

# Promotion of the Energy and Environment Businesses — Realization of Carbon Neutrality —

The realization of carbon neutrality by 2050 has become a common issue worldwide. Along with the widespread adoption of clean energy such as solar and wind power, we are required to address the question of how to stably supply these forms of energy, for which the amount of electricity generated fluctuates depending on the weather, and also to adopt energy saving in the utilization of energy and electrification from fossil fuels.

Fuji Electric has a wide range of products from the supply side to the demand side of energy, and we are contributing to “making clean energy mainstream,” “stabilizing the energy supply,” “spreading energy-efficient equipment and systems” and “improving the electrification rate” to realize carbon neutrality.

## Value Provided by Fuji Electric

### Making clean energy mainstream



Geothermal power

Hydro power



Solar power

Wind power

We have a broad lineup of clean energy, including geothermal, hydro, solar, and wind power. In recent years, hydrogen has gained attention as new energy; therefore, we are advancing the development of products and systems that contribute to building the hydrogen supply chain.

### Stabilizing the energy supply



Environmentally friendly substation equipment

Energy management systems (EMS)



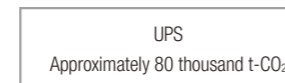
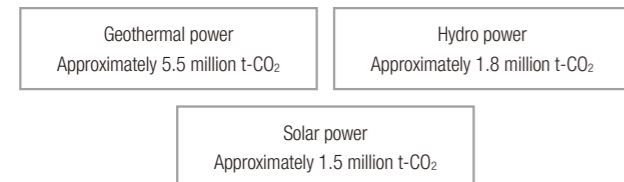
Uninterruptible power supply systems (UPS)

Power conditioning systems (PCS)

We contribute to the stable supply and optimization of electricity and the greater resilience of industrial infrastructure through package proposals that include product and system supply and maintenance; for example, the provision of uninterruptible power supply systems (UPSs) to data centers, and the provision of environmentally friendly substation equipment to power companies. In recent years, we have expanded the scope of our efforts, including district-integrated energy operation and stable supply of electricity in Hokkaido and the remote islands.

Reduction of CO<sub>2</sub> emissions\*1 (FY2022 Results)

Reduction of CO<sub>2</sub> emissions\*1 (FY2022 Results)



Environmental impact reduction



### Spreading energy-efficient equipment and systems



Inverters

Motors

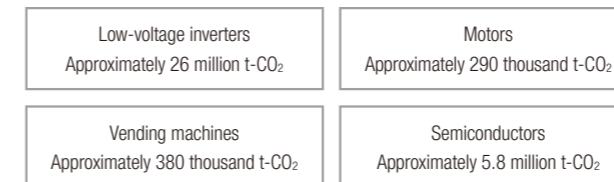


Sustainable vending machines

Semiconductors

We are aiming to promote energy saving in factories, office buildings, facilities, and other structures through the visualization of energy saving issues using the measuring and control technologies we have cultivated over many years, the power electronics equipment using highly efficient power semiconductors manufactured in-house, drive control systems, and also energy saving proposals based on the effective utilization of thermal energy.

Reduction of CO<sub>2</sub> emissions\*1 (FY2022 Results)



### Improving the electrification rate

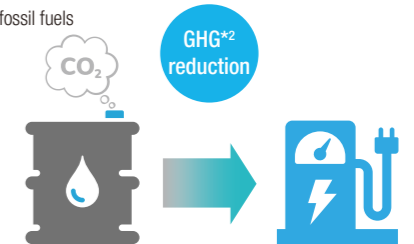


Power semiconductors for electrified vehicles

Electric propulsion systems for vessels

We are utilizing our technological ability, with which we have pursued the miniaturization and higher efficiency of power electronics devices, to contribute to improving the electrification rate with power semiconductors for electrified vehicles (xEVs), electrical propulsion systems for vessels, onshore power supply systems, and other solutions.

Electrification from fossil fuels



## Initiatives for New Markets

Fuji Electric is working on initiatives to open up new markets related to carbon neutrality.

