

# Contributing to the Creation of Sustainable Societies Through Energy and Environment Businesses Centered on Power Electronics Systems and Power Semiconductors

Since its foundation in 1923, Fuji Electric has always pursued innovations in energy and environment technology, making its contributions to society in the field of industrial and social infrastructure. The international community today engages in various environmental initiatives, such as the Paris Agreement, an international framework for mitigating greenhouse gas emissions, and the Sustainable Development Goals (SDGs), which aim to realize sustainable societies. Businesses are also expected to proactively participate.

In these circumstances, Fuji Electric pursues environmentally-aware manufacturing through the development of technologies and products that facilitate efficient use of electric and thermal energies, reduction of greenhouse gas emissions and effective utilization of resources. In June 2019, we announced the Environmental Vision 2050, as the objectives for our medium-to-long-term environmental activities.

At present, Fuji Electric operates in four businesses comprising five segments: Power Electronics Systems, which consists of the energy and industry segments; Electronic Devices; Power Generation; and Food and Beverage Distribution. Fuji Electric's Five-Year Medium-Term Management Plan sets forth to achieve net sales of 1 trillion Japanese yen and an operating margin of at least 8.0% during the period starting from fiscal 2019 and ending in fiscal 2023, which marks the 100th anniversary of the company's foundation. To achieve these goals, we plan to deploy our resources mainly in power electronics systems and power semiconductors for electronic devices, dedicating 80% of our research and development budget to them. Through these efforts, we will create new products with clearly identified value for customers.

In the energy solutions of the power electronics systems business, we roll out products such as switchgear, transformers and protective relays, as

well as systems that incorporate these to the social infrastructure and industrial markets. These products are based on our large-capacity power electronics technology and energy monitoring and control technology. In the field of transmission and distribution systems, we have developed the world's smallest 115-kV, 50-MVA transformer in terms of its size, mass and oil volume, targeting the global market where the demand for electric power is expected to grow in the future. We also had our first success in delivering new 145-kV gas insulated switchgear (GIS) compliant with the latest international standards to power companies abroad.

In the industry solutions of the power electronics systems business, we aim to expand our overseas operations by creating competitive components based on power electronics systems technology and bolstering system sales in combination with control and IoT technologies. In the field of automation, we have developed inverters, servos, measuring equipment, controllers and other components, as well as controlling systems combining these, to contribute toward enhanced productivity and energy saving. To leverage the IoT, we have developed and marketed a new edge device, "OnePackEdge System," which collects time-synchronized data from various devices at production sites, accumulates the data centrally and provides analytical services. Furthermore, analytics AI will be applied to create new value such as EMS, predictive diagnosis, quality analysis and quality improvement. Focusing on the marine field, we have also leveraged the electrostatic precipitator and water treatment technologies that we have fostered over the years to develop an exhaust gas cleaning system for marine vessels, ensuring compliance with regulations on sulfur oxides (SO<sub>x</sub>) and particulate matter (PM). In the field of control devices, we approach markets that require high reliability, such as lifeline infrastructure, by developing duplex programmable controllers and high-speed controllers for electrical machinery con-



trol. These enable highly reliable high-speed drive control systems, such as those for steel plants.

In the field of power semiconductors for the electronic device business, we have developed power semiconductor chips using silicon carbide (SiC), which is superior to a conventional silicon semiconductor in terms of low resistance, high breakdown voltage, and high operating temperature. Using the chips, we have developed SiC modules with world-class performance. These products are used for next-generation high-speed railways, contributing to a reduction of size and weight. Their performance evaluation is currently under way.

With power electronics systems and power semiconductors as the core technology, we are committed to the electrification of rapidly advancing transportation systems as our important target. We have therefore developed compact, lightweight power semiconductor modules for automotive applications by using Fuji Electric's unique technologies for power semiconductors, heating and cooling, and modularization. We are developing automotive power electronics equipment using them as well.

In the field of power generation, we are shifting our business to renewable energy as the world is increasingly being driven toward decarbonization. Fuji Electric received orders for four solar power generation plants as entire process of engineering, procurement and construction (EPC) projects and completed them in fiscal 2018. Of them, the Tomakomai Mega Solar Power Station No. 1 is one of the largest facilities in Japan with storage batteries, and it complies with the technical requirements of the Hokkaido Electric Power Co., Inc. for measures against output fluctuation.

In the field of food and beverage distribution business, we are working on the challenge of improved convenience, labor and energy saving in response to constant manpower shortages. For example, we pursue the development of coffee mills that require less cleaning and IoT technology to

simplify work processes. In the same vein, we have improved a coffee machine with an enhanced coffee extraction process, making it possible to provide tastier coffee more quickly and reduce customer's stress due to waiting time.

Furthermore, our R&D pursues fundamental technology that is applicable to a wide range of products, as well as advanced technology in anticipation to the future. More specifically, we build more solid technological basis by integrating existing technology with digital technology. Examples of this include a molecular simulation technology to identify defective structures in the boundary between a SiC semiconductor and a gate oxide film; model-based designing technology to develop the detailed models for control amplifiers, motors and mechanical loads of a servo system; and image recognition technology with AI for the automation of visual examination processes.

The corporate mission of Fuji Electric is to "pledge as responsible corporate citizens in a global society to strengthen our trust with communities, customers and partners," and our slogan is "To be enthusiastic, ambitious and sensitive." What this represents is the "enthusiasm" for creating new technologies and products in order to make contributions to society; "ambitious" objectives backed by firm determination to overcome any difficulty; and the "sensitivity" that derives from gratitude toward our customers and colleagues as well as family members, who support us. These kinds of feelings and attitudes comprise the DNA of Fuji Electric.

This slogan is the anchorage for our teams of diverse members, as we strive to contribute to the creation of responsible and sustainable societies. As Fuji Electric engages in these challenges, we would like to ask all of our stakeholders for their continued support and understanding.

KITAZAWA, Michihiro  
President and Chairman of the Board of Directors

A handwritten signature in black ink, appearing to read 'M. Kitazawa'. The signature is fluid and cursive, written over a white background.



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