

# Special Feature: Realizing a Sustainable Society

Fuji Electric aims to realize a safe, reliable, and sustainable society through its business activities.

In this section, we spotlight how our electric and thermal energy technologies help resolve customer problems and social issues in various fields around the globe.

## 1 Pursuing Energy Savings, Security, and Safety for Manufacturers' Factories and Production Equipment

Fuji Electric draws on its technologies in transformer, drive control, and measurement control systems to support manufacturers through products and systems that help save energy and through services that underpin equipment security and safety.

### Case Example

### Taiheiyo Cement Corporation — Saitama Plant

#### Diverse Range of Products and Services Help to Solve Issues in Safe Plant Operations and Energy Saving



The cylinder in the foreground at the Saitama Plant of Taiheiyo Cement Corporation is a cement incineration kiln

The Saitama Plant of Taiheiyo Cement Corporation conducted joint research with the municipal government of Hidaka City to tackle the issue of aging waste disposal facilities. The solution was to develop a cement recycling system using municipal waste\*1. The setup employs an in-house rotary

cement kiln for the AK System, which recycles the waste. The AK system enables the effective use of the waste as a cement material after fermentation.

The fermentation process for recyclable waste necessitates gradual fermentation by slashing garbage bags inside a more than 10-meter-long-cylinder rotary kiln over three days while processing a large volume of waste. Fuji Electric's inverter and motor rotate the heavy kiln consistently at low speeds. Such a kiln must be extremely reliable, as once started it must operate uninterrupted around the clock for at least six months. Operations to date have been stable.

Fuji Electric has been helping the Saitama Plant with electrical equipment since the facility entered service in 1995. As the customer's primary concern is stable operation, we built a monitoring control system for the entire cement production process with a DCS\*2 to support process control and quality management. We contribute to energy savings with a large inverter-controlled



The production monitoring control system visualizes cement production processes

boiler fan and kiln exhaust fan.

We will continue to respond to the customer's expectations and uphold their trust by supporting the entire plant with a diverse range of products and services.

\*1 Municipal waste: Combustible waste generated from households and businesses in Hidaka City, Saitama Prefecture, Japan (excluding such recyclable resources as used paper and PET bottles).

\*2 DCS: Distributed Control System.



The drive control system (inverter) controls kiln rotation



Power receiving and distribution substation equipment

Voice

## Comment from the Customer



**Naomitsu Shinoda,**  
Manager, Maintenance & Engineering Department  
Taiheiyo Cement Corporation

As a raw material manufacturer, a key challenge we face in pursuing customer satisfaction is fulfilling our supply stability responsibilities. We therefore strive daily to run production facilities without any hitches. The AK System, which has operated since 2002, delivers complete recycling without such secondary waste as incinerated ash, recycling almost 100% of municipal waste for cement manufacturing. With municipalities encountering numerous waste disposal issues, we aim to contribute to communities as we cultivate our business. We will continue to build resource recycling systems for the future of the earth in keeping with our commitment to CSR.

## Case Example

## Emirates Aluminium Company PJSC, UAE

### The World's Largest Rectifier for Aluminum Electrolysis to Ensure Customer's Frontline Safety and Security

Aluminum smelting has become popular in such Middle Eastern countries as the United Arab Emirates (UAE) owing to the locally low cost of fuel. Emirates Aluminium Company PJSC (EMAL) is accordingly upgrading its facilities to become the world's largest aluminum smelting business.

Aluminum smelting consumes a lot of electricity in the electrolysis process. The rectifier that generates electricity through power conversion must constantly ensure high energy savings and efficiency. Operations must remain reliably stable over long periods. EMAL chose the Fuji S-Former rectifier for its high reliability and conversion efficiency and a global track record underpinned by technologies that we have accumulated over more than 50 years.

Product performance is not the only priority for customers. More than anything, they prize accident-free installations and operations at sites. EMAL rated our safety-oriented systems designs very highly and placed its trust in our local construction work driven by highly experienced engineers. We are currently moving forward with the second phase of construction.

Aluminum is used around the world to reduce weight in automobiles and aircraft. Demand for this material is expected to keep growing, especially in emerging countries. We will continue to ensure safety and security to customers around the globe through our products and services, thereby earning their trust.



This photo at EMAL's aluminum smelting plant shows some of 12 S-Formers delivered for first-phase construction. Once six more S-Formers are delivered for the second phase, the smelter will be among the world's largest

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# 2 Contributing to Food Security and Safety

Fuji Electric aims to offer security and safety, freshness and good taste in its food and beverage distribution operations.

