

Section
01

Growth Strategies

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Long-Term Vision

Vision 2030

Aim to maintain our role of being an indispensable presence in society as a leading company in the field of renewable energy utilization and environmental protection by realizing sustained growth alongside our customers and society through implementation of ESG management.

External environment outlook

Global-scale concerns include a worsening of the problem of climate change, deterioration in sanitation, and growth in energy demand due to rapid population growth and urbanization, particularly in emerging nations. Concerns in Japan include falling internal demand caused by the shrinking and aging of Japan's population, shortages of human resources and future leaders, fiscal challenges, and aging infrastructure.

- Global**
 - Rising demand for resources, food, water, energy, and waste treatment as the world's population grows
 - Increasingly serious problem of climate change
 - Progress in the Fourth Industrial Revolution and digital transformation (DX)
- Domestic (Japan)**
 - A shortage of human resources and leaders and depopulation of suburban and rural areas as a result of the shrinking and aging of Japan's population
 - Reduced tax revenue due to Japan's shrinking population and tight financial conditions due to the measures addressing natural disasters and infectious disease
 - Contraction and rationalization of public services and increasing use of private-sector companies due to tight financial conditions
 - Dismantling, consolidation, effective use, and replacement of aging and underutilized infrastructure, housing, and other facilities



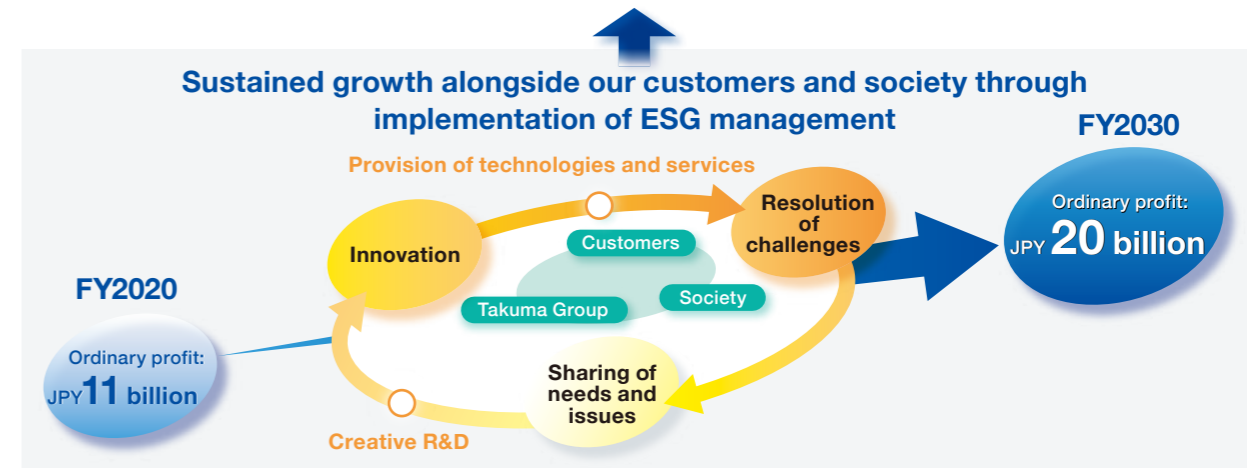
Vision for FY2030

Based on external environmental factors, the Takuma Group will implement ESG management, an approach that consists of addressing key ESG-related issues in an effort to achieve sustained growth by resolving issues faced by customers and society through business activities.

In pursuing business activities built on a core of ESG management, we will strive to become a great partner for our customers by leveraging the technologies and expertise related to energy utilization and environmental protection that are the Group's strengths, along with the relationships of trust we have developed with customers over the long term through after-sales service and other interactions. With the useful technologies and services created through innovation by the Group, which carries on the spirit of a tenacious inventor, we will resolve challenges faced by customers and society, with a focus on the fields of renewable energy utilization and environmental protection.

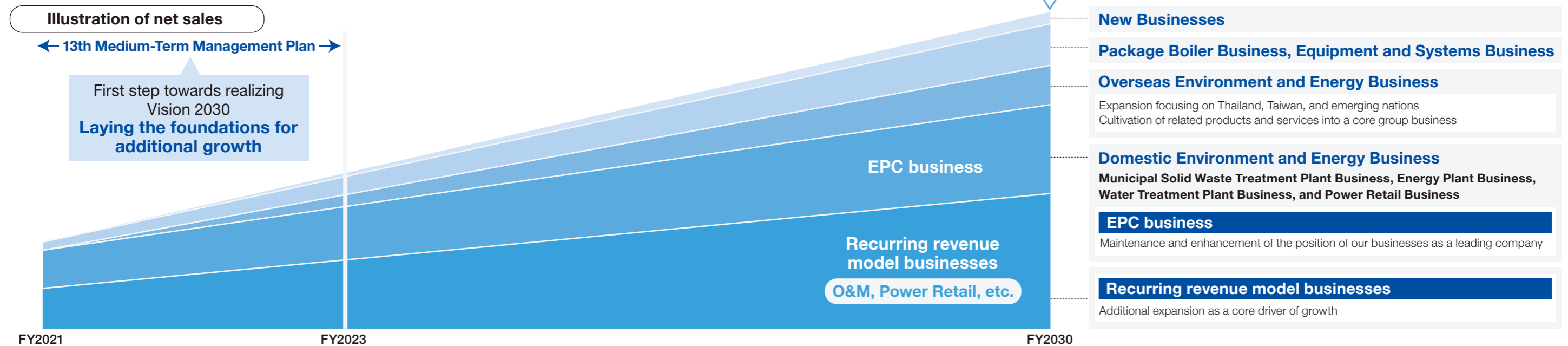
Through the practice of ESG management, we will grow together with customers and society and contribute to the realization of a sustainable society while striving to achieve ordinary profit of JPY 20 billion.

Aim to maintain our role of being an indispensable presence in society as a leading company in the field of renewable energy utilization and environmental protection.



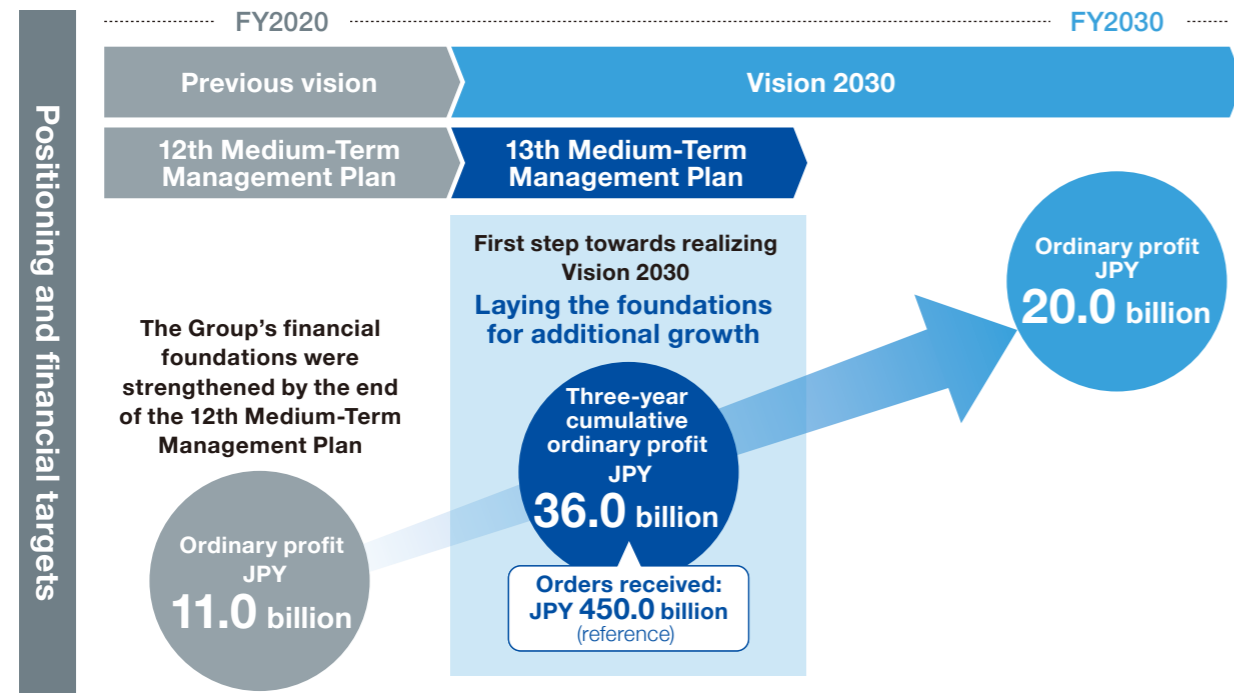
Medium- and long-term roadmap

In addition to further expanding recurring revenue model businesses as the core driver of growth, we will strive to realize steady growth in all businesses, for example through maintaining and expanding of our EPC business. Moreover, we will expand businesses in the environmental and energy fields through new-business creation, M&As, and other means.



