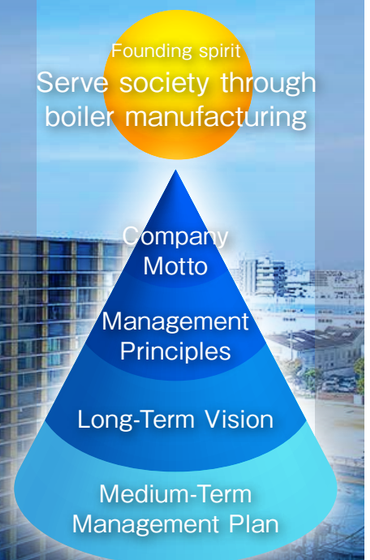
Section 01

Growth Strategies

The Takuma Group's Values and Vision

The Takuma Group's system of principles

The foundation of the Takuma Group is founder Tsunekichi Takuma's directive to "Serve society through boiler manufacturing" –in other words, to contribute to customers and society through the company's products and services. We have formulated our Company Motto and Management Principles based on that philosophy, and our management strategies rest on those principles.



Founding spirit (from 1938)

Serve society through boiler manufacturing

This philosophy served as the Company Motto of Takuma, then Takuma Boiler Manufacturing Co., Ltd., which was founded by Tsunekichi Takuma, one of the 10 great inventors of Japan during the Meiji and Taisho periods (1868-1926). The central tenet is to contribute to society through corporate activities such as the manufacture, sale, and service of boilers.

Our Founder Tsunekichi Takuma

Company Motto (from 1992)

Value Technology, Value People, Value the Earth

The previous Company Motto, "Serve society through boiler manufacturing", was replaced with the above in 1992, reflecting recognition that the company was operating a multifaceted business as a manufacturer of not only boilers, but also environmental sanitation systems like waste treatment facilities and water treatment equipment. It captures Takuma's stance of leveraging the personality and ability of each employee to refine technologies that consistently lead the industry and then using them to safeguard the Earth's environment.

Management Principles (from 2006)

Takuma will strive for social contribution, corporate value enhancement, long-term corporate development and the satisfaction of all stakeholders by providing goods and services that are needed and recognized as valuable in society.

The Management Principles were crafted by organizing and articulating the value system embodied in the original Company Motto of "Serve society through boiler manufacturing".

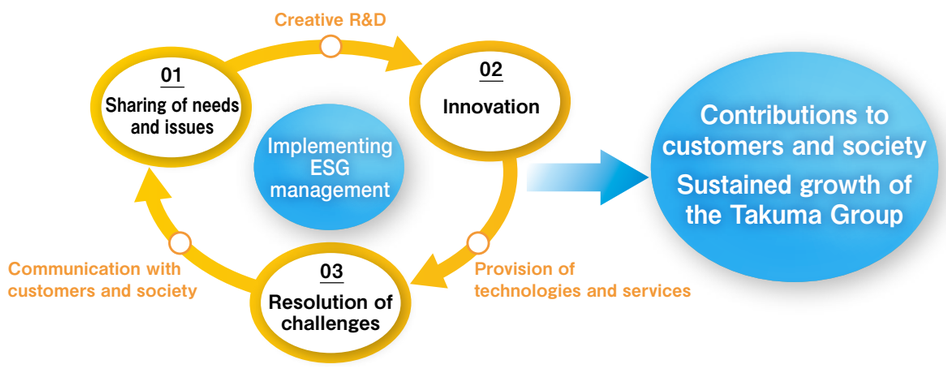
Our goal is to contribute to customers and society as a whole through the goods and services we create.

Vision 2030 (Long-Term Vision) (FY2021 to FY2030)

Future vision

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.

By formulating Vision 2030, our long-term vision looking towards 2030, we are seeking to realize sustained growth alongside customers and society.



Business portfolio

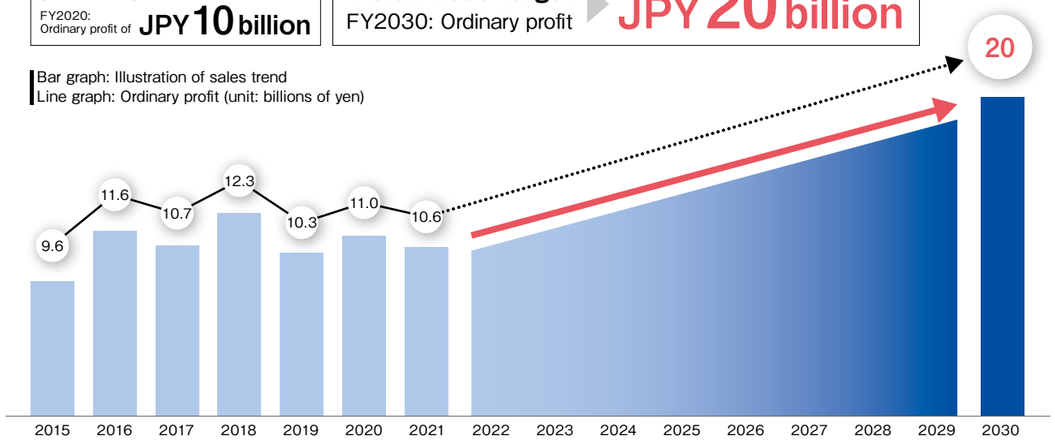
To realize our vision, we will grow while contributing to customers and society through the business described below.

