Invisible Assets

Technology Development

Establish core technologies for decarbonization of gas and electricity

The Tokyo Gas Group, under its management vision Compass2030, is aiming to establish methanation and hydrogen production as its core technologies to decarbonize gaseous energy. We are also targeting achievement of a renewable energy transaction volume of 6 million kW as our contribution to the decarbonization of electric power. We will develop mass-production technologies and low-cost technologies for floating offshore wind power generation to become the top runner in this type of power generation.

Innovative methanation technology

Compass Action P.28

Methanation is a technology to synthesize methane, the main component of city gas, through the chemical reaction of hydrogen with CO_2. The existing methane producing technologies present issues concerning equipment costs, limitation in raising efficiency in methane synthesis via water electrolysis, difficulty in increasing production scale, and thermal management. To solve these issues, we are working to develop innovative methane manufacturing technology*1, to reduce cost, improve overall energy conversion efficiency, increase production scale, and achieve thermal management. We thereby aim at realizing early implementation in society, while being conscious of how long it takes and where to widely deploy the technology.

*1: On April 19, 2022, Tokyo Gas, in a joint proposal with Japan Aerospace Exploration Agency (JAXA) and IHI Corporation, was selected as the prospective recipient of the Innovative Technology Development for Synthetic Methane Production of the Green Innovation Fund Project: CO_2 Fuel Production Technology Development Project (for the development of innovative technology for synthetic methane production), which is sponsored by the New Energy and Industrial Technology Development Organization (NEDO).

		Existing technology	Innovative methanation technologies under development by Tokyo Gas		
		Sabatier reaction	Hybrid Sabatier reaction	PEMCO$_2$ reduction	Bioreactor
Characteristics	Raw materials	H_2 CO_2	H_2O CO_2	H_2O CO_2	H_2 CO_2
	Reaction	Catalyst	Electrochemistry/Catalyst	Electrochemistry	Microorganisms
	Temperature	Up to 500°C	Up to 220°C	Up to 100°C	Up to 100°C
Advantages		• Established basic technology	• High efficiency	• Low cost	• Low cost • Easy to increase scale
Challenges		• Large-scale practical application (thermal management)	• Increase in size • Ensure durability and reliability	• Increase in size • Ensure durability and reliability	• Slow reaction speed • Stability and culturability of bacteria
Overview diagram		Water electrolysis → H_2 CO_2 → Methane synthesis → CH_4	H_2O CO_2 → Water electrolysis / Methane synthesis → CH_4	H_2O CO_2 → Electrolysis + synthesis → CH_4	Water electrolysis → H_2 CO_2 → Methane synthesis → CH_4

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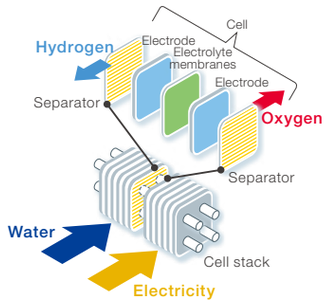
Low-price hydrogen manufacturing equipment (water electrolysis)

