Environmental and Social Action Report

2003
Introduction of Sustainability Indicators

We set Environmental Sustainability, Monetary Value of Reducing the Environmental Impact and Monetary Value of Reducing Environmental Impact of Customers’ Business Activities

By establishing indicators that clarify the relationship between its business performance and the environmental impact of its business activities, Osaka Gas intends to further its environmental actions.

Establishment of Medium-Term Environmental Plan

We set up the 34 targets including 24 quantitative targets

The Medium-Term Environmental Plan has been established with precise targets and action plans that will facilitate achieving the 2010 Environmental Goals.

Environmental Actions

Reduction in CO₂ Emission Per m³ of Gas Sold

We reduced CO₂ emission by 5.2% from FY2001.

Reusing Excavated Soil

69% Reuse Rate, Final Disposal of 80,000 tons

We reused excavated soil and other materials from gas pipeline construction as asphalt, regenerated roadbed material or improved soil.

Production Sector Achieves Zero Emission

Final Disposal of Industrial and General Waste of 19 tons, less than 10% of the 230 tons of FY1998

We have managed to significantly reduce the final disposal amount of industrial waste by reusing and recycling waste such as concrete, oil, plastics and sludge.

ECOWILL Residential Natural Gas Engine Co-generation System Released

Osaka Gas began selling ECOWILL, an ultra-compact, high-efficiency system that automatically generates electricity when energy savings are highest based on its self-learning function.

Osaka Gas Earns METI Minister Prize from the Reduce, Reuse, Recycle Promotion Association

Reusing Speakers from Gas Leak Alarm Systems

During the year, we removed speakers from gas leak alarm systems after their five-year warranty had expired, submitted them to rigorous testing and then reused them in about 40% of the new systems.

Contribution to Energy Efficiency through ESCO

We achieved utilities savings of 76 million yen at the Osaka Medical Center and Research Institute for Maternal and Child Health.

This effort gained widespread attention for its superb energy savings and for being the first ESCO project with the cooperation of local government through shared savings approach.

Osaka Gas Develops and Markets a Dioxin Absorption Filter Using Activated Carbon Fiber (ACF)

We developed an ACF filter that traps more than 99% of dioxins, and incorporated this into a dioxin removal device, which we subsequently released.

Carbon Nano Tubes (CNTs) with Walls of Amorphous Construction, a World First

Carbon nano tubes, which have a high hydrogen adsorption capacity, are attracting increasing interest as a material for storing, transporting and using hydrogen.

Social Actions

Compliance

We have thoroughly briefed all our affiliates, management and employees on the Osaka Gas Group Code of Conduct.

Environmental Education for Schools

Osaka Gas welcomes school field trips to the Gas Science Museum, and it also sends employees to educate schools about the environment.

One Good Environmental Deed

Every Osaka Gas employee constantly works towards the environment as part of the local community.
Corporate Profiles of Osaka Gas, Subsidiaries and Affiliates

G8 Structure (From April 2003)

Osaka Gas
- Energy Resources Business Unit
- LNG Terminal Feeder Generation Business Unit
- Pipeline Business Unit
- Residential Energy Business Unit
- Commercial & Industrial Energy Business Unit
- Osaka Gas, Subsidiaries and Affiliates

NIPG Group
- LPG (Liquefied Petroleum Gas)

LNG Group
- Industrial Gas / Fuel Gas Business

Energy Business
- Non-Energy Business

Urbanex Group
- Urban Development

Kinrei Group
- Food/Restaurant

OGIS Research Group
- Information Communication Business

OG Capital Group
- Engineering / Residential Services

Corporate Profile (as of 31 March, 2003)

Head office
4-1-2, Hiramochi, Chuo-ku, Osaka 541-0046, Japan
Phone: +81-6-6202-2221

Capital
132,166 million yen

Major business fields
1. Manufacture, supply and marketing of gas
2. Marketing of gas equipment and related construction work
3. Contracted pipe installation

Number of customers
6,562,000 (Number of gas meters installed)

Amount of gas sold
7,513 million m³ (FY2002)

Net profit, Ordinary profit
43.5, 39.4, 32.9, 25.4 (billion yen)

Net Sales, Total sales
999.9, 989.1, 754.1, 751.0, 722.2, 712.0 (billion yen)

Number of employees
7,946

Sales Ratio of Subsidiaries and Affiliates by Business Category

Restructuring of the Osaka Gas Group

The previous organization of Osaka Gas, with its five regional business headquarters, have been restructured in April 2003. The new structure has five business units covering the company’s natural gas value chain, Energy Resources, LNG Terminal and Power Generation, Pipeline, Residential Energy, and Commercial and Industrial Energy. At the corporate headquarters of the Group, we established five support/shared services divisions: Strategy and Finance, Communication & HR, Administration & General Affairs, Technology, and Tokyo. The group companies have also been reorganized into eight fields (G8) from 10 fields (G10), with a core company in respective fields.

Subsidiaries and Affiliates (as of 31 March, 2003)

Number of Affiliates
118 (including 56 consolidated subsidiaries)

Total sales
378.4 billion yen (as of FY2002)

Number of employees
8,538

Consolidated Financial Data

Sales Ratio of Subsidiaries and Affiliates by Business Category

Consolidated Financial Data

Sales Ratio of Subsidiaries and Affiliates by Business Category
Scope of the Report

Environmental Action Report:
Report based on business operations (gas and other) of Osaka Gas Co., Ltd.
1. The report covers our efforts, in cooperation with pipeline construction companies and other companies in our service chain, to reduce the amount of excavated soil during pipeline construction, to increase soil recycling, to recover and recycle used gas equipment, etc.
2. We disclosed data pertaining to the environmental performance of our major affiliates in the section, Efforts by our Affiliated Companies (See pages 65-66).

Social Action Report:
Report based on the activities of Osaka Gas Co., Ltd.
This report covers our activities, in cooperation with pipeline construction companies and other companies in our service chain, stability of supply, and security and safety measures, etc.

Period under review: April 1, 2002-March 31, 2003
The next edition is scheduled for publication in August 2004 (tentative).

Contents

| Corporate Profiles of Osaka Gas, Subsidiaries and Affiliates | 2 |
| Message from the President | 5 |
| Message from Chairperson of Committee on Energy and the Global Environment | 7 |
| Sustainability Indicators | 9 |
| Medium-Term Environmental Goals and Results in FY2002 | 11 |
| Environmental Impacts of Our Gas Operations in FY2002 | 13 |
| Environmental Accounting | 15 |
| Environmental Management Improvement | 17 |
| Reduction of the Environmental Impacts of Our Business Activities | 21 |
| Emission Control of Greenhouse Gases and Nitrogen Oxides (NOx) | 22 |
| Reduction of Resource Consumption and Promotion of the Use of Recycled Materials | 26 |
| Green Purchasing/Green Distribution | 31 |
| Control of Chemicals | 33 |
| Wastewater Management | 34 |
| Environmental Protection Concerning Soil and Groundwater | 35 |
| Contribution to Environmental Impact Reduction through Our Products and Services | 36 |
| Contribution to CO2 Emission Reduction | 37 |
| Gas Equipment and System Efficiency Technology | 39 |
| Reducing Emissions of NOx and Other Air Pollutants | 44 |
| Promoting the Use of Natural Gas Vehicles | 44 |
| Eco-Design for Household Equipment | 45 |
| Reusing and Recycling Resources | 46 |
| Reducing CFCs, HFCs and HCFCs | 47 |
| Contribution to Environmental Improvement Locally, Nationally and Overseas | 48 |
| Contribution to the Environmental Impact in Regional, Domestic and International Communities | 49 |
| Development of New Technologies Other Than Gas Appliances and Systems | 52 |
| Living Up to Our Social Responsibility | 54 |
| Becoming a Corporate Enterprise Open to Society | 55 |
| Compliance/Information Disclosure/Protection of Customer Information | 56 |
| Safe and Reliable Gas Supply | 56 |
| Stable Supply/Ensure Safety of Gas Operations/Hello Service | 58 |
| Contributing to Local Communities as a Good Corporate Citizen | 58 |
| Local Community Activities/Everyone’s Environmental Effort Campaign | 59 |
| Communication with Society | 61 |
| Information Disclosure | 62 |
| Employee Satisfaction at Work | 62 |
| Personnel System Fostering Personal Growth/Fostering Employee Development/Human Rights Awareness/Hiring/Labor Safety and Health | 65 |
| Efforts by Our Affiliated Companies | 65 |
| Stakeholders Survey | 69 |
| Osaka Gas Response to Opinions and Comments | 70 |
| History of Osaka Gas Environmental Activities | 72 |
| Editor’s Postscript | 72 |
Osaka Gas and its commitment to making positive contributions to the global environment and to society’s well-being

Osaka Gas has made a positive contribution to the environment an integral part of its managerial goals through the awareness of its responsibility as a leading Japanese energy company. The 2003 report addresses a broader range of subjects that the company has addressed during the past year, including the environment, human rights, labor health/safety and community activities. Hirofumi Shibano, President of Osaka Gas, shares his thoughts on the company's environmental and social actions.

Sustainable society and corporate activities

We all know that technological innovations and economic development during the last century have created material wealth for mankind. However, for the past few decades, we have faced critical global challenges, including the depletion of resources, food shortages, global warming and other serious problems.

With these issues in mind, we need to raise our awareness as to how we can realize a “sustainable society,” the fruits of which can be enjoyed by future generations. Part of that effort should be focused on reducing the environmental impacts of our lifestyles and economic activities. Businesses should fully recognize their responsibilities in reducing environmental impacts, given the relative size that their business activities have on the environment and on society. As a corporate citizen, we need to assume the responsibility of contributing to the environment and helping to achieve a sustainable society over the long term.

Gas business and the environment

Osaka Gas serves the community through supply of natural gas, the cleanest of all fossil fuels. Though it is an important fuel, natural gas is limited in its availability and reserves. As a public utility supplying this indispensable energy source, we are closely interwoven with the well-being of our customers and the community. Therefore, protection of the environment in the community we serve is a responsibility, as well as the key to our future prosperity. Because of our responsibility as an energy company, we have heightened our awareness of the environment compared with businesses in other industrial sectors. This is not something we boast about, but a challenge we accept and address positively.

Prior to switching to natural gas, Osaka Gas supplied manufactured gas made from coal and oil. Osaka Gas implemented a major corporate initiative by converting from manufactured gas to natural gas following the introduction of LNG to the company in 1972. The conversion to natural gas was a landmark event in the history of our gas operations in a number of ways, and we are committed to improving the environment through distribution of this environmentally friendly energy source. As natural gas has come to play an increasingly important role in Japan’s and the world’s energy industries, our environmental commitment has become even greater than before.

Environmental actions in business strategies

Our actions to reduce environmental impacts in business activities have been positioned as a mainstay in the company’s management strategies because our commitment to the environment is crucial for survival in the market. Furthermore, our stakeholders assess our environmental performance in the same way as our economic performance. Our awareness of our responsibility led us to the establishment of the environmental principles, which were conceived in 1992. Based on these principles, we established three action guidelines that clearly define the directions and objectives of our environmental activities.

Osaka Gas’ strategy calls for the business management that creates corporate value. We seek to enhance the company’s value at three levels: value for customers, value for shareholders and value for society. Our objective is to maximize the value of Osaka Gas in the energy industry; therefore, we have positioned the company’s environmental activities as an important cornerstone in enhancing our social value. This led us to the formulation of the 2010 Environmental Targets. In the same way, we have drawn up the Medium-term Environmental Targets with specific action plans including quantitative targets in our Medium-term Business Plans, “Innovation Centennial,” formulated in early 2002.

It is a fact that natural gas is the most benign energy for the environment among fossil fuels. However, we should maximize its value while minimizing its environmental impacts, in addition to promoting its wider use, because we believe that natural gas is a practical energy solution until renewable energies become commercially and economically feasible. With this in mind, Osaka Gas has aggressively worked in the promotion of R&D to enhance the value of natural gas, including the development of highly efficient energy systems and equipment.

Social responsibilities of a business enterprise

In addition to maintaining profitability and growth, business enterprises need to respond to society by positively respecting human rights, ensuring employment, addressing environmental issues, contributing to the local community, complying with regulations, among other issues. As we grow as a public utility with the community we serve, we should contribute to the society at large. Compliance of our business practice with our roles and obligations is another area upon which our business exists. We have been actively implementing actions, including the establishment of the Code of Practice of the Osaka Gas Group in 2000, which clearly states the roles and obligations of all those working in the group. Furthermore, we established a Compliance Committee within the company to further ensure that we meet our responsibilities. The code encompasses all the realms of the company’s activities, and it clearly defines our social responsibilities covered in this report.

Future

Osaka Gas needs to pursue its business goals within an economic environment that poses unprecedented challenges, including the prolonged recession and intensifying competition in the energy market. Osaka Gas intends to remain a leading energy company with a number of defining strengths. We will not only achieve greater profits, but also we will continue to lead others in the fields of environmental and social actions.
Osaka Gas Vision 2010

We contribute to society through our business activities and our activities to improve the environment at our customers’ homes and businesses.

We undertake philanthropic activities mainly in the areas of welfare, regional cooperation, environmental conservation and international exchange.

Information disclosure and legal compliance

Corporate Values

Value for Customers

Value for Shareholders

Value for Society

Gas rates and rate menus
We make efforts to reduce gas rates and to broaden the menu variety.

Service standards
We endeavor to increase our customers’ satisfaction by providing new customer centers with wide regional coverage.

Safety standards
We strive to maintain “zero serious accidents” status at our major facilities and to further improve the safety of our customers’ equipment.

Environmental actions
We contribute to society through our business activities and our activities to improve the environment at our customers’ homes and businesses.

Philanthropic activities
We undertake philanthropic activities in the areas of welfare, regional cooperation, environmental conservation and international exchange.

Information disclosure and legal compliance
We promote information disclosure and legal compliance by improving our internal regulations and our internal awareness-raising activities.

Value for Customers

Value for Shareholders

Value for Society

Ordinary profit
Osaka Gas: Not less than 80 billion yen
Consolidated: Not less than 100 billion yen

Net profit
Osaka Gas: Not less than 48.5 billion yen
Consolidated: Not less than 57.3 billion yen

Return on equity (ROE)
Osaka Gas: Not less than 10.3%
Consolidated: Not less than 10.0%

Return on assets (ROA)
Osaka Gas: Not less than 4.4%
Consolidated: Not less than 4.1%

Free cash flow
Osaka Gas: Not less than 71.0 billion yen
Consolidated: Not less than 85.0 billion yen

The Osaka Gas group is shifting from a conventional energy business that focuses mainly on local gas services to a wide-ranging, diversified business.

We are also working to boost competitiveness and profitability of our non-energy businesses centered around our core companies.

We are undergoing four major management shifts.

1. A shift from a focus on companies in the Kansai region to a broader focus that includes companies outside the region.
2. A shift from management focusing on Osaka Gas to one focusing on our core companies.
3. A shift from a vertically integrated business model for all stages from raw materials procurement to retail sales, to value chain unit business model aimed at improving the competitiveness and profitability of the five business units for natural gas from upstream to downstream.
4. From business focusing on gas to a multiple energy business that includes electricity and LPG.
Furthering Our Environmental and Social Actions

Adoption of Environmental Sustainability Indicators

Environmental principles

Through the supply of natural gas, the most environmentally friendly energy of all fossil fuels, Osaka Gas provides its customers with services that are indispensable for modern and comfortable lifestyles. As a leading energy company, we are fully aware that the activities of Osaka Gas are deeply related to the global environment; namely, the efficient use of energy resources, the control of CO2 emissions and the reduction of environmental impacts caused by our company’s business activities.

Osaka Gas’ Environmental Principles, which were formulated in 1992, clearly state that environmental protection is an important mission for all energy businesses, and that Osaka Gas endeavors to harmonize its business activities with the environment. These principles are the foundation for the three Environmental Action Guidelines that define our environmental actions.

Environmental Action Guidelines

The first guideline calls for our company’s efforts in reducing environmental impacts deriving from Osaka Gas’ business activities throughout its natural gas operations from receiving LNG at terminals to distributing gas to customers.

Secondly, we will work to reduce environmental impacts caused by the company’s products. Through promotion of natural gas and the maximization of its value, Osaka Gas will contribute to environmental protection. We will further contribute to the reduction of environmental impacts from gas equipment and systems to the development of energy-efficient natural gas equipment and systems.

In the third guideline, Osaka Gas has committed itself to broader environmental contributions both at home and abroad. This should be achieved through community activities as well as through R&D and international technology transfer. Some specific examples include environmental technologies such as wastewater treatment and tree-planting operations overseas.

Medium-term environmental targets

In order to enhance the corporate value of Osaka Gas, which we presented in our long-term business vision, ‘Vision 2010,’ we have drawn up the 2010 Environmental Targets for each of the environmental action guidelines.

We conceived these long-term targets by projecting the future of our company in ten years in order to clearly define our long-term objectives. The 2005 Medium-Term Environmental Targets were drawn up in early 2003, and they represent a milestone in our efforts to specifically monitor our achievements over 34 items. For example, we plan to achieve the following: less than 20 grams of CO2 emission per cubic meter of gas sold (20% less than the 1998 level); total soil excavation volume of less than 70,000 tons; zero-emission at LNG terminals and acquisition of ISO 14001 certification throughout the company.

All these visions and targets have been made with our firm belief in making a positive contribution to the environment based on our business strategies. It is also our response to public demands for the implementation of forward-looking environmental actions. We can no longer only remain an environmentally friendly company; we should be a proactive enterprise that expresses our environmental vision.

Environmental Sustainability Indicators

Effective April 2003, we have decided to introduce the Environmental Sustainability Indicators, which figuratively and monetarily quantify the status and results of the company’s environment-related activities. From these indicators, we can assess the effectiveness of our activities. The indicators have been established in the following three areas:

1. efficiency indicator on a relative value of environmental impact generated in our business activities,
2. environmental impact control shown in monetary terms resulting from use of gas equipment and systems marketed by the company, and
3. effectiveness of environmental impact control obtained by dividing the environmental impact control value by the amount of gas sales.

These indicators have been established on the basis of the 2005 Medium-Term Environmental Targets, which state specific action plans. We will continue to improve the indicators for the smooth implementation and the achievement of our goals.

Strengthening our community and social orientation

In addition to the environment, companies are now charged with broader responsibilities in the community and society at large. They can no longer be only concerned with the financial aspects of their businesses. They are also responsible for broader social aspects including human rights, employment, health and safety and community contribution. Osaka Gas has long been aware of these social and community responsibilities and has implemented a number of actions. We have run company-wide employee volunteer programs for over 20 years, and in more recent years, we have maintained educational assistance programs for Indonesian and Malaysian schools through our international cultural exchange foundation.

Another important element of our corporate orientation is compliance of our business activities with our ethical philosophy. Following the establishment of the Osaka Gas Group Code of Conduct for the management and employees in 2000, we launched the Compliance Department as part of the corporate reorganization in April 2003. We have steadily taken actions to pursue compliance within the company through launching of the Compliance Committee. In addition to regulatory compliance we are seeking to achieve greater compliance as a leading gas utility including safety, stable supply and customer service. Some of these activities are described in the report.

In closing

As with stays that hold sails to a ship, environmental actions, community and social activities and compliance are an integral part of our overall operations. Even though these considerations are in a sense restricted to business activities, I believe that they should be positively enforced in Osaka Gas so we continue to be a wholly responsible corporate citizen. We can only gain confidence from the community and society by incorporating these activities into our corporate strategies, which will enable us to make a positive contribution to the achievement of a truly sustainable society.
Environmental conservation at both the local and global levels is an extremely important mission for energy utility companies. Bearing in mind that all of its business activities are closely related to the natural environment, the Osaka Gas Group pursues harmony with the environment and realizes the efficient use of energy and resources through its business operations.

### Environmental Philosophy

Environmental conservation at both the local and global levels is an extremely important mission for energy utility companies. Bearing in mind that all of its business activities are closely related to the natural environment, the Osaka Gas Group pursues harmony with the environment and realizes the efficient use of energy and resources through its business operations.

### Environmental Action Guidelines

1. **Reduction of the Environmental Impacts of Our Business Activities**
   - We aim to reduce the environmental impacts of our business activities. To this end, Osaka Gas will strengthen its environmental management system and promote internal activities aimed at saving energy and resources.

2. **Contribution to Environmental Impact Reduction through Our Products and Services**
   - We aim at environmental conservation through promoting the widespread use of natural gas, and we will make efforts with our customers towards reducing the environmental impacts through our products (natural gas, heat supply and our equipment and systems). To this end, we will strive to develop and implement energy-saving and environmental conservation technologies and to promote recycling of resources.

3. **Contribution to Environmental Improvement Locally, Nationally and Overseas**
   - We aim to take an active part in environmental improvement activities in areas wherever we conduct business, both in and outside Japan.

### Osaka Gas Group Code of Conduct

1. **As a good corporate citizen**
   - Respect for human rights
   - Consideration for the environment

2. **In gas supply activities**
   - Responsibility of a gas company
   - Ensuring safety of products

3. **Business transaction**
   - Compliance with Anti-Monopoly Law
   - Fair trade practice
   - Working with customers
   - Relations with trading partners and other related parties

4. **Information management**
   - Information handling and disclosure
   - Handling intellectual property

5. **In the Workplace**
   - Creating a comfortable work environment
   - Employment and benefits

6. **Social Actions**
   - Countering anti-social groups, prohibiting facilitation and payments
   - Fair tax payment
Introduction of Sustainability Indicators

In 1999, Osaka Gas established the 2010 Environmental Goals as a blueprint for its long-term environmental actions. To achieve these goals in a smooth manner, the 2005 Medium-Term Environmental Goals were established in 2003. Consisting of 34 items, these goals form the basis of the company’s activities over the next three years.

During the year under review, Osaka Gas newly established its Sustainability Indicators, and began monitoring the progress of the Medium-Term Environmental Goals as part of its overall evaluation. These indicators enable assessment of the company’s business performance and the environmental impact of business activities, as well as its overall progress in environmental actions.

Perspectives incorporated in the Sustainability Indicators

1. In order to assess the progress of our environmental actions, we established integrated indicators rather than those for individual incidences of environmental impact.
2. In consideration of our business activities, and the extent of their impact on the environment, we created indicators to cover the following items: CO2 emissions, excavated soil from gas-related construction, industrial waste, NOx emissions and chemical oxygen demand (COD) of wastewater.
3. The indicators are defined by two Environmental Action Guidelines: Guideline 1 shows the extent to which Osaka Gas has reduced the environmental impact of its business activities, while Guideline 2 shows the magnitude to which the company has helped customers reduce the environmental impact of its business activities.
4. We have provided indicators that include target figures for reducing the environmental impact of business activities on a fiscal yearly basis, as well as target figures for meeting the 2005 Medium-Term Environmental Goals.
5. Indicators should be those that can be incorporated into the in-house performance evaluation system.

Sustainability Indicators

For all indicators, larger numerical figures show that Osaka Gas has been effective in undertaking environmental actions and in reducing environmental impacts in business activities.

Indicators for Guideline 1: Reduction of the Environmental Impact of Business Activities

Environmental Sustainability (m³/yen)

This is the value of the amount of gas sold in a given fiscal year compared with the total environmental impact of business activities such as CO2 emissions converted to a monetary value x. Instead of the amount of gas sold, calculations could be based on a variable such as net sales; however, because net sales are influenced by fluctuations in gas prices, the amount of gas sold is a more reliable base for calculation.

\[ \text{x} \]
\[ \text{Monetary value is based on value per ton for each item} \]

Monetary Value of Reducing the Environmental Impact (100 million yen)

This shows the extent of the reduction of environmental impact, including CO2 emissions and industrial waste, expressed in a monetary value, resulting from environmental activities.

\[ \text{Effectiveness of Reducing the Environmental Impact} \]
\[ \text{(yen/thousand m}^3\text{)} \]

This is the monetary value of reducing the environmental impact of business activities divided by the amount of gas sold in that FY.

Figure 1

Figure 2

Figure 3

Utilized for Performance Evaluation System

*1 Monetary value is based on value per ton for each item

*2 Amount of reduction compared to the benchmark year, 1998
Indicators for Guideline 2: Contribution to Environmental Impact Reduction Through Products and Services

Monetary Value of Reducing Environmental Impact of Customers’ Business Activities (100 million yen)

The monetary value of reducing the environmental impact indicates to what extent new, energy-efficient Osaka Gas equipment and systems help customers reduce their CO₂ emissions compared with previous equipment and systems.

Effectiveness in Reducing Environmental Impact of Customers’ Business Activities (yen/thousand m³)

The extent to which customers' business activities reduce their CO₂ emissions compared with previous equipment and systems helps customers.

2005 Target Figures for Sustainability Indicators

2005 Environmental Sustainability Indicators have been established on the basis of the projected reduction of environmental impact volume upon achieving the 2005 Business Plans and the 2005 Medium-Term Environmental Targets. Compared with FY2001 results, these indicators for Guideline 1, environmental impact of business activities. They also call for under Guideline 2 – approximately 1.9 times the monetary value of reducing the environmental impact of customers’ business activities and approximately 1.7 times the effectiveness in reducing the environmental impact of customers’ business activities.

Consideration of the Result of FY2002

Reduction in the final disposing amount of excavated soil and the amount of industrial waste raised the effectiveness of the indicators for Guideline 1, environmental sustainability, monetary value of reducing environmental impact and the effectiveness in reducing environmental impact. (See figures 1, 2 and 3.) Also, for the indexes in Guideline 2, our efforts for widespread use of high-efficiency equipment including co-generation enable favorable developments. (See figures 4 and 5.)

Incorporating Sustainability Indicators into the Performance Evaluation System

Osaka Gas has a Performance Evaluation System for assessing annual business performance in each division within its organization. In FY1999, a new assessment item was added: an indicator for measuring the reduction of the environmental impact of business activities. This item will help us determine whether all employees have achieved their targets for reducing CO₂ emissions from energy consumption (electricity, gas, gasoline for vehicles, etc.) and the amount of paper used for in-house copying.

With the aim of further reductions, in FY2003, Osaka Gas set specific targets for the monetary value of reducing the environmental impact of business activities, under Guideline 1, for each division within the company. In the Pipeline Business Unit, for example, as its goal is to reduce the amount of the final disposed excavated soil, the achievement in that goal is incorporated into its business performance evaluations. Additionally, under Guideline 2, the company set targets for the effectiveness of reducing the CO₂ emissions of our customers through new energy-efficient equipment and systems. The company incorporated these targets into its business performance evaluations.

These indicators now enable Osaka Gas to evaluate reduction of the overall environmental impacts, though we have evaluated the reduction of energy consumption and copy papers consumed. Osaka Gas can evaluate reduction of the environmental impact of its business activities such as NOx emissions and waste generation, and the environmental impact of our products such as CO₂ emissions reduction. The indicators are supposed to be incentives to promote overall environmental activities, which enables us to reduce environmental impacts effectively.

Voice

Prospects for Sustainability Indicators

While a rapidly increasing number of companies are advocating environmentally sustainable management, we are still in the process of developing ways to assess the level of environmentally sustainable management of private enterprises. Environmentally sustainable management is an integral part of business activities, for which we must have accurate indicators.

However, it is not easy to develop sustainability indicators because, unlike other corporate assessment indicators, we need quantitative assessment methods for a wide range of environmental protection activities.

This makes the development of Osaka Gas’ sustainability indicators extremely significant. The creation of these indicators, which convert varying environmental impacts into monetary figures, contributes significantly to progress in the area of environmentally sustainable management. If environmental protection activities can be evaluated in monetary value terms, we can apply these indicators throughout the management of operations of a company.

The goal of environmentally sustainable management is to create environmental benefits, and Osaka Gas’ indicators hold enormous potential for achieving this goal.
Medium-Term Environmental Goals and Results in FY2002

In striving for early achievement of its 2010 Environmental Goals, Osaka Gas has established specific 2005 Medium-Term Environmental Goals for implementation in 2003. Among these medium-term goals, 34 goals, including 24 quantitative goals, have been established in our efforts to promote environmental activities.

### Key Measures | Targets | 2005 Medium-Term Environmental Goals | Achievements During FY2002 | 2010 Environmental Goals
--- | --- | --- | --- | ---

*Formation of environmental consciousness in order to reduce carbon dioxide emission in gas generation* | 2005: Reduce the amount of carbon dioxide emission per cubic meter of gas sold | 2005: 27.5 kg CO₂/m³ (FY1998: 30 kg CO₂/m³) less than 27.5 kg CO₂/m³ (22% reduction) | 2010: 20 kg CO₂/m³ | In our efforts to achieve 20 kg CO₂/m³, the CO₂ emission unit within our business operations should be reduced by 22% as compared with FY1998 (27.5 kg CO₂/m³).

*NOCs emission control* | 2005: Emission rate of NOCs within the company | 2005: 70% (FY1998: introduction rate higher than 50%) | 2010: 60% | NOCs emission control shall be reduced to 57% by FY2010, which is an 81% reduction as compared with FY1998.

*Efforts to promote environmental activities* | 2005:博彩腦 5.4 million (approximately 36%) reduction | 2005: 5.4 million (approximately 36%) reduction | 2010: 4.2 million | 5.4 million reduction (approximately 36%) are expected in FY2010.

*Recycling of gas pipe materials* | 2005: Recycling rate of gas polyethylene pipe | 2005: Recycling rate 100% (internal utilization rate 75%) | 2010: Recycling rate 100% | Recycling rate of gas polyethylene pipe shall be 100% from FY2001.

*Improvement of recycling rate for used gas devices* | 2005: Recycling rate for used gas devices 30% | 2005: Recycling rate 30% (approximately 60% reduction) | 2010: Recycling rate 30% | Recycling rate 30% will be achieved by FY2010, which is a 60% reduction from FY1998.


### Contribution to Environmental Impact Reduction Through Our Products and Services

*Development of gas appliances* | Field of water heaters for household use | 2005: Commercialize large type model with 45% increased generating efficiency as compared with FY1998 (129 partners) | 2010: Commercialize LPG furnace with 45% increased generating efficiency as compared with FY1998 (129 partners) | Commercialize large type model with 45% increased generating efficiency as compared with FY1998.

