SanRex LEADING THE NEW POWER ELECTRONICS ▸▸

Green Energy Solutions

2nd ed.

SANSHA ELECTRIC MFG.

Global Power Solution Partner

In a society that is being urged to quickly improve energy efficiency and shift to low-carbon energies to reduce greenhouse gas emissions, Sansha Electric Group steps up as a partner of choice, and introduce value-added equipment in both environmental and technological aspects.

Environmental policy

1 **Observation of environmental laws and regulations**
We will observe environmental laws and regulations and meet equivalent requirements.

2 **Prevention of global warming**
We will work to conserve energy and reduce emissions of substances that cause global warming.

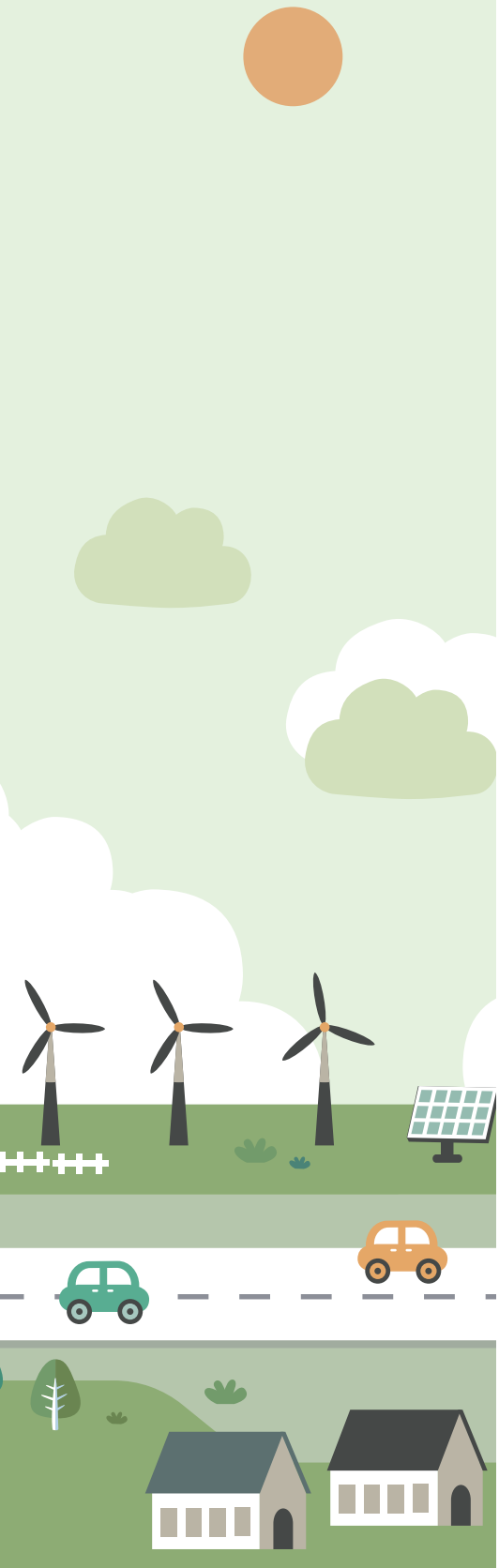
3 **Contribution to a recycling-based society**
We will push ahead with the 3Rs, reduce, reuse and recycle, to realize a sustainable recycling-oriented society.

4 **Reduction of harmful substances**
We will work to reduce emissions of substances that adversely impact the environment and to prevent pollution.

5 **Reduction of the environmental impact of products**
We will always strive to create environmentally-friendly product designs to provide products with little environmental impact throughout their life cycle.

6 **Consideration of biodiversity conservation**
All our personnel will be aware of importance of conserving biodiversity and act in due consideration of it.

7 **Continuous improvement of the environmental management system**
We will be aware of impact our business activities and products have on the environment and work to continuously improve our environmental management system.



Our Strengths

Alliance of Power Semiconductors and Power Supply

Power semiconductors closely control the electric current flow and the voltage level, and they are critical to electric power efficiency and energy conservation.
With the alliance of power semiconductor and power supply equipment, we contribute to a sustainable society, providing power semiconductors for various power supply equipment and a wide variety of industrial power supply equipment ranging from low to high power both domestically and internationally.