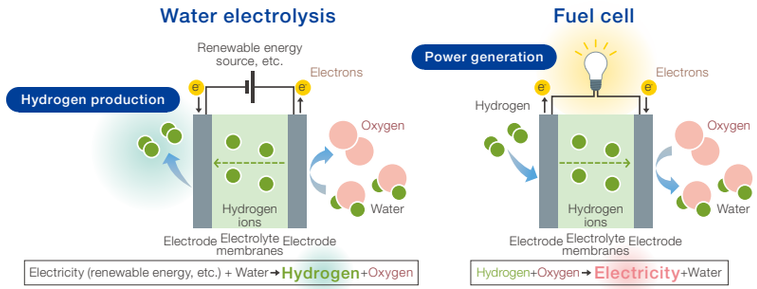
Compass Action P.28

For the production of low-cost “green” hydrogen, the key is to reduce the cost of water electrolysis equipment. In May 2021, Tokyo Gas and SCREEN Holdings Co., Ltd. (SCREEN) agreed to jointly develop a water electrolysis cell stack*1 and its manufacturing equipment with the goal of establishing low-cost manufacturing technology in two years. A cell stack accounts for a large portion of costs of water electrolysis equipment. Tokyo Gas will work on reducing material costs by making use of its technologies in materials selection and in evaluation of performance and durability, which have been cultivated in the development of residential fuel cells (ENE-FARM). SCREEN will be in charge of developing the manufacturing technology and a water electrolysis cell stack device, using its proprietary roll-to-roll*2 continuous production technology. The two companies will thereby pursue the drastic reduction of manufacturing costs that have so far been difficult to reduce. In conjunction with this development, they will also develop technology for the systemization of water electrolysis equipment to reduce the cost of green hydrogen production and aim to achieve the Japanese government’s hydrogen supply cost target*3 of 30 yen/Nm^3-H_2 by 2030 at the early stage and to further reduce the cost of hydrogen production.

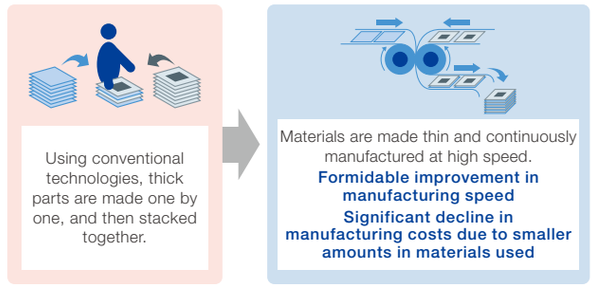
Concept and basic composition of a water electrolysis cell stack



Summary of water electrolysis system hydrogen production methods (left) and fuel cell power generation method (right)



Low-cost production of a water electrolysis cell stack (illustration)



*1: Multiple stacks of thin parts (cells) that produce hydrogen and oxygen through water electrolysis (fuel cells have a reverse reaction).
*2: A low-cost manufacturing process for functional films, which are continuously processed using coating and other methods during the rewinding process of a long film substrate wound in a roll. This time, this manufacturing process will be used in the manufacturing of water electrolysis cell stacks.
*3: To achieve this goal, we expect to reduce the cost of the hydrogen production system through this development, as well as to procure low-priced power mainly through the growth of the renewable energy market.

Floating-type offshore wind power generation technology with the expected commercial deployment at an early stage

Compass Action P.29

The WindFloat® technology developed and possessed by Principle Power, Inc. in the U.S. (investment by Tokyo Gas in May 2020) has significant stability in various maritime conditions and is expected to be widely adopted by floating offshore wind projects around the world. In Europe, it has already been deployed in a project*4 featuring large wind turbines. In Japan, where shallow sea beds are limited, the potential for floating offshore wind power generation is large and this can be broadly adopted in the future. Tokyo Gas will promote the development of floating offshore wind power in domestic and overseas oceans through research and development*5 for mass production and cost reduction of Principle Power’s WindFloat® basic technology.

Photo courtesy of Principle Power. Artist: DOCK50

*4: Demonstration testing (2 MW) was conducted in the offshore of Portugal for 5 years, and commercial deployment (3 units x 8.5 MW) started in 2020.
*5: On January 21, 2022, Tokyo Gas was selected as the prospective recipient for the development of low-cost technology for manufacturing and installing floating foundations of the Green Innovation Fund Project: Offshore Wind Power Cost Reduction Project of the New Energy and Industrial Technology Development Organization (NEDO).

Diversity of Human Resources

"Diversity is the Key to Growth"

- The new challenges that the Tokyo Gas Group will tackle require having people from diverse backgrounds to get together and work diligently, which leads to create new value.
- Particularly in the new areas and strategic areas for the realization of Compass2030, we are fostering and utilizing personnel within the Group, while recruiting professional—people who have expertise that is difficult to secure within the Group. We are thereby strengthening our human resources base to add strength and capability to our individual businesses.

