

Special Feature

Contributing to Solutions to Customers' Problems through New Technologies and Services

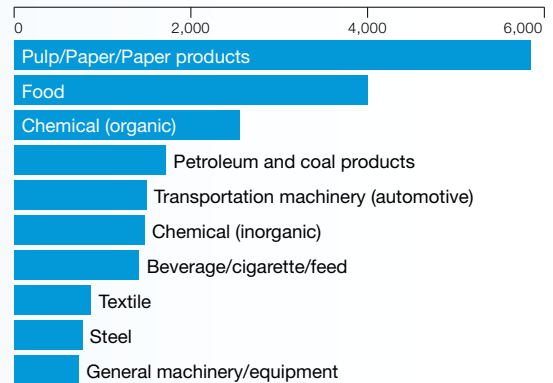
Through innovation in electric and thermal energy technologies, Fuji Electric aims to provide society with technologies and products that contribute to solutions for customers' problems. These special features introduce some of the initiatives intended to bring us closer to that goal.

1 Saving Energy through Reuse of Factory Exhaust Heat

With changes in the energy situation in recent years, factories and other production sites have also turned to smart energy systems that enable them to use energy intelligently. One method that is garnering attention is reusing factory exhaust heat. Expectations for reuse are high, particularly in industries that make wide-ranging use of heat applications, including the pulp, paper and paper products, food, and (organic) chemical industries.

Applying technology honed through the manufacture of vending machines, Fuji Electric developed one of the industry's first products to make use of a heat pump for heat exchange. By targeting industries with significant volumes of reusable steam, we will promote efficient use of heat energy within factories to contribute to our clients in the industrial sector.

Reusable Steam Volume by Industry (Ton/hour)

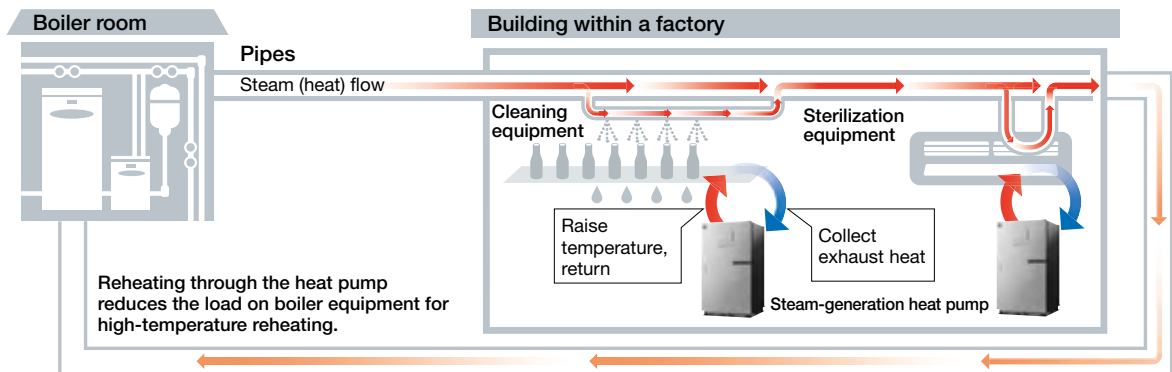


(Fuji Electric estimates based on data from Fuji-Keizai Co., Ltd.)

Reusing Heat Energy through Steam-Generation Heat Pumps

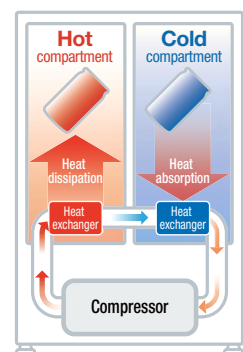
During the production process, factories use and emit a great deal of heat, particularly in cleaning and sterilization equipment. Steam-generation heat pumps can collect and re-heat the exhaust heat from such equipment, making it available for reuse.

Because this method reduces the high-temperature reheating load on boiler equipment, it can lower fuel costs and enable the factory to save energy.



Explanation What is a "heat pump?"

Because the equipment pumps heat from a "cold side" to a "hot side," similar to a system used for pumping water, it is known as a "heat pump." In vending machines, the heat absorbed in the cold compartment where beverages are chilled is condensed in a compressor, and the heat generated in this process is then used to heat beverages in a hot compartment. This greatly reduces the amount of energy used for heating, and contributes to energy saving.



Vending machine heating and cooling system

Saving Energy by Utilizing Surplus Heat from Diesel Engines

Energy Use Reduced by More Than Half

Fuji Electric Power Semiconductor Co., Ltd.'s Iiyama Factory is a manufacturing base for power semiconductors used in automobiles. To ensure a stable supply of electric power to sustain the factory's operation 24 hours a day, 365 days a year, power is generated on site using a diesel engine generator. The exhaust heat generated by this engine is reused in the factory's heating, ventilation, and air conditioning, but about 50% of the overall exhaust heat remained unused. We evaluated possible ways to use that heat more effectively to achieve greater energy savings.

