are a key to creating metabolic societies on a local scale. As part of its own management policy, companies consider things like ecology, geography, microorganisms, and local artisans, all those valuable resources that make each region unique. Companies thus work independently to contribute to the creation of a metabolic society.

The company's main products include barn bedding that is easy on the environment and livestock, raw material for compost, and soil improvement agents for gardening. The company also operates a farm for the purpose of studying the idea of returning wood products to the soil.

2 Earnest Exchange and Cooperation with External Groups

① Community Relations Facilities

In an attempt to provide information on our electric utility business and our environmental preservation efforts and to communicate with local residents, community relations facilities have been built on power station sites, where people can familiarize themselves with our operations and equipment.

Kansai Electric has major plans to build facilities with exhibits that introduce the public to our environmental policies and where they can see working models of things like solar energy systems and thus learn about new energy sources.

Wakasa Takahama ELdoland

Tropical Wonder

At Wakasa Takahama ELdoland, Kansai Electric's community relations facility, visitors can observe all kinds of tropical plants and various tropical fish in the Tropical Wonder greenhouse. Exhibits placed around the site assist in teaching people about environmental problems and energy issues.

Address	4-1 Aoto, Takahama-cho, Ohi-gun, Fukui Prefecture
Hours	From 10:00 a.m. to 6:00 p.m. (winter 5:00 p.m.) (Closed Mon. and Dec. 29 to Jan. 3) *If closing day falls on a national holiday, following weekday is holiday in lieu. Open Apr. 29-May 5, Jul. 20-Aug. 31
Contact information	Wakasa Takahama ELdoland Tel: (0770) 72-5890

Mihama Nuclear Power Community Relations Center

The Mihama Nuclear PR center at the Mihama Power Station features models of a nuclear reactor and power station and various exhibits on nuclear power, giving visitors the chance to enjoy while learning.

Address	Niu, Mihama-cho, Mikata-gun, Fukui Prefecture
Hours	From 9:00 a.m. to 5:00 p.m. (Closed Dec. 29 to Jan. 4)
Contact information	Mihama Nuclear Power Plant Community Relations Center Tel: (0770) 39-1210

Ohiri-kan, EL Park Ohi (Ohi Power Station)

At the Ohiri-kan, visitors can see the actual workings of a nuclear power station at the Nuclear Power Theater, a model of a nuclear reactor containment built to one-third scale. They can also view the plant's actual radiation management section through a glass barrier.

Address	Tsutsumishita 40, Oshima, Ohi-cho, Ohi-gun, Fukui Prefecture
Hours	From 9:00 a.m. to 5:00 p.m.(Closed Dec. 29 to Jan. 3)
Contact information	Ohiri-kan, EL Park Ohi Tel: (0770) 77-3053

EL City Nanko (Nanko Power Station)

A great place to experience the freshness of the wilderness in Osaka, the EL City Nanko community relations center boasts surrounding forested hills with walking trails, an open grass field, and a brook for playing or relaxing.

Address 7-3-8 Nanko Minami, Suminoe-ku, Osaka

Hours From 10:00 a.m. to 5:30 p.m.
(Closed 3rd Thurs. of every month, Dec. 29 to Jan. 4)

Contact information EL City Nanko
Tel: (06) 6613-7458

Tango Watch-kan (Miyazu Energy Research Center)

Aquarium

Darrieus wind turbine power generator

The Tango Watch-kan community relations center at the Miyazu Energy Research Center has an aquarium with fish and shellfish native to the coastal areas near the site as well as a "petting pool" where kids can reach in and touch the fish. Visitors can also see a wind-powered generator and solar-powered house.

Address 1001 Oda Shukuno, Miyazu, Kyoto

Hours From 9:00 a.m. to 5:00 p.m.
(Closed Dec. 29 to Jan. 3)

Contact information Tango Watch-kan
Tel: (0772) 25-2026

EL Village Okawachi (Okawachi Power Station)

The EL Village Okawachi community relations facility has log house style buildings that fit in perfectly with the surrounding mountains and forests. The buildings house a library where visitors can learn about nature and plants of the world and a center where guests can receive advice on planting their own flowers and gardens.