Energy solutions using advanced power electronics technology

CREATE energy

- Solar (PV) power generation
- Fuel cell
- Wind power generation
- Equipment for hydrogen generation

STORE energy

- Energy storage system
- Charge-discharge products

SAVE energy
- Use electricity efficiently -

- Uninterruptible power supply
- Plating rectifier
- Welding machine
- Power supply for various equipment

Core Technology

System interconnection | Smart inverters | Battery charging and discharging | Plasma generation | bi-directional power conversion | Combined power module

Power semiconductors for power supply equipment

High-voltage, high-current devices

Next generation power devices

Core Technology

Si mesa structure | Transfer mold structure | SiC | High voltage and high reliability package

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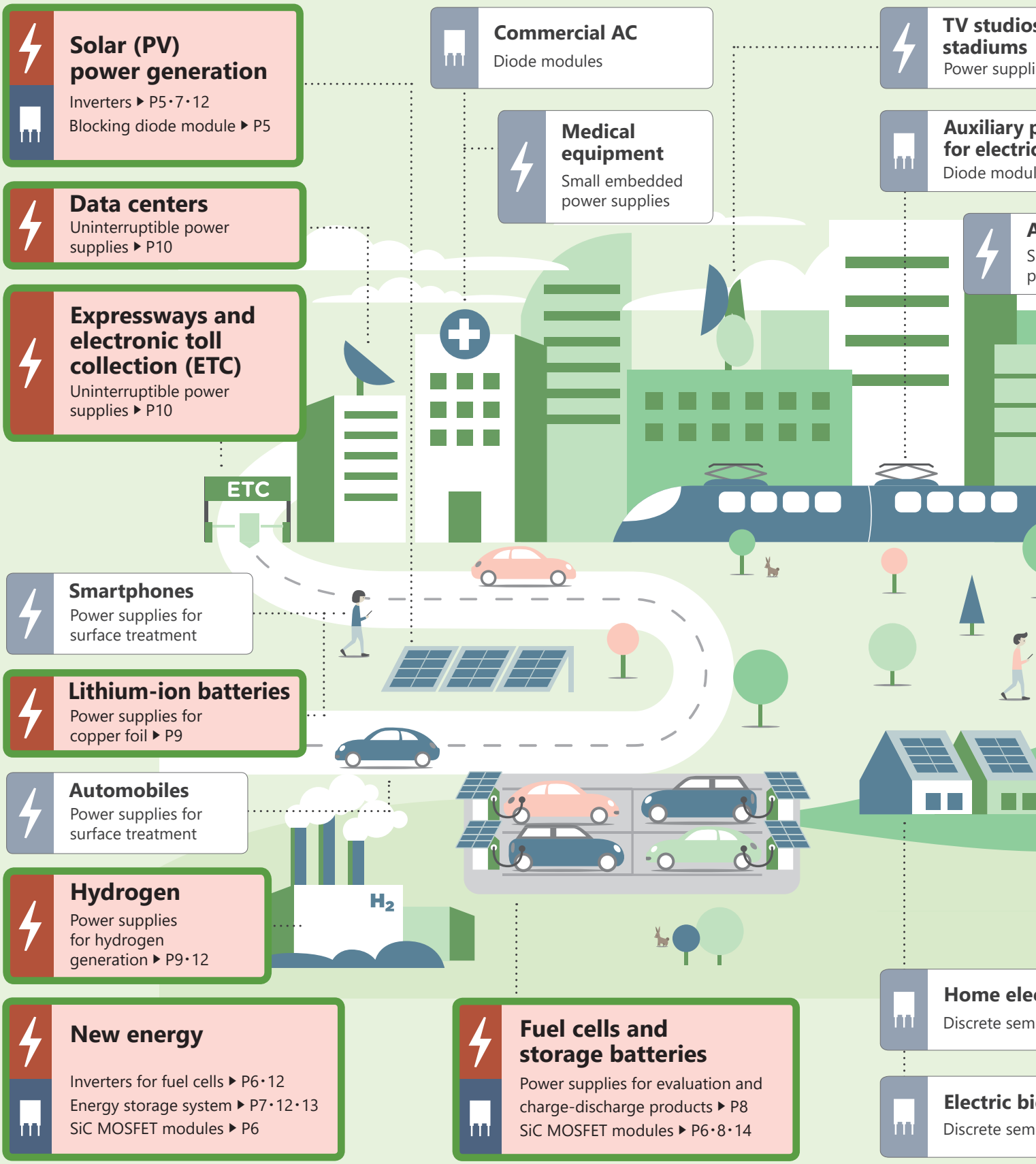
Sansha Electric Products That Support Society