Takuma Group 13th Medium-Term Management Plan

The 13th Medium-Term Management Plan began in FY2021 as an effort to realize the Vision 2030 goal of achieving ordinary profit of JPY 20 billion. The plan lays the foundations for further growth and takes the first steps towards realizing the plan's goals. Under it, we will strengthen conventional businesses by reinforcing the Group's management foundation and at the same time accelerate its response to future environmental changes. We will strive to realize sustained growth alongside customers and society by implementing ESG management through our business activities.



Progress towards implementing the 13th Medium-Term Management Plan

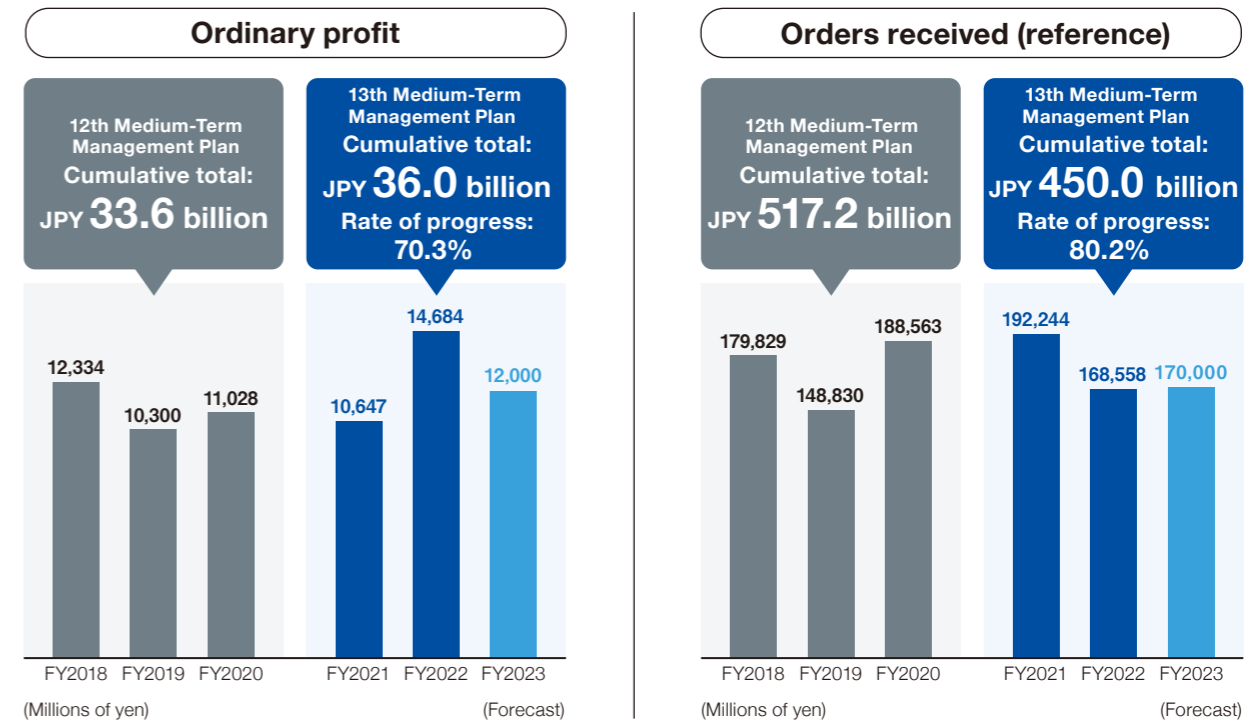
FY2022 financial highlights

Although the market environment continued to strengthen during FY2022 (the fiscal year ended March 2023), the second year of the current Medium-Term Management Plan and orders received remained high at 168.5 billion yen, including one construction and operation (BTO) business order for a municipal solid waste treatment plant and seven new-construction orders, including for biomass power plants, orders received fell 23.6 billion yen from FY2021 (the fiscal year ended March 2022), when we received three construction and operation (DBO) business orders for municipal solid waste treatment plants. Nonetheless, steady progress on construction of previously ordered plants boosted net sales by 8.5 billion yen to 142.6 billion yen, and ordinary profit rose 4.0 billion yen to 14.6 billion yen from the previous fiscal year by improved profitability as well as augmented growth in net sales.

	FY2021	FY2022	Year-on-year
Orders received (Millions of yen)	192,244	168,558	(12.3%)
Backlog (Millions of yen)	445,304	471,211	5.8%
Net sales (Millions of yen)	134,092	142,651	6.4%
Operating profit (Millions of yen)	9,928	13,813	39.1%
Ratio of operating profit	7.4%	9.7%	2.3pt
Ordinary profit (Millions of yen)	10,647	14,684	37.9%
Profit attributable to owners of parent (Millions of yen)	7,434	9,621	29.4%
Net income per share (Yen)	91.53	120.22	31.3%

*DBO and BTO businesses: Construction and operation businesses (EPC + O&M), consisting either of design, build, operate (DBO) or build, transfer, operate (BTO).