We wish to help ensure that products that agriculture and fisheries workers have put their sincere efforts into making safely reach store shelves as fresh and tasty offerings for consumers.

Based on our long-term strengths in cooling technology, we propose total food distribution solutions utilizing IT and energy-saving technologies to producers, distributors and retailers.



### Case Example

### Kumamoto Uki Japan Agricultural Co-operatives

## Temperature Management for Refrigeration Facilities Used in Food Production Areas

Kumamoto Uki Japan Agricultural Co-operatives is in Kumamoto Prefecture, Japan, a major citrus fruit production area. The main challenge for this cooperative is to control the sweetness, sourness, and freshness of the dekopon, considered the king of citrus fruits. The key consideration is temperature management in the facility at which the fruit is stored after picking.

To be able to supply the fruit beyond the peak picking season of March through April, dekopons slated for sorting are kept in refrigerated storage. While vegetables and other produce are generally stored at 3°C to 4°C, dekopons are refrigerated at slightly higher temperatures to avoid sudden changes on exposure to outside air during loading, and to ensure that the fruit reaches consumers in the best condition.

Fuji Electric provides a monitoring system that helps maintain perfect temperature and good taste.

This setup meticulously manages refrigerator temperatures as stored fruit volumes fluctuate and workers open and close doors during shipment times. The system warns managers of any abnormal refrigeration conditions.



Warehouse where temperature is maintained by a refrigeration facility



The dekopon, a local speciality of Kumamoto Prefecture

### Voice

### Comment from the Customer



**Hideji Kawasaki**  
Representative  
West Agriculture Center, Citrus Sorting Facility,  
Kumamoto Uki Japan Agricultural Co-operatives

We place the highest value on quality maintenance and management. Refrigerator temperature management ensures we can deliver fruit in the best condition to more people because we can maintain quality for as long as possible. We treat dekopons carefully, like children, shipping the fruit after packing each piece by hand to protect it from damage. We strive daily to safeguard the Dekopon brand to encourage more consumers to become fans of this fruit.

Case Example

Lawson, Inc.

### Distribution System Transformed by E-Commerce Fuji Electric Provides Support with Refrigeration Technology, and Design and Implementation Know-How

Internet shopping and other e-commerce activity has expanded rapidly in recent years with the spread of household Internet usage. Lawson, Inc., a major convenience store chain operator, runs the Smart Kitchen delivery service for foods and daily items in conjunction with major online business Yahoo Japan Corporation.

To create a new business that supplies food without passing them through stores, Lawson launched Lawson EC Distribution Center Zama, a refrigerated facility in Zama, Kanagawa Prefecture. Fuji Electric's refrigeration technology ensures strict temperature management in each compartment for different product categories such as frozen foods and perishables.

The refrigeration technology that Fuji Electric cultivated in vending machine and refrigerated showcases over the years and its expertise in designing and constructing stores and warehouses has enabled it to support the retail industry from the distribution side to help make lifestyles more convenient.



Goods disposal space at the distribution center. The room is kept at low temperatures

Case Example

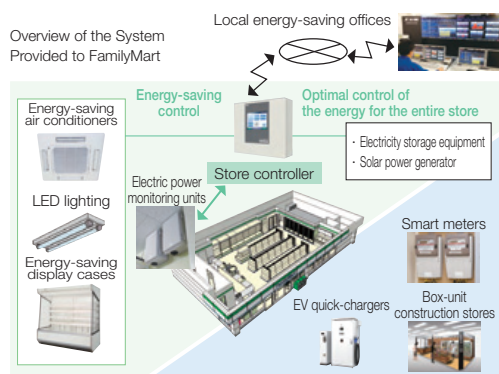
Familymart Co., Ltd.

### Proposing State-of-the-Art Eco-Stores to Lead the Industry

Familymart Co., Ltd., a major convenience store chain, is participating in the experimental Kitakyushu Smart Community Project\*. The company has opened FamilyMart Media Park Yahata Shop, which employs advanced energy management systems.

Fuji Electric built systems to optimize the energy consumption of store fixtures such as

energy-saving air conditioners and lighting. These systems automatically minimize electricity costs while maintaining comfortable store areas and product quality. This setup links with a Community Energy Management System (CEMS) to optimize community-wide energy consumption.