*Commercialization of highly efficient gas devices* | Commercialize large type model with 45% increased generating efficiency as compared with FY1998 (129 partners) | 2005: Commercialize LPG furnace with 45% increased generating efficiency as compared with FY1998 (129 partners) | 2010: Commercialize LPG furnace with 45% increased generating efficiency as compared with FY1998 (129 partners) | Commercialize large type model with 45% increased generating efficiency as compared with FY1998.

*Recycling of natural gas* | Commercialize large type model with 45% increased generating efficiency as compared with FY1998 (129 partners) | 2005: Commercialize LPG furnace with 45% increased generating efficiency as compared with FY1998 (129 partners) | 2010: Commercialize LPG furnace with 45% increased generating efficiency as compared with FY1998 (129 partners) | Commercialize large type model with 45% increased generating efficiency as compared with FY1998.

*Development of highly efficient gas devices and systems* | Commercialize large type model with 45% increased generating efficiency as compared with FY1998 (129 partners) | 2005: Commercialize LPG furnace with 45% increased generating efficiency as compared with FY1998 (129 partners) | 2010: Commercialize LPG furnace with 45% increased generating efficiency as compared with FY1998 (129 partners) | Commercialize large type model with 45% increased generating efficiency as compared with FY1998.

### Contribution to Environmental Improvement Locally, Nationally and Overseas

*Environmental contribution to local communities* | Promotion of step-by-step measures to improve the environmental condition in communities in which our company operates | 2005: Continued and further environmental activities in communities in which our company operates | 2010: Continued and further environmental activities in communities in which our company operates | Continued and further environmental activities in communities in which our company operates.

*Environmental contribution to local governments* | Promotion of step-by-step measures to improve the environmental condition in communities in which our company operates | 2005: Continued and further environmental activities in communities in which our company operates | 2010: Continued and further environmental activities in communities in which our company operates | Continued and further environmental activities in communities in which our company operates.

*Environmental contribution to local communities* | Promotion of step-by-step measures to improve the environmental condition in communities in which our company operates | 2005: Continued and further environmental activities in communities in which our company operates | 2010: Continued and further environmental activities in communities in which our company operates | Continued and further environmental activities in communities in which our company operates.

*Environmental contribution to local governments* | Promotion of step-by-step measures to improve the environmental condition in communities in which our company operates | 2005: Continued and further environmental activities in communities in which our company operates | 2010: Continued and further environmental activities in communities in which our company operates | Continued and further environmental activities in communities in which our company operates.

*Environmental contribution to local communities* | Promotion of step-by-step measures to improve the environmental condition in communities in which our company operates | 2005: Continued and further environmental activities in communities in which our company operates | 2010: Continued and further environmental activities in communities in which our company operates | Continued and further environmental activities in communities in which our company operates.
Environmental Impacts of Our Gas Operations in FY2002

Global Environmental Conservation and Natural Gas

The demand for energy is increasing with the development of modern society. Despite such development, mass production and consumption increase environmental loads and problems, such as global warming, ozone layer depletion, acid rain and global desertification, all of which are growing in their severity.

Natural gas is a clean fuel with low environmental impacts. The major component of natural gas is methane (CH₄). Methane has a ratio of carbon to hydrogen that is less than other fossil fuels, and from which the emission of carbon dioxide (CO₂) generated in its combustion is the least among fossil fuels.

In addition, natural gas emits less nitrogen oxides (NOₓ) and little sulfur dioxide (SOₓ), which cause acid rain or photochemical smog. Natural gas is imported to Japan in liquefied form, sulfur compounds are removed in the liquefaction process, which is why it emits less SOₓ than other fossil fuels.

The Advisory Committee on Resources and Energy, a consultative arm of the Minister of Economy and Industry, reported on future prospects to 2010 (1986) and released a report on thermal power plant atmospheric impact assessment technology demonstration surveys, March 1990, Energy Engineering Research Center.
Comparison of Greenhouse Gas Emissions Associated with Combustion of Fossil Fuels as Determined by LCA

The table below compares total greenhouse gas emissions, from drilling to combustion, for various fossil fuels as determined by the life cycle assessment (LCA*1) method.

### Comparison of Greenhouse Gas Emissions (g-CO₂/1,000kcal)

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Coal</th>
<th>Oil</th>
<th>LPG</th>
<th>LNG</th>
<th>Gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td>19.18</td>
<td>17.01</td>
<td>21.60</td>
<td>40.77</td>
<td>38.43</td>
</tr>
<tr>
<td>Drilling</td>
<td>3.85</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquefaction</td>
<td>33.55</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manufacturing</td>
<td>1.03</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transportation</td>
<td>7.15</td>
<td>3.30</td>
<td>7.52</td>
<td>7.77</td>
<td>6.01</td>
</tr>
<tr>
<td>Unit at time of fuel combustion</td>
<td>370.59</td>
<td>286.04</td>
<td>250.54</td>
<td>206.76</td>
<td>214.10</td>
</tr>
<tr>
<td>Total</td>
<td>397.40</td>
<td>306.68</td>
<td>280.14</td>
<td>255.81</td>
<td>260.70</td>
</tr>
<tr>
<td>Ratio</td>
<td>152</td>
<td>118</td>
<td>107</td>
<td>98</td>
<td>100</td>
</tr>
</tbody>
</table>

Note: Converted from g-C/Mcal to g-CO₂/Mcal, to based on a report of the institute of Energy Economies, Japan (August/1999)  
*1 LCA (Life Cycle Assessment): A method of survey analysis and evaluation, which is as quantitative and comprehensive as possible, of the amount of resource and waste disposal of products and services  
*2 The figures for gas equipment include all equipment from the overseas production phase to gas pipeline construction

**Properties of City Gas**

**Heat value**  Gross calorific value 45.0MJ/m³N  10,750kcal/m³N

**Physical and Chemical properties**

<table>
<thead>
<tr>
<th>Appearance, etc.</th>
<th>Specific gravity</th>
<th>Combustion range</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.638 (air=1)</td>
<td>5-15 vol%</td>
</tr>
</tbody>
</table>

**Effects on the Human Body**

If the gas is inhaled at high concentrations for an extended period of time, it can have adverse effects on the human body, such as suffocation due to a lack of oxygen supply.

**Ingredients and Composition**

**CO₂ emission coefficient**  50.9g-CO₂/MJ  (2.29kg-CO₂/m³N)

**Note:** As gas composition is variable, the figures indicate a representative case.
Environmental Accounting

Results for FY2002
(Overall conservation benefit estimated at 1.8 billion yen/Internal economic benefit at 5.7 billion yen/Monetary value of the environmental conservation benefit at 1.9 billion yen)

Our FY2002 environmental accounts showed that investments for environmental conservation came to 0.4 billion yen. Environmental conservation expenses were 5.8 billion yen; the internal economic benefit was estimated at 5.7 billion yen; the monetary value of the environmental conservation benefits was 1.9 billion yen; and the net monetary value of these benefits was 1.8 billion yen. The total amount of environmental conservation investments showed a gradual decline due to cutbacks in the installation of co-generation equipment at our business facilities (installation has already been completed at major facilities). On the other hand, since our environmental surveys and measures concerning oil contamination on land owned by Osaka Gas and elsewhere have been advanced, we were able to reduce 0.9 billion yen. Also, we were able to reduce the cost for waste disposal by reducing waste generation, and reusing R&D cost by selecting and concentrating R&D theme. Consequently, overall environmental conservation costs decreased by about 1.2 billion yen in FY2002 compared with the previous year. Internal economic benefits were largely unchanged. Conservation efforts were effective in further reducing expenses, but the overall decline in construction activities resulted in fewer cost savings effect with the reduction and recycling of excavated soil.

Environmental Accounting Calculations
Governing Standards: Osaka Gas prepared environmental accounts according to the Guidelines for Implementing Environmental Accounting in the City Gas Industries, FY2000 edition (published by the Japan Gas Association). Developing an Environmental Accounting System (Year 2000 Report) issued by the Ministry of the Environment formed the basis for these guidelines, which account for the unique characteristics of the city gas industry.
Scope: Osaka Gas Co., Ltd.
Period under review: April 1, 2002-March 31, 2003
Also, since FY2000, in order to attain more precision of our environmental accounting and less loads of our calculating procedures, we have developed and implemented a computer system linked with our financial accounting system.

Item Classification and Content

Environmental Conservation Cost Items
So far as possible, the totals shown include only the amount spent for environmental conservation purposes (using a calculation of differences method).

For items in which the expenses for environmental purposes alone were difficult to assess, we calculated the relative costs using an "environmental ratio," which is established for the purpose of determining the degree of association with environmental actions.
Investments: Calculations include the proportion of fixed assets acquired during the period under review that contribute to environmental improvement.
Expenses: Calculations include depreciation, personnel and other expenses incurred for environmental purposes.

We calculated depreciation expenses for fixed assets acquired after FY1997 (with the exception of previously acquired fixed assets consisting of large-scale equipment at manufacturing plants, etc.) using the legal durable years for equipment. We calculated personnel expenses using standard unit costs.

Environmental Benefit Items
Items include both environmental conservation benefits (quantitative benefits), and the internal economic benefits (cost-saving benefits) achieved as a result of reduced energy consumption, etc.

1. Environmental conservation benefits
Three kinds of environmental conservation benefits were calculated:
• Environmental impact levels (per m³ of gas sold)
• Total environmental impact
• Reduction in environmental impacts

a) Environmental impact reduction in Osaka Gas business operations
• For NOx and COD, we calculated the reduced amounts compared to legal emission levels.
• For CO₂, industrial waste and general waste, we calculated the amount of reduction using FY1998 as the base year. The difference between the base discharge unit (discharge per m³ of gas sold) in the present period and that in the base year was multiplied by the amount of business activity (amount of gas sold) in the present period.

b) Environmental impact reduction on the customer side
This represents the amount of environmental impact reduction for the period under review due to promotion of the use of natural gas and energy-saving systems and devices, using FY1998 as the base year.

2. Internal economic benefits
We calculated cost-saving benefits that could be determined accurately from actual figures from our own operations. We also determined environmental conservation benefits (quantitative benefits) and internal economic benefits from reduced energy consumption, etc. (cost-saving benefits).

Environmental Conservation Cost

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal Efforts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Global Environment</td>
<td>Equipment investment and maintenance, personnel, etc. for energy-saving, etc.</td>
<td>147</td>
<td>42</td>
<td>655</td>
<td>580</td>
</tr>
<tr>
<td>Pollution Prevention</td>
<td>Equipment investment and maintenance, personnel, etc. for prevention of air pollution</td>
<td>4</td>
<td>5</td>
<td>129</td>
<td>117</td>
</tr>
<tr>
<td>Recycling Resources</td>
<td>Equipment investment and maintenance, personnel, etc. for recycled soil reduction and recycling</td>
<td>44</td>
<td>72</td>
<td>340</td>
<td>407</td>
</tr>
<tr>
<td>Environmental Management</td>
<td>Green purchasing, environmental education, EMS construction, etc.</td>
<td>0</td>
<td>0</td>
<td>276</td>
<td>227</td>
</tr>
<tr>
<td>Others</td>
<td>Tree planting at plants, soil surveys and countermeasures, environmental conservation subsidies, etc.</td>
<td>61</td>
<td>1</td>
<td>2,529</td>
<td>1,763</td>
</tr>
<tr>
<td>Environmental Impact Reduction at Customers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental R&amp;D</td>
<td>R&amp;D of environmental impact reduction technologies, environmentally friendly products, etc.</td>
<td>91</td>
<td>156</td>
<td>2,017</td>
<td>1,827</td>
</tr>
<tr>
<td>Recycling of Used Gas Equipment</td>
<td>Recovery and recycling of used gas equipment, container, packages, etc.</td>
<td>0</td>
<td>0</td>
<td>166</td>
<td>154</td>
</tr>
<tr>
<td>Philanthropic Activities</td>
<td>voluntary tree planting, environmental advertising, environmental information disclosure, etc.</td>
<td>3</td>
<td>5</td>
<td>725</td>
<td>633</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>430</td>
<td>395</td>
<td>7,037</td>
<td>5,788</td>
</tr>
</tbody>
</table>

*1 Includes about 2.3 billion yen for soil surveys and measures on land owned by Osaka Gas and elsewhere
*2 Includes about 1.4 billion yen for investment for the Tsuura LNG Terminal Biotope
*3 Includes 645 million yen for depreciation

Environmental Accounting in the City Gas Industries, FY2000 edition (published by the Japan Gas Association). Developing an Environmental Accounting System (Year 2000 Report) issued by the Ministry of the Environment formed the basis for these guidelines, which account for the unique characteristics of the city gas industry.

Scope: Osaka Gas Co., Ltd.
Period under review: April 1, 2002-March 31, 2003
Also, since FY2000, in order to attain more precision of our environmental accounting and less loads of our calculating procedures, we have developed and implemented a computer system linked with our financial accounting system.
Environmental Conservation Benefits

<table>
<thead>
<tr>
<th>Economic Benefits</th>
<th>FY2001</th>
<th>FY2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost reduction effect</td>
<td>Savings through reduction of excavated soil disposal</td>
<td>5,480</td>
</tr>
<tr>
<td></td>
<td>Savings through energy-saving investments</td>
<td>74</td>
</tr>
<tr>
<td></td>
<td>Sales of marketable articles (LNG cryogenic energy)</td>
<td>240</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>5,829</strong></td>
<td><strong>5,566</strong></td>
</tr>
</tbody>
</table>

Notes:
- From FY2002, the cost reduction effect was accounted for compared to the previous fiscal year (by FY2001, it was accounted for compared to FY1999).

Environmental Conservation Benefits

<table>
<thead>
<tr>
<th>Item</th>
<th>Contents</th>
<th>Level of environmental impact</th>
<th>Total environmental impact</th>
<th>Reductions in environmental impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osaka Gas</td>
<td>NOx (LNG Terminals)</td>
<td>mg/m³</td>
<td>1.5</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>CODX LNG Terminals</td>
<td>mg/m³</td>
<td>0.19</td>
<td>0.34</td>
</tr>
<tr>
<td></td>
<td>CO₂ (LNG Terminals)</td>
<td>g-CO₂/m³</td>
<td>13.92</td>
<td>13.26</td>
</tr>
<tr>
<td></td>
<td>CO₂ Other sites</td>
<td>g-CO₂/m³</td>
<td>7.25</td>
<td>6.81</td>
</tr>
<tr>
<td></td>
<td>Final disposal of excavated soil</td>
<td>t/km</td>
<td>99</td>
<td>89</td>
</tr>
<tr>
<td></td>
<td>Disposal of industrial waste</td>
<td>g/m³</td>
<td>0.66</td>
<td>0.36</td>
</tr>
<tr>
<td></td>
<td>Disposal of general waste</td>
<td>g/m³</td>
<td>0.11</td>
<td>0.09</td>
</tr>
<tr>
<td>Customers</td>
<td>CO₂ emission reduction</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Gas equipment recovery rate</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

Note: The amount of gas sold in FY2002 was 7,530 million m³ (7,309 m³ in FY2001). The total length of new gas pipelines installed was 990 km (813 km in FY2001).

Calculating the Monetary Value of Environmental Conservation Benefits (Social Benefits)

In FY2001, we began evaluating the monetary value of the social benefits accruing from the reductions in total environmental impacts achieved by our environmental conservation activities.

We calculated the monetary value of reductions in total excavated soil final disposal using a unit value of 22.128 yen per ton determined by the Contingent Valuation Method (CVM). In the CVM, we calculate the value of environmental conservation activities by surveying residents about how much they would be willing to pay for certain environmental protection benefits.

With regard to the calculation of the monetary value of environmental impact items other than excavated soil disposal, we determined external benefits by reviewing data on environmental damage costs both in Japan and abroad, and by evaluating case studies involving valuation of the natural environment. We then used relevant data to estimate the monetary value of the social benefits derived from our efforts to reduce the environmental impacts of our business activities. The combined total value of these benefits came to 1.9 billion yen in the period under review (about the same as in the year earlier).

Future Efforts

As part of our efforts to promote environmentally sustainable management, we will continue to look for ways to apply the results of our environmental accounts to improve environmental management. We plan to work toward implementing a consolidated environmental accounting system that includes Osaka Gas along with its subsidiaries and affiliates.

Measures to reduce greenhouse gases produce benefits valued at approximately 60 million yen

<table>
<thead>
<tr>
<th>Net Environmental Benefits</th>
<th>FY2001</th>
<th>FY2002</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Net Environmental Benefits</strong></td>
<td><strong>52</strong></td>
<td><strong>64</strong></td>
</tr>
<tr>
<td><strong>Net Environmental Benefits</strong></td>
<td><strong>98</strong></td>
<td><strong>131</strong></td>
</tr>
<tr>
<td><strong>Internal Economic Effects</strong></td>
<td><strong>109</strong></td>
<td><strong>179</strong></td>
</tr>
<tr>
<td><strong>Environmental Expenses</strong></td>
<td><strong>259</strong></td>
<td><strong>246</strong></td>
</tr>
</tbody>
</table>

Notes:
- CO₂: Cumulative total: Co-generation facility, Boiler facility, Natural gas vehicles (Not include personnel cost)
Environmental Management Improvement

Osaka Gas Environmental Action Promotion System

Under the leadership of the Committee on Energy and the Global Environment headed by the Executive Vice President, the Osaka Gas plans, implements and follows up on environmental action measures based on our basic environmental philosophy and Environmental Action Guidelines.

Scheme of the PDCA Cycle in the Company-wide Environmental Management System

Action
- Review by the Committee
- Incorporation in the program and goals

Plan
- Formulation of action programs
- Establishment of goals

Check
- Follow-up activities and results
- Incorporation in the performance evaluation system

Do
- Implementation of environmental activities
- Summary of results
States of Acquiring ISO 14001 Certification and Future Planning

ISO 14001 is an international Environmental Management System (EMS) standard that aims to improve environmental performance by providing environmental management system procedures (applying the Plan-Do-Check-Act [PDCA] cycle), and complies strictly with legal regulations.

The status of acquiring ISO 14001 certification within Osaka Gas is shown in the accompanying figure.

The results show that 38% of 7,946 Osaka Gas employees now work at sites that have acquired ISO 14001 certification.

Future Planning

Osaka Gas is working hard to have all sites acquire ISO 14001 certification by 2005. In 2003 major organizational reforms were implemented. The work of the sales/marketing divisions and the pipeline divisions, which was formerly divided into a number of regional units, is now operated independently in each business unit.

Furthermore, the Environmental Management System (EMS) of the Osaka Business Headquarters gained ISO 14001 certification in FY2001. Using this as a model, EMS will be developed for each of the other regional Sales and Pipeline Departments that have not yet acquired ISO 14001 certification, and ISO 14001 certification will then be obtained on a Department by Department basis.

Current EMS

- Head Office Building
- Production Department
- Engineering Department (Construction Sector)
- Research and Development Dept.
- Transmission Department + Osaka Business Headquarter (Pipeline Department)
- Osaka Business Headquarters (Residential Sales Dept.)
- Osaka Business Headquarters (Market Development Dept.)

Restructuring EMS

- Head Office Building (dismemberment)
- LNG Terminal and Power Generation Business Unit (nominal change)
- Energy Technology Laboratories (enlarged)
- Pipeline Business Unit
- Residential Energy Business Unit
- Commercial & Industrial Business Unit

Results of Environmental Auditing

As described above, we are working towards acquiring ISO 14001 certification across the entire company. In areas that have not acquired ISO 14001 certification, we are undertaking Eco-checks to evaluate their environmental activities and enable them to steadily improve the environment.

The Osaka Business Headquarters that obtained ISO 14001 certification in FY2002. For 4 other regional Business Headquarters that are not yet certified, Eco-checks were conducted at these sites in March 2003 to evaluate their compliance with basic environmental regulations.

The Eco-checks consisted of the evaluation of 41 items covering the appropriate handling of general waste (34 items), polychlorinated biphenyl (PCB), storage (one item) and recovery of ozone-depleting chemicals (fluorocarbons; six items).

Results of the Eco-checks confirmed that all Regional Business Headquarters completely complied with environmental regulations for all items surveyed.

The Environmental Department exchanged information with the Regional Headquarters about the status of environmental laws and possible future revisions in compliance standards.

Examples of Items in the Eco-Check Program

<table>
<thead>
<tr>
<th>Category</th>
<th>Items</th>
<th>Description</th>
<th>Number of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluation of status of waste treatment</td>
<td>General Waste</td>
<td>Legal compliance by contractors and in contract agreements</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Industrial Waste</td>
<td>Legal compliance by contractors and in contract agreements</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Manifest System for proper disposal of waste</td>
<td>Legal compliance in waste manifest description and storage</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Response to the Home Appliance Recycling Law</td>
<td>Legal compliance at disposal</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Response to the Construction Material Recycling Law</td>
<td>Legal compliance by-outsourcers and contractors</td>
<td>14</td>
</tr>
<tr>
<td>Evaluation of status of hazardous material</td>
<td>Response to the PRTR Law</td>
<td>Legal status of storage</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Response to the Cholorofluorocarbon Recovery Law</td>
<td>Legal compliance at disposal</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>41</td>
</tr>
</tbody>
</table>
Environmental Management Improvement

Environmental Management System (EMS) Activities Based on ISO 14001

**Production Department (Acquired in October 1997)**

**Activity Features**  
The three Production Department’s sites (Senboku 1 and 2 LNG Terminals and Himeji Terminal) acquired ISO 14001 certification as one site. Each plant is committed to EMS activities, which involve affiliates and cooperating companies based within the plants.

**Future Efforts**  
In recent organizational restructuring, the LNG Terminal and Power Generation Business Unit took over the ISO 14001 certification acquired by the Production Department in April 2003.

**Environmental Policies and Objectives (examples)**

<table>
<thead>
<tr>
<th>Policy</th>
<th>Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reducing gas emissions that may impact the environment</td>
<td>Reducing emissions of methane, CFCs, HFCs and NOx</td>
</tr>
<tr>
<td>Generating energy using cryogenic power, and improving energy efficiency</td>
<td>Promoting efficient use of electricity and fuels, and increasing use of LNG cryogenic power</td>
</tr>
<tr>
<td>Promoting resource conservation primarily through waste reduction</td>
<td>Strengthening waste management and reducing waste volume</td>
</tr>
<tr>
<td>Contributing to local environmental conservation</td>
<td>Disclosing environmental information and implementing local environment conservation activities</td>
</tr>
</tbody>
</table>

**Transmission Department (Acquired in June 2001)**

**Activity Features**  
Of the Osaka Gas pipeline divisions, the Transmission Department was the first to acquire ISO 14001 certification. As the Department covers a large area, it has to follow a number of local environmental regulations, therefore, it thoroughly examines construction work conducted in multiple administrative areas.

**Future Efforts**  
In recent organizational restructuring, the Pipeline Business Unit took over the ISO 14001 certification acquired by the Transmission Department in April 2003.

**Environmental Policies and Objectives (examples)**

<table>
<thead>
<tr>
<th>Policy</th>
<th>Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controlling generation of excavated soil and other construction byproducts, and promoting their recycling</td>
<td>Improving excavated soil recycling rate</td>
</tr>
<tr>
<td>Promoting energy and resource conservation at facilities and offices, and reducing vehicle fuel consumption</td>
<td>Promoting energy conservation at facilities and offices, and reducing vehicle fuel consumption</td>
</tr>
<tr>
<td>Reducing greenhouse gas emissions</td>
<td>Reducing CO2 emissions</td>
</tr>
<tr>
<td>Controlling waste generation</td>
<td>Reducing general waste and use of copy paper</td>
</tr>
<tr>
<td>Promoting compliance with environmental laws/transactions</td>
<td>Observing environmental laws and ordinances</td>
</tr>
</tbody>
</table>

**Head Office Building (Acquired in September 2001)**

**Activity Features**  
The Head Office promotes environmental activities common to all in-house organizations (office activities), such as reduction of paper consumption and trash generation, as well as energy conservation and specific activities relevant to individual organizations (staff activities).

**Future Efforts**  
To further promote energy conservation and reduction of CO2 emissions, the Head Office will take various measures, including the improvement of facilities. The Head Office will also strengthen specific activities relevant to individual organizations (staff activities), requesting each individual section to implement at least one environmental program.

**Osaka Business Headquarters (Acquired in March 2002)**

**Activity Features**  
Of the five Osaka Gas’ regional business headquarters, the Osaka Business Headquarters was the first to acquire ISO 14001 certification. The Osaka Business Headquarters has incorporated various activities related to its main services, including energy conservation and recycling campaigns at our customers’ facilities, in the EMS. The Headquarters is particularly focused on natural gas sales, led mainly by the Sales Department, with the view that promoting natural gas will benefit the environment.

**Future Efforts**  
Osaka Gas plans to acquire ISO 14001 certification across the company, based on the actions of the Osaka Business Headquarters. Practical initiatives are described in the table on the right.

**Environmental Policies and Objectives (examples)**

<table>
<thead>
<tr>
<th>Policy</th>
<th>Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promoting energy conservation and reducing greenhouse gas emissions</td>
<td>Reducing CO2 emissions</td>
</tr>
<tr>
<td>Strengthening resource conservation initiatives, reducing waste and promoting recycling</td>
<td>Maintaining the present recycling rate of general waste</td>
</tr>
<tr>
<td>Promoting green purchasing</td>
<td>Introducing uniforms made from eco-friendly fabrics</td>
</tr>
<tr>
<td>Raising employee awareness</td>
<td>Reinforcing environmental education</td>
</tr>
</tbody>
</table>

**R&D Department (Kyoto Office) (Acquired in July 2002)**

**Activity Features**  
The Kyoto Office, located in the Energy Technology Laboratories in Kyoto Research Park, is committed to research and development in such domains as information and communications, energy, environmental preservation and food. Most of the research is related to the environment. The Kyoto Office handles various kinds of chemicals in limited volumes.

**Future Efforts**  
The Kyoto Office EMS will be expanded to Torishima Office, which serves as an energy technology research hub. After the expansion, the new system will be inspected in December 2003.
Environmental Education and Awareness-Raising Activities for Employees

In order to raise employees' environmental awareness and promote in-house environmental activities, Osaka Gas organizes various kinds of environmental education programs and awareness-raising activities. For example, environmental education programs targeting all employees are arranged at least once a year at our plants and offices that have acquired ISO 14001 certification.

In addition, environmental education targeting employees of specific levels is provided within the framework of the skill-development system of the Personnel Department, so as to raise employees' awareness about environmental conservation.

● Environmental education for employees

Curriculums of Environmental Education

In the personnel system of the Personnel Department, as shown in the right table, step-by-step environmental education programs are provided for new recruits and managing officers appointed to new positions (captains, chiefs and managers).

These programs comprise lectures on global environmental problems, the Osaka Gas Environmental Action Guidelines and environmental management systems, along with Osaka Gas’s commitment to ISO 14001 certification and achieved results. The curriculums also include recent trends concerning various business approaches to environmental management. These educational programs are designed to enhance environmental awareness of employees, who are involved in the energy business.

● Environmental Awareness-Raising Activities

Environmental Symposium

Since June is specified as Environmental Month in Japan, on June 11, 2002, Osaka Gas held an environmental symposium entitled “Environmental Problems and Eco-Friendly Lifestyles at Home and Office” in the Head Office Building.

Following the keynote lecture on the theme “Global Environmental Problems and Japan’s Energy Policy” by Director Hidetoshi Nakagami of the Jukankyo Research Institute Inc., the four panelists, including Director Nakagami, discussed initiatives that should be taken at home and at the office to prevent global warming. The panel discussion was coordinated by Director Jun Adachi of the Osaka Gas Research Institute for Culture, Energy and Life (CEL).

Environmental Action Case Study Report Meeting

As an in-house environmental awareness-raising program, Osaka Gas held the “Fourth Osaka Gas Environmental Action Case Study Report Meeting” in the Head Office on November 27, 2002.

Following the keynote lecture on “Eco-Friendly House Remodeling and Energy Consumption” by Mr. Keisuke Hama, chief researcher of CEL, presentations were provided regarding three case studies by the Sales Department, the Production Department and the R&D Department.

Internal Awards for Environmental Activities

Since 1993, Osaka Gas has commended organizations and employees who made significant contributions to local and global environmental conservation. In 2002, President's awards for Environmental Activities were offered on October 19 to the following organizations.

President's Awards

<table>
<thead>
<tr>
<th>Classification</th>
<th>Title</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business activities</td>
<td>Development of biogas-natural gas fueled engines</td>
<td>Hokuto Business Headquarters</td>
</tr>
<tr>
<td>Business activities</td>
<td>Contribution to environmental improvement through the introduction of CNG forklifts to Takara Shuzo Co., Ltd.</td>
<td>Keiji Business Headquarters</td>
</tr>
<tr>
<td>Business activities</td>
<td>Activities to obtain ISO14001 certification</td>
<td>Osaka Business Headquarters</td>
</tr>
<tr>
<td>Business activities</td>
<td>Activities to obtain ISO14001 certification</td>
<td>Transmission Dept.</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>Effects of environmental conservation activities on CO2 control, analyzed by life-cycle assessment (LCA) method</td>
<td>R&amp;D Dept.</td>
</tr>
</tbody>
</table>

In-house Environmental Information Sharing

To raise the environmental awareness of individual employees and inspire them to act for protecting the environment, Osaka Gas provides environmental information through such means as the Intranet, in-house newsletters and video news.

Intranet

Environment-related ordinances of municipalities within Osaka Gas service area, details of legal amendments, other environment-related topics and in-house events related to environmental preservation.

In-house newsletters and video news

Environment-related topics, including the development of “Everyone's Environmental Effort Campaign”.

Relevant conferences held within and outside Osaka Gas

Trends in environmental issues, details of environmental legal amendments, in-house data on environmental impact, etc.
Environmental Actions

Reduction of the Environmental Impacts of Our Business Activities

Because we realize the extent to which our business activities can impact the environment, one of our most important tasks is keeping this impact to the absolute minimum by working towards concrete environmental protection goals.