Our attention was drawn to the steam supplied to the factory's clean rooms. Power semiconductors are precision components, and any static electricity generated and released in the manufacturing process can have a negative impact on quality. To prevent this, particularly in the winter season when the air is dry, steam is generated and supplied to the clean rooms using a dedicated boiler. In March 2015, the factory began field testing a steam-generation heat pump developed at Fuji Electric's Mie Factory, aiming to make further energy savings by using the exhaust heat from their diesel engine to generate a supply of steam for the clean rooms.

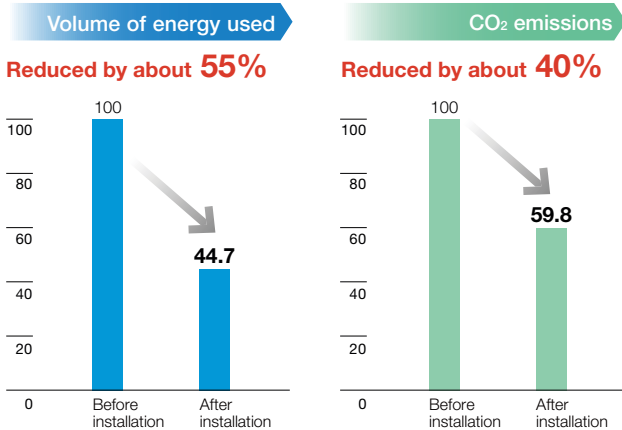


Power semiconductor post-process

The steam-generation heat pump itself is about the size of a typical vending machine. It is simple to operate and can be installed in just a few hours without requiring any special construction. After installation, the volume of energy used in April was down about 55% compared to before, while CO₂ emissions dropped by about 40%. Use of the boiler was also reduced. With energy savings exceeding original estimates, the factory intends to continue its testing to verify product quality and accelerate efforts to commercialize the product.

Post-deployment effects

(%)



Steam-Generation heat pump

Voice Message from the Factory Staff



Hirofumi Uehara
General Administration Department,
Iiyama Factory
Fuji Electric Power Semiconductor Co., Ltd.

The installation of the steam-generation heat pump has enabled us to reduce fuel costs significantly compared to the energy conservation plan we had created previously. Our location along the Sea of Japan means our need for heating between October and June is high, and we now expect to reduce our annual fuel costs and CO₂ emissions well beyond our original estimates.



Special Features

2

The Challenge of Optimizing Energy in the Agricultural Sector

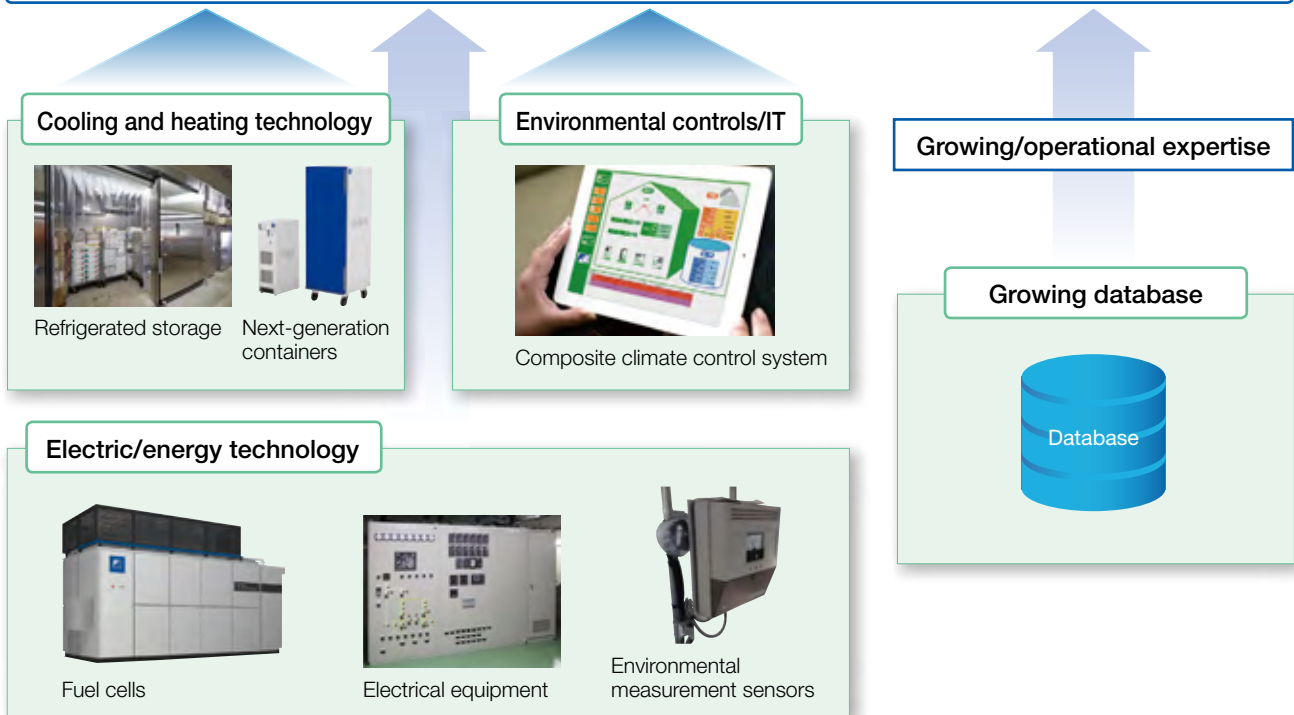
Conditions in Japanese agriculture are changing, with an aging society and falling birthrate, along with a growing awareness of food safety and security. In response to emergent needs in the food and beverage distribution market, new services and business models are appearing. One area attracting considerable attention is plant factories, which make it possible to provide advanced control over growing conditions, ensuring consistent quality and high productivity.

