

Environmental

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Environment

Summary

Basic approach

Contributing to regional and global environmental conservation is a pivotal mission of the Daigas Group, which conducts business mainly in the field of energy. Being seriously aware of the close linkage between all its activities and the environment, the Daigas Group will respond to environmental issues, including climate change, develop and promote innovative technologies, address the most critical challenge of working out low-carbon/carbon-neutral energy solutions, and achieve more efficient use of energy, raw materials, and other resources.

In March 2017, the Daigas Group unveiled Long-Term Management Vision 2030, which shows the Group's vision for FY2031, and Medium-Term Management Plan 2020. Under these, we have devoted active efforts to helping increase the use of natural gas, developing and facilitating more widespread use of highly efficient equipment, including fuel cells, offering customers proposals for the use of energy-saving products and services, and introducing renewable energy.

The Daigas Group announced the Daigas Group Carbon Neutral Vision in January 2021, and Medium-Term Management Plan 2023 in March of the same year. Thus, the Group indicated its aim to become carbon neutral by 2050 by decarbonizing the raw materials of city gas through methanation* using renewable energy and hydrogen and by decarbonizing power sources through introduction of renewable energy, in addition to conventional efforts to expand the use of natural gas.

In March 2024, we announced Medium-Term Management Plan 2026, in which we presented our key strategy, positioning the 2024-2026 period as a period to be focused on contributing to the energy transition toward achieving carbon neutrality in 2050 and building a foundation to accelerate our initiatives for a carbon neutral society.

We have positioned climate change as one of our material issues in the Medium-Term Management Plan 2023. In the Medium-Term Management Plan 2026, we have positioned providing carbon neutral energy as one of our material issues to accelerate our initiatives to become carbon neutral.

* A technology for synthesizing methane, which is the main component of city gas, from hydrogen and carbon dioxide (CO₂)

Specific initiatives

Policy and promotion system

To achieve our medium- to long-term vision, measures, and targets in the environmental field and in line with the Daigas Group Environmental Policy and other bylaws, important environmental matters are monitored by the Environment Subcommittee and the ESG Committee, reported to and deliberated by the ESG Council (Management Meeting), and submitted to the Board of Directors.

Theme	Items to be addressed	Specific initiatives															
Environmental management → p.032 Environmental targets → p.038	<ul style="list-style-type: none"> Strengthening environmental governance Maintenance and continuation of the environmental management system Follow-up and raising awareness toward achievement of environmental targets Enhancing environmental compliance 	Initiatives undertaken in FY2024.3 <ul style="list-style-type: none"> Continued operation of the environmental management system Monitored the environmental impacts in the value chain Developed environmental human resources through e-learning (5,539 people) 															
Climate change measures → p.040 Disclosure based on the TCFD Recommendations → p.047	<ul style="list-style-type: none"> Carbon neutrality Reduction of CO₂ emissions from the Group's own business activities Reduction of CO₂ emissions from customers' activities and their value chains Contribution to CO₂ emissions reduction in society as a whole <p>Materiality Climate change</p>	<table border="1"> <thead> <tr> <th>Environmental targets</th> <th>KPIs based on the materiality</th> <th>FY2024.3 results</th> </tr> </thead> <tbody> <tr> <td>CO₂ emissions of the Daigas Group</td> <td></td> <td>25.63 million t / 24.63 million t* *Emissions in domestic supply chain (Scopes 1, 2 and 3)</td> </tr> <tr> <td>Percentage of renewables in our power generation portfolio in Japan</td> <td></td> <td>22.4%</td> </tr> <tr> <td>Contribution to developing renewables capacity on a global basis</td> <td></td> <td>3.17 GW</td> </tr> <tr> <td>Avoided emissions (Baseline: FY2017.3)</td> <td></td> <td>5.01 million t</td> </tr> </tbody> </table> <ul style="list-style-type: none"> Operating LNG carriers efficiently and increasing the use of low-emission vehicles Accelerating low-carbon/carbon-neutral solutions by using natural gas and facilitating more widespread use of highly energy-efficient and high-value-added equipment Providing environmental value by disseminating high-quality solutions in the fields of information, real estate, and materials 	Environmental targets	KPIs based on the materiality	FY2024.3 results	CO ₂ emissions of the Daigas Group		25.63 million t / 24.63 million t* *Emissions in domestic supply chain (Scopes 1, 2 and 3)	Percentage of renewables in our power generation portfolio in Japan		22.4%	Contribution to developing renewables capacity on a global basis		3.17 GW	Avoided emissions (Baseline: FY2017.3)		5.01 million t
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Theme	Items to be addressed	Specific initiatives
<p>Contributing to creating a resource recycling society</p> <p>→ p.050</p>	<ul style="list-style-type: none"> Promoting 3R efforts in business activities Promoting 3R efforts in the value chain Plastic resource recycling activities Response to water risks Chemical substance management in business activities 	<p>Environmental targets</p> <ul style="list-style-type: none"> Osaka Gas (including Network Company and core energy business companies) (1) Final disposal rate of industrial and general waste: 2% or lower, (2) Final disposal rate of soil excavated during piping works: 1% or lower, (3) PE pipe recycling rate: 100%, (4) Gas meter reuse rate: 98% or higher Affiliates (1) Final disposal rate of industrial and general waste: 4% or lower Promoting 3R efforts concerning used equipment collected from customers or business activities <p>Initiatives undertaken in FY2024.3</p> <ul style="list-style-type: none"> Osaka Gas (including Network Company and core energy business companies) (1) Final disposal rate of industrial and general waste: 1.0%, (2) Final disposal rate of soil excavated during piping works: 0.1%, (3) PE pipe recycling rate: 100%, (4) Gas meter reuse rate: 98.7% Affiliates (1) Final disposal rate of industrial and general waste: 3.6% Water usage reduced through water saving in operations Response to CDP's climate change and water security
<p>Biodiversity</p> <p>→ p.053</p>	<ul style="list-style-type: none"> Promoting ecosystem conservation efforts Efforts to minimize impact on natural capital Preparing for the TNFD response 	<p>Environmental targets</p> <ul style="list-style-type: none"> Paying due attention to biodiversity in business activities in line with the Daigas Group Biodiversity Promotion Policy <p>Initiatives undertaken in FY2024.3</p> <p>Continued efforts to avoid or reduce impacts on biodiversity in the value chain</p> <ul style="list-style-type: none"> Management of ballast water Conservation of native seeds, seedlings, and rare species Utilization of native seeds and seedlings in urban development business Reduced excavated soil due to non-excavating method Education and training on biodiversity provided for local communities and customers
<p>Development of environmental technology</p> <p>→ p.059</p>	<ul style="list-style-type: none"> Contribution to carbon neutrality Utilization of unused energy 	<p>Environmental targets</p> <p>Facilitating the development of technologies that will contribute to realizing a low-carbon or decarbonized society and provide a strong business foundation</p> <p>Initiatives undertaken in FY2024.3</p> <ul style="list-style-type: none"> Promotion of development of methanation technology, etc. Promotion of development of hydrogen/ammonia combustion technology, etc. Expanding sales of radiative sky cooling material
<p>Green procurement and purchase</p> <p>→ p.098</p>	<ul style="list-style-type: none"> Promotion of green procurement and purchase 	<p>Environmental targets</p> <p>Promoting green purchase, the Green Partner Initiative,* etc. in cooperation with business partners</p> <p>*A system for evaluating proactive environmental initiatives such as building an environmental management system and obtaining certification</p> <p>Initiatives undertaken in FY2024.3</p> <ul style="list-style-type: none"> 85 suppliers registered with the Green Partner Initiative

Environmental Management

Principle and Outline

The Daigas Group has established and operated an environmental management system (EMS) in line with the Daigas Group Environmental Policy, aiming for its achievement. The Policy declares our commitment to addressing climate change and other environmental issues, stating that we will work to further reduce environmental impact, prevent pollution, and protect the environment including biodiversity.



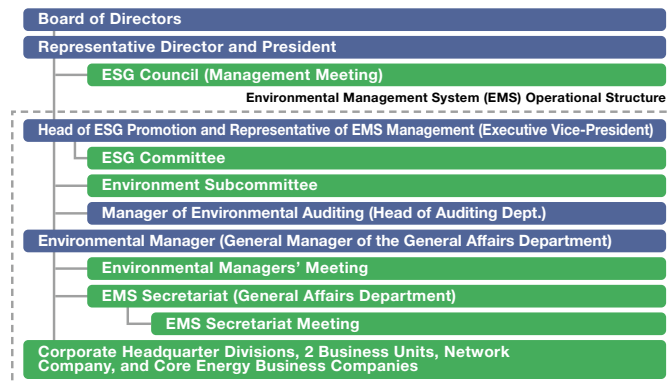
Environmental Governance Promotion Structure

To carry out appropriate and robust activities toward sustainability under the leadership of the Representative Director and President, the Daigas Group has established the ESG Council, which comprises executives and deliberates sustainability action plans and reports, and the ESG Committee chaired by the Head of ESG Promotion (Representative Director and Vice-President), who supervises the Group's sustainability activities. The ESG Committee meets four times a year to discuss and report to the Board of Directors on important matters, including the status of performance against ESG management targets related to sustainability and business plans that are expected to have a significant financial impact due to climate change.

In addition, the Environment Subcommittee has been set up to advance environmental management in coordination with the ESG Committee. Under the supervision of the Head of ESG Promotion, Osaka Gas operates a company-wide integrated environmental management system (EMS) based on ISO 14001 to ensure that all employees reduce the environmental impact of our business activities and comply with environmental laws and regulations.

Domestic Daigas Group companies also operate under EMS standards, such as ISO 14001 and the Daigas Group Environmental Management System and others.

Environmental Management Promotion Structure

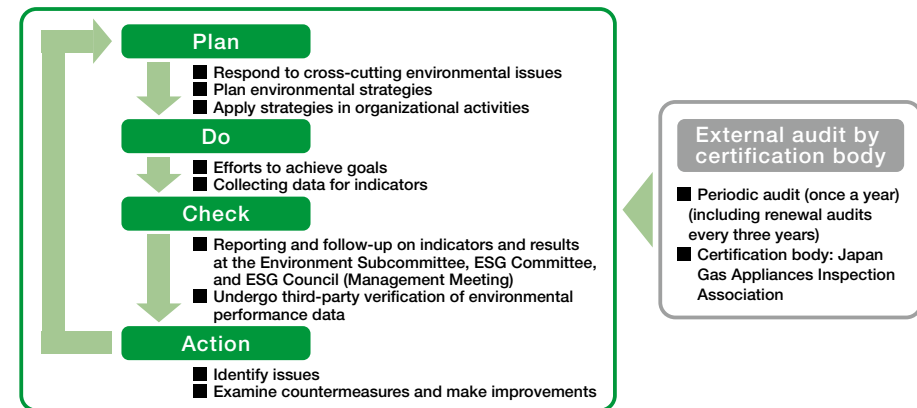


How the Daigas Group's Environmental Management System Works

To reduce the environmental impact of its Group-wide business activities, the Daigas Group has set medium-term environmental targets in its Long-Term Management Vision 2030 and other plans and manages progress in achieving the targets. The environmental targets include those for CO₂ emissions reduction, more widespread use of renewable energy, waste reduction and recycling, and the reduction of excavated soil for final disposal. We also annually calculate GHG emissions that affect climate change from the activities throughout our Group's value chain and use that data to advance our efforts to reduce GHG emissions. These targets and the results of our efforts to achieve the targets are managed by following a PDCA (plan-do-check-act) cycle, which utilizes the mechanism of the EMS.

Please see [P.049](#) for information on the climate change-related framework.

PDCA Cycle Utilizing the Mechanism of EMS



Remuneration system for executives with environmental value taken into account

Osaka Gas at its Board of Directors meeting held on December 23, 2021 resolved that remuneration for the executives would reflect the ESG indicators achievement coefficient of the previous fiscal year in order to help short- and medium- to long-term improvements in corporate value. The resolution took effect with remuneration for July 2023 and thereafter, paid based on the results for FY2023.3. From FY2025.3 onward, the ESG indicators achievement coefficient includes the achievement of the target for providing carbon neutral energy and other non-financial (materiality) indicators included in the Medium-Term Management Plan 2026. Please see [P.123-P.124](#) for officer remuneration system.

Introduction of ICP

Osaka Gas introduced the concept of “Environmental Management Efficiency” in 2003, which is used to quantify the environmental impact of business activities by converting environmental impacts per volume of gas produced into monetary values.

From 2023, we have adopted internal carbon pricing (ICP) to conduct scenario analysis when evaluating investments with a large carbon impact, which we reference as one of tools when making decisions, including the degree of risk and the existence and effectiveness of countermeasures.

Prices are set according to investment target countries/timeframes with reference to carbon price trend forecasts by the International Energy Agency (IEA), etc. They are to be reviewed annually based on the latest policy trends and other factors.

■ Example: ICP Applied to Domestic Investment Projects (as of June 2024)

2030	40 dollars/t-CO ₂
2040	70 dollars/t-CO ₂
2050	90 dollars/t-CO ₂

ISO 14001 Certification Acquisition Status

In FY1998.3, Osaka Gas launched efforts to acquire certification of each business unit’s compliance with ISO 14001, a set of international standards for EMSs, resulting in seven business-unit-specific EMSs covering the entire Company by FY2006.3. In FY2007.3, the Company began to work to integrate all the different EMSs into a unified one and obtained certification of its Company-wide compliance with ISO 14001 in December 2007. Since 2009, the Company has undergone triennial ISO 14001 renewal audit and has continued to obtain integrated certification in response to organizational restructuring, including the transfer of functions to three Core Energy Business Companies in 2020 and Osaka Gas Network Co., Ltd. in 2022.



Certificate of Registration for ISO14001



External audit meeting for renewal of ISO 14001 certification

All affiliates in Japan completed EMS building and certification

As a general, all affiliates in Japan have constructed and operate an EMS, and these efforts are based on the Group common rules “Environmental Management Rules.”

The EMSs introduced by affiliate companies include ISO 14001 and an EMS established under the leadership of local governments as well as the Daigas Group Environmental Management System (OGEMS), a voluntary EMS that functions in a similar way to such an EMS.

Violations of Laws and Fines

During FY2024.3, Osaka Gas did not impose any administrative sanction due to the violation of environment-related laws.

Osaka Gas Certified as the Eco-First Company

On April 5, 2023, Osaka Gas was certified as an Eco-First company by the Minister of the Environment. Under this certification program, companies declare Eco-First Commitments, which are commitments to advanced and unique environmental conservation activities that have ripple effects, and the Minister of the Environment certifies environmentally advanced companies in each industry. We are the first Eco-First company in the energy industry.



From left, Masataka Fujiwara, President of Osaka Gas; Miki Yamada, State Minister of the Environment (Job titles are as of the time of the certification ceremony.)



Environmental Communication

Environmental education

Various events during the Environment Month

Every year in June, designated as Environment Month, employees of the Daigas Group engage in various environmental activities. Among them are energy-saving efforts at offices, environmental preservation activities, environmental education both inside and outside the Company, and participation in regional environmental events such as cleaning activities. By participating in these activities, each and every employee comes to recognize the great connection existing between his or her activities, and their impact on the environment. Such activities provide the Group with opportunities to continue efforts to build an environmentally harmonious society.

E-learning and collective training programs for employees

The Daigas Group provides e-learning and collective training programs as part of operating the environmental management system to ensure that employees are capable of keeping up with the environmental initiatives.

In the ISO Environmental Education Course via e-learning, employees learn basic knowledge about the environment, details of group initiatives, and knowledge of environmental laws and regulations.



E-learning

In addition, in collective training programs, employees learn about the latest trends in environmental issues and practical examples of initiatives, increasing their awareness of the environment.

Environmental awareness-raising activities

Environmental communication based on expertise we have accumulated through business activities

As a corporate group operating in a community-based manner, the Daigas Group believes that its good relationships with local communities is an indispensable foundation for its management. In addition to disseminating knowledge on energy conservation and information useful for familiar energy conservation activities through media such as the “My Osaka Gas” membership site, we are also striving to foster the next generation through “energy and environmental education” and other programs that leverage expertise the Group has cultivated through its business activities.

Verified by a third party A third-party verification has been conducted by Bureau Veritas Japan Co., Ltd.