Case1  
Power supply for hydrogen production



For details, refer to P23

Case2  
Storage battery system for the power system



For details, refer to P24

Case3  
Community energy management system



For details, refer to P25

Case4  
Onshore power supply system, electric propulsion ship



For details, refer to P26

\*1 Reduction of CO<sub>2</sub> emissions (fiscal 2022 result) is calculated with the CO<sub>2</sub> reduction amount in the case that the products during the operating period shipped in or after fiscal 2009 have operated for one year as the contribution amount.  
\*2 Greenhouse Gases

Initiatives for New Markets Case1

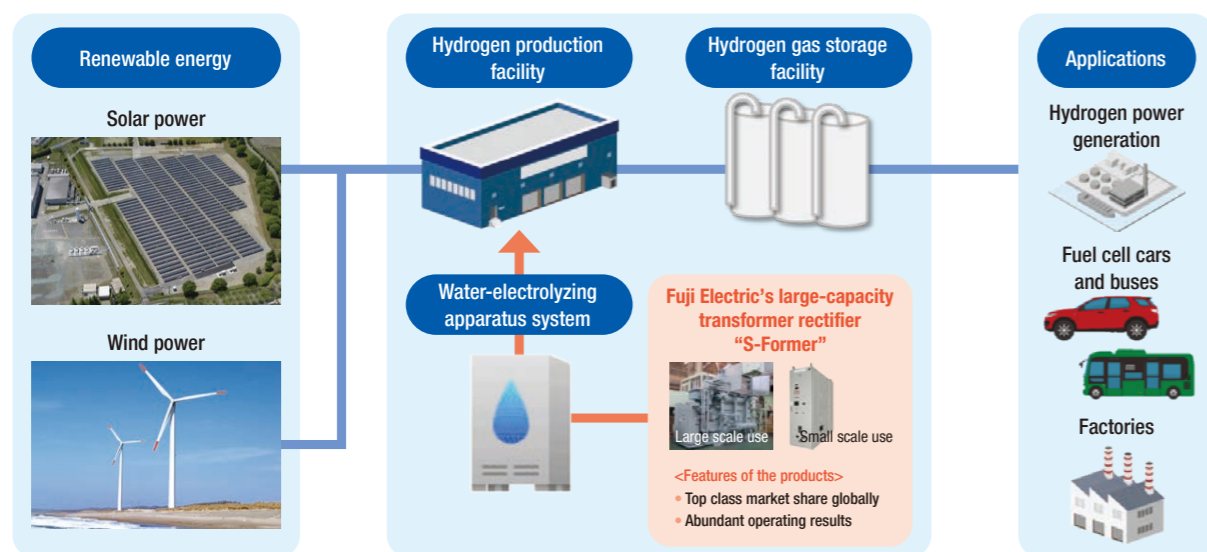
Making clean energy mainstream

Power Supply for Hydrogen Production

Case Study: NEDO Development of Technologies for Realizing a Hydrogen Society

Utilizing Our Results in the Industrial Field to Offer Power Supply for Expanding “Green Hydrogen” Production

Production flow for green hydrogen



Social issues

Hydrogen is gaining more attention as an environmentally friendly clean energy, and the market is growing rapidly, especially overseas. Hydrogen production facilities utilizing renewable energy

produce hydrogen (green hydrogen) by electrolyzing water using a water-electrolyzing apparatus system. This process requires a stable large capacity direct current power supply.

Provided value

Since the 1950s, Fuji Electric has been delivering the large-capacity transformer rectifier S-Former in order to supply power for the refinement process of non-ferrous metals, such as aluminum, copper, and zinc, and chemicals such as caustic soda. Our market share is top class globally, and we are utilizing our unique, outstanding technologies to realize a high level of safety and trustworthiness.