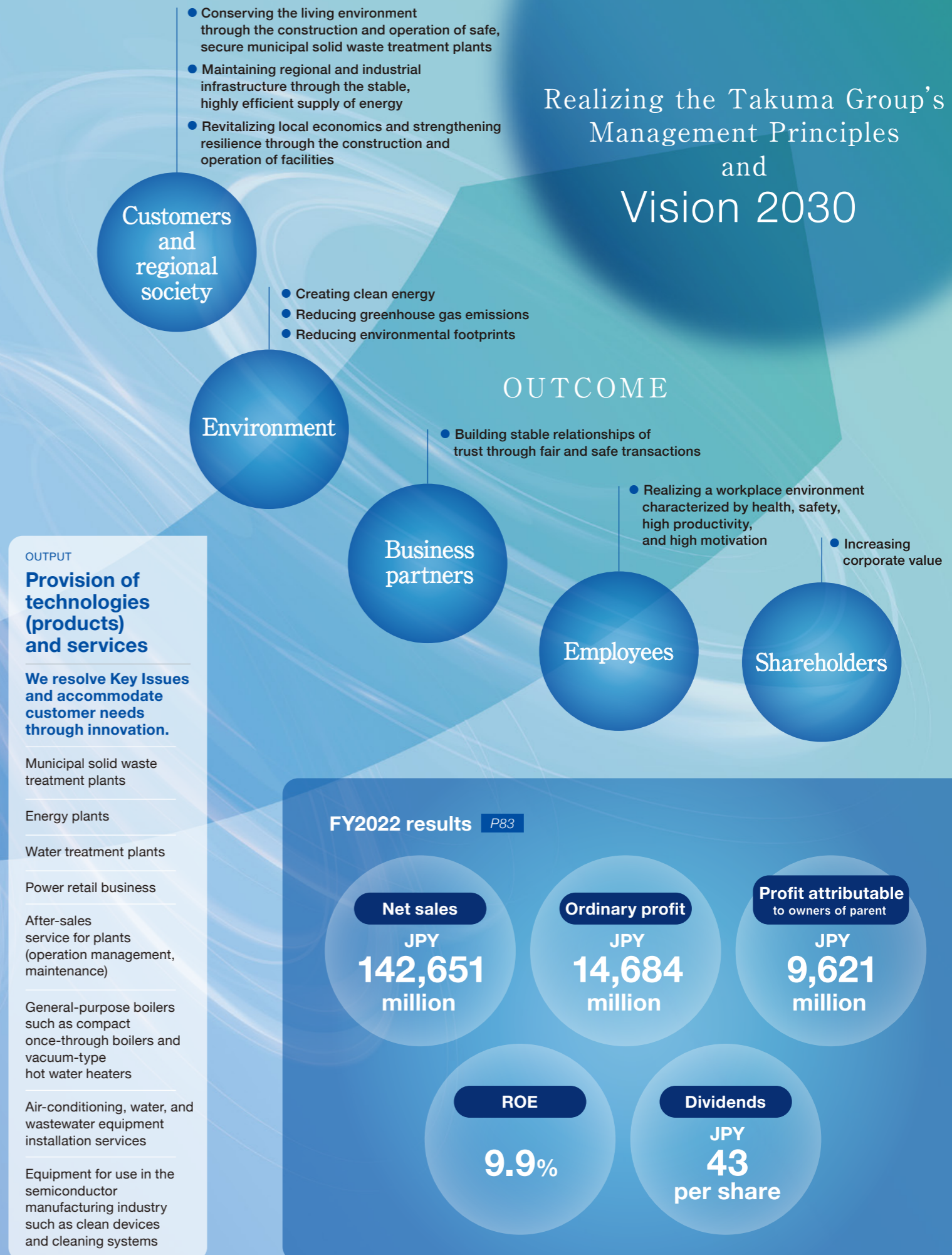
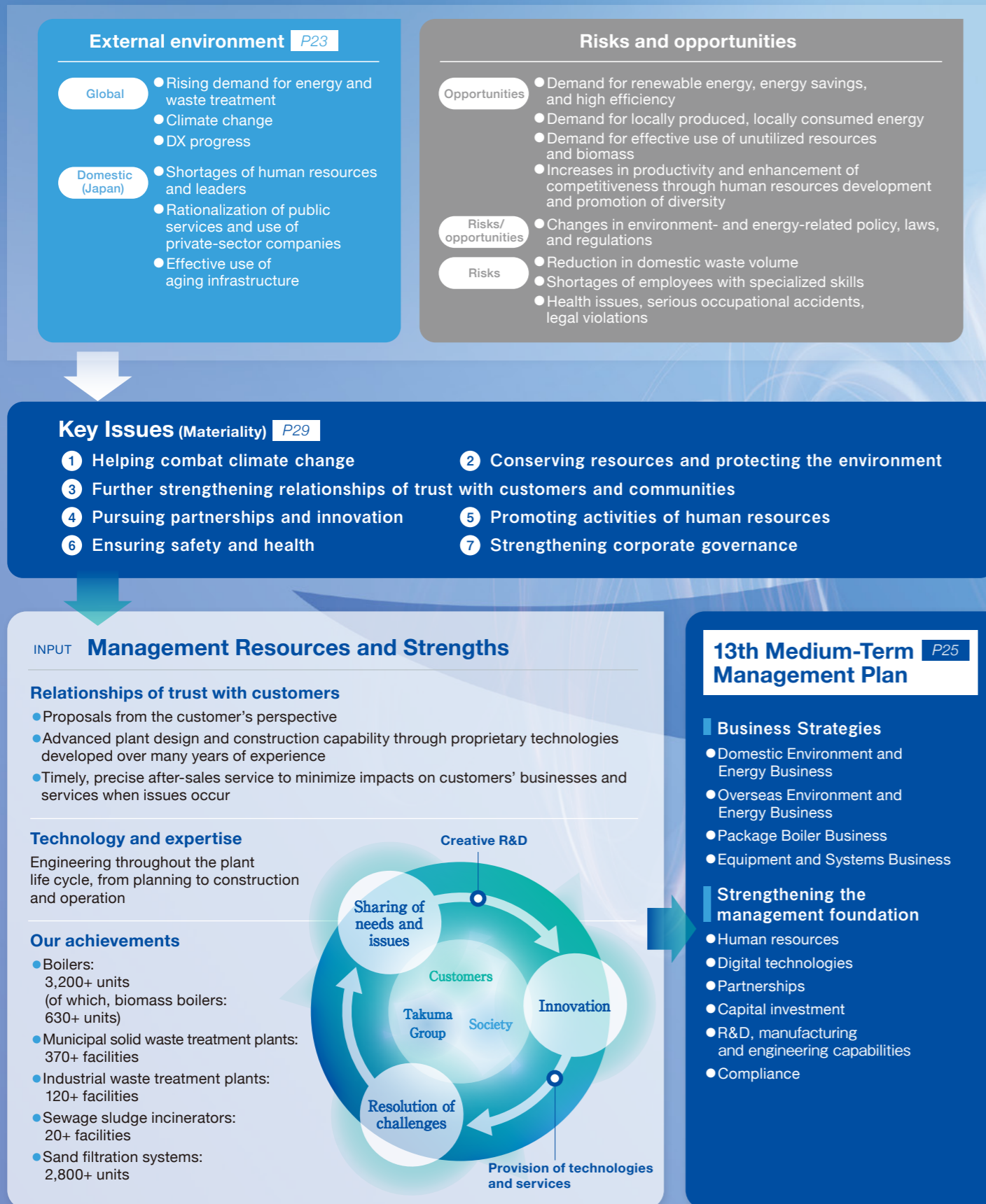
Progress towards targets



Cumulative ordinary profit at the end of the plan's second year totaled 25.3 billion yen, including ordinary profit of 10.6 billion yen posted during FY2021. We anticipate realizing ordinary profit of 12.0 billion yen during FY2023 (the fiscal year ending March 2024) for a total of 37.3 billion yen, achieving the three-year cumulative ordinary profit target of 36.0 billion yen under the plan. Based on this outlook, we plan to increase the annual dividend by 5 yen to 48 yen per share.

Value Creation Process

We will significantly strengthen our efforts to address Key Issues (Materiality) and create new value through business activities that take advantage of the Group's strengths based on medium- and long-term trends and societal issues.



Key Issues (Materiality)

In implementing ESG management, in 2021 we identified seven Key Issues (Materiality) related to ESG that deserve to be given priority when being addressed through our business activities.

We are practicing ESG management to address each Materiality while balancing contributions to customers and society and sustained growth by developing our businesses based on the medium-term management plan and providing necessary technologies and services.

Identification process

The following process was used to identify key issues.

Step 1 Analyzing the status quo and organizing issues

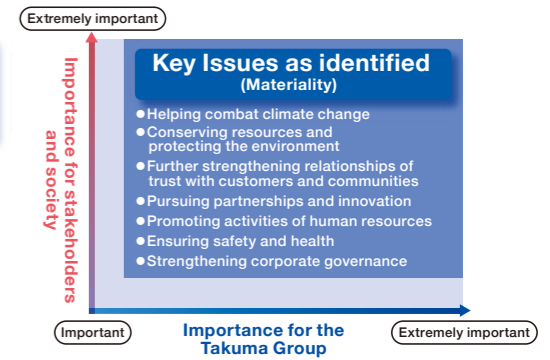
We analyzed a variety of management issues that affect the company from the dual perspectives of the external and internal environment. We compiled a list of 64 issues by analyzing the external environment from the standpoint of ISO 26000, GRI, SDGs, FTSE, and DJSI indicators and requirements, and the internal environment from the standpoint of indicators provided by the Group's Management Principles, strategies, current initiatives, and other yardsticks.

Step 2 Evaluating importance and verifying suitability

We created a matrix organizing the 64 issues described below by analyzing and evaluating their importance for stakeholders and society on the vertical axis and their importance for Takuma on the horizontal axis. We then verified the suitability of the list through a process that included steps such as comparisons with other companies and exchanges of views with responsible departments to narrow down the list of Key Issues to 19 that deserved to be addressed by the Group.

Step 3 Identifying Key Issues

Through discussions among members of the company's executive leadership, seven Key Issues to be addressed by the Group were finalized based on the 19 issues as described to the right.