Reform the human resource system to one that encourages challenges and diversity

- Through the realization of the Three Promises defined in Compass2030, we aim to develop personnel who work energetically, keep trying to improve themselves, make maximum effective use of their abilities, and consistently deliver strong results. We will continue with the HR system reform to facilitate each individual to grow and be empowered as a professional in each field.
- We will accept diversity in values, ideas, and workstyles, and encourage innovation that creates new value.

Three Promises

1	2	3
We will produce work that will have a major impact on society.	**We will create a venue for encounters with diversity and friendly competition.**	**We will emphasize the self-fulfillment of each person.**
We commend a spirit of taking on challenges and the ability to learn from mistakes.	The Tokyo Gas Group will be a gathering place for diverse thinking and experience.	We believe in the potential of each individual and will support each employee's activities.

Compass Action: Human Resources P.32

Our talented people utilize their diverse range of experiences and lead our key strategic areas with immediate results

Mid-career employees actively dedicated in the key strategic areas

FURUKAWA Ken
Chief Manager
Business Management Sect.
Global Business Planning Dept.

FURUKAWA Ken was engaged in international operations at a Japanese mega bank and spent close to 12 years on overseas assignments. After joining Tokyo Gas in 2017, he was assigned to the Global Business Division and CP, and was involved in support of new business investment and development in Asia and the United States, etc. making use of his experience in financial analysis and credit judgment, which were the core business functions of the bank, and in finance, legal affairs, marketing, and negotiation in the international financial field. Currently, as a Chief Manager, his assignment includes monitoring, accounting management and portfolio review of our overseas invested projects.

UEHARA Shinnosuke
LNG Trading Sect.
LNG Business Dept.

UEHARA Shinnosuke worked at an oil company as a trader of naphtha, a petrochemical raw material, dealing mainly with Middle Eastern oil countries and petrochemical companies in Singapore, where many trading companies are located. He joined Tokyo Gas in 2020 and since then has been engaged in LNG trading, making full use of his trading knowledge and the network he has developed in his previous job. He believes that the recent volatile environment in market prices and with various geopolitical risks can be a great opportunity.

MARUYAMA Hiroshi
Team Leader, Renewable Energy Sect.I
Renewable Energy Business Development Dept.

MARUYAMA Hiroshi has spent about five years in construction management at a general contractor and about six years in the development of solar, wind and biomass power sources at a renewable energy business company. After joining Tokyo Gas in 2019, he has been involved in planning work for renewable energy strategy, and has worked on the development and acquisition of biomass power sources. In the last three years, he has led the efforts for acquisition of five projects with equity stakes for a total of approximately 200,000 kW of power source. As a leader of the development team, he is concentrating on Tokyo Gas's acquisition of more renewable energy sources with a target set at 6 million kW in renewable energy transaction volume by 2030.

YAMAGUCHI Manabu
Sales Manager
TG Octopus Energy

YAMAGUCHI Manabu has about 19 years of experience in retail sales, mainly in the apparel industry, maximizing the presence and added value of products, managing and analyzing sales, and conducting external negotiations centered on events and outlets. He joined TG Octopus Energy in 2022 as a sales manager and is utilizing his skills and experience to open a wide variety of channels from scratch and to maximize the brand value of Octopus Energy.

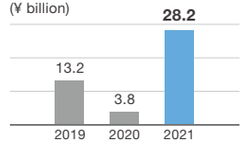
YONEDA Takayuki
Digital Innovation Planning Sect.
Digital Innovation Strategy Dept.

YONEDA Takayuki was engaged in business development using digital technology for the realization of DX at multiple companies, and has a track record of building a business ecosystem. After joining Tokyo Gas in 2020, by utilizing his experience in new business development and know-how in open innovation, he has been making efforts for value co-creation with companies with domestic and overseas technology seeds that may contribute to the realization of Net-Zero CO_2, and for development of new business and systems that solve social problems.