Address 34-1 Nitta Hase, Okochi-cho, Kanzaki-gun, Hyogo Prefecture

Hours From 10:00 a.m. to 5:30 p.m.
(Closed 2nd Mon. of every month, Dec. 29 to Jan. 3)

Contact information EL Village Okawachi, Okawachi Power Station
Tel: (0790) 35-0888

② Education to Help Spread Energy Conservation Awareness

Spreading energy conservation awareness through education

In order to deepen understanding of energy conservation, Kansai Electric, at the request of local governments, women's groups, and consumer associations, cosponsors lectures and courses targeted at housewives on the basics of electricity and its efficient use. Our widespread education campaigns also include running special energy conservation supplements in major newspapers and in our in-house publication and cosponsoring exhibitions on effective energy use with outside groups like the Energy Conservation Center. Furthermore, our meter-readers give customers a statement that compares the amount of electricity used each month with the same month of the previous year.

We also try to make our information pamphlets and publicity goods as entertaining and interesting as possible so that learning about energy conservation can be more fun for more people.

Kansai Electric booth at the Energy Conservation Center's ENEX 99 fair

Energy conservation pamphlets and publicity goods

③ Everyone's Eco-Friendly Campaign

Kansai electric employees tackle global emvironmental preservation locally

Since 1993, all Kansai Electric employees have taken part in the Everyone's 1-2-3 Campaign, which calls for participants to plant trees, reduce paper waste, and collect empty cans for recycling. For this effort, our company received a Ministry of International Trade and Industry Award in 1995 for outstanding contributions to the promotion of recycling.

This success led to the start in 1996 of the New Everyone's 1-2-3 Campaign, which comprises the three activities of tree planting, resource and energy conservation in the office, and community beautification.

In 2000, we started the Everyone's Eco-Friendly Campaign, in which employees continue to contribute to the protection of the local environment through our previous activities by working in cooperation with the local community.

Tree planting with elementary school children

Tree planting

Kansai Electric advertises the importance of keeping and cultivating greenery by planting the saplings cultivated in its nurseries in cooperation with local residents. We have planted a total of 235,000 saplings in public facilities such as schools and parks as of fiscal 1999.

Community beautification

For some time Kansai Electric has been promoting environmental beautification programs together with the local community. Based on this experience, we have been promoting companywide environment beautification with the cooperation of the local community since fiscal 1996, and in fiscal 1999 alone we carried out 801 of these activities.

Community beautification activity near an office

④ 100,000 People's Eco-Family Campaign

Kansai Electric tackles global environmental preservation with the local community.

There has been a drastic increase in CO_2 emissions in households and the transportation sector in recent years. The call for people to change their lifestyles in order to save energy is growing stronger. It is also important for enterprises to tackle the global warming problem in cooperation with the local community.

We have been promoting the 100,000 People's Eco-Family Campaign since 1998 to become environmentally friendly in our homes. Simple ways to conserve energy include turning off the TV at the mains when not in use and not running idle car engines. The results of an internal survey conducted in 1998 showed that many of our employees have been actively engaged in these simple actions.

Since 1999, we are promoting Green Purchasing, encouraging everyone to purchase eco-friendly products such as recycled toilet paper.

We will continue making efforts to spread this circle of activity in the local community through PR campaigns, well-timed events, and cooperation with PTAs and local municipalities.

Leaflets and stickers for the 100,000 People's Eco-Family Campaign

⑤ Cooperation with the Kansai Economic Federation and Other Groups

Working with outside groups to create a society dedicated to environmental protection

The Kansai Economic Federation has projects like the Green Purchasing Promotion and the Summer Energy Conservation Fashion Statement, in which employees are encouraged to dress lightly in the office so that the temperature can be kept at the ideal cooling temperature of 28 degrees.

These projects are part of activities geared towards the Construction of an Eco-cyclical Society and Shift to a New Lifestyle, which is one of the action plans of the Kansai Economic Federation's Kansai Revitalization Plan adopted in December 1999. Kansai Electric is participating in these activities in earnest, practicing green purchasing by buying things like 100% recycled paper and having employees dress energy-wise in the office to save on air conditioning.

