1. Municipal Solid Waste Treatment Plant Business

(Related SDGs)

+ Seeing municipal solid waste treatment plants through to completion

Takuma is helping protect the global environment through business activities consisting of an integrated approach that extends from the design, manufacture, and procurement of equipment and systems to plant construction. This section introduces the process that goes into bringing a municipal solid waste treatment plant online in one of Takuma's core businesses.

1 Sales

During the sales stage, we precisely assess the needs of the local government that is our customer. Working with our in-house planning team, we develop a proposal that will satisfy the customer and work to earn an order.

2 Planning and cost estimation

During the planning and cost estimation stage, we plan plant systems (including equipment flow, specifications, and layout) to satisfy the customer's needs. We then focus our technological capabilities on those needs and offer the proposal along with an optimally priced quotation.

Bidding

Order receipt

3 Design

During the design stage, we develop a detailed design through a series of meetings with the customer based on the basic plan. Specialists in technologies such as combustion, exhaust gas treatment, and electric instrumentation systems work together to create a specific solution for the customer.

4 Procurement and manufacturing

Waste treatment plants consist of multiple pieces of equipment. During the procurement and manufacturing stage, we manufacture this equipment at our Harima Plant under a rigorous quality control system while carefully choosing the optimal manufacturers to satisfy the project's cost and lead time requirements.

5 Construction and commissioning

During the construction and commissioning stage, we manage the construction process, from civil and construction work to the installation and commissioning of plant equipment. This management process, which addresses safety, quality, construction process, and cost management, culminates in the delivery of the completed facility to the customer.

Completion and acceptance

6 After-sales service

We carry out periodic inspections and maintenance after the plant has been handed over to the customer in order to ensure it will operate safely over the long term. In recent years, an increasing number of customers are turning to Takuma for turnkey solutions that extend from the construction of new facilities to their operation.

Impressions from employees who worked on the Imabari New Waste Treatment Facility maintenance and operation project

Takashi Kubo
Plant Sales Department 2
Environmental Plant Division

As a salesperson, I visited the site numerous times to ensure that the customer would choose to entrust the project to Takuma. The process leading up to our receipt of the order was a truly challenging one.

This effort had numerous components, including precisely assessing the customer's needs; proposing a project that would satisfy those needs; building relationships of trust with the customer, local residents, and others; coordinating and negotiating with in-house teams and outside entities; negotiating with other companies; and dealing with various problems as they arose. Our hard work was rewarded and turned into immeasurable pleasure when the customer made the following response on a customer satisfaction questionnaire after the project was completed and handed over: "I believe that we've just seen one of the best facilities of its kind in Japan completed."

Nobuo Akae
Environmental Engineering Department 3
Engineering Center

My involvement with this project began as we sought to work out the system that Takuma was going to propose after we received the order for the project while listening carefully to the customer's requests. As an example, we ended up changing equipment that uses waste heat from incinerating waste at the facility from a hot water supply system to an electricity supply system after a series of discussions with involved agencies and other stakeholders so that the plant could supply the electricity it generates to nearby facilities.

After the basic design was finalized, we were able to design a facility that earned the customer's approval by explaining information including the capacity, operating methods, and maintenance methods for all machinery and participating in numerous meetings.

The process leading up to the transfer of the facility to the customer brought one challenge after another, and I'll strive to take advantage of those experiences so that we can continue to deliver facilities that make customers happy in the future.

Kenji Fujita
Civil & Architectural Engineering Department
Construction Center

Expert staff members manage operations at each construction site on a daily basis to ensure that the facility will be completed as outlined in design drawings and in a way that satisfies the customer.

As many as more than 500 workers worked on this plant's site every day. Daily construction management included safety patrols to ensure that workers were doing their jobs safely and a variety of inspections to verify that the plant was being built in accordance with drawings.