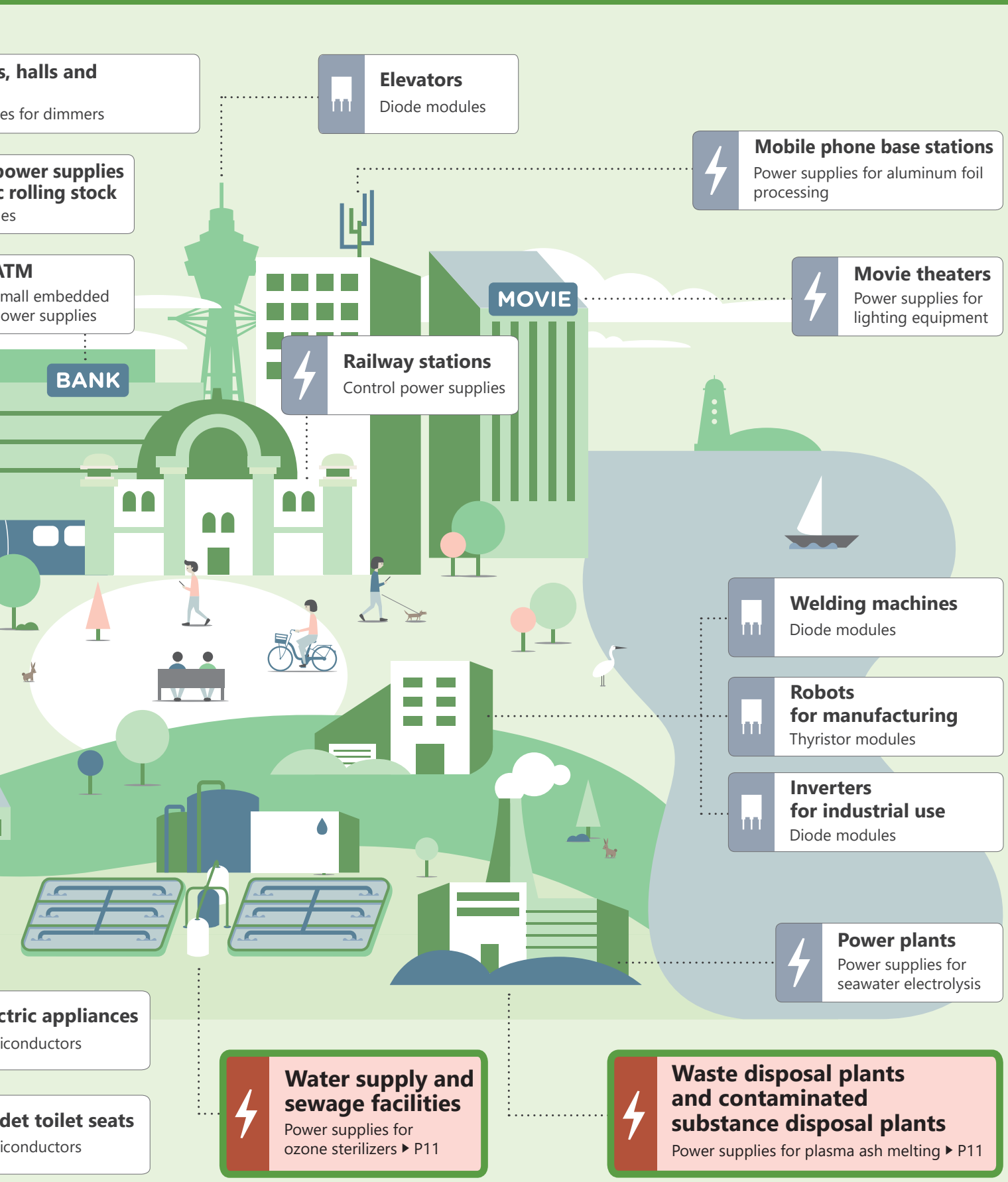


Energy & Environment

Development of high-efficiency power semiconductors and power supplies for renewable and new energy fields such as solar power generation and hydrogen energy, as well as power supplies for evaluation and testing of storage batteries and fuel cells. To contribute to environmental preservation, we have developed power supplies for plasma arc generation and seawater electrolysis to detoxify waste disposal.

Infrastructure

Power semiconductors and power supplies ensuring the long-term, stable operation of infrastructures supporting people lives, including electric, gas and water utilities, rail transportation and logistics. Development of uninterruptible power supplies and other equipment essential to business continuity plans (BCP) in the event of a disaster.



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det toilet seats
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Elevators
Diode modules

Mobile phone base stations
Power supplies for aluminum foil processing

Movie theaters
Power supplies for lighting equipment

Railway stations
Control power supplies

Welding machines
Diode modules

Robots for manufacturing
Thyristor modules

Inverters for industrial use
Diode modules

Power plants
Power supplies for seawater electrolysis

Water supply and sewage facilities
Power supplies for ozone sterilizers ▸ P11

Waste disposal plants and contaminated substance disposal plants
Power supplies for plasma ash melting ▸ P11

Power semiconductors
Are devices that closely control the electric current flow, the voltage level, but also the transformation from an alternating current into a direct current. They are critical to electric power efficiency and to energy conservation.