EPC businesses	Recurring revenue model businesses	Overseas businesses
Domestic Environment and Energy Business Municipal Solid Waste Treatment Plant Business P32 Energy Plant Business P33 Water Treatment Plant Business P34	Domestic Environment and Energy Business Municipal Solid Waste Treatment Plant Business P32 Energy Plant Business P33 Water Treatment Plant Business P34 Power Retail Business P35	Overseas Environment and Energy Business P36
Package Boiler businesses P37	**Equipment and Systems business** P38	**New businesses**

Financial target

Target under the previous corporate vision
FY2020: Ordinary profit of **JPY10billion**

Vision 2030 target
FY2030: Ordinary profit **JPY20billion**



Value Creation Process

We are working to create new value by strengthening initiatives that address Key Issues (Materiality) through businesses that tap the Group's strengths in light of medium- to long-term trends and social issues.

External environment

Global
- Rising demand for energy and waste treatment as the planet's population and economies grow
- Increasingly serious problem of climate change
- Progress of the Fourth Industrial Revolution and the digital transformation (DX)

Domestic (Japan)
- Shortages of human resources and future leaders caused by the shrinking and aging of Japan's population; depopulation around large cities and in rural areas
- Tight financial conditions caused by declining tax revenues in the face of the shrinking population and the need to deal with natural disasters and infectious disease
- Contraction and streamlining of public services due to tight financial conditions; increasing reliance on private-sector companies
- Demolition, consolidation, effective use, and replacement of aging and underutilized infrastructure, houses, etc.

Risks and opportunities

Opportunities
- Growth in demand for renewable energy, energy savings, and streamlining of initiatives to realize carbon neutrality by 2050
- Growth in demand for local production and local consumption of energy; rising expectations with regard to disaster-prevention facilities and energy centers
- Rising expectations with regard to effective use of unutilized resources and biomass
- Growth in demand for the streamlining of initiatives that take advantage of digital technologies
- Strengthening of competitiveness through human resources development and management that promotes diversity
- Improvement in productivity and strengthening of competitiveness through improvements in the workplace labor environment

Risks/Opportunities
- Changes in the environment, energy policy, and laws and regulations

Risks
- Reduction in domestic waste volume due to the shrinking of the population
- Shortages of employees with specialized skills
- Discontinuity in the passing down of skills as highly experienced employees leave the workforce
- Reduction in productivity and social trust due to problems involving safety and health
- Loss of opportunities for earning orders due to the occurrence of serious occupational accidents
- 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

Key Issues (Materiality) P25

1. Helping combat climate change
2. Conserving resources and protecting the environment
3. Strengthening relationships of trust with customers and communities
4. Pursuing partnerships and innovation
5. Promoting activities of human resources
6. Ensuring safety and health
7. Strengthening corporate governance

INPUT

Management Resources and Strengths

Relationships of trust with customers
- Proposals crafted from the customer's perspective
- Advanced plant design and construction capability founded on proprietary technology developed over many years of experience
- Fast, precise after-sales service to minimize the impacts of problems on customers' businesses and services

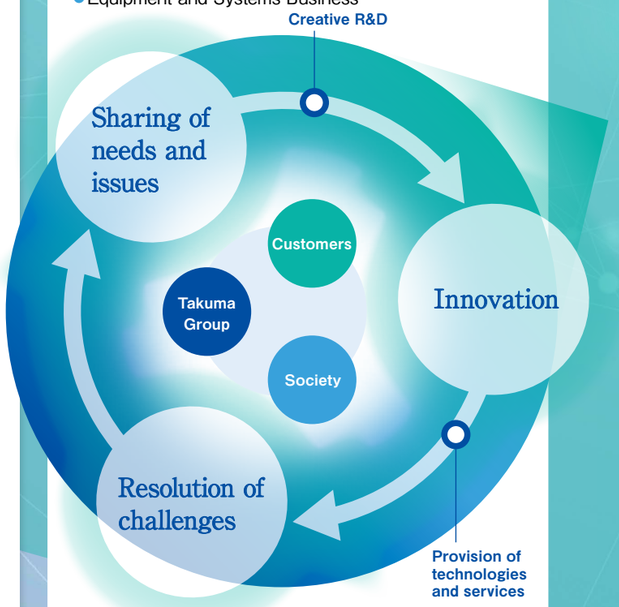
Technology and expertise
Engineering throughout the plant life cycle, from planning to construction and operation

Our achievements
- Boilers: About 3,200 units (of which, biomass boilers: about 630 units)
- Waste incineration plants: About 360 facilities
- Industrial waste treatment plants: About 120 facilities
- Sewage sludge incinerators: 20 facilities
- Sand filtration systems: More than 2,700 units

Human resources
Tough, dedicated human resources who will carry on Takuma's founding spirit and work closely with customers in the spirit of good faith

13th Medium-Term Management Plan P27

Business Strategies
- Domestic Environment and Energy Business
- Overseas Environment and Energy Business
- Package Boiler Business
- Equipment and Systems Business



Strengthening the management foundation
- Human resources
- Digital technologies
- Partnerships
- R&D; manufacturing and engineering capabilities
- Capital investment
- Compliance

OUTPUT

Provision of technologies (products) and services

We resolve Key Issues and accommodate customer needs through innovation.