Currently we are also utilizing these technologies in hydrogen production. In 2017, as a part of Development of Technologies for Realizing a Hydrogen Society by the New Energy and Industrial Technology Development Organization (NEDO), Asahi Kasei Engineering Corporation received an order for 10 MW class large-scale electrolysis equipment, then amongst the largest in the world, from Toshiba Energy Systems & Solutions Corporation. Fuji Electric then received the contract for the design and production of the power supply system for the electrolysis equipment and delivered S-Former as the power supply system for the hydrogen production process. We are currently advancing the development

of new products with greater capacities, starting with the 40 MW class and aiming to launch the 100 MW class in the future, for further market expansion, especially in the overseas market.



The S-Former Series delivered for the NEDO Development of Technologies for Realizing a Hydrogen Society (For 10 MW class large-scale water-electrolyzing apparatus system)

Co-creation partner companies and organizations Asahi Kasei Corporation, Asahi Kasei Engineering Corporation

Initiatives for New Markets Case2

Stabilizing the energy supply

Storage Battery System for the Power System

Case Study: Hokkaido Minami-Hayakita Substation (Hokkaido Electric Power Network, Inc.)

Contribution to Expanded Introduction of Renewable Energy Power Generation as Adjustment Capability for the Power System



Minami-Hayakita Substation (Left: exterior view of the building Right: Fuji Electric power conditioning system inside the building)

Social issues

Power generation using renewable energy, such as solar and wind power, is spreading in a number of regions now. In order to stably supply electricity, it is necessary to keep the balance of demand (amount of electricity consumption) and supply (amount of electric power generation) in the power system constant, and to stabilize the frequency, which is the quality of the electricity. The

amount of power generation using solar and wind power fluctuates greatly depending on factors such as the weather and wind speed; therefore, maintaining a constant frequency is an issue, and storage batteries, among other solutions, are seen as being effective as “adjustment capability” for demand and supply.

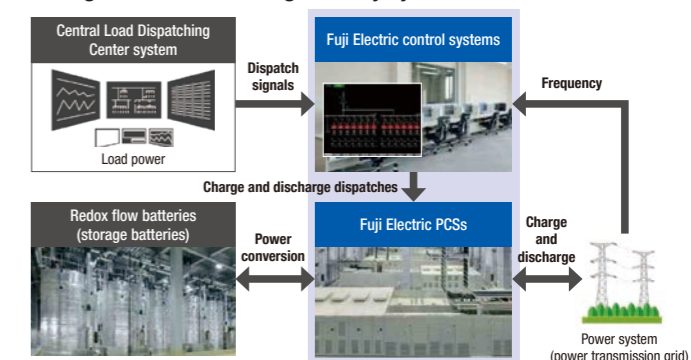
Provided value

Fuji Electric is providing storage battery systems for the power system, which contributes to society as the “adjustment capability” of the power system. Fuji Electric started developing the storage battery system with the application of system stabilization from the 1990s, and since 2015 we have participated in the Large-Scale Storage Battery System Demonstration Project jointly implemented by Hokkaido Electric Power Network, Inc. and Sumitomo Electric Industries, Ltd., building up results quickly. We delivered power conditioning systems (PCSs) and controllers (control panel) comprising the storage battery system using redox flow batteries and with a power storage capacity amongst the largest in the world (60 MWh), and currently it is active as the adjustment capability in Hokkaido's power system.

From April 2024, the supply-demand adjustment market, which trades “adjustment capability” using storage batteries will begin full-scale operation also in Japan. Fuji Electric is intend to provide storage battery systems to business operators, such as trading companies, power companies, oil companies, and

renewable energy companies, to encourage them to enter into the market, contributing to the further adoption of renewable energy power generation.

Configuration of the storage battery system



Co-creation partner companies and organizations Hokkaido Electric Power Network, Inc., Sumitomo Electric Industries, Ltd.