Environmental Impact throughout the Daigas Group Value Chain

Main materials and fuels

Amount of LNG procured	6,121 thousand tons
	The figure above includes the amounts of the items listed below: <ul style="list-style-type: none"> ● Materials of city gas ● Fuels at LNG terminals ● Fuels for power generation by Group companies
LPG used for calorific adjustment of city gas	231 thousand tons

Procurement of materials and fuels (Business activities by companies outside the Group)

LNG, natural gas City gas use/power generation use/marketing use	LPG City gas use/marketing use
Coal, biomass Power generation use	Other purchased goods Materials/consumable goods/capital goods/gas equipment for sale/electricity/gasoline and others

Amount of energy used

City gas	1,382 million m³ (including gas whose calorific value has yet to be adjusted)
Purchased electricity	494 million kWh
Other energy sources	11,516 TJ

Amount of vehicle fuel used

Gasoline	1,494 kl
City gas	24 thousand m³
Diesel	801 kl
LPG	4 thousand m³

Business activities by Osaka Gas

City gas production/supply	Business office
Power generation	Heat supply
LBS business	Others*

* Engineering/energy services/renovation/maintenance service/R&D etc.

Sales, waste disposal (Business activities by companies outside the Group)

Commuting, business trips	Waste disposal
Product shipment	Leasing of assets
Outlets providing sales support to Osaka Gas	

Sales volume of main products

Gas	6,845 million m³
Electricity	15,883 million kWh

Use at customer site

City gas	Gas appliances
Electricity	Chemical products
LNG	Services

GHG (scope 3*1)

	Emissions (1,000 t-CO ₂ e)
LNG, natural gas	3,386
LPG, coal, biomass	179
Other procurement items	1,062
Total	4,627

GHG (scope 1 and 2)

	Emissions (1,000 t-CO ₂ e)	
	Scope 1	Scope 2
City gas production	34	82
Business office (including supply)	15	16
Power generation	4,011	20
Heat supply	56	34
LBS and others	325	173
Total	4,441	324

GHG (scope 3*2)

Emissions (1,000 t-CO ₂ e)
97

GHG emissions due to energy consumption arising from various activities, including commuting of employees, business trips, transportation of products, business activities at outlets that provide sales support to Osaka Gas, disposal of own waste, disposal of product waste, and leasing of assets.

GHG (scope 3*3)

	Emissions (1,000 t-CO ₂ e)
Combustion of city gas	15,219
Combustion of LNG	923
Total	16,143

Companies subject to the calculation of GHG emissions: 69 companies in total, including Osaka Gas Co., Ltd., 2 overseas subsidiaries and 66 companies among 159 consolidated subsidiaries, are subject to calculation of GHG emissions. Those housed in office buildings as tenants and whose environmental data are difficult to grasp and whose environmental effects are minimal and overseas companies, except two companies, are not subject to such calculation.

Please refer to □□ P.035 for CO₂ emission factors used.

Waste

	Generated	Recycled
General waste	1,007 t	96%
Industrial waste	105,439 t	97%
Excavated soil	566,000 t	100%
PE pipe	126 t	100%
Used gas appliances recovered	1,498 t	86%

Amount of water intake and water discharge Stated on □□ P.058

Breakdown of Scope 3 categories

*1 Category 1-4 (purchased products, capital goods, fuel procurement, upstream transportation)

*2 Category 5-7, 9, 12-14 (waste, business trips, commuting, leased assets, product shipment, end-of-life treatment of sold products, franchises)

*3 Category 11 (use of sold products)

Calculation of environmental impacts in the value chain on [P.034](#)

■ CO₂ emission factors used (GHG scopes 1 and 2)

- Electricity: 0.65 kg-CO₂/kWh (Average emission factor of thermal power plants in FY2014.3, stipulated in the Plan for Global Warming Countermeasures issued by the government in 2021)
- City gas: 2.29 kg-CO₂/m³ (based on Osaka Gas data)
- Others: Factors listed under the Law Concerning the Promotion of Measures to Cope with Global Warming

■ Sources of emission factors used for calculating CO₂ emissions (GHG scope 3)

- Production and transmission of city gas: “Life cycle evaluation of city gas” on the website of the Japan Gas Association
- Production and shipment of LNG: Calculation of life cycle greenhouse gas emissions of LNG and City Gas 13A (papers presented at research presentation meetings of the 35th Meeting of the Japan Society of Energy and Resources, June 2016)
- Production and shipment of LPG and coal: Future forecast for life cycle greenhouse gas emissions of LNG and City Gas 13A (Energy and Resources, Vol. 28, No. 2, March 2007)
- Other main emission factors: Emission factors for calculating supply-chain greenhouse gas emissions, etc. (Database Ver. 3.3) published in March 2023 by the Ministry of Environment

LCA comparison of GHG emissions by fossil fuel (CO₂ equivalents)

The chart below uses life cycle assessment (LCA^{*1}) to show a comparison of fossil fuel greenhouse gas emissions (as carbon dioxide equivalents), covering all processes from production to combustion. LNG is the cleanest energy of all fossil fuels in terms of GHG emissions.

■ Greenhouse Gas Emissions Comparison (g-CO₂/MJ, Total Calorific Value)

	Coal ^{*2}	Oil ^{*2}	LPG ^{*2}	LNG ^{*2}	City gas 13A ^{*3}
Production	4.58	4.06	4.94	8.62	7.63
Transport	1.71	0.79	1.80	1.83	1.48
Domestic manufacturing	–	–	–	–	0.49
Infrastructure	0.11	0.08	0.11	0.05	0.34
Combustion	88.53	68.33	59.85	49.40	50.96
Total	94.93	73.26	66.70	59.90	60.90
Ratio	160	122	111	100	–

*1 LCA

Life Cycle Assessment. A comprehensive quantitative method of survey, analysis, and evaluation for best assessing the amount of environmental impact of products and services. The assessment covers all processes related to products and services from resource extraction to waste disposal including production, transportation, consumption, recycling, and disposal.

*2 Source

Future Forecast for Life Cycle Greenhouse Gas Emissions of LNG and City Gas 13A (Energy and Resources, Vol. 28, No. 2, March, 2007)

*3 Source

Emission factors related to the production and transportation of city gas: “City Gas’s Life Cycle Assessment” on the Japan Gas Association’s website. However, for domestic manufacturing, the figures are based on the Company’s emissions in FY2024.3.

Environmental Accounting

FY2024.3 results of environmental accounting

In FY2001.3, we introduced environmental accounting, which we see as an important tool for quantifying environmental costs and economic benefits toward more efficient environmental activities and continuous enhancement of our environmental performance. Regarding environmental conservation costs for FY2024.3, environmental investment increased from the previous fiscal year mainly due to an increase in environmental R&D-related investment, while expenses decreased from the previous fiscal year mainly due to a decrease in the amount of green purchasing. In terms of internal economic effects, cost reduction progressed due to reducing and recycling excavated soil.

We will continue to follow up on our environmental initiatives in monetary terms to ensure efficient environmental investment and expenses.

(1) Environmental conservation costs

Environmental conservation costs item			Investment (million yen)			Expense (million yen)		
Details			FY2022.3	FY2023.3	FY2024.3	FY2022.3	FY2023.3	FY2024.3
In-house activities	Global environment	Capital investment in and management and labor costs incurred by energy conservation, efficient energy use, the protection of the ozone layer, etc.	216	48	68	577	597	493
	Pollution prevention	Capital investment in and management and labor costs incurred by the prevention of air, water, and noise pollution	54	6	5	49	31	33
	Resource recycling	Capital investment in and management and labor costs incurred by the reduction and recycling of excavated soil, waste management, etc.	0	2	0	32	20	21
	Environmental management	Costs of green purchasing, environmental education, the development of environmental management systems, the operation of environmental organizations, etc.	0	0	0	8,927	4,320	4,265
	Other	Greening at plants, environmental preservation grants, etc.	3	2	7	50	15	18
Environmental impact reduction at customers' sites	Environmental R&D	Cost of researching and developing technologies for environmental impact reduction, environmentally sustainable products, etc.	127	128	174	328	156	136
Environmental impact reduction by recycling	Recycling of used gas appliances	Cost of collecting and recycling sold gas appliances, their packaging, etc.	0	0	0	47	37	16
Social contribution activities		Costs of voluntary greening, environmental advertising, the disclosure of environmental information, etc.	1	22	0	7	115	138
Total			400	208	253	10,018	5,291	5,119

(2) Internal economic benefits

	Economic benefits (million yen)		
	FY2022.3	FY2023.3	FY2024.3
Saving from reducing and recycling excavated soil	1,847	1,836	2,585
Sales of valuable resources (LNG cold heat)	169	195	218
Saving from conserving energy, resources, etc.	128	-940	-69
Total	2,143	1,091	2,734

(3) Environmental conservation results

	Impact per output			Total amount			Reduction		
	Unit	FY2023.3	FY2024.3	Unit	FY2023.3	FY2024.3	Unit	FY2023.3	FY2024.3
NOx emissions from LNG terminals in the city gas business	mg/m ³	2.35	2.53	t	16.01	16.55	t	94.18	101.05
COD at all LNG terminals	mg/m ³	0.40	0.40	t	2.72	2.60	t	9.55	8.66
CO ₂ emissions from LNG terminals	g-CO ₂ /m ³	16.25	17.37	1,000 t-CO ₂	116.30	115.43	1,000 t-CO ₂	0.00	0.00
CO ₂ emissions from other sites	g-CO ₂ /m ³	4.35	4.68	1,000 t-CO ₂	31.15	31.07	1,000 t-CO ₂	34.41	29.80
Excavated soil for final disposal	t/km	0.00	0.00	1,000 t	0.65	0.63	1,000 t	22.20	39.90
General waste for disposal	g/m ³	0.00	0.00	t	11.15	11.11	t	1,062.40	985.79
Industrial waste for disposal (including used gas appliances)	g/m ³	0.03	0.03	t	223.64	218.67	t	1,238.76	1,213.28

(4) Social benefits of environmental conservation efforts (monetary value)

	FY2022.3 monetary value (million yen)	FY2023.3 monetary value (million yen)	FY2024.3 monetary value (million yen)
NOx emissions from LNG terminals in the city gas business	14	34	36
COD at all LNG terminals	13	14	13
CO ₂ emissions from LNG terminals	0	0	0
CO ₂ emissions from other sites	120	121	105
Excavated soil for final disposal	447	491	883
General waste for disposal	3	3	3
Industrial waste for disposal (including used gas appliances)	103	38	37
Total	700	702	1,077

Environmental Targets

Principle and Outline

Contributing to regional and global environmental conservation is a pivotal mission of the Daigas Group, which is mainly engaged in the energy business. In line with its Charter of Business Conduct, Code of Business Conduct, and Environmental Policy, the Daigas Group promotes environmental conservation activities.

Having set the medium-term environmental targets for the reduction of GHG emissions from its business activities, resource recycling, and the like, we have devoted active efforts to helping increase the use of natural gas, developing and facilitating more widespread use of highly efficient equipment, including fuel cells, offering customers proposals for the use of energy-saving products and services, and introducing renewable energy.

In line with the worldwide trend toward action against climate change, we are striving to reduce GHG emissions from its business activities, including CO₂ and methane (CH₄), to help realize a low-carbon or decarbonized society. Specifically, we devote positive efforts to reduce CO₂ emissions from liquefied natural gas (LNG) transportation, city gas production, and power generation. We also implement various energy-saving measures at offices.

In addition, as the trend toward decarbonization further accelerates, and as global economic stagnation and increased volatility in the energy market become apparent, it is becoming more important from the perspective of “S + 3Es”^{*}—the basic policy of the nation’s energy policy—to make energy carbon-neutral without compromising stability and security of energy supply.

In line with the “Carbon Neutral Vision” announced in January 2021 and “Medium-Term Management Plan 2023” in March of the same year, we are further accelerating our efforts toward lowcarbon/decarbonized business operations. In March 2023, we announced “Energy Transition 2030 (ET2030),” which provided an overall picture of the path toward low-carbon/carbon-neutral energy solutions.

We will accelerate our efforts to combat climate change toward our medium- to long-term targets.

The results for each target established based on the Daigas Group Environmental Policy and “Medium-Term Management Plan 2023” are presented below.

^{*} S + 3Es: safety, energy security, economic efficiency, and environment

Environmental Targets (FY2024.3 Targets) and Results

Osaka Gas underwent a third-party verification by Bureau Veritas Japan Co., Ltd. (Verified items are indicated with an asterisk [*].)

Field	Indicators	Targets	Target fiscal year	FY2024.3 results	
Climate change	CO ₂ emissions of Daigas Group*	Net zero emissions	2051.3	25.63 million tons	
		27.02 million tons* ¹ (5 million tons less than FY18.3)	2031.3	24.63 million tons	
	CO ₂ emissions reductions from our own business activities	Percentage of renewables in our power generation portfolio in Japan	Nearly 50%	2031.3	22.4%
		Contribution to developing renewables capacity on a global basis	5 GW	2031.3	3.17 GW
	2.5 GW		2024.3		
CO ₂ emissions reductions at customer sites and through the value chain	<ul style="list-style-type: none"> Accelerating low-carbonization/decarbonization by facilitating more widespread use of highly energy-efficient and highvalue- added equipment using natural gas, renewable energy, etc. Operating LNG carriers efficiently and increasing the use of low-emission and other environmentally sustainable vehicles Providing environmental value by disseminating high-quality solutions in the fields of informatiOSSn, real estate, and materials 		Every year until 2031.3	Please see □□ P.044 for major initiatives.	
Contribution to CO ₂ emissions reductions across society	Avoided emissions (Including reductions contributed at customer sites and overseas*)	10 million tons (Baseline: FY2017.3)	2031.3	5.01 million tons	
Resource recycling	3R (reduce, reuse, and recycle) efforts in the Group's own business activities	Osaka Gas (including network company and the core energy business companies)	Industrial and general waste (final disposal rate)*	2% or lower	1.4%
		Affiliates	Soil excavated during piping works (final disposal rate)*	1% or lower	0.1%
			Soil excavated during piping works (final disposal rate)*	100%	100%
			Industrial and general waste (final disposal rate)*	98% or higher	99.4%
		Value chain	Gas meters (reuse rate)*	4% or lower	3.0%
	Promoting 3R efforts concerning used equipment collected from customers or business activities			Please see □□ P.050-052 for major initiatives.	
Biodiversity	Paying due attention to biodiversity in business activities in line with the Daigas Group Biodiversity Promotion Policy		Every year until 2031.3	Please see □□ P.053-058 for major initiatives.	
Development of technology	Facilitating the development of technologies that will contribute to realizing a low-carbon or decarbonized society and provide a strong business foundation		Every year until 2031.3	Please see □□ P.059-062 for major initiatives.	
Green procurement and purchase	Promoting green purchase, the green partner system, etc. in cooperation with business partners		Every year until 2031.3	Please see □□ P.098 for major initiatives.	

¹ Emissions in domestic supply chain (Scopes 1, 2 and 3) (Targets for FY2031.3 newly set in “ET2030”)

New Environmental Targets

In March 2024, the Daigas Group announced Medium-Term Management Plan 2026, in which we presented our key strategy, positioning the 2024-2026 period as a period to be focused on contributing to the energy transition toward achieving carbon neutrality in 2050 and building a foundation to accelerate our initiatives for a carbon neutral society.

In addition, we revised the Daigas Group Biodiversity Promotion Policy and the Daigas Group Environmental Policy in April 2024, with reference to the National Biodiversity Strategy and Action Plan of Japan 2023-2030 formulated based on the launch of the Taskforce on Nature-related Financial Disclosures (TNFD) in June 2021 and Kunming-Montreal Global Biodiversity Framework, which was adopted at the 15th Conference of the Parties to the Convention on Biological Diversity (COP15) held in December 2022.

Based on these policies, we have established new environmental targets.

Daigas Group Environmental Targets (2024-2026)

Field	Indicators		Targets	Target fiscal year
Climate change	CO ₂ emissions of Daigas Group	Net-zero CO ₂ emissions		2051.3
		27.02 million tons* ¹ Domestic: 5 million tons less than FY2018.3.		2031.3
	Contribution to CO ₂ emissions reductions across society	Avoided emissions* ²	10 million tons	2031.3
			7 million tons	2027.3
	CO ₂ emissions reductions from our own business activities	Renewable energy development contribution	5 GW	2031.3
			4 GW	2027.3
		Percentage of renewables in our power generation portfolio in Japan	Nearly 50%	2031.3
			Nearly 30%	2027.3
	CO ₂ emissions reduction in the Group company offices and vehicles	100%	2031.3	
		67%	2027.3	
Contribution by development of technologies	Promotion of e-methane practical application	1% e-methane in gas grid	2031.3	
		Final investment decisions in e-methane supply chain PJ	2027.3	
	Promotion of methanation technology development	Establishing a pilot-scale (400 Nm ³ /h class) SOEC technology	2031.3	
Transition to the second phase of SOEC GI funds business		2027.3		
Resource recycling	Osaka Gas, core energy business companies, and Osaka Gas Network	Industrial and general waste	Recycling rate: 98% or higher	Every year until 2031.3
		Polyethylene (PE) pipes	Recycling rate: 100%	
		Gas meters	Recycling rate: 100%	
	Affiliates	Industrial and general waste	Recycling rate: 96% or higher	
Value chain	Promoting 3R efforts concerning used equipment collected from customers or business activities			
Biodiversity	Identifying risks and promoting conservation initiatives through biodiversity impact assessments			Every year until 2031.3
	Conserving the environment by promoting reuse of soil excavated during gas piping works	Recycling rate of soil excavated during piping works: 99% or higher		
Water resources	Identifying water risks through water stress impact assessments and promoting water resources conservation			Every year until 2031.3
	Preventing water pollution	Violation of environmental regulations related to water pollution: 0		

*1 Emissions in domestic supply chain (Scopes 1, 2 and 3)

*2 Calculate the estimated effect of CO₂ emissions reduction in one year of the calculation FY by introducing high efficiency facilities and low carbon energy, etc. to customer side and the company's business activities in and after FY2018.3.