- Municipal solid waste treatment plants
- Energy plants
- Water treatment plants
- Power retail business
- After-sales service for plants (operation management, maintenance)
- General-purpose boilers such as compact once-through boilers and vacuum-type hot water heaters
- Air-conditioning, water, and wastewater equipment installation services
- Equipment for use in the semiconductor manufacturing industry such as clean devices and cleaning systems

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FY2021 results

Net sales
JPY 134,092 million

Ordinary profit
JPY 10,647 million

Profit attributable to owners of parent
JPY 7,434 million

ROE
8.1%

Dividends
JPY 36 per share
(Fiscal year ended March 2022)

Realizing the Takuma Group's Management Principles and Vision 2030

Increasing corporate value while balancing contributions to society and sustained growth by implementing ESG management

Customers and regional society
- Protecting the living environment through the construction and operation of safe, secure municipal solid waste treatment plants
- Maintaining regional and industrial infrastructure through the highly efficient and stable supply of energy
- Revitalizing the regional economy and strengthening resilience through the construction and operation of facilities

Environment
- Creating clean energy
- Reducing greenhouse gas emissions
- Reducing environmental impacts

Business partners
Building stable relationships of trust through fair and safe transactions

Employees
Realizing a workplace environment characterized by health, safety, high productivity, and high motivation

Shareholders
Increasing corporate value

Created Value (OUTCOME)

Key Issues (Materiality)

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

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

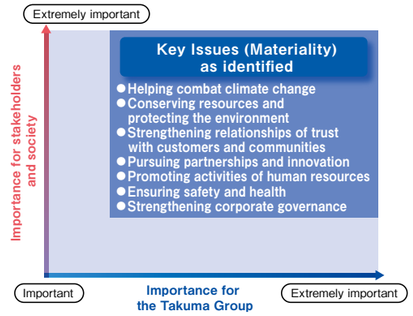
We analyzed a variety of management issues that affect the company from the dual perspectives of the external and internal environment.
We compiled a list of 64 issues by analyzing the external environment from the standpoint of ISO 26000, GRI, SDGs, FTSE, DJSI indicators and requirements, and the internal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

Step 2
Evaluating their importance and verifying suitability

We created a matrix organizing the 64 issues described to the left 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 (FY2021)
E Environmental Initiatives	**Helping combat climate change** 1. Promoting renewable energy (non-fossil energy) 2. Improving energy efficiency	**Risks** ●Accommodation of 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 P47	**CO_2 emission reduction targets through our own products and services** **Magnitude of potential reduction in CO_2 emissions due to newly delivered power plants*** ・FY2023: 800,000 tons per year ・FY2030: 2.5 million tons per year *Biomass power plants and Energy from Waste plants delivered from FY2021 to FY2030 **Newly certified from FY2022** **In-house CO_2 emissions reduction targets** **・FY2023: Effectively zero CO_2 emissions by the Takuma Head Office and the Harima Factory (Scope 1 and Scope 2)** **・FY2030: Effectively zero CO_2 emissions by all Takuma worksites (Head Offices, branch offices, factories, and construction sites) (Scope 1 and Scope 2)** *FY2030 targets including group companies remain under consideration. *CO_2 emissions from procured products and use of Takuma products by customers (Scope 3) also remain under consideration.	**CO_2 emission reduction targets through our own products and services** **Magnitude of potential reduction in CO_2 emissions due to newly delivered power plants** **・FY2021: 30,000 tons per year*** *Calculated based on available generating capacity (renewable energy) as of one month after delivery for plants delivered in FY2021 (two waste treatment plants, one sewage sludge plant, and four biomass plants).
	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 P47		
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 budgets of local governments **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 P57	**Number of female employees brought into the main career track and management positions** 35 or more (Cumulative total for FY2021 to FY2025) **Percent utilization of parenting support programs** 25% or greater (Average for FY2021 to FY2025) **Number of fatal accidents** 0	**Number of female employees brought into the main career track and management positions** 10 **Percent utilization of parenting support programs** 32% **Number of fatal accidents** 1
	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 P59		
	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 P61		
	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 the safety and health of employees and affiliates (loss of order opportunities 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 P63		
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 P65	**Number of serious compliance violations** 0	**Number of serious compliance violations** 0