We also actively promoted exchanges with local residents to ensure they understood the construction process and to give them peace of mind, for example by inviting them to tour the site, by cleaning up the area around the site, and by participating in community events.

I realized that all the hard work was worth it when the customers' representatives expressed their gratitude at the completion ceremony after construction was finished.

Yasushi Kamei
Operation & Maintenance Services Department 2
Environmental Plant Division

When operating a plant, we provide optimal maintenance and management services that utilize POCSYS, a proprietary system designed to provide comprehensive support for plant operation, maintenance, and management so the plant can live up to its concept of providing safe and stable waste treatment.

Going forward, we will go beyond plant operation, maintenance, and management as we work to allow the facility to bring local residents together and to play a disaster prevention role by offering tours, hands-on events, and disaster prevention training together with local residents. In this way, the facility will protect the community and earn a place in residents' hearts while simultaneously raising environmental awareness, facilitating hands-on learning, and disseminating information.

1. Municipal Solid Waste Treatment Plant Business

+ Main Recent Projects

The following are the main plants supplied by Takuma during FY2017.

●New construction

Uwajima Public Association Environment Center

- **Project name**
  Regional New Waste Treatment Facility Construction Project (tentative)
- **Capacity**
  Incineration facility: 120 tons per day (60 tons per day × 2 units)
  Recycling facility: 20 tons per day for 5 hours
  Power output: 2,500 kW
- **Location**
  Ehime Prefecture

Hanno City Clean Center

- **Project name**
  Hanno Waste Treatment Facility Construction Project
- **Capacity**
  Incineration facility: 80 tons per day (40 tons per day × 2 units)
  Recycling facility: 11.8 tons per 5 hours
  Power output: 830 kW
- **Location**
  Saitama Prefecture

Imabari City Waste Management Center

- **Project name**
  Imabari New Waste Treatment Facility Maintenance and Operation Project
- **Capacity**
  Incineration facility: 174 tons per day (87 tons per day × 2 units)
  Recycling facility: 41 tons per 5 hours
  Power output: 3,800 kW
- **Location**
  Ehime Prefecture

●Primary equipment improvements

Chiyoda Clean Center

- **Project name**
  Okitama Administrative Association Chiyoda Clean Center Incineration Facility Primary Equipment Improvement Project
- **Capacity**
  Incineration facility: 255 tons per day (85 tons per day × 3 units)
  Power output: 2,150 kW
- **Location**
  Yamagata Prefecture

2. Energy Plant Business

(Related SDGs)

+ Seeing energy plants through to completion

This section introduces the process that goes into bringing an energy plant online in one of Takuma's core businesses.

1 Sales

During the sales stage, we gather information about the business being planned by the customer, conduct a series of discussions and studies with internal departments, develop a proposal that precisely meets the customer's needs, and work to earn an order.

2 Planning and cost estimation

During the planning and cost estimation stage, we plan a plant system (flow, layout, equipment specifications, etc.) that will satisfy the customer's needs and create a competitive proposal.

Order receipt

3 Design

During the design stage, specialists from various fields, including combustion technology, exhaust gas treatment, and electrical control systems, work together to develop a detailed plan.

4 Procurement and manufacturing

The procurement and manufacturing stage consists of manufacturing equipment and systems whose specifications have been finalized at our Harima Plant under a rigorous quality control system and of choosing and procuring equipment from optimal venders in Japan and overseas to satisfy specifications and quality requirements.

5 Construction and commissioning

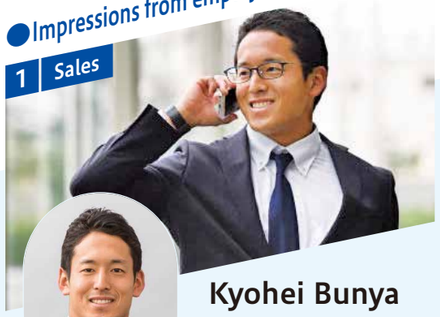
During the construction and commissioning stage, we work to ensure construction proceeds smoothly while carefully managing safety, quality, and construction processes. Once the plant has been completed, we carry out tests and inspections to assess whether equipment and systems are operating as designed and to specifications, and then we verify the plant's performance.