Actions for Climate Change

Principle and Outline

The Daigas Group believes that climate change represents an important management challenge, and that initiatives to reduce CO₂ emissions are a crucial mission. In January 2021, we established and announced the “Daigas Group Carbon Neutral Vision,” indicating our vision of how we strive to become carbon neutral by 2050. In light of the global trend to address climate change, we aim to become carbon neutral by 2050 by reducing CO₂ emissions at the Group, customers, and their value chains, to contribute to achieving a carbon neutral society.

Carbon Neutral Vision

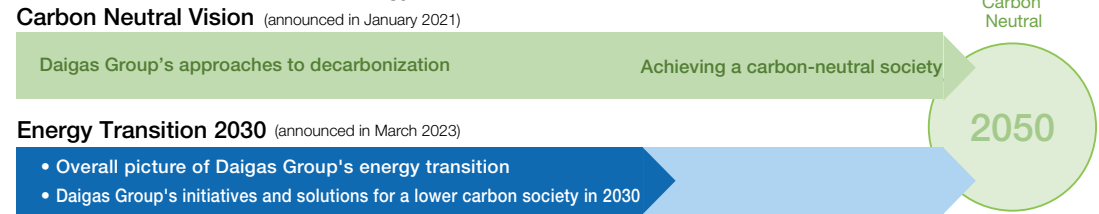
In response to the further increase in social demands for global warming countermeasures, the Daigas Group aims to become carbon neutral by 2050. We plan to reach the goal through decarbonization of our gas and electricity by introducing methanation to generate gas with renewable energy and hydrogen and by increasing the share of renewables in its power generation portfolio, in addition to continuing efforts to expand the use of natural gas to date.

Energy Transition 2030 (ET2030)

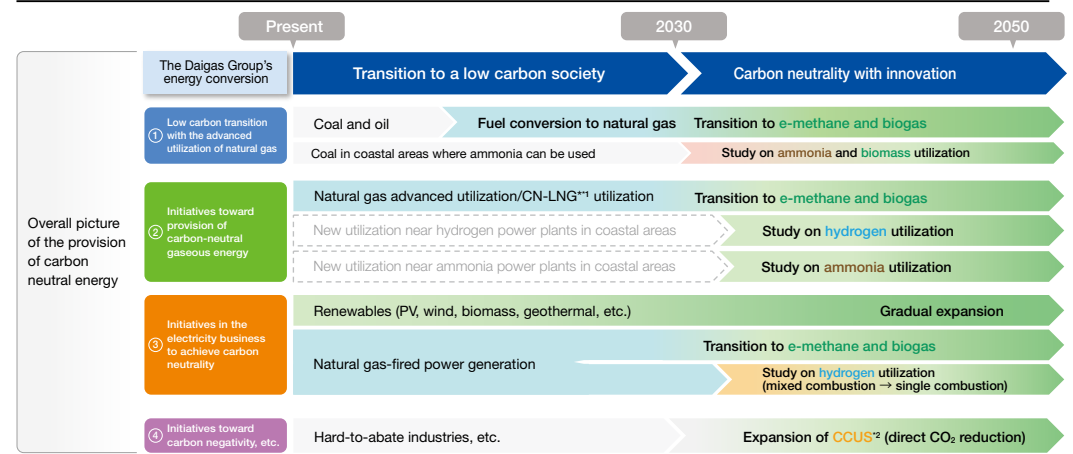
In Energy Transition 2030 (ET2030) released in March 2023, the Daigas Group outlines the overall picture of the provision of carbon neutral energy. The Group has been working on specific initiatives in accordance with a roadmap.

In order to achieve carbon neutrality, a steady transition to low-carbon energy is crucial, as a great deal of time and social cost will be required for technological innovation and the building of supply chains. It is also important to choose optimal energies and supply methods to suit the customer's energy use characteristics, such as the balance of electricity and heat use and their location. Focusing on the transition to low-carbon energy by 2030 through a shift from coal and oil to natural gas, and the seamless transition to carbon neutral energy with the introduction of e-methane and biogas in the future, we will continue to pursue carbon neutrality of power sources in ways that meet customer needs. This will include the use of hydrogen and ammonia, as well as carbon neutrality of power sources, such as renewable energy generation and zero-emission thermal power plants. [Please see our Integrated report 2024, P.32 to P.37](#) for initiatives under the Medium-Term Management Plan 2026.

Carbon Neutral Vision and Energy Transition 2030



	2030	2050	
FY2031.3 Targets	Contribution to developing renewables capacity on a global basis 5 GW Reduction of Daigas Group CO ₂ emissions 5 million tons (relative to FY2018.3)	Percentage of renewables in our power generation portfolio in Japan Approx. 50% e-methane 1% introduction	Avoided emissions 10 million tons (baseline: FY2017.3) Establishment of a pilot-scale (400 Nm ³ /h class) SOEC technology

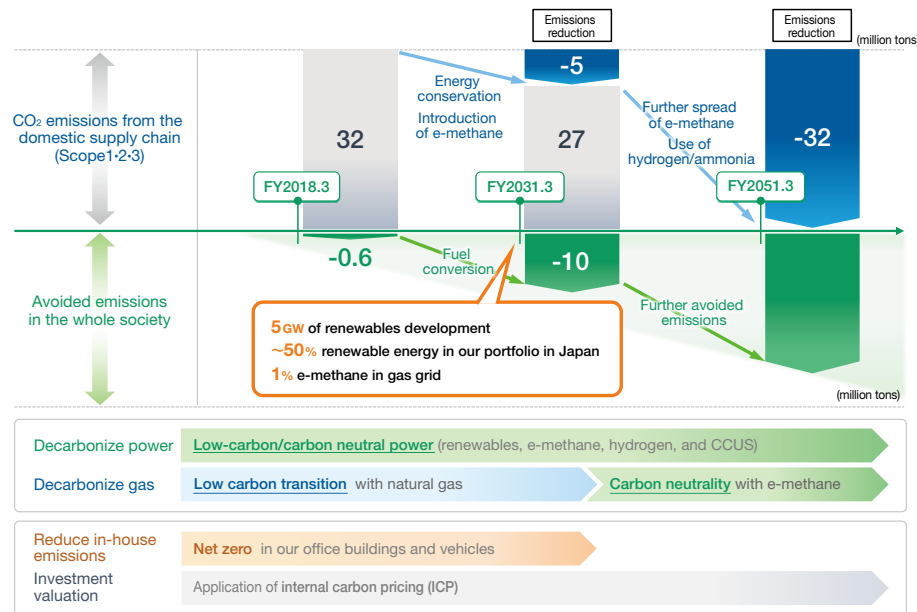


*1 CN-LNG: Carbon Neutral LNG, which is considered to produce no CO₂ on a global basis when greenhouse gases emitted in the supply chain from natural gas production to combustion are offset by CO₂ absorbed and reduced in a separate process from the value chain.

*2 CCUS: Carbon dioxide Capture, Utilization and Storage

Daigas Group's CO₂ Emissions Reduction Roadmap

In Energy Transition 2030, we have declared targets for 2030 and 2050 regarding CO₂ emissions in our domestic supply chain and avoided emissions in the whole society, and presented a CO₂ emissions reduction roadmap. Through such measures as the 1% introduction of e-methane into existing infrastructure, we will aim to reduce the CO₂ emissions of the Daigas Group's supply chain in Japan by 5 million tons, and 10 million tons of avoided emissions in society as a whole in FY2031.3 through the Group's activities. After the introduction of "e-methane" in FY2031.3, we will pursue decarbonization through its wider use.

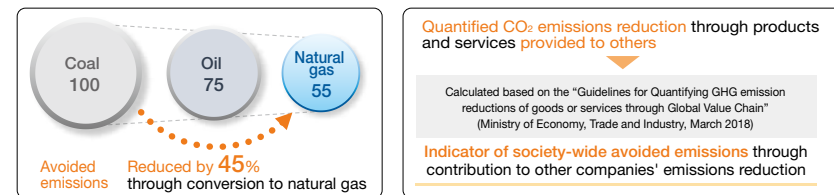


Approach to Avoided Emissions in Society

The following sums up our approach to avoided emissions in society. For example, we can reduce approximately 45% of CO₂ emissions with the switch from coal to natural gas. However, if we have supplied the natural gas, our gas sales volumes increase, which means an increase in Scope 3 CO₂ emissions according to the GHG Protocol*1 that is commonly used by companies to calculate their CO₂ emissions. For this reason, in the transition phase until 2030, our CO₂ emissions will increase by promoting fuel conversion from oil and coal to natural gas. On the other hand, by switching to natural gas, CO₂ emissions per the same calorific value will be reduced, which means that we can contribute to CO₂ emissions reduction in the whole society. However, under the current GHG Protocol, there is no way of evaluating the CO₂ reduction effect on society as a whole through contributions to other parties.

To steadily promote the transition to low-carbon/decarbonization together with our many customers, we believe that it is important to understand our progress with an indicator that shows the effect of CO₂ emissions reduction in the whole society (avoided emissions) and to obtain the understanding of our stakeholders.

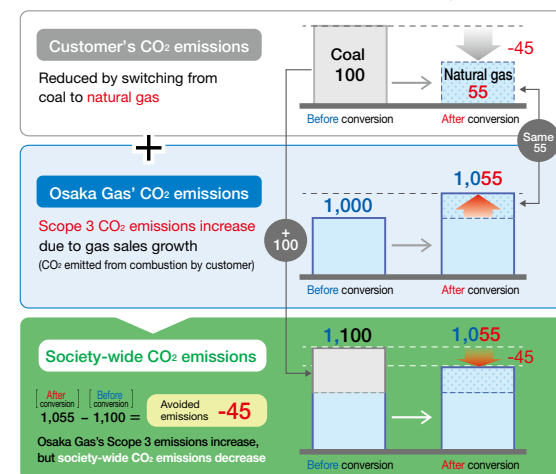
CO₂ Emissions Per Same Calorific Value*2 ■ What is "Avoided Emissions"?



*1 International standard for calculating and reporting GHG emissions

*2 Prepared based on the "Ordinance Concerning Calculation of GHG Emissions from Business Activities of Specified Emitters" issued by METI and the Ministry of the Environment

■ Avoided Emissions Calculation Example



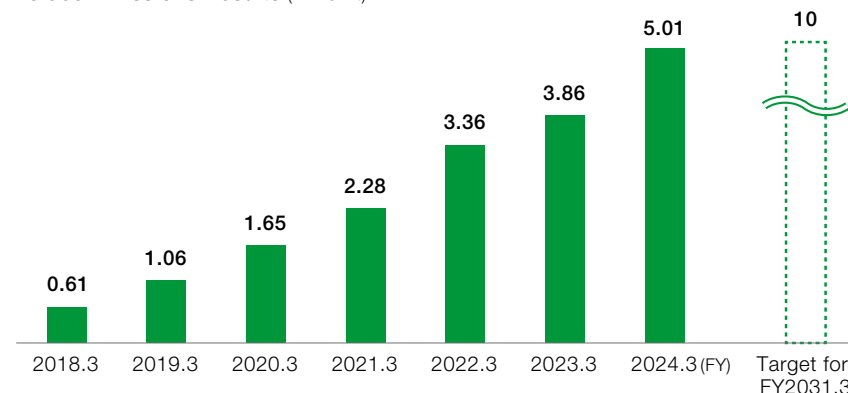
Daigas Group's Avoided Emissions

The Daigas Group is working to introduce various low-carbon or decarbonized systems both domestically and internationally at our customers' sites and in our own business activities. The avoided CO₂ emission is calculated for such systems that contribute to the reduction of CO₂ emissions in society as a whole.



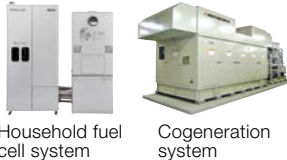



The Daigas Group contributed to a 5.01-million-ton CO₂ emissions reduction, as revealed by the results of calculations of the effect of reducing CO₂ emissions in FY2024.3 (FY2024.3 results) achieved by using the systems listed below that the Daigas Group has introduced since FY2018.3 at customer sites and in its own business activities.

The results were calculated using the stock-based approach, based on the "Guidelines for Quantifying GHG Emission Reductions of Goods or Services through Global Value Chain" (published by the Ministry of Economy, Trade and Industry in March 2018), assuming the calculation method and baseline concept shown in the table below. The calculation results were validated by a third-party review by Bureau Veritas Japan Co., Ltd.

■ Avoided Emissions Results (million t)



■ Calculation Method

	Low-carbon/ carbon-neutral system	Reduction effect calculation method	Baseline concept		Low-carbon/ carbon-neutral system	Reduction effect calculation method	Baseline concept
Reduction of CO ₂ emissions from business activities	Renewable energy sources  Wind farm Solar power plant  Biomass power plant etc.	Amount of electricity generated or procured × Average electricity emission factor of thermal power*	Substitution for thermal power generation	Reduction of CO ₂ emissions at customer sites	High-efficiency distributed system  Household fuel cell system Cogeneration system	Household fuel cell system: Number of installed units × Reduction per unit Cogeneration system: Installed capacity × Reduction per unit capacity	Substitution for conventional water heaters (boilers) and purchased electricity
	High-efficiency thermal power generation  High-efficiency thermal power plant	Amount of electricity generated × Difference in CO ₂ emission factor between high-efficiency and existing thermal power	Comparison with emission factor of existing thermal power generation		Expanded and advanced use of natural gas  Fuel conversion High-efficiency water heater	Fuel conversion: Amount developed × Difference in CO ₂ emission factor Gas-powered air conditioning: Capacity sold × Reduction per unit capacity	Emissions comparison with other fuels Substitution for conventional air conditioners
	Cryogenic power generation facilities using cold heat generated in the manufacturing process of city gas	Amount of electricity generated × Average electricity emission factor of thermal power	Substitution for thermal power generation		 Gas-powered air conditioning	High-efficiency water heater: Number of installed units × Reduction per unit	Substitution for conventional water heaters
				Proposals for energy saving (Photovoltaic power generation systems/Conversion to LED lighting)	Amount of electricity generated or saved × Average electricity emission factor of thermal power*	Substitution for thermal power generation	

*Calculated using the average electricity emission factor of thermal power given in the Plan for Global Warming Countermeasures (approved by the Cabinet on October 22, 2021): 0.65 kg-CO₂/kWh (FY2014.3)

Efforts to achieve net zero emissions regarding the Group's CO₂ emissions (environmental impact throughout the Daigas Group value chain)

The Daigas Group calculated the amount of greenhouse gas (GHG) emissions from companies that constitute the Daigas Group's value chain network, based on the GHG Protocol, an international emission accounting standards. The methodology of the calculation and its results have been certified by an independent organization to verify their reliability and accuracy.

Combined GHG emissions by the Daigas Group and value chain companies, measured by CO₂, totaled about 25.63 million tons in FY2024.3. The sum breaks down into about 4.77 million tons, or about 19%, for GHG emitted through business activities by the Daigas Group (Scope 1 and Scope 2), and about 20.87 million tons, or about 81%, emitted by others in our value chain (Scope 3). GHG emissions from city gas and LNG combustion on the customer side amounted to 16.14 million tons in the reporting year in terms of CO₂, accounting for about 63% of the total. GHG emissions through electricity generation, as measured in terms of CO₂ in the year, amounted to 4.03 million tons, accounting for about 16% of the total emissions, which represented the majority of GHG emissions from the Group's own business activities. As a way of reducing GHG emissions from power generation, the Group will continue to actively introduce highly advanced energy-efficient power generation facilities and use renewable energy sources.

GHG emissions from material and fuel procurement totaled 4.63 million tons, as measured in terms of CO₂ in the year, accounting for about 18% of the total emissions. The procurement of energy sources, especially LNG, accounted for over 70% of that amount. Under these circumstances, we will continue our efforts to improve fuel efficiency regarding the operation of LNG tankers in collaboration with resource suppliers.