Fuji Electric will continue to cultivate smart store operations, proposing optimal solutions through products, technologies, and expertise that conserve electricity and heat energy. Key examples are store energy management systems and showcases and air conditioners that consume less energy.

\* The Kitakyushu Smart Community Project is an experimental initiative in which 73 companies and organizations are taking part. The City of Kitakyushu is overseeing the project. FamilyMart and Fuji Electric are among the six companies taking part in the smart store experiment.

**Voice** Comment from the Customer



**Fumiaki Ohno**  
General Manager, CSR Department  
Management Division  
Familymart Co., Ltd.

FamilyMart has actively addressed energy-saving at stores as part of efforts to conserve the environment in the course of business. As a new experiment, we have linked the FamilyMart Media Park Yahata Shop with a CEMS. We aim to contribute to the community by helping lower energy consumption fluctuations.

A major attraction of the project is that FamilyMart can contribute to flattening energy consumption not only at stores but also throughout communities in cultivating our operations globally. We hope to extend our business model to Southeast Asia and other areas in which electricity demand is continuing to surge.

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# 3 Contribution to the Promotion of Clean Energy

There is growing attention on power generation from renewable energy, in light of global warming and other environmental problems.

Fuji Electric aims to realize a sustainable society by providing products that contribute to the promotion of clean energy, such as equipment that can efficiently convert solar and wind power into electricity, steam turbines for power generation based on craftsmanship technology from knowledge of the nature of geothermal steam, and fuel cells that create electricity from hydrogen and oxygen.



### Case Example

### Fuji Electric Minami Alps Energy Park (Yamanashi Factory)

#### Start of Onsite Solar Power Business

#### Contribution to the Promotion of Mega Solar through the EPC (Engineering, Procurement, Construction) Business Model

Fuji Electric Minami Alps Energy Park, a mega solar power generation plant (2 MW), was constructed on the grounds of Fuji Electric's Yamanashi Factory. It started operations in April 2013. The plant sells all of its generated electricity to Tokyo Electric Power Company, Inc., based on Japan's feed-in tariff fixed purchase price system.

When we explore a potential mega solar power generation operation, we verify sunlight conditions, interconnectable transmission lines, and any needs for land improvements. We also discuss transmission grid connections with electric power companies. Power plant construction necessitates total engineering. This encompasses designing of overall facilities, procuring and constructing of materials such as panels and electrical facilities on site, and

maintaining and running facilities after operations start. Fuji Electric has the engineering, procurement, and construction (EPC) expertise to comprehensively deliver these capabilities.

Power conditioners are the core devices for solar power generation systems. They are proprietary products of Fuji Electric for use in mega solar systems. These conditioners employ Fuji Electric's energy-saving power semiconductors, and can operate at a world-leading efficiency of 98.5%, with minimal energy loss.

Fuji Electric will contribute to the promotion of renewable energy by moving forward with its power electronics technologies and expanding its mega solar EPC business.



Solar panels installed onsite at the Yamanashi Factory



Fuji Electric power conditioners (1 MW x 2)

## Case Example

## U.S. Hudson Ranch I and II Geothermal Power Plants

## Participation in Geothermal Power Project in the U.S.



Hudson Ranch I Geothermal Power Plant (HRI): HRI and HRII each generate enough power to serve 50,000 homes in the Southwestern region of the U.S.

Fuji Electric has supplied and installed major facilities for geothermal power generation plants for many customers in Southeast Asia, New Zealand, the U.S., Iceland, and other countries since the 1970s. We have established a position as a leading manufacturer of geothermal steam turbines and generators over the last 10 years, enjoying a 40%

share of the world market.

Fuji Electric supplied a turbine and generator to the Hudson Ranch I geothermal power plant (HRI) in California, which started commercial operations in March 2012. We were selected by the customer based on their evaluation of our rich experience and highly developed technologies, including technologies for enduring geothermal environments, which are highly erosive and corrosive.

We participated as an equity-holding member in the Hudson Ranch II (HRII) project, an expansion project being developed in the same area. Through the implementation of HRII, we will acquire further know-how in the geothermal power generation business. This will enable us to continue supplying even more efficient and reliable geothermal power generation plants to the market.