Completion and acceptance

6 After-sales service

Once the plant has been handed over to the customer, we carry out periodic inspections and maintenance to prevent problems and ensure that the plant will be able to operate in a safe and stable manner.

Impressions from employees who worked on the Biomass Power Technologies Inc. project (delivered during FY2017)



Kyohei Bunya
Section 1,
Plant Sales Department 2
Energy Plant Division

In this project, we proposed a plant capable of burning and generating electricity from a variety of fuels harvested from Japan's forested mountains in a stable manner, reflecting our desire to achieve the customer's concept of using all the trees from mountains in order to regenerate and develop the country's forested mountains. I met with the customer and various governmental offices, visited the planned construction site frequently, checked on the status of the infrastructure that would be needed for the power plant to operate, and worked to finalize the overall plan. Going forward, I will offer assistance so that the plant we proposed can operate smoothly and thereby contribute to the customer's business and to the local community.

Hiroyuki Hikita
Section 2,
Energy Engineering Department 2
Project Center

We refine each plant's plan through repeated meetings with our sales team and with the customer. While listening to the customer's wishes, we offer a proposal that incorporates our expertise and work closely with the sales team to earn an order. Once we've received that order, we proceed with the plant design process while enlisting the cooperation of the customer, public agencies, equipment manufacturers, and others. The completed design drawings are handed off to our construction team, and once construction is completed, the engineering staff works with the commissioning team to carry out inspections, offer instruction on plant operation, and perform related tasks. Seeing the customer's personnel working at the operating plant following its completion always gives me a strong sense of how we're contributing to the customer's business.

Naoki Hara
Section 1,
Construction Department (Osaka)
Construction Center

I was involved with this wood chip biomass-fueled power plant installation project, which is Takuma's first 2 MW-class power plant, as a site manager from the construction planning stage through to construction and completion of the facility. We worked especially hard to stick to the schedule, first, due to the project's short six-month timeline, which included four months for construction and two months for commissioning, and second, because it didn't differ from a large power plant in terms of the number of pieces of equipment, even though it was only a 2 MW-class facility. Thanks to the cooperation of the customer and other involved parties, we were able to complete the project on time. I hope the plant will be able to promote local employment and help revitalize the forestry industry by using unused lumber.

Fumitoshi Takahashi
Section 2,
Plant Service Department 2
Energy Plant Division

Although the plant has only been operational for a short time, we as a maintenance team will plan periodic inspections and maintenance and carry them out safely so that the facility can operate in a stable manner over the long term.

We'll also help increase the customer's profitability by maintaining a high level of performance with functional improvements and proposals for preventive maintenance measures and other enhancements that take advantage of our many years of experience and by eliminating unplanned stoppages.

2. Energy Plant Business

+ Main Recent Projects

The following are the main plants supplied by Takuma during FY2017.

●Energy plants

Chugoku Mokuzai Co., Ltd. Head Office Plant

- **Project name**
  Chugoku Mokuzai Biomass-fueled Power Plant (Head Office) Construction Project
- **Capacity**
  Fuel: Wood fuel
  Steam conditions (normal operation):
  42 tons per hour × 6.0 MPaG × 460°C
  Power output: 9,850 kW
- **Location**
  Hiroshima Prefecture

SGET Green Power Sanjo Godo Kaisha

- **Project name**
  Biomass Power Plant Construction Project
- **Capacity**
  Fuel: Wood fuel
  Steam conditions (normal operation):
  28 tons per hour × 6.0 MPaG × 425°C
  Power output: 6,250 kW
- **Location**
  Niigata Prefecture

Pultec Energy Co., Ltd.