Our LNG terminals and offices do everything they can to minimize environmental impact, and to reduce energy and resource use through efforts that include generating less soil during pipeline construction and reusing as much of this soil as possible.
1. **Emission Control of Greenhouse Gases and Nitrogen Oxides (NOx)**

**Key Points and Future Directions**

In FY2002, although the amount of gas sold has increased by 2.8% (year-on-year), our CO₂ emissions have decreased by 2.6% from about 155,000 tons to about 151,000 tons. These figures show that the ratio of CO₂ emission to the amount of gas sold has decreased by 5.2% over the previous year to 20.07 g-CO₂/m³. As a consequence, the ratio of CO₂ emission to gas sales has progressed steadily towards the final target for our 2005 fiscal year. We have integrated this reduction target into our evaluation standards for annual results, and it represents a part of our integrated corporate effort.

From now on, we will aim at further reduction of CO₂ emissions to achieve these 2005 Medium-Term Environmental Goals as early as possible by improving management and thinking innovatively in each section.

---

**CO₂ Emissions Reduction**

**C₀₂ Emissions from Osaka Gas**

<table>
<thead>
<tr>
<th>Year</th>
<th>CO₂ Emissions (1,000 t-CO₂/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>'98</td>
<td>165</td>
</tr>
<tr>
<td>'99</td>
<td>163</td>
</tr>
<tr>
<td>'00</td>
<td>155</td>
</tr>
<tr>
<td>'01</td>
<td>151</td>
</tr>
<tr>
<td>'02</td>
<td>163</td>
</tr>
</tbody>
</table>

**C₀₂ Emissions from LNG Terminals**

<table>
<thead>
<tr>
<th>Year</th>
<th>CO₂ Emissions (1,000 t-CO₂/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>'98</td>
<td>127</td>
</tr>
<tr>
<td>'99</td>
<td>13.6</td>
</tr>
<tr>
<td>'00</td>
<td>13.6</td>
</tr>
<tr>
<td>'01</td>
<td>13.6</td>
</tr>
<tr>
<td>'02</td>
<td>13.6</td>
</tr>
</tbody>
</table>

**C₀₂ Emissions from Other Sites**

<table>
<thead>
<tr>
<th>Year</th>
<th>CO₂ Emissions (1,000 t-CO₂/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>'98</td>
<td>4</td>
</tr>
<tr>
<td>'99</td>
<td>5</td>
</tr>
<tr>
<td>'00</td>
<td>5</td>
</tr>
<tr>
<td>'01</td>
<td>4</td>
</tr>
<tr>
<td>'02</td>
<td>3</td>
</tr>
</tbody>
</table>

**Five-year Transition in CO₂ Emissions**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Purchased electricity consumption</td>
<td>Terminals (1,000 kWh)</td>
<td>114,212</td>
<td>115,635</td>
<td>117,694</td>
<td>110,184</td>
<td>109,397</td>
</tr>
<tr>
<td>Other sites (1,000 kWh)</td>
<td>48,182</td>
<td>45,544</td>
<td>44,188</td>
<td>43,081</td>
<td>39,408</td>
<td>81.8%</td>
</tr>
<tr>
<td>Total (1,000 kWh)</td>
<td>162,394</td>
<td>161,179</td>
<td>161,882</td>
<td>153,265</td>
<td>148,805</td>
<td>91.6%</td>
</tr>
<tr>
<td>Gas consumption</td>
<td>Terminals (1,000 m³)</td>
<td>11,053</td>
<td>11,134</td>
<td>11,481</td>
<td>11,632</td>
<td>10,216</td>
</tr>
<tr>
<td>Other sites (1,000 m³)</td>
<td>10,538</td>
<td>9,010</td>
<td>9,345</td>
<td>8,327</td>
<td>8,468</td>
<td>80.4%</td>
</tr>
<tr>
<td>Total (1,000 m³)</td>
<td>21,590</td>
<td>20,144</td>
<td>20,826</td>
<td>19,959</td>
<td>18,684</td>
<td>86.5%</td>
</tr>
<tr>
<td>Vehicle fuel consumption</td>
<td>Gasoline (1,000 liters)</td>
<td>1,794</td>
<td>1,701</td>
<td>1,645</td>
<td>1,526</td>
<td>1,366</td>
</tr>
<tr>
<td>Light oil (1,000 liters)</td>
<td>25</td>
<td>38</td>
<td>18</td>
<td>18</td>
<td>24</td>
<td>96.0%</td>
</tr>
<tr>
<td>Natural gas (1,000 m³)</td>
<td>158</td>
<td>248</td>
<td>288</td>
<td>334</td>
<td>350</td>
<td>221.5%</td>
</tr>
</tbody>
</table>

**CO₂ emissions**

- **Terminals (t-CO₂)**: 103,156 (68,816), 106,196 (71,428), 106,476 (71,089), 101,772 (68,644), 99,598 (63,497), 96.6% (82.3%)
- **Other sites (t-CO₂)**: 61,896 (47,409), 56,353 (42,839), 56,369 (43,083), 53,022 (40,069), 51,168 (36,163), 82.7% (80.5%)
- **Total (t-CO₂)**: 165,052 (116,226), 162,748 (114,287), 162,845 (114,172), 154,794 (108,713), 150,766 (101,660), 91.3% (87.5%)

**Gas sold (million m³)**: 6,603, 7,160, 7,407, 7,309, 7,513, 113.8%

**CO₂ emissions per unit of gas sold**

- **Terminals (g-CO₂/m³)**: 15.62, 14.83, 14.38, 13.92, 13.26, 84.9%
- **Other sites (g-CO₂/m³)**: 9.37, 7.90, 7.61, 7.25, 6.81, 72.7%
- **Total (g-CO₂/m³)**: 25.00, 22.73, 21.99, 21.18, 20.07, 80.3%

---

1. Before FY2001, CO₂ emissions associated with purchased electricity were calculated using the supply site CO₂ emission coefficient (0.6747 kg-CO₂/kWh), which was calculated by the average thermal power coefficient for 71% of the Federation of Electric Power Companies of Japan and the integrated loss factor from supply to demand. For details, see page 24. Figures in parentheses, provided as references, were calculated using the supply site CO₂ emission coefficient (0.374 kg-CO₂/kWh) calculated similarly by the average coefficient for all power sources.
2. For FY2002, we used the average coefficient for thermal power generation (0.09 kg-CO₂/kWh) from the Interim Report by the Research Working Group of Ministry of Environment for the Protocol of Attaining Targets in the Medium-Term Environmental Goals of the Central Environmental Council issued in July 2001. For details, see page 24.
3. The values calculated by use of the average coefficient for all types of electric sources (0.34 kg-CO₂/kWh) are shown in parentheses.

**Environmental Actions**

- For FY2002, we used the average coefficient for thermal power generation (0.09 kg-CO₂/kWh) from the Interim Report by the Research Working Group of Ministry of Environment for the Protocol of Attaining Targets in the Medium-Term Environmental Goals of the Central Environmental Council issued in July 2001. For details, see page 24.

---

**Highlight**

- The major reduction in carbon dioxide emissions from 1990 to 1998 is explained by the elimination of coke furnaces associated with the introduction of natural gas as raw material.

---

**Environmental and Social Action Report 2003**
Measures at LNG Terminals – CO₂ Emissions Reductions

Between 1975 and 1990, Osaka Gas implemented a major corporate initiative of converting manufactured gas made from coal and oil to natural gas. Consequently, we have drastically reduced the environmental impacts of our operations by consuming less energy and emitting fewer environmentally damaging substances. We have focused on conserving energy through purchasing less power from suppliers and consuming less fuel gas. In FY2002, we achieved a 15.1% reduction in CO₂ emission per m³ of gas sold at all plants compared to FY1998.

In July 2002, we introduced a natural-gas-fired generating system at our Senboku 1 Terminal. This combined cycle generator utilizes gas and steam turbines, and it has a generation efficiency of 44%, which produces 30% fewer CO₂ emissions compared with purchased power from the utility.

Reducing the Purchase of Power

Osaka Gas is reducing the purchase of power by using various types of energy generated in the process of LNG regasification. As of March 2003, the total capacity of power generation by use of LNG cryogenic energy and gas pressure at Osaka Gas plants reached 14 MW.

1. Cryogenic Power Generation

LNG, a liquid with an ultra-low temperature of -160°C, absorbs heat in its surrounding area when it evaporates, which can be used to generate electricity. Osaka Gas utilizes cryogenic energy generated in the process of LNG regasification to compress and expand refrigerants, which can be used to drive turbines and generate power.

Examples

1. Cryogenic Power Generation

LNG expands by up to 600 times its volume in the regasification process. Osaka Gas utilizes this energy to drive turbines for power generation. Also expansion energy at the time of pressure reduction is used for power generation prior to gas sent out to pipelines. We presently operate two expansion turbines to carry out these two functions.

LNG Cryogenic Power Generation Systems (Including Expansion Turbines)

2. Gas Pressure Power Generation Using Expansion Turbines

LNG cryogenic power from LNG as a refrigerant can be used to drive turbines and generate power.

Reducing Gas Consumption

Osaka Gas is also working to reduce its internal gas consumption. In FY2002, all our plants consumed 10,216,000 m³ of natural gas, which was 7.6% lower compared to FY1998.

Example

Using Sea Water to Reduce the Environmental Impacts of the Caloric Adjustment Boiler

After vaporization of LNG, we add a small amount of LPG to regasified natural gas to adjust the caloric value. Osaka Gas’ new vaporization technology using sea water is helping to reduce the amount of gas used, which is more efficient than the previous method of evaporating LPG by using steam generated in a boiler as a heating source.

Using LNG Cryogenic Power

As mentioned above, Osaka Gas is utilizing previously unused LNG cryogenic power for cryogenic power generation, gas pressure generation (using expansion turbines) and BOG reliquefaction. These methods currently account for approximately 80% of the total cryogenic power used within Osaka Gas. The amount of LNG utilizing cryogenic power during FY2002 was approximately 4.19 million tons, which accounts for approximately 53% of the LNG handled.

We are also saving energy by using the cryogenic power from LNG as a refrigerant in the manufacturing process of liquid nitrogen and liquid oxygen.

3. Reliquefaction of BOG (Boil-off Gas) Using Cryogenic Power

A portion of the LNG stored in a tank at the terminal evaporates to become boil-off gas (BOG). Formerly, we used this BOG for distribution, after raising its pressure with a compressor. However, the cryogenic temperature of LNG can be utilized to reliquefy BOG, thus reducing power consumption for compression. The Senboku Terminal has been using this BOG reliquefaction system since 1996 to reduce its power consumption.

Use of LNG Cryogenic Power

<table>
<thead>
<tr>
<th>Year</th>
<th>Cryogenic Power Generation</th>
<th>Air Separation</th>
<th>BOG Re-liquefaction</th>
<th>Liquefied Carbon Dioxide</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>'98</td>
<td>4,007</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>'99</td>
<td>4,101</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>'00</td>
<td>4,592</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>'01</td>
<td>4,600</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>'02</td>
<td>4,191</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Reason for Reduction in Cryogenic Power

Osaka Gas has installed cryogenic power generators on certain sections of their LNG handling and regasification lines. We used less cryogenic power in FY2002 because of demand fluctuations. Accordingly, the LNG used in these generators, and then cryogenic power generation, fell. We are currently planning to revamp our lines to make adjustments for this.
Measures Other than LNG Terminals – CO2 Emissions Reductions

Osaka Gas also works to reduce the amount of CO2 emissions from offices and other sites besides LNG terminals. In each office and site, we are making concerted efforts to reduce power and gas consumption. The following examples illustrate our efforts:

1. Improve and upgrade air conditioning and other equipment to reduce the amounts of electricity and gas consumed;
2. Remove unnecessary lighting and turn off lights during lunch, at night and at other times when they are not needed;
3. Turn off air conditioning during lunch breaks; keep air conditioning off for longer periods of the year; and keep the air conditioner/heater below or above a certain temperature (28˚C in summer and 18-20˚C in winter) to reduce the amount of gas consumed;
4. Use public transportation to reduce the number of company cars and the amount of gasoline used, and encourage employees not to idle their cars when stationary and to drive at fuel-efficient speeds.

The above efforts resulted in a 3.5% reduction in CO2 emissions from FY2001 to FY2002. The figure below shows that this represents a 17.3% reduction from FY1998.

Calculation of CO2 Emission from Purchased Power

The following formula is used to calculate CO2 emissions resulting from purchased power.

\[
\text{CO2 emissions from the use of electrical power (kg-CO2/year)} = \frac{\text{Purchased electric power (kWh/year)}}{\text{CO2 emission coefficient of electricity (kg-CO2/kWh)}}
\]

The CO2 emission coefficient of electricity is the amount of CO2 emitted at a power plant per unit of energy that the plant generates, for example, 1 kWh. This coefficient is often stated as the average value for all types of electric sources, such as thermal power generation; hydroelectric power generation and nuclear power generation (the average coefficient for all types of electric sources). However, this value can be used to maintain an inventory, and it also can be used to calculate the amount of CO2 emissions when electricity is used. It is not necessarily appropriate for evaluating the effect of measures against global warming. To evaluate the effect, it is necessary to use a coefficient for an electric source whose amount of power generation is affected by the measures. This electricity source is determined to be thermal power generation for the following reasons:

1. Nuclear power generation is used to its maximum capacity, and, except for during regular inspections, plants consistently operate at constant power.
2. Hydroelectric power generation is also used to its maximum capacity, and annual power production is mainly dependent on the amount of rainfall.
3. The government estimates that there will be no major changes in the amount of nuclear and hydroelectric power produced because of energy conservation issues and/or new energy sources, even if measures for global warming are taken.

Considering the above factors, we believe that it is appropriate to use the thermal power generation coefficient in evaluating the effects of measures taken for global warming. To evaluate the amount of CO2 emissions through power generation by using the average coefficient of all types of power generation means to reduce all types of power generated at the same ratio. This will not reflect actual power generation, and it will underestimate the actual effects of controlling emissions by about half.

Because of the importance of correctly evaluating the effect of our emission-reduction measures, we chose to utilize the thermal power generation coefficient stated below to calculate CO2 emission figures that we will use to help reduce CO2 emissions. This report, therefore, shows the figures using this calculation. (Note that the annual emission values in this report include CO2 emission calculated using the average coefficient of all types of power generation. This is a reference to help manage inventory.)

Coefficient Used in This Report

Coefficient used for evaluating measures:
- Thermal power generation coefficient
  - Before FY2001: 0.674kg-CO2/kWh
  - FY2002: 0.69kg-CO2/kWh

Coefficient for inventory efficiency of electricity use:
- Average coefficient of all types of power generation
  - Before FY2001: 0.374kg-CO2/kWh
  - FY2002: 0.36kg-CO2/kWh

Reduction of the Environmental Impacts of Our Business Activities
1. Emission Control of Greenhouse Gases and Nitrogen Oxides (NOx)

Reducing NOx and Greenhouse Gases Other Than CO2

Measures at LNG Terminals

Reducing Greenhouse Gases Other Than CO2

Methane (CH₄)
Osaka Gas emits methane (CH₄), the most among the greenhouse gases other than CO₂, which is emitted in the process of analyzing gas composition. Therefore, Osaka Gas is working on efforts to control CH₄ emissions.

As a part of our ISO 14001-related activities, we undertook the following:

1. To recover CH₄ emitted from specific gravity meters, calorimeters and laboratory analyses, which are used for analyzing the components and properties of gas, and then store it in low-pressure pipes,
2. To replace calorimeters from which CH₄ cannot be recovered with ultra-sound-type and other calorimeters that do not emit CH₄.

These efforts resulted in CH₄ emissions falling from 98 tons in FY1999 to 67 tons in FY2002.

Gases other than CH₄
Osaka Gas uses 2.6 tons of SF₆ as insulation gas in the switches of electrical equipment at LNG terminals. There is no danger of this SF₆ leaking because it is hermetically sealed.

We do not store PFC and we hardly emit HFC and N₂O. We store an extremely small amount of hydrochlorofluorocarbon (HCFC), which influences the ozone layer (For the emission amount, see page 33).

Reducing NOx Emissions
Our LNG terminals’ NOx emissions per m³ of gas sold is decreasing every year because of the efficient operation of combustion facilities.

Natural gas vehicles (NGVs), which utilize burning natural gas as fuel, emit almost no suspended particulate matter (SPM) or acid-rain-causing sulfur oxides (SOx). NGVs can also keep NOx and CO₂ emissions lower than gasoline or diesel vehicles.

Osaka Gas is gradually replacing its former vehicles with NGVs. The introduction of 71 NGVs in FY2002 brings the total to 939, accounting for 37.6% of all Osaka Gas vehicles as of March 2003.

Introduction of NGVs at Osaka Gas

Introduction of NGVs at Osaka Gas

<table>
<thead>
<tr>
<th>Year (FY)</th>
<th>Total number of NGVs</th>
<th>Ratio of NGVs</th>
</tr>
</thead>
<tbody>
<tr>
<td>'98</td>
<td>562</td>
<td>19.4</td>
</tr>
<tr>
<td>'99</td>
<td>660</td>
<td>23.6</td>
</tr>
<tr>
<td>'00</td>
<td>788</td>
<td>29.2</td>
</tr>
<tr>
<td>'01</td>
<td>885</td>
<td>34.0</td>
</tr>
<tr>
<td>'02</td>
<td>939</td>
<td>37.6</td>
</tr>
</tbody>
</table>

NOx Reduction
Compared as a total vehicle weight of 1.5 tons

CO₂ Reduction
Compared as a total vehicle weight of 1.5 tons

Source: Extracted from Proposals for Mass-Diffusion of Low-Pollution Vehicles (1994) by the Environmental information Center
*1 Calculated with the Thermal Power Generation Source Unit for the Metropolitan Areas
*2 CNG means Compressed Natural Gas

Reduction of the Environmental Impacts of Our Business Activities

2. Reduction of Resource Consumption and Promotion of the Use of Recycled Materials

**Key Points and Future Directions**

Osaka Gas is working towards Zero Emission of waste in its business activities based on the 2010 Environmental Goals and 2005 Medium-Term Environmental Goals.

We reused 69.6% of excavated soil as a result of gas pipeline construction in FY2002, which is better than 69% set out in the 2005 Medium-Term Environmental Goals.

The final amount of disposed waste (including residues left behind from recycling processes) generated at LNG terminals has been decreasing yearly, falling to 19 tons in FY2002. This is equivalent to 8.4% of the final amount of disposed waste in FY1998. This means we have met our zero emission goals (less than 25 tons). General waste generated from Osaka Gas was 1,809 tons, an approximately 4% fall from the 1,877 tons generated in FY2001. Through garbage-separating efforts at the Osaka Gas head office, we improved our company-wide resource reuse rate to 95%.

We are planning to further reduce waste and reuse resources in FY2003.

---

**Reduction and Recycling of Excavated Soil During Gas Pipeline Construction**

**FY2002 Results**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated amount generated by conventional method (10,000 tons)</td>
<td>185</td>
<td>187</td>
<td>177</td>
<td>194</td>
<td>184</td>
</tr>
<tr>
<td>Amount reduced (10,000 tons)</td>
<td>29</td>
<td>30</td>
<td>64</td>
<td>77</td>
<td>74</td>
</tr>
<tr>
<td>Amount generated (10,000 tons)</td>
<td>159</td>
<td>157</td>
<td>115</td>
<td>117</td>
<td>112</td>
</tr>
<tr>
<td>Amount recycled (10,000 tons)</td>
<td>67</td>
<td>80</td>
<td>71</td>
<td>79</td>
<td>78</td>
</tr>
<tr>
<td>Recycling rate (%)</td>
<td>42.2</td>
<td>51.0</td>
<td>61.4</td>
<td>67.4</td>
<td>69.6</td>
</tr>
<tr>
<td>Amount used efficiently (10,000 tons)</td>
<td>54</td>
<td>46</td>
<td>30</td>
<td>29</td>
<td>26</td>
</tr>
<tr>
<td>Amount of disposal (10,000 tons)</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>9</td>
</tr>
</tbody>
</table>

Note: The figures for amount recycled include both reuse and recycling. The figures for the amount used efficiently indicate other purposes, such as for farmland and residential landfill. The above figures include asphalt.

*The figures for FY2000 onward include reductions through shallow laying of service pipes and preliminary reinstatement work, as well as urban district gas pipe work.

---

**Reduction of Excavated Soil**

Roads have to be excavated during conventional gas pipeline construction, thus generating soil containing waste asphalt. To prevent this, Osaka Gas is increasing the use of trenchless methods (such as the bore-more method, the compact-pipe-jacking method and the pipe splitter method), which do not require excavation to bury the polyethylene (PE) pipes. We also use the shallow-pipe-laying method, which buries gas pipes at shallow depths.

Through these methods, Osaka Gas reduced the amount of excavated soil by 720,000 tons compared to the amount of excavated soil using the conventional method.

---

**Trenchless Methods (Bore-more Method)**

In this method, PE pipes are buried to an extended length (30–100 m) without excavating the soil.

**Step 1**
A steel rod inserted into the ground injects slurry to make digging easier. The position of the nozzle is checked from ground level.

**Step 2**
When it reaches the drawing point, the steel rod is connected to a PE pipe. As the rod is pulled back and the hole is dilated to the size of the pipe’s diameter using a dilation reamer, the PE pipe is drawn in.

---

**Shallow-Pipe-Laying Method**

Japan’s Road Law previously designated that gas pipes be buried at a depth of 1.2 meters. However, extensive testing and research showed it safe to bury pipes at shallower depths. In March 1999, the Ministry of Construction announced that the regulation would be modified within the framework of current laws to allow pipes to be buried at shallower depths.

As the shallow-pipe-laying method requires smaller excavation widths, less excavation and less soil for backfill, Osaka Gas uses this method whenever possible.

In FY2002, we obtained approval from 98% of the local governments in our service area for use of the shallow-pipe-laying method.

---

**LCA Evaluation of CO2 Emission Reduction Effects of Trenchless Methods**

<table>
<thead>
<tr>
<th>Source</th>
<th>PE pipe production and transportation</th>
<th>Construction machine production, etc.</th>
<th>Asphalt composite material production and transportation</th>
<th>Trenchless method (saved excavated soil and waste asphalt disposal)</th>
<th>Backfill oil and crushed stone production and transportation</th>
<th>Constructon machine fuel</th>
<th>Dumpy truck fuel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Pipe Laying Method</td>
<td>3,305</td>
<td>343</td>
<td>810</td>
<td>1,199</td>
<td>1,650</td>
<td>343</td>
<td>343</td>
</tr>
<tr>
<td>Trenchless Method</td>
<td>2,450</td>
<td>233</td>
<td>494</td>
<td>1,256</td>
<td>881</td>
<td>233</td>
<td>233</td>
</tr>
</tbody>
</table>

50% reduction

For LCA-Life Cycle Assessment, see page 14

Trenchless methods reduce the amount of excavated soil, and subsequently, the amount of road repaving. Compared to conventional excavation methods, trenchless methods reduce the life cycle (including production/procurement of asphalt composite material and soil to cover excavated holes, as well as the manufacturing of construction tools) amount of CO2 emissions by 50%.

---

**Recycling Rate**

<table>
<thead>
<tr>
<th>Year</th>
<th>Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>98</td>
<td>42.2</td>
</tr>
<tr>
<td>99</td>
<td>51.0</td>
</tr>
<tr>
<td>00</td>
<td>61.4</td>
</tr>
<tr>
<td>01</td>
<td>67.4</td>
</tr>
<tr>
<td>02</td>
<td>69.6</td>
</tr>
</tbody>
</table>

---

**Environmental Actions**

This page is part of the Environmental Actions section of the Environmental and Social Action Report 2003.
Reusing Excavated Soil—69.6% Recycling rate in FY2002

Since 1983, Osaka Gas and its affiliates have been operating a comprehensive road waste reuse system. As shown in the figure below, this system divides road waste into waste asphalt and excavated soil, reusing them as asphalt and the latter as either regenerated roadbed material or improved soil.

In 1998, Osaka Gas established a mobile soil reuse (SR) plant for reusing excavated soil. This plant improves and reuses excavated soil on-site, thus allowing the best use of excavated soil. Osaka Gas began using this system in 1999, in the Kyoto/Shiga, Nara and Wakayama areas, and has since expanded it to other areas.

Osaka Gas has also been obtaining approval from local governments to use the FK (simplified sieving) method. In the FK method, we use simple instruments to measure the water and particle content of excavated soil to determine whether or not it can be used for backfill.

These efforts allowed Osaka Gas to reuse 69.6% of excavated soil in FY2002, compared to 67.4% in FY2001. In FY2002, the SR application rate was 57% (compared to 53% in FY2001), and the FK-method application rate was 26% (compared to 24% in FY2001).

Recycling of Gas Pipe Materials

Osaka Gas has been replacing conventional metal pipes with polyethylene (PE) pipes, which are highly resistant to uneven ground subsidence, earthquakes and erosion. At the same time, we have been recycling PE pipe scraps from construction sites.

In FY1997, Osaka Gas began recycling PE pipes for use as pipe indication posts for locating buried gas supply pipes. In FY1999, we further expanded our recycling of different types of pipe indication posts. In addition, in FY2000, we developed a method using joints, which were previously hard to recycle because they contained metals. This method has now enabled us to fully recycle metals by reusing them as materials for resin pipes for heating or other purposes. As a result, the recycling rate of gas pipes reached 100%.

In FY2002, the amount of scrapped PE pipe, associated with a decrease in the amount of gas supply construction, decreased to 133 tons (from 140 tons in FY2001), all of which was recycled. Furthermore, we have consigned electrical furnace makers and recycling businesses to recover and recycle metal pipes replaced by PE pipe, such as steel, cast-iron and flexible pipe.

### PE Pipe Recycling Rate

<table>
<thead>
<tr>
<th>Year</th>
<th>FY1999</th>
<th>FY2000</th>
<th>FY2001</th>
<th>FY2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount wasted (t)</td>
<td>90</td>
<td>105</td>
<td>140</td>
<td>133</td>
</tr>
<tr>
<td>Amount recycled (t)</td>
<td>45</td>
<td>105</td>
<td>140</td>
<td>133</td>
</tr>
<tr>
<td>Recycling rate (%)</td>
<td>50</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Measures for Zero Emissions (Zero waste production)

Zero Emissions is a concept created by the United Nations University that promotes the production of no industrial waste. Osaka Gas is striving to achieve Zero Emissions with industrial waste produced from our LNG terminals as well as general waste produced from our offices.

Currently, we are promoting a reduction in the final amount disposed by controlling the production of, reducing the volume of and recycling all types of industrial and general waste.

We have two plans for recycling and volume reduction: Material Recycle, which promotes the reuse of industrial waste as raw material for other products, and Thermal Recycle, which promotes the use of heat energy generated when burnable waste combusts.

In FY2002, we achieved close to Zero Emissions in the final amount of waste disposed by our LNG terminals (excluding residue after recycling); more specifically, we achieved the final amount disposed less than 2.4% of the maximum final amount disposed (1,027 tons) in 1993.

Goals and performances for amounts disposed

<table>
<thead>
<tr>
<th>Year</th>
<th>Waste from plants (Industrial and general)</th>
<th>General waste from other sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY1993 (results)</td>
<td>1,027 t</td>
<td>685 t</td>
</tr>
<tr>
<td>FY1998 (results)</td>
<td>230 t</td>
<td>500 t</td>
</tr>
<tr>
<td>FY2002 (results)</td>
<td>19 t</td>
<td>500 t</td>
</tr>
<tr>
<td>2005 (goals)</td>
<td>25 t</td>
<td>500 t</td>
</tr>
<tr>
<td>2010 (goals)</td>
<td>25 t</td>
<td>500 t</td>
</tr>
</tbody>
</table>

* In 2005 and beyond, the amount disposed will approach zero, provided that residues from material recycling and thermal recycling are excluded.

Generating Less and Recycling More Industrial Waste

The Revised Industrial Waste Disposal Law (effective from April 2001) placed tougher restrictions on waste disposal. Accordingly, Osaka Gas revised regulations in consignment contracts for industrial waste outsourcing and tightened its control on manifests.*

We generated 9,751 tons of industrial waste in FY2002, about the same as the previous year. We did, however, significantly improve our recycling rate to 72% from 52% the previous year. The Construction Recycling Law, enacted in May 2002, enabled us to recycle rubble that we previously could not recycle. Consequently, we were able to recycle over 90% rubble by outsourcing.

Environmental Actions

Example

Recycling waste fluorescent lamps and the other items

Osaka Gas categorizes waste fluorescent lamps and batteries as industrial waste, which we contract out to intermediaries for processing. In FY2002, we conducted an on-site investigation of the processing, and confirmed that all waste materials are recycled following intermediate processing.
Reduction of the Environmental Impacts of Our Business Activities

2. Reduction of Resource Consumption and Promotion of the Use of Recycled Materials

Our Responses to the Construction Recycling Act

Gas pipe construction is categorized as structural construction in civil engineering/construction. The “Construction Work Materials Recycling Act,” enacted on May 30, 2002, regulates this type of construction as specific construction materials (construction materials made from asphalt concrete, iron and wood). The Facilities/Technology Department and the Environmental Department jointly established a task force to respond to the law, and then created a manual to ensure compliance.

Osaka Gas, as a contractor and contractor of gas supply constructions, is expected to fulfill both of these requirements (provided by the law) independently according to the case. To satisfy such expectations, our Pipeline & Facilities/Engineering Department and Environmental Department provided individual seminars for all our district construction contractors, as well as for our internal groups and affiliates, with the objective of explaining the requirements of the law. Consequently, we have effectively and efficiently disseminated the information.