We are also taking active part in the Toward a Metabolism-Oriented Society, an initiative advocated by the Global Environment Forum–Kansai whose members include academics, economists, representatives from government, and labor and women's groups, as well as aiding outside independent research through our Kansai Research Foundation for Technology Promotion.

Proposals of the Global Environment Forum–Kansai

⑥ Cooperation with the Local Community

Kansai Electric works to preserve the environment with local residents.

Symposium on global environmental issues

We regularly hold symposiums, supported by the Osaka city and prefectural governments, that focus on global environmental issues. This is an important opportunity to consider these issues together with the local community.

Environment Month Symposium

Environmental events and cooperation with local governments

During Kansai Electric's "Environment Month" and "Customer Service Month," our branches and offices hold a variety of events with environmental themes, such as flea markets and recycling fairs, in exchange and affiliation with the local community through non-profit organizations and local governments.

Flea market

Supporting environmental education

For elementary and junior high school students, we produced an animated video that explains global environmental issues titled "Mako-chan's Parrot - What is the Global Environment?" and a picture book with information concerning how to lead an eco-friendly lifestyle titled *Mako-chan and Mimi's Lifestyle Check*.

The ecology of animals and plants living in our service area is introduced in a booklet titled *Our Friends on the Earth*. This booklet has gained popularity as a teaching material for environmental education.

We also produced a video titled "Let's Consider the Global Environment," appealing to each individual to reconsider their lifestyle and improve their environmental awareness.

A number of other environment-related publications are in wide use (see Table 6).

Environmental education materials

■List of Environment-Related Publications by Kansai Electric (Table 6)

	Title	Main Contents
	Kansai Electric Power's Global Environmental Action Report	An annual report on the progress of our environment-related activities
	Kansai Electric Power's Global Environmental Action Report - A Well-Balanced Environment Today and Tomorrow –	An annual report in English on the progress of our environment-related activities
	Grandma's Earth-Friendly Ideas	Presents traditional earth-friendly wisdom collected from community residents
	The Eco-Family's Way to Live and Be Kind to the Earth	Q&A format on how to live in harmony with the environment
	Mako-chan and Mimi's Check on Life	A book introducing eco-friendly lifestyles to the next generation (elementary and junior high school students) in the form of a check list for daily living
	Listen to Small Voices of the Earth	Explains global environmental problems, with illustrations of animals and plants from around the world
	Our Friends on the Earth	A series of booklets introducing the ecology of rare species of fauna and flora in our service area
Videos	A Well-Balanced Environment - Kansai Electric Power's activities to fight global environmental problems –	Produced in both Japanese and English, introducing our activities to fight global environmental problems
Videos	Let's take a look at the global environment	Introducing global environmental problems and energy problems in friendly terms
Videos	Mako-chan's Parrot – What's the Global Environment? (animated)	Explaining global environmental problems to the next generation (elementary and junior high school students)

These materials are distributed free of charge while stocks last. Inquiries should be directed to: Environment Department, Environmental Management Group
Phone: 06-7501-0136 (direct line)

⑦ Information Exchange with Overseas Electric Power Utilities

Kansai Electric is engaged in information exchange and technical cooperation with overseas electric utilities.

One company or one country acting on its own cannot solve global environmental problems such as global warming. Action on a global scale is required. Japan is a world leader in technologies such as nuclear power, energy conservation and pollution control, and expectations of Japan's electric utilities are high in terms of international technical cooperation.

Kansai Electric has been actively promoting international technological cooperation in a number of ways. The main thrust of our efforts is to contribute to environmental preservation by utilizing the knowledge and expertise we have accumulated. For example, we offer training courses in topics related to power generation, participate in joint international research projects aimed at developing latest technologies, and team up with power companies in other advanced countries to offer aid to developing countries.