- **Project name**
  No. 5 Biomass Power Generator Installation Project
- **Capacity**
  Fuel: Wood fuel, PKS
  Steam conditions (normal operation):
  85 tons per hour × 6.0 MPaG × 480°C
  Power output: 22,100 kW
- **Location**
  Hyogo Prefecture

DS Green Power Generation Yonezawa LLC.

- **Project name**
  Biomass Power Plant Construction Project
- **Capacity**
  Fuel: Wood fuel
  Steam conditions (normal operation):
  28 tons per hour × 6.0 MPaG × 425°C
  Power output: 6,250 kW
- **Location**
  Yamagata Prefecture

Biomass Power Technologies Inc.

- **Project name**
  Biomass Power Technologies Inc. Matsusaka Woody Biomass Power Plant Installation Project
- **Capacity**
  Fuel: Wood fuel
  Steam conditions (normal operation):
  11.4 tons per hour × 4.2 MPaG × 405°C
  Power output: 1,990 kW
- **Location**
  Mie Prefecture

Ehime Forest Generation, LLC

- **Project name**
  Matsuyama Biomass Power Plant Construction Project
- **Capacity**
  Fuel: Wood fuel, PKS
  Steam conditions (normal operation):
  48.5 tons per hour × 6.0 MPaG × 480°C
  Power output: 12,500 kW
- **Location**
  Ehime Prefecture

●Industrial waste treatment plants

Shin nihon kaihatsu Co., Ltd.

- **Project name**
  No. 5 Incinerator Construction Project
- **Capacity**
  Treated waste type: Industrial waste
  Incineration capacity: 93.6 tons per day
- **Location**
  Hyogo Prefecture

Kurihalant Co., Ltd.

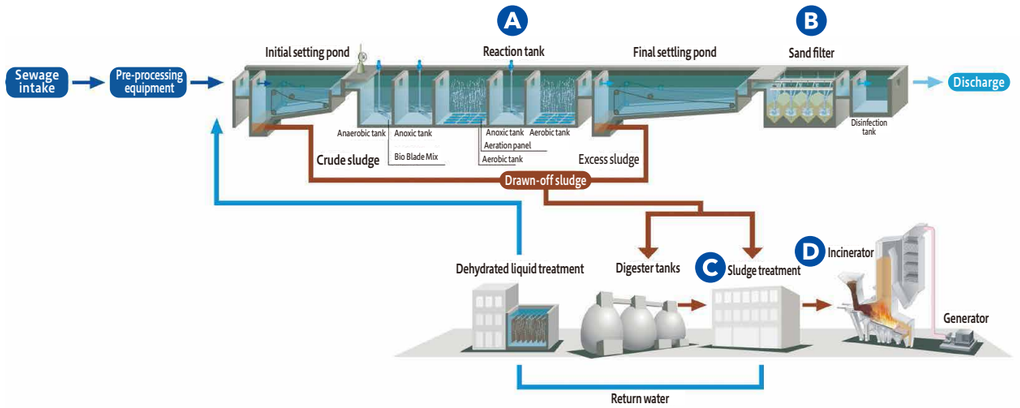
- **Project name**
  Daigo Biomass Power Plant Construction Project
- **Capacity**
  Fuel: Wood fuel
  Steam conditions (normal operation):
  11.4 tons per hour × 4.2 MPaG × 405°C
  Power output: 1,990 kW
- **Location**
  Ibaraki Prefecture

3. Water Treatment Plant Business

(Related SDGs)

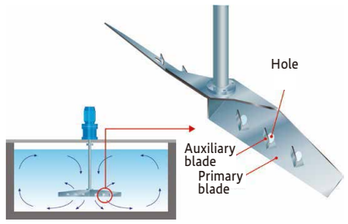
More than 50 years have passed since Takuma entered the water treatment business. To date, we have helped improve the water environment by building water treatment facilities. Recently, the industry has been called upon not only to improve the water environment, but to reduce the amount of power that treatment equipment consumes and to create energy from sludge.

