

Through Our Innovation in Energy and Environment Technology, We Strive to Create New Customer Value and Resolve Social Issues While Addressing the Changes in the Market Environment

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One of the Fuji Electric's management policies is to contribute to the creation of a responsible and sustainable society through our innovation in energy and environment technology. To achieve this, we are fully committed to the research and development for creating new products. In fiscal 2022, to work toward the FY2023 Medium-Term Management Plan and the growth strategy thereafter, we focused our resources on electrification in the field of mobility, including automobiles, railcars, and marine vessels, as well as on developing commercial products for the global market. Our main initiatives for each business field are as follows.

In the Power Electronics Energy segment, we launched a transformer with a rated capacity of 2 to 100 MVA that uses natural ester oil as an insulating oil in December 2022. Since natural ester oil is non-toxic and highly biodegradable, it has a low environmental impact in the event of a spill, and since its flash point is higher than that of conventional mineral oil, it can streamline ancillary equipment such as firefighting equipment, as well reduce the installation cost of transformers. In the ED&C components business, we redesigned the "command switch" of operating and indicating devices. In addition to enhancing compatibility with recent mechanical devices that emphasize design, we have improved visibility by equalizing the brightness of the illuminated surface.

In the Power Electronics Industry segment, we have renovated the "FRENIC-Ace (E3) Series" of low-voltage inverters that support factory automation. In addition to the lineup of models with built-in Ethernet that support the adoption of IoT at production sites, we have incorporated a life expectancy diagnostic function for IGBT devices, which are key components. This enables the detection of inverter failures before they occur, thereby preventing sudden equipment shutdowns. We have also incorporated a traceback function to save the driving waveform immediately before the alarm stops so that it can be used to investigate the cause of the alarm stop. To ensure the quality of regional designs in applications outside of Japan, our door system for railcars has obtained Level 2 certification for Capability Maturity Model Integration (CMMI), an international standard for software development processes. The door system that we developed by applying

this process was adopted in New York City Transit's R211 cars, which went into commercial operation in March 2023.

In the semiconductor segment, we have developed power semiconductors that achieve highly efficient power conversion for industrial and automotive use. For industrial use, we have developed 2,300-V/1,200-A rated modules suitable for 1,500-V DC systems in response to the growing demand for higher efficiency, higher capacity, and reduced size in power conditioning system for renewable energy sources such as solar and wind power generation, the markets for which have been expanding in recent years. We have incorporated a 7th-generation IGBT chip to increase the current density compared with conventional products. In addition, we designed a terminal arrangement that facilitates multiple parallel connections. We are also developing a series of products equipped with SiC-MOSFET chips with a breakdown voltage of 2,300 V to meet the demand for further reductions in power dissipation. For automotive use, we have developed the "M675" direct water-cooled power module with a rating of 750 V/820 A, which is used in the drive inverter of electric vehicles. We have achieved reduced power dissipation in the equipped RC-IGBT and high heat dissipation in the cooler, leading to a 30% improvement in output current compared to conventional products. We are planning to expand into the rapidly growing Chinese market.

In the power generation business, Olkaria I Geothermal Power Station Unit 6 (86.9 MW), which was delivered to Kenya Electricity Generating Company PLC, began commercial operation in June 2022. We applied the technologies we have cultivated through the practical application of geothermal power generation equipment to achieve the maximum capacity for a single unit in Kenya. In the new energy market, we are developing hydrogen fuel cell systems for factories and facilities using polymer electrolyte fuel cell modules that are mass-produced for automobiles in preparation for the future advent of a hydrogen society. The configuration enables selection of the rated generation capacity from 50 to 480 kW according to the amount of hydrogen available at the installation site. We are currently conducting demonstration tests using

a prototype.

In the food distribution segment, we have developed the “Sustainable Vending Machine Series,” which features higher energy saving performance than the previous series. In addition to using an inverter to drive the compressor of the cooling units, we optimized the structure of the refrigerator and the arrangement of vacuum heat insulation materials to reduce annual power consumption by up to 20% compared with our vending machine from the previous year. In addition, sales and inventory can be checked remotely via the newly equipped bi-directional communication devices, thereby contributing to labor saving in operations.

In the fields of fundamental and advanced technolo-

gies, we worked to advance electrical insulation technology, which is essential to further reduce the size of electrical equipment. To achieve both thermal conductivity and insulation, we have developed a technology to increase thermal conductivity by mixing insulating resin with a high thermal conductivity filler, as well as to modify the filler surface to prevent aggregation of the filler, which is the starting point for dielectric breakdown.

Fuji Electric will continue to pursue innovation in energy and environment technology to create new value for customers and resolve social and environmental issues, thereby contributing to the creation of a responsible and sustainable society.





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