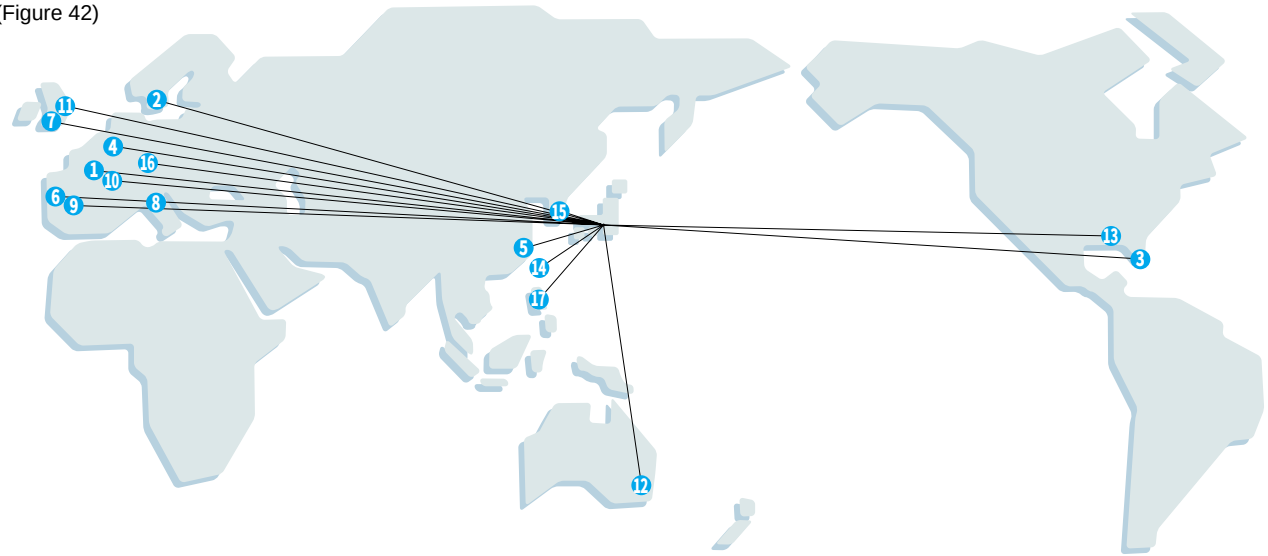
Information and technology exchange with overseas organizations

We have information and technology exchange agreements with 17 electric utilities in 14 different countries. In addition to exchanging the latest information and technology, we send lecturers abroad and offer training courses as part of our international cooperation program (see Table 7 and Figure 42).

■Information exchange agreements with overseas electric utilities (Table 7)

	Electric utility	Date of agreement
①	Electricité de France (EdF), France	March 1979
②	Vattenfall AB, Sweden	June 1985
③	Florida Power & Light Company (FPL), U.S.A.	June 1986
④	Rheinisch-Westfälisches Elektrizitätswerk Energie (RWE-EAG), Germany	October 1987
⑤	East China Electric Power Group Corporation, China	March 1988
⑥	Empresa Nacional de Electricidad, SA (ENDESA), Spain	March 1990
⑦	Nuclear Electric plc. (NE), U.K.	September 1990
⑧	Ente Nazionale per L'Energia Elettrica (ENEL), Italy	November 1990
⑨	Unión Eléctrica - FENOSA, SA, Spain	July 1991
⑩	Nordostschweizerische Kraftwerke AG (NOK), Switzerland	August 1991
⑪	National Power plc., U.K.	October 1991
⑫	The Pacific Power Corporation, Australia	November 1991
⑬	Entergy Operations, Inc., U.S.A.	May 1992
⑭	Taiwan Power Company, Taiwan	March 1995
⑮	Korea Electric Power Corporation, Korea (KEPCO)	March 1996
⑯	Czech Power Company (CÉZ)	May 1997
⑰	MERALCO, The Philippines	October 1998

(Figure 42)