	Materiality and issues	Risks and opportunities	Specific initiatives	KPI	Progress (as of the end of FY2022)
E Environmental Initiatives	Helping combat climate change 1. Promoting renewable energy (non-fossil energy) 2. Improving energy efficiency	Risks • Accommodating policies and regulations intended to realize a decarbonized society • Changes in customer requirements, for example additional improvements in energy efficiency • Reduction in support from policies, for example as a result of the review of the FIT program Opportunities • Growth in the market for renewable energy and environmental businesses due to strengthening of environmental regulations • Growth in energy usage demand for biomass (including waste, sewage sludge, and other resources) in order to alleviate climate change	• Supply of biomass power plants • Supply of fuel conversion (biomass, RPF, etc.) boilers • Supply of renewable energy and CO ₂ -free power • Reduction in CO ₂ emissions (energy consumption) by Takuma • Improvement in energy efficiency at facilities Takuma operates on a contractual basis • Proposal of energy efficiency improvements for customer facilities and equipment P53	CO₂ emission reduction targets through our own products and services Magnitude of potential reduction in CO₂ emissions due to newly delivered power plants* (FY2023) 800,000 tons per year (FY2030) 2.5 million tons per year <small>*Biomass power plants and Energy from Waste plants delivered from FY2021 to FY2030</small>	184,000 tons per year* <small>*Calculated based on available generating capacity (renewable energy) as of one month after delivery for plants delivered in FY2021 and FY2022 (four waste treatment plants, one sewage sludge plant, and 10 biomass plants).</small>
	Conserving resources and protecting the environment 1. Conserving resources and reducing environmental impacts 2. Making effective use of unutilized resources	Risks • Reduction in domestic waste volume due to the shrinking of the population Opportunities • Growth of appropriate treatment of waste and growth in demand for use of energy from waste in emerging nations • Growth in expectations towards resource-saving and low-environmental-impact systems and the effective use of unutilized resources	• Supply of high-efficiency, low-environmental-impact Energy from Waste plants • Supply of sewage sludge-fueled power plants • Supply of advanced treatment sand filter systems • Establishment of combustion technology for unutilized biomass • Development of technology for reusing bottom ash • Development of technology for recovering and using CO ₂ P53	In-house CO₂ emissions reduction targets (FY2023) Effectively zero CO₂ emissions by the Takuma Head Office and the Harima Factory (Scope 1 and Scope 2) (FY2030) Effectively zero CO₂ emissions by all Takuma worksites in Japan (Head Offices, branch offices, factories, and construction sites) (Scope 1 and Scope 2) <small>*FY2030 targets including group companies remain under consideration. *CO₂ emissions from procured products and use of Takuma products by customers (Scope 3) also remain under consideration.</small>	356 tons per year* <small>*Total of Scope 1 and Scope 2 for the Head Office and Harima Factory.</small>
S Social Initiatives	Further strengthening relationships of trust with customers and communities 1. Pursuing customer satisfaction 2. Ensuring the stable, continuous operation of plants and equipment 3. Recycling local resources and creating new value for communities	Risks • Loss of trust in the event Takuma fails to provide safe, high-quality products and services • Shrinking local government budgets Opportunities • Growth in demand for biomass power generation as a type of energy that can be produced and consumed locally • Growth in expectations toward the creation of new value for communities, for example through disaster prevention facilities and energy centers • Additional growth in the use of private-sector entities to provide government services	• Supply of products and services that satisfy customers • Improvements in the quality of Takuma's operation and O&M businesses • Increasing sophistication of maintenance service • Initiatives addressing the Regional Circular and Ecological Sphere (Regional CES), regional use, and decentralized power supplies • Initiatives such as PPP that address additional use of private-sector entities P59		
	Pursuing partnerships and innovation 1. Utilizing digital technologies (AI, IoT, robots, etc.) 2. Developing open partnerships 3. Pursuing innovation	Risks • Opportunity loss due to lag in accommodating new technologies such as artificial intelligence (AI) and the Internet of Things (IoT) Opportunities • Growth in demand for efficiency-boosting and labor-saving technologies in plant operation (Remote monitoring and operation, data analysis, maximization of amount of power sold, etc.) • Creation of revolutionary technologies and services as well as new business opportunities through the expansion of partnerships	• Increases in the added value of facilities and plants • Strengthening of competitiveness in EPC operations, operation management, and maintenance service • Pursuit of open innovation • Pursuit of new businesses that contribute to the enhancement of existing businesses and services • Development of technologies and products that are sought by society and customers P61	Number of female employees brought into the main career track and management positions (Cumulative total for FY2021 to FY2025) 35 or more	(Cumulative total for FY2021 to FY2022) 16 (Average total for FY2021 to FY2022) 35%
	Promoting activities of human resources 1. Securing and training human resources 2. Promoting diversity 3. Improving employee satisfaction	Risks • Reduction in competitiveness due to a shortage of employees with specialized skills • Discontinuity in the passing down of skills as highly experienced employees reach retirement age and leave the workforce Opportunities • Strengthening of competitiveness through human resources development and management that promotes diversity	• Hiring of new graduates and mid-career employees • Development of optimal human resources programs in response to social changes • Development of an effective training system • Active hiring of diverse human resources and development of career support programs P63	Number of fatal accidents 0	(FY2022) 0
	Ensuring safety and health 1. Ensuring occupational safety and health 2. Managing employee health 3. Creating a comfortable working environment	Risks • Reduction in productivity and social trust due to problems involving safety and health among employees and affiliates (loss of opportunities for earning orders due to the occurrence of serious occupational accidents, etc.) Opportunities • Improvement in productivity and strengthening of competitiveness through improvements in the workplace labor environment	• Reduction in the occurrence of occupational accidents • Prevention of health problems and rectification of overwork • Implementation of workstyle reforms P67		
G Governance Initiatives	Strengthening corporate governance 1. Strengthening corporate governance 2. Strengthening risk management 3. Ensuring compliance	Risks • Reduction in business sustainability due to a lack of appropriate decision-making • Cessation of business due to violations of competition or environmental law or regulations on conduct such as corruption, and associated reduction in social trust Opportunities • Improvement in the ability to create value along with avoidance and reduction of risk as a result of strengthened corporate governance	• Sustained improvement through practices such as evaluations of the effectiveness of the Board of Directors • Continued conduct of appropriate internal audits • Additional improvement in the effectiveness of risk management activities • Even more thorough project risk management • Implementation and ongoing reassessment of business continuity planning (BCP) • Ongoing implementation of compliance education P69	Number of serious compliance violations 0	(FY2022) 0

*For more information about the reasoning underlying our Materiality identification process, please see the Takuma website.

Strengthening the Management Foundation

We will work to strengthen the following six core areas of our management by allocating and investing management resources to steadily implement our business strategies.



Human resources

Theme 1 Strengthening recruiting activities and reviewing employment systems

- Planning new-graduate and mid-career hiring
- Reviewing programs to make use of older workers and to hire specialized workers

Theme 2 Reviewing the human resources development system

- Implementing career development support measures such as job rotation programs to help train engineers and other personnel, programs to follow up on the development of young workers, etc.

Theme 3 Pursuing workstyle reforms and enhancing the workplace environment

- Examining a diverse range of workstyles that allow workers to do their jobs without regard to time or place
- Implementing health-focused management



Progress

We were able to significantly increase the number of people participating in recruiting information sessions by adopting a hybrid format that combines in-person and online components. Career hires also rose, particularly in the Construction Division and Engineering Division. Hiring of female employees is also rising gradually. We are also working to improve utilization of parenting support programs. [P63-65](#)

Digital technologies

Theme 1 Bringing digital technologies to products and services

- Applying digital technologies in order to reduce labor requirements and streamline operations at plants, improving maintainability and functionality, and realizing even more stable operation

Theme 2 Improving management efficiency

- Implementing paperless workflows and Robotic Process Automation (RPA)
- Sharing knowledge and expertise on a companywide basis

Progress

In addition to developing and rolling out technologies that help improve added value, including use of AI in combustion control technology and technology for realizing staffing reductions through remote control from our Solution Lab (a plant remote monitoring and operational support facility), we reviewed business workflows and other operations and made progress computerizing them and utilizing Robotic Process Automation (RPA).



R&D, manufacturing and engineering capabilities

Theme 1 Strengthening R&D

- Creating products and services required in this new era by utilizing open innovation

Theme 2 Strengthening manufacturing and engineering capabilities

- Refining core technologies, overall plant operations, and principal equipment and further improving quality
- Increasing intrinsic safety in design and installation, and preventing occupational accidents



Progress

In addition to refining existing plant-related technologies and pursuing joint research and development on decarbonization technologies with other companies and universities, we work to prevent occupational accidents, for example by making work equipment safer and offering VR-based hazards experience education.

Capital investment



Progress

Our New Harima Factory began operating in January 2023. The facility has put in place production structures capable of accommodating diversifying customer needs based on the following three concepts:

- Improving productivity by utilizing state-of-the-art equipment and streamlining work
- Ensuring the skills of craftsmen dedicated to pursuing the highest possible level of quality are passed down
- Becoming a sustainable, people- and environment-friendly production center

[P17-20](#)

Partnerships

Theme Creating new value through alliances

- Robustly pursuing partnerships with outside companies and other entities in a variety of situations

Compliance

Theme Increasing the effectiveness of compliance and risk management

- Improving and enhancing educational programs
- Continuing and improving risk management activities

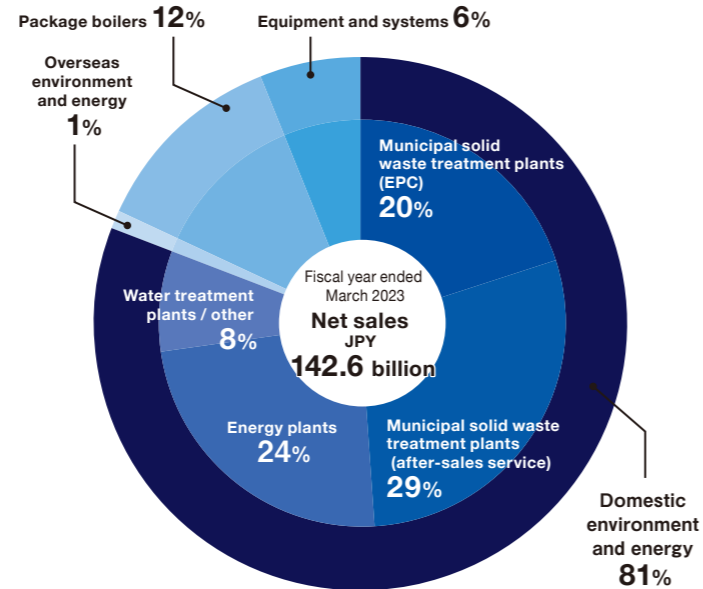
Principal figures related to our effort to strengthen our management foundation are as follows: (Millions of yen)