Number of Projects Subjected to the Construction Recycling Act in FY2002

(Money amount: Not less than 5 million yen)

<table>
<thead>
<tr>
<th>Business Headquarters</th>
<th>Number of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osaka</td>
<td>175</td>
</tr>
<tr>
<td>Nanbu</td>
<td>122</td>
</tr>
<tr>
<td>Hokutobu</td>
<td>372</td>
</tr>
<tr>
<td>Hyogo</td>
<td>254</td>
</tr>
<tr>
<td>Kei</td>
<td>139</td>
</tr>
<tr>
<td>Total</td>
<td>1,062</td>
</tr>
</tbody>
</table>

Reducing and Recycling General Waste

Osaka gas strives to generate less and recycle more waste by collecting and separating general waste and finding proper recycling operators of general waste. In FY2002, we generated 1,809 tons of waste, down 4% from the 1,877 tons of FY2001.

While our distribution centers used approximately 55 tons more cardboard from FY2001 to FY2002, the Hokutobu Business Headquarters reduced magazines by approximately 50 tons and the Keiji Business Headquarters reduced waste paper and other garbage by approximately 80 tons, giving us a slight overall decrease in waste. The amount of cardboard in the distribution centers increased because we shifted packaging materials for gas equipment from Styrofoam to molded pulp, a cushioning material made from recycled papers that is heavier than cardboard.

Example

Introduction of a kitchen garbage processor at our head office building

Since May 2001, when we installed a garbage processor on the rooftop of our head office building, we process diverting food scraps from the company cafeteria, the Gas Building Cafeteria and cooking classes.

The introduction of this processor has been associated with the acquisition of ISO 14001 certification in the head office building. Before, these garbage materials were processed as business-related general waste with a disposer. The waste was discharged into sewers after being crushed.

The processing system utilizes exhaust heat generated by the co-generation system to vacuum-dry and reduce the amount of kitchen garbage. Through utilization of the processor, we were able to reduce the volume of kitchen scraps from approximately 22 tons to approximately 5 tons during FY2001, and from approximately 28 tons to approximately 5 tons during FY2002.

The waste is converted to compost, which is utilized in the production of fertilizer mixed with fermented materials, lime and other materials at fertilizer plants. Growers use the fertilizers to promote organic crops.

Composting device

General Waste Generated and Its Recycling Status in FY2002

(FY 2001 results (t/year)

<table>
<thead>
<tr>
<th>Waste type</th>
<th>Generated</th>
<th>Recycled</th>
<th>Disposed</th>
<th>Recycling rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper (copy paper)</td>
<td>427 (413)</td>
<td>323 (304)</td>
<td>104 (109)</td>
<td>76% (74%)</td>
</tr>
<tr>
<td>Newspapers</td>
<td>126 (129)</td>
<td>125 (129)</td>
<td>1 (0)</td>
<td>99% (100%)</td>
</tr>
<tr>
<td>Magazines</td>
<td>110 (162)</td>
<td>106 (158)</td>
<td>4 (4)</td>
<td>97% (98%)</td>
</tr>
<tr>
<td>Comaground cardboard</td>
<td>290 (228)</td>
<td>274 (222)</td>
<td>16 (6)</td>
<td>94% (97%)</td>
</tr>
<tr>
<td>Confidential documents</td>
<td>170 (143)</td>
<td>144 (105)</td>
<td>26 (38)</td>
<td>85% (73%)</td>
</tr>
<tr>
<td>Waste paper and others</td>
<td>239 (329)</td>
<td>13 (64)</td>
<td>226 (265)</td>
<td>5% (19%)</td>
</tr>
<tr>
<td>Total paper</td>
<td>1,362 (1,404)</td>
<td>985 (982)</td>
<td>377 (422)</td>
<td>72% (70%)</td>
</tr>
<tr>
<td>Cans</td>
<td>14 (25)</td>
<td>12 (18)</td>
<td>3 (7)</td>
<td>82% (72%)</td>
</tr>
<tr>
<td>Bottles</td>
<td>13 (27)</td>
<td>11 (13)</td>
<td>2 (14)</td>
<td>86% (48%)</td>
</tr>
<tr>
<td>Kitchen debris</td>
<td>295 (318)</td>
<td>82 (67)</td>
<td>213 (251)</td>
<td>28% (21%)</td>
</tr>
<tr>
<td>Plastics</td>
<td>28 (28)</td>
<td>24 (20)</td>
<td>4 (8)</td>
<td>86% (71%)</td>
</tr>
<tr>
<td>Others</td>
<td>98 (75)</td>
<td>6 (3)</td>
<td>92 (72)</td>
<td>6% (4%)</td>
</tr>
<tr>
<td><strong>General waste total</strong></td>
<td>1,809(1,877)</td>
<td>1,119(1,103)</td>
<td>690(774)</td>
<td>62% (59%)</td>
</tr>
</tbody>
</table>

General Waste Disposal and Recycling Rate

<table>
<thead>
<tr>
<th></th>
<th>Amount disposal</th>
<th>Recycling rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY2002</td>
<td>1,260</td>
<td>62.0%</td>
</tr>
<tr>
<td>'99</td>
<td>43</td>
<td></td>
</tr>
<tr>
<td>'00</td>
<td>48</td>
<td></td>
</tr>
<tr>
<td>'01</td>
<td>774</td>
<td></td>
</tr>
<tr>
<td>'02</td>
<td>690</td>
<td></td>
</tr>
</tbody>
</table>

Graph: Trend of waste disposal and recycling rate from 1999 to 2002
Reducing Paper Used and Increasing Paper Recycled

Osaka Gas has worked to use less and recycle more paper for years. Using less paper for copies, printouts, internal and external forms, business cards and letter paper enabled us to reduce the total weight of paper used in FY2002 to 349 tons, about half the 1998 level.

We achieved this because we used double-sided printing for internal forms, reduced paper size, eliminated paper through using templates for forms and used less copier paper. Internal forms account for approximately 20% by weight of all paper we use. We plan to completely eliminate these forms through computerization by FY2005.

To reduce copier paper, we instituted measures such as incorporating paper reduction into in-house business performance evaluation, using the back of used paper, making double-sided copies and printouts and using duplex printers. We used 43.05 million sheets of paper (FY2002, one sheet of A3 paper counts as two sheets) in FY2002, an approximate 15-million-sheet decrease from FY1998.

We were already using 100% recycled paper as of FY1998, and we have continued to do so since.

![Paper Consumption and Recycled Paper Use Rate](image)

**Using Less Water**

Consistent water conservation has enabled us to reduce the amount of tap water used by approximately 6% over last year. For example, by using rice that requires no washing in the head office staff cafeteria, we reduced water use from 13,100 m³ in FY2000 to 11,200 m³ in FY2002, a saving of approximately 15%.

Example

**Separating Waste at the Head Office**

Since FY2001, as part of our head office building EMS (environmental management system), we have been separating general waste into 14 categories and weighing this waste at each department everyday. We set a goal for 90% recycling of general waste from FY2002. Every month, each department posts recycling rate figures on a bulletin board in front of the staff cafeteria.

These efforts have resulted in a final waste disposal amount of 17.4 kg per person in FY2001 and 10.2 kg in FY2002, compared to 72 kg in FY1998.

<table>
<thead>
<tr>
<th>Reduction of water resources consumed (Clean water)</th>
<th>0,000 m³</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>LNG terminals</td>
<td>FY2001</td>
<td>FY2002</td>
</tr>
<tr>
<td>Business Headquarters</td>
<td>248</td>
<td>235</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>99</td>
<td>78</td>
</tr>
<tr>
<td>Head Office/Others</td>
<td>109</td>
<td>110</td>
</tr>
<tr>
<td>total</td>
<td>541</td>
<td>508</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reduction of water resources consumed (Industrial water)</th>
<th>0,000 m³</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>LNG terminals</td>
<td>FY2001</td>
<td>FY2002</td>
</tr>
<tr>
<td>840</td>
<td>1,022</td>
<td></td>
</tr>
</tbody>
</table>

The increase in the amount of industrial water use is associated with the increasing operation of manufacturing equipment required by the increase in gas sales and with the operational start of the power generator for domestic use (18,000 kW) in Sendo1 LNG terminal in FY2002.

A “Bulletin Board” to exchange supplies among our departments

As Osaka Gas did not previously have a company-wide network to monitor surplus stocks, we designed our “Bulletin Board Site” on the intranet in December 2002, which we have used for the support of utilizing these stocks across department boundaries.

Employees can easily access the site from our supply procurement center’s home page or the business index on the company-wide portal site. This network helps us to avoid the purchase of surplus stocks and to efficiently maintain appropriate stock levels in a unified, company-wide effort.

The networking system has enabled supply exchanges for office desks, meeting tables, chairs, whiteboards, form pads, etc.

![Bulletin Board on our intranet](image)
The total amount spent for stationary supplies, copier paper, working clothes and PE-recycled products, purchased according to the Green Purchase plan, reached 160 million yen during FY2002 (a 70% increase over the previous year).

Moreover, we decided to use recycled non-pulp-based paper for our printing matter in the middle of FY2001. The total amount ordered for such printing matter reaches 950 million yen per year. When this amount is included in the green purchase amount, the green purchase amount for FY2002 is 1.1 billion yen.

Furthermore, as we started using non-pulp-based paper and recycled paper for our printing matter in FY2001, the amount of green purchasing reached approximately 1.1 billion yen when this amount is included. The number of stationery supplies and furniture, etc. registered in our Green Purchasing list as green products is currently 679, and the ratio of green products purchased accounts for as high as 62.8% of the total purchase amount.

In the future, we will further refine green purchasing, and we will concurrently work towards the early achievement of one of our goals, set for 2005, which is to achieve a “green purchase ratio of stationery goods at a level of more than 70%,” through the expansion of green product items. In regards to Green Distribution, we will request our business partners to use low-pollution vehicles, and at the same time we will promote the introduction of natural-gas-operated vehicles within our company and our affiliated companies.

---

**Key Points and Future Directions**

Osaka Gas has been promoting Green Purchasing and Green Distribution by establishing the “Guide to Green Purchasing” (established in May 2000) and “Osaka Gas Green Distribution Policy” (established in December 2001). The amount of green purchasing during FY2002 was increased to 160 million yen, which is an increase of 67 million yen as compared to the previous year, due to the increase in recycled products from polyethylene pipes and environmentally friendly stationery goods. Furthermore, as we started using non-pulp-based paper and recycled paper for our printing matter in FY2001, the amount of green purchasing reached approximately 1.1 billion yen when this amount is included. The number of stationery supplies and furniture, etc. registered in our Green Purchasing list as green products is currently 679, and the ratio of green products purchased accounts for as high as 62.8% of the total purchase amount.

In the future, we will further refine green purchasing, and we will concurrently work towards the early achievement of one of our goals, set for 2005, which is to achieve a “green purchase ratio of stationery goods at a level of more than 70%,” through the expansion of green product items. In regards to Green Distribution, we will request our business partners to use low-pollution vehicles, and at the same time we will promote the introduction of natural-gas-operated vehicles within our company and our affiliated companies.

---

**Green Purchasing**

**Measures towards Green Purchasing**

Osaka Gas established its “Guide to Green Purchasing” in May 2000. Since then, for purchasing supplies, construction and services, we have promoted a purchasing procedure that has a minimal impact on the environment (Green Purchasing) in parallel with the optimization of quality, price and delivery. In accordance with this policy, we have achieved the following:

1. Use of 100% recycled copier paper (with a bleaching rate of 70%)
2. Use of non-pulp-based and recycled printing paper
3. Substantial expansion of Green Purchasing for our business supplies (stationary supplies, furniture, fixtures, etc.)
4. Recycling of surplus PE gas pipes to produce clear folders and marking stakes
5. Use of 100% recycled PET bottle for work uniform fabrics
6. Control of noise and vibration from construction to minimally acceptable levels, and the utilization of recycled asphalt to cover dug holes

In addition to the above-stated efforts, in outsourcing construction for our gas facilities, Osaka Gas requests that its contractors reduce the environmental impacts of construction by issuing written specifications relevant to procedures. These measures have helped our customers become more aware of environment-related conservation, and they have represented our proactive, ongoing relationship with our customers to preserve the environment.

**Achievements in Green Purchasing**

The total amount spent for stationary supplies, copier paper, working clothes and PE-recycled products, purchased according to the Green Purchase plan, reached 160 million yen during FY2002 (a 70% increase over the previous year).

Moreover, we decided to use recycled non-pulp-based paper for our printing matter in the middle of FY2001. The total amount ordered for such printing matter reaches 950 million yen per year. When this amount is included in the green purchase amount, the green purchase amount for FY2002 is 1.1 billion yen. Furthermore, the number of stationery goods and furniture/fixture items registered in our Green Purchasing products list as green products is currently 679, which is an increase of 175 as compared to the figure of the previous year (a 35% increase compared to the previous year).

**Example: Environmentally Friendly Products Items**

<table>
<thead>
<tr>
<th>Copy paper</th>
<th>Ballpoint pen</th>
<th>Highlight pen</th>
<th>Pencil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical pencil</td>
<td>Stapl pad</td>
<td>Ink-pad</td>
<td>Common seal</td>
</tr>
<tr>
<td>Mechanical pencil refill</td>
<td>Ruler</td>
<td>Rubber eraser</td>
<td>Stapler</td>
</tr>
<tr>
<td>Stapler-type paper clips</td>
<td>Bookstand</td>
<td>Scissors</td>
<td>Tape cutter</td>
</tr>
<tr>
<td>White-out (fluid)</td>
<td>Punch</td>
<td>Mouse pad</td>
<td>Cutter knife</td>
</tr>
<tr>
<td>White-out (tape)</td>
<td>File</td>
<td>Binder</td>
<td>Card case</td>
</tr>
<tr>
<td>Computer cleaning wipes (pre-moistened)</td>
<td>Office envelopes</td>
<td>Ruled paper</td>
<td>Notebook</td>
</tr>
<tr>
<td>Zipper case</td>
<td>Tag paper</td>
<td>Dust box</td>
<td>Recycle box</td>
</tr>
<tr>
<td>Index</td>
<td>Desk</td>
<td>White board</td>
<td></td>
</tr>
<tr>
<td>Chair</td>
<td>Glue</td>
<td>Paste</td>
<td></td>
</tr>
</tbody>
</table>
Establishment of Policy for Green Distribution at Osaka Gas

Osaka Gas established an Osaka Gas Green Distribution Policy in December 2001, and it has led the Green distribution movement within the Kansai area.

Osaka Gas Green Distribution Policy

1. Objective
Strategies to reduce pollution have become more urgent as urban air pollution from automobile exhaust has become an increasingly serious problem. Consequently, Osaka Gas has been striving to improve the environment through the promotion and dissemination of natural gas vehicles (NGVs), which are environmentally friendly vehicles that emit less pollutant.

Since April 1, 2002, Osaka Prefecture’s “Green Distribution System” has promoted the utilization of vehicles for distribution services that cause less harm to the environment than existing vehicles. Neighboring municipal governments are following Osaka's lead in introducing this type of system.

As a part of its activities related to Green distribution, Osaka Gas has also established its own “Osaka Gas Green Distribution Policy” in order to promote the further reduction of air pollution resulting from automobile exhaust by increasing the number of vehicles with less emissions in our business activities.

2. Green Distribution Policy

The policy is as follows:

1. **Vehicles owned by Osaka Gas**
   To replace all replaceable vehicles with low-pollution vehicles, such as natural-gas-operated vehicles, by 2010.

2. **Regarding vehicles used by our affiliated companies, for the Gas Group (Service Chain and Construction Companies) and for our customers’ distribution and sales activities with our operational offices**
   We request their voluntary cooperation in the use of low-pollution vehicles depending on their respective circumstances.

Environmental Goals for 2010
- As an action goal, we will work towards increasing the number of natural-gas-operated vehicles in operation from 788 (introduction rate of 29%) as of the end of 2000 to 1,760 (introduction rate more than 80%) by 2010.
- Considering the total number of company-owned vehicles and the life-span of the vehicle, the switch to natural-gas-operated vehicles should be undertaken as early as possible before 2010.

3. Start date for guidelines application
January 10, 2002

*Vehicles of lower pollution level refer to natural gas vehicles, electric vehicles, hybrid electric vehicles, methanol vehicles, vehicles certified as having low levels of fuel consumption and emissions (vehicle types for which automobile taxes are reduced due to their low environmental impact status) and new-generation vehicles of lower pollution level, such as electric fuel battery vehicles.

Local Governments in Kansai District Move towards Green Distribution

A growing number of local governments in the Kansai District (West Japan) are requiring low-pollution vehicles for use in goods delivery as part of a wider trend towards green distribution.

Measures towards Green distribution

Air pollution problems caused by NOx, SPM (airborne particles) and other substances from diesel-operated vehicles have become increasingly problematic and pose significant difficulties for society. As a measure of anti-air pollution, Osaka Gas has been working on Green distribution in conjunction with national and local governments.

This strategy is aimed at reducing the emission of air pollutants through the utilization of vehicles (commonly referred to as “low-pollution cars”) that have a minimal impact on the environment.

Green Distribution

<table>
<thead>
<tr>
<th>Amount of money spent to Green Purchasing products and number of the Green Purchasing inventory products</th>
</tr>
</thead>
<tbody>
<tr>
<td>(million yen)</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Office supplies</td>
</tr>
<tr>
<td>Copy paper</td>
</tr>
<tr>
<td>Gas pipe indication posts, etc.</td>
</tr>
<tr>
<td>Work uniforms</td>
</tr>
<tr>
<td>Number of products registered in the green purchasing inventory</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Amount of money spent to purchase environmentally friendly stationary products</th>
</tr>
</thead>
<tbody>
<tr>
<td>(million yen)</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Carbon copies</td>
</tr>
<tr>
<td>Work uniforms</td>
</tr>
<tr>
<td>Office supplies</td>
</tr>
<tr>
<td>Copy paper</td>
</tr>
<tr>
<td>Gas pipe indication posts, etc.</td>
</tr>
<tr>
<td>Number of products registered in the green purchasing inventory</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of Green Purchasing inventory products of the printed material</th>
</tr>
</thead>
<tbody>
<tr>
<td>(FY)</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Office supplies</td>
</tr>
<tr>
<td>Copy paper</td>
</tr>
<tr>
<td>Gas pipe indication posts, etc.</td>
</tr>
<tr>
<td>Work uniforms</td>
</tr>
<tr>
<td>Environmental and Social Action Report 2003</td>
</tr>
</tbody>
</table>

Environmental and Social Action Report 2003
Reduction of the Environmental Impacts of Our Business Activities

4. Control of Chemicals

Key Points and Future Directions

Osaka Gas (as shown in pages 13-14 and 23) has converted to natural gas as the primary source for gas. Consequently, compared to when we used coal or petroleum as raw materials for gas, the amount of chemicals used through the process of producing and supplying gas has decreased significantly, and the impacts on the environment have become relatively small.

In the future, we will continue to follow restrictions related to environmental protection, and through environmental management based on ISO 14001 and other methods, we will further improve the control of chemicals by lowering the amount of their release and by minimizing their use.

Efforts for PRTR (related to environmental release of specified chemicals)

In FY2003, we released and transferred 7.45 tons of PRTR Law-designated chemicals, which was a fairly small amount considering our scale of operations, while domestic operators released 537,000 tons in FY2001. In the FY2002 data, Osaka Gas had no operational centers that were obligated to report this information to central administration.

The conversion of raw materials into natural gas and efforts to reduce the use of chemicals resulted in a significant decrease in the total amount of chemicals handled. In addition, a further reduction efforts in the use of chemicals in FY2002 also affected the results.

To restrict the amount of chemicals used and released, Osaka Gas has taken the following measures:

1. To set effective recovery devices for the release of chemicals, for example, the setting of CFC-, HCFC- and HFC-recovery devices;
2. To promote the conversion from chemical to non-chemical alternatives;
3. To incorporate a program of chemical use reduction in environmental management.

These measures have enabled us to restrict the release of toxic chemicals to fairly small quantities, but we will continue to use these measures and aim at Zero Emission of chemicals. Even though we handle many types of chemicals in our research institutes, the amount is less than legally specified handling amounts.

Substances Subject to Reporting under the PRTR Law (FY2002)

<table>
<thead>
<tr>
<th>Name</th>
<th>Handled annually</th>
<th>Discharged (atmospheric)</th>
<th>Transferred</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCFC-22</td>
<td>2.7</td>
<td>2.7</td>
<td>0</td>
</tr>
<tr>
<td>HCFC-141b</td>
<td>4</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Cyclohexylamine</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Xylene</td>
<td>4.7</td>
<td>4.7</td>
<td>0</td>
</tr>
<tr>
<td>Toluene</td>
<td>1.7</td>
<td>1.7</td>
<td>0</td>
</tr>
</tbody>
</table>

In FY2002, Osaka Gas did not handle the amount of chemicals obliged to notify under the PRTR Law (more than 5 tons).

Response to the Fluorocarbon Recovery and Destruction Law

In April 2002, the Fluorocarbon Recovery and Destruction Law was enforced. The law limits the emissions of fluorocarbons into the atmosphere, by providing guidance for the recovery and the treatment of fluorocarbons from specified products (including industrial air conditioners, freezers and car air conditioners). Fluorocarbons are categorized into three types: the ozone layer depletion chemicals, CFCs, HCFCs and the greenhouse gas, HFCs, which are all used in refrigerators.

In Osaka Gas’ offices, the disposal of fluorocarbons used for industrial air conditioners and freezers is cause for concern. We contract registered companies to dispose of fluorocarbons properly. When we dispose of industrial vehicles, we contract disposal through car dealers to the registered companies. For gas heat pump (GHP) air conditioners sold, we have established a system to contract out proper disposal to our registered companies.

Pollutant Release and Transfer Register

PRTR, which was promulgated in Japan in 1999, is a system for tracking, quantifying and announcing the release and transfer amounts of toxic chemicals. In addition, since April 2002, if operators of the industries designated by a cabinet order (including Osaka Gas) handle more than the specified amount of any of the designated 354 chemical, they are obliged to notify the administration, through local authorities, of the release and transfer amounts.

Operators are obliged to notify the administration if they handle the following:

- More than 1 ton per year of any of the Class 1 Designated Chemical Substances (since the enforcement of PRTR Law, more than 5 tons for the first two years);
- More than 0.5 tons per year of any of the Specific Class 1 Designated Chemical Substances (12 chemicals regarded as oncogenic).

Figures refer to operational centers that handle more than 1 ton of Class 1 Designated Chemical Substances or 0.5 tons of Specific Class 1 Designated Chemical Substances in a year.
Management of Polychlorinated Biphenyls (PCBs)

On Storage
In accordance with the PCB Special Measures Law enacted in 2001, Osaka Gas manages PCB waste procedures properly.

In FY2001, we investigated fluorescent lamp stabilizers that can use PCBs in our company’s buildings. When we detected PCBs, we removed and stored them appropriately.

On Disposal
In February 2003, the Japan Environmental Corporation announced that it would construct a PCB treatment facility in Maishima, Osaka.

For the PCB waste kept in storage by Osaka Gas, we are planning to dispose of it in this facility on a contract basis.

Storage of waste PCBs

Measures for Dealing with Dioxin
Osaka Gas had abolished all of its incinerators capable of burning 50 kg/h, before the “Dioxin Special Measures Law” was established in 1999. Therefore, we currently do not own any facilities that transgress this law.

Also, Osaka Gas has been continuously working on reducing waste through resource conservation and waste reduction (See pages 28 and 29), which has also indirectly contributed to the reduction of dioxins at public waste-incineration sites.

Moreover, Osaka Gas has developed various kinds of technologies, in cooperation with plant makers, for the purpose of reducing dioxin emitted from waste-incineration sites within the metropolitan area. An example of this is “Reburning Technology,” which drastically reduces the dioxin concentration of emitted gas by blowing natural gas into the emitted gas, and then heating the gas at a high temperature, which eventually reduces NOx as well. This technology was introduced for use at Osaka’s Maishima waste-incineration site in 2001, and also introduced in December 2002 by the Senboku Environmental Maintenance Facilities Union for use within Izumi City.

Storage of waste PCBs

Reduction of the Environmental Impacts of Our Business Activities
5. Wastewater Management

Wastewater Management and Water Pollution Prevention

Osaka Gas’ LNG terminals have been implementing an indirect heat exchange method that utilizes ocean water heat in the process of evaporating LNG. This method only reduces the temperature of the ocean water used, and it does not produce nor emit environmentally impacting substances.

Furthermore, domestic wastewater categorized as general wastewater is drained after being properly processed in the wastewater treatment tank located at our plant compound; therefore, the emission of environmentally impacting substances is strictly controlled.

At operational offices other than LNG terminals, almost no wastewater other than domestic wastewater is discharged. When domestic wastewater is discharged, it flows into sewage; therefore, it does not contaminate the public water supply.

<table>
<thead>
<tr>
<th>COD emission per unit of gas sold</th>
<th>'98</th>
<th>'99</th>
<th>'00</th>
<th>'01</th>
<th>'02 (FY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>mg/m^3</td>
<td>0.35</td>
<td>0.3</td>
<td>0.25</td>
<td>0.19</td>
<td>0.34</td>
</tr>
</tbody>
</table>

Note: The increase in FY2002 is associated with the increase in industrial water use (See page 30)

<table>
<thead>
<tr>
<th>Wastewater discharge from plants (FY2002) (industrial water + water)</th>
<th>Item</th>
<th>Discharged</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of wastewater discharged</td>
<td>1.1 million t</td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>7.5 – 8.6</td>
<td></td>
</tr>
<tr>
<td>Total nitrogen (T-N)</td>
<td>1.9 t</td>
<td></td>
</tr>
<tr>
<td>Total phosphorus (T-P)</td>
<td>0.4 t</td>
<td></td>
</tr>
<tr>
<td>Chemical Oxygen Demand (COD)</td>
<td>2.6 t</td>
<td></td>
</tr>
</tbody>
</table>

Note: Items above satisfy emission regulatory standards
Osaka Gas has continued to voluntarily investigate environmental risks concerning soil and groundwater to take the necessary measures. We started those investigations in January 2001 ahead of enactment of the Soil Pollution Control Law in February 2003 to meet the coming demand on environmental risk management. If any contamination is found as a result of the investigation, we report it to the relevant administrative authorities, and we take appropriate risk management measures (with the authorities' instructions) to improve the environment.

**Procedure of Investigations**

The subject of investigations is the soil and groundwater of the former sites for coal gas plants susceptible to environmental risks. For these investigations, we begin by historically previewing the operation or the location of manufacturing equipment. Consequently, we investigate the conditions of surface soil and groundwater. In case we find contaminations, we launch test borings and specify the zones of contaminations. Since FY2000, we have started this kind of investigation, which we are planning to complete by FY2003.

**Investigation Results and Impacts on the Neighboring Environment**

The table below shows the results of environmental investigations into the 9 former plant sites that we found to surpass environmental standards. Every former plant site is covered with protecting materials such as asphalt and clean soil, and thus there is no risk of direct exposure. Besides, according to the results of investigations about well water of nearby areas or the conditions of groundwater use, there is also no risk of exposures through groundwater. Therefore, we regard that there is no impact on the neighboring environment.

**Measures for Environmental Risk Management**

Although there is no impact on the neighboring environment, we take the following measures to ensure the control of environmental risk in the future.

---

**Plant Site Land Environmental Survey Results (FY2002)**

<table>
<thead>
<tr>
<th>Analytical results</th>
<th>Acceptance criteria (mg/l)</th>
<th>Former plant sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total cyanides</td>
<td>Not detected</td>
<td>x2</td>
</tr>
<tr>
<td>Lead</td>
<td>0.01</td>
<td>0.03</td>
</tr>
<tr>
<td>Hexavalent chromium</td>
<td>0.05</td>
<td>0.12</td>
</tr>
<tr>
<td>Arsenic</td>
<td>0.01</td>
<td>0.20</td>
</tr>
<tr>
<td>Total mercury</td>
<td>0.0005</td>
<td>0.0008</td>
</tr>
<tr>
<td>Benzene</td>
<td>0.01</td>
<td>0.49</td>
</tr>
<tr>
<td>Selenium</td>
<td>0.01</td>
<td>3.0</td>
</tr>
<tr>
<td>Fluorine</td>
<td>0.8</td>
<td></td>
</tr>
<tr>
<td>Groundwater</td>
<td>Not detected</td>
<td>0.2</td>
</tr>
<tr>
<td>Date of publication</td>
<td></td>
<td>7.1</td>
</tr>
</tbody>
</table>

- **x2**: We have already published the result of environmental investigations about these former plant sites. Further details can be found on our website (in Japanese only).
- **x3**: Most of the cyanides in the soil of the sites for our former gas plants using coal as the material are ferrocyanide-complexes.
- **x4**: By “Not detected,” we mean the result is below the quantification limit (0.1 mg/l).

**Estimated Causes of Contamination**

In the purification process of manufacturing coal gas, chemicals were handled, such as cyanides and benzene. Also, coal as a raw material could have included traces of lead, mercury and other heavy metals. It seems that these chemicals osmose into soil with war damage or natural disasters, manufacturing equipment failures and other causes. We supply gas using LNG today so thus there is no occurring of these contaminations.

**Efforts for the Utilization of Soil Environment Protection Technologies**

In order to decrease the soil environment countermeasure costs, Osaka Gas makes efforts for technological development and utilization studies. As a part of these efforts, in FY2002, in reply to the announcement for private companies by the Ministry of Environment, we applied with other companies for study projects concerning low-cost and low-load type cleanup technologies. Two projects were approved.

One is the “Indirect Heating Thermal Desorption System,” where the heating of soil in a container externally by a heat source, such as a burner, enables separation and recovery, through volatilization and vaporization, of the contaminants from the soil.