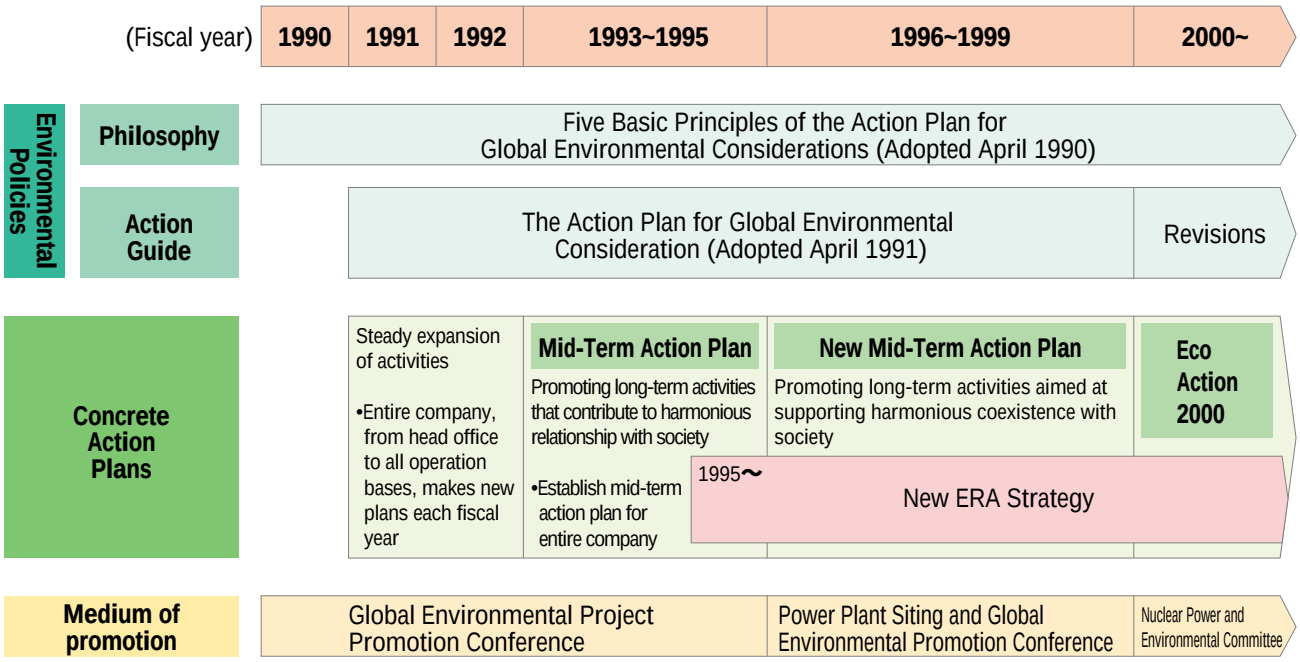
3 Raising Employees' Awareness of Their Responsibility as Global Citizens

Promoting employee awareness throughout the Kansai Electric Group

Kansai Electric has placed Global Environmental Project Promotion staff throughout the Kansai Electric Group to foster a sense of global citizenship among employees and encourage them to act based on an awareness of environmental problems. The specially trained staff of 360 relay information to their co-workers and promote cooperative projects with other organizations.

Furthermore, we have chosen about 50 employees of our affiliated companies to serve as Global Environmental Promotion staff at their respective companies. Each year the Conference for the Global Environmental Promotion Staff of Kansai Electric Affiliates is held to promote groupwide action on global environmental problems.

[Reference] Changes Up to Now in Environmental Policies and Concrete Action Plans



[Reference] Report on the New Mid-term Action Plan for Global Environmental Considerations (Companywide Action Plan)