Reduction of CO₂ emissions from the Group's own business activities—facilitating the development of renewable energy sources

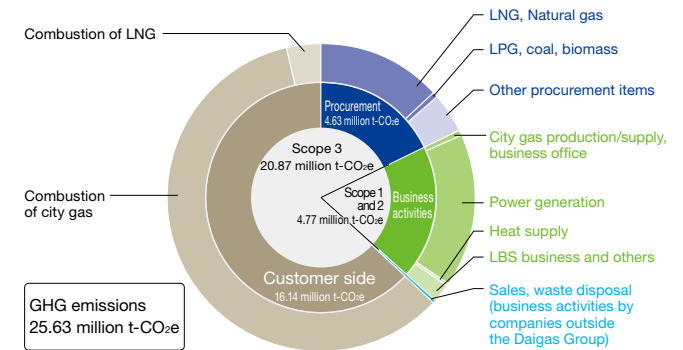
The Daigas Group aims to raise by FY2031.3 the percentage of renewables in its power portfolio in Japan to about 50% and renewables development contribution on a global basis to 5 GW. To achieve these targets, it is engaged in renewable energy businesses such as wind, solar, and biomass.

In FY2024.3, the percentage of renewables in our power portfolio was 22.4%, and renewable power development contribution was 3.17 GW.

In November 2023, we acquired a 40% stake in Sano Solar Power Plant operated by a company owned by Sonnedix Power Holdings Limited, a global renewable energy generator. As a result of the investment in the power plant, we have achieved the target set forth in the Daigas Group Medium-Term Management Plan 2023 (to increase our contribution to developing renewables capacity to 2.5 GW by FY2024.3).

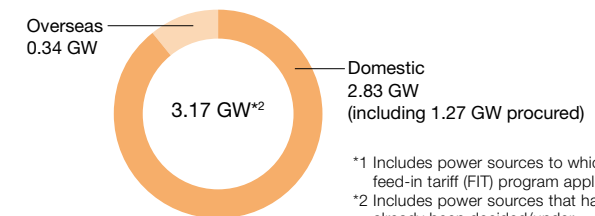
GHG Emissions from the Value Chain (FY2024.3 results)

Please see P.034 for detailed data.



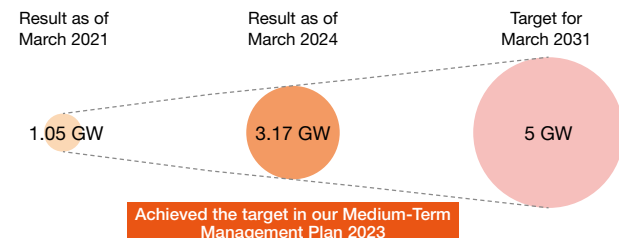
Companies subject to the calculation of GHG emissions: 67 companies in total, including Osaka Gas Co., Ltd. and 66 companies among 159 consolidated subsidiaries are subject to calculation of GHG emissions. Those housed in office buildings as tenants and whose environmental data are difficult to grasp and whose environmental effects are minimal are not subject to such calculation. Also excluded from the calculation are overseas companies, except two companies.

Contribution to Developing Renewables Capacity on a Global Basis*1 (FY2024.3)



*1 Includes power sources to which the feed-in tariff (FIT) program applies
*2 Includes power sources that have already been decided/under construction

Contribution to Developing Renewables Capacity on a Global basis: Targets and Results



CO₂ Reduction Initiatives at Customers and in the Value Chain

The Daigas Group believes that it is important to reduce not only GHG emissions from its own business activities but also CO₂ emissions at customers' sites. We are seeking to assist customers in reducing their CO₂ emissions by popularizing the use of natural gas and developing and proposing highly energy-efficient equipment. We are also cooperating with our business partners and affiliated companies to reduce CO₂ emissions from logistics.

Efforts to reduce CO₂ emissions in LNG transportation

In 2022, Osaka Gas began chartering the low-fuelconsumption LNG carrier Grace Freesia to achieve even greater energy savings when transporting LNG, an essential material for city gas. The new type of LNG carrier is equipped with a dualfuel low-speed diesel engine and a reliquefaction device that effectively utilizes surplus boil-off gas to further reduce fuel consumption, CO₂ emissions, and transport costs.



Low fuel consumption LNG carrier chartered

Reducing CO₂ emissions in logistics

In Japan, the number of trucks accounts for less than 20% of the overall number of automotive vehicles, yet CO₂ emissions in the transportation sector are as high as about 35%. Large trucks generate particularly high emissions, so the introduction of natural gas-powered large trucks can have a significant effect on reducing CO₂ emissions. According to a road verification report by the Organization for the Promotion of Low Emission Vehicles (LEVO), large natural gas trucks have 12.9% lower CO₂ emissions than large diesel trucks. Osaka Gas is working to expand the use of large natural-gas trucks for long-distance transport between cities, and small and medium-sized natural-gas trucks for transport within municipalities.

We have also transported LNG using LNG tanker trucks fueled by compressed natural gas (CNG). These LNG tanker trucks can help reduce CO₂ emissions by about 7%, compared with diesel-fueled tanker trucks.

Japan's first commercial LNG station was opened in Osaka City in June 2018, allowing the start of transport using large LNG trucks. LNG features high-efficiency fuel storage, which lets trucks run for over 1,000 kilometers without refueling for further reductions in CO₂ emissions.



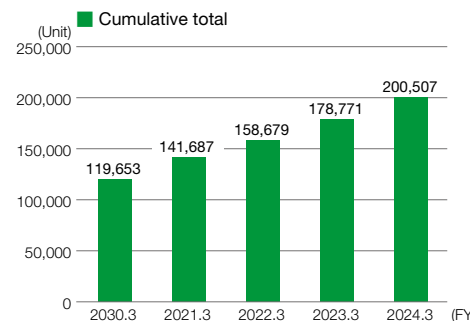
LNG tanker truck fueled by CNG

Approaches at customer sites to reduce CO₂ emissions through the introduction of high-efficiency decentralized system

To help realize a low-carbon society, Osaka Gas is striving to sell and disseminate "ENE-FARM" as a co-generation system for household use that helps conserve energy and reduce CO₂ emissions, which generates electricity through chemical reactions between the hydrogen extracted from city gas and oxygen in the air. "ENE-FARM" is a high-efficiency energy system that makes effective use of the heat generated alongside electricity to supply hot water.

"ENE-FARM type S," launched in April 2020, attains the highest power generation efficiency in the world*1 of 55%*2. Moreover, the main unit has improved in durability and has been significantly downsized. It is equipped with the industry's first electric water-heating mode, which allows customers to use hot water heated by a built-in electric heater even when the supply of city gas is interrupted. As these features were highly regarded, "ENE-FARM type S" won the 7th Japan Resilience Award (2021)*3 and other awards. Additionally, we offer various enhanced services, which have been chosen by many customers. These include IoT connection service, which benefits the user with improved convenience and security, and the surplus power purchase service "E-Share," designed to improve ENE-FARM's environmental friendliness and economical efficiency even more.

Cumulative Sales Total of the Fuel Cell Systems



*1 Household fuel cell system whose rated output is 1 kW or less in Lower Heating Value (LHV). (based on a survey conducted by Osaka Gas as of the end of January 2020)

*2 Power generation efficiency when rated power generation is continued for at least three hours (e.g. under the surplus electricity purchase system). In the cases other than the above, the rated power generation efficiency is 54% (overall efficiency: 87%) in Lower Heating Value (LHV).

*3 A system organized by the Association for Resilience Japan that discovers, evaluates, and awards advanced activities related to resilience which are being developed throughout Japan in order to build a resilient society for the next generation. The award was held for the seventh time in FY2022.3.

Participated in the "Keidanren Carbon Neutrality Action Plan" (formerly titled "Commitment to a Low Carbon Society")

Recognizing that global warming is a global long-term issue to be solved, the Japan Business Federation (Keidanren) formulated a plan titled "Keidanren's Commitment to a Low Carbon Society" in 2013 (revised in 2017), presenting a vision common to the Japanese industries of leveraging their technological prowess to play a central role in achieving the target of reducing global GHG emissions by half by 2050. This plan envisions that each member industry should work to reduce CO₂ emissions from business activities and people's lives in Japan by introducing the best available technologies (BAT) to the maximum and that aspiring initiatives to stop global warming should be actively encouraged abroad. The plan also sets targets for strategically developing innovative technologies that will help achieve a breakthrough for the reduction of CO₂ emissions by half by 2050.

Among the industrial organizations participating in this plan, the Japan Gas Association and the Electric Power Council for a Low Carbon Society have established their own action plans to achieve a low-carbon society in the city gas industry and the electricity industry, respectively. Osaka Gas, a member of both organizations, participates in those plans for both industries and promotes initiatives to address global warming (climate change).

In June 2021, this plan was renewed as the "Keidanren Carbon Neutrality Action Plan." From now on, we will formulate a plan to achieve carbon neutrality by 2050 and promote initiatives to serve that purpose.

A business aiming to achieve local production for local consumption of biomass fuel and a stable supply system using fast-growing trees

In March 2019, Osaka Gas established Green Power Fuel Corporation (hereinafter, “GPF”), a joint venture company that procures and sells domestically grown woody biomass for biomass power plants, in cooperation with Seishin Shinrin Shigen Co., Ltd. and Nippon Paper Lumber Co., Ltd. The Daigas Group already operates or plans to operate seven biomass plants in Japan, including participating in operating the Matsusaka Woody Biomass Power Plant, which is fueled 100% by locally available biomass. In cooperation with Seishin Shinrin Shigen, which has abundant knowledge about forestry, and Nippon Paper Lumber, which has a long track record in dealing in domestically grown woody biomass, GPF procures and transports unused wood from woodlands in Japan as power generation fuel to ensure stable, long-term biomass supply for several biomass power plants owned or under development by the Daigas Group.

On December 17, 2021, Green Power Fuel Corporation signed a cooperation agreement with Shiso City, Hyogo Prefecture, on the utilization of fast growing trees*1 for fuel applications, aiming for local production and consumption of biomass fuels and sustainable growth of domestic forestry. GPF decided to start a demonstration project that aims to build a stable supply system of biomass fuels using fast growing trees, in cooperation with Shiso City, which has abundant forest resources (land suitable for project operationalization). The company focuses on fast growing trees, which are expected to have shorter growth and logging cycles than those of general tree species, from the viewpoint of further increasing its biomass procurement volume and reducing cost. As the first step of this project, the company plans to examine the growth of fast growing trees and evaluate their usefulness as biomass fuels through trial planting in the forests and on abandoned cultivated land owned by Shiso City. Through this demonstration project, GPF will work to build a sustainable business model for domestic forestry by utilizing fast growing trees as fuels. In addition, by utilizing the output of this project, the company will try to realize the independent operation*2 of biomass power plants after the purchase period under the FIT scheme expires.

*1 A general term for trees that grow faster than the commonly planted tree species. Some representative species include Chinaberry and Chinese Fir.

*2 Under the feed-in tariff (FIT) scheme, renewable electricity is purchased at fixed prices for 20 years at maximum. After this period, the generated electricity must be sold at market prices. For this reason, GPF aims to substantially reduce mainly transportation costs by using domestically produced fuels, thereby realizing sustainable fuel costs.

Involvement in a forestry fund formed by the Sumitomo Forestry Group

In July 2023, Osaka Gas announced its joint investment, along with nine other Japanese companies, in the Eastwood Climate Smart Forestry Fund I (“the Fund”) established by the Sumitomo Forestry Group.

The size of this fund is approximately USD 415 million, and the investment period is planned for 15 years. By 2027, the pooled capital will have been invested in the acquisition and management of 130 thousand hectares of forest, primarily in North America. The Fund will contribute to the realization of a carbon-neutral society by generating new absorption of CO₂ and the production and trading of high-integrity carbon credits. (Approx. 46 thousand hectares of forest assets acquired as of June 2024.) The value of forests as natural capital will also be enhanced, such as by maintaining biodiversity and conserving water resources. The Fund will deliver global climate benefits by supporting responsible forest management at an area and financial scale beyond that which individual companies could achieve on their own.



An example of forests purchased by the fund (Courtesy of Eastwood Forests, LLC)

Received “Director-General of the Agency for Natural Resources and Energy Award and the Energy Conservation Center, Japan Chairman’s Award for Energy Conservation Grand Prize 2023”

Daigas Energy Co., Ltd. received two awards in the Product and Business Model Category of the Energy Conservation Grand Prize 2023, sponsored by the Energy Conservation Center, Japan: Director-General of the Agency for Natural Resources and Energy Award and the Energy Conservation Center, Japan Chairman’s Award.

The Energy Conservation Grand Prize is awarded to business operators that promote energy conservation in companies, factories, and business places in industrial, operation, and transportation sectors in Japan, as well as to business operators who have developed products with excellent energy conservation performance, and their activities are shared widely at the award ceremony. By so doing, it aims to contribute to the spread of energy-conservation awareness, promotion of energy-saving products, development of energy-saving industries, and building an energy conservation society.

Director-General of the Agency for Natural Resources and Energy Award in the Product and Business Model Category: “Dr.Flame,” digital combustion control system for industrial furnaces

The system, launched in June 2022, is a digital combustion control system that is capable of precisely controlling the air ratio of gas fuel supplied to industrial furnace burners.

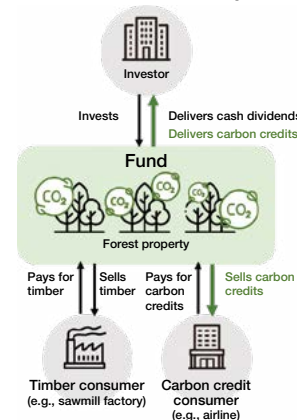
Since conventional combustion control system requires experience and skill to adjust the air ratio, it is difficult to adjust air ratio to ideal ratio. Dr.Flame is capable of automatically performing precise air ratio control over a wide range of combustion volume, making it a solution for the entire industrial furnace issues including energy conservation, CO₂ emissions reduction, and eliminating labor shortages.

The Energy Conservation Center, Japan Chairman’s Award in the Product and Business Model Category: small pressure cooker for commercial use that both saves energy and reduces working hours (awarded jointly with HATTORI KOGYO K.K., which has co-developed the product)

Launched in November 2022, this product is a compact, low-priced product that can significantly reduce energy use without spending time and effort while maintaining the same good taste.

This product is the first pressure cooker for commercial use to be certified by the Japan Gas Appliances Inspection Association (“formal certification” and “gas appliance fire prevention performance rating”).

Structure of forestry fund



Osaka Gas Urban Development Co., Ltd. completed construction of its first logistics facility “MFLP•OGUD Osaka-Torishima” –environmentally friendly facility, including ZEB certification –

Osaka Gas Urban Development Co., Ltd. completed construction of “MFLP•OGUD Osaka-Torishima” (Konohana-ku, Osaka), a joint project with Mitsui Fudosan Co., Ltd., in February 2024. “MFLP•OGUD Osaka-Torishima” is the first logistics facility project by Osaka Gas Urban Development, with solar panels installed on its rooftop that generate approximately 650,000 kWh of electricity through a corporate PPA project*1 with Daigas Energy Co., Ltd. In addition, it supports carbon neutrality, including provision of LED lighting for indoor lighting in common and private areas and RE100-compliant green power to meet customer needs.

These environmentally friendly efforts were highly regarded, and it received the A rank of the CASBEE Osaka Mirai (Comprehensive Assessment System for Built Environment Efficiency in Osaka City) and the highest rank of ZEB certification.

DBJ Green Building Certification*2 was also obtained.

*1 Corporate PPA project

Long-term contracts for the purchase of renewable energy power between companies as consumers of electricity and power producers.

*2 DBJ Green Building Certification

A certification system established by the Development Bank of Japan Inc. (DBJ) in April 2011 to support real estate with environmental and social consideration.

Osaka Gas Urban Development Co., Ltd. has adopted ZEH-M Oriented as standard features of its condominium.




Osaka Gas Urban Development Co., Ltd. obtained ZEH developer certification in April 2022, and has since adopted ZEH-M Oriented as standard features for its new condominium brand “Scenes.” For Scenes, efforts have been made to obtain Comprehensive Assessment System for Built Environment Efficiency (CASBEE) rank A certified, and certification as a low-carbon building (a building that contributes to the reduction of carbon dioxide emissions). In addition, the company is actively adopting energy-saving equipment such as household fuel cell system ENE-FARM, low-E double glazing, heated bathtubs, water-saving toilets, and LED lighting. Four new condominiums have been offered with ZEH-M Oriented as standard features by FY2024.3 (Ready: 1 and Oriented: 3).

Rental apartment series “Urbanex” of Osaka Gas Urban Development Co., Ltd. obtained certification for CASBEE for Real Estate

Osaka Gas Urban Development Co., Ltd. develops urban-type rental apartment series “Urbanex.” Urbanex Kobe Rokko obtained CASBEE for Real Estate*1 rank S★★★★★, and Urbanex Sanadayama, Urbanex Doshin, Urbanex Kitahorie II, Urbanex Shinsaibashi II, Urbanex Shinosaka, Urbanex Kobe Mizukidori, and Urbanex Sannomiya Isobedori obtained rank A★★★★, as of April 21, 2023.