The turbine Fuji Electric supplied for HRI

## Case Example

## Yokohama Tsurugamine Hospital

## Fuel Cells Ensure Continuous Power Supply When Disaster Strikes

Following the Great East Japan Earthquake, the Yokohama Tsurugamine Hospital installed fuel cells as emergency power generators out of a heightened awareness of the need for uninterrupted power supply systems. Fuji Electric's fuel cells normally run on city gas, supplying 100 kW of electricity and hot water at 60°C. In the event of a disaster, proprietary fuel changeover technology enables these fuel cells to switch to stored LP gas and keep running, maintaining supplies of electricity and hot water for evacuees.

Because fuel cells can deliver uninterrupted supplies of electricity and heat during emergencies, Fuji Electric is endeavoring to expand the use of these systems to hospitals and other key public facilities. We are applying our technology in Japan

to fuel cells\* that run on digestive gases from sewage treatment facilities. In Europe, we are working on fuel cells with low oxygen content by-product levels for fire suppression.

\* Fuel cells running on digestive gases became subject to Japan's feed-in tariff fixed purchase price system for renewable energy, which went into effect in July 2012.



Fuel cells installed adjacent to a residential area

## Voice

## Comment from the Customer



Masaki Uchida  
Head Office Manager  
Yokohama Tsurugamine Hospital

The initial impetus for installing fuel cells was to secure electricity in the event of a disaster. Once the system was in place, we found that we were able to produce hot water from waste heat. We have not had to worry about noise, and have cut carbon dioxide emissions, so we have been satisfied at having a power supply source that is good for the community. We hope that more hospitals and public facilities employ Fuji Electric's fuel cells.

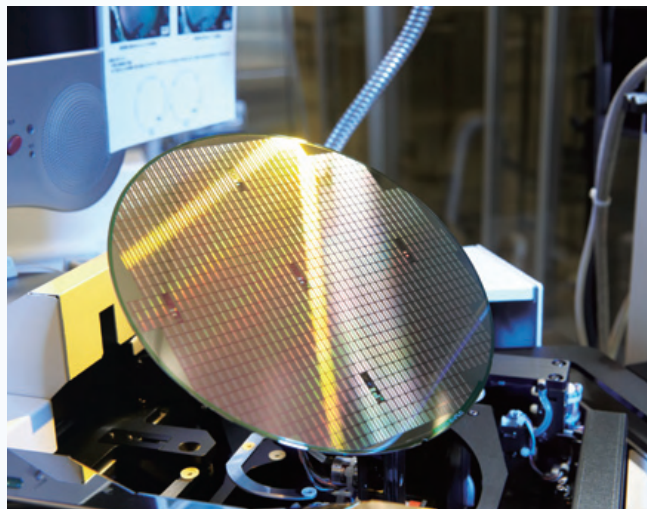
## Special Feature: Realizing a Sustainable Society

# 4

## Power Semiconductors Realize Advances in Electrical Equipment

Power semiconductors are all around us, including in manufacturing facilities and automobiles and as power converters in such renewable energy applications as wind and solar power generation. Power semiconductors are electronic parts that regulate electricity. Customer products incorporate these devices, which vary in form according to functional or power requirements and play a key role in performance and electricity consumption.

Fuji Electric will draw on its advanced power electronics technologies to constantly evolve power semiconductors and contribute to industrial and social infrastructure energy savings and comfortable living.



### Case Example

FANUC CORPORATION

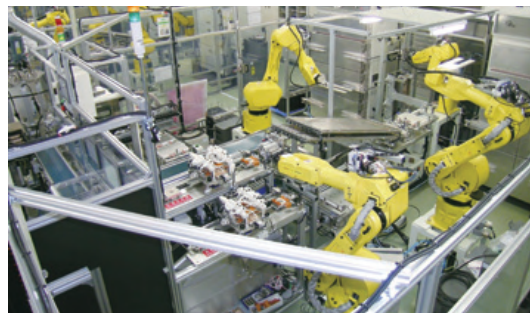
### Power Semiconductors Indispensable to Energy-Saving in the Industrial Sector

The yellow robots of FANUC CORPORATION incorporate state-of-the-art electronics technologies and have an excellent reputation for their smooth and agile movements. Robots perform machining at high speed, and with precision and efficiency around the clock at manufacturing sites around the world. Core components of these robots are Fuji Electric's insulated gate bipolar transistor modules (IGBTs)\*.