Fiscal year	2018	2019	2020	2021	2022	2023 (Forecast)
Capital investment	638	1,564	2,420	3,844	7,100	3,600
R&D costs	960	1,154	1,047	1,006	1,150	2,000
Number of employees (consolidated)	3,619	3,816	3,925	4,145	4,247	—
Number of employees (non-consolidated)	852	875	894	958	1,002	—

Business Strategies

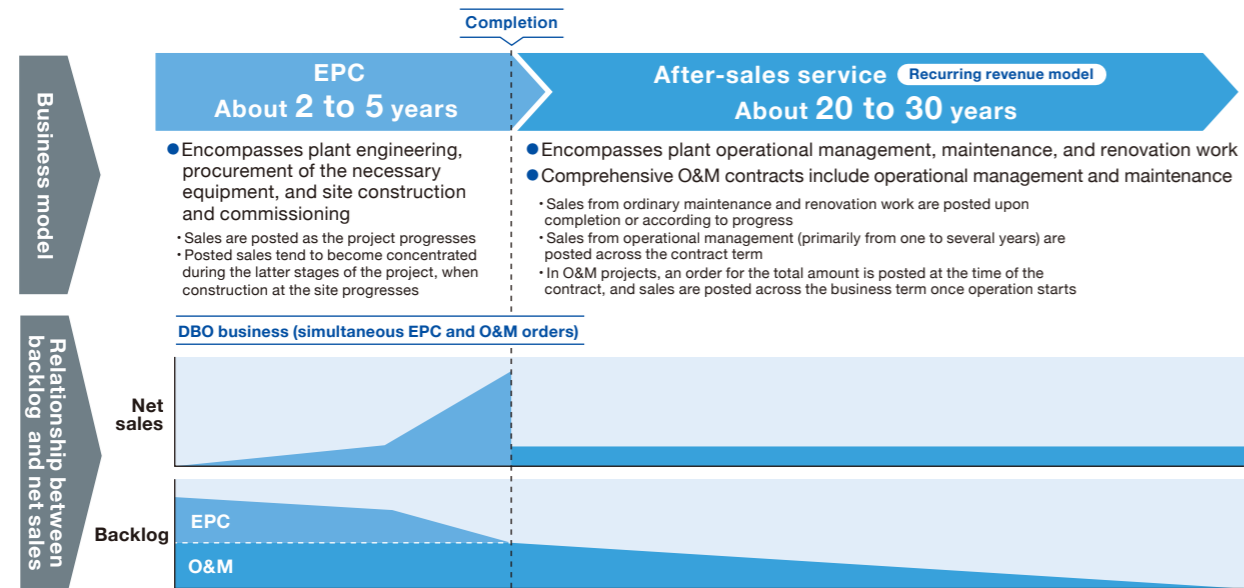
Business Composition

Takuma's business domain consists of four segments: Domestic and Overseas Environment and Energy Businesses, a Package Boiler Business, and an Equipment and Systems Business. The Domestic Environment and Energy Business accounts for about 80% of total net sales. While the breakdown of products and services in our Domestic Environment and Energy Business fluctuates from year to year with the EPC project mix, municipal solid waste treatment plants generally account for about 50% of sales; energy plants, about 20%; and water treatment plants and other products and services, about 10%.



Business Model (Domestic Environment and Energy Business)

Plant engineering, procurement, and construction (EPC) and after-sales service (operational management, maintenance, O&M, etc.) are our primary sources of revenue.



Domestic Environment and Energy Business



Municipal Solid Waste Treatment Plants

1 Business overview and strengths

We provide solutions that extend throughout the plant life cycle, from construction (EPC) of municipal solid waste treatment plants for local governments to maintenance, primary equipment improvement* and service life extension, operation management, and operation and maintenance (O&M).

Since delivering Japan's first 24-hour operating waste incineration plant in 1963, Takuma has delivered more than 370 waste incineration plants, the most of any domestic manufacturer. In addition to supplying products and services that meet regional needs based on the technology and expertise that we have accumulated through a long series of improvements across more than half a century, we have been working to further increase the value we provide by incorporating leading-edge technologies like Artificial Intelligence (AI) and the Internet of Things (IoT).

Principle products ● Waste incineration plants, biogas recovery plants, recycling plants, etc.

*Primary equipment improvement: Large-scale modification work to make effective use of existing municipal solid waste treatment plants by maintaining and improving their performance and extending their service life.

2 Market environment

Of Japan's approximately 1,000 operational waste incineration plants (municipal solid waste treatment plants), which together have a daily treatment capacity of about 170,000 tons, about 60% have been operating for at least 20 years, highlighting the extent to which equipment aging is a serious issue as well as the resulting outlook for replacement and service life extension demand in the near term.

Use of O&M arrangements, which comprise a comprehensive contract for facility operation management and maintenance, and DBO arrangements, which comprise orders for both facility construction and O&M, is growing from the standpoint of taking advantage of private-sector expertise. At the same time, facilities are expected to provide functionality that creates multifaceted value for their region, for example by serving as regional disaster prevention facilities or energy centers, rather than simply treating waste.

Moreover, as society works to realize carbon neutrality by 2050, demand for Carbon Capture, Utilization, and Storage (CCUS) is expected to grow in the medium and long term, augmenting a trend that is also supported by adoption of increasingly advanced use of power and heat from waste and combined systems that pair incineration with technologies like methane fermentation.

3 Initiatives

We work continually to capture orders by offering proposals that meet a diversifying range of customer and community needs, and during FY2022 we earned orders for one BTO project (an approach that involves a contract for facility construction and operation, in the same manner as DBO projects), one primary equipment improvement project, and one long-term (meaning a contract term of 10 or more years) O&M project. The BTO project involves the construction and operation of four facilities—an incineration facility, a recycling facility, a sludge recycling and treatment center, and a biogas recovery facility—at the same site. The combined system used by the incineration and biogas recovery facilities, which lies at the heart of the project, can recover energy much more efficiently than a standalone stoker-type incinerator, and the project marks Takuma's fourth order for such a system. In addition to starting long-term (22 years) operation of a new facility, we are steadily expanding our recurring revenue model business by proposing optimal solutions that meet customers' respective needs.



Energy Plants



1 Business overview and strengths

In addition to construction (EPC) and maintenance of energy plants for private-sector operators, we offer operation and maintenance (O&M) and other services.

Since its founding in 1938, Takuma has delivered more than 3,200 boilers, both in Japan and abroad. Drawing on proprietary combustion technologies and heat recovery technologies that we have improved and evolved together with customers over the course of that long history, we are helping customers and society reduce and eliminate carbon dependency by supplying plants that recover energy from a variety of biomass resources and non-fossil fuels, including wood, poultry manure, and RPF.

Principle products ● Biomass power and heat utilization plants, RPF power and heat utilization plants, industrial waste treatment plants, etc.

2 Market environment

Demand for biomass power plants has grown rapidly since the start of the FIT program, which provides for fixed-price purchases of renewable energy, and Takuma, which has long engineered and constructed biomass boilers, has delivered more than 50 biomass power and heat utilization plants, including facilities not eligible for the FIT program, since 2014, when it delivered its first FIT-eligible unit. Today, changes to the FIT program and other factors are driving a shift in demand to small and medium-size biomass power and heat utilization plants to supply power for local use and to serve as locally produced, locally consumed energy sources.

Additionally, many industrial boilers that use fossil fuels such as coal and heavy fuel oil, which are common in factory applications, are due to be updated, and we expect that the level of need for conversions to non-fossil fuels such as biomass and RPF will grow as society works to reduce and eliminate dependence on carbon.

3 Initiatives

We are working to steadily capture orders for biomass power plants, especially the small and medium-size facilities that represent a key Takuma strength (with power output on the order of 2 to 10 MW), and during FY2022 we earned orders for six new biomass power plants. In addition to securing an order for an industrial waste treatment plant, we offered proposals for solutions targeting the ever-growing number of plants we have delivered, including precisely targeted maintenance service, energy savings, power output enhancements, improvements in equipment functionality, and service life extensions. In this way, we are helping customers both resolve issues and reduce carbon dependency while steadily growing our recurring revenue model businesses.

We are working to apply and evaluate use of absorbing liquid with flue gas from plants with the ultimate goal of commercializing the approach based on a CCUS technology study that used a biomass power plant as a model, and we are actively moving forward with studies and research geared towards future decarbonization and resource and environmental conservation, for example through effective use of biomass combustion ash.

We will continue to contribute to increased adoption of renewable energy and efforts to reduce and eliminate carbon dependency in customers' business activities through increased deployment of power and heat utilization plants that use biomass and non-fossil fuels in response to plans and proposals that precisely assess customers' issues and needs.



Water Treatment Plants



1 Business overview and strengths

In addition to construction (EPC) and maintenance of water treatment and sludge treatment plants, particularly for sewage treatment plants run by local governments, we supply operation management and other services.