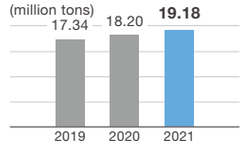
Reference

KPIs related to Key Strategies

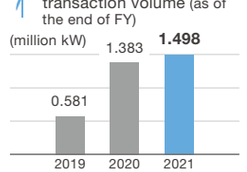
Segment profit from Overseas Business (per FY)
(¥ billion)



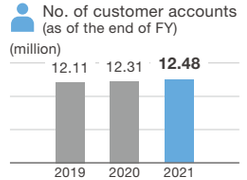
Natural gas transaction volume (per FY)
(million tons)



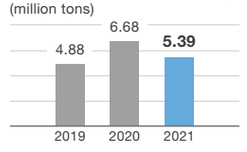
Renewable power source transaction volume (as of the end of FY)
(million kW)



No. of customer accounts (as of the end of FY)
(million)



Contribution to CO_2 emissions reduction (as compared to FY2013 levels)
(million tons)



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Taking up a new challenge on behalf of the future of the planet: Renewable energy business in the Nordics

CFO, TOWII Renewables A/S
ODATE Yusuke
(Assigned from Business Development Sect.III Global Business Development Dept. Tokyo Gas Co., Ltd.)

I will make use of my experience in Tokyo Gas overseas business

The Tokyo Gas Group is making efforts to expand its renewable energy business in Japan and abroad, with the goal of achieving Net-Zero CO_2.

I joined Tokyo Gas in November 2019 because I was particularly attracted to its expansion of the renewable energy business overseas. Until then, I was engaged mainly in the development of nuclear power plants at a Japanese manufacturer, and was involved in contract negotiation for power plant construction and was involved in contract negotiation for power plant construction, in financial arrangements, and in negotiation with the government in the U.S. and other countries such as the U.K., the Baltic States, and the United Arab Emirates. The experience of creating a huge project on the scale of several hundred billion yen to more than one trillion yen over a lengthy period, working with many people of different nationalities and backgrounds brought me a great sense of satisfaction and achievement.

Then one day, I saw a news report: Tokyo Gas and a French electric power company ENGIE were to jointly enter the renewable energy business in Mexico. Learning about Tokyo Gas plans to expand overseas in this new field, I felt an urge to use my experience in creating something new from scratch, for Tokyo Gas. I thought that my experience in overseas projects and know-how in negotiations could be of use and I could contribute to Tokyo Gas's dealing with this new challenge.

After being involved in projects in Mexico and the U.S., Tokyo Gas is now participating in a joint development project in Europe

In January 2022, Tokyo Gas decided to team up in renewable energy business in the Nordics with the Danish energy group EWII.

After joining Tokyo Gas, I had worked on exploring various projects, especially those in which Tokyo Gas would directly participate. I was heavily involved in the start-up negotiations phase of a deal, which has grown to be a joint company, TOWII Renewables. Subsequently, I joined the management team as CFO.

Europe is striving to create rules for the environment and make them a global standard, being highly committed as environmentally advanced. Having a European base where we can keep track of the world's movements related to the global environment is extremely valuable to our Group, and having Tokyo Gas directly participate in management is a big step toward our further growth in Europe as a whole. We will first focus on growing TOWII and make it a pillar of Tokyo Gas's European business.

Press release: Developing a 1GW of renewable energy in the Nordics with EWII in Denmark
https://www.tokyo-gas.co.jp/Press_e/20220121-01e.pdf

Making the project to be a pillar of the Tokyo Gas Group's Compass2030 Management Vision

TOWII's goal of developing 1GW of renewable energy by 2030 can be included in Tokyo Gas's challenge to lead the effort to achieve Net-Zero CO_2, which is stated as one of the pillars of Tokyo Gas's management vision. TOWII is striving to expand the business, which includes the use of electricity generated from renewable energy.

Project members from EWII and Tokyo Gas

For achieving the Compass2030 Vision, including the realization of Net-Zero CO_2, we need to attract, hire, and develop human resources for work in new fields, and do so with a sense of speed. Many employees at Tokyo Gas have a strong interest in thinking about what they should do and how to advance on their own. Among other aspects, this is an indispensable basic characteristic for working overseas. I believe it is important to develop human resources with a global perspective through the frontline experiences of overseas business operations and at the same time to flexibly recruit good human resources in overseas countries where there is high job mobility, and to build relationships with diverse business partners.