Initiatives for New Markets Case3

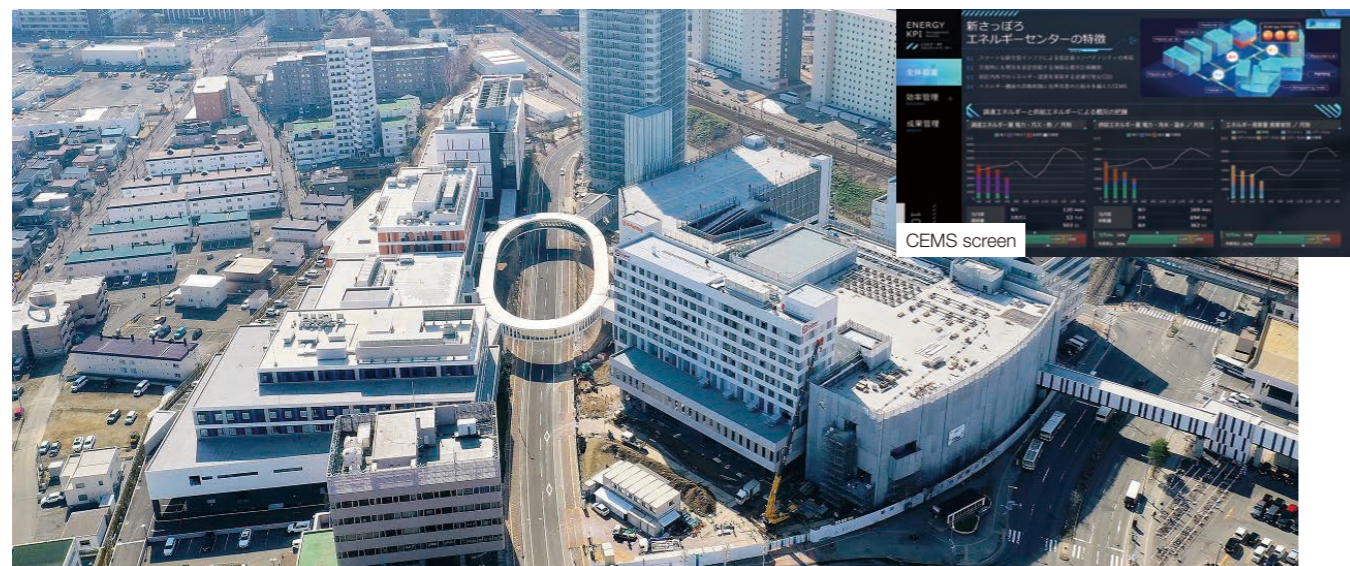
Stabilizing the energy supply

Spreading energy-efficient equipment and systems

### Community Energy Management System

Case Study: The Area in the Vicinity of Shin-Sapporo Station

## Supporting the Efficient Energy Operation of the District and Leading to Decarbonization and Energy Saving



The area in the vicinity of Shin-Sapporo Station

### Social issues

Primarily in redevelopment zones, the adoption of energy saving is being advanced through the establishment of energy centers and centralized management of the energy supply of a district. For example, in cold regions, large amounts of energy are consumed in order to operate the lighting, air conditioning, hot water supply,

melting of snow, and other functions in each facility. For low carbon and environmentally friendly urban development, the issue is how to efficiently utilize the energy used in the district such as electricity and exhaust heat.

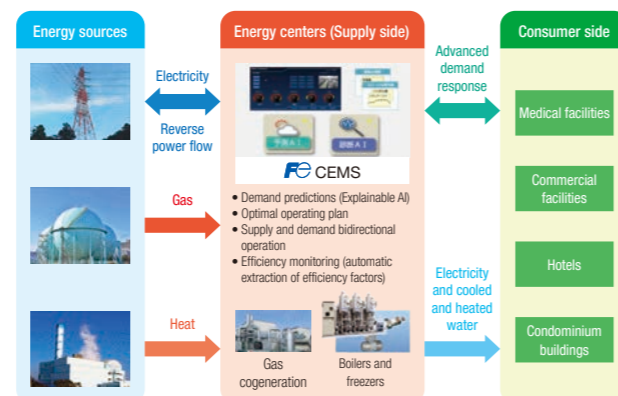
### Provided value

One method of solving this issue is a community energy management system (CEMS), a system for efficiently managing the energy of the whole city. Fuji Electric has participated in a variety of demonstration projects, beginning with the 2011 Kitakyushu Smart Community Creation Project, and it has thus accumulated know-how regarding the optimal operation of energy in a community.