Energy-saving and energy-creating products play key roles in the industry, particularly at sewage treatment plants, and we remain committed to helping realize sustainable sewage systems.



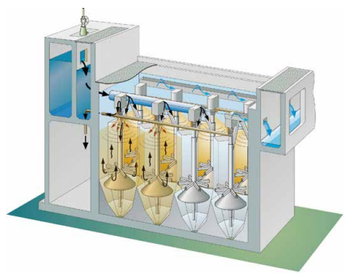
A Reaction tank facility — Saving energy

【Principal equipment】
Aeration systems
Low power agitator
(Bio Blade Mix)



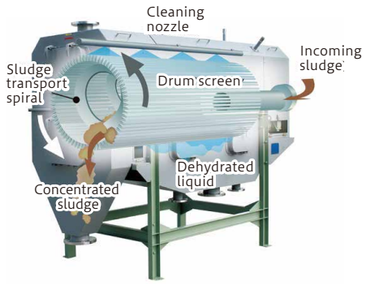
B Rapid filtration facility — Saving energy

【Principal equipment】
Upflow moving-bed filtration
(Uniflow Sand Filter)



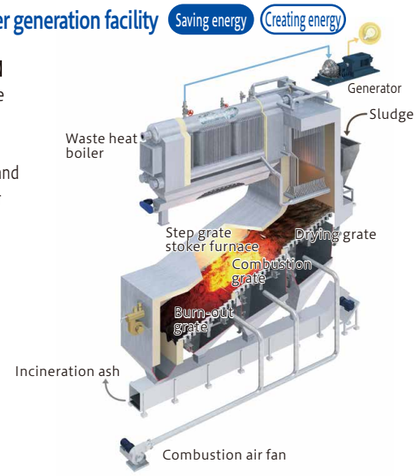
C Sludge treatment facility — Saving energy

【Principal equipment】
Rotating drum-type concentrator



D Sludge-fueled power generation facility — Saving energy — Creating energy

【Principal equipment】
Step grate stoker furnace sewage sludge power generation system
(Step grate stoker furnace and innovative step grate stoker furnace)



+ Main Recent Projects

The following are the main facilities supplied by Takuma during FY2017.

Tarumi Sewage Treatment Plant

- **Project name**
  Tarumi Sewage Treatment Plant Sand Filter Machinery and Equipment Project
  (Sand Filter Machinery and Equipment Renovation Project)
- **Capacity**
  Treatment volume: 7,992 m³ per day
  Treatment method: Upflow moving-bed filtration (high-speed type)
  Specifications: M40 × 1 unit × 3 basins
- **Location**
  Hyogo Prefecture

Homare Sewage Relay Pumping Station

- **Project name**
  Homare Sewage Relay Pump Station Screening Equipment Renovation Project
  (Automatic Screen Renovation Project)
- **Capacity**
  Type: Back-raked continuous automatic screen
  Specifications: 800 (W) × 1,300 (D) mm
- **Location**
  Hyogo Prefecture

Kita-Tama No.2 Water Reclamation Center

- **Project name**
  Kita-Tama No.2 Water Reclamation Center Sludge Concentration Equipment Reconstruction Project
  (Sludge Concentrator Delivery)
- **Capacity**
  Type: Rotating drum
  Specifications: 50 m³ per hour
- **Location**
  Tokyo Prefecture

4. Activities of Our Overseas Business

(Related SDGs)

+ Biomass-fueled power plant business in the Southeast Asian market

The biomass-fueled power generation boiler business in Southeast Asia is an essential part of any discussion of Takuma's history. We have delivered more than 370 biomass boilers to customers overseas, and we have an especially extensive track record since 1959 of delivering boilers fueled by bagasse (fiber remaining after sugarcane is crushed) in Thailand, where we have a local subsidiary. Takuma takes pride in having supported the Thai sugar industry for many years.