Item		Fiscal 1996	Fiscal 1997	Fiscal 1998	Fiscal 1999	Evaluation of results	Goals for fiscal 2000
Reduction of CO_2 emissions per unit of power generation		0.07kg-C/kWh	0.06kg-C/kWh	0.06kg-C/kWh	0.07kg-C/kWh	Due to improved capacity factor of nuclear power stations, the focus on increasing nuclear power, which does not emit CO_2, has contributed greatly to a decrease in CO_2 emissions. As the demand for electric power grows, we will aim at promoting the New ERA Strategy.	Not more than 0.09kg-C/kWh (fiscal 1990 levels)
Capacity factor of nuclear power stations		73.8%	84.2%	84.3%	82.0%	We achieved our goals, thanks to efforts to shorten time between regular inspections and prevent breakdowns and accidents.	Maintained at 80% or more
Thermal efficiency of fossil fuel power stations (Compared to fiscal 1993; sending end thermal efficiency)		Increased by 1.1%	Increased by 1.2%	Increased by 1.2%	Increased by 1.2%	We achieved our goals.	Increased by 1.2%
Enlargement of LNG use		5,090,000t	4,990,000t	5,190,000t	5,490,000t	We achieved our goals. We have secured LNG supplies for a number of years thanks to the signing of long-term contracts.	5,300,000t
Output expansion through hydro power station renovation		13,672kW	17,342kW	17,842kW	27,052kW	Things are moving as planned and we will continue to increase capacity.	29,652kW
Reduction of power transmission and distribution losses		5.2%	5.4%	5.6%	5.3%	The loss has been maintained on a lower level.	Reducing as much as possible
Leveling off peak load	① Increase number of "time-of-use lighting" contracts	49,000 contracts	65,000 contracts	80,000 contracts	95,000 contracts	Things are moving as planned and we will work aggressively to increase the number of contract customers.	105,000 contracts
	② Increase number of "load heat storage adjustment" contracts	1,103 contracts	1,392 contracts	1,877 contracts	2,804 contracts	Things are moving as planned and we will continue to increase the number of contract customers.	3,000 contracts
	③ Increase peak-shift demand though planned adjustment contracts	370,000kW	380,000kW	530,000kW	530,000kW	We will work to ensure medium- and long-term systematic adjustment.	500,000kW
	④ Promotion of peak-cut-type equipment	7,000	51,000	98,000	148,000	We will continue to work to introduce more of these vending machines as planned.	200,000 units
Introduction of electric vehicles		99 vehicles	122 vehicles (as of April 1998)	144 vehicles	162 vehicles	We have achieved our goals.	Determine every year by market trends and technological innovation (176 vehicles in 2000:Not including specialty vehicles)
Use of untapped energy sources/heating districts		9 districts	9 districts	9 districts	10 districts	In 1999, we began supplying heat to the area south of Sannomiya Station in Kobe.	11 districts
Collaboration on power generation using waste material		287 million kWh	346 million kWh	352 million kWh	394 million kWh	In April 1999, we began buying electricity from two new customers.	Purchase of surplus electricity produced by incinerating waste based on our policy of contributing to solutions towards local waste disposal problems
Use of new energy sources (Kansai Electric facilities)	① Photovoltaic power generation	489kW	587kW	667kW	740kW	In 1999, we introduced a total of 73 kW at five locations, thus achieving our goals.	735kW
	② Wind power generation	160kW	160kW	164kW	159kW	We have almost achieved our goals. We will continue our efforts to increase operational knowledge.	160kW
New Everyone's 1-2-3 Campaign	① Number of trees planted	37,000 trees	73,000 trees	107,000 trees	140,000 trees	Employees of all divisions are working with local communities as much as possible to solve environmental problems. We will continue to work with local communities in contributing to environmental preservation.	125,000 trees (five-year cumulative total)
	② In-house resource and energy conservation	In-house resource: 1% Energy conservation: 1%	In-house resource: 5% Energy conservation: 1%	In-house resource: 13% Energy conservation: 1%	In-house resource: 12% Energy conservation: 2%		5% electricity savings, reduction in paper garbage compared to fiscal 1995
	③ Local environmental beautification	647 times	575 times	730 times	801 times		Continue to cooperate with local community
Recycling of industrial wastes		92%	90%	88%	88%	We will continue to improve our recycling efforts by striving for waste reduction and effective waste utilization.	90% or more
SF6 gas exhaust control/ gas reclamation rate during equipment inspection		60%	60%	60%	83%	To achieve our goals, we have decided to reclaim gas of 77 kV and lower, in addition to our previous reclamation of gas 154 kV and higher.	90%
Reduction of SOx and NOx emissions per fossil fuel power generation	① SOx	0.14g/kWh	0.11g/kWh	0.08g/kWh	0.08g/kWh	Emission levels of Japanese power companies are remarkably low compared to leading developed Western nations. As Kansai Electric's levels are particularly low, our main focus is on maintaining current levels.	Maintaining at current reduced levels
	② NOx	0.18g/kWh	0.19g/kWh	0.15g/kWh	0.15g/kWh		Maintaining at current reduced levels