Since entering the water treatment field in 1962, we have accumulated technology and expertise by supplying water treatment plants and sludge treatment plants in a variety of fields, including sewage, human waste, and industrial wastewater. In recent years, we have been particularly focused on the sewage treatment field, and we are helping resolve customers' issues with unique technologies like an energy-saving and energy-creating sludge-fueled power system featuring low emissions of the greenhouse gas N₂O and moving-bed sand filtration systems (Uniflow Sand Filter), of which we have delivered about 2,800 units since 1979.

Principle products ● Sewage sludge-fueled power plants, moving-bed sand filtration systems (Uniflow Sand Filter), etc.

2 Market environment

There are some 2,200 sewage treatment plants in Japan, and those facilities are aging, with about 90% having been operating for at least 15 years.

As we work to realize a decarbonized society, demand for the ability to reduce emissions of greenhouse gases from sewage treatment and to utilize sewage sludge, a type of biomass, as renewable energy is growing.

At the same time, utilization of private-sector structures such as Public Private Partnerships (PPPs) and Private Finance Initiatives (PFIs) is expected to continue to grow due to the challenging business environment in which local governments' sewage services operate.

3 Initiatives

We have been offering customers equipment update proposals that take advantage of the features of the high-speed sand filtration systems we have developed, and during FY2022, we received multiple orders. These systems, which deliver two to three times the filtration capacity of past designs, feature a compact, space-saving design, making it possible to reduce the number of basins that must be installed as well as the time required for construction compared to the alternative of replacing existing fixed-bed sand filtration systems.

With regard to sewage sludge incineration plants equipped with power generation equipment, our step grate stoker type sewage sludge incineration and power generation system received two awards, including the Agency for Natural Resources and Energy Commissioner's Award at the New Energy Foundation's FY2022 New Energy Awards. The system, which can generate power while incinerating sewage sludge without using auxiliary fuel, which has been an issue with conventional designs, won praise for realizing energy savings, creating energy, and reducing greenhouse gas emissions. We will continue to help reduce greenhouse gas emissions in sewage treatment by working continually to secure orders.



Power Retail Business



1 Business overview and strengths

Group company Takuma Energy Co., Ltd., operates a power retail business using primarily power generated by municipal solid waste treatment plants and biomass power plants delivered by Takuma.

The company was established in August 2015 to offer services that increase the added value of plants delivered by Takuma through the procurement and supply of power. Takuma Energy is taking advantage of its relationships with customers and group companies to contribute to the adoption of regional renewable energy, for example by operating a local power production/consumption business by supplying power generated at municipal solid waste treatment plants and biomass power plants to public facilities and other sites in the surrounding community, a service that it currently offers in eight communities.

2 Market environment

Demand for decentralized energy and local production and consumption of power is rising from the standpoint of considerations such as ensuring a supply of energy in times of emergency, efficiently utilizing energy, and revitalizing local communities. Against that backdrop, we expect the importance of power and energy services in the Group's business domains to grow in the future, for example in development of the Regional Circular and Ecological Sphere (Regional CES) for waste treatment and regionally utilized power supplies in the FIT program.

Additionally, the level of need for renewable energy and CO₂-free power that have environmental value is growing from the perspective of reducing and eliminating dependence on carbon in business activities. The market is expected to grow further as society works to realize carbon neutrality by 2050.

3 Initiatives

In projects involving the local production and consumption of power, we began supplying power (in January 2023) to public facilities and other users in the city of Kurume, Fukuoka Prefecture. We also began self-consignment using surplus power from a municipal solid waste power generation facility in January 2023 in the city of Imabari, Ehime Prefecture, where we began supplying power in April 2022, in a first for the Shikoku region. By offering agent service for self-consignment, Takuma Energy Co., Ltd., is contributing to the development of schemes for more direct local production and consumption of power and to the stabilization of power costs.

In addition, the company began supplying 100% effectively renewable energy to Takuma's Head Office and Harima Factory in April 2022, reducing CO₂ emissions at the two sites by about 80%.

In addition to continuing to contribute to measures to address climate change through the supply of renewable energy-derived, CO₂-free power, we will help resolve regional issues, for example by proposing local power production and consumption schemes that have been custom-tailored for specific communities.



Overseas Environment and Energy Business



Overseas Businesses

1 Business overview and strengths

We supply construction and maintenance services for biomass power plants and Energy from Waste plants with a focus on Thailand and Taiwan, where we have local subsidiaries.

Since delivering a bagasse-fired boiler (bagasse: the residual material left after pressing sugarcane) to a customer in Taiwan in 1949, we have delivered more than 380 biomass-fired boilers to overseas customers, primarily in Southeast Asia. We have also delivered about 120 boilers, primarily to sugar refineries in Thailand making a significant contribution to the development of the country's sugar industry.

We have also delivered a total of 16 waste treatment plants to customers in Taiwan, China, South Korea, and the U.K. since delivering our first such plant overseas in the U.S. in 1986.

Principle products ● Biomass power plants, Energy from waste plants

2 Market environment

Although a certain level of demand is expected to continue for bagasse-fueled biomass power plants in Thailand, the business environment remains characterized by intense competition with Indian and Chinese manufacturers. At the same time, the Thai government has announced a policy of promoting biomass power generation, and demand for biomass fuels other than bagasse is expected to grow in the future.

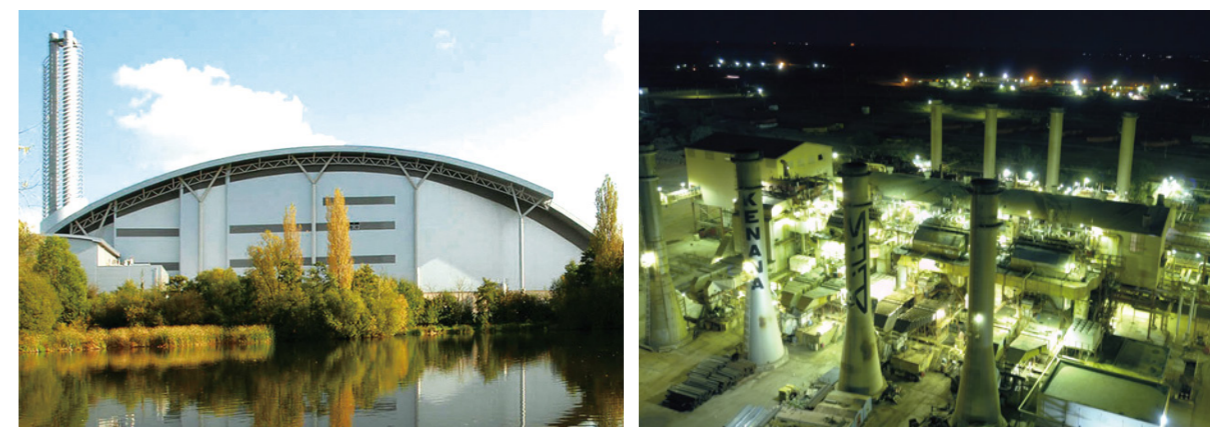
On the other hand, Energy from Waste projects in the emerging nations of Southeast Asia are often derailed for reasons such as a lack of programs and standards related to waste treatment and insufficient government funding, and a stable market has not yet developed. Nevertheless, the level of need for Energy from Waste plants is growing due to population growth and urbanization, and we expect the sector to evolve into a growth market over the medium and long term.

3 Initiatives

Following an order for an equipment replacement project at an Energy from Waste plant in Taiwan received in the last fiscal year, we secured orders for a waste treatment plant in Vietnam and energy plants in Thailand during FY2022.

Demand for equipment replacement and service life extensions is rising in Taiwan as waste treatment plants built from the late 1980s to the 2000s age. Also, demand for biomass power plants in Thailand is expected to remain strong going forward as the need for new biomass fuels other than bagasse is growing.

In addition to working to lower costs, for example by expanding overseas procurement, we will work to increase added value and differentiate ourselves from our competitors by accommodating new biomass fuels and enhancing maintenance services offered through our local subsidiary in Thailand as we continue to strive to earn orders with a focus on Thailand and Taiwan. We will continue to put in place structures to help us secure orders, including through partnerships with local companies, as we look to tap future demand.



Package Boiler Business

Package Boiler Business



1 Business overview and strengths

Group company Nippon Thermoener Co., Ltd., manufactures, sells, and maintains general-purpose boilers in addition to designing and building related heat source equipment and systems for various types of manufacturing plants as well as hotels, hospitals, commercial buildings, and other facilities.

Over the many years since its establishment in 1961, Nippon Thermoener Co., Ltd., has supported consumer lifestyles as well as industry by accumulating extensive experience in an array of package boilers, which are used in a variety of industries and applications. In an effort to accommodate the changing times and environment as a manufacturer specializing in heat source equipment, the company meets a diverse range of customer needs by developing new heat source systems such as hybrid hot water systems based on the technological capabilities and expertise it has accumulated over its long history.