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

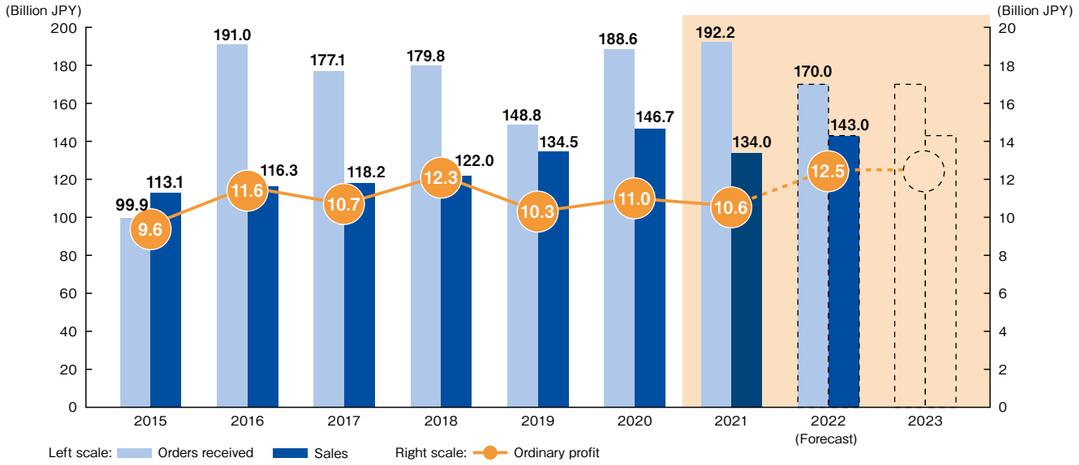
13th Medium-Term Management Plan

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 sustainable growth alongside customers and society by implementing ESG management through our business activities.

Targets for the period covered by the 13th Medium-Term Management Plan

FY2021 to FY2023 **Total ordinary profit:** JPY **36** billion

FY2021 to FY2023 **Total orders received:** JPY **450** billion (reference)



Basic policy

Strengthening the management foundation P29・30

- Human resources
- Digital technologies
- R&D, manufacturing, and engineering capabilities
- Capital investment
- Partnerships
- Compliance

Pursuit of business activities that help resolve challenges faced by customers and society

1. Municipal Solid Waste Treatment Plant Business P32
2. Energy Plant Business P33
3. Water Treatment Plant Business P34
4. Power Retail Business P35
5. Overseas Businesses P36
6. New Businesses
7. Package Boiler Business P37
8. Equipment and Systems Business P38

Implementing ESG management

Progress towards implementing the 13th Medium-Term Management Plan

Kunio Hamada
Director &
Managing Executive Officer
Executive Manager of
Corporate Planning &
Administration Division

FY2021 results

During FY2021, the Takuma Group posted net sales of JPY 134 billion and ordinary profit of JPY 10.6 billion. Although both revenue and profit fell compared to the previous fiscal year, we set an all-time record for orders received thanks to robust demand, including replacement demand for municipal solid waste treatment plants. The order backlog is growing favorably since we are steadily booking orders for Design, Build, Operate (DBO) projects involving such plants.

Reflections on FY2021 initiatives

Reflecting the year's positioning as a time for laying the foundation for achieving Vision 2030, we hired more human resources than in a normal year and fostered their development in an effort to secure enough staffing, primarily in the Engineering, Procurement, and Construction (EPC) business and in recurring revenue model businesses, as we look to realize sustained growth. In addition to working to increase productivity through utilization of digital technologies, we are developing proposals for increasing added value by using AI in products and services. We are also updating our Harima Factory, which produces the boilers and combustion equipment that lie at the heart of the plants we manufacture, in order to transform it into a new plant capable of addressing issues like aging of equipment and the passing on of production technologies to a new generation of workers. The new plant is scheduled to be completed in December 2022.

In addition, the 13th Medium-Term Management Plan identifies a number of issues with which we must contend in order for the Group to realize sustained growth alongside society and our customers as Key Issues (Materiality). We are working to address those issues through our business activities. We are pursuing a variety of initiatives, including R&D targeting effective use of CO_2 and the development of programs and an environment in which female employees and other components of a diverse workforce can flourish professionally.

Prospects as we look towards 2030

We are steadily capturing demand in the current EPC business, and we are tapping recurring revenue model businesses such as after-sales service of delivered plants and the supply of power as drivers of growth. In addition to developing structures through the Medium-Term Management Plan so that we can consistently earn orders for Energy from Waste plants and biomass power plants, particularly in Southeast Asia, we will work to develop businesses that complement the direction in which society is moving, for example by commercializing decarbonization technologies, realizing a cyclical economy, and implementing the Regional Circular and Ecological Sphere (Regional CES). With the above initiatives, we will strive to realize our future vision as stated in 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"— and to achieve its target of ordinary profit of JPY 20 billion.

Hiroshi Oishi
Director & Executive Officer
Executive Manager of
Corporate Services Division

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

- Systematically hiring new graduates and mid-career employees
- 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 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. Other initiatives included broadening the scope of short-time work for parenting and reviewing our telework program. P61・62

Digital technologies

Theme 1 Bringing digital technologies to products and services

- Rolling out digital technologies to reduce manpower requirements and streamline operations at plants, improve maintainability and functionality, and realize more stable operations

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 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 and improving the quality of core technologies, the overall plant, and main equipment
- 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 into decarbonization technologies with other companies and universities, we worked to prevent occupational accidents, for example by making work equipment safer and offering VR-based hazards experience education.