The other is the development of an enhanced version of our own technology, the “Soil Classification Washing Method,” which enables the separation of contaminant as sludge by classifying and washing contaminated soil with water. Both of these studies were completed in FY2002, the results of which we reported to the Ministry of Environment, and which have been evaluated by scientists and experts. From now on, Osaka Gas, with Osaka Gas Engineering Inc. (See page 66), is planning to make efforts for the dissemination of these technologies.
<table>
<thead>
<tr>
<th>Measures concerning natural gas presented by the Climate Policy Program</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Conversion of fuel to natural gas</td>
<td>37</td>
</tr>
<tr>
<td>2. Natural gas co-generation</td>
<td>41</td>
</tr>
<tr>
<td>Fuel cells</td>
<td>44</td>
</tr>
<tr>
<td>Natural gas vehicles (NGV)</td>
<td>42</td>
</tr>
<tr>
<td>High-efficiency water heaters (latent heat recovery water heaters)</td>
<td>40</td>
</tr>
<tr>
<td>High-performance industrial furnaces</td>
<td>49</td>
</tr>
<tr>
<td>High-performance boilers</td>
<td>48</td>
</tr>
<tr>
<td>Wide-spread use of dish washers, etc.</td>
<td>44</td>
</tr>
</tbody>
</table>

**Environmental Actions II**

**Contribution to Environmental Impact Reduction through Our Products and Services**

Natural Gas emits less CO₂ and harmful substances compared to other fossil fuels such as petroleum and coal. Osaka Gas contributes to the reduction of environmental impact by promoting natural gas, a natural gas co-generation system as an energy-saving system and a gas absorption-type cooler/heater that uses refrigerant free from ozone-depleting substances or greenhouse gases. For factories, homes and office buildings, Osaka Gas is developing effective technologies to reduce environmental impact. Moreover, through the recycling of used gas-related equipment, we actively promote the reutilization of resources.

- **Co-generation cumulative number of units installed**
  - 1,550
- **Cumulative capacity installed**
  - 1.13 million kW
- **NGV use**
  - 4,762 NGVs
- **Natural gas filing stations**
  - 55 stations
- **Gas absorption type cooler/heaters (non-fluorocarbons air conditioners)**
  - Cumulative capacity installed
    - 2.19 million RT
- **Power consumption peak cut effect**
  - Gas air conditioner and co-generation
    - 4.07 million kW
- **Energy conservation rate**
  - 94%
- **Amount of Energy Saved**
  - 858.109 kcal
- **CO₂ emissions control rate**
  - 27.6%
- **Amount of CO₂ emissions controlled**
  - 816,000 t-CO₂
- **NGV use**
  - 4,762 NGVs
1. Contribution to CO₂ Emission Reduction

**Key Points and Future Directions**

Osaka Gas strives to save customers’ energy and reduce CO₂ emissions by spreading the use of natural gas, the fossil fuel with the lowest CO₂ emissions, and by developing and promoting the use of high-efficiency gas equipment and systems, such as gas co-generation systems.

From FY2003, we began a number of new activities aimed at achieving the 2005 Medium-Term Environmental Goals, which we set in FY2002. In FY2002, our rate of energy saved was 7.9%, and the rate of CO₂ emission reduction was 27.6% compared with FY1998. (The rates are based on the calculations below.) This result shows that we are on the track of the achievement of the 2005 Medium-Term Environmental Goals.

Also, we have set targets in developing high-efficiency technology for gas equipment and systems in our 2005 Medium-Term Environmental Goals. Osaka Gas is working on developing those technologies to save energy and CO₂ emissions.

Osaka Gas will undertake ongoing efforts to develop and promote the use of co-generation systems, industrial equipment and gas air conditioning systems with the aim of achieving the 2005 Medium-Term Environmental Goals.

### Promotion of the Use of Natural Gas and Energy-Saving Systems and Equipment

We calculated the energy savings and CO₂ emission reduction achieved by increasing the use of natural gas and high-efficiency gas equipment as well as systems such as co-generation systems.

#### Rate of energy saved

\[
\text{Rate of energy saved} = \frac{\text{A) Energy saved}}{\text{A) Energy saved + B) Energy of gas sold}} \times 100 \text{ (%)}
\]

**A) Energy saved**

This is the amount of energy saved resulting from the introduction of energy-saving equipment and systems, such as co-generation, industrial and air conditioning systems, which were added between FY1998 and the year in question.

#### Rate of CO₂ emission reduction

\[
\text{Rate of CO₂ emission reduction} = \frac{\text{C) CO₂ emission reduction}}{\text{C) CO₂ emission reduction + D) CO₂ emissions from gas sold}} \times 100 \text{ (%)}
\]

**C) CO₂ emission reduction**

The amount of CO₂ reduction resulting from the introduction of energy-saving equipment and systems, such as co-generation, industrial and air conditioning systems, which were added between FY1998 and the year in question.

**D) CO₂ emissions from gas sold**

The amount of CO₂ emissions from the increased amount of gas sold between FY1998 and the year in question.

### Natural Gas Co-generation System

**Gas Co-generation System**

Not only do co-generation systems generate electrical power using gas engines, gas turbines or other motive power generators, but they also exhaust heat, which can be efficiently used for air-conditioning, hot water supply, industrial steam generation and other purposes. In this way, this system enables us to save a significant amount of energy by utilizing both electrical and thermal energy, as well as using exhaust heat appropriately. Up to about 70–80% of energy input can be consumed efficiently.

**Comparison of Energy Efficiencies of Co-generation and Conventional Systems**

**Comparison of Energy Savings**

**Rate of CO₂ emission reduction**

In July 2001, the Comprehensive Research Committee on Resources and Energies of METI announced their long-term perspective of energy demand and supply. Supply targets for FY2010 are indicated: for natural gas co-generation, about 4.64 GW (the total result for FY2002: about 2.15 GW) and for electric fuel battery (See page 41), which is a kind of co-generation, about 2.20 GW.

Expectations for the widespread use of natural gas co-generation and fuel cell are rising at national level.
Spreading the Natural Gas Co-generation System

Osaka Gas has designated the dissemination of co-generation, an energy efficiency-raising system, as an important company theme. The system’s performance has been advanced, and the positive results of its utilization have accumulated through approximately 20 years of research and development activities.

Many customers are utilizing the system, primarily in industry and for commercial use as well in medical care. Accumulated equipment capacity has reached approximately 1.13 GW (as of the end of FY2002), which amounts to nearly half of all natural gas co-generation power generated nationwide.

In 1998, Osaka Gas released its 9.8 kW Type Natural Gas Mini Co-generation System. Since then, the system has primarily been used in hotels and spas. As of February 2003, the number of actual units in operation within the Osaka Gas service area was approximately 700, and the overall volume of generated electricity was 9,000 kW.

In particular, the 5 kW type, released in December 2002, is becoming widely used mainly in the food service industry. It has an energy-saving feature with its combined efficiency (power generation and exhaust heat) 87% at maximum. Additionally, it is easy to install since the capacity of the system is the smallest of its type in the business-use market.

Moreover, Osaka Gas is working to develop equipment suitable for the utilization of exhaust heat, such as a dehumidifying air conditioner, equipment for kitchen scrap processing and hot water equipment for exhaust heat utilization.

Spreading the Mini Co-Generation System

Facilities Using Untapped Energy

<table>
<thead>
<tr>
<th>Facility</th>
<th>Heat source</th>
<th>Usage</th>
<th>Purpose</th>
<th>Scale</th>
<th>Start</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morinomiya Energy Center</td>
<td>Municipal refuse incinerator exhaust heat</td>
<td>Steam heat exchanger</td>
<td>Heating and hot water</td>
<td>41.9 GJ/h</td>
<td>1976.5</td>
</tr>
<tr>
<td>Rokko Island City</td>
<td>Sludge treatment exhaust heat</td>
<td>Steam heat exchanger</td>
<td>Hot water</td>
<td>19.9 GJ/h</td>
<td>1988.3</td>
</tr>
<tr>
<td>Osaka Nanko Cosmo Square</td>
<td>Sea water temperature differential energy</td>
<td>Water absorption chiller heat pump</td>
<td>Air conditioning, etc.</td>
<td>406.9 GJ/h</td>
<td>1994.4</td>
</tr>
<tr>
<td>Osaka Dome City Energy Center</td>
<td>Gas pressure energy</td>
<td>Expansion turbine</td>
<td>Power generation</td>
<td>1,155 kW</td>
<td>1996.4</td>
</tr>
<tr>
<td>Sakai City Clean Center</td>
<td>Municipal refuse incinerator exhaust heat</td>
<td>Refuse-burning power generation</td>
<td>Electricity generation</td>
<td>12,400 kW</td>
<td>1997.4</td>
</tr>
</tbody>
</table>

LCA Evaluation

Natural Gas Co-generation System Contributed to Approximately 21% Reduction in CO2 Emissions

LCA evaluation of environmental performance of natural gas co-generation system introduced at hospital facilities showed an approximately 21% CO2 reduction compared to the level before the system was introduced. This result was due to three factors: the high efficiency of power generation, energy conservation due to the utilization of exhaust heat and this system’s substitution of electrical power generated from thermal power generation.

\( \text{LCA Evaluation of CO}_2 \text{ Emissions (t-CO}_2/\text{year)} \)


For LCA (Life Cycle Assessment), see page 14
2. Gas Equipment and System Efficiency Technology

Key Points and Future Directions

Osaka Gas makes the most effective use of natural gas, which is the fossil fuel with the lowest CO\textsubscript{2} emissions. We are also developing a range of technologies, systems and equipment to save energy and reduce the environmental impact.

Some typical examples of this are the developments to raise the efficiency of natural gas co-generation systems and absorption-type cooler/heaters.

Gas Engines Co-generation

Our gas engines for co-generation systems boast an industry-leading generating efficiency of more than 40%. Osaka Gas' advancing technology is developing products with increased efficiency and lower costs.

Gas Absorption-type Cooler/Heater

Osaka Gas' research and development efforts are yielding greater efficiency from gas absorption-type cooler/heaters, CFC- HCFC-

Examples of Energy-Saving Equipment Development

High-Efficiency Gas Engines and Turbines

There are two kinds of gas co-generation systems: those using gas engines and those using gas turbines. Great strides are being made in gas engines: Osaka Gas systems have gone from about 30% efficiency to between 40% (500 kW size) and 43% (6,000 kW size) today. Also, we are putting those high-efficiency technologies into practices one after another.

These advances are enabled by:
1. Better engine control through electronics,
2. Improved turbocharger efficiency through advances in fluid technology\textsuperscript{1}, and
3. Application of miller cycle technology\textsuperscript{2}.

Development is moving slower, however, in the field of gas turbine technology. Some promising technologies exist, such as a product that boosts 40% efficiency from Solar Turbines Inc. (developed with support from the US Department of Energy) and ceramic gas turbines (supported by the Japanese Government). Needless to say, we are on the verge of the practical application of these technologies.

a1 Fluid technology: technology that analyzes the flow of gas
a2 Miller cycle technology: high-efficiency cycle where the ratio of expansion to compression is high

Principle of Lean-burning gas engine

Principle of gas turbine

Developments to Enhance the Efficiency of the Gas Absorption-type Cooler/Heater

Osaka Gas released the world-first Double-effect gas absorption-type cooler/heater in 1969. Since then, we have been working on the development of models for improving freezing cycle efficiency and heat recovery. With regards to these double-effect models, Osaka Gas achieved the world-highest chilling efficiency (COP), 1.35. Furthermore, to further conserve resources and extend the life of products, Osaka Gas is developing a more efficient air conditioner, triple effect cycle absorption-type cooler/heater. Osaka Gas will keep developing energy-saving systems and equipment to help our customers use natural gas efficiently.

We are working on these developments for improving efficiency and also reducing NO\textsubscript{x} emissions, saving and reusing resources and extending the life of products.
High Efficiency Gas Engine Heat Pump (GHP) Air Conditioners

A gas engine heat pump (GHP) air conditioner provides warm and cool air using a gas engine.

The development at Osaka Gas is aimed at making GHP technology more efficient by (1) raising the pressure ratio and using miller cycle technology to improve engine efficiency, and (2) improving compressor efficiency (by reducing internal pressure loss, reducing excess pressure and improving partial load efficiency through the development of variable capacity compressors).

These efforts have produced high-efficiency GHP technology with a standard COP of 1.3 in 2002. Our researchers have also successfully developed systems with low NOx emissions and are working towards the FY2005 release of a high-efficiency GHP system with a COP of 1.5. *

Average rate of cooler and heater

**Improvement of GHP Efficiency**

<table>
<thead>
<tr>
<th>COP</th>
<th>0</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>'98</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>'99</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>'00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>'01</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>'02</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Launch COP 1.5 system in 2005
Launch COP 1.3 system in 2001

Growing Lineup of Heat Accumulation Combustion Systems

Osaka Gas is developing new models of heat accumulation combustion systems (also known as regenerative burner systems) that will generate large energy savings in industrial heating furnaces by recovering combustion heat stored by a heat accumulator inside the burner.

Osaka Gas’ development of an inexpensive, compact system marks a significant breakthrough in self-regenerating burners capable of heat accumulation combustion with a single unit, which now makes it possible to incorporate a regenerative burner system into small furnaces that could not previously use the technology. In FY2003, we will introduce a product that applies this system to steel and crucible furnace burners.

A wide selection of regenerative burners systems has enabled Osaka Gas to help our customers reduce energy use (about 35% with steel furnaces) and achieve a 50% reduction in CO2 emissions.

**Principle of Regenerative burner system**

(Recovering combustion heat stored by a heat accumulator inside the burner)

Direct Hot Blast-type Tumbler

In 1997, Osaka Gas developed a direct hot blast-type tumbler that enables linen supply businesses to save energy in the linen drying process. In addition to saving a substantial amount of energy and reducing running costs, these machines dry linen faster than ordinary steel dryers that use indirect heat.

Shorter drying times causes less damage to the fabric and transfers less static electricity. Moreover, the new dryer uses an Osaka Gas burner with substantially lower emissions of NOx less than 10 ppm, or about 90% less than steam indirect heat dryers (equivalent when O2 = 0%).

This minimizes the environmental impact, and prevents discoloration and color bleeding of the fabric caused by exhaust. There are currently 42 of these units in service contributing to reduced energy and improved drying quality.

* Linen supply businesses: Businesses that rent linen to customers, and supply collection and laundry services

**Voice** A Customer Assesses a Direct Hot Blast-type Tumbler

**Q.** Please introduce your company.

A. Koyama Sangoy washes, refurbishes and processes hospital linen such as gowns and bedding. We serve more than 60% of the hospitals in the Kyoto-Osaka-Kobe area, processing about 60,000 pieces of linen per day, which is approximately equivalent to the laundry output of 3,000 households.

**Q.** How does the Direct Hot Blast-type Tumbler work?

A. We previously used oil boilers (four 2-ton drums each) to produce the steam heat for washing, drying and ironing, but when the gas service began in Tenri City in the spring of 2001, we installed four direct hot blast-type tumbler to boost our drying capacity. The tumble dryers themselves produced an energy savings of 30%, and our plant has reduced energy and steam use by more than 3% overall.

**Q.** Please let us know your future energy saving plan.

A. In FY2003, we will be replacing our 3 remaining steam tumble dryers with direct heat, and after that replacing all our boilers with natural gas units. This will make us more competitive while benefiting the environment.
Contribution to Environmental Impact Reduction through Our Products and Services

2. Gas Equipment and System Efficiency Technology

Development Examples of Household Co-generation Systems

Osaka Gas is developing two types of household co-generation systems: one using a gas engine, and the other using a polymer electrolyte type fuel cell, for saving energy and reducing CO₂ emissions in households.

Effective use of electricity and heat from household co-generation systems can reduce energy consumption (primary energy equivalent) by 20% and CO₂ emissions by 30% (compared to themoelectric power).

ECOWILL Household Natural Gas Engine Co-generation System

ECOWILL is a natural gas co-generation system driven by a 1 kW gas engine that is perfect for household use. It was the first product of its kind in the market in March 2003, and since then it has attracted significant interest among consumers. The system recovers heat from the engine, and it also uses an exhaust heat exchanger with excellent heat recovery. Despite its compact size, ECOWILL’s high overall efficiency of 85% is equivalent to that of larger co-generation systems. As ECOWILL can recognize the user’s power, hot water and heating use patterns, it can automatically generate electricity while saving energy with high efficiency. ECOWILL enables our customers to save 20% of energy per 1kWh of power generation.

In a standard detached single-family home of four people, ECOWILL can provide 30% of all electricity, as well as supply almost all of hot water and heating from hot water.

Polymer Electrolyte Fuel Cell (PEFC) Co-generation System

Polymer electrolyte fuel cell (PEFC) technology offers high-energy efficiency and superior environmental performance for household co-generation systems.

It is estimated that PEFC systems can achieve more than 35% energy efficiency (LHV*) even at low output. Osaka Gas is working on research and development of the system with the aim of market release of 1 kW and 500 W household co-generation systems in FY2005.

Household Co-generation System

(Using ECOWILL)

<table>
<thead>
<tr>
<th>Electricity</th>
<th>Hot water heating system using exhaust heat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas engine</td>
<td>Hot water reservoir</td>
</tr>
<tr>
<td>Gas</td>
<td>Supplementary water heating</td>
</tr>
</tbody>
</table>

Q. How did the ECOWILL come into being?
A. We originally developed the gas engine used in the ECOWILL for small commercial co-generation systems. While we developed the gas engine, however, we became to believe that we should contribute to the environment by spreading such a small, highly efficient gas engine for household co-generation systems. This is why we developed ECOWILL.

Q. What was the hardest part of development?
A. Each household has its own pattern of electricity and hot water use; some households even have different use patterns depending on the season and day of the week. So even if the gas engine itself is energy efficient, this efficiency is canceled out by problems such as electricity not being used effectively within the home, or hot water being left in the tank for long periods and losing its heat. That’s why we developed an intelligent operation system that memorizes how a home actually uses electricity, hot water and heating, and automatically generates power at the most energy efficient operating pattern. During development, we thoroughly examined ECOWILL’s energy efficiency by having customers monitor the system and having Osaka Gas employees simulate power usage patterns by temporarily living in an experimental house.

Q. How have customers responded to the ECOWILL?
A. Although the ECOWILL requires an initial installation cost higher than conventional systems, users can recover this cost through energy savings in about 5 years. Despite the startup cost, 1,400 ECOWILL units have been either installed or contracted for installment. I think this is proof that many customers are concerned about the environment and have calculated the long-term energy savings of ECOWILL. We will continue to further develop ECOWILL into an even better product that will benefit more households everywhere.

Shin Iwata
Leader of the Engine Co-generation Development Team

OG-type reformer (1 kW)

LHV: Lower heating value: the amount of heat produced after subtracting the condensed latent heat of the steam when gas is completely combusted

PEFC co-generation system 1 kW pilot model

* Based on a comparison of an ECOWILL household using electricity and thermal energy, and a home using commercial power and a conventional hot water supply/space heater

Voice

Interview with an ECOWILL developer
**Household Latent Heat Recovery-Type Hot-Water Heater**

Hot water and space heating consume a lot of household energy so there is significant potential for savings.

In June 2000, Osaka Gas released Prior Eco, a latent heat recovery-type hot water heater, which is the first for household use in the industry. The Energy Conservation Grand Prix Minister of International Trade and Industry Prize was awarded to Osaka Gas’ Prior Eco, for its environmentally friendly features such as high efficiency and less CO2 emissions, in 2000. Starting in FY2002, Japan’s Guidelines for Measures to Prevent Global Warming are advocating the use of Prior Eco, and the Ministry of Economy, Trade and Industry introduced subsidies for homeowners installing such systems under the Project for the Promotion of Introduction of High Efficiency Energy Systems to Houses and Buildings.

In October 2002, Osaka Gas released a high performance hot water heater that uses a heat exchanger with small, long stainless steel stacked plates to give 95% water heating efficiency and 89% space heating efficiency (compared to 93% and 88%, respectively, for a product launched in 2000). Osaka Gas is aiming to introduce low-cost hot water supply/space heaters and bath water heaters in the near future.

**High Efficiency Gas Stove**

Osaka Gas has boosted thermal efficiency of household gas stoves from 45% to more than 50% by redesigning the burner and lowering the pan supports. The majority of Osaka Gas stoves sold are high-efficiency stoves: 83% of all tabletop stoves and 95% of all built-in units in FY2002.

**Basic Research on Reducing Pipe Friction to Energy Saving**

In a gas absorption-type cooler/heater, the cold or hot water from the water cooler/heater goes through pipes and is sent by pump into the room, where an internal unit uses the cold or hot water to either cool or heat the room by heat exchange. In a gas co-generation system, water warmed by exhaust heat goes through pipes and is sent by a pump to facilities that use the heat. Both systems use a pump, and for many years the problem was that the pump used a lot of the energy needed for operation.

Osaka Gas solved this problem by developing a pipe friction reduction technology that involved adding a special surface activator to the water. This drastically reduced the friction and cut down on the power needed to run the pump. Experiments have so far reduced the required pump power by up to 50%, and we plan to make this technology more widely available by developing small, low environmental impact energy systems.

**LCA* Evaluation**

### CO2 Emissions Reduction Effects of Products

<table>
<thead>
<tr>
<th>Product Type</th>
<th>CO2 Emissions (kg-CO2)</th>
<th>% Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual</td>
<td>102</td>
<td>29</td>
</tr>
<tr>
<td>Washer-dryers</td>
<td>36</td>
<td>36</td>
</tr>
<tr>
<td>Washers</td>
<td>2,250</td>
<td>55%</td>
</tr>
</tbody>
</table>

An LCA comparison of washing dishes by hand with a dishwasher-dryer that uses gas to heat the water shows that the dishwasher-dryer uses 30% less water than hand washing, and it reduces CO2 emissions by approximately 17%.

An LCA comparison of gas stoves and induction heating cookers reveals that the gas stove uses energy more efficiently overall and reduces CO2 emissions by about 55% across the product lifecycle (from materials and fuel procurement to the use of gas or electricity to run the product).

Source: Osaka Gas, A Study of LCA Evaluation of City Gas Systems, Proceedings of 8th Assembly of the Japan Institute of Energy

*See page 14 for LCA
## Contribution to Environmental Impact Reduction through Our Products and Services

### 2. Gas Equipment and System Efficiency Technology

#### Awards Given to Osaka Gas in the Category of Energy Conservation for Gas Equipment

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Year/award/sponsor</th>
<th>Reason for award</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Household use</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gas table cooking stove equipped with waterless grill</td>
<td>2000/Technology Prize]apan Gas Association</td>
<td>Burner position and angle adjusted to minimize heat effect on grill saucer and create a convection effect without water.</td>
<td>Jointly with Paloma Industries Ltd.</td>
</tr>
<tr>
<td>High-efficiency gas hot water heater “Ex Prior Eco”</td>
<td>2001/Technology Prize]apan Gas Association</td>
<td>Uses condensing technology to boost thermal efficiency. Improving hot water efficiency from 80% to 93% and cut energy use by 12%.CO2 emission saving of 50 kg/year.</td>
<td>Jointly with Takagi Sangyo Co., Ltd.</td>
</tr>
<tr>
<td>Gas cooking stove equipped with high-efficiency burner</td>
<td>2000/Energy Conservation Grand Prix, Minister of Economy Trade and Industry Prize/Energy Conservation Center</td>
<td>Supports were shortened, burner heads made smaller and flame jet angle raised in new burner design. Achieved thermal efficiency of 57%.</td>
<td>Jointly with Toho Gas, Tokyo Gas and Paloma Industries, Inc.</td>
</tr>
<tr>
<td>High-efficiency gas hot water heater “EX Prior Eco”</td>
<td>2002/Technology Prize]apan Gas Association</td>
<td>Achieves 95% hot water thermal efficiency, through condensing technology, while maintaining the same size as the current CH boiler.</td>
<td>Jointly with Toho Gas, Tokyo Gas and Nortiz Corporation</td>
</tr>
<tr>
<td><strong>Commercial use</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.8 kW gas mini co-generation system</td>
<td>1999/Energy Conservation Grand Prix, Energy Conservation Center President Prize/Energy Conservation Center</td>
<td>Co-generation system with multi-switching equipment consumes 20% less primary energy and causes 29% less CO2 emissions than using thermoelectric power and gas boiler.</td>
<td>Jointly with Yanmar Diesel Engine Co., Ltd.</td>
</tr>
<tr>
<td>Condensing Tough Jet</td>
<td>2001/Energy Conservation Grand Prix, Energy Conservation Center President Prize/Energy Conservation Center</td>
<td>Newly developed latent heat collector heat exchange boosts thermal efficiency from 78% to 93%.</td>
<td>Jointly with Toho Gas, Tokyo Gas, Takagi Sangyo Co., Ltd. and Nortiz Corporation</td>
</tr>
<tr>
<td>Tough Jet 16-633-1001 gas hot water supply connecting to commercial kitchen ducts</td>
<td>2002/Energy Conservation Grand Prix, Energy Conservation Center President Prize/Energy Conservation Center</td>
<td>Latent heat collection boosts thermal efficiency from 78% to 93% and warm air flow is reduced 75%, creating energy savings.</td>
<td></td>
</tr>
<tr>
<td>High-efficiency gas heat pump air conditioner</td>
<td>2002/Fourth Citation for Equipment Equalizing Electricity Demand, Chairman’s Award/Heat Pump &amp; Thermal Storage Technology Thermal Storage Technology Center of Japan</td>
<td>Cited for its high efficiency (COP 1.3) and significant reduction of summer peak energy demand.</td>
<td>Jointly with Aisin Seiki Co., Ltd., Sanyo Electric Air Conditioning Co., Ltd., Mitsubishi Heavy Industries, Ltd. and Yaman Co., Ltd.</td>
</tr>
<tr>
<td><strong>Industrial use</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy-saving low-cost fuel gas compressor for gas turbines</td>
<td>1999/Technology Prize]apan Gas Association</td>
<td>An inexpensive, energy-saving fuel gas compressor, a freezer general screw compressor modified to be used with gas turbines of 650 to 2,000 kW.</td>
<td>Jointly with Toho Gas, Tokyo Gas, Mlwa Kuro Co., Ltd., and Nihon Commutec Co., Ltd.</td>
</tr>
<tr>
<td>Exhaust gas recombination technology for gas turbine co-generation</td>
<td>1999/Technology Prize]apan Gas Association</td>
<td>The boiler burns natural gas with gas turbine exhaust 500°C instead of conventional air sources. This is 3% more efficient.</td>
<td>Jointly with Volcano Co., Ltd. and Chugai Ro Co., Ltd.</td>
</tr>
<tr>
<td>500 kW class high-efficiency gas engine package</td>
<td>2000/Technology Prize]apan Gas Association</td>
<td>Gas engine power generating sets that have a proven track record in Europe are procured directly, tuned for optimal performance during output and gimbol and merchandized as a low-cost, low-NOx co-generation package. Power generation efficiency is 38.8% (compared to about 35% with domestic products of same class).</td>
<td></td>
</tr>
<tr>
<td>Lean Burn Mirror Cycle Gas Engine for Co-generation System</td>
<td>2002/Technology Prize]apan Gas Association</td>
<td>Praised for achieving 40% generating efficiency, world’s best in under 1,000 kW class, and reducing CO2 emission per unit of power generated by 13%. About 40 units (unofficial count) had been implemented in J apan at the end of 2002.</td>
<td>Jointly with Mitsubishi Heavy Industries, Ltd.</td>
</tr>
<tr>
<td>High efficiency double-effect absorption-type cooler/heater</td>
<td>2002/JIE Progress Award, Technical Division/apan Institute of Energy</td>
<td>Double-effect equipment with world-class efficiency (cooler COP 1.35).</td>
<td></td>
</tr>
<tr>
<td>Gas direct hot blast-type tumbler</td>
<td>2002/Chairman’s Prize for Excellent Energy-Saving Equipment]apan Machinery Federation</td>
<td>Super low-NOx burner developed to save energy, reduce running costs, shorten drying time and extend the life of the fabric.</td>
<td></td>
</tr>
</tbody>
</table>
In 2001, Osaka Gas developed a low-NOx burner (NOx emission concentration of 30 ppm, the lowest in Japan) for once-through boilers. This burner realizes low-NOx because it lowers the temperature of the flame through split flame and flue gas recirculating flow. Osaka Gas is currently researching the application of this technology in hot water boilers and flue and smoke tube boilers. We expect to commercialize the former in the summer of 2003.

We promote various gas systems to meet local air pollution regulations in each area. Because the gas that we supply is vaporized liquefied natural gas (LNG), there are almost no sulfur or impurities. Systems using natural gas emit comparatively little NOx and almost no SOx (sulfur oxides) or dust.

Osaka Gas has been doing its utmost to promote the spread of environmentally friendly natural gas vehicles (NGVs), which emit almost no SOx (sulfur oxides), and SPM (suspended particulate matter), and comparatively little NOx and CO2. As of the end of March 2003, there were 4,762 NGVs and 55 natural gas stations in the Kansai region of Japan (16,561 and 224 throughout Japan).

Presently, there is a strong movement in Japan towards the introduction of low-polluting vehicles. National and local governments are taking the initiative in introducing NGVs and establishing green distribution systems and subsidies. Osaka Gas’ aggressive efforts to introduce more natural gas vehicles make it an integral part of this movement.

In 2001, Osaka Gas developed a low-NOx burner (NOx emission concentration of 30 ppm, the lowest in Japan) for once-through boilers. This burner realizes low-NOx because it lowers the temperature of the flame through split flame and flue gas recirculating flow. Osaka Gas is currently researching the application of this technology in hot water boilers and flue and smoke tube boilers. We expect to commercialize the former in the summer of 2003.

We promote various gas systems to meet local air pollution regulations in each area. Because the gas that we supply is vaporized liquefied natural gas (LNG), there are almost no sulfur or impurities. Systems using natural gas emit comparatively little NOx and almost no SOx (sulfur oxides) or dust.

Osaka Gas has been doing its utmost to promote the spread of environmentally friendly natural gas vehicles (NGVs), which emit almost no SOx (sulfur oxides), and SPM (suspended particulate matter), and comparatively little NOx and CO2. As of the end of March 2003, there were 4,762 NGVs and 55 natural gas stations in the Kansai region of Japan (16,561 and 224 throughout Japan).

Presently, there is a strong movement in Japan towards the introduction of low-polluting vehicles. National and local governments are taking the initiative in introducing NGVs and establishing green distribution systems and subsidies. Osaka Gas’ aggressive efforts to introduce more natural gas vehicles make it an integral part of this movement.

In 2001, Osaka Gas developed a low-NOx burner (NOx emission concentration of 30 ppm, the lowest in Japan) for once-through boilers. This burner realizes low-NOx because it lowers the temperature of the flame through split flame and flue gas recirculating flow. Osaka Gas is currently researching the application of this technology in hot water boilers and flue and smoke tube boilers. We expect to commercialize the former in the summer of 2003.