Diversity & Inclusion Achievement

The Tokyo Gas Group has made a primary commitment to promoting diversity and inclusion, encouraging diverse workstyles, and empowering diverse workers, with the aim of creating a vibrant organization in which all employees can fully demonstrate their knowledge, ability and experience.

	FY2020	FY2021	FY2022	Target	Remarks
Ratio of women in management	8.7% 251	9.2% 264	9.5% 271	Over 11% by 2025	Non-consolidated
Male employees' utilization rate for childcare leave, etc.	92.4%	93.9%	–	100%*	
Employment rate for persons with disabilities	2.55% 172	2.54% 167	2.64% 169	(Reference) Statutory employment rate: 2.3%	
Number of mid-career hires	207	159	–	–	Consolidated

* 100% utilization rate for a system that helps both male and female employees balance working and taking care of children

Web Site

Energy Security

Aiming at stable supply of safe and low-priced energy

For more than 130 years since being founded, Tokyo Gas has been committed to providing customers safe, reliable energy through ensuring stable supply and maintenance.

With regard to LNG procurement, our focus has been to ensure stable, low-priced and flexible procurement by promoting three types of diversification: Procurement sources, terms of contracts, and LNG networks. We will continue to respond to changing demand by taking appropriate measures in response to changes in the procurement environment.

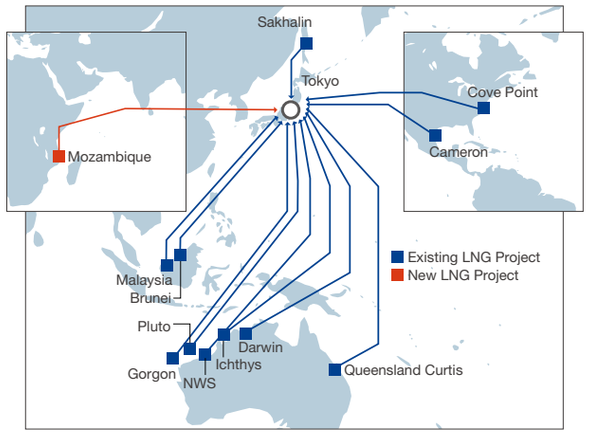
In order to realize a stable supply of energy, we have worked to strengthen our energy infrastructure in the Greater Tokyo Area and to enhance resilience by expanding our decentralized energy system using natural gas. Furthermore, we have further advanced our disaster countermeasures, given Japan's history of suffering damage by major earthquakes.

Despite the uncertain economic outlook driven by destabilizing international situations and the persistent COVID-19 infection problems, we will continue to support our customers' safe, secure everyday lives and industries with a strong sense of commitment to "never ever stop the energy supply."

Stable procurement

Stable, low-priced and flexible LNG procurement

Since the start of LNG imports in 1969, Tokyo Gas has diversified its procurement sources to encompass 15 suppliers projects in five countries, reducing procurement risks. We have also enhanced procurement flexibility through diversification of contract contents, by making contracts based not only on crude oil price indicators, but also on U.S. natural gas prices and coal prices, and making contracts with no destination restrictions. Through strategic partnerships with domestic and overseas companies, we have established an LNG network that connects the Asian, North American, and European markets, thereby increasing LNG transport efficiency and contract flexibility, and reducing costs. In 2020, we established a subsidiary in charge of LNG trading business to foster more flexible LNG trading.



Stable supply

Enhanced natural gas infrastructure

Tokyo Gas Network

Gaseous Energy Expansion Business P.60

We have completed a loop of high-pressure gas pipelines in the northern Kanto region and the mutual backup system of four LNG terminals in order to enhance supply stability and increase the capacity to transport gaseous energy. In order to limit damage in case of major earthquakes, our manufacturing and supply facilities have employed the structural design, materials and safety technology for excellent seismic resistance. The Supply Command Center of Tokyo Gas performs 24/7 monitoring and control of the operating status of city gas production and supply facilities. Replacement of old gas pipes and regular gas leakage inspections are also carried out in a planned manner.