Principle products ● Once-through boilers (Equos), vacuum-type hot water heaters (Vacotin Heater), heat-transfer oil boilers (Thermoheater), smoke tube boilers (RE Boiler), hybrid hot water systems, etc.

2 Market environment

Although the domestic general-purpose boiler market has matured and will shrink over the medium- and long-term, we expect demand for equipment replacement and related services to continue in the near term due to the large size of the installed base. Additionally, demand for energy-saving boilers is expected to increase overseas, particularly in emerging nations. We expect efforts to gain additional energy savings and efficiency gains from boilers as part of the larger drive to reduce and eliminate carbon dependency to accelerate and the market to shift to heat-source systems that use non-fossil fuels over the long term.

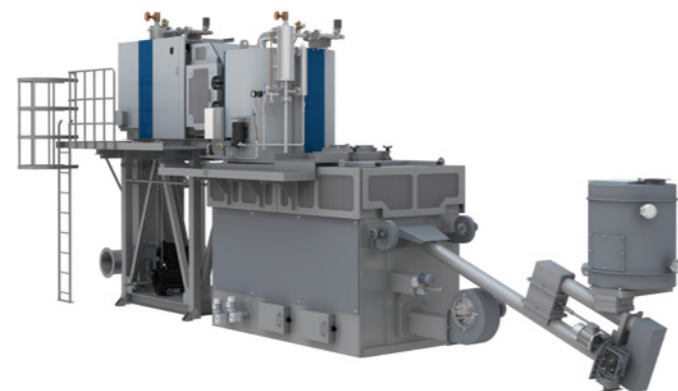
3 Initiatives

FY2022 brought a recovery in equipment availability and new-equipment demand, which had suffered as a result of the COVID-19 pandemic. Going forward, we will work to maintain and expand the scale of orders earned in the domestic market by continuing to provide a diverse line of products and by proposing systems that have been optimized to meet customers' needs. In addition to supporting both consumer lifestyles and industry by working to enlarge our overseas business, particularly in Southeast Asia, where our Thai subsidiary operates, we will contribute to reducing greenhouse gas emissions through adoption of high-efficiency, energy-saving systems.

Moreover, we will strive to pioneer new heat source equipment markets based on our vision for a decarbonized society by supplying highly efficient systems that yield greater energy savings, for example hybrid hot-water systems that pair a heat pump with a vacuum-type hot water heater, and new heat-source systems that utilize non-fossil fuels, for example wood chip-fueled biomass boilers and vacuum-type hot water heaters that use hydrogen as fuel, which we announced in April 2023.



GTL-300ZE Vacotin Heater
(zero-emission, hydrogen-fired vacuum-type hot water heater)



BSU-1200D wood chip-fired biomass once-through boiler

Equipment and Systems Business

Equipment and Systems



1 Business overview and strengths

Group company Sunplant Co., Ltd., designs and installs a range of building equipment, including air-conditioning, water, wastewater, and hygienic, and firefighting systems, while group company Dan-Takuma Co., Ltd. supplies and provides service for clean system-related equipment and devices that provide a suitable environment for semiconductor and electronic device manufacturing equipment.

Sunplant, which operates a building equipment business, was established as a boiler installation company in 1941. After entering the equipment construction business in 1965, the company began offering a variety of building equipment for use in education and research facilities, healthcare and social welfare facilities, commercial and cultural facilities, plants, railroad facilities, and other sites. In this way, it has supplied optimal environments that are custom-made to suit a variety of applications and requirements based on the technology and expertise it has accumulated over many years.

Since its establishment in 1969, Dan-Takuma, which supplies equipment to the semiconductor industry, has consistently contributed to the development of the semiconductor manufacturing industry over more than half a century by drawing on its extensive track record and accumulated experience to build close customer relationships and accommodate realistic customer wishes from the customer's perspective, with a focus on the semiconductor and electronic device industries.

Principle products and services ● Building equipment installation, chemical filters, magnetically shielded chamber equipment, washing systems, AMC analysis and monitoring systems, etc.

2 Market environment

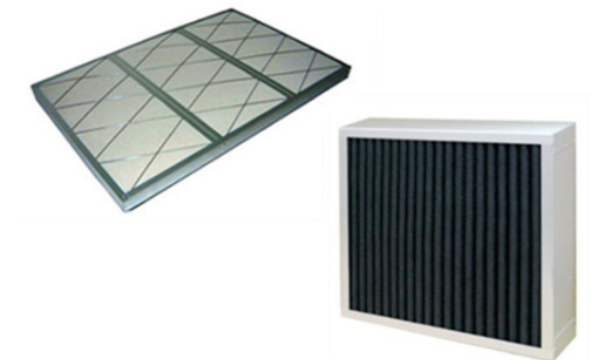
Private-sector investment, which had fallen off due to the COVID-19 pandemic, is recovering, and robust construction demand, including for replacement and repair of aging public facilities and the construction of new healthcare and social welfare facilities, is expected to continue over the medium- and long-term.

While observers have noted that the semiconductor market peaked and entered a plateau period after the prosperity lasted for several years, demand in the manufacturing equipment sector is expected to remain steady thanks to policy support for new-plant construction and corporate relocation in various countries seeking economic security in the face of trade friction between the U.S. and China and the decoupling of global supply chains, ongoing demand for on-vehicle power semiconductors, and other factors.

3 Initiatives

In the building equipment business, we will work to further strengthen our sales and installation capabilities by securing and training human resources, and we will strive to achieve steady growth in the scale of orders received by creating optimal environments that are custom-made to suit a variety of applications and requirements.

To restore the sustained growth of our business in the semiconductor and electronic device equipment sector in a short period of time, we will look to cushion the impact of changes in the external environment by realizing increased business opportunities through strategic sales measures and developing and strengthening the internal platform functions that underpin our business execution. In addition, we will strive to make an even broader contribution to society by continuing to play an essential role in the manufacturing segment of that industry, developing alongside our customers, and participating constructively in industry.



Main Recent Projects

This section introduces major projects delivered by Takuma during FY2022 in the Domestic Environment and Energy Business.

Municipal Solid Waste Treatment Plants



New Construction Suminoe Plant, Osaka Waste Management Authority

Project name Osaka city · Yao city · Matsubara city environment facilities association Suminoe Plant Update construction and Operation Project

Location Osaka Prefecture

Capacity 400 tons per day (200 tons per 24 hours × 2 units)
Power output: 11,300 kW



New Construction Kahoku District Clean Center

Project name Kahoku District Area Administrative Association Energy Recovery Waste Treatment Facility Construction Project

Location Ishikawa Prefecture

Capacity Energy from waste facility: 98 tons (49 tons per 24 hours × 2 units)
Indirect Heating Sludge Dryer: 30 tons per 24 hours
Power output: 1,700 kW



Primary Equipment Improvements Ota Incineration Plant No. 1 Plant

Project name Equipment Replacement Project for Resumption of Ota Incineration Plant No. 1 Plant Operation

Location Tokyo Metropolis

Capacity 600 tons per day (200 tons per 24 hours × 3 units)
Power output: 9,000 kW



Primary Equipment Improvements Fujimi Environmental Center

Project name Fujimi Environmental Center Incineration Facility Primary Equipment Improvement Project

Location Saitama Prefecture

Capacity 180 tons per day (90 tons per 24 hours × 2 units)



Primary Equipment Improvements Dogo Clean Center

Project name Dogo Clean Center Primary Equipment Improvement Project

Location Shimane Prefecture

Capacity 25 tons per day (12.5 tons per 8 hours × 2 units)

Energy Plants



Yufutsu Energy Center, LLC

Project name Yufutsu Biomass Power Plant No. 1 Generation Equipment Installation Project

Location Hokkaido Prefecture

Capacity Fuel: Wood fuel
Steam conditions (regular operation): 271 tons per hour × 6.0 MPaG × 480°C
Power output: 74,950 kW



Gohara Plant, Chugoku Lumber Co., Ltd.

Project name Wood Biomass Power Plant Design, Procurement, and Commissioning Project

Location Hiroshima Prefecture

Capacity Fuel: Wood fuel
Steam conditions (regular operation): 42.0 tons per hour × 5.9 MPaG × 480°C
Power output: 9,990 kW



Amagasaki Mill, Rengo Co., Ltd.

Project name Biomass Incineration Equipment Installation Project

Location Hyogo Prefecture

Capacity Treated waste: Paper manufacturing waste
Incineration capacity: 95 tons per day



F Bit Communications Corp.