In addition to obtaining environmental certifications for its rented apartments, the company also works to obtain ZEH-M Oriented certification*2, and to introduce renewable energy through Style Plan E-ZERO*3.

Rented Apartments with Renewable Energy

Name	Urbanex Doshin II	Urbanex Shinsaibashi EAST	Urbanex Namba WEST
Exterior view			
Outline	Completed in 2023 Total number of units: 91	Completed in 2023 Total number of units: 70	Completed in 2023 Total number of units: 112

*1 CASBEE for Real Estate

CASBEE evaluates and rates the building’s environmental performance. It is a system that comprehensively assesses the building’s environmental performance including indoor comfort and consideration for the landscape, in addition to aspects of reducing environmental impact such as energy conservation, resource conservation, and recycling performance. CASBEE for Real Estate was developed to utilize the environmental assessment results of buildings in CASBEE for real estate assessment. The assessment is conducted on existing buildings that have been completed for at least one year, and buildings are scored in five categories of energy/greenhouse gases, water, resource use/safety, biodiversity/site, and indoor environment, and rated on four levels: “rank S★★★★★,” “rank A★★★★,” “rank B+★★★,” and “rank B★★.”

*2 ZEH-M Oriented certification

ZEH is an abbreviation for “net Zero Energy House.” ZEH-M Oriented certification is obtained by reducing annual primary energy consumption by 20% or higher by achieving substantial energy conservation while maintaining the indoor environment through measures such as improving insulation performance and introducing efficient equipment, etc. in ZEH-M, the housing complex version.

*3 Style Plan E-ZERO

Electricity price menu offered by Osaka Gas, with zero CO₂ emissions and consisting of 100% renewable energy.

Disclosure Based on the TCFD Recommendations: Recognition of and Action on Risks and Opportunities

Principle and Outline

Tackling climate change is seen as one of the Sustainable Development Goals (SDGs) adopted by the United Nations. Since the Paris Agreement came into force in November 2016, initiatives to tackle climate change are being undertaken around the world. In Japan, the country declared carbon neutral by 2050 in October 2020, making it even more important to address climate change.

For the Daigas Group, which is engaged primarily in the energy business, climate change represents an important management challenge, and initiatives to reduce CO₂ emissions are a crucial mission. In January 2021, the Daigas Group established and announced the “Daigas Group Carbon Neutral Vision,” indicating its vision of how it strives to become carbon neutral by 2050. In March of the same year, the Company announced its “Medium-Term Management Plan 2023.”

In March 2023, we released “Energy Transition 2030 (ET2030),” which outlines the overall roadmap for the transition to carbon neutral energy, as well as our Group’s specific initiatives and solutions we can offer our customers toward 2030. In the Daigas Group Medium-Term Management Plan 2026, announced in March 2024, we position providing carbon neutral energy as one of our key initiatives.

The recommendations of the Task Force on Climate-Related Financial Disclosures (TCFD) announced in June 2017 (the “TCFD recommendations”) encourage companies to disclose climate change-related financial information to promote appropriate investment decisions by investors. Osaka Gas supports the TCFD recommendations, and utilizes them as indicators to validate its climate change response. We also participate in the TCFD Consortium*, where discussions take place on efforts toward information disclosure on responses to climate change based on the TCFD recommendations.

* TCFD Consortium

The TCFD Consortium was established on May 27, 2019, whose members from the Japanese private sector discuss how companies can effectively disclose information on tackling climate change and how financial institutions can use the disclosed information to make appropriate investment decisions. From the Japanese government, the Ministry of Economy, Trade and Industry, the Financial Services Agency, and the Ministry of the Environment participate as observers in the consortium.

Climate Change Governance

The Daigas Group regards tackling climate change as a key management issue. Just as with other important business activities across the Group, the Board of Directors is responsible for making decisions on and supervising activities aimed at tackling climate change and other environmental issues. At the ESG Council (Management Meeting), which is held three times a year, executives discuss activity plans and activity reports related to ESG issues, including climate change issues, and submit reports to the President.

The Group also has the ESG Committee, chaired by the Executive in Charge of ESG Promotion (Representative Director and Executive Vice President), who supervises the Group’s sustainability activities, and consisting of the heads of related organizations. The ESG Committee meets three times a year for the cross-organizational deliberation, coordination, and supervision of climate-change-related issues, including the planning and promotion of related business activities, progress in achieving relevant targets, and risk management. The committee submits to the Board of Directors deliberation proposals and reports on important agenda items, such as the status of achievement of sustainability-related ESG management targets and business projects expected to sustain a major financial impact due to climate change.

Directors other than Outside Directors are paid performance-linked remuneration, and one of the performance indicators is the ESG indicators achievement coefficient. For ESG indicators, CO₂ emissions aimed at carbon neutrality and other climate change-related indicators are employed.

Strategy

Scenario analysis

The Daigas Group has been working on climate change scenario analysis that is intended to be utilized as reference material in the evaluation and preparation of countermeasures, and to understand the impact of climate change on the Group’s business on a medium- and long-term basis. For the analysis, we used the scenarios* published by IEA.

We assessed our energy businesses (gas, electricity and related businesses in Japan and overseas) which are expected to experience the greatest impact from climate change among the Group’s businesses, assuming a multi-track scenario (1.5°C Scenario (NZE2050), 2.6°C Scenario (STEPS)*) that takes into account the progress of energy conservation and changes in the composition of power sources, etc.

We steadily implement initiatives to increase the resilience of the Group’s businesses, while applying the suggestions gained from scenario analysis to our evaluation of medium- and long-term business strategies. Moreover, as the global response to climate change continues to progress, the scenario’s preconditions may also change in the future. We will continue to deepen our scenario analysis, renewing our assumptions in line with the latest conditions as necessary, taking into account scenarios established by external authorities.

Source: IEA “World Energy Outlook 2021”

■ Governance System for Climate Change



- Board of Directors
15 Directors (8 Internal Directors and 7 Outside Directors)
- ESG Council (Management Meeting)
1 President, 3 Executive Vice Presidents and
8 Senior Executive Officers
* In principle, it is held three times per year as “ESG Council.”
- ESG Committee
Executive Vice President (Head of ESG Promotion) and
heads of related business units, etc.

(As of June 27, 2024)

Recognition of risks and opportunities

Using a multi-track scenario analysis, the Daigas Group identified anticipated risks and opportunities, based on the environment surrounding its domestic and overseas energy businesses, evaluated them, and examined countermeasures in the short- to medium-term toward 2030 and the long-term toward 2050.

The Group is engaged in gas and electricity businesses, primarily in the Kansai region, which use natural gas as their main raw material and fuel. The external environment is undergoing various changes due to climate change. We have classified the major factors associated with these changes into “transition risks” and “physical risks,” and identified the major risks and opportunities. Significant risks for the Group related to climate change include the possibility that rising sea levels and natural disasters such as typhoons and torrential rains due to localized abnormal weather events, etc. may cause damage to our manufacturing/distribution equipment. In addition, it is possible that our businesses may be affected by significant increases in the carbon tax rate in Japan, or an increased desire among our customers to switch to non-fossil fuels. However, promotion of the development and spread of renewable energy and technologies for carbon neutrality also represents a significant opportunity for the Group.

The Group will pursue sustainable growth by promoting portfolio management through diverse businesses in order to respond appropriately to the identified risks and opportunities.

Evaluation of Risks and Opportunities

		Impact on Business			
		Scenario	Impact	Short- and Medium-Term	Long-Term
Risks	Physical	Physical risks 2.6°C	Damage to facilities arising from meteorological disasters	Increase in capital investment costs and insurance premiums	Increase in facilities countermeasure costs
	Transition	Market	Switch to natural gas	Increase in prices due to greater competition in LNG procurement	Further price hikes and impediments to procurement, due to increasing competition in LNG procurement
			Switch to non-fossil fuel energy	Fall in sales of gas and thermal power	Fall in sales of gas and thermal power
		Reputation	Focus of investment criteria on low-carbon or decarbonized businesses	Diminished capital procurement power in gas-related businesses	Declining investment in fossil fuels businesses
		Policy and legal	Introduction of a carbon tax	Carbon tax burden on gas and thermal power businesses	Increasing burden with rising carbon tax rates
Opportunities	Physical	Physical Opportunities 2.6°C	Increase in awareness and support measures for weather disaster countermeasures	Increase in sales of products /services with disaster response function	Expansion of decentralized energy systems
	Transition	Market	Switch to natural gas	Switch to LNG in Japan; Expansion of LNG business oversea	Switch to LNG and expansion of sales of high-efficiency equipment abroad
		Technology	Development of renewable energy and CCUS technologies	Expansion of development of renewable energy sources	Introduction of "e-methane," expansion of renewable energy sources, utilization of thermal power generation with CCS
		Policy and legal	Implementation of a national policy for the mass introduction of renewable energy sources	Expansion of sales of electricity from renewable energy sources	Expansion of sales of electricity from renewable energy sources
		Technology	Development of AI/IoT	Participation in decentralized power sources aggregation business	Expansion of decentralized power sources aggregation business

Financial impact : Small Financial impact : Large

Strategies/Countermeasures for Risks and Opportunities

		Short- and Medium-Term	Long-Term
Risks	Physical	● Implement disaster countermeasures for facilities	
	Transition	<ul style="list-style-type: none"> ● Diversify procurement sources ● Develop and expand sales of renewable energy power sources in Japan and abroad ● Engage in dialogue with investors Please see the following material for our major initiatives*	
Opportunities		● Investigate, develop, and verify "e-methane" technologies	● Full-scale introduction of CCUS/"e-methane," hydrogen, etc. and establishment of supply chains
	Physical	● Development and sale of equipment with disaster response functions	
	Transition	<ul style="list-style-type: none"> ● Develop and expand sales of renewable energy power sources in Japan and abroad ● Develop and sell high efficiency, compact decentralized power sources (CHP, fuel cells) ● Expand fuel switching, sales of high efficiency equipment in Japan and abroad ● Verify and participate in the decentralized power sources aggregation business Please see the following material for our major initiatives*	
		● Further develop energy-saving technologies	● Full-scale introduction of CCUS/"e-methane," hydrogen, etc. and establishment of supply chains

*  Carbon Neutral Vision  Energy Transition 2030

Financial Impact of Climate Change Risks and Opportunities

In its Medium-Term Management Plan 2026, the Daigas Group expects to invest 100.0 billion yen in the carbon neutral field (renewable energy, e-methane, etc.) for a future earnings structure as investment for growth from FY2025.3 to FY2027.3.

The Daigas Group is actively contributing to the spread of renewable energy, and estimates that the sales impact of expanding its renewable energy business in FY2031.3 will be on the order of 100 billion yen.

It should be noted that there are uncertainties and assumptions in the above estimation of financial impact. In practice, the impact may vary significantly as a result of changes in key factors.

Initiatives to Reduce Greenhouse Gas Emissions

Initiatives to reduce greenhouse gas emissions are a crucial mission for the Daigas Group. We focus on reducing CO₂ emissions, not only from our own business activities, but also from customers who use the energy we provide. In the Daigas Group Energy Transition 2030 (ET2030), we have set a target of reducing CO₂ emissions in our domestic supply chain by 5 million tons by FY2031.3 compared to FY2018.3, and we are taking various initiatives to reduce CO₂ emissions.

Under the Daigas Group Carbon Neutral Vision, we have established the goal of contributing 10 million tons per year of CO₂ emissions reductions in FY2031.3. This indicator will enable us to contribute to reductions throughout society, and we therefore use it as a management target linked to the Group's business initiatives. Please see □□P.038-P.046 for each initiative.

Initiatives Ensuring Resiliency for a Carbon Neutral Society

Securing a stable supply of energy, a core social infrastructure, is one of the major climate change-driven challenges facing society as a whole. By continuing to provide a range of services, including multiple sources of clean energy such as gas and electricity utilizing technologies for carbon neutrality, disaster response equipment, and the widespread and advanced use of energy, the Daigas Group will strive to contribute to society in terms of stable supply and resilience toward a carbon neutral society.

The Daigas Group will aim to achieve both business growth and stable social infrastructure, and promote activities that contribute to reducing CO₂ emissions throughout society, promote the advanced use of gas, and develop technologies for carbon neutrality, in response to the growing global trend toward carbon neutrality. Please see □□P.040 for an overall picture of the Daigas Group's efforts to provide carbon neutral energy.

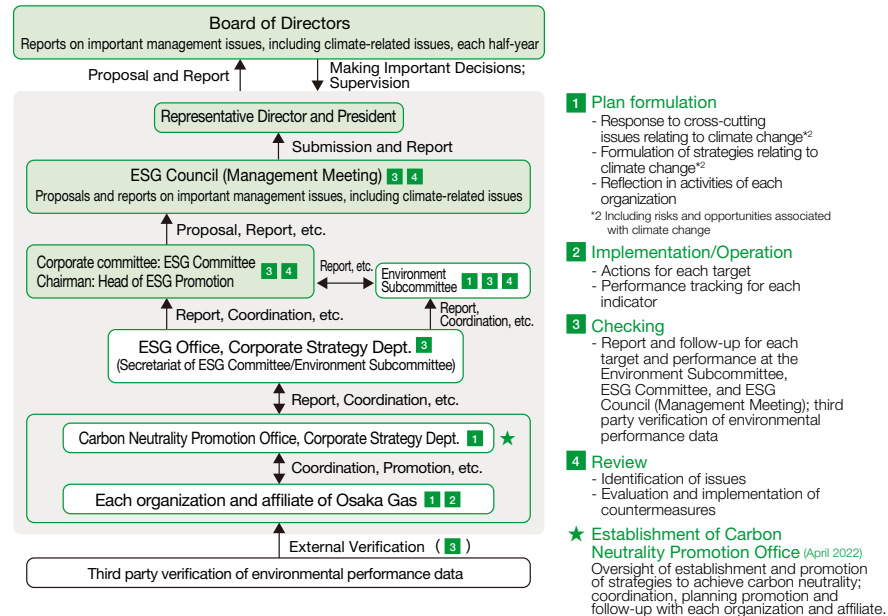
Risk Management

When deciding on the Daigas Group's business plan and investment plan, the internal organizations responsible for the gas, electricity and other businesses analyze the risk factors and their impact on each business, distill and identify risks, and submit these together with other business risks, etc. to the Management Meeting for deliberation. Climate change risks in the formulated plans are managed through a PDCA cycle, and are reported and followed up at the Environment Subcommittee, ESG Committee, and ESG Council (Management Meeting).

Decisions on climate-related risks and sustainability, including investment decisions, are made by the Board of Directors and the Management Meeting. Matters related to climate change that were proposed or reported by March 31, 2024, included those listed right.

- Resolutions for collaboration and participation in projects for a carbon neutral society, based on the Carbon Neutral Vision
- Formulation and disclosure of Medium-Term Management Plan 2026
- Monitoring of the results for indicators used to manage climate change response, etc.

■ Governance/Risk Management System for Climate Change



Indicators and Targets

The Daigas Group will proceed to contribute to radically reducing CO₂ emissions and realizing a carbon neutral society, through initiatives such as energy conservation, the advanced use of natural gas, and the widespread use of renewable energies.

	Field	Indicators	Targets	Target FY	
Climate Change		CO ₂ emissions of Daigas Group	Net-zero CO ₂ emissions 27.02 million tons* ¹ Domestic: 5 million tons less than FY18.3	2051.3 2031.3	
		Contribution to CO ₂ emissions reductions across society	Avoided emissions* ²	10 million tons 7 million tons	2031.3 2027.3
		CO ₂ emissions reductions from our own business activities	Renewable energy development contribution	5 GW 4 GW	2031.3 2027.3
			Percentage of renewables in our power generation portfolio in Japan	Approx. 50% Approx. 30%	2031.3 2027.3
			CO ₂ emissions reduction in the Group company offices and vehicles	100% 67%	2031.3 2027.3
		Contribution by development of technologies	Promotion of e-methane practical application	1% e-methane in gas grid Final investment decisions in e-methane supply chain PJ	2031.3 2027.3
			Promotion of methanation technology development	Establishing a pilot-scale (400 Nm ³ /h class) SOEC technology	2031.3
				Transition to the second phase of SOEC GI funds business	2027.3

*1 Emissions in domestic supply chain (Scopes 1, 2 and 3)

*2 Calculate the estimated effect of CO₂ emissions reduction in one year of the target FY by introducing high efficiency facilities and low carbon energy, etc. to customer side and the company's business activities in and after FY2018.3.