[Reference] History of Energy and Environmental Issues

	Kansai Electric Power	Japan	World
1950s	1951 Kansai Electric Power Co., Inc. established.		
1960s	1962 Direct burning of crude oil begun. 1963 R&D on flue gas desulfurization begun.	1962 Law Concerning Flue Gas Control enacted. 1967 Anti-Pollution Basic Measures Law enacted. 1968 Air Pollution Control Law enacted.	
1970s	1971 Public Pollution Investigation Department established. 1972 Exhaust gas recirculation and two-stage combustion methods introduced. Use of naphtha begun. 1973 Public Pollution Investigation Department reorganized as Environmental Affairs Department. Use of NGL and LNG begun. 1974 Practical use of flue gas desulfurization facility begun. R&D on flue gas denitrification facility begun. 1975 Environment Month introduced as an annual event. 1979 Low-NOx burners introduced.	1970 Water Pollution Control Law enacted. Law Concerning Waste Treatment and Cleanup enacted. 1971 Environment Agency established. 1974 Total pollutant load control for SOx introduced. 1977 Strengthening of Environmental Impact Reviews in Power Plant Siting determined by MITI's Ministerial Council. 1979 Law Concerning Efficient Use of Energy enacted.	1972 Limitation of Growth Report presented by the Club of Rome United Nations Conference on the Human Environment held in Stockholm. 1973 First oil crisis. 1979 Second oil crisis. Accident at Three Mile Island Nuclear Power Plant in USA.
1980s	1980 Flue gas denitrification facility implemented. 1984 Deming Award for TQC activities received. 1988 New corporate management plan Vision for the Year 2030 released.	1981 Total pollutant load control for NOx introduced. 1984 Details on environmental impact assessment determined by the Cabinet. 1989 Ministerial Committee on Global Environmental Protection established.	1985 Vienna Convention for Protection of the Ozone Layer adopted. 1986 Accident at Chernobyl Nuclear Power Plant in former USSR. 1987 Montreal Protocol adopted. 1988 Intergovernmental Panel on Climate Change (IPCC) established.
1990s	1990 Global Environmental Project Promotion Conference established. Five Basic Principles of Action Plan for Global Environmental Considerations adopted. Environmental Technology Research Center opened. Research and development of flue gas carbon dioxide recovery system begun.	1990 Action Program to Arrest Global Warming adopted. Global Environment Forum Kansai established.	1990 Second World Climate Conference held (IPCC's interim assessment report presented).