Capital investment

Theme Pursuing plans for the new Harima Factory

- Developing a sustainable plan that aims to achieve effectively CO_2 emission-free operation
- Improving boiler manufacturing capabilities (quality and efficiency)
- Examining ways to utilize the Supply Lab

(Photograph of construction progress at the new Harima Factory) Date: June 16, 2022
Scheduled completion: December 2022 Capital investment: Approx. JPY 13 billion

Partnerships

Theme Creating new value through alliances

- Pursuing robust partnerships with non-group companies and other stakeholders in a variety of contexts

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 as are follows: (Millions of yen)

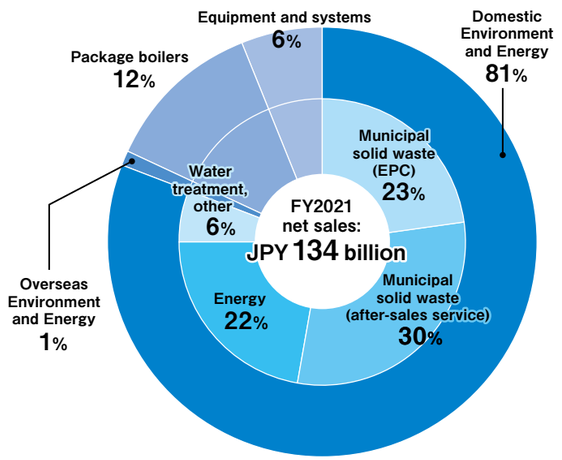
FY	2016	2017	2018	2019	2020	2021	2022 (Forecast)
Capital investment	342	505	638	1,564	2,420	3,844	9,000
R&D costs	972	928	960	1,154	1,047	1,006	1,600
Number of employees (consolidated)	3,447	3,609	3,619	3,816	3,925	4,145	–
Number of employees (non-consolidated)	824	837	852	875	894	958	–

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. Although the precise proportions vary with the nature of ongoing Engineering, Procurement, and Construction (EPC)* projects, the municipal solid waste treatment plant business generally accounts for about 60% of sales in the Domestic Environment and Energy Business, while the energy plant business accounts for about 30%, and the water treatment plant and other business, about 10%.

*EPC: A turnkey service extending from plant design to procurement and construction



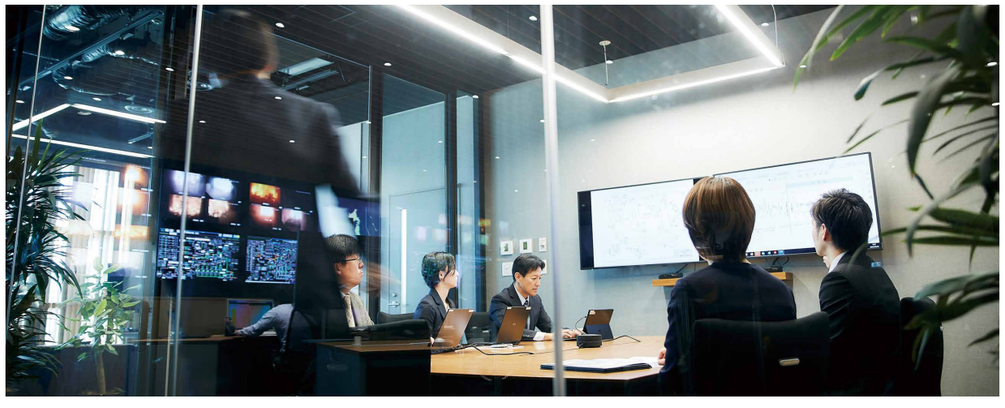
Business Model (Domestic Environment and Energy)

EPC
About 2 to 5 years

Recurring revenue model businesses (after-sales service)
About 20 to 30 years

Engineering (E) → Procurement and production (P) → Construction and commissioning (C) → After-sales service

The plants Takuma delivers are called upon to operate in a stable and consistent manner for an extended period of time, generally 20 to 30 years, as key infrastructure that not only supports treatment of local waste, but also supplies power and heat. After spending several years constructing each plant, we build relationships of trust by supporting customers' government services and business activities through continuous after-sales service over the course of the next two or three decades. By putting the technologies and expertise we have accumulated through such operations to use in EPC and after-sales service, we operate our businesses while further enhancing our strengths.



Domestic Environment and Energy Business

Municipal Solid Waste Treatment Plant Business

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 O&M*.

Since delivering Japan's first domestic 24-hour operating waste incineration plant in 1963, Takuma has delivered more than 360 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.

*O&M: Operation & Maintenance

2 Market environment

Of Japan's approximately 1,000 operational waste incineration 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 the O&M business, which comprises 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 new 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 dioxide 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 FY2021 we earned orders for three DBO projects. In addition to launching long-term operation (on the order of 10 to 20 years) projects at five new sites, including DBO projects, we are leveraging new orders to steadily expand our recurring revenue model businesses by crafting proposals for optimal solutions that meet individual customers' needs.

