## Preface

Pursuing Innovation in Energy and Environment Businesses, We Contribute to the Creation of Responsible and Sustainable Societies Under the Slogan "To Be Enthusiastic, Ambitious and Sensitive"

Fuji Electric has been contributing to society in the fields of industrial and social infrastructure since it was established in 1923.

The earth currently faces energy and environmental problems as a result of rapid increases in population and industrialization. Fuji Electric's brand statement is "Innovating Energy Technology." By pursuing innovation in energy and environment technology, we will continue to provide the world with environmentally friendly and high added-value products and systems that utilize energy stably and most efficiently. This will contribute to the creation of responsible and sustainable societies.

In April 2016, we announced our FY2018 Medium-Term Management Plan, in which we are engaged in the Further Renovation of Fuji Electric. In April 2017, as operational reforms, we reorganized our Social Systems, Industrial Infrastructure, and Power Electronics businesses into the Power Electronics Systems Business Group that has newly started. Its aim is to create competitive components and enhance systems through competitive components to increase sales of systems outside Japan. In a wide range of industrial fields, we will deliver energy solutions that achieve energy optimization and stabilization and industry solutions that are aimed at productivity improvement and energy conservation through factory automation and visualization.

In order to accelerate research and development, Fuji Electric has transformed the development system into one in which each business group takes on functions related with product development, while the Corporate R&D Headquarters tackles advanced research and fundamental research. The Power Electronics Systems Business Group has also newly established and expanded its product development management function. At the same time, we have upgraded our research and development bases. In FY2015, we constructed the Development Center for power semiconductors in the Matsumoto Factory, and the Core R&D Center in the Tokyo Factory for company-wide R&D and instrumentation and control technology. In FY2016, we built the Power Electronics Technical Center in the Suzuka Factory to bring our power electronics researchers and engineers together.

Against this backdrop, our R&D focuses on producing power electronics products with top-level power semiconductors as core devices and then creating integrated and differentiated component and system products by adding our instrumentation and control technology. We are also thoroughly pursuing value for our customers by connecting these distinctive component and system products through the Internet of Things (IoT) and employing analysis, prediction and optimization engines (analytics software).

The result of our R&D is that we are establishing a product line of 7th-generation IGBTs to renovate our power semiconductors using Si. We are also committed to research and develop power semiconductors made of silicon carbide (SiC), which provides a lower switching loss and is expected to revolutionize power semiconductors, and pursuing synergy with power electronics products that utilize them. With a 1.2-kV SiC trench gate MOSFET, which we are developing as the next generation of planar gate devices already on the market, we have realized world-beating low-loss performance ( $R_{\rm on} \cdot A =$  $3.5 \text{ m}\Omega \cdot \text{cm}^2$ ) and high reliability. For power electronics products utilizing SiC power semiconductors, we have launched a large-capacity UPS (300 kVA) equipped with SiC hybrid modules that achieve an equipment conversion efficiency of 97.5%, the highest level in the industry. We are also developing power electronics equipment with All-SiC modules, in which both diodes and transistors are made of SiC. At the same time, we are researching and developing high-end inverters utilizing the characteristics of SiC semiconductor of low-loss and highthermal-resistance and power distribution equip-



ment utilizing that of high withstand voltage.

In line with the trend toward electric vehicles, we are comprehensively developing power semiconductors for automotive applications, including discrete devices, modules, inverters and motors. Leveraging RC-IGBTs, thermal-cooling technology and packaging technology has reduced outer size and increased power density. Sample shipments have already begun for direct liquid-cooling power modules for automotive applications.

In the process automation field, to address our customers' challenges of high-quality product manufacturing and stable and efficient operation, we have enhanced the functionality of the plant monitoring and control system "MICREX-VieW XX." Greatly enhanced functions include faster data collection and display processing, long-term storage of plant data and improved security. We intend to provide the product to monitoring and control systems in plants of various industries, including chemistry, oil, gas and electricity.

In the factory automation field, we are developing components and systems that can meet different demands such as performance, cost, and openness. Through these development, we will offer systems, solutions, and services that allow customers to create values that differ depending on the region or industry. To give an example, our developed the new servo system "ALPHA7" achieves the highest level of fast and accurate control in the industry. In future, it will contribute to the fields of packaging machinery, robots and semiconductor manufacturing equipment.

Regarding the IoT, we have built an IoT platform with edge controllers for gathering data from field equipment at various sites and handling it and a mathematical engine for diagnosing and analyzing the data to perform prediction and optimization. Using this, we have operated a number of pilot projects including those at our own factories. While increasing its application examples, we confirmed its effects, such as improving productivity, manufacturing quality, operation and maintenance efficiency, and plant efficiency, as well as ensuring process quality traceability. We also aim to increase opportunities for use of vending machines utilizing the IoT. We are developing interactive communication technologies, such as digital signage, linkage with smartphones, voice and face recognition and gesture discrimination. Making use of these examples, we will provide valuable systems and services from our customers' perspective.

We will continue to work on common fundamental technologies for our wide range of products and advanced technologies that look to the future. Major themes include big data analysis, simulation, solid insulation using resin materials, semiconductor interface analysis, remaining life diagnosis for turbines applying metallic corrosion research, sensors, and current interruption technology for the design of GIS and other switchgears.

Fuji Electric has formulated the corporate mission of "We, Fuji Electric, pledge as responsible corporate citizens in a global society to strengthen our trust with communities, customers and partners" and adopted the slogan of "To be enthusiastic, ambitious and sensitive." "Enthusiastic" means the passion to contribute to society by creating new technologies and products for the world, "ambitious" means the vitality to set and strive for high goals whatever the difficulties may be, and "sensitive" means the richness of human spirit to be able to feel our customers' pleasure as our own. Under this slogan, Fuji Electric intends to continue accurately assessing the needs of society, to build a team from our diverse human resources and to contribute to the creation of responsible and sustainable societies through our innovation in energy and environment. We are truly grateful for the guidance and encouragement received from everyone.

KITAZAWA, Michihiro President and Chairman of the Board of Directors

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