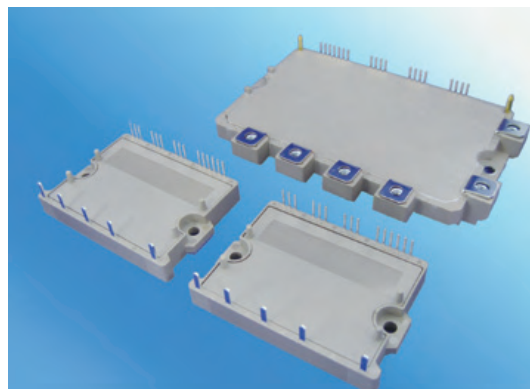
IGBTs control the rotational speed of the motors of robots so that they can move swiftly and smoothly. These modules also control rotational angles. They enable fine machining at a precision of one-250,000th per 360° turn making it possible to manufacture small precision products.

Apart from in robots, power semiconductors — whose applications also include elevators, commercial air conditioners, and other industrial areas — are used in everything from general purpose inverters for conserving energy to uninterruptible power supply systems that safeguard equipment. Power semiconductors contribute to manufacturing technologies, product advances, and energy savings around the world.

\* IGBTs are power semiconductors that can handle high voltages and currents.



A robot in use at Fuji Electric Power Semiconductor's Omachi Factory

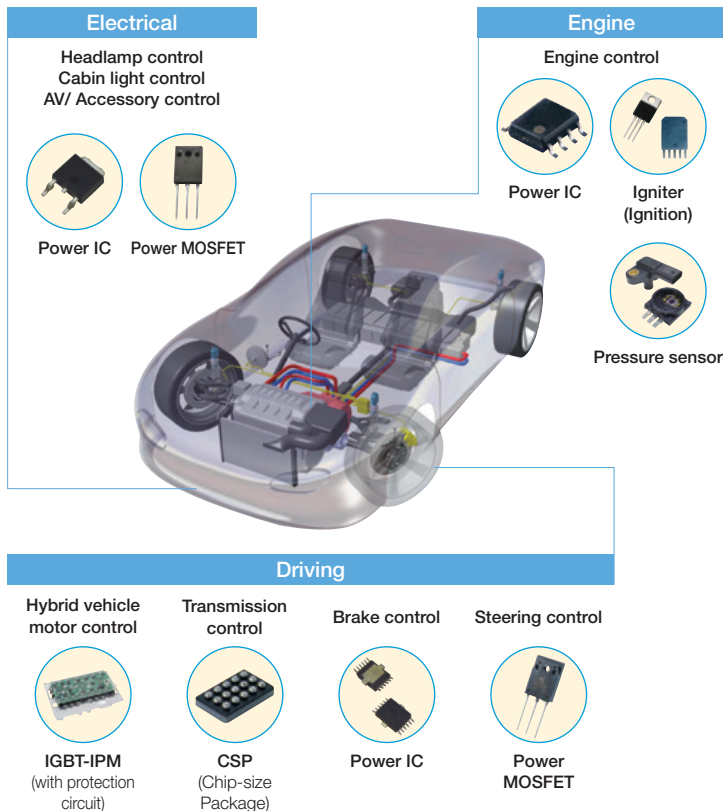


IGBT modules installed in robots

## Case Example

## Automakers

## Meeting the Need for Vehicle Safety and Security with High Reliability and High Performance



Electricity is playing an increasingly important role in hybrid cars, electric vehicles, and other next-generation automobiles. Power semiconductors, which regulate electricity, are used in engines, brakes, and steering controls, and many Fuji Electric products are used in these applications.

For example, in battery-powered next-generation automobiles, IGBTs control charges and discharges between batteries and motors, playing a vital role in improving fuel economy, and maximizing the distance that a vehicle can travel on a single charge.

Automotive parts must withstand the most demanding usage conditions to fulfill all-important safety requirements. Fuji Electric's power semiconductors satisfy these requirements through high reliability and performance. We will continue to supply environmentally friendly products and technologies in the years ahead.

## Case Example

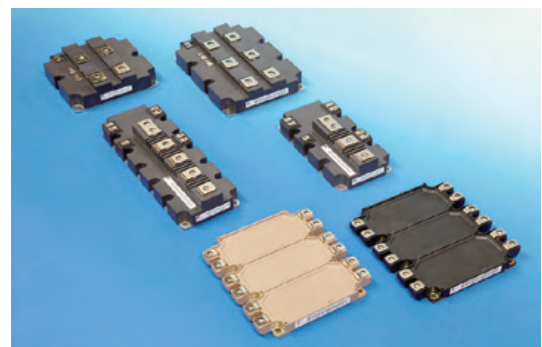
## Major Wind Power Generation Equipment Manufacturer in the U.S.