Project name Wood Biomass Power Generation Equipment/Plant Design, Procurement, and Commissioning Project

Location Kochi Prefecture

Capacity Fuel: Wood fuel
Steam conditions (regular operation): 11.1 tons per hour × 4.2 MPaG × 405°C
Power output: 1,990 kW



SGET Toki Biomass G.K.

Project name Biomass Power Plant Construction Project

Location Gifu Prefecture

Capacity Fuel: Wood fuel
Steam conditions (regular operation): 29.0 tons per hour × 6.0 MPaG × 480°C
Power output: 7,100 kW



Hirata Bioenergy GK

Project name Wood Biomass Power Generation Equipment/Plant Design, Procurement, and Commissioning Project

Location Fukushima Prefecture

Capacity Fuel: Wood fuel
Steam conditions (regular operation): 11.1 tons per hour × 4.2 MPaG × 405°C
Power output: 1,990 kW



Hirata Bioenergy GK (No.2 Power Plant)

Project name Wood Biomass Power Generation Equipment/Plant Design, Procurement, and Commissioning Project

Location Fukushima Prefecture

Capacity Fuel: Wood fuel
Steam conditions (regular operation): 11.1 tons per hour × 4.2 MPaG × 405°C
Power output: 1,990 kW

A new biomass power plant, one of the largest in Japan

Yufutsu Biomass Power Plant was established by Nippon Paper Industries Co., Ltd., which has carried out its businesses utilizing wood as a renewable resource, under the slogan, “Shaping the future with trees”, and Sojitz Corporation, which has accumulated expertise through domestic and international power generation and forestry resource businesses.

As one of Japan’s largest biomass-fired single-fuel facilities, the plant supplies the electricity needed to power people’s lives while helping prevent global warming.

Feature 02 | Yufutsu Biomass Power Plant

Power plant overview

Customer: Yufutsu Energy Center, LLC
Power output: 74,950 kW
Fuel: Wood chips, palm kernel shells (PKS), Japan-sourced unutilized wood chips
Design and construction: Takuma and Penta-Ocean Construction Special Construction Joint Venture
Project dates: March 29, 2019, to January 16, 2023

A facility for supplying clean energy to more consumers

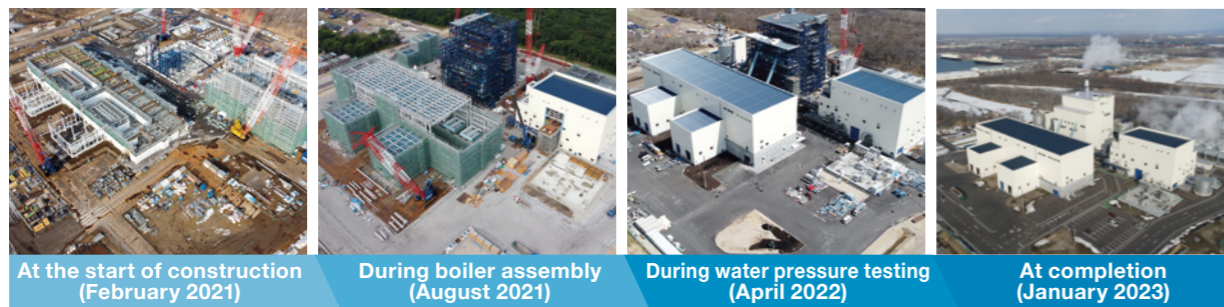
The combustion system used by the plant includes one of the world's largest traveling stokers. Traveling stokers, one of Takuma's flagship technologies, anchor a combustion method that is characterized by an ability to accommodate fuel with a broad range of calorific values, moisture content, and shapes. It allows plants which, like the Yufutsu facility, utilize fuels that have various properties to take maximum advantage of each fuel type's energy. Lower parasitic load*1 compared to other combustion methods make it possible to efficiently deliver clean, renewable energy generated from biomass fuel to more people, helping reduce CO₂ emissions.

*1 Parasitic load: The energy necessary to operate the plant's systems and equipment.



Largest construction to date

Construction of the plant, which was completed on a site of about 70,000 m² adjacent to land owned by Nippon Paper Industries Co., Ltd. in the city of Tomakomai, Hokkaido, began in 2021. The undertaking, which was Takuma's largest biomass power plant construction project to date, imposed various challenges, including restrictions resulting from the COVID-19 pandemic, but a total of 109,615 workers came together to complete the facility, which was delivered to the customer on time as specified by the initial plan.



Message from the engineering coordinator

This biomass power plant uses a high-efficiency traveling stoker to burn wood chips and PKS and generate 74,950 kW of power, one of the highest capacities of a facility of its kind in Japan. Even as it began, the long-term construction project was affected by the unforeseen COVID-19 pandemic; however, we were able to deliver it without incident and on time in January 2023 as originally planned, despite having had to work in the midst of a state of emergency. That achievement was the result of the customer, vendors, and other stakeholders working closely together. I would like to take this opportunity to express my deep gratitude. I pray that Yufutsu Biomass Power Plant will contribute to the stable supply of regional power long into the future.

Yuzuru Nakae
Assistant General Manager,
Section 1, Energy Engineering Dept. 2, Takuma Co., Ltd.



Promoting forestry and creating jobs through the effective use of unutilized materials

Creating clean, renewable energy to support people's lives*2 while safeguarding the local forest environment and contributing to regional revitalization by promoting forestry and creating jobs

Experts believe Japan produces about 9 million tons of unutilized wood material in the form of thinned timber and timber left on forestland each year. About 6 million tons of that material is left on the forest floor due to the enormous cost of collection and transportation*3. Unutilized material left in forests has long been seen as a problematic cause of destruction of the woodland environment because the methane gas it gives off as it rots can adversely affect forest ecosystems and because it can cause forest fires.

By treating unutilized biomass material in Hokkaido as an important regional resource and using it as a source of renewable energy, Yufutsu Biomass Power Plant is giving such material a role to play while revitalizing forestry and local industry in the region.

*2 The plant can supply enough electricity to power 160,000 households for one year. Renewable energy power generated by the plant is sold to Hokkaido Electric Power Network, Inc.
*3 Estimate based on data from "Annual Report on Forest and Forestry in Japan Fiscal Year 2020" (Forestry Agency) (<https://www.maff.go.jp/e/data/publish/attach/pdf/index-22.pdf>).

Wood chips
Wood chips are produced by running timber through a wood chipper. Since the wood chips are made with low-quality logs which are poorly suited to use in the production of paper, the process contributes to the effective utilization of resources.



PKS (Palm Kernel Shell)
Palm kernel shells are left over after palm seeds are pressed to extract palm oil. The shells are attracting attention as a source of biomass energy due to their low moisture content and high calorific value.



Unutilized wood chips in Japan
These wood chips are produced from thinned timber that is not large enough to be used in the production of lumber along with branches, tree roots, and other materials left over when trees are harvested. There is a need to put these materials to good use in order to revitalize Japan's forestland, forestry industry, and communities in mountainous areas.



Message from the customer

We moved forward with the construction project of Yufutsu Biomass Power Plant with the cooperation of Takuma over a six-year period from planning to completion. These six years encompassed a number of significant changes in the external environment, including the COVID-19 pandemic and a worldwide semiconductor shortage, but Takuma completed the project on time while dealing with problems that were unforeseen at the outset in a timely and sincere manner. Moreover, Takuma exhibited an understanding of the operational technologies we had accumulated to that point, and we believe the company achieved an even higher level of technological sophistication by augmenting their basic specifications with those technologies, particularly with regard to central monitoring of site instruments in the central control room and remote operation.

In addition to leveraging the operational technologies cultivated with us in the future development of Takuma technologies, we look forward to Takuma's continued guidance and support in maintenance as we work to operate Yufutsu Biomass Power Plant in a safe and stable manner.



Teruhiko Oosaki
Deputy General Manager
Shiraoi Mill - Power Dept
Power Generation Sec,
Yufutsu Manager
Shiraoi Mill - Plant Engineering
Dept Construction
Project Manager,
Yufutsu Biomass Powerplant.
NIPPON PAPER
INDUSTRIES Co., Ltd.



Takashi Sasama
Senior Manager
Energy Business Department
Energy Business Div.
NIPPON PAPER
INDUSTRIES Co., Ltd.

Message from the sales coordinator

It fills me with deep emotion that we were able to deliver one of the largest biomass-fired single-fuel power plants in Japan, and that the facility will serve as an environmentally friendly source of power from renewable energy while promoting local forestry. Over the course of the six years from planning to completion, we drew on all of Takuma's resources in the planning, engineering, and construction of the plant. I am extremely grateful that we were able to bring the project to completion while enjoying the customer's assistance. Going forward, we will do our best to provide after-sales service so that the plant continues to operate long into the future.

Kyohei Bunya
Plant-2 Dept., 2nd Sect (Marketing & Sales), Energy Plant Div., Takuma Co., Ltd.