We are also moving forward with initiatives to reduce power and labor in plant operation by utilizing digital technologies, for example by developing the Intelligent Control System (ICS), an AI combustion control system, and through remote operation and monitoring via our Solution Lab, a remote monitoring and operational support facility. In addition, we are pursuing initiatives to help realize a decarbonized society in partnership with a variety of corporate and organizational partners, including by developing technologies for isolating, recovering, and effectively utilizing CO_2 emitted by plants and by participating in the Carbon to X (C2X) project.

Energy Plant Business

1 Business overview and strengths

In addition to construction (EPC) and maintenance of energy plants for private-sector operators, we offer 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 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-use plants, industrial waste treatment plants, etc.

2 Market environment

Since the introduction of the Feed-in Tariff (FIT) program, which locks in purchase prices for renewable energy, demand for biomass power plants has grown rapidly, and we have delivered more than 40 biomass power and heat utilization plants, including facilities that are not eligible for the FIT program, since 2014, when we augmented our long experience in biomass boilers by delivering our 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 FY2021 we earned orders for six new biomass power plants. In addition to securing an order for our third long-term O&M project for a private-sector entity, 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 launched a CCUS technology study using a biomass power plant currently under construction 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 Plant Business

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 N_2O and moving-bed sand filtration systems (Uniflow Sand Filter), of which we have delivered about 2,700 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 more than 80% 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 FY2021 we secured multiple orders in this product area, including a large project for the Bureau of Sewerage Tokyo Metropolitan Government (Ochiai Water Reclamation Center). 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.

In addition, a generator-equipped sewage sludge incineration plant that we built (Sapporo City Seibu Sludge Treatment Center) ("New System 1"), our second such project, began operating in August 2021. With power output of 200 kW, the generation system is making a significant contribution to reducing greenhouse gas emissions, for example by providing about 80% of the plant's power needs. 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 seven 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 CO_2-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 addition to starting to supply power to public facilities and other sites in the cities of Imabari, Ehime Prefecture, and Machida, Tokyo, as part of our local power production/consumption business, we have started supplying locally produced, CO_2-free power to contribute to decarbonization in the village of Kunohe, Iwate Prefecture, with which we have entered into an agreement, in partnership with Iwate-Kenpoku Clean Co., Ltd., a group company based in the village that operates a waste treatment business. (Service in all three locations was launched in April 2022.)

We also began supplying 100% effectively renewable energy to the Head Office and Harima Factory in April 2022. Thanks to this initiative, we expect to reduce CO_2 emissions at Takuma's Head Office, branches, and factory by about 80%.

In addition to continuing to contribute to measures to address climate change through the supply of renewable energy-derived, CO_2-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 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 UK 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, 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, including for biomass other than bagasse, is expected to grow.

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 waste-fueled power generation is rising significantly due to population growth and urbanization, and we expect the sector to remain a growth market over the medium- and long-term.

3 Initiatives

Despite a tough environment in FY2021 whose challenges included the pandemic, which greatly limited sales activities, as well as delays in plans and other adverse developments, we earned an order for an equipment replacement project at an Energy from Waste plant in Taiwan. Demand for facility replacement and service life extension work is rising in the country as Energy from Waste plants built from the second half of the 1980s to 2000s age. 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, particularly in Thailand and Taiwan.

In addition to working to further lower costs for biomass power plants, for example by enlarging the scope of overseas procurement, we will strive to capture orders on an ongoing basis by increasing added value to differentiate our products and services from competitors, including by enhancing maintenance service through our subsidiary in Thailand.

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

While demand, which had fallen due to the COVID-19 pandemic, has shown signs of a partial recovery, the market remained challenging during FY2021 as a full-throated recovery failed to materialize. Nonetheless, we worked to maintain the scale of orders, for example by proposing optimal systems, and initiatives to open up new markets for heat-source equipment made some progress as we continued to earn orders for wood chip-fueled biomass boilers.

Going forward, we will work to maintain and increase 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 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.

Equipment and Systems Business

Equipment and Systems Business

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 Technologies Inc. supplies clean system-related equipment and devices that provide a suitable environment for prime manufacturing systems for the semiconductor and electronic device manufacturing industry.

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 environment 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 state-of-the-art semiconductor industry, continues to make a steady contribution to the development of that industry based on more than half a century of experience in the semiconductor and electronic device industry and a high level of trust built on its ability to solve issues from the customer's perspective.

Principal products and services

- Building equipment installation, chemical filters, magnetically shielded chamber equipment, semiconductor material washing systems, AMC analysis and monitoring systems, etc.

2 Market environment

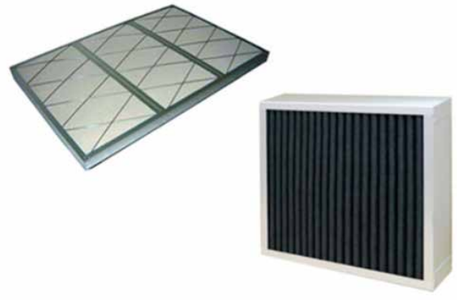
Although construction demand has been affected by a temporary drop-off in private-sector investment due to the effects of the pandemic, we expect robust demand to continue over the medium and long term as orders for healthcare and social welfare facilities augment equipment replacement and improvement work at aging public facilities.