	Kansai Electric Power	Japan	World
1990s	1991 Kansai Electric Power Co., Inc. Action Plan for Global Environmental Considerations adopted .	1991 Global Environment Charter adopted by Keidanren (the Federation of Economic Organizations). Law Concerning Promotion of Reprocessed Resource Use enacted. Law Concerning Waste Treatment and Cleanup revised. Act Charter adopted by Global Environment Forum Kansai.	1991 Intergovernmental Negotiating Committee of the Framework Convention on Climate Change begun.
		1992 Law on Protection of Endangered Flora and Fauna enacted.	1992 United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro.
	1993 Kansai Electric's Mid-Term Acition Plan for Global Environmental Considerations adopted.	1993 Temporary Law Concerning the Promotion of Business Activities in Regard to Economizing the Use of Energy and the Utilization of Recycled Resources adopted. Basic Environmental Law adopted.	
		1994 Global Environment Forum-Kansai reorganized. Action plans for each country presented, based on Framework Convention on Climate Change. Basic Environment Plan formulated.	1994 Framework Convention on Climate Change (FCCC) effected.
	1995 New ERA Strategy (Global Warming Prevention Measures) formulated.	1995 Law on the Classified Collection of Container and Packaging Waste, and the Promotion of Recycling adopted. AIJ Japan Program launched.	1995 First Conference of the Parties (COP1) to the FCCC. IPCC Second Assessment Report presented.
	1996 Power Plant Sites/Global Environmental Promotion Conference established. Global Environmental Project Promotion Conference abolished. New Mid-Term Action Plan for Global Environmental Considerations adopted.	1996 JIS Environment Management System and Environment Auditing established. Environmental Action Program of Electricity Utilities Industry formulated.	1996 Second Conference of the Parties (COP2) to the FCCC. ISO Environment Management System and Environment Auditing established.
		1997 Environmental Impact Assessment Law enacted. Federation of Economic Organization's Environmental Autonomy Action Plan formulated. Electric Utilities Industry Law amended.	1997 UN General Assembly Special Session on Environment. Third Conference of the Parties for Framework Convention on Climate Change (Global Warming Prevention Conference in Kyoto: COP3).
		1998 Law Concerning the Rational Use of Energy amended (enacted April 1999). Outline for Promotion of Efforts to Prevent Global Warming decided. Law Concerning Promotion of Measures to Cope with Global Warming formulated (enacted April 1999).	1998 Fourth Conference of the Parties for Framework Convention on Climate Change (COP4).
		1999 Basic Policies Relating to Global Warming determined by Cabinet. Law Concerning Special Measures Against Dioxins enacted. Japan's PRTR Law enacted. Accident at JCO uranium processing plant.	1999 Fifth Conference of the Parties for Framework Convention on Climate Change in Bonn (COP5).
2000s	2000 Kansai Electric's Action Plan for Global Environmental Considerations revised. Eco Action 2000 adopted. Nuclear Power and Environmental Committee established. (Power Plant Siting and Global Environmental Promotion Conference abolished.)	2000 Metabolic Society Creation Promotion Law enacted.	

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Please give us your thoughts and impressions

This report has been written in detail to help as many people as possible learn of the efforts Kansai Electric is taking to protect the environment. There may be, however, some points that are hard for the reader to understand, places where the information is insufficient, or other deficiencies.

We would like to ask you to read this report and give us your frank opinions and impressions so that we may use them for future reference. When you have finished reading the report, please fill out the questionnaire on the back and fax it to the company's Environmental Management Group.

Thank you very much.

Environmental Management Group
Environmental Considerations Department
Kansai Electric Power Co., Inc.

FAX: 81-6-6441-3549

To: Environmental Management Group, Environmental Considerations Department, Kansai Electric Power Co., Inc.

Please check the items that most closely match your opinions or impressions.

① I think this report is:

☐ Easy to understand ☐ Average ☐ Difficult to understand

Reason:

② What do you think about Kansai Electric's approach to environmental problems?

☐ Very good ☐ Fairly good ☐ Not very good ☐ Not good

Reason:

③ Do you want to know more details? Please tell us the page number and describe what you want to know more about.

Page	Detailed description	Page	Detailed description

④ If there is something that you think does not need to be written in this environmental report, please tell us what it is.

Please write the page number and give a description of the information.

⑤ If there is something that should be emphasized more or for which more PR is required, please tell us.

In detail:

⑥ What in particular should Kansai Electric do in the future to protect the environment?

In detail:

⑦ From what perspective are you reading this report?

☐ A customer of the company ☐ Investor/shareholder

☐ A party doing business with the company ☐ Government employee

☐ Affiliated with an environment-related NPO ☐ Mass media-related person

☐ Corporate environment-related person ☐ Student

☐ Other (Explain:)

⑧ From where did you learn about this report?

☐ Newspaper/magazine ☐ The company's website

☐ Heard from one of the company's employees

☐ Heard from a friend or acquaintance ☐ Other (Explain:)

Thank you very much for your cooperation. If you do not mind, please also fill in the following information.

Name: Gender: ☐ Male ☐ Female Age:

Address:

Occupation (Company name or organization):

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