Disaster-resilient everyday lives and city development

We are expanding the introduction of decentralized energy systems such as ENE-FARM and Gas cogeneration systems, as well as formation of smart energy networks for heat and electricity used in the ICT-managed areas. We are thereby promoting the creation of cities with enhanced disaster prevention functions and assurance of the continual energy supply even in an emergency.

Safety measures

Customers' safe and reliable use of energy services

Tokyo Gas Network

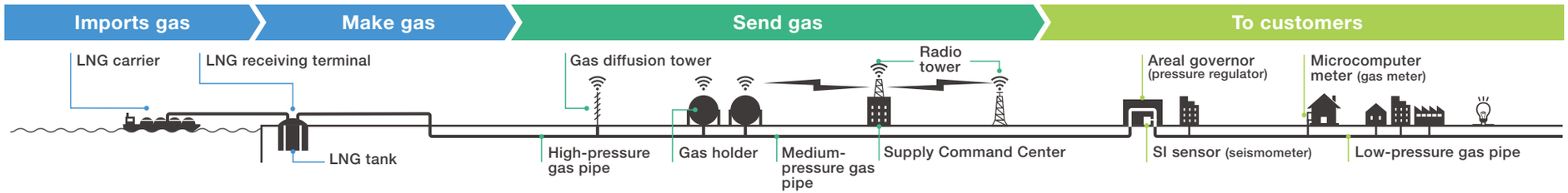
The Safety Command Center of Tokyo Gas is in operation 24/7 to accept gas leak reports. When such notification is received, Gaslight 24 (our emergency reaction team) promptly responds and dispatches technical staff even at night or on holidays. Periodic security inspections* are conducted at least once every four years for all customers using city gas.

Complete earthquake protection

Tokyo Gas Network

We have adopted preventive measures to minimize earthquake damage, such as the use of PE pipes for low-pressure gas pipelines. As emergency-preparation measures, we have expanded the installation of microcomputer meters that automatically shut off gas supply during earthquakes of seismic intensity of five or higher, and have divided the medium- and low-pressure pipelines into multiple blocks so as to minimize gas supply cut-off areas and to prevent secondary disasters. As recovery measures, we have established a thorough disaster prevention system that is capable of monitoring seismometers which are installed with high locational density, and controlling gas shutoff. This system enables us to grasp the damage situation of each block where gas supply has been stopped, and to determine the most appropriate recovery method.

* The leakage inspection of the inner tube is carried out by the pipeline business operator, and the inspection of consumer equipment is carried out by the retail business operator.



Last mile operation of Tokyo Gas

Our bonds and relationships of trust with customers are precious assets

Tokyo Gas LIFEVAL, Enesta, and Enefit have 150 outlets and 13,000 employees, mainly in the Greater Tokyo Area. We satisfy specific needs of customers and serve as a all-in-one provider of products and services that help improve the quality of everyday life, and in so doing build close ties with individual customers.

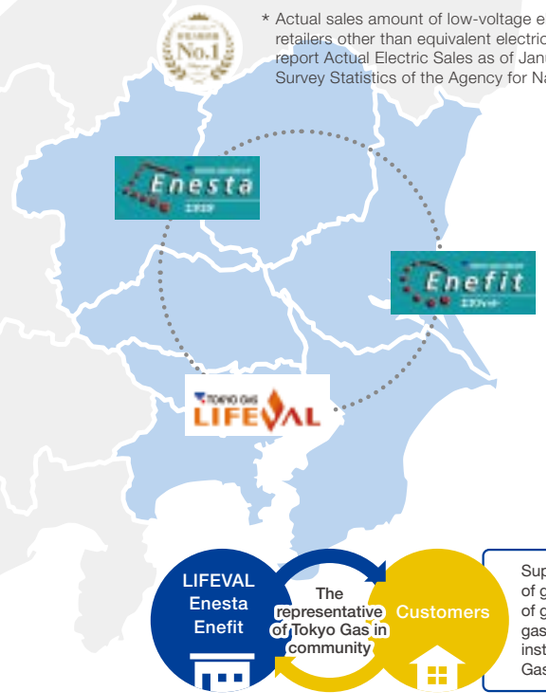
Through our community-based strong bonds with customers, we have acquired three million* retail electricity contracts as of 2022, the seventh year of the full deregulation of the electric power retail market, putting us in the number one position in electricity sales among new power suppliers for the sixth consecutive year.