The Shin-Sapporo Energy Center produces the electricity, heated water, and cooled water used in the area in the vicinity of Shin-Sapporo Station using power generators (gas cogeneration) and heat source devices, and Fuji Electric has delivered a CEMS utilizing AI to this location. This system predicts the energy demand of each of the facilities inside the district, such as medical facilities, commercial facilities, hotels, and condominium buildings with high precision, and makes automatic adjustments of both the supply side and demand side of energy based on those predictions, contributing to CO<sub>2</sub> reduction of approximately 35% in the district overall (equivalent to the CO<sub>2</sub> emissions of approximately 1,000 households\*).

\* The Survey on the Actual Conditions of Carbon Dioxide Emissions from Residential Sector conducted by the Ministry of the Environment in FY2019

#### Manage energy optimally through bidirectional coordination with the consumer side



Co-creation partner companies and organizations Hokkaido Gas Co., Ltd., Taisei Corporation

Initiatives for New Markets Case4

Improving the electrification rate

### Onshore Power Supply System, Electric Propulsion Ship

Case Study: Ministry of Land, Infrastructure, Transport and Tourism, Port and Harbour Decarbonization Promotion Plan

## Advancing the Electrification of Ports and Ships to Contribute to the Realization of Carbon Neutral Ports



Ports



Onshore power supply system (exterior view)



Japan's first zero emissions ship, e-Oshima (built by Oshima Shipbuilding Co., Ltd.)

### Social issues

Interest in the decarbonization of ports for the realization of carbon neutrality by 2050 is growing in countries around the world. Oil refineries, power generation plants, iron and steel, and chemical industries, among others, account for approximately 60% of CO<sub>2</sub> emissions in Japan, but most of these are located in coastal areas and use ports for exports, imports, and transportation. In order to

move from conventional fossil fuels to electrification, and achieve further decarbonization, the government of Japan has built a consortium comprised of companies and organizations related to ports and ships and is advancing studies toward the realization of "carbon neutral ports."

### Provided value

Fuji Electric is participating in various councils on carbon neutral ports and is promoting studies aimed at the standardization of its own products and systems.

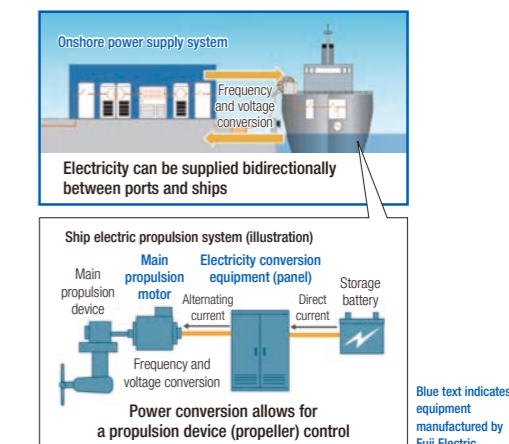
To date Fuji Electric has been tackling initiatives for carbon neutral ports and ships, and the electric propulsion system made by Fuji Electric has been employed in e-Oshima, Japan's first fully battery-powered ship. Furthermore, Fuji Electric is the only manufacturer in Japan to employ a direct current electricity distribution system, and therefore has achieved downsizing and space saving in electricity conversion equipment.

In addition, the onshore power supply system of Fuji Electric is responsible for supplying electricity to ships docked in a port. When a ship docks in a port, the power generator (diesel engine) inside the ship is stopped, and the electricity necessary for the ship is transmitted from onshore, which can contribute to CO<sub>2</sub> emissions reduction. Regarding this system, we will launch new products on the market during fiscal 2023, achieving the industry's top class large capacity and small size.

We will contribute to significant decarbonization through the

building of carbon neutral ports.

#### "Electricity conversion equipment using power electronics technologies" is our core product



Co-creation partner companies and organizations Local governments related to ports, shipping and shipbuilding companies