Amidst rapid growth recently in demand for semiconductors in various industries, a global shortage has emerged as a social phenomena, with industry observers pointing to an inability to obtain semiconductors used in semiconductor manufacturing equipment. From a long-term perspective, the sector is expected to grow thanks to large-scale investment accompanying a global supply chain decoupling in semiconductor manufacturing driven by national security issues of various countries and demand for infrastructure maintenance and improvements.

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.

Drawing on favorable business performance that has gained momentum thanks to the recent market environment in the semiconductor and electronic device manufacturing equipment field, we will work to expand our business on an ongoing manner through additional, stable contributions to customers and related industries as we build products and enlarge business opportunities by implementing measures under our Medium-Term Management Plan.



Main Recent Projects

This section introduces major projects delivered by Takuma during FY2021 in the Domestic Environment and Energy Business.

Municipal solid waste treatment plants

New Construction

Machida City Bio-energy Center

Project name: Machida City Heat Recovery Facility (tentative name) Development and Operation Project

Location: Tokyo

Capacity:
Waste incineration facility:
258 tons per day
(129 tons per day × 2 units)

Biogas recovery facility:
50 tons per day
(25 tons per day × 2 units)

Unburnable/bulk waste processing facility:
47 tons per 5 hours

Power output:
6,220 kW (waste incineration facility)
750 kW (biogas recovery facility)

New Construction

Ariake Himawari Center

Project name: Waste Incineration Facility Construction Project

Location: Fukuoka Prefecture

Capacity: 92 tons per day (46 tons per day × 2 units)
Power output: 1,810 kW

Primary Equipment Improvements

Clean Center Tonami

Project name: Clean Center Tonami Primary Equipment Improvement Project

Location: Toyama Prefecture

Capacity: 90 tons per day (45 tons per hour × 2 units)

Energy plants

Satsuma-cho Biomass Power Generation LLC

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

Location: Kagoshima Prefecture

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

Meiken Lamwood Corp.

Project name: Wood Biomass Power Generation Plant Installation Project

Location: Okayama Prefecture

Capacity: Fuel: Wood fuel
Steam conditions (regular operation):
27.7 tons per hour × 6.0 MPaG × 425 ℃
Power output: 4,990 kW

Rikyuu Co., Ltd.

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

Location: Kanagawa Prefecture

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

Kyushu Renewable Energy Co., Ltd.

Project name: Kikuchi Biomass Power Plant Construction Project

Location: Kumamoto Prefecture

Capacity: Fuel: Wood fuel
Steam conditions (regular operation):
29.2 tons per hour × 6.0 MPaG × 425 ℃
Power output: 6,250 kW

Water treatment plants

Sapporo City Seibu Sludge Treatment Center

Project name: Sapporo City Seibu Sludge Treatment Center (Disaster Prevention and Safety Grant Program) "New System 1" Incineration Facility Incineration Machinery and Equipment Installation Project

Location: Hokkaido

Capacity: Stoker furnace
Facility scale: 100 tons per day × 1 unit
(Power output: approximately 200 kW)

Oita City Public Sewage Benten Water Resources Recycling Center

Project name: Oita City Public Sewage Benten Water Resources Recycling Center Amenity External Machinery and Equipment Renovation Project

Location: Oita Prefecture

Capacity: Treatment capacity: 6,900 ㎥ per day
Type: High-speed moving-bed continuous sand filter
Specifications: M20 × 4 units × 3 basins

Feature

Realizing a New Type of Sound Material-Cycle Facility

Machida City Bio-energy Center

A bio-energy center that processes municipal waste together with a biogas recovery facility— the first in the Tokyo metropolitan area and a leading facility for the world

The City of Machida, the owner of this facility, has worked to reduce waste volume in keeping with its core philosophy of avoiding the generation, incineration, and landfill of waste in order to safeguard the local and global environment. The Machida City Bio-energy Center, which was delivered by Takuma, breathes new life into its predecessor facility, the Machida Recycling Cultural Center, which previously handled waste treatment in the city, as a more environmentally friendly facility.

What is biogas?

Biogas is a gas that is created by using the power of microorganisms to ferment waste and other materials. It contains methane, a readily combustible gas, that can be used as a source of energy by gas power plants. Biogas promises to help reduce carbon dioxide emissions by enabling waste to be used effectively.