Outlets 150

Employees 13,000

Direct contacts 5.3 million

* Actual sales amount of low-voltage electricity by new electricity retailers other than equivalent electricity retailers operators in the report Actual Electric Sales as of January 2022, per the Electric Power Survey Statistics of the Agency for Natural Resources and Energy



(Prefecture)

Gunma	Tochigi	Ibaraki	
Enesta	Enesta	Enesta	Enefit
6	1	5	2

Chiba		Saitama	
LIFEVAL	LIFEVAL	Enesta	Enefit
5	5	5	5

Kanagawa		Tokyo	
LIFEVAL	Enefit	LIFEVAL	Enefit
32	9	37	38

Supply of gas, electricity and other services; Sales and installation of gas and other residential equipment; Inspection and repair of gas equipment; Water system repair; Opening and closing of gas fixtures when residents move; Home renovation; Design and installation of drainage facilities and air-conditioning equipment; Gas fitting work; Gas meter reading, etc.

* Number of cases of supplies as of April 19, 2022

バッチョ　水バッチョ

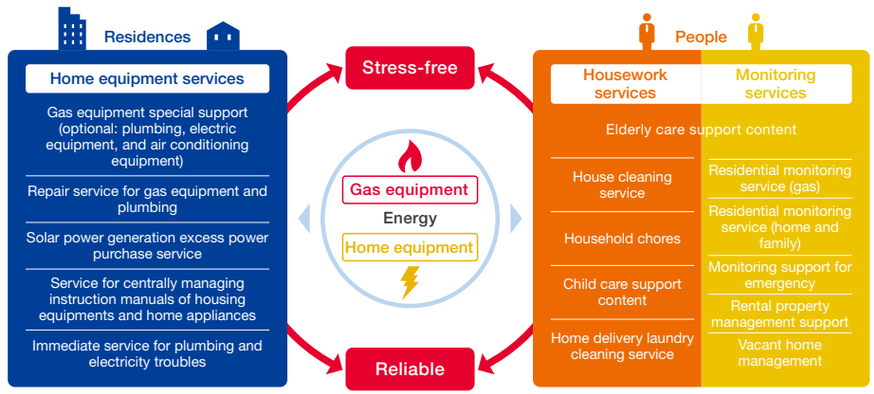
Last mile of Tokyo Gas

Even with ongoing, accelerated digitalization, now made more important by the COVID-19 pandemic, we believe that services that require direct, personal human intervention continue to be necessary and vital. LIFEVAL and Enesta are in charge of the last mile operation by Tokyo Gas, and have the strength required for this by employing many engineers and being connected with customers and communities. Leveraging these strengths, we aim to perfect repair, installation, and other services at customers' homes that require quality and technology and to develop a more satisfying and more trustworthy relationship with our customers.

Certified holders of gas equipment repair licenses	Certified holders of water repair licenses	Registered personnel for equipment installment
2,286	876	3,365
As of May 2022	As of April 2022	As of May 2022

Service expansion using last mile service as a business advantage

The Tokyo Gas Group had closely served customers' everyday lives over the years and will expand services to solve their everyday problems. We intend to work with our diverse partners and co-create services that can satisfy customers' desire to live with peace of mind and in comfort. We are committed to further strengthen our bonds of trust with customers by providing more satisfying services and contributing to solving their everyday problems.



* As of July 2022