Contributing to the Resource-Recycling Society

Principle and Outline

With the aim of creating a recycling-oriented society, the Daigas Group strives to minimize waste emissions through efficient use of resources throughout its business activity value chain and through resource recycling by means of promoting the 3R + Renewable efforts. The Group also strives to conserve water through appropriate use of water and wastewater management.

More Specifically, Daigas Group is thoroughly implementing the 3Rs (reduce, reuse, recycle), cutting its resource consumption and waste generation, and endeavoring to reuse and recycle used resources. We are recycling resources throughout our business activity value chain by such means as striving for zero emissions at LNG terminals, reusing gas meters, recycling gas pipe materials, reusing excavated soil from gas pipe installation, and recycling used gas equipment.

Consumption of Resources by Daigas Group

Recycling of used gas pipes

The polyethylene (PE) pipes waste material generated at work sites is mainly used as covers to protect gas pipes and as post markers to indicate the location of supply pipes. In FY2024.3, 127 tons of polyethylene (PE) pipe waste was generated and all was reused. Metal pipes, such as steel and cast-iron pipes, are sold to electric furnace manufacturers and recycling companies, who use them as raw materials for products.

Reusing of gas meters

To measure the amount of gas used by customers, Osaka Gas has installed approximately 7.4 million gas meters. Under the Japanese Measurement Law, these devices must be replaced every 10 years.*1

After 10 years in use, gas meters are repaired (taken apart, inspected, and fixed) to make them perform as well as new ones. They are then installed at customer sites. In the past, this type of repair was conducted a third time to give the gas meters a total lifespan of 40 years. After conducting evaluations including durability tests*2 jointly with the gas meter manufacturers, we came to a decision that these gas meters can be used another 20 years if twice of additional repairs are conducted. Based on the result, the Company has decided to increase the maintenance of gas meters by two times since FY2010, and to use them for 60 years.

As a component material, around 2 kg*3 of aluminum is used in each gas meter body. Reusing gas meter reduce 80%*4 of CO₂ emissions, that includes CO₂ emission that would have been emitted in the process of casting a new gas meter body, giving a cumulative total reduction of 85,000 tons over the next 20 years, compared with producing new meters.

*1 Replacement of meters: Some exceptions apply. (Meters from #25 or higher need to be replaced every seven years)

*2 Durability test: Cyclic tests, accelerated temperature tests, etc.

*3 Calculation of aluminum use: A body of gas meter contains approximately 2 kg (average of from #2.5 to #6) of aluminum.

*4 Calculation of CO₂ emissions: Calculated with new meters also using regenerated aluminum.

Electronic issuance of a manifest certifying waste disposal via the Daigas Group's e-Cycle system

The Daigas Group operates a proprietary "e-Cycle" system that links appliance sales agents, collection and transportation companies, and disposal companies via the Internet. This system

enables prompt confirmation of "manifests," which certify that used equipment collected by sales agents has been appropriately handled by the shipping companies and the disposal companies.

The manifest is electronically issued, as the Daigas Group's e-Cycle system is connected to the Japan Industrial Waste Information Center (JWNET) through the EDI.*

* EDI

EDI stands for electronic data interchange. Electronic data are exchanged between the JWNET and Osaka Gas's e-Cycle system.

Compliance with the Home Appliance Recycling Law

The Daigas Group appropriately disposes of gas air conditioners for household use and clothes dryers, covered by the Home Appliance Recycling Law, in line with the law. In FY2024.3, about 106 tons of gas air conditioners for household use were collected, and 91% of them were recycled, higher than the minimum mandatory recycling rate of 80%. The amount of clothes dryers collected during the same year came to about 17 tons, 91% of which was recycled, far above the mandatory recycling rate of 82%.

■ Air Conditioners

	FY2020.3	FY2021.3	FY2022.3	FY2023.3	FY2024.3
Number of units recycled (units)	4,348	3,656	2,921	2,755	2,645
Gross weight recovered (t)	177	147	118	111	106
Weight recycled (t)	161	134	107	101	97
Recycling rate (%)	91	90	90	91	91

■ Clothes Dryers

	FY2020.3	FY2021.3	FY2022.3	FY2023.3	FY2024.3
Number of units recycled (units)	476	523	393	445	408
Gross weight recovered (t)	19	21	16	19	17
Weight recycled (t)	17	19	15	17	15
Recycling rate (%)	88	89	90	90	91

Environmentally Conscious Procurement

The Daigas Group aims to contribute to the development of a sustainable society and believes that environmental and social consideration is important in procurement. We have established the Daigas Group Procurement Policy, and are promoting purchasing activities based on the Daigas Group Environmental Policy.

Considering the balance between economic conditions and the reduction of environmental impact, we are promoting green purchasing that prioritizes the purchase of products and services with the lowest possible environmental impact throughout their product life cycle, from resource extraction to waste disposal, from business operators who strive to reduce their environmental impact.

■ Main examples

By replacing the plastic folder opening packs (distributed 587,500 packs/year) that are provided when gas is opened at customers' homes with paper folders, we have reduced approximately 13 tons of plastic.

Before change



After change



We have adopted “waterless printing*” in our Group’s brochure to present corporate profile (issued 10,000 copies/year) for the first time.

* Waterless printing is a printing method that produces no harmful waste fluid. This method is also effective in reducing CO₂ emissions including VOCs (volatile organic compounds) in the print production process. (Source: Japan Waterless Printing Association website)



We promote environmentally friendly purchasing in our “SOLOEL Purchasing Convenience Book,” a product catalog purchasing system for Group companies, by introducing environmentally friendly items available through SOLOEL external catalogs (ASKUL, Biznet). Such items include “HOTAMET,” an environmentally friendly helmet made from scallop shells. Approximately 14,000 out of 33,000 items (approx. 42%) offered by ASKUL, and approximately 12,000 out of 30,000 items (approx. 40%) offered by Biznet are environmentally friendly products.



Chemical substance management

Legal compliance and proper management

There are very few hazardous chemicals handled by the Daigas Group during the processing and supply of natural gas. The Group will continue to manage and reduce the amount of chemicals it uses under the policies shown below.

■ Daigas Group Chemical Substance Management Principles

1. We comply with laws and environmental regulations concerning the use of chemical substances.
2. We use ISO 14001-compliant and other environmental management activities to step up management and decrease emissions of chemical substances.
3. We disclose information on chemical substance management mainly on our website.

Soil and groundwater conservation



Inspecting soil and groundwater on former coal gas production sites

In compliance with relevant laws and regulations, Osaka Gas has checked the possibility of soil pollution at former coal gas production sites by measuring the amount of specified chemical substances contained in the soil and groundwater taken from the sites and assessing their impact on the sites and surrounding areas. The results of the surveys have been disclosed and response measures have been implemented where necessary. For example, when chemical substances (mainly cyanide compounds and benzene) in excess of the maximum amount allowed under the Soil Contamination Countermeasures Law were found, the incidents were reported to administrative authorities and adequate measures, including removal and cleaning the problematic soil, were taken promptly. Before changing the form of land, we conducted surveys based on relevant laws and regulations, followed by implementing appropriate response measures, including disposing of the contaminated soil and on-site containment of the soil. We have issued press releases regarding the results of investigations and the response measures, all of which have already been implemented. We will continue to take necessary measures based on the Soil Contamination Countermeasures Law.

Management of asbestos

The status of asbestos use at major facilities and buildings of the Group, and in its gas equipment, is given below.

Gas manufacturing and supply facilities	Gas equipment, combustion equipment	Daigas Group's buildings
Asbestos is not used in new facilities. The asbestos used in existing facilities as installed does not disperse into the air. When these facilities are serviced or reclaimed, nonasbestos material will be used in place of asbestos.	Asbestos is not used in new gas equipment or combustion equipment. Some of the gas equipment sold in the past used asbestos in gaskets or the like, which does not disperse into the air under ordinary conditions of use.	Measures to systematically eliminate spray-on asbestos insulation in buildings have been completed. Showrooms and other open spaces visited by customers do not use spray-on asbestos.

Compliance with the Act on Promotion of Recycling of Plastic Resources

The Daigas Group promotes resource recycling efforts through the promotion of the 3Rs (reduce, reuse, and recycle) plus renewable with the aim of creating a recycling-oriented society.

With regard to plastic resources, we are actively implementing material recycling in our business supply chain, including 100% recycling of waste polyethylene (PE) pipes, which are gas pipe materials, and recycling of resin used for gas alarms.

We will also continue our efforts to minimize the amount of landfill waste and other waste finally disposed of by effectively utilizing waste from other plastic products as thermal energy by, for example, converting it into refuse paper & plastic fuel (RPF).

Management of waste containing PCBs

Proper management and disposal of PCBs in line with government policy

Every company in the Daigas Group manages and disposes of waste containing PCBs in accordance with Japan's Act on Special Measures for Promotion of Proper Treatment of Polychlorinated Biphenyl (PCB) (PCB Special Measures Act). All capacitors and transformers with a high density of PCBs over 10 kg were disposed of by FY2013.3. All ballasts and other equipment that contain PCBs were also disposed of by the statutory processing deadline. Low-density PCBs have been consigned to approved decontamination facilities since FY2014.3 in a systematic process of disposal.

Going forward, we will continue to store and dispose of PCBs properly, in accordance with the government's disposal schedule and policies.

Gas appliance eco-design

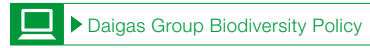
Conform with all laws and take the environment into consideration, such as by restricting the use of chemical substances

July 2006 was the start of the RoHS Directive, which restricts the use of specified substances, such as lead and cadmium, in appliances. Also in July 2006, in Japan the revised Law for the Promotion of Effective Utilization of Resources went into effect, obligating companies to label products as containing the six specific hazardous substances of the RoHS Directive according to J-MOSS, the JIS standard for the labeling of electrical and electronic products containing chemical substances.

In line with the measures propelled in the automobiles and home appliances sectors, we are working together with gas appliance manufacturers on the development of environmentally-friendly gas appliances and its labeling. The Daigas Group currently does not manufacture or sell gas appliances containing any of the specified substances that require labeling under J-MOSS. The Group abides by Japanese regulations on chemical substances (the Law Concerning the Examination and Regulation of Manufacture, etc. of Chemical Substances, and the Law for the PRTR and Promotion of Chemical Management). We also engage in independent evaluations of chemical management according to the RoHS Directive and are working to reduce chemical substances outlined therein.

Biodiversity

Principle and Outline



Believing that the many blessings of biodiversity are essential for the promotion of the Group's business, the Daigas Group in April 2010 established the "Osaka Gas Group Biodiversity Promotion Policy," which was revised to the Daigas Group Biodiversity Promotion Policy in March 2018. Subsequently, we made revisions to the Daigas Group Biodiversity Promotion Policy in April 2024 to clearly state that we will work to "understand our dependence and impact on biodiversity, as well as the risks and opportunities that come with them," and to "avoid or minimize our impact on biodiversity." Prior to the revisions, we referred to Japan's National Biodiversity Strategy 2023-2030 formulated based on the launch of the Taskforce on Nature-related Financial Disclosures (TNFD)* in June 2021 and Kunming-Montreal Global Biodiversity Framework, which was adopted at the 15th Conference of the Parties to the Convention on Biological Diversity (COP15) held in December 2022. The Group have begun to identify the relevance (dependencies/impacts) between nature and our business as recommended by the TNFD and to study our response, in line with the Policy. Through its business activities, the Group intends to offset its negative impacts on biodiversity and aims to build a nature-positive society.

* An international organization, originally conceived at the Annual Meeting of the World Economic Forum (known as the Davos Meeting) in 2019. It requires companies to disclose and act on their nature-related dependencies and impacts, and risks and opportunities.

Start of Study for TNFD Response

The recognition that natural capital is in crisis has been shared globally, as it was reported at the World Economic Forum that more than half of the world's GDP (approximately 44 trillion US dollars) has been potentially threatened by the loss of nature. In response to this situation, "nature positive," a global societal goal to halt the loss of nature and put it on a recovery track by 2030, and achieve a society in harmony with nature by 2050, was established. Recognizing that companies are required to make efforts to contribute to achieving that goal, the Daigas Group has embarked on an analysis and assessment in line with the LEAP approach*, recommended by the TNFD, in studying nature-related dependencies, impacts, risks and opportunities.

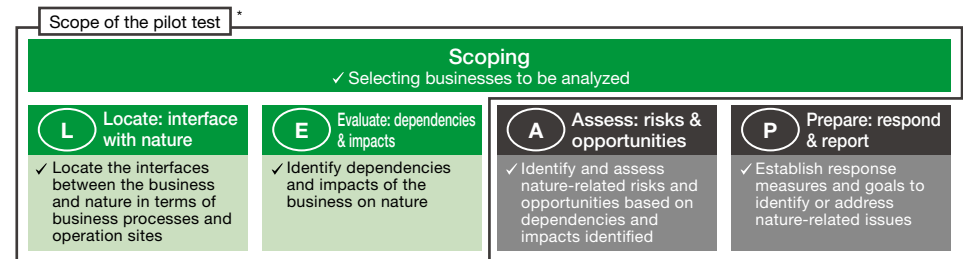
* A methodology developed by the TNFD to enable assessment of nature-related issues in corporate activities such as interfaces with nature, dependencies and impacts on nature, and nature-related risks and opportunities.

TNFD and LEAP approach

Taking into consideration the Group's business scale and the degree of its dependencies and impacts on biodiversity, we included the direct operations of the Group's domestic and international energy (LNG utilization) business in the scope of analysis under the LEAP approach. In the analysis, items related to Locate (interface with nature) and Evaluate (dependencies & impacts) were pilot tested within the scope of the LEAP approach.

As for governance, our biodiversity-related initiatives are managed and supervised under the same system as for climate change. Please see "Disclosure based on the TCFD Recommendations" (P.047) for details.

Pilot Test Process Using the LEAP Approach



* L (Locate) and E (Evaluate) processes were analyzed and assessed this time.

Analysis result 1 Dependencies and impacts on nature

Under the LEAP approach, we used ENCORE,* one of the analysis tools recommended by the TNFD, to analyze the ecosystem services of the business analyzed and their relationship to natural capital in terms of potential dependencies and impacts. We also created a heat map showing the dependencies and impacts relationship between the business analyzed and nature, based on the results of the ENCORE analysis.

As a result of the ENCORE analysis, in the nature impacts category, the impact on nature through GHG emissions was assessed as high, in common except for the storage process in the gas business. For the production process, the impact was assessed as high in the category of impacts on nature through input such as the use of terrestrial and freshwater biological systems.

In the category of dependencies on nature, it was assessed that the businesses analyzed were commonly dependent on the supply service of surface water and underground water. The transportation process was also assessed as being dependent on the climate control services through ocean currents and wind. The ENCORE data used in the analysis (as of April 2024) did not include the impacts by invasive species in the assessment metrics. However, we are aware of their impacts on nature in the Group's businesses, and will continue our existing initiatives.

* A tool jointly developed by UNEP-FI, UNEP-WCMC, and Global Canopy that can be used to identify the general dependencies and impacts of each business process relevant to a company.

Heat Map Showing Dependencies and Impacts of the Business on Nature*1

Business category		Dependencies on nature								
		Supply services		Adjustment and maintenance services						
Name of business	Category	Water		Removal/mitigation of hazardous substance	Atmosphere-related	Water-related		Land-related	Other	
		Surface water	Underground water	Decomposition function	Filtration	Climate control	Water quality	Water flow maintenance	Slope stabilization and erosion control	Flood and storm prevention
Gas business	Transportation*2	H	H	—	—	VH	M	M	M	H
	Storage	—	—	—	—	VL	—	—	L	M
	Production	H	VH	M	M	M	H	—	M	H
	Supply	—	—	VL	VL	M	VL	VL	H	M
Electricity business	Power supply	VH	M	VL	L	VL	L	M	L	M

Business category		Impacts on nature									
		Input				Output					
Name of business	Category	Use of terrestrial ecosystems	Use of freshwater ecosystems	Use of marine ecosystems	Use of water	GHG emissions	Non-GHG air pollutants	Water pollutants	Soil contaminants	Solid wastes	Disturbance (disturbance to life)
Gas business	Transportation*2	H	VH	VH	—	VH	H	H	H	M	H
	Storage	H	—	—	—	—	—	L	L	—	—
	Production	VH	VH	VH	VH	VH	VH	H	H	H	H
	Supply	H	H	H	H	VH	M	H	H	M	—
Electricity business	Power supply	—	H	—	VH	VH	H	H	H	H	H

Analysis result 2 Interface with important areas in relation to natural capital

In addition to identifying dependencies and impacts on natural capital in the Group’s businesses, we identified areas requiring attention*2 in the Group by using a tool*1 recommended as an assessment perspective in the TNFD, with the aim of understanding the relationship between the Group’s operation sites and the surrounding natural environment.