We promote various gas systems to meet local air pollution regulations in each area. Because the gas that we supply is vaporized liquefied natural gas (LNG), there are almost no sulfur or impurities. Systems using natural gas emit comparatively little NOx and almost no SOx (sulfur oxides) or dust.

Osaka Gas has been doing its utmost to promote the spread of environmentally friendly natural gas vehicles (NGVs), which emit almost no SOx (sulfur oxides), and SPM (suspended particulate matter), and comparatively little NOx and CO2. As of the end of March 2003, there were 4,762 NGVs and 55 natural gas stations in the Kansai region of Japan (16,561 and 224 throughout Japan).

Presently, there is a strong movement in Japan towards the introduction of low-polluting vehicles. National and local governments are taking the initiative in introducing NGVs and establishing green distribution systems and subsidies. Osaka Gas’ aggressive efforts to introduce more natural gas vehicles make it an integral part of this movement.

Contribution to Environmental Impact Reduction through Our Products and Services

3. Reducing Emissions of NOx and Other Air Pollutants

To reduce the amount of NOx emissions that result from the reaction of the nitrogen in the air needed for combustion of gas, we are developing and promoting the use of gas equipment systems and combustion technologies. In 2001, we developed a low-NOx burner (NOx emission concentration of 30 ppm) for once-through boilers, and in FY2002, we worked to make this practical for use on various boilers. In FY2003, we plan to release a hot water boiler that achieves NOx emission concentrations of less than 40 ppm, our goal for 2005. Osaka Gas will continue to develop and promote the use of technology for low-NOx equipment and systems. In FY2002, we introduced into operation 992 natural gas vehicles (NGVs) in the Kansai region of Japan, bringing the total number of NGVs in operation to 4,762. NGVs release significantly less NOx, soot, dust and CO2 than gasoline-powered cars. Osaka Gas will continue to promote the use of NGVs to reduce emissions of air pollutants such as NOx and greenhouse gas CO2.

Example of Low-NOx Product Development

Application of Low-NOx Burner for Boilers

In 2001, Osaka Gas developed a low-NOx burner (NOx emission concentration of 30 ppm, the lowest in Japan) for once-through boilers. This burner realizes low-NOx because it lowers the temperature of the flame through split flame and flue gas recirculating flow. Osaka Gas is currently researching the application of this technology in hot water boilers and flue and smoke tube boilers. We expect to commercialize the former in the summer of 2003. In FY2002, we worked to make this practical for use on various boilers. In FY2003, we plan to release a hot water boiler that achieves NOx emission concentrations of less than 40 ppm, our goal for 2005. Osaka Gas will continue to develop and promote the use of technology for low-NOx equipment and systems. In FY2002, we introduced into operation 992 natural gas vehicles (NGVs) in the Kansai region of Japan, bringing the total number of NGVs in operation to 4,762. NGVs release significantly less NOx, soot, dust and CO2 than gasoline-powered cars. Osaka Gas will continue to promote the use of NGVs to reduce emissions of air pollutants such as NOx and greenhouse gas CO2.

Reducing Emissions of NOx, SOx and Dust

We promote various gas systems to meet local air pollution regulations in each area. Because the gas that we supply is vaporized liquefied natural gas (LNG), there are almost no sulfur or impurities. Systems using natural gas emit comparatively little NOx and almost no SOx (sulfur oxides) or dust.

Osaka Gas will continue to develop and promote the use of technology for low-NOx equipment and systems. In FY2002, we introduced into operation 992 natural gas vehicles (NGVs) in the Kansai region of Japan, bringing the total number of NGVs in operation to 4,762. NGVs release significantly less NOx, soot, dust and CO2 than gasoline-powered cars. Osaka Gas will continue to promote the use of NGVs to reduce emissions of air pollutants such as NOx and greenhouse gas CO2.

Contribution to Environmental Impact Reduction through Our Products and Services

4. Promoting the Use of Natural Gas Vehicles

Osaka Gas has been doing its utmost to promote the spread of environmentally friendly natural gas vehicles (NGVs), which emit almost no SOx (sulfur oxides), and SPM (suspended particulate matter), and comparatively little NOx and CO2. As of the end of March 2003, there were 4,762 NGVs and 55 natural gas stations in the Kansai region of Japan (16,561 and 224 throughout Japan).

Presently, there is a strong movement in Japan towards the introduction of low-polluting vehicles. National and local governments are taking the initiative in introducing NGVs and establishing green distribution systems and subsidies. Osaka Gas’ aggressive efforts to introduce more natural gas vehicles make it an integral part of this movement.

Japan’s Goals for Promoting NGVs

A goal of one million NGVs in Japan by 2010 was established in the Goals for Alternative Energy Sources at both the METI Resources and Energy Meeting (June 2001) and at a Cabinet meeting (March 2002).

NGV Use in the Kansai Region (cumulative total)

NGV Use in Japan (cumulative total)
5. Eco-Design for Household Equipment

Eco-Design Concept

In FY1995, Osaka Gas, Tokyo Gas and Toho Gas began working on eco-design with the aim of creating environmentally friendly gas equipment.

We published the Eco Design Manual in 1995; sponsored the Eco Design Contest from FY1995 to FY1997; then included eco-design elements in the commercialization standard check sheet in FY1999; and revised these check sheets in FY2000 and FY2001 to reflect laws relating to effective use of resources (Law for Promotion of Effective Utilization of Resources).

These efforts have enabled us to reduce the size and weight of household gas equipment as well as to increase the rate at which we reuse and recycle equipment and parts.

Making Gas Equipment Smaller

An example of smaller gas equipment is the Osaka Gas “Kawakku” bathroom heater/dryer. Our current ceiling and wall units are just half the size with the same performance level compared to 1995 models.

We are also continuously working toward the reduction in size and weight of hot water heaters and other equipment.

Downsizing of Gas Equipment

Reusing Speakers from Gas Leak Alarms

In January 2002, Osaka Gas began reusing the speakers from its gas leak alarms, the first time that household equipment parts have been used as parts for new products in Japan. We remove speakers from alarms after their 5-year warranty has expired, then we submit them to rigorous testing and reuse only those with performance equal to new speakers.

In FY2002, we reused about 200,000 speakers (approximately 3 tons) in about 40% of our new gas leak alarms.

This achievement earned Osaka Gas the METI Minister Prize from the Reduce, Reuse, Recycle Promotion Association sponsored by eight ministries including METI.

Reusing Gas Meters

After gas meters used to measure our customers’ gas consumption have passed their expiration date, they are repaired and inspected at the plant and their aluminium diecast casing is reused. Not only does this save 2,000 tons of aluminium annually, it also saves 40 million kWh of electricity, the amount required to refine this much aluminium.

40 million kWh is equivalent to the annual electricity used by 10,000 average households. Osaka Gas has employed these reusable gas meters since 1976.

Reducing Packaging by Shrink Wrap

Product packaging accounts for a significant amount of garbage. In 2000, Osaka Gas began using shrink wrap for gas equipment to reduce the amount of packaging. Shrink wrap uses 60% fewer resources than conventional packaging such as cardboard.

Osaka Gas is expanding the use of shrink wrap to make delivery and freight handling easier and more resource efficient.
In FY1977, Osaka Gas and its service chains established a system for collecting and recycling used gas equipment and other items when a new product is delivered. We also collect and recycle the Styrofoam used as packing material. From FY2001, we began collecting and recycling cardboard used as packing material for gas equipment.

As a member of an appliance recycling system set up by Matsushita Electric Industrial Co., Ltd. and other companies, Osaka Gas adheres to the Home Appliances Recycling Law, which covers household gas air conditioners.

In FY2002, we achieved a 75% recycling rate for gas air conditioners, well above the regulated goal of 60%.

The Home Appliances Recycling Law

Recycling of specified home appliances

<table>
<thead>
<tr>
<th>Item</th>
<th>FY2001</th>
<th>FY2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Number recovered at designated stations</td>
<td>3,726</td>
<td>4,931</td>
</tr>
<tr>
<td>2. Number treated for recycling</td>
<td>3,791</td>
<td>4,920</td>
</tr>
<tr>
<td>3. Weighted treated for recycling</td>
<td>172 t</td>
<td>224 t</td>
</tr>
<tr>
<td>4. Weighted recycled</td>
<td>129 t</td>
<td>169 t</td>
</tr>
<tr>
<td>5. Recycling rate (based on weight, (4/3))</td>
<td>75%</td>
<td>75%</td>
</tr>
</tbody>
</table>

Note: The number and the weight treated for recycling represent the total number and weight of discarded specified household appliances undergoing essential treatment for recycling, etc.

Environmental Actions

Collecting and Recycling Lead to 64% Reduction in CO₂ Emissions

The LCA method, which assesses our reusing of and recycling of metal parts through collecting and recycling of used gas equipment, shows that we effectively reduced approximately 3,267 tons (64% recycling rate) of CO₂ annually.

See page 14 for LCA.

A gas absorption-type cooler/heater (chiller) is an air conditioning system that uses water as a refrigerant, thus eliminating the dangers from ozone-destroying CFCs and HCFCs, and greenhouse gas HFCs. Osaka Gas is working to make these systems more energy efficient and has achieved a COP (coefficient of performance) of 1.35 for commercial products, an improvement of more than 40% over the first products (see page 39).

Superior performance and economy have made absorption-type cooler/heaters increasingly popular, mainly for building air conditioning. In FY2002, we installed equipment with a capacity equivalent to 85,000 RT*, bringing the total to 2.19 million RT. This equipment has resulted in a power consumption peak cut effect equivalent to about 2 million kW.

*RT (refrigerant ton): Amount of heat required to turn 1 ton of water at 0˚C into one ton of ice in 24 hours

1 USRT = 3,024 kcal/h

---

Recovering CFCs, HCFCs and HFCs from Used Gas Room Air Conditioners

Osaka Gas has a complete system for recovering and treating CFCs, HCFCs and HFCs from commercial gas engine heat pump (GHP) air conditioners and household air conditioners.

We participate in an appliance recycling system established by Matsushita Electric Industrial Co., Ltd. and other companies to ensure that we handle CFCs, HCFCs and HFCs in compliance with the Home Appliance Recycling Law.

<table>
<thead>
<tr>
<th>Total Weight of Refrigerant Fluorocarbons Recovered</th>
<th>FY2001</th>
<th>1,692 kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY2002</td>
<td>2,613 kg</td>
<td></td>
</tr>
</tbody>
</table>

---

Route of Recovery and Treatment of Fluorocarbons from Commercial GHP and Household Air Conditioners

Customers -> On-site recovery of Fluorocarbons -> Transportation -> Temporary Storage at Maintenance Service Company

Destruction of Fluorocarbons -> Collection and Transportation

---

NEXT 21-Experimental Housing Complex Where People Meet Nature

Osaka Gas’ experimental housing complex, NEXT 21, is built on the concept of a healthy urban lifestyle that brings people and nature together. The complex was built in 1993 as an experiment in creating energy-efficient, environmentally friendly lifestyles for people in crowded urban settings.

Housing 16 Osaka Gas’ families, NEXT 21 is environmentally and energy conscious, featuring a garden with native plants and birds, a design adapted to residents’ lifestyles, fuel cell power generation, and garbage and wastewater treatment facilities. NEXT 21 represents the future of urban planning, housing construction, energy efficiency and environmental harmony.

Aqua-Loop Garbage and Wastewater Treatment System

NEXT 21 has its own facilities for treating garbage and wastewater. After microorganisms purify wastewater, the resulting sludge, along with garbage from the housing complex, is decomposed into water, CO₂ and nitrogen using an Osaka Gas developed catalyst technology. The water is then used to flush toilets and water plants, thus lessening sewage disposal and tap water consumption.

Greener Living

NEXT 21’s 1,012 m² of rooftop and terraces with trees, plants, and flowers harmonizes with the nearby green spaces of Osaka Castle Park. Since April 2000, residents have been responsible for managing the gardens as part of efforts to encourage people to find ways of making the housing complex greener.
Osaka Gas has been striving to achieve enhancement of the environment within regional, domestic and international communities in which we conduct our business activities. We promote and disseminate environmental technologies developed by our own company and subsequently transmit such technologies overseas, which contributes to environmental enhancement within those international communities.

Furthermore, we promote a wide range of new technological developments, such as the resource recycling technologies, waste material processing technologies, bio-related technologies and reforestation technologies, so that we can make a contribution in various environmental fields. Moreover, in our efforts to be personally involved in environmental issues, we participate in environmental activities and community activities within the local communities in which our operational offices are located.
Contribution to Environmental Improvement Locally, Nationally and Overseas

1. Reduction of the Environmental Impact in Regional, Domestic and International Communities

Domestic Activities

Energy Service Company (ESCO) Business

The "ESCO Business," which is positioned as one of our national strategies for energy conservation, provides buildings and factories with total energy conservation services. In recent years, not only private enterprises, but also local governments have been actively introducing such services.

The content of the ESCO business ranges from the evaluation of energy efficiency and the creation of energy conservation plans to the design, installation, maintenance and management of energy conservation facilities. Osaka Gas utilizes its accumulated technologies and expertise, and operates ESCO business in cooperation with its affiliated company, Gas and Power Investment Co., Ltd.

Circumstances Bearing on ESCO Operations

- Deregulation of Energy Businesses
- Amendment of the Energy Saving Law
- Law for Promotion of Measures against Global Warming
- PFI (Private Finance Initiative) Law

ESCO Operations

Gas and Power Investment Co., Ltd. started ESCO operations with the Osaka Medical Center and Research Institute for Maternal and Child Health in April, 2002. The primary energy conservation strategies at this site are as follows:

1. Introduction of a high-efficiency gas co-generation system (730 kW, power generation efficiency 38%)
2. Introduction of a high-efficiency gas absorption-type cooler/heater (COP=1.4)
3. Introduction of the inverter controller to control the pump and fan for the cooler/heater
4. Introduction of a three-stage-adjusting inverter ballast for lighting and bright guide light

We achieved the utility reduction goal for FY2002 of 76 million yen, including electricity, heat and water in February 2003, before the end of FY, by implementing these methods.

This was the very first ESCO business to be implemented in Japan with the cooperation of local government, and in the shared savings approach in which the energy conservation service provider owns the related facilities. The new operational approach, as well as its energy conservation effects, has attracted the public’s attention through media coverage. In the future, Gas and Power Investment Co., Ltd. is planning to expand the ESCO business through the shared savings approach.

District Heating and Cooling (DHC) Business

Osaka Gas Group has been operating its DHC business at 19 locations within the Kansai Area. The DHC system is operated based on the establishment of one regional energy center per region, where we manufacture chilled/heated water and steam that are transported through pipes to be used for air conditioning and hot water supply.

The energy center utilizes energy-efficient systems, for example, it operates a large-scale natural gas co-generation system and garbage incineration facilities, from which it utilizes waste heat. In this way, Osaka Gas promotes energy conservation within regional areas, reduces CO2 emissions and eventually contributes to the prevention of global warming.

Osaka Gas Group seeks to reduce its environmental impact throughout society, and promotes strategies for energy conservation at each of our energy centers.
Promotion and Dissemination of an OG-type Wet Catalyst Oxidation Process

We are developing a technology that cleans industrial wastewater and sludge to the same purity level as tap water, utilizing the catalyst technologies that Osaka Gas has accumulated.

This technology has been introduced not only to various industrial facilities within the country, but also to Kunming, China. Furthermore, this technology was useful in the kitchen scraps/wastewater processing system, and is expected to be used for high-rise condominiums.

Examples of Introduction of Environmental Technologies (Excluding Gas Business)

<table>
<thead>
<tr>
<th>Technology</th>
<th>General description</th>
<th>FY</th>
<th>Client</th>
<th>Technology</th>
<th>General description</th>
<th>FY</th>
<th>Client</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste hydrochloric acid recycling</td>
<td>Recovery and reduction of waste hydrochloric acid (in combination with gas co-generation system)</td>
<td>1997</td>
<td>Kakoku Steel Wire Co., Ltd.</td>
<td>Sewage sludge melting technology</td>
<td>Sludge is fused by the coke bed method, recovered and recycled as harmless slag</td>
<td>1985</td>
<td>Osaka Prefectural Government</td>
</tr>
<tr>
<td>technology</td>
<td></td>
<td>1999</td>
<td>Tesac Corporation</td>
<td></td>
<td></td>
<td>1989</td>
<td>Japan Sewage Works Agency</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1999</td>
<td>Sunrock Oyodo Co., Ltd.</td>
<td></td>
<td></td>
<td>1990</td>
<td>Osaka Prefectural Government</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2000</td>
<td>Nichia Steel Co., Ltd.</td>
<td></td>
<td></td>
<td>1993</td>
<td>Japan Sewage Works Agency</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1992</td>
<td>NEXXT21 (Osaka Gas)</td>
<td></td>
<td></td>
<td>1999</td>
<td>Osaka Prefectural Government</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2000</td>
<td>Nichia Steel Co., Ltd.</td>
<td></td>
<td></td>
<td>2000</td>
<td>Japan Sewage Works Agency</td>
</tr>
</tbody>
</table>

Interview with a developer of the dioxin absorption filter that utilizes active carbon fiber

Q. Would you tell me the history leading up to development?
A. Approximately 90% of dioxin generated in Japan is contained within emissions produced through the incineration of garbage. However, the development of strategic technologies which would be useful for medium- or small-sized garbage incineration sites account for 95% of all registered waste incineration sites, has lagged behind. Thus, we processed a type of active carbon fiber (ACF) made out of pitch to create an ACF sheet of unwoven fabric. We initiated the development of a dioxin-removal device by combining this sheet with a bug filter.

Q. What are the effects of the active carbon fiber (ACF) and its prospects for future development?
A. In basic experimentation using gas emissions from an incinerator, we confirmed that sheer ACF as thin as 10 mm can absorb and remove more than 99% of dioxin from the emissions. Furthermore, during the course of experimentation, we found the order with which dioxin isomers are adsorbed, and we also found that the isomers, which are more harmful to humans, are the first to be adsorbed by the ACF. These findings were previously unknown. Subsequently, with a manufacturer, we co-developed a compact removal device that integrates the adsorption tower and the bug filter, and conducted a performance test. We confirmed that the device performed in removing dioxin from the concentrate at a level far lower than the regulated value. The device has been on the market since April, 2002, and has been evaluated highly by our customers. We will continuously improve the device, and we will further promote and distribute it.

International Activities

China

Technology Transfer of the OG-type Wet Catalyst Oxidation Process to the Kunming Yunnan Advanced Environmental Conservation Processing Company (YHC)

With the growth of industry, the problem of environmental pollution has become increasingly serious in China in recent years. Therefore, environmental conservation awareness has been heightened, and consequently nationwide strategies directed towards conservation have been proceeding.

Osaka Gas has been promoting the technology transfer of a compact highly efficient wastewater treatment system—the OG-type Wet Catalyst Oxidation Process—to China. This system is already in operation. In 1997, we introduced a compact experimental device, and we successfully completed wastewater treatment tests for various types of industrial wastewater.

Subsequently, we offered financial and technical assistance for the construction of a plant, and we completed a facility capable of processing 20m³/day in March 2001. Thereafter, we conducted processing tests to examine the system’s performance relative to processing various kinds of heavily polluted wastewater, and we confirmed that its processing performance met the highest quality levels. With these high technological and economic evaluations, we started operations in 2002. We also plan to complete Plant No.1, which processes heavily polluted wastewater produced by an oil company, in 2003.
Northern Taiwan  Participation in LNG Terminal Project

For the purpose of accommodating environmental conservation and economic growth, Taiwan has a national policy to promote the utilization of natural gas.

However, at present, Taiwan has only one terminal that is capable of receiving LNG—the Youngang Terminal (Chinese Petroleum Company). With only one station, it will be very difficult to meet future increases in demand, and to transport gas to the north, where the demand is concentrated, will be risky. Therefore, we initiated a project to construct a new LNG terminal in North Taiwan (Taoyuan Province). When the station is completed, the stable supply of natural gas for electric power generation and gas to the northern region will be possible.

Osaka Gas joined the project, in which we utilize our 30 years of experience in operating terminals for receiving LNG. Our involvement includes financial assistance to Tung Ting Gas Corporation, the corporation in charge of promoting the project, along with project management focused on technical assistance. These efforts will contribute to the success of the project.

Planned construction site

Indonesia  Development of VAM Fungi Application Technology

VAM fungi is a bacteria that symbiotically lives in plant roots, absorbs nutrition and water from the soil, and then provides this to the plants, thereby enabling plant growth. In tropical areas, the burning of fields and over-grazing produces low-productive, acid-baren land (devastated land) over vast areas. On this kind of land, trees planted for forestation do not grow well, and in many cases, they do not settle. Thus, we have been working on the Implementation Project of Forestation Technology for Tropical Devastated Land, which is an environmental conservation project utilizing VAM fungi (in cooperation with the Indonesian Government from 1998).

So far, we have conducted on-site evaluations over 18 hectares at eight locations. We have confirmed the effects of VAM fungi; more specifically, the initial growth of acacia and eucalyptus was tripled, and the settlement rate after planting was doubled. Furthermore, we developed a technology, which mass-produces VAM fungi that is suitable for the region.

Scene of the on-site evaluation test  Growth promoting effect by VAM fungi for Acacia
Left: With VAM fungi  Right: Not with VAM fungi

Philippines  Investigation Regarding the Development of Natural Gas for Industrial Purposes

Through our affiliated company, Osaka Gas Engineering Co., Ltd., Osaka Gas conducted a feasibility study on the Bataan LNG Terminal and Pipeline Project (Philippines) in cooperation with Nippon Steel Corporation and Marubeni Corporation.

Then, we submitted a report upon completion of the investigation. This is a project sponsored by the Japan External Trade Organization (JETRO) for the Ministry of Energy of the Philippine Government and an oil exploration company, PNOC-EC.

The Philippines has established a long-term gas plan, with assistance from our company, based on the utilization of domestically produced natural gas, which began in 2001. In pursuing the new plan, we confirmed the effectiveness of combining LNG imports with a long-term perspective. Promotion of the utilization of the gas itself is expected to contribute to the improvement of air pollution and the global environment. Furthermore, in the investigation conducted this time, environmental impact evaluations related to the project have been conducted with the help of local consultants. The evaluations are based around newly established Japan Bank for International Cooperation (J BIC) guidelines and local environmental laws.

Macau  Investigation Regarding LNG Terminal

Through Osaka Gas Engineering Co., Ltd., Osaka Gas conducted a feasibility study on an LNG terminal in Macau, and then completed a report. We believe the shift from the use of petroleum to natural gas will contribute to the improvement of the local and global environment.

Australia  Forestation Project

Osaka Gas has been involved in a 30-year forestation project since 2001, which aims at planting 1,000 hectares of eucalyptus trees in Australia. We started this project in cooperation with Mitsui & Co., Ltd. through the establishment of a local corporation, Eco Tree Farm Pty. Ltd.

This project is the first of its kind by a Japanese gas company. Although the main purpose of the forestation project is to obtain raw material for paper, forests also remove CO2, which preserves forest resources and suppresses global warming.

Forested eucalyptus tree
2. Development of New Technologies Other Than Gas Appliances and Systems

**Development of a Hydrogen Supply Station for Automobiles (Natural Gas Reforming Type)**

The practical use of a clean fuel-cell automobile has been keenly sought after. Osaka Gas participated in a national project seeking to develop facilities for supplying hydrogen—the fuel for this type of automobile. We also constructed the first experimental facilities in Japan for a hydrogen supply station (with 10% of the manufacturing capability of an actual full-scale station) in 2002.

The station utilizes natural gas as a raw material, and refines it to produce hydrogen. Furthermore, the system for storing and filling hydrogen utilizes two methods: one is to use hydrogen-adsorbing alloy, and another is to use compressed hydrogen.

In FY2002, we conducted a working test of these facilities to evaluate performance and reliability, and we also undertook research on the miniaturization and cost reduction of the hydrogen production device.

![Hydrogen supply station](image1)

![New compact hydrogen production device](image2)

**Development of New Hydrogen-Adsorbing-Material through the Application of Nanotechnology**

Although hydrogen has been recognized as a clean energy type for the next generation, it also has problems related to effective storage and transportation.

As a new material that could potentially solve these problems, Osaka Gas selected Carbon Nano Tubes (CNTs), which are a type of nanotechnology. In 2002, we successfully developed wholly innovative type of CNTs.

We utilized our unique technology for synthesizing carbon materials in the development. The walls of conventional CNTs are structured with graphite (crystals in which carbon molecules connected on a plane are laminated), while our new CNTs are structured with amorphous materials (non-crystal materials).

Presently, we have obtained CNTs, which possess a hydrogen-adsorbing capability greater than a 3-weight percentage (under room temperature and a hydrogen pressure of 10 Mpa). This hydrogen-adsorbing capability is greater than that of the hydrogen-adsorbing alloy.

**Newly Developed Carbon Nano Tubes (CNTs)**

![Newly developed CNTs](image3)

![Conventional CNTs (Highly crystalline)](image4)

This technology is expected to promote the efficient storage and transportation of hydrogen, and it will contribute to the greater use of hydrogen utilization. Osaka Gas will continuously improve hydrogen-adsorbing capability.

**Development of Natural-Gas Storage Technology Utilizing New Adsorbing Materials**

To utilize and promote natural gas, a national project for the development of new storage technology was initiated in 1998, and then it was implemented in a five-year plan.

Among other things, Osaka Gas has been promoting the development of new materials (methane-adsorbent materials, etc.) with a storage capacity several times greater than that of conventional compressed natural gas. Gas holders and systems for operating natural-gas vehicles utilize these new materials. We have already succeeded in developing a new adsorbing material for automobiles with a storage capacity at an atmospheric pressure of 35, which is 6 times greater than that of compressed gas. When the newly developed material is utilized in a natural gas operated, 2-ton truck, the conceptual design shows that its calculated mileage performance is 1.6 times better than that of compressed gas.

![A new adsorbing material for automobiles (formed)](image5)

![Pilot-scale device (installed in Senboku Terminal)](image6)
Development of Ultra-High Temperature Methane Fermentation Technology

The merits of methane fermentation technology for kitchen waste have been recognized for the provision of recycling resources and energy. However, most of these technologies, which are currently drawing attention in Japan, were developed in Europe. They are problematic in that they have a low decomposition ratio and high wastewater processing costs when applied for Japan.

Therefore, Osaka Gas, in cooperation with JFE Engineering, Inc., has been promoting the development of Ultra-High Temperature Methane Fermentation Technology—conceived in Japan and adapted to its own waste—which utilizes ultra-high temperature anaerobic solubilizing bacteria from hot springs.

When this technology is realized, the residue generated will be reduced to approximately one third of the present level, and wastewater processing costs will be reduced to half compared to European technologies. This should help to promote the use of methane fermentation facilities in Japan.

Development of Technology for Waste Conversion and Biomass into Fuel Gases Utilizing Supercritical Water

Osaka Gas has been promoting the development of a series of technologies for creating supercritical water by applying a high temperature of 374°C and a pressure of more than 22.1 MPa. The water is changed to a state where it is neither water nor steam, then the resulting supercritical water is utilized to decompose organic waste, which is difficult to decompose under room temperature and atmospheric pressure. The end result is the production of methane and hydrogen.

Because such supercritical water reacts easily and reaches a high temperature, it can quickly decompose organic waste, which facilitates reactions for generating gases. By utilizing supercritical water, it is also possible to obtain fuel gases such as methane and hydrogen from organic waste, such as agricultural and forest waste, sludge, city waste and unused biomass. In other words, two goals can be simultaneously obtained: the processing of waste, and the utilization of previously unused energy. In developing this technology series, we utilized wet catalyst oxidation processing technology and SNG (Substituted Natural Gas) producing technology.

Development of Co-generation Technology Utilizing Biogas

Biogas and refined gas generated from waste originate from food processing plants, sewage treatment plants, kitchen scraps/city waste processing facilities and livestock fecaluria processing facilities. Osaka Gas has been promoting the development of biogas co-generation system technology, which efficiently converts these gases into electrical energy. Currently, 5,700 kW of converted electrical energy has been already adopted (6 units used at 5 locations), and operated in good condition.

This system utilizes a gas engine made by J enbacher Corporation, and it has a generating efficiency of 37%, which is equivalent to a power plant. By efficiently utilizing waste heat for increasing the temperature of the biogas-generating device and for buildings’ air conditioning, the system’s overall efficiency can be increased to a level close to 80%.

Osaka Gas contributes to the construction of a circulating society in which energy and materials are circulated without being wasted through its comprehensive range of services, from the creation of plans for new introductions through engineering, including gas refining and maintenance.

Development of Technology for Fusing Sewage Sludge/City Waste Incineration Ash

Although ash generated by incineration at wastewater treatment plants and city waste processing facilities is often processed by means of a final disposal method (landfill), there are not enough final disposal sites, and the ash, which contains harmful substances, is problematic. Therefore, Osaka Gas is developing a technology for melting the incinerated ash, reducing its volume and eventually rendering the ash innocuous.

Osaka Gas has already completed a fusing furnace, heated by gas, which is capable of melting 2 tons of sludge incineration ash per day. We are repeating pilot operations, which are in the process of optimizing temperature distribution within the furnace, improving furnace efficiency and conserving energy.

The slag resulting from melting the incinerated ash is reduced to one half or one third of the original volume of the incinerated ash, which extends the life of the final disposal sites. Furthermore, dioxins and heavy metals are detoxified, and they can be efficiently used as clean civil engineering and construction materials.

Recycling Technology for Waste Plastic

With the enactment of the Containers and Packing Recycling Act, corporations are striving for Zero Emissions, which is necessary for a society where energy and materials are recycled. However, in many cases, plastic products are mixtures or complex resins, which makes it difficult to dispose of them separately. Moreover, when incinerated, they are likely to cause dioxin problems.

