

# Research and Development

We attempt to create new customer value and resolve social issues by integrating power semiconductor and power electronics technologies with advanced digital technologies.



## Shiro Kondo

Managing Executive Officer  
Corporate General Manager, Corporate R&D Headquarters

Fuji Electric has core technologies in such areas as power semiconductors, power electronics, measurement and control, and heating and cooling. Utilizing these technologies, we have been involved in many advanced systems, from energy creation to energy supply stabilization, energy saving, automation, and mobility electrification. In the process, we have helped resolved

various issues. Going forward, we will continue providing new value to our customers by fusing our cutting-edge digital technologies with real-world ones mainly consisting of our field-based core technologies, which we have cultivated since our foundation. We will also work to solve social issues through partnerships and open innovation.

## Medium- to Long-Term R&D Initiatives

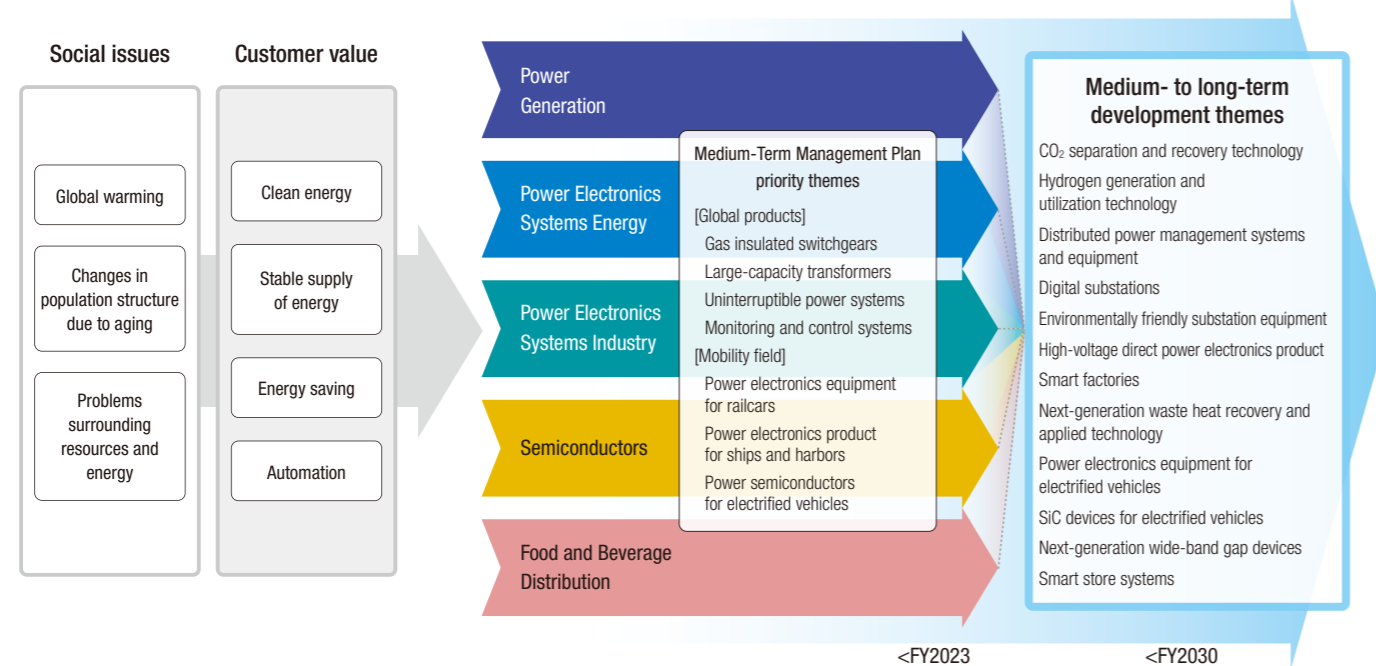
To achieve the targets of our FY2023 Medium-Term Management Plan, we are concentrating resources on the power electronics systems business and the semiconductors business. Our aim is to expedite development of products that will open up new markets in the mobility field, such as automobiles, railways, and ships, as well as global products for expanding our overseas business.

As a medium-to long-term initiative, we are strengthening our technology marketing\*, which envisages social issues 10 years into the future. At the same time, we are stepping up our search for themes to address increasingly complex issues through both advanced technology

development and social acceptability research. All of our research divisions are pursuing complex synergies by integrating advanced digital technologies with various real technologies, including those related to energy conversion, materials and properties, structures, insulation, heating and cooling, and mechanical systems.

To address issues that cannot be solved by Fuji Electric alone, such as carbon neutrality, we will value strategic partnerships while refining our technologies for energy creation, energy saving, and energy conversion.