Facility overview

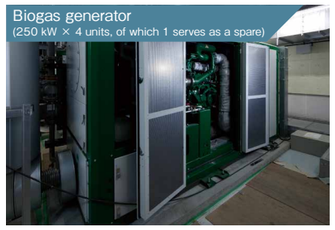
Name: Machida City Bio-energy Center
Treatment capacity: Heat recovery facility (waste incineration facility):
258 tons per day (129 tons per day × 2 units)
Biogas recovery facility: 50 tons per day (25 tons per day × 2 units)
Unburnable/bulk waste processing facility: 47 tons per 5 hours
Generation systems: Waste incineration facility: 6,220 kW; biogas recovery facility: 750 kW
Design and construction: Takuma Co., Ltd.
Operation: Machida High Trust Co., Ltd.
Project dates: December 22, 2016, to June 30, 2024 (start of operation: January 1, 2022)

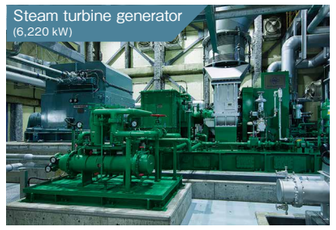
System combining methane fermentation and incineration components

This combined-system facility, which pairs methane fermentation with incineration, consists of a biogas recovery facility that recovers biogas from garbage through methane fermentation and a waste incineration facility that incinerates waste that is not suited to methane fermentation. By performing biogas power generation using methane fermentation and steam turbine power generation using incineration as appropriate based on the properties of the waste being processed, the facility is able to make maximum possible use of the energy contained in waste.

Additional power-generation initiatives at the site, including solar power generation, micro wind power, and hydropower utilizing cooling water used at the facility, further reduce CO_2 emissions.

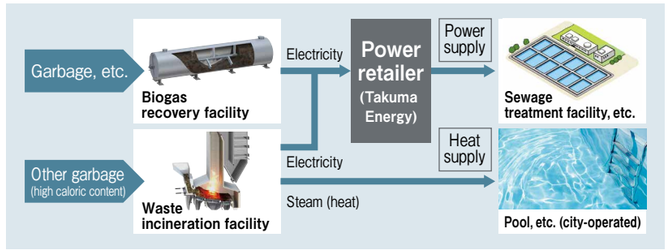

Methane fermentation tank


Biogas generator
(250 kW × 4 units, of which 1 serves as a spare)


Steam turbine generator
(6,220 kW)

Realizing local production and consumption of energy

Electricity generated at the facility is supplied to the city's sewage treatment plant via Takuma Energy Co., Ltd., while steam is used to warm the city's heated swimming pool, which is located adjacent to the site, as part of a series of initiatives to return energy created from waste to the local community.



A facility where visitors can learn, play, and grow

The facility's visitor area includes unique spaces as well as hands-on and experience-based exhibits that let visitors have fun while learning about recycling at its bulk and unburnable waste treatment facility, biogas power generation, and waste incineration treatment.


A quiz about waste sorting


A hands-on booth where visitors can learn about biogas power generation systems


An experience-based learning area where visitors can learn about incineration

Message from the engineering coordinator

This composite facility combines conventional incineration and unburnable/bulk waste treatment facilities with a biogas recovery facility, making it a state-of-the-art environmental facility that can generate electricity from various types of energy (steam, biogas, solar power, hydropower, and wind power). Construction was impacted by the COVID-19 pandemic, and I would like to thank everyone involved for the hard work that made a successful outcome possible despite constraints on meetings, supplies, and human resources. I hope the Center will see long use as a regional energy facility and as an important place of environmental learning.

Jun Watanabe **Assistant Manager, Section 2, Environmental Design Dept. 3**
Takuma Co., Ltd.

An advanced exterior design that blends into the surrounding environment

The design limits the height of buildings at the site to reduce its presence out of consideration for the surrounding residential area. The administrative building, which welcomes visitors, adopts an advanced, open-feeling design incorporating a curved roof and a glass curtain wall. Incorporation of greenery into wall surfaces and the roof creates synergistic effects with surrounding tree growth. The front of the facility incorporates a gate park and three terraces that are open to the public, creating spaces where residents can gather, meet, and relax.


Glass curtain wall


Ecovoid


Wall Greenery


Gate Park


Sky Terrace


Work Terrace

Contributing as a disaster-prevention facility in times of emergency

The facility features an earthquake-resistant design that allows its buildings to continue functioning in the event that an earthquake with a seismic intensity of 6+ were to strike directly underneath Tokyo. In addition, since biogas generation in the site's methane fermentation tanks can continue even in the event of an interruption in the supply of outside power, the facility can continue to process waste in the event of a disaster by relying on biogas power generation and emergency power generation.

The administrative building's training room and large conference room can be used as shelter space to accommodate 100 people in the event of an emergency, with power generated on-site providing electricity for necessary lighting and air conditioning. In addition to storing enough water for 300 people along with a variety of disaster-prevention supplies, the facility has shelter-related equipment like the Kamado Bench, a bench that can be converted into wood-fired cooking stations, and underground sewage pipes that can be connected to temporary toilets.


Conference room that can be used as shelter space in the event of an emergency


Kamado Bench

Message from the operation management company

At-scale deliveries of waste began in November 2021, prior to the completion of the facility, which was able to open on January 1, 2022, without major incident. As the Tokyo metropolitan area's first biogas recovery plant, the facility is attracting attention from Tokyo and other nearby local governments. All of our employees look forward to working together to ensure the facility will be able to operate and supply energy safely so that city residents can go about their lives with peace of mind.

Toru Shimajiri **Site Manager, Machida City Bio-energy Center**
Machida High Trust Co., Ltd.