Using our experience in electric and thermal energy and plant control technologies, we are offering proposals for the various facilities, equipment, and information and control systems that support the engineering of plant factories. We also contribute to our customers' businesses by providing complete support for everything from business planning, to construction and operation, including growing and operational expertise.



Smart food distribution chain provided by Fuji Electric

Plant factory engineering, support and services provided by Fuji Electric



The Composite Climate Control System Is the Key to Plant Factories

Plant growth is affected by a complex interplay between a variety of environmental factors, including temperature, humidity and amount of sunlight. Our composite climate control system can manage these complex growing environments, enable growers to check the status via PCs and tablet devices, and create the ideal environment for plant growth, resulting in higher yields and improved quality.

Energy savings can also be achieved by adjusting equipment operation flexibly in response to the immediate situation.



The Optimal Environment for Year-Round Strawberry Cultivation

Tomato Farm Co., Ltd., (located in Tomakomai, Hokkaido) in which Fuji Electric has invested, took advantage of the Ministry of Agriculture, Forestry and Fisheries' "Supportive Projects for Accelerating the Introduction of Next-generation Greenhouse Horticulture" to build a new factory, and in the fall of 2014 began strawberry cultivation. The factory currently raises six different varieties, but in the future, plans to narrow the range down to two or three varieties most suited to cultivation.

Distribution volumes of domestic strawberries decline from summer into autumn, increasing the reliance on imported products. The goal of this cutting-edge growing facility, which is unaffected by climate or weather, is to achieve stable, year-round production and shipments.

The technology required to create the ideal environment for cultivation with minimal use of energy utilizes just the kind of expertise Fuji Electric has developed in its manufacturing business. With a composite climate control system based on our sensor and control technology, crops of consistent quality and volume can be cultivated year-round, while reducing fuel oil, electricity and other energy use by as much as 30% compared to an ordinary greenhouse.

Fuji Electric's entry into agriculture began nearly 20 years ago with the IT sector, but this is our first attempt at engineering a large-scale plant factory measuring two hectares. Plants are living things, and even when handled in a similar fashion, it is not always possible to maintain similar quality. In creating this system, we studied the agricultural expertise needed to create an optimal cultivation environment from the ground up. We also made repeated adjustments to arrive at the ideal combination of Fuji Electric facilities, equipment and



A large-scale, two-hectare greenhouse

systems needed to meet the needs of Tomato Farm. By incorporating feedback from growing data, knowledge, and expertise into the operating and growing process, we are contributing to a stable supply of strawberries that meet the needs of consumers.



Strawberries produced by Tomato Farm are currently being shipped to confectioners and other users in Hokkaido. To provide consumers with the safest, freshest products, Fuji Electric is continuing its efforts to optimize energy use in the agricultural sector too.

Topic

D-BOX Proving Useful in Plant Factories

D-BOX is a next-generation cold storage container launched in 2014. It not only enables constant-temperature distribution control during delivery from the production site to stores and sales areas, but can be used for movement of goods within the plant factory. This helps prevent the deterioration of quality in easily-damaged strawberries, and ensures that safe and highly fresh products are delivered to consumers.