\* This means uncovering new customer value from a technology-oriented perspective, creating an ecosystem with potential customers, and co-creating a product market, before creating the product itself.

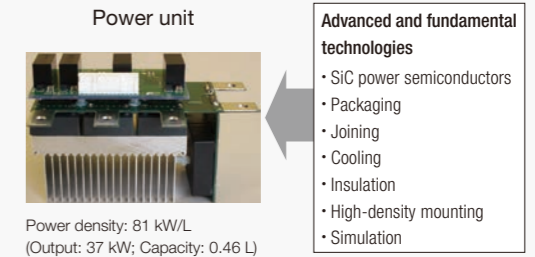


## Examples of R&D Initiatives

The R&D initiatives described below are aimed at strengthening our power electronics systems business.

### Raising power density of power units

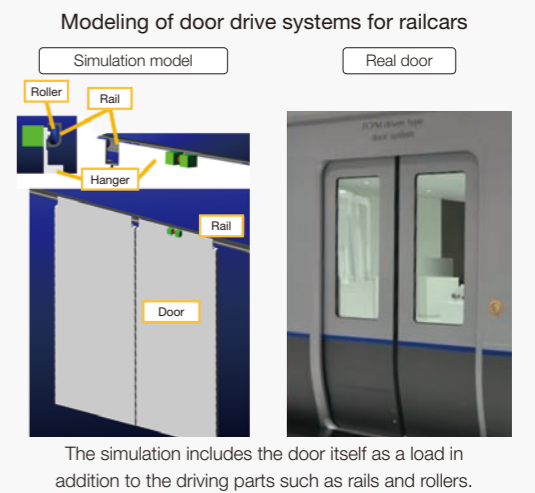
We are developing technologies to increase the power density of power units, which are responsible for power conversion in motor drives, automobiles, rolling stock, and uninterruptible power systems. This is part of an initiative to dramatically reduce the energy consumption and size of power electronics equipment on the pathway to carbon neutrality. Specifically, we are developing power units with more than 20 times the power density of conventional units by combining and optimizing advanced and fundamental technologies. These include packaging and cooling structures designed to maximize the performance of SiC power semiconductors and thermal analysis simulations to evaluate their capabilities.



### Progress of product development process with digital technology

To achieve better product quality, reliability, and faster development, we are advancing the digital transformation (DX) of our product development processes and pushing ahead with initiatives designed to further expand the capabilities of conventional computer-aided engineering (CAE).

In developing door drive systems for railcars, by simulating the driving parts, doors that are loads to bear, electric circuits, and control software together, we determine the performance in the initial stage of development, optimizing the overall design. Compared with the conventional method of repeating tests on actual equipment, this reduces development manhours and improves product quality and reliability by validating operations when a malfunction occurs.



## Intellectual Property Initiatives

Fuji Electric considers intellectual property to be an important management resource. We are strengthening intellectual property at the source of business planning and R&D and promoting global intellectual property strategies, including the promotion of international standardization. Our aim is to build a group of patents that will give us an advantage in our business, such as:

- (1) Patents related to enhancing efficiency and energy saving of power electronics equipment
- (2) Patents related to power semiconductors, including SiC-related technology
- (3) Patents related to our food and beverage distribution sector

Among our global intellectual property activities, we are continuing to address intellectual property issues overseas and take measures against counterfeit products. For international standardization, we foster the development of standards in close cooperation with the International Electrotechnical Commission (IEC), which is in charge of standards related to electrical and electronics technologies, as well as other industry organizations in Japan and overseas.

In fiscal 2020, in collaboration with R&D divisions, we focused on searching for new businesses, partnerships with other companies, and development themes using the IP landscape\*1. In international standardization activities, one of our employees was appointed as the Japanese

representative of the Conformity Assessment Board (CAB), an upper-level IEC committee, and will spearhead activities toward standardization from fiscal 2021. In addition, the Company received the Award from Commissioner of the Japan Patent Office, part of the FY2021 Intellectual Property Achievement Awards\*2 presented by the Ministry of Economy, Trade and Industry and the Japan Patent Office. The award recognizes our contribution to the creation of better intellectual property systems through opinion exchange meetings with the Japan Patent Office, proactive in-house intellectual property activities, and assertive use of patent rights at the time of market entry.

\*1 A method that utilizes intellectual property and market information for the benefit of business and management strategies.

\*2 The Ministry of Economy, Trade and Industry and the Japan Patent Office annually select and present awards to individuals who have contributed to the development and proliferation of the IP rights system in Japan, as well as to awareness-raising activities related to the system, and to companies that have effectively utilized the system and contributed to its smooth operation and development.