As the feed-in tariff program for renewable energy becomes increasingly well established in various industries, a growing number of customers in Thailand are looking beyond simply gaining a source of power for plant operation and instead opting to construct boilers with the goal of using 10 MPa·520°C class boilers that operate at comparatively high temperature and high pressure levels to actively generate electricity for resale to boost their income. In this way, demand for this type of boiler facility is expected to continue to grow.

Under these conditions, we look forward to helping supply environmentally friendly power from biomass, particularly in Southeast Asia, by accommodating demand not only in Thailand, but also in neighboring countries such as Indonesia and Vietnam with reliable technology and fine-grained customer service based on our extensive experience in the field.

Sugarcane deliveries

+ Main Recent Project

- **Bagasse boiler delivered in FY2017**

Steam capacity: 170 tons per hour
Steam pressure: 4.2 MPa
Steam temperature: 485°C
Number of boilers: 2

+ Message

I oversaw my first overseas project in FY2017. Overseas projects pose unique challenges because they tend to have larger boilers than domestic Japanese projects and because all interactions with the customer during the design process must be carried out in English. I was relieved that we were able to deliver this boiler plant to the customer without any issues. I'm looking forward to taking advantage of the experience I've gained from this project so that I can embrace the challenges of similar projects in the future.

Yasuyuki Kawabe

Section 3, Energy Engineering Department 2
Project Center

+ Overseas Energy from Waste plant business

Waste processing problems have been manifesting themselves in countries around the world recently due to the effects of trends such as rapid urbanization, and there have been reports of various adverse effects of burying waste as-is on living conditions, including soil pollution and fires, especially in developing nations. Such countries are pursuing initiatives to resolve waste treatment issues, and demand for Energy from Waste plants has been growing with each passing year, seemingly in proportion to the volume of waste being disposed of. Growth in construction of large-scale plants nonetheless remains gradual. One cause of this mismatch between demand and construction is likely to be inadequacies in terms of programs, financing, and technologies as expectations concerning renewable energy combine with robust requirements with regard to safety and environmental friendliness.

Takuma has deep experience and an extensive track record that together make it a market share leader in waste incineration and processing equipment in Japan. The photograph below depicts a plant that we delivered to Lakeside Energy from Waste Limited in the UK, one of a series of nine facilities we have delivered in various countries and regions, including China and the UK. Our Lakeside Plant in the UK and our Gaoantun Plant in Beijing have earned a high level of praise and trust from their respective customers, for example due to the facilities having achieved continuous operation for more than 8,000 hours a year.

We are confident that taking advantage of our extensive experience in the field, working closely with stakeholders as we share detailed information, and actively cooperating in order to solve waste treatment-related issues will allow us to better deliver plants that operate in a safe and stable manner to bring peace of mind to the residents of those countries and regions.

We look forward to contributing to initiatives designed to encourage the adoption of waste power plants in the future by drawing on the technological expertise that is our strength and partnerships with local companies and other entities to propose solutions to local needs.

+ Main Recent Project

- **Lakeside Energy from Waste Plant**

Processing capacity: 1,370 tons per day
(685 tons per day × 2 units)
Steam capacity: 95 tons per hour per unit
Steam pressure: 4.5 MPa
Steam temperature: 400°C
Power output: 36,650 kW

+ Message

Recently, I've noticed a big increase in awareness around waste issues, be it in developed or developing countries. But already for over half-a-century, Takuma has been providing environmental technology solutions by designing and building hundreds of household waste treatment facilities. As one of the few foreigners in Takuma, I'm working to bring our technology and expertise overseas and while these projects are very difficult and complicated, the resulting facilities undoubtedly help towards creating a cleaner environment for ordinary people and their communities.

Marc Nyhan

Sales Section, Environmental Plant Sales Department
International Operations Division