## Highly Reliable IGBT Module for Long-term Operation in Wind Power Generator

Wind power generation systems transform the energy of wind into electricity. The role of power converters is to transform the electrical energy produced from the irregular rotations of windmills into stable currents. Fuji Electric's IGBT modules are incorporated in the power conversion equipment of a leading U.S. wind power generator manufacturer that is growing its business worldwide.

We created an IGBT in an unprecedented 1,400-amp, 1,700-volt package to enable efficient conversion of electricity from windmills that are dozens of meters tall.

Wind power generation systems produce electricity over long periods, so power conversion devices must deliver long-term reliability. Fuji Electric's IGBT modules surpass the high quality standards of customers, and have been central components of power conversion devices. We will continue to create offerings that match strict quality requirements.



IGBT modules installed in power transformer equipment



## Special Feature: Realizing a Sustainable Society

# 5 Developing Products to Meet the Needs of Emerging Markets

Demand for electricity in fast-growing emerging markets is soaring as many new plants, office buildings, and other structures are put up. As new power stations are constructed to stabilize electricity supplies, a key challenge is to reduce energy consumption and CO<sub>2</sub> emissions.

Fuji Electric endeavors to manufacture products that satisfy customers around the world by localizing engineering, manufacturing, and consumption. We are striving to resolve energy issues by offering products that contribute to energy savings.



### Case Example

### Air Conditioning System Design Company in Singapore

## Major Contribution to Energy Saving in Asia, Where Demand for Electric Power is Rising

### Development of Special Inverter for Air Conditioners — FRENIC-HVAC

The various applications of inverters include air-conditioning systems, pumps, elevators, cranes, conveyors, and machine tools. Fuji Electric draws on its world-leading technologies to create a diverse lineup of products that it sells throughout the world.

Air-conditioning systems are living essentials in office buildings, hotels, hospitals, schools, and shopping centers. Markets for these systems are expanding, particularly in emerging market

countries. Inverter control of the motors that drive the pumps and fans of the systems can greatly conserve power consumption. Air conditioning systems applications are the greatest segment of the global market for inverters. Specialty inverters that Fuji Electric developed for the Asian air-conditioning market have started to be adopted broadly, particularly in Asia, since commercialization in March 2012.



Fuji Electric inverter  
FRENIC-HVAC

### Voice

### Comment from the Customer



**Mr. Don Yeo**  
Project Manager  
Air System Technology (s) Pte. Ltd.

We had known about Fuji Electric but this was the first time for us to use its products. Air conditioning systems of new buildings generally incorporate inverters to control energy savings. But inverters for such systems need water- and dust-proof structures, special protocols for communicating with building monitoring systems, and noise filters, reactors, and other special functions and circuits. We thought very highly of Fuji Electric's FRENIC-HVAC inverters for incorporating all these functions. We therefore decided to employ them for one of our key projects where our reputation is at stake.

### Exhaustive Survey of Market Needs

We developed FRENIC-HVAC for air conditioning systems in Asia after extensively researching local needs. For example, it is the first wall-mountable slim inverter from a Japanese manufacturer. The inverter is easy to install anywhere, unlike conventional Japanese models that must be stored in protective cases. We enabled outside installation by making the structure waterproof and dustproof, incorporating the noise filter and all other key air conditioner functions in one unit. The operation panel can handle 19 languages, including Asian ones. We have made the system very affordable by manufacturing it overseas and procuring around 80% of components outside Japan.



Fuji Electric Asia Pacific employees discussed all aspects of the specifications based on local market needs

FRENIC-HVAC simplifies air conditioning systems while retaining its inherent quality and performance. It has been very well received by customers constructing air conditioning systems, particularly in Asia.

FRENIC-HVAC is a global model developed with collaboration between various business units at Fuji Electric. We aim to extend our lineup in the years ahead.



External unit of the air conditioner system installed on an office building roof

### Voice

## Comment from an Employee



**Samson Lim** (Photograph, right)  
Sales  
Fuji Electric Asia Pacific Pte. Ltd.

We decided to create a new air conditioner inverter for the Asian market, so we needed to assess the specifications and pricing that Asian customers sought. FRENIC-HVAC fully reflects Asian needs, and we can proudly recommend it to our customers. This offering has enabled us to approach completely new customers. We will continue to enhance Fuji Electric's presence in the enormous Asian market.