Voice

Message from a Customer



Seiki Aoyama
Director
Tomato Farm Co., Ltd. (Back row, far left)

Traditionally, agriculture relied largely on experience and instinct. Fuji Electric participated in this project from the initial proposal phase, and worked with us to conceive and build the system. Today, we see enormous potential in the systemization of worker expertise and knowledge through the composite climate control system. We will accumulate more operational data to increase the accuracy of our controls.

3

Contributing to Facility Safety and Security and Higher Productivity throughout the Lifecycle

With the aging of Japan's factories, an increasing amount of infrastructure equipment and machinery is due for renewal, and the demand is growing for products and equipment that offer improved safety and security, as well as higher productivity and energy savings.

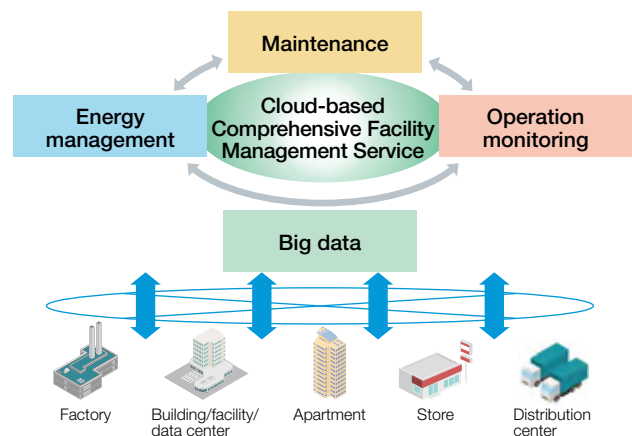
Fuji Electric provides its customers with a wide range of maintenance services throughout the product and equipment lifecycle, from management support and preventative maintenance, to improvement proposals and renewal plans. This contributes to stabilizing operations, reducing overall costs and improving productivity.

Providing Maintenance Services by Product and Equipment Lifecycle



Topic Developing a Cloud-based Comprehensive Facility Management Service System

In addition to the above lifecycle services, we have also developed a service that incorporates the functions of an energy management system on an integrated cloud platform. Operational status can be monitored in a cloud environment, while integrated management of various types of information provides appropriate support for maintenance, inspection, repair and renewal.



Maintenance Services Supporting Stable Data Center Operations

Fujitsu Limited's Tatebayashi System Center is Japan's most advanced data center, offering the country's highest level of information system services. Data from a wide range of corporations is stored on its servers, and the company also assists its customers with system operations. Because customers can enjoy significantly reduced costs compared with managing their own servers, the center has seen data volumes increase along with the number of customers year by year.



Exterior of the Tatebayashi System Center (illustration)

Data centers managing such enormous volumes of data are truly the heart of the customer's business. Security measures must of course be thorough, and power outages must also be avoided because resulting loss of data would directly affect the customer's business. To maintain appropriate temperatures, cooling and ventilation systems also operate 24 hours a day. Given the amount of electrical power required by these data centers, maintaining a quality supply of power and saving energy are massive challenges.

Since the center was established in 1995, Fuji Electric has provided it with substation equipment for converting power to the appropriate voltage, and with uninterruptible power systems (UPS) and other equipment for ensuring a stable supply of power. Because data centers operate 24 hours a day, 365 days a year, backup systems for this kind of equipment are always in place. Still, should a fault occur, service staff must immediately head to the center regardless of the time of day or night, resolve the problem, and implement measures to prevent a recurrence. To prevent these



Substation equipment

kinds of problems, we emphasize regular equipment diagnostics and preventative maintenance. Also, to ensure live data centers are not affected by such problems, we conduct annual systematic maintenance and inspection of substation equipment and UPSs by shutting down individual systems in order and, if necessary, replacing parts and so forth.

Over the 20 years since the center's establishment, we have built a relationship of trust with the client through this kind of day-to-day management, and by offering energy-saving proposals tailored to the client's needs, as well as renewal planning. We will contribute to the next generation of data centers by leveraging our experience in providing and maintaining data center equipment and our expertise in introducing smart technologies in other fields.



Inspecting a UPS unit

Voice

Message from a Customer



Hiroshi Baba
Expert, Energy Management Department
Facility Management Division Department
Outsourcing Business Unit
Fujitsu Limited

We have been using substation equipment and UPSs from Fuji Electric since the center's establishment. Their service staff help ensure stable operation by providing detailed equipment diagnostics and preventative maintenance, and our on-site staff rate their capabilities highly. They also offer technical advice during the renewal planning process.

Today, many IT-related firms have entered the data center business, and competition is intensifying. For customers using these services, cost is of course a factor, but safety and reliability are also extremely important. To ensure we are able to provide our customers with even better service, we will continue to strengthen our relationship with Fuji Electric.