The results of the analysis showed that five of our domestic and overseas sites (overseas offices and domestic LNG terminals and power plants) are located in protected areas and areas of biodiversity importance, and we have identified them as falling under areas requiring attention.

As for water stress assessment of our business sites, Osaka Gas has been compliant with CDP,*3 a global environmental protection organization that evaluates environment-related strategies and initiatives of companies and other organizations, and we conducted water stress assessment using Aqueduct at our sites, including office sites not covered by the LEAP approach. As a result, business sites covered by the LEAP approach were not located in areas of high water stress. We found that several business sites not covered by the LEAP approach were located in areas of high water stress, mainly overseas sites. Since businesses at these sites do not use a large amount of freshwater, the Group considers them to be areas of low priority for response while identifying them as areas requiring attention.

Furthermore, we studied trends in the state of the natural environment at our business sites using Biodiversity Risk Filter of WWF, and found that tree cover is on a decreasing trend in the surrounding areas at our overseas sites. The study results suggested that the ecosystem condition tends to deteriorate in the surrounding area of sites in Japan. We will analyze these trends to see how they relate to our business and assess the effectiveness of environmental impact reduction measures through our various existing initiatives.

*1 Area where activities in the organization’s direct operations (or in the entire value chain) interface with environments assessed as requiring attention based on each standard. Standards defined by the TNFD are “biodiversity importance,” “ecosystem integrity,” “water stress,” and “importance of ecosystem services supply.”

*2 We used four tools: IBAT (Integrated Biodiversity Assessment Tool), Global Forest Watch, BRF (Biodiversity Risk Filter), Aqueduct (WRI Aqueduct Water Risk Atlas and Tools). These tools help us to identify areas requiring attention.

*3 Non-governmental organization (NPO) managed by UK charity. It runs the global information disclosure system for investors, companies, states, regions, and cities to manage their environmental impacts.

Relationship between the Daigas Group’s Businesses and Nature Based on the LEAP Approach (Conceptual Diagram)



Ecosystem services we depend on

- Water resources
- Climate control functions
- Slope stabilization and erosion prevention functions
- Flood and storm prevention functions

Impact drivers on nature

- Use of terrestrial, marine, and freshwater ecosystems
- GHG and non-GHG emissions
- Water use
- Water pollution
- Soil contamination
- Solid wastes
- Disturbance
- Invasive species

- VH ... Very High
- H ... High
- M ... Medium
- L ... Low
- VL ... Very Low
- ... Not Detected

*1 Created in April 2024 using ENCORE. A heat map is created for each business and supply chain (if multiple processes can be considered, the assessment with higher impact is adopted as the result.) [Example of integration]: If there are two processes upstream of Business A, and L and VH are shown in impacts category A, then assessment is determined to be VH. Items that were assessed as ND in all categories of dependencies and impacts were excluded.
*2 Since the same process and assessment results apply to those for electricity business, they are omitted in its section.

Present and future initiatives

In terms of the dependencies and impacts on natural capital identified in ENCORE, the Daigas Group has implemented a wide variety of activities to conserve biodiversity and reduce impacts on nature, including conducting environmental assessments and activities to conserve biodiversity. In the energy business, we conduct ballast water management during transportation by LNG tankers, and appropriately use water resources and control water discharge at our power plants and LNG terminals. Please see P.055-P.058 for more information on our initiatives.

Going forward, we will conduct analysis and assessment in accordance with “Assess” (risks & opportunities) and “Prepare” (respond & report) of the LEAP approach based on “Locate” (interface with nature) and “Evaluate” (dependencies & impacts) obtained from the LEAP approach, as well as the business process specific to the Group’s business and the status of our initiatives, and strive to proactively disclose information.

Efforts live up to the Policy

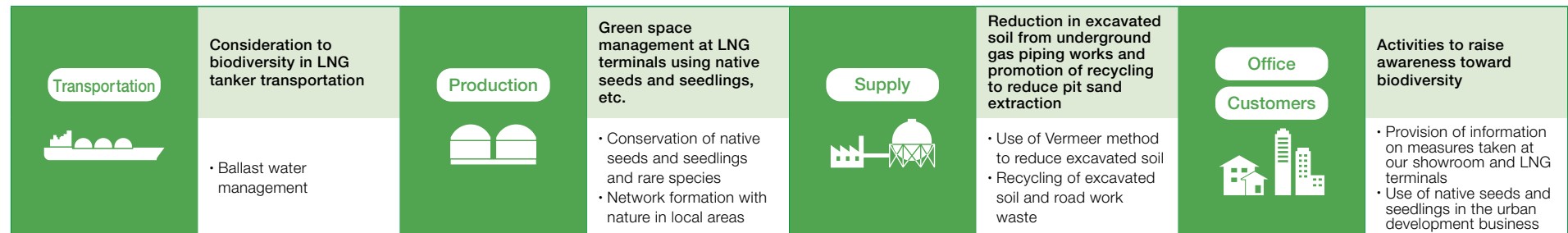
The Daigas Group has been striving to conserve biodiversity through various measures, including protecting rare native plants growing on the LNG terminal sites, reusing soil excavated during gas piping works, building multi-level gardens at the experimental residential complex NEXT 21,* and planting trees in Japan. Since we formulated the Daigas Group Biodiversity Promotion Policy in April 2010, we have made positive efforts in line with this policy and actively provided information thereon. Our efforts to conserve biodiversity, have been made under the guidance of government and research institutes, outside experts, and external consultants. Since 2003, Osaka Gas has been participating in the Keidanren Nature Conservation Council as a member company; we also participate in the Keidanren Initiative for Biodiversity Conservation to collaborate with stakeholders, including the government and regulatory bodies. Based on its Green Purchasing Guidelines (formulated in 2000, revised in 2022), Osaka Gas works with business partners to promote green purchasing: prioritized procurement of biodiversity-friendly goods and construction works that have less impact on the environment.

In the Daigas Group, every new investment and development project, whether in Japan or abroad, follows an environmental impact assessment at the planning stage when required by law. We survey the water environment, flora and fauna on land, and ecosystems to assess environmental impacts and take necessary measures to achieve a sustainable society. We have set environmental targets in line with our environmental management system (EMS) and the Group Medium-Term Management Plan 2026, both of which are aimed at the complete implementation of the Daigas Group Environmental Policy. These environmental targets also include paying due consideration to biodiversity in business activities.

*Experimental Residential Complex “NEXT 21”

The “NEXT 21” was constructed in October 1993 by Osaka Gas to propose an ideal neo-futuristic urban multiple-unit housing under the concept of “Achieving both comfortable and convenient life and energy-saving/ environmental preservation.” With Osaka Gas’s employees and their families actually living there, NEXT 21 has conducted demonstrative experiments based on the themes that are in tune with the times. Such themes include energy saving for the entire building, reducing its CO₂ emissions, greenery restoration and environmental symbiosis in urban areas, ideal forms of residence that reflect diverse lifestyles, and product development. Also, many proposals and presentations that may lead to ideal multiple-unit housing in the future have been made at a time when the liberalization of the energy market is advancing. Some of the proposals have been commercialized.

Daigas Group’s Biodiversity Efforts in the Value Chain



Biodiversity conservation activities

The Daigas Group is committed to helping build a society harmonious with nature that can conserve biodiversity and enjoy the bounties of nature into the future, and will undertake efforts that promote the conservation of biodiversity and sustainable use, based on the “Daigas Group Biodiversity Promotion Policy.” We promoted the following initiatives in FY2024.3.

Transportation We manage ballast of LNG tankers we use in accordance with regulations of the country where the port of call is located. In addition, our tankers are equipped with water-processing facilities that meet the conditions set under the International Convention for the Control and Management of Ships’ Ballast Water and Sediments stipulated by the International Maritime Organization (enacted in September 2017). We have reduced the impact of ballast on ecosystems by, for example, replacing ballast taken on at a Japanese port with water from the open ocean before releasing the ballast in a foreign port.

Production At our LNG terminals (Senboku LNG Terminals I and II, Himeji LNG Terminal), green areas were managed in a way that contributes to biodiversity through native seeds and seedlings utilization, etc. In addition, biotopes were created, which also serve as refuge for rare species, and biodiversity monitoring studies were conducted at LNG terminals in collaboration with external experts.

Supply The Daigas Group works to reduce the amount of excavated soil and waste asphalt generated as a result of gas pipe installation, which contributes to reduce impact on the ecosystem. Ways to achieve this include the Vermeer method, which requires soil excavation of only two points, and the shallow pipe installation method. In FY2024.3 these methods allowed us to reduce the amount of excavated soil generated by approx. 399 thousand tons compared to what would have been generated using conventional methods. Our soil and asphalt recycling system promotes the reuse of waste asphalt and excavated soil as either recycled asphalt, regenerated roadbed material, or improved soil. These efforts allowed us to recycle 98% of material excavated during gas pipeline construction in FY2024.3 and send to final disposal approx. one thousand tons.

* Since April 2022, the city gas supply business has been conducted by Osaka Gas Network Co., Ltd.

Business office Customers We conduct community and environmental communication, as well as environmental education in collaboration with local educational institutions, in approximately 100 m² of rice paddies and 12 m² of fields created on the roof of its own facilities. In addition, our group company engaged in urban development projects is working on planting plants that take biodiversity into consideration at its facilities and the condominiums they develop, encouraging interaction with the local community and creating connections between people and the city.

Habitat creation for biodiversity: Use of native seedlings in green space management at LNG terminals

At Osaka Gas LNG terminals, we are conducting afforestation activities that recreate the area’s original ecosystems and are capable of supporting a high level of biodiversity. We are also regularly conducting biodiversity monitoring studies to verify the effectiveness of our biodiversity efforts.

At the Senboku LNG Terminal, our concept is “a network of greenery that brings us closer to the community.” We are striving to create a green belt that will be home to a diverse range of life through efforts such as planting native seedlings in a green area, the “Senboku no Mori,” and planting a field of Japanese blood grass as described in “The Pillow Book,” an ancient Japanese essay written in the Heian Period.

Since 2002, under the guidance of the Museum of Nature and Human Activities, Hyogo, the Himeji LNG Terminal has been preserving rare plants native to the area of Nishi Harima, Hyogo Prefecture. We are currently growing rare plants including *Gardneria multifolia* “CHITOSEKAZURA” and Red-root Lithospermum (both rated level 2 endangered on the Ministry of the Environment’s endangered species list). The new biotope created in FY2014.3 reproduces satoyama woodlands, grasslands and marshes with plants originating from the area of Nishi Harima, preserving such rare species as the Platycodon or Japanese Bellflower.

LNG terminals are required to form green areas by laws and regulations, and a certain amount of greenery needs to be secured. Both LNG terminals believe that the quality of greenery is important, and are contributing to the preservation of biodiversity in the local communities by using seedlings of local origin.

As there are indications that these efforts are resulting in an increase in the number of insect and bird species, it is hoped that these trends will also spread to neighboring green belts. In the future, we will continue to monitor these areas under the guidance and advice of experts.

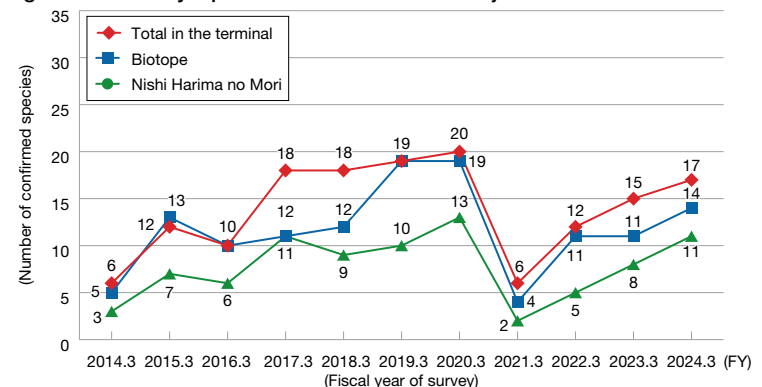


Green belt planted with Cogon Grass at Senboku LNG Terminal



Biotope at Himeji LNG Terminal

Changes in Butterfly Species Confirmed at Himeji LNG Terminal



*The decline in the number of confirmed species in FY 2020 was due to the fact that survey activities were suspended due to COVID-19 measures.

Creation of biodiversity habitats: Development of condominiums introducing the indigenous species in their gardens

Osaka Gas Urban Development Co., Ltd. is a real estate company and is engaged in the development and management of office buildings and condominiums/rented apartments. In addressing “co-existence with the environment,” one of its “five focuses” for urban and property development, Osaka Gas Urban Development Co., Ltd. is pursuing a planting plan that takes biodiversity into consideration.

The planting of native seedlings of “Chimakizasa,” a species of bamboo grass called Sasa, was introduced to the garden of The Urbanex Kyoto Matsugasaki, which was completed in March 2014. Chimakizasa has been recognized as an endangered plant in Kyoto City as a result of excessive eating by wild deer, whose population in the neighboring woodlands has been increasing in recent years. All of the 10 bamboo grass plants that were planted in the garden of The Urbanex Kyoto Matsugasaki were donated by the Chimakizasa revival committee, a local team formed to increase numbers of the plant, with members being mainly residents of Sakyo Ward, Kyoto City and researchers from Kyoto University.

At the “Urbanex Kobe Okurayama” completed in February 2016, Osaka Gas Urban Development has planted Japanese blue oaks, gooseneck loosestrife, and other local seeds/seedlings with support from the Museum of Nature and Human Activities, Hyogo. Signs describing plant names and their characteristics were also installed to help local residents learn about the importance of biodiversity. These combined efforts, including the active use of native seedlings, earned the 2016 Good Design Award.

Osaka Gas Urban Development Co., Ltd. has steadily increased the use of native seedlings in the planting of its properties, and has introduced them to 37 properties as of March 31, 2024. Osaka Gas Urban Development will continue to standardize biodiversity-friendly planting plans as specifications and work on such plans at the condominiums it develops.



Scenes Tsukaguchi (Completed in May FY2024)

As of March 31, 2024, 37 properties have introduced local biodiversity-friendly planting. (including properties for sale and for rent)

Biodiversity-conscious initiatives at the Scenes Tsukaguchi condominium selected for the 10th ABINC Certification and Good Design Award 2020

In February 2021, Scenes Tsukaguchi, a condominium in Amagasaki City, Hyogo Prefecture, developed by Osaka Gas Urban Development Co., Ltd., acquired the 10th Ikimono Kyosei Business Establishment *1 certification organized by the Association for Business Innovation in harmony with Nature and Community (ABINC)*2.

The ABINC certification aims to foster harmony between nature and human beings in business activities. ABINC conducts a third-party assessment of biodiversity-conscious initiatives to create, manage and use green spaces, and it certifies eligible business sites as “Business Sites in Harmony with Nature.” Osaka Gas Urban Development constructed Scenes Tsukaguchi while implementing biodiversity-conscious initiatives in cooperation with experts, including those from the Museum of Nature and Human Activities, Hyogo. On the condominium site, native plant species, such as the bamboo-leaf oak and the sawtooth oak, were planted to create green spaces in consideration of local vegetation. These green spaces were designed to create a network with other small green spaces dotted nearby and help birds and butterflies find places to inhabit. In addition, seedlings thinned in the planting management process on land owned by the Daigas Group were transplanted to the condominium site to help preserve the genes of plant species native to the Rokko mountains in Hyogo prefecture.

Scenes Tsukaguchi also won the Good Design Award 2020 organized by the Japan Institute of Design Promotion. Following the Good Design Award 2016, this was the second time that Osaka Gas Urban Development had won the same award. The 2020 award came to the company in recognition of its success in facilitating interactions between the condominium and the neighborhood and creating a linkage between residents and the local community by designing the condominium to be open under the concept of “Re:CONNECT,” and in fostering communication between people from different areas or age groups in the living environment abundant with rich natural features by building three gardens with different themes on the condominium site.

*1 “Ikimono Kyosei Business Establishment” (lit. “Business Sites in Harmony with Nature”) is the registered trademark of the Japan Business Initiative for Biodiversity (JBIB).

*2 ABINC (Association for Business Innovation in harmony with Nature and Community)



GOOD DESIGN AWARD 2020



Scenes Tsukaguchi

Appropriate Use and Discharge of Water Resources

Water is not a primary material among the products handled by the Daigas Group. We recognize that the use of water does not pose a major business risk for our Group. However, the Group controls water discharge after using drinking water, industrial-use water, groundwater and seawater. At power plants, core facilities for its electricity business, the Group uses industrial water as a coolant in a steam turbine condenser, and vaporizes it inside the cooling tower. Drinking water, industrial-use water and groundwater are also used at LNG terminals, power plants and offices, and discharged. Seawater is mainly used for vaporization of LNG at city gas plants and for cooling in steam turbine condensers at some power plants. We discharge the seawater to the sea without consuming it or affecting its composition. In discharging water, we have conducted water quality inspections in line with relevant laws, ordinances and agreements with local municipalities. We continued to comply with the effluent standards of the Water Pollution Prevention Act, etc. in FY2024.3, and there were no violations. The Group sees water as a limited natural resource. We will continue to use water adequately, control its discharge strictly, and promote water saving.