Under these circumstances, Osaka Gas, in cooperation with a boilermaker, is developing a system that aims at recovering energy from plastic products without generating any harmful substances. This system retrieves heat-decomposed gas from plastic products, mixes the retrieved gas with natural gas, and then burns the mixture, which eventually recovers steam efficiently. Furthermore, the amount of dioxins generated is reduced to less than 1/17,000 of the regulated value.
Our Ideas on Social Performance Reporting

Osaka Gas grows with local communities by supplying homes and businesses with the energy they need. As an energy company, we have a great social responsibility to fulfill providing our customers with a safe, stable supply of energy with reliable services. This report discusses these social aspects of our business activities, some of which are particular to an energy company, along with the other aspects including compliance, human rights, labor health and safety.
Compliance

Establishment and Instilling Understanding of Osaka Gas Group Code of Conduct

The management philosophy common to the Osaka Gas Group is “Value Creation Management,” which seeks to expand three types of value: for customers, for shareholders and for society.

To enhance the idea of value for society, we aim to become a company with an open attitude toward society and with high moral standards. In April 1998, we established the Osaka Gas Code of Conduct and Osaka Gas Affiliates Code of Conduct. Then, in February 2000, we established the Osaka Gas Group Code of Conduct consisting of 14 items such as human rights and product safety assurance. This code integrates and applies the guidelines.

The code applies to all officers and employees, including those of affiliated companies. Full penetration of the conduct within the group has been facilitated through distribution of booklets, an in-house magazine, in-house video news as well as by training.

Establishing an Organization for Compliance

To further implant the Corporate Action Standards, Osaka Gas set up a Compliance Committee and appointed Compliance Promoters for each workplace in April 2003.

The Compliance Department was also set up to oversee all compliance activities.

Information Disclosure

Osaka Gas actively works to make information available following internal rules relating to this disclosure.

We use a number of media and tools, including the internet, to efficiently supply customers, shareholders, the local community and other stakeholders with appropriate information such as management policies, targets and financial data.

Osaka Gas aims to be a leader in information disclosure and accountability.

Protection of Customer Information

With the rapid development of information technology and the spread of the internet, protecting customer information is more important than ever before.


These documents establish a system of responsibility for managing customer information that we acquire in our day-to-day business, and they define the conditions for using and releasing such information. In this way, we protect personal information.
Establishing a Stable LNG Supply System

Osaka Gas currently imports about six million tons of LNG (liquefied natural gas) per year, which is the source of natural gas distributed to its customers. To ensure a stable supply from diversified sources, we have long-term contracts with six nations, including Qatar and Oman, with whom trade began in recent years.

As part of our efforts to strengthen our position upstream of the natural gas chain, we are working to acquire concession rights in natural gas fields and ownership of LNG tankers.

For our gas field interests, we have a stake in a producing gas field in Indonesia and equity shareholding in some Australian fields under development.

As for LNG tankers, unlike the conventional practice of sellers to arrange LNG transportation, Osaka Gas jointly owns 3 LNG carriers with other companies and another one under construction. This is to ensure greater buying flexibility in LNG transportation.

Constructing Gas Pipelines to Meet Demand

Osaka Gas is constructing an efficient gas pipeline network following supply plans based on medium- to long-term demand forecasts.

We are installing high-pressure gas pipelines to meet growing demand in the Himeji and Shiga districts. These pipelines are the new Himeji Line, Keiji Line (to be completed in FY2003) and Shiga Line (work to start in FY2003). Medium- and low-pressure pipelines, forming a loop for stable supply, provide a network closely tuned to local demand.

Whenever Osaka Gas installs a pipeline, it seeks to protect the local environment and to keep costs down. To reduce road and soil excavation, we use new processes including trenchless and shallow pipe laying methods.

Safety Activities at LNG Terminals

LNG is transformed to regasified natural gas at LNG receiving terminals. We take actions to minimize damage from disasters, which are centered on prevention, early detection and containment of damages.

1. Prevention measures

Osaka Gas works to prevent gas leaks in the event of earthquakes or other disasters by designing and building LNG facilities to withstand these disasters. We verified the seismic-resistance of those facilities at the time of the Great Hanshin-Awaji Earthquake of 1995.

2. Early detection measures

Cryogenic and flame detectors are installed in pipes at unloading berths, LNG tanks and gas pipelines to assure that any gas leaks are detected as early as possible. If a gas leak occurs, a central control room, which is able to remotely monitor the situation with TV cameras, detects it immediately.

3. Containment measures

Osaka Gas uses water curtain systems and powdered fire extinguishers at berths in the case of a ship fire. To prevent LNG tank leaks from spreading, we have water curtain systems, cooling sprinklers and dikes outfitted with high-expansion foam generators to contain leaked LNG.

4. Three-part safety measures

Osaka Gas is striving for the complete implementation of computer systems to run and monitor facilities, and it is providing training to the operators who oversee them. Operators will monitor equipment around the clock to predict and detect problems early. Furthermore, Osaka Gas offers training programs within terminals so that staff members respond appropriately in the event of a disaster. In addition, it regularly provides firefighting training with neighboring businesses to ensure a high level of safety. These efforts support the safety of production facilities and operations, and they consist of three parts: facilities, systems and people.
Ensuring Safety of Gas Transmission and Distribution

Osaka Gas delivers natural gas from its LNG terminals to its customers through approximately 54,000 kilometers of gas pipelines.

To transfer gas safely and stably, it is essential to create a security system that anticipates all situations, and also to devise and improve pipes with the hardware and software approaches.

Osaka Gas’ security system operates around the clock throughout the year, and the company manages its service area in an integrated way so that security is ensured company-wide, which is the role of the headquarters office’s central distribution control center. Additionally, district security command rooms can dispatch personnel to sites any time from 48 security depots within our service area.

We have a variety of gas pipes made of highly seismic-resistant materials. All newly installed low-pressure pipes, for example, are polyethylene (PE) pipes, which were not damaged in the Great Hanshin-Awaji Earthquake. As older pipes age, we replace them with seismic-resistant pipes.

To maintain a higher level of security, we regularly inspect supply equipment such as pipes, pressure governors and valves for gas leaks, which we maintain and diagnose for problems. Additionally, when a third party is undertaking construction work near our pipelines, we confer with them on security issues and meet them on-site to check security issues.

Safety Measures at Customer Sites

Osaka Gas provides microcomputer-controlled meters, gas appliances with safety devices and gas leak detectors to residential customers so they can use gas safely. In the event of a gas leak, the microcomputer-controlled meter shuts off the gas, and then a warning lamp and buzzer notify the user of a problem. Additionally, we also attach safety devices to gas appliances. This gas equipment safety system provides efficient safety measures.

Moreover, we visit customer homes every 3 years to check the safety of gas equipment.

Earthquake Preparedness and Training

Osaka Gas has established and implemented a five-year earthquake preparedness plan based on our experience of the Great Hanshin-Awaji Earthquake. However, even after we completed the plan, we continued to seek more effective and efficient earthquake countermeasures.

In November 2002, about 800 individuals took part in a company training that assumed a magnitude 8.4 earthquake in a Wakayama bay. This practical training used previously reinforced or newly built facilities, systems and manuals, of which we were able to confirm the effectiveness.

Osaka Gas will continue to strengthen and improve its earthquake countermeasures.

Hello Service (Osaka Gas service for billing, repairs and other services)

Osaka Gas has operated Hello Service since 1987 to assure customers about the use of gas and gas equipment. This service responds to a range of inquiries and requests, for example, billing and repairs, besides urgent safety situations.* We clearly identify when the inquiry or request was received, and we determine when staff members will respond to it.

In addition, Osaka Gas has built the Hello Network, a computer network to support our services, which is incorporated in our information system that includes service chains (agents).

We send customer requests and inquiries received by our general call centers to the appropriate personnel through the Hello Network, which speeds up the response process. In August 2000, we made the telephone service toll free, a first among suppliers of electricity or gas.

Finally, we use customer contact to make fundamental work improvements with our C-Voice system.

Service Chain System, “Hello Service” and Activity Content

*Emergency situations: Our head office or a district safety command office deals with these situations
Visiting USJ with people in wheelchair
Walk trolley with lots of participants

To be a good corporate citizen, Osaka Gas’ local office and LNG terminals and Osaka Gas Group employees undertake two types of activities: those that contribute to the local community (community activities), and those that promote dialogue with the local communities and with customers (community public relations and opinion forums).

Community activities include participation in local festivals, exchanges with senior citizens homes and the provision of a school for the disabled.

Community public relations activities include the hosting of citizen forums to get feedback related to our business, to invite citizens to Osaka Gas’ facilities and to visit government offices, consumer and women’s aid and health promotion for the elderly.

Established in 1985 to celebrate our 80th anniversary, this foundation is our way of thanking customers in the 6 prefectures of the Kansai area by contributing to a long, healthy and fulfilling life for Japan’s elderly.

The foundation is committed to improving the life of senior citizens through various support activities, aid for research and surveys, and the establishment of regular health-improvement activities in local communities.

Educational Assistance for Children in Countries that Produce Natural Gas

After completing the conversion to natural gas, Osaka Gas established the Foundation of International Cultural Exchange in 1992 to help develop relationships with countries that produce natural gas.

Aimed at educational institutions from elementary school to university, the foundation’s programs include the following:

1. financial aid for educational equipment,
2. aid for research into natural gas and environmental technology,
3. scholarships for high school and university students and
4. aid for training of engineers and researchers.

Better Citizenship activities represent support for Osaka Gas’ employees involved in volunteer and other community activities.

Started in 1991 with the goal of helping employees live a fulfilling life and contributing to the local community, these activities provide participants with information, funding, facilities and time off from work.

The Small Light Campaign

Started in the International Year of the Disabled (1981), the Small Light Campaign is an Osaka Gas volunteer program. Operated from the Osaka Gas head office, the program runs a wide range of activities including afternoon concerts, charity donation collecting, sign language and Braille classes and community clean-ups. These activities are funded by proceeds from bazaars and donations organized by Osaka Gas’ employees.
Environmental Education for Elementary and High School Students
Gas Science Museum, etc.

Examples

1. Field Trips for Elementary and Junior High School Students

   Osaka Gas opened its Gas Science Museum (at the Senboku Terminal) and the Gas Energy Hall (at the Himeji Terminal) for school field trips.

   Elementary and high school students learn about energy (natural gas) and environmental issues through hands-on exhibits, films and bus tours of Osaka Gas’ LNG terminals.

   Students try a hands-on exhibit

2. Gas Science Museum Extension Service

   Offering Environmental Classes at Elementary and Junior High Schools

   Osaka Gas’ employees visit schools whose students cannot get to the museums. Using education booklets, they give lectures and scientific demonstrations of phenomena such as gas liquefaction. We visited 47 schools in FY2002.

   On December 13, 2002, employees visited fifth grade students at Kyoto Municipal Katsura Higashi Elementary School to teach students about the environment. They also taught students about the environmental benefits of natural gas with the help of Eco Truck Co. Ltd., a transport company that uses only natural gas-powered trucks. The stimulating class generated many questions from the students.

   These outreach classes marked the first of a series of Environmental Learning Classes for Elementary School Students sponsored by the Kyoto Chamber of Commerce and Industry. The Chamber sends technical staff from its member companies to raise students’ interest in science and the environment.

   Osaka Gas energy and environmental education booklets
   Gas Science Museum

3. Internet School

   At Osaka Gas’ online school, students can learn about energy and environment before and after visiting the Gas Science Museum, which broadens their knowledge.

   In FY2002, 62 elementary schools used this online learning tool.

   Website (Japanese only)
   http://www.osakagas.co.jp/inpaku/

4. Environmental Education at Junior and Senior High Schools

   At the request of teachers at junior and senior high schools, Osaka Gas has been assisting with environmental education during integrated studies classes since 2000.

   These 90-/120-minute classes focus on topics such as environmental issues, measures to prevent global warming, energy issues, effective use of energy and actions to prevent global warming.

   Osaka Gas held such classes at 5 junior high schools and 3 high schools in FY2002 and a total of 690 students participated in the classes.

   Environmental education at junior high-school
Osaka Gas believes that it must do more than just reduce its impact on the environment; it must also ensure that each and every employee constantly improves the environment as part of the local community. This is exactly what our Everyone’s Environmental Effort Campaign is all about: getting employees out of the workplace and out into the community to work with locals on preserving the environment. Both Osaka Gas and individual company offices undertake activities including nature walks and clean-ups.

Company-wide “Everyone’s Environmental Effort Campaign”

Examples

1. Environment Events
   Nature walks and environment seminars give people a deeper understanding of the environment and ecosystems.

<table>
<thead>
<tr>
<th>Month</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jul.</td>
<td>Let’s Learn About the Forest (Takatsuki City)</td>
</tr>
<tr>
<td>Dec.</td>
<td>Let’s Learn About Ecosystems in Nara Park (Nara City)</td>
</tr>
</tbody>
</table>

Learning about ecosystems in Nara Park

2. Eco-Cooking Classes
   In July 2002 and January 2003, Osaka Gas held eco-cooking classes in Yodoyabashi, Osaka. Both sessions saw 40 participants from nearby companies learn to be more environmentally aware in daily life and to meet other people.

Eco-cooking class

3. Clean-Up Activities
   Every year, Osaka Gas employees go to a different part of the Kansai area to clear waste and to contribute to a cleaner city.
   In FY2002, a total of 180 employees cleaned the three main streets of Midosuji, Yotsubashisuji and Naniwasuji in Osaka.

Clean-up Osaka

Osaka Gas’ Bases Take Part in Local Environmental Activities

Examples

1. Research and Development Division
   At the Summer Evening Festival in Konohana-ku, Osaka, August 2002, the Research and Development Division of Osaka Gas sold organic vegetables such as eggplants, tomatoes and cucumbers, which it grew using VAM fungi technology. The profits were donated to the Little Lantern program.

VAM fungi: A kind of fungi that absorbs minerals and water from the soil, and then supplies them to plants to help them grow better (See related article on page 51)

2. Hyogo Business Headquarters in Environment Festival
   On October 12 and 13, 2002, Osaka Gas set up a booth at the 14th Environment Festival, sponsored by the Hyogo Environmental Advancement Association and Hyogo Prefecture and held at Hankyu Nishinomiya Stadium in Osaka. Under the theme, “The Future is Here,” Osaka Gas promoted natural gas as an environmentally friendly energy source, and exhibited an actual household gas engine and hot water tank as well as a model of a fuel cell battery. The beautiful weather and various attractions drew 80,000 visitors to the entire event. Many visitors to the Osaka Gas booth expressed interest in the cost and workings of the gas engine, which went on sale in spring 2003.

Osaka Gas booth

3. Clean-up Kyoto
   On June 23, Osaka Gas employees cleaned the Arashiyama area of Kyoto. Blessed with perfect weather, about 400 people broke into nine groups and cleared rubbish on the banks of the Katsura River and around Tenryuu Temple, and finished their walk at the Togetsu Bridge.

Clean-up Kyoto

4. Hokutobu Business Headquarters in Earth Day in Nara
   On April 21, 2002, the square of the Nara Prefecture No. 1 Purification Plant was the site of Earth Day 2002 in Nara. Osaka Gas exhibited a natural-gas-powered car and displayed panels explaining our environmental efforts.
   2000 locals participated in this worldwide Earth celebration.

   In addition to these, Osaka Gas is working on various community-based environmental conservation activities.
Information Disclosure

Environmental Website

The Osaka Gas website has a link to our environmental efforts. In addition to a wide range of information on Osaka Gas environmental action, the site contains a wealth of information covering natural gas and the environment and ideas for conserving energy. The site also has advanced data that is not included in the 2003 Environmental and Social Action Report.

Environmental website
http://www.osakagas.co.jp/kankyoe/ *Environmental website*

Gas Science Museum and Gas Energy Hall

The Gas Science Museum opened in 1982 at the Senboku Terminal. This is Japan’s first museum dedicated to gas science. The fun-filled Gas Energy Hall opened in 1985 at the Himeji Terminal with a focus on learning about the environment and natural gas. Both facilities are busy throughout the year with visits from people of all ages.

The museum was awarded the incentive award, Osaka Environmental Award, for its 20 years of environmental awareness activities.

<table>
<thead>
<tr>
<th>Number of Visitors</th>
<th>FY2001</th>
<th>FY2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas Science Museum</td>
<td>65,792</td>
<td>71,343</td>
</tr>
<tr>
<td>Gas Energy Hall</td>
<td>25,672</td>
<td>24,033</td>
</tr>
</tbody>
</table>

left: Gas Science Museum
Opened in October 1982 as Japan’s first museum for gas and energy science
Senboku 2 LNG Terminal, 3-1, Takasago, Takaishi-City, Osaka, 592-0001 Japan
Phone: +81-72-268-0071

right: Gas Energy Hall
Various exhibits are presented to enable visitors to enjoy learning about earth, science and energy
Himeji Terminal, 1, Nadahama, Shira stricter, Himeji-City, Hyogo, 672-8524 Japan
Phone: +81-792-46-1908

Participation in Exhibitions and Lectures

Every year, Osaka Gas presents its environmental efforts at seminars and lecture meetings sponsored by academic societies, economic federations and industry groups.

We also inform the general public of our environmental policies position by participating in and sending environmental education specialists to exhibitions such as New Earth 2002 and other environmental events.

DILIPA is a total living showroom where visitors can experience first-hand the latest gas appliances for the household.

Visitors can see how a home can truly match one’s lifestyle by looking at floor plans of kitchens and bathrooms as well as trying out gas systems for floor heating and bathroom heating and clothes drying. There are also fun-filled interactive exhibits for the whole family.

<table>
<thead>
<tr>
<th>Number of Visitors</th>
<th>FY2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>DILIPA</td>
<td>392,629</td>
</tr>
</tbody>
</table>

left: Gas Science Museum
Opened in October 1982 as Japan’s first museum for gas and energy science
Senboku 2 LNG Terminal, 3-1, Takasago, Takaishi-City, Osaka, 592-0001 Japan
Phone: +81-72-268-0071

right: Gas Energy Hall
Various exhibits are presented to enable visitors to enjoy learning about earth, science and energy
Himeji Terminal, 1, Nadahama, Shira stricter, Himeji-City, Hyogo, 672-8524 Japan
Phone: +81-792-46-1908

Environmental and Social Action Report

Osaka Gas has published an Environmental Action Report every year since 1994. Expanded to include reporting on social issues of concern to the general public, this year’s report is titled the 2003 Environmental and Social Action Report.

Since 2001, we have also published a digest version, called the Osaka Gas Eco Note (Japanese version only), summarizing the report highlights.

List of Awards Received

<table>
<thead>
<tr>
<th>FY</th>
<th>Awards</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>Environmental Report Award for Excellent Reporting (sponsored by Toyo Keizai Inc.)</td>
</tr>
<tr>
<td>1999</td>
<td>Environmental Report Award Grand Prix (co-sponsored by the Environmental Agency)</td>
</tr>
<tr>
<td>2001</td>
<td>Environmental Report Award for Excellent Reporting (sponsored by Toyo Keizai Inc.)</td>
</tr>
<tr>
<td>2002</td>
<td>Prize for Excellence in the sixth Environmental Report Award Grand Prix (co-sponsored by the Environmental Agency)</td>
</tr>
</tbody>
</table>

Circulation of the Environmental Report

<table>
<thead>
<tr>
<th>FY</th>
<th>Japanese</th>
<th>English</th>
<th>Digest</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>8,000</td>
<td>2,000</td>
<td>1</td>
</tr>
<tr>
<td>2000</td>
<td>8,500</td>
<td>1,500</td>
<td>1</td>
</tr>
<tr>
<td>2001</td>
<td>7,000</td>
<td>1,500</td>
<td>1</td>
</tr>
<tr>
<td>2002</td>
<td>10,000</td>
<td>1,500</td>
<td>1</td>
</tr>
<tr>
<td>2003</td>
<td>10,000</td>
<td>1,000</td>
<td>1</td>
</tr>
</tbody>
</table>

Meetings with the Kansai Consumer Group Network Committee

As part of Osaka Gas’ community public relations and opinion forums, which aim to gather customer feedback to incorporate into our business, we hold a round table discussion with the Kansai Consumer Group Network Committee.

Both sides discuss a wide range of topics such as business plans, company performance, accident prevention and service. They also participate in lively exchanges regarding environmental issues such as the reduction of greenhouse gases.

The FY2002 meeting took place on September 6th in Osaka Gas head office.
The basic philosophy of Osaka Gas’ personnel system is “Management for Personal Growth.” Work that enables employees to reach their full potential eventually contributes to the dynamism of our company.

Osaka Gas is working to create a personnel system that makes employee’s job environment better by catering to employees’ values and lifestyles through transparent, objective job evaluations as well as benefits.

**Osaka Gas Personnel System**

<table>
<thead>
<tr>
<th>Philosophy of the System</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Emphasize employee results</td>
</tr>
<tr>
<td>2. Let employees make their own decisions</td>
</tr>
<tr>
<td>3. Maintain high level of transparency</td>
</tr>
<tr>
<td>4. Give employees flexibility</td>
</tr>
</tbody>
</table>

**Evaluation and Benefits**

- Evaluation of results
- Evaluation of performance
- Employee evaluation that reflects the job

**Personnel System**

**Personnel Development Holiday System**
Employees can take holidays to do volunteer work or obtain a work-related license for a period of up to 4 years. (Initiated April 2003)

**Child Care Leave System**
Both female and male employees can receive child care leave until the end of the month in which the child turns 3 years old. (Employees may also work reduced hours during this time.)

**Challenge System**
Anyone in the Osaka Gas Group can apply for these study courses.

**OG Venture System**
We accept ideas and offer support for new business ventures.

**Utilization of Personnel System (case)**

<table>
<thead>
<tr>
<th></th>
<th>FY2000</th>
<th>FY2001</th>
<th>FY2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child Care Leave System</td>
<td>41</td>
<td>42</td>
<td>45</td>
</tr>
<tr>
<td>Nursing Care Leave System</td>
<td>6</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Challenge System (number of cases applied)</td>
<td>17</td>
<td>14</td>
<td>45</td>
</tr>
</tbody>
</table>

Osaka Gas System for Fostering Employee Development

**Phase Training**
New employee training
Leader education program (Work report)
Managers education program
Directors education program

**Management Training**
Training for performance evaluators
Training for newly appointed managers
Training for newly appointed executives

**Business leader program**
OG Business School
Riddle management program
Directors program

**Scholarship program**

**Overseas study program**

**Fostering Leaders**

- Challenge seminars (Open to applicants)
- Sunday Business School
- License acquisition
- English proficiency tests
- Correspondence courses

**Self-Awareness Support**

- **Challenge Seminars** (Training open to applicants)
  - 19 courses
  - Total of 197 participants

- **Correspondence courses**
  - Spring session 1,881 classes
  - Autumn session 281 classes

Osaka Gas works to foster employee development by helping our people become professionals who can get the job done and contribute to profits.

To foster the development of people who can think and act on their own, we are building a system that helps employees become career-minded individuals who can make their own choices and take individual responsibility.

We also have programs for quickly and systematically training employees to be the next generation of creative leaders.
Living Up to Our Social Responsibility

Employee Satisfaction at Work

Human Rights Awareness

With increasing concern for human rights around the world, the concept of “human rights” is changing. This is why Osaka Gas is doing everything it can to create an atmosphere in which all employees can understand the scope of human rights from the basic concept to individual issues such as sexual harassment.

Human Rights Awareness System

Osaka Gas has a Human Rights Awareness Center in the Personnel Division, where employees plan and undertake activities for the whole company. Every year in July, the Human Rights Awareness Raising Committee holds meetings at which members decide on basic items for Osaka Gas human rights awareness raising activities. Each of the main Osaka Gas organizations has its own Human Rights Awareness Promotion Committee, which, under the guidance of appointed Human Rights Awareness Promotion Leaders, plans and undertakes activities for its own company department.

Human Rights Awareness Plans for FY2002 (Outline)
1. Reinforce and Enrich Our Human Rights Awareness System
2. Enrich Human Rights Awareness and Education
3. Train and Improve Skills of Human Rights Awareness Promotion Leaders and Others in Charge of Human Rights Matters
4. Gather and Provide Human Rights Information

Human Rights Awareness Raising System

Preventing Sexual Harassment

Osaka Gas is fostering an environment that is free of sexual harassment. To this end, we have established a sexual harassment consultation section in the Personnel Division and similar sections in each Osaka Gas office. Counselors, who work to prevent sexual harassment, or to quickly spot and properly deal with cases of sexual harassment, run these centers.

We also train newly appointed managers, offer sexual harassment education in each workplace using Osaka Gas information videos and we check the effectiveness of our sexual harassment consultation efforts every 6 months.

Participation in Study Sessions

With employees’ awareness and human rights in mind, Osaka Gas undertakes two kinds of study meetings: sessions for all employees sponsored by the Personnel Division, and departmental sessions run by Human Rights Awareness Promotion Leaders.

Training is divided into sessions specially designed for new employees, regular employees, managers and directors.

Education on Human Rights (FY2002)

<table>
<thead>
<tr>
<th>Month</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managements</td>
<td>Apr. 262</td>
</tr>
<tr>
<td>Newly appointed supervisors</td>
<td>Jan., Jul., Dec. 98</td>
</tr>
<tr>
<td>Employees</td>
<td>Oct., Dec., Jan., Feb. 1,202</td>
</tr>
<tr>
<td>Incoming employees</td>
<td>Apr., 82</td>
</tr>
</tbody>
</table>

Hiring

We employ fair and impartial hiring practices, working to match employees’ aptitude and working styles with the job requirements we are looking to fill.

Osaka Gas Employees

<table>
<thead>
<tr>
<th>As of March 31, 2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Employees</td>
</tr>
<tr>
<td>Average Age</td>
</tr>
<tr>
<td>Average Length of Service</td>
</tr>
<tr>
<td>As of April 1, 2003</td>
</tr>
<tr>
<td>Number of New Graduates Hired</td>
</tr>
</tbody>
</table>

Hiring the Mentally and Physically Challenged

Osaka Gas does its utmost to hire the mentally and physically challenged throughout the year. Besides hiring the legal quota, we also work to create an environment conducive to employees’ special needs.

Re-Hiring System

For retirement age employees who wish to continue working, we have a system that allows those who satisfy certain work requirements to continue working part-time until 63 years old.

Creating Equal Employment Opportunities

In the spirit of the Equal Employment Opportunity Law, Osaka Gas has an employment system that advocates equal hiring, benefits, duties and training, regardless of sex. Our childcare leave system, which is open to both male and female employees, is an example of how we are working to change with the times and create a fair and impartial workplace.
Labor Safety and Health

Organization for Control of Safety and Health

Osaka Gas, in cooperation with its affiliates, strives for labor safety and health with the objective of ensuring that employees enjoy a safe and healthy working environment. As well as abiding by laws related to occupational safety and health, Osaka Gas has a number of its own manuals, such as “Labor Safety and Health Control Rules” and “Driving Business Vehicles.”

Our Labor Safety and Health Control Organization manages the creation and implementation of all measures.

Preventing Labor Accidents

Osaka Gas has devised an accident index, a quantified in-house calculation of the degree of labor accidents, which we use to assess the safety level of our offices.

Traffic accidents are an example of labor accidents. With 3,500 company vehicles, one of our top priorities is the prevention and reduction of traffic accidents. To drive a company vehicle, employees must have an internal company driver’s license in addition to a regular driver’s license.

These five-year-renewable internal company driver’s license require employees to take driver skills training and classroom instruction at the internal driving training center. We also have training for employees who have been involved in an accident to ensure that the same thing does not happen again.

Safety and Health

Osaka Gas works to maintain and improve employees’ physical and mental well-being following the Health, Labour and Welfare Ministry “Total Health Promotion Plan” (THP).

Employees aged 35 and older take medical check-ups to ensure that the workplace remains mentally and physically vital. Check-up results are used to assist individuals in the early detection and prevention of diseases.

With the belief that we are responsible for managing our own health, Osaka Gas has programs such as “Walk 10,000 Steps Daily” and health awareness-raising activities focusing on the dangers of smoking and alcohol.

To ensure employees’ mental well-being, we also provide counseling based on the Health, Labour and Welfare Ministry’s “Guidelines for Promoting Mental Health Care in Enterprises.” One of the main responsibilities of company management is helping employees maintain mental health care, which is why all newly appointed managers are required to take training in this area.

Measuring vital functions during a medical check-up
Efforts by Our Affiliated Companies

Environmental conservation-related activities of our affiliated companies

As of the end of March 2003, 76 companies were affiliated with Osaka Gas (of these, 31 are consolidated subsidiaries) in the energy business field, including companies in businesses such as district heating/cooling, gas appliance sales/maintenance, industrial gas manufacturing/sales, LPG imports/sales, power generation/power supply and ESCO.

Furthermore, we have 42 affiliated companies (of these, 25 are consolidated subsidiaries) in the city business field, including companies in businesses such as the development/management/leasing of real estate, building maintenance/office services, restaurants, frozen food production/sales, information processing services, sales of coke/chemical products, manufacturing/sales of carbon fiber, contract research and consulting, sales of residential equipment, leasing of automobile/office equipment and operation/management of sports facilities/nursing homes.

The affiliated companies of Osaka Gas have been focusing on environmental conservation-related activities and businesses as a central pillar in the improvement of their corporate values. Additionally, as stated in this report, our affiliated companies, in cooperation with Osaka Gas, have been promoting environmental conservation-related activities such as Green Purchasing/Green Distribution (See page 32), the recycling of used gas devices (See page 46), regional air-conditioning, the ESCO business (See page 49) and the utilization of cryogenic energy (See page 23).

Energy/water/copier paper amounts used and industrial waste amounts produced by our affiliated companies

As shown in the table below, CO₂ emissions, water use and industrial waste production at our affiliated companies have been on the increase during the past 3 years because of the addition of three new companies and the initiation of their businesses from 2001. If these three companies are excluded, CO₂ emissions, water use and industrial waste production have been steady and have not increased.

The affiliated companies of Osaka Gas have been promoting environmental conservation-related activities and businesses as a central pillar in the improvement of their corporate values. Additionally, as stated in this report, our affiliated companies, in cooperation with Osaka Gas, have been promoting environmental conservation-related activities such as Green Purchasing/Green Distribution (See page 32), the recycling of used gas devices (See page 46), regional air-conditioning, the ESCO business (See page 49) and the utilization of cryogenic energy (See page 23).

<table>
<thead>
<tr>
<th>Chemical Substance</th>
<th>Toluene</th>
<th>Benzene</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Handled annually</td>
<td>Discharged</td>
</tr>
<tr>
<td>FY2001</td>
<td>85.8</td>
<td>13.2</td>
</tr>
<tr>
<td>FY2002</td>
<td>80.4</td>
<td>7.4</td>
</tr>
</tbody>
</table>

Calculation range of affiliates

1. 29 affiliates which have plants

2. 10 affiliates with more than 100 employees which do not have plants

ISO 14001 Certified Companies

Companies marked with *acquired ISO 14001 certification with (former) production departments of Osaka Gas
Examples of activities of our affiliated companies towards environmental conservation

Examples

1. Enetech Kyoto Co., Ltd.

Enetech Kyoto is an energy-related business that sells products, such as gas-heat-pump air conditioning equipment and co-generation systems, which contribute to energy saving. It is deeply connected to and concerned about the environment, and it is also an active participant in the environmental management of today’s recycle-based society. Enetech Kyoto has been working on its own environmental activities, for example, its own “Environmental Declaration,” as well as energy saving, waste management at construction sites, water conservation and cleaning-up activities. We will follow the concept of KES* management system, and will make further efforts including Green Purchasing and Green Distribution. Also, we will put our Environmental Declaration on our website for our employees’ information.

We will promote:
- Green Purchasing: the act of purchasing goods and labor with a low level of impact on the environment, in addition to product quality and timely delivery.
- Green Distribution: the utilization of low-pollution vehicles

* KES (Kyoto Environmental Management Standard): A simplified version of ISO 14001 that Kyoto’s Agenda 21 Forum decided to use for Kyoto City Industries

2. Osaka Gas Security Service Co., Ltd.

Osaka Gas Security Service’s main business is security services for gas equipment/devices. It has dealt with 1,400 cases of repair work resulting from remodeling. In dealing with industrial waste such as wallpaper resulting from remodeling, it has implemented the planned processing of such waste based on “Manifest” (waste disposal log). In 2002, it acquired ISO 9002 certification.

Furthermore, it has participated in clean-up activities held by local governmental offices such as the Yodogawa Ward Office, the Yodogawa Police Department and regional communities. Also, it has participated in educational activities for beautifying the neighborhood environment as well as the prevention of illegal bicycle parking and littering. Through these activities, it is striving to be closer to the people in the community.

Its internal environmental activities include garbage separation, which it has undertaken for some time, the control of room temperatures, the turning off of lights during the lunchtime and the use of recycled stationery. With these efforts, it received the “Corporate Excellence in Garbage Reduction” Award from the Osaka City Environmental Management Bureau in October 2001. We will wholeheartedly work towards environmental conservation, and it will work towards becoming a corporation trusted by the community.

3. Liquid Gas Group

The Liquid Gas Group has focusing its efforts on the environment, and its manufacturing departments have been leading those activities. In FY1997, the Liquid Gas Carbonic Acid Center, the High Purity Methane Center and the CRYO-AIR liquefaction center (together with the Osaka Gas Production Division) acquired ISO14001 certification; and in FY2002, Cold Air Products Co., Ltd also met the same standards. We will save electricity by operating machinery equipment properly, and we will improve recycling rate by separating waste.

Environmental Businesses by Osaka Gas Affiliates

<table>
<thead>
<tr>
<th>Company name</th>
<th>Main environmentally-related business</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apriti Sesamo Co., Ltd.</td>
<td>Offers environmentally friendly cooking methods</td>
<td>phone: +81-6-6205-4557    fax: +81-6-6204-5066</td>
</tr>
<tr>
<td>OG Road Co., Ltd.</td>
<td>Reuse of waste asphalt, waste concrete, and excavated soil as modified soil, crushed stone, or asphalt composite material</td>
<td>1-4-132, Hokko, Kohnan-ku, Osaka 554-0033, Japan</td>
</tr>
<tr>
<td>Cogenration Technology Service Co., Ltd.</td>
<td>Provision of an environmentally friendly on-site power generation system</td>
<td>phone: +81-6-6205-4609    fax: +81-6-6204-5066</td>
</tr>
<tr>
<td>Gas and Power Co., Ltd.</td>
<td>ESCO business for energy-saving and environmental conservation planning for buildings and manufacturing plants</td>
<td>1-4-5, Awa-jima, Chuo-ku, Osaka 554-0047, Japan</td>
</tr>
<tr>
<td>Kyoto Research Park Co., Ltd.</td>
<td>Support, under the auspices of the Kyoto Prefectural government, for environmental businesses in industry and academia, mainly focusing on research groups</td>
<td>phone: +81-75-693-6530    fax: +81-75-693-6535</td>
</tr>
<tr>
<td>Osaka Gas Engineering Co., Ltd.</td>
<td>Environmentally-friendly technologies such as sludge processing, water processing, soil purification, and special gas co-generation systems that use gas from thermal decomposition of garbage to make fuel</td>
<td>phone: +81-75-693-6530    fax: +81-75-693-6535</td>
</tr>
<tr>
<td>KRI Kansai Research Institute, Inc.</td>
<td>Environmentally-related research on contract, technology- and management-related consulting services</td>
<td>Minamimoshi-machi, Chuo-ku, Osaka 554-0052, Japan</td>
</tr>
<tr>
<td>OG Auto Service Co., Ltd.</td>
<td>Leasing of low-pollution vehicles, mainly NGVs</td>
<td>phone: +81-6-6228-3301    fax: +81-6-6228-3302</td>
</tr>
<tr>
<td>OGIC Co., Ltd.</td>
<td>Reuse and recycling business for used PCs and peripherals that can no longer be leased</td>
<td>phone: +81-6-6264-3000    fax: +81-6-6264-3000</td>
</tr>
<tr>
<td>Techno Green Co., Ltd.</td>
<td>Green space creation using non-chemical fertilizers, soil improvement using micro-organisms, monitoring of ecosystems, and other environmental technologies</td>
<td>Osaka Gas Sendai 2 Terminal Facility, 3-1, Takasago, Takashim-chy, Osaka 550-0011, Japan</td>
</tr>
<tr>
<td>Osaka Gas Chemicals Co., Ltd.</td>
<td>Development, manufacturing and marketing of products that contribute to environmental conservation, such as carbon absorbents</td>
<td>phone: +81-75-693-6530    fax: +81-6-6264-3000</td>
</tr>
<tr>
<td>Tolyo Kasei Co., Ltd.</td>
<td>Sale of diatomaceous soil, painting and coating work, sale of products made from recycled PET bottles</td>
<td>phone: +81-6-6264-3247    fax: +81-6-6262-5599</td>
</tr>
<tr>
<td>Gasnet Co., Ltd.</td>
<td>Sale of fluorocarbons recovery devices, recovery and disposal of fluorocarbons</td>
<td>phone: +81-6-6264-3247    fax: +81-6-6262-5599</td>
</tr>
<tr>
<td>KBI Kansai Business Information, Inc.</td>
<td>Consulting for environmentally-related survey/research, assistance in ISO certification</td>
<td>phone: +81-6-6264-3247    fax: +81-6-6262-5599</td>
</tr>
<tr>
<td>Enetech Osaka Co., Ltd.</td>
<td>Sale and installation of environmentally friendly gas air conditioning equipment and co-generation systems</td>
<td>phone: +81-75-693-6530    fax: +81-75-693-6535</td>
</tr>
<tr>
<td>Enetech Kyoto Co., Ltd.</td>
<td>Sale and installation of environmentally friendly gas air conditioning equipment and co-generation systems</td>
<td>phone: +81-75-693-6530    fax: +81-75-693-6535</td>
</tr>
</tbody>
</table>
Third Party Recommendation Report on Osaka Gas 2003 Environmental and Social Action Report

Dear Mr. Hironori Yamada, Executive Vice-President, Chairman of the Energy and Global Environment Committee

Third Party Recommendation Report on Osaka Gas’ 2003 Environmental and Social Action Report

As a specialist who publishes information about corporations’ social responsibilities, I have suggested improvements and future directions based on the “Osaka Gas Environmental and Social Action Report 2003” (cited below as “the report”) specifically related to environmental and social issues, and the characteristics and progress of these issues. These suggestions do not concern the validity of the gathering and reporting of information or the reliability of the report.

I took the following steps in preparation for these suggestions: interviewing the executives, questioning those in charge of the report, taking part in the editing sessions, touring the Senboku Terminal, the Gas Science Museum and the Osaka Residential Service Department and visiting sites to see the non-extraction method and the reuse of excavated soil in action.

A Company’s Social Responsibility

Value-Creating Management for All Stakeholders

The 2010 Vision advocates “value-creating management” and maximization of overall value, which is an integration of customer value, shareholder value and social value. The Osaka Gas Corporate Group Action Standards clearly state that social value encompasses the environment, employees and their families, the local community and Osaka Gas business partners. The corporate group seeks dividends and value for its shareholders, as well to create value for a wide range of its stakeholders. I evaluated the report highly as it represents an integrated representation of value creation from the above perspectives. It essentially meets the spirit and framework for sustainability reports (reports on corporate social responsibilities) by publishing information about the “triple bottom line” of environment, society and economy. As for the future, I expect Osaka Gas to offer more useful information by developing an operational management tool for reporting the creation and distribution of the aforementioned social value through quantitative and monetary values.

Quality of Environmental Management

Osaka Gas is sincere about environmental management. This is evident in everything the company does—the clarity of its management creed and vision; the building of management systems for all business activities; efforts to evaluate progress through measurements such as environmental accounting; and the continuing drive for improvement. In particular, I was impressed with how Osaka Gas melds its manufacturing and business activities with environmental actions, based on the company philosophy that an energy company “must understand that all activities are inextricably linked to the environment, and those activities must balance business and the environment through the most efficient use of energy and resources.” Furthermore, the company’s supply and sale of natural gas, which has relatively low environmental impact and high safety levels, forms the foundation of its environmental management. I also see a bright future in the company’s development of next-generation energy technologies such as cogeneration, natural gas vehicles, gas pressure power generation, and district cooling and heating. In this report, Osaka Gas disclosed its sustainability indicators for the first time. Also, it published comprehensive objective information about environmental performance or environmental cost gives the company an extra dimension as a company. As for the validity of the gathering and reporting process of information or the reliability of the described information, I think that the verification of a third party is required.

Reporting on Social Responsibilities

The report shows that the company improved its own reporting of its social responsibilities. Osaka Gas describes its philosophies, systems, activities and the results related to compliance, operational safety levels, social contributions largely to local communities, social communications and respect for human rights and labor. Thus, I can say that the report provides important information for stakeholders about the social aspects associated with Osaka Gas’ corporate operations. As for the future, with regard to its social responsibilities, I expect Osaka Gas to publish comprehensive performance information through the development of operational indexes, establishment of action targets, implementation of monitoring and improvements in the monitoring of results.

Communicating with a Wide Range of Stakeholders

With this report, Osaka Gas has stated its desire to lead the industry leader in the release of information and accountability. The report describes the many tools that the company uses in a wide range of areas—an environmental web site, community activities, the Gas Science Museum and Discover Life Pavilion (DILIPA) to create and maintain dialogue with stakeholders. It also demonstrates a clear, open communication process by including opinions from environmental NGOs, consumers, researchers, specialists and readers, as well as responses from Osaka Gas. To identify relevant information for publishing is important because society recognizes the importance of accountability in the triple bottom line—society, environment, economy—and demands useful and relevant information. At this point in time, it is important to ensure that accountability develops as part of the communication process with stakeholders. In this sense, I feel that Osaka Gas’ communication efforts are improving the transparency of information and raising the standard of accountability.

As the energy industry enters an era of fierce international competition, I am confident that Osaka Gas will be rated highly for integrated efforts that uphold principles like competitiveness, efficiency, human and social values. The company will also be respected for its environmental focus as the foundation of management activities and the company’s health. In one corner of the Senboku Terminal, I found that the company is rehabilitating the local woods by growing acorn tree seedlings, oak, Sawthorn oak and lithocarps glabra oak from the groove of a local shrine. To me, this small but significant event represents the real intentions of Osaka Gas.
Osaka Gas’s Environmental Actions from a Global Warming Prevention Perspective

Under its Climate Change Program, the WWF (World Wide Fund for Nature) is targeting the energy sector, the largest emitter of CO₂, with the Power Switch Campaign. The objective is to make the energy sector CO₂-free by the middle of this century by encouraging energy conservation, by using cleaner fuels and by adopting natural, renewable energy sources.

Natural gas can play an important role in achieving this objective because it is an important fuel that can fill the gap between today’s coal and oil economies with renewable natural energy that efficiently utilizes resources. Natural gas co-generation is a particularly important technology whose use should be more widespread.

According to its Environmental Report, Osaka Gas has positioned co-generation as one of its main themes. The company has already installed natural gas co-generation systems in half of its nationwide plants. This is admirable, but it would be more relevant if it was compared with installations in other countries.

I also applaud Osaka Gas’ reduction of CO₂ emissions from its operational sectors through reducing the purchase of power by introducing in-house sources such as cryogenic power generation and gas pressure power generation. This will help the company operate more efficiently by using energy that was previously wasted in business processes.

Osaka Gas is also helping its customers to reduce CO₂ emissions with numerous on-site systems such as gas mini co-generation systems and gas engines. Such systems are creating a paradigm shift to an energy system with a lower level of environmental impact and of non central power generation. Such transformations can build a society that efficiently uses small amounts of energy, which then reduce CO₂ emissions that contribute to prevent global warming. I hope that Osaka Gas emphasizes its energy vision in its Environmental Report.

Required to Create Further Social Value

Today’s companies cannot only think about expanding the market for their goods and services. Through continuous management efforts to increase customer value, shareholder value and social value, Osaka Gas advocates “management that creates value.” The company focuses on social values in much the same way as it focuses on environmental problems. These activities reduce the environmental impact of business; develop products that have a minimal impact on the environment and contribute to a better environment in Japan and abroad.

The report describes the “social actions” that display the corporate awareness of its social responsibilities. The corporate action standards of the Osaka Gas Corporate Group, including respect for human rights and understanding of environmental protection, are nearing implementation by the Compliance Committee. These days, a company’s perceived level of reliability among the general public depends largely on how it releases both positive and negative information. Many companies publish information only on compliance; however, I hope that Osaka Gas will fulfill its objective of becoming an industry leader in information dissemination and accountability. Osaka Gas is developing products that reduce environmental impacts. In March 2003, it released a residential gas engine cogeneration system. The company is on the verge of releasing a system using fuel cell technology. It is crucial that we make all efforts to encourage development of these 21st century co-generation systems. Osaka Gas has the power to create an environmentally friendly, sustainable society as the nucleus of its business. I hope that the Osaka Gas group will do everything it can to create the highest level of value for society.

Our Third Party Review Perspective

According to the Ministry of Environment’s “Committee on Promotion Measures for Environmental Reports,” there are two kinds of third-party reviews on environmental report: (1) those for qualitative evaluation or advice, and (2) those for quantitative verification. For the quantitative verification type (2), officials (including the Ministry of Environment) are planning to discuss verification or standards. We plan to review the introduction of this. For FY2002 and 2003, we have adopted type (1), which enables us to gather opinions about our own environmental action. This will provide us with information to help us improve our publicity and reliability. For the FY2003 report, we collected opinion briefs from environmental auditing corporations, environmental NGOs and consumer groups. We also sent questionnaires to 50 people in each group of stakeholders, and then published their opinions and relevant responses.
Stakeholders Survey

Osaka Gas distributed a questionnaire on the 2002 Environmental Report to stakeholders in various fields in order to gather opinions that will help us improve upon our environmental action.

Survey Method

We sent survey questionnaires mainly to stakeholders who had requested a copy of our 2002 Environmental Report.

Survey Respondents

In order to get the widest range of opinions possible, we sent questionnaires to 101 stakeholders: end consumers, researchers, educators, environmental officers of companies and organizations, NPO and NGO members, students and government officials. The 55 effective replies (54.5% response rate) are shown in the table below.

<table>
<thead>
<tr>
<th>Survey Respondents</th>
<th>No.</th>
<th>% of total</th>
<th>Response rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumers</td>
<td>6</td>
<td>10.9%</td>
<td>37.5%</td>
</tr>
<tr>
<td>Researchers and Educators</td>
<td>10</td>
<td>18.2%</td>
<td>55.6%</td>
</tr>
<tr>
<td>Environmental officers of companies and organizations</td>
<td>14</td>
<td>25.5%</td>
<td>82.3%</td>
</tr>
<tr>
<td>NPOs, NGOs</td>
<td>7</td>
<td>12.7%</td>
<td>46.7%</td>
</tr>
<tr>
<td>Students</td>
<td>7</td>
<td>12.7%</td>
<td>43.8%</td>
</tr>
<tr>
<td>Government officials</td>
<td>11</td>
<td>20.0%</td>
<td>57.9%</td>
</tr>
<tr>
<td>Total</td>
<td>55</td>
<td>100%</td>
<td>54.5%</td>
</tr>
</tbody>
</table>

Survey Content

Respondents gave free answers on insufficiencies or possible improvements with the report, based on the individual sections and items in the report. They also commented on the how easy the text and figures were to understand.

Respondents also rated the clarity of a number of items in our Environmental Report or relating to our environmental action, from "easy to understand" to "very hard to understand." There was also space where respondents were free to write any other opinions or suggestions relating to our Environmental Report or our environmental action.

Survey Results

(1) Respondents’ Evaluation of Osaka Gas Environmental Action

All respondents gave our environmental actions either an “extremely high evaluation” or a “high evaluation.”

<table>
<thead>
<tr>
<th></th>
<th>Consumers</th>
<th>Researchers and Educators</th>
<th>Environmental officers of companies and organizations</th>
<th>NPOs, NGOs</th>
<th>Students</th>
<th>Government officials</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely high evaluation</td>
<td>2</td>
<td>4</td>
<td>7</td>
<td>3</td>
<td>3</td>
<td>8</td>
<td>27</td>
</tr>
<tr>
<td>High evaluation</td>
<td>4</td>
<td>6</td>
<td>7</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>28</td>
</tr>
<tr>
<td>Not very high evaluation</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Low evaluation</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Highly Evaluated Points

1. Osaka Gas has made environmental issues a top priority of its management policy and has set a clear vision of goals to achieve by 2010.
2. With the 2005 Medium-Term Environmental Goals, Osaka Gas has set a clear path to reaching the 2010 Environmental Goals.
3. Osaka Gas is working to integrate business and environmental goals by making sustainability indicators a part of its in-house performance evaluation system.

(2) Respondents’ Evaluation of Osaka Gas Environmental Report

A total of 81.8% of all respondents rated our Environmental Report either “very easy to understand” or “easy to understand,” while 12.7% rated it “hard to understand” and 5.5% rated it “average.”

<table>
<thead>
<tr>
<th></th>
<th>Consumers</th>
<th>Researchers and Educators</th>
<th>Environmental officers of companies and organizations</th>
<th>NPOs, NGOs</th>
<th>Students</th>
<th>Government officials</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very easy to understand</td>
<td>1</td>
<td>4</td>
<td>9</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>13</td>
</tr>
<tr>
<td>Easy to understand</td>
<td>4</td>
<td>5</td>
<td>9</td>
<td>4</td>
<td>4</td>
<td>6</td>
<td>32</td>
</tr>
<tr>
<td>Average</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Hard to understand</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Very hard to understand</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Highly Evaluated Points

1. The report gives actual quantitative figures rather than just abstract information.
2. The report divides environmental efforts into action guidelines that cover everything from general to individual issues.
3. Third party review adds objectivity to the report.
Osaka Gas Response to Opinions and Comments

1. Osaka Gas Responses to the Opinions and Comments

<table>
<thead>
<tr>
<th>What Osaka Gas Is Expected to Do</th>
<th>How Osaka Gas Will Achieve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osaka Gas must develop sustainability indicators and set action goals for social performance, and it must monitor these and release the results of progress.</td>
<td>Social performance indicators will become increasingly important for quantitatively assessing a company's social action. The GRI's Sustainability Reporting Guidelines include qualitative and other indicators that a growing number of companies worldwide are expected to incorporate. With this in mind, Osaka Gas will look into incorporating more social performance indicators.</td>
</tr>
<tr>
<td>Introductions of natural gas co-generation should be compared to those of other countries.</td>
<td>Osaka Gas is looking into comparing natural gas co-generation use in Japan and other countries in next year's report.</td>
</tr>
<tr>
<td>A third party review is needed on the effectiveness of the information gathering and reporting processes, and the reliability of the information contained in this report.</td>
<td>Japan's Ministry of the Environment is working out the details of examination-type, third party review. Osaka Gas will examine the results and contents then, decide whether to use this type of review and in what situations.</td>
</tr>
<tr>
<td>Osaka Gas must strive to be an industry leader in information release and accountability.</td>
<td>Osaka Gas has been lauded for its efforts at information release and accountability, but will aim to do even better. An example of this is our effort to foster communication between the community and us, as mentioned in the survey summarized on the previous pages.</td>
</tr>
<tr>
<td>The company must create value by using its strengths to make the creation of an environmentally friendly, sustainable society the nucleus of its business.</td>
<td>Through development and promotion of high-efficiency gas equipment and systems such as much talked-about diffusion-type co-generation system, we can contribute to greater use of natural gas and less impact on the environment.</td>
</tr>
<tr>
<td>Osaka Gas must advocate its medium- and long-term energy vision.</td>
<td>We must figure out how we can respond to answers that survey respondents gave in the categories of a sustainable society and Japan's energy measures and make this response part of our medium- and long-term energy vision.</td>
</tr>
</tbody>
</table>

* We had the same opinions in the stakeholders survey

2. Survey Results (Environmental Action)

<table>
<thead>
<tr>
<th>What Osaka Gas Must Do</th>
<th>How Osaka Gas Will Achieve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Some of the target figures are the same for both 2005 and 2010.</td>
<td>Some target figures for 2005 are the same as 2010 because we set these 2005 figures with the goal of achieving them before the originally intended 2010 deadline. (2010 target figures were formulated in 1999)</td>
</tr>
<tr>
<td>I would like to see Osaka Gas work towards reducing environmental impact through reuse of resources and reduction of CO2 emissions over the natural gas life-cycle.</td>
<td>Osaka Gas is doing its utmost in these areas, as shown on pages 26 to 30 (reuse of resources) and pages 13 and 14 (reduction of CO2 emissions over the natural gas lifecycle).</td>
</tr>
<tr>
<td>Osaka Gas should set targets for Green Distribution in its 2010 goals.</td>
<td>Although we were able to set Green Distribution Targets when we established the 2010 goals in 1999, we formulated our Green Distribution Policy in 2001 and are implementing this in earnest.</td>
</tr>
<tr>
<td>Osaka Gas should work to ensure that its business partners and affiliated companies improve their environmental efforts.</td>
<td>Osaka Gas efforts in this area include encouraging business partners to follow the Green Distribution Policy and helping affiliated companies by gathering their environmental performance data and providing them with environmental information.</td>
</tr>
</tbody>
</table>
Osaka Gas Response to Opinions and Comments

3. Survey Results (Environmental Action Report)

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Osaka Gas Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>The report should include ideas on environmental efficiency.</td>
<td>The Osaka Gas Sustainability Indicators section on pages 9-10 includes Osaka Gas ideas on environmental efficiency. The sustainability indicators were established in 2002 and introduced in FY2003 as a way to improve our environmental efforts by understanding the relationship between business activities and environmental impact, and our overall progress in environmental action.</td>
</tr>
<tr>
<td>The report should include details on ISO 14001-related action.</td>
<td>Page 19 shows the main policies and goals of our company departments in their efforts to acquire ISO 14001 certification. Page 18 shows the restructuring of departments into new EMSs (environmental management systems).</td>
</tr>
<tr>
<td>Rather than just the amount of money spent on purchasing environmentally friendly supplies, the report should show this amount as a percentage of all supply purchases</td>
<td>Page 32 has a graph showing what percentage of money spent on stationery was for environmentally friendly products.</td>
</tr>
<tr>
<td>COD should be included in the section on wastewater.</td>
<td>Page 34 shows our efforts to prevent pollution from wastewater.</td>
</tr>
<tr>
<td>The report should include reductions in environmental impact for the processes from natural gas drilling to delivery to Japan.</td>
<td>Osaka Gas is not itself in charge of these processes. However, page 13 shows what our business partners (oil and gas developers) are doing to reduce CO2 emissions during drilling at the natural gas fields and during ocean transportation of the LNG to Japan.</td>
</tr>
<tr>
<td>The report should include corporate ethics.</td>
<td>From FY2003, the report includes more information on our social action and responsibilities (See pages 54-64). Of particular note is the issue of compliance (See page 55).</td>
</tr>
<tr>
<td>The report should include information on what women are doing in the company.</td>
<td>Page 63 details this.</td>
</tr>
<tr>
<td>The report is hard to read because the text is small and crammed together.</td>
<td>There is more space between lines in this year’s report.</td>
</tr>
<tr>
<td>There are too many technical terms that are not sufficiently explained.</td>
<td>We have tried to use a more familiar style and explain technical terms in this year’s report.</td>
</tr>
<tr>
<td>There is too much information covered and hard to read.</td>
<td>The inclusion of social performance reporting has resulted in more pages.</td>
</tr>
</tbody>
</table>

Actions Responding to Opinions and Comments on 2002 Report

Osaka Gas took specific action to deal with items listed in the 2002 report under “Tasks Requiring Long-Term Efforts or Cooperation from Government and Local Communities.” These are shown in the table below;

<table>
<thead>
<tr>
<th>Item</th>
<th>Opinion</th>
<th>Osaka Gas Efforts in FY2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method of Action</td>
<td>I hope that all departments of Osaka Gas will acquire ISO 14001 certification.</td>
<td>The Research and Development Department was certified for ISO 14001 in FY2002, and we aim to have all departments certified by FY2005. (See page 18)</td>
</tr>
<tr>
<td>Gas Equipment Systems</td>
<td>I hope Osaka Gas will create ergonomic products with the user in mind.</td>
<td>We established the Ergonomics Group for research into ergonomic products that are comfortable, safe, easy to use and easy to work with. The group’s achievements include floor heating, bathroom heater/dryer and renovation techniques.</td>
</tr>
<tr>
<td>Community Activities</td>
<td>I hope Osaka Gas will step up efforts to assist integrated studies and environmental education in schools.</td>
<td>Osaka Gas staff visit schools, whose students cannot visit the Gas Science Museum, and gives lessons with specially designed materials and gives scientific demonstrations of phenomena such as gas liquefaction. Osaka Gas visited 47 schools in FY2002; See page 59) We have also been assisting with environmental education classes during integrated studies classes in junior and senior high schools. (Osaka Gas visited 8 schools in FY2002; See page 59)</td>
</tr>
</tbody>
</table>
## History of Osaka Gas Environmental Activities

<table>
<thead>
<tr>
<th>FY</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1989</td>
<td>Environmental Management Department, previously part of our production sector, reorganized into the Environmental Department, with staff from all company departments.</td>
</tr>
<tr>
<td>1990</td>
<td>Committee on Energy and the Global Environment established. Osaka Gas receives Environment Agency Secretary-General's Award in 17th Environmental Awards for a coke bed process for melting and recycling sewage sludge.</td>
</tr>
<tr>
<td>1992</td>
<td>Osaka Gas Environmental Philosophy and Osaka Gas Environmental Action Guidelines published.</td>
</tr>
<tr>
<td>1993</td>
<td>Action plans for each department formulated. First Annual President’s Awards for Environmental Activities established. Futuristic experimental housing complex, NEXT 21, completed.</td>
</tr>
<tr>
<td>1996</td>
<td>Osaka Gas receives MITI Minister Prize for a recovery and recycling system for used gas equipment. Osaka Gas receives Japan Builders Association Award Special Prize for NEXT 21 housing complex.</td>
</tr>
<tr>
<td>1997</td>
<td>Production Department achieves ISO 14001 certification.</td>
</tr>
</tbody>
</table>

## Editor's Postscript

The environment is a valuable asset for all of us. Everybody is affected by changes in the environment, whether they are dedicated to protecting it or not. If that’s the case, which side are you on? I certainly want to protect the environment. And so does Osaka Gas, as part of its efforts to build a sustainable society.

To achieve this we are
1. reducing the environmental impact of our business activities,
2. contributing to environmental impact reduction by offering products such as natural gas and environmentally friendly systems, and
3. contributing to environmental improvement wherever we do business, be it in Japan or around the world.

This year’s publication is called the Environmental and Social Action Report. Companies today are expected to be socially responsible. In addition to reporting on environmental action, this year’s report has a strong social orientation with detailed information on our many social action efforts.

The report also has a section on third party review, including opinions from environmental auditing research organizations, environmental NGOs, and consumer groups, as well as responses to a survey given to 50 stakeholders. And our newly developed sustainability indicators have allowed us to include more detailed environmental performance data.

According to last year’s feedback, such as characters are too small and hard-to-read, we have tried to design and edit this year’s report to make it easy to read including enlarging the fonts in the text. As a result, however, we had to increase the number of pages. More detailed information such as site data can be found on our website.

We will continue in earnest with our environmental action and ensure that this action is fully understood by our customers through more detailed and improved reports like this. We look forward to hearing your frank and valuable opinions and to serving you as best we can.
Environmental and Social Action Report 2003

The Committee on Energy and the Global Environment, Osaka Gas Co., Ltd.
Published in August 2003 (First edition)
4-1-2, Hiranomachi, Chuo-ku, Osaka 541-0046, Japan
For inquiries, contact the Environmental Department on +81-6-6205-4605

The Environmental and Social Action Report is posted on our website. For more extensive data, see the additional data on the Osaka Gas Environmental Website at the following address:
http://www.osakagas.co.jp/kankyo_e/

This brochure is printed on recycled paper with highly biodegradable soy ink that allows easy recycling of printed matter.