Osaka Gas has pleased to announce that we have been recognized for leadership in corporate transparency and performance on water security by global environmental non-profit CDP, achieving a place on the CDP A- List.

■ Amount of Water Intake in FY2024.3

General water, industrial water	11,744 thousand m ³
Underground water	3,493 thousand m ³
Seawater	519,326 thousand m ³

■ Amount of Water Discharge in FY2024.3

Sewer	687 thousand m ³
River	3,043 thousand m ³
Sea	520,739 thousand m ³

Efforts to reduce water use

The Daigas Group is working together with business partners and customers to reduce water consumption.

In its employee activities at offices, the Group strives to conserve water and addresses the challenge of reducing the amount of water it uses.

Making use of its technological capabilities cultivated in the gas business, Daigas Energy Co., Ltd., a wholly owned subsidiary of Osaka Gas, provides customers with water purification and treatment services, including cooling water chemical services, to reduce water consumption.

Biodiversity risk assessment

The Daigas Group, being aware of the environmental impact of its value chain, strives to minimize its impact on biodiversity and expand its contribution.

We conduct questionnaires regarding sustainability activities at our LNG suppliers to check on the status of their monitoring activities for local ecosystems and their efforts to conserve the biodiversity of local ecosystems.

In the Group, every new development project, whether in Japan or abroad, follows an environmental impact assessment at the planning stage when required by law. For example, in the process of constructing the Senboku Natural Gas Power Plant, the core facility for the Group's electricity business, between 2002 and 2006, we conducted an environmental impact assessment. It covered the construction work (the impact of transportation of construction materials, such as air pollution, noise, and vibration) and the presence and shared use of land and workpieces (the impact of ground modification and the facility's existence on local flora and fauna and the impact of exhaust gas and wastewater from the facility in operation on the quality of air and water). We also adopted environmental conservation measures against air pollution, noise, vibration, and wastewater, as well as measures to form green areas that foster biodiversity, in order to further reduce the environmental impact of the project.

Also, in the Himeji Natural Gas Power Plant construction project, which Himeji Natural Gas Power Generation Co., Ltd., a wholly owned subsidiary of Osaka Gas, is implementing, an assessment process has been completed in compliance with the Environmental Impact Assessment Act.

Please see the following website for more information about the initiatives in the Himeji Natural Gas Power Plant Construction Project.

Development of Environmental Technology

Principle and Outline

The Daigas Group views technology as the foundation for its corporate competitiveness and views research and development as one of its most important strategies for differentiating itself from the competition. While accelerating low-carbon transitions through development of technologies contributing to the reduction of CO₂ emissions, we take on the challenge of technical research and development for the carbon neutrality of our gas and electricity. We will actively tackle a wide range of subjects, from the advanced use of natural gas to the further utilization of renewable energy and the research and development of carbon-neutral gas technologies such as methanation, to accelerate development of technologies that will contribute to achieving carbon neutrality.

Development of New Technologies that Contribute to Carbon-Neutral Solutions

The Daigas Group believes that “e-methane,”* which is synthesized from hydrogen produced using renewable energy and CO₂, is the key to making city gas carbon-neutral. The Group is working on establishing a variety of methanation technologies toward full-scale introduction of “e-methane” in 2030. Moreover, we are promoting development of technologies that contribute to further low-carbon/carbon-neutral solutions by making use of the gas synthesis/catalyst technology, combustion technology, and material technology that Osaka Gas has developed so far. The Company has developed a variety of natural gas combustion technologies tailored to our customers’ uses, and it is now leveraging that know-how to develop hydrogen and ammonia combustion technologies. Such efforts include development of a small ammonia engine system in cooperation with Toyota Industries Corporation. The Company is also working on the development of chemical looping combustion technology as a technique for producing carbon-neutral hydrogen and electricity from biomass. In addition to energy, Osaka Gas also develops and sells SPACECOOL[®], a radiative cooling material. The Carbon Neutral Research Hub of Osaka Gas conducts these research and development projects, disseminates information, and forms business alliances. To further accelerate these efforts, we are establishing a new research and development base in the Torishima district of Osaka City, with full-scale operations scheduled for FY2026.3.

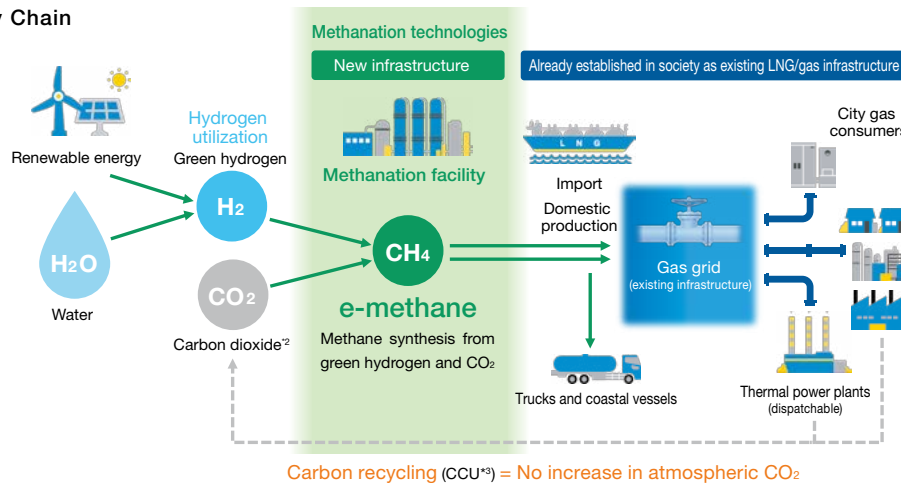
*Synthetic methane produced from non-fossil energy sources, such as green hydrogen, is called “e-methane”.

“e-methane” – the key to carbon-neutral solutions created by methanation technology

“e-methane,” which is produced by recycling CO₂ otherwise emitted into the atmosphere and synthesizing it with hydrogen, is a carbon-neutral hydrogen carrier*1.

Since “e-methane” has almost the same composition as city gas, existing city gas infrastructure and combustion equipment at customers’ sites can be used as is, enabling seamless carbon neutralization during the transition period and advantageously reducing the cost of its social implementation.

■ e-methane Supply Chain



*1 Hydrogen compounds that make it possible to store, transport and use hydrogen efficiently. (Hydrogen is inefficient to store or transport over long distances in its gaseous state.)

*2 Biogenic CO₂ and possibly CO₂ derived from DAC (Direct Air Capture: a technology used to capture and remove CO₂ directly from the atmosphere) might be utilized in the future.

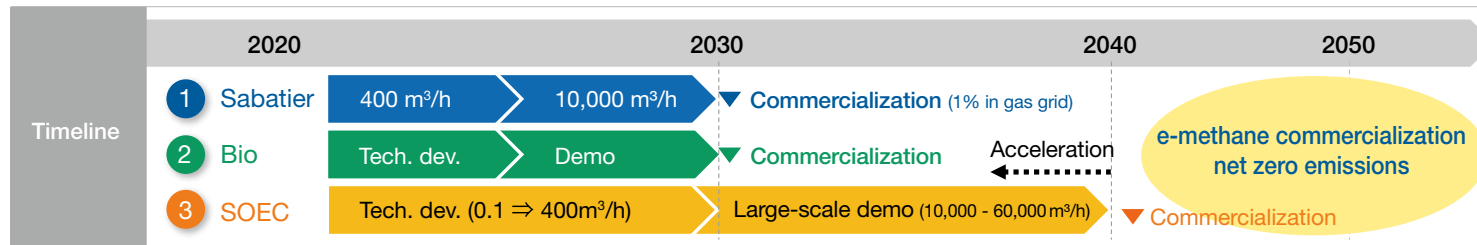
*3 Carbon dioxide Capture and Utilization

Efforts to establish three methanation technologies to enable the introduction of "e-methane"

In addition to working to scale up the existing technology, Sabatier methanation, we aim to commercialize biomethanation, a locally produced and locally consumed energy generation technology, and to achieve early introduction of highly efficient SOEC methanation, an innovative technology.

- 1 Sabatier methanation*1 (existing technology): Scaled up and implemented in society at an early stage
- 2 Biomethanation*2 (innovative technology): Produce and use energy locally for local consumption
- 3 SOEC methanation*3 (Innovative technology): Reduce cost by enhancing energy efficiency

Roadmap for Social Implementation of Methanation Technology



*1 CO₂ conversion by a catalytic reaction with hydrogen derived from renewable energy, etc. to synthesize methane.

*2 Technology that uses biological reactions to synthesize methane from CO₂ and hydrogen

*3 Use of SOEC equipment to electrolyze water and CO₂ into hydrogen and carbon monoxide using renewable energy, etc., and then synthesize methane by catalytic reaction of the hydrogen and carbon monoxide.

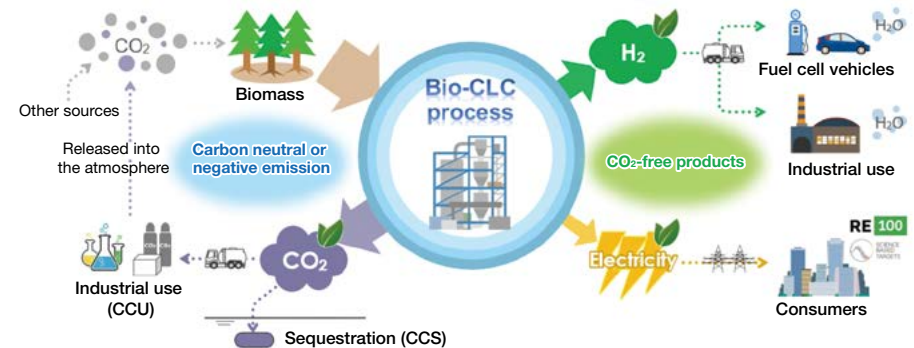
Development of chemical looping combustion technology for simultaneous production of hydrogen, electricity and CO₂

Osaka Gas is working on the development of chemical looping combustion (CLC) technology, which produces hydrogen, electricity, and CO₂ by leveraging the redox action of iron oxide. CLC technology circulates iron oxide to have it react with fuel, water, and air, through which hydrogen, electricity, and CO₂ are produced simultaneously. The fuel may be coal or biomass. When carbon-neutral biomass fuel is used, this technology is expected to produce or supply green hydrogen, electricity, and biomass-derived CO₂.

Meanwhile, there has been no implementation example of CLC technology aimed at producing hydrogen using biomass as fuel. For commercialization, it is necessary to solve technical issues such as elemental technology development toward the establishment of system design technology and process verification.

Osaka Gas aims to utilize this technology to produce and supply green hydrogen using biomass as fuel, helping customers achieve carbon neutrality.

Our Vision for the Practical Application of CLC Technology



Radiative cooling material SPACECOOL®, a new product by SPACECOOL Inc. —Also contributing to realizing a carbon neutral society with world-class cooling performance—

SPACECOOL®, developed by Osaka Gas and manufactured and sold by SPACECOOL Inc., is a radiative cooling material with zero-energy cooling capability. By releasing heat into space under direct sunlight, it lowers the temperature*¹ below the outside temperature without using energy. It has the potential of contributing to carbon-neutral solutions for society as a whole.

A demonstration test conducted by Osaka Gas found that the surface temperature of the material was up to about 6°C*² lower than the outside air temperature under direct sunlight, realizing world-class*³ cooling performance.

The material is available in film, magnet sheet, tarpaulin, etc., and is expected to be deployed as products for implementing measures against global warming, achieving energy conservation and ensuring cooling comfort.

The material was selected for the environmental technology exhibition at the Japan Pavilion of the 28th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP28), which was held in Dubai from November 30 to December 12, 2023. SPACECOOL demonstrated the material at physical and virtual exhibitions. This material was exhibited at the COP for the second consecutive year following the previous year. At the exhibitions, people from various countries facing heat issues showed a lot of interest in the material.

It is also expected to be adopted in the Gas Pavilion to be exhibited by The Japan Gas Association at the Osaka/Kansai Expo to be held in 2025, reducing the air conditioning burden in the Gas Pavilion and contributing to lower CO₂ emissions. In the future, we would like to promote the spread of this material both domestically and internationally and contribute to the realization of a carbon neutral society.

*1 This has been achieved by using Osaka Gas's proprietary optical control technology to develop a material design that reduces the solar heat input and increases heat dissipation through thermal radiation.

*2 The temperature was measured at Osaka Gas Energy Technology Laboratories in Konohana-ku, Osaka (ambient temperature at the time of measurement: approximately 35°C). The temperature on the reverse side of a steel sheet covered with the radiative cooling material was measured.

*3 The survey was conducted by Osaka Gas, based on published papers.



Radiative cooling material (thin film material)

Development of technology for predicting solar power generation

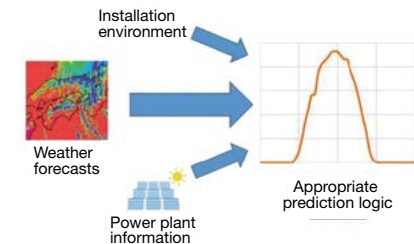
With an eye on the increasing number of solar power plants to realize a carbon neutral society, the Daigas Group is working to develop technology to predict solar power generation and improve the accuracy of the prediction.

Under the previous system, electricity generated in solar power plants was traded at a fixed price, known as FIT. In the future, it is expected that the number of solar power plants operating under schemes other than FIT will increase, as a new purchase method, FIP, has been implemented since FY2023.3. For solar power plants operating under non-FIT schemes, power producers need to predict power generation, and may have risks of paying imbalance costs*. In addition, unexpected fluctuations in the ever-increasing amount of renewable energy may destabilize the grid, leading to the increased risk of power outages. To prevent such incidents from occurring, it will become increasingly necessary to accurately predict solar power generation in advance.

The Group has developed technology to predict weather at a level comparable to that of weather companies, based on our long-accumulated knowledge of fluid analysis. We are implementing highly accurate solar power generation predictions utilizing this technology.

Initiatives to improve accuracy

We conducted a comparative analysis of predicted and actual solar power generation at solar power plants throughout Japan by using solar power generation forecast developed by the Osaka Gas Energy Technology Laboratories. As a result, we confirmed high prediction accuracy. We are also working to further improve the prediction accuracy by analyzing and improving the error factors between predictions and actual results.



Examples of utilization Please see P.067 “AI-Based Self-Wheeling Scheme for Renewable Electricity—Starting supply and demand management service for self-wheeling, using a solar power generation system—.”

* Imbalance costs: Monetary penalties incurred when there is a discrepancy between the planned and actual amount of electricity generated when operating a solar power plant.

Initiatives to develop the world's first "ultra-long life" storage batteries that last five times longer than current storage batteries

The storage battery market is expected to continue to expand worldwide for multiple applications, such as automotive and stationary use. In Japan as well, storage batteries are positioned as one of the most crucial technologies to achieve the electrification of automobiles and the utilization of renewable energy as the main power source, with a view to achieving the greenhouse gas emissions reduction target for FY2031.3 and carbon neutrality by 2050.

KRI, Inc., one of the Group companies, is a comprehensive private contract research company with both advanced research and development capabilities and consulting functions. The company supports customer businesses by engaging in contract research and analysis evaluation, primarily focusing on energy, environmental technology, and material technology. It also pursues the excavation of new technological seeds and the creation of new value through its own research. In particular, storage batteries are emphasized as one of its key fields of focus, and the company is actively expanding its contract research and development business related to such products. We have been discussing and developing "ultra-long life" storage batteries from two aspects of "materials, electrodes, and batteries" and "diagnosis and operation" with manufacturers who agree on KRI's "ultra-long life concept," with the aim of achieving "ultra-long life," which is the direction of the storage batteries needed for a 2030 society.

Having had the prospect of completing the basic technology for "ultra-long life" lithium ion batteries (LIB)*1 that last five times longer than current storage batteries and reaching its goal, KRI, Inc. plans to start supplying 10Ah (around 400 Wh/L)*2 samples for user evaluation in FY2026.3. The above assumes the use of prototyping and demonstration technology of SEI CORPORATION, which became a subsidiary of KRI, Inc in February 2024.

Ultimately, the company aims to increase the life of conventional 30 kWh batteries installed in electric vehicles (e.g. 160,000 km guaranteed) by more than five times.

*1 A type of storage battery that uses an oxide containing lithium for the positive electrode and carbon material for the negative electrode. This battery has high performance and can be miniaturized. It is used in a variety of applications, including batteries for mobile devices and electric vehicles.

*2 Approximately the capacity installed in an electric motorcycle.