Power supplies
Refer to systems supplying the electric power necessary for the operation of machinery and equipment for industrial purposes. Using power semiconductors, they efficiently supply stable electric power for a wide variety of applications, including everything from high to low electric power.

Contributes especially to the environment and energy society

Solar Inverter

A solar inverter is a device that convert power generated by solar cells, fuel cells, storage batteries, etc. into grid power.

Functions

■ Power generation control

Inverter function to convert DC to AC
Output power control in accordance with the power generated by solar cells, fuel cells and batteries

■ Operation control

Start/stop operation according to the power generation status

■ Grid interconnection protection

Detect system abnormality and stop operation

CREATE energy

For solar power generation

Our company has established a single-unit, large-capacity solar inverter in response to the growing global "mega-solar" orientation of photovoltaic power generation.

Features

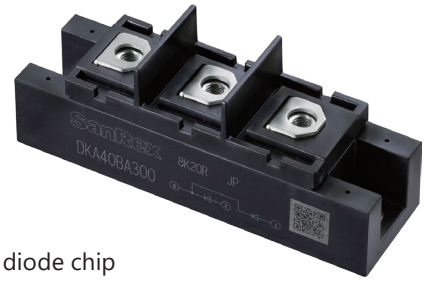
DC power generated from solar panels is converted to AC power and supplied to the grid. MPPT control is used to ensure that solar-generated power is generated at maximum power. Due to the need for resilience, an optional standalone operation function is also available.

For more information, visit our website!
https://www.sansha.co.jp/eng/products/solar.html

Proprietary power semiconductors embedded in our equipment

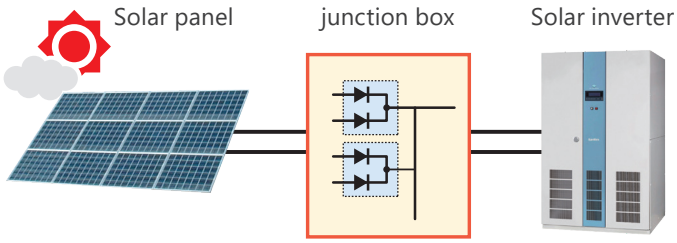
Blocking diode module

The photovoltaic blocking diode requires the use of a product that has a reverse breakdown voltage twice as much as the string voltage in consideration of the safety aspects. Now, with the current trend toward higher voltages in photovoltaic power generation systems, we offer a lineup of bloking diodes with ultra-high reverse breakdown voltages up to 3000 V for use in 1500 VDC strings.



Features

- Low loss and high heat dissipation achieved using a dedicated diode chip
- Unique terminal layout for easy wiring
- Lineup for string voltages from DC450V to DC1500V
- Use of high voltage strings = overall system loss ↓, parallel strings number ↓



For more information, visit our website!
https://www.sansha.co.jp/eng/products/blocking-diode.html

CREATE energy

Inverters for fuel cells

We will contribute to the establishment of a hydrogen society with the inverter technology we have cultivated!

Channeling the technology we have developed for solar inverters over the years, we offer now inverters for fuel cells that use hydrogen, said to become one of the major energy sources present in our societies. We will pursue our efforts in shaping the coming hydrogen society.

Features

- Use as emergency power source
  Standalone operation function ensures continuous supply of hydrogen by generating power even in case of power failure
  Possibility to increase capacity with the parallel operation function during standalone operation
- Numerous track records
  We've been supplying various equipment, from small products of about 3 kW to large products of 250 kW class
  We can also produce hybrid inverters for parallel connection with solar cells, storage batteries, etc.
- High efficiency
  Fuel cell inverters equipped with our SiC MOSFET modules achieve industry-leading conversion efficiency of 97.5% or higher

For more information, visit our website!
https://www.sansha.co.jp/eng/products/solar.html

Proprietary power semiconductors embedded in our equipment

SAVE energy

SiC MOSFET module

SiC (silicon carbide) MOSFET modules offer lower loss and faster operation than conventional Si (silicon), contributing to energy savings in high-current, high-voltage applications.

Features

- Compact and reliable transfer molding*1 package.
- Improved reliability*2, lower loss, and smaller size

*1 Transfer molding is a type of thermosetting resin, molding method in which the material is heated to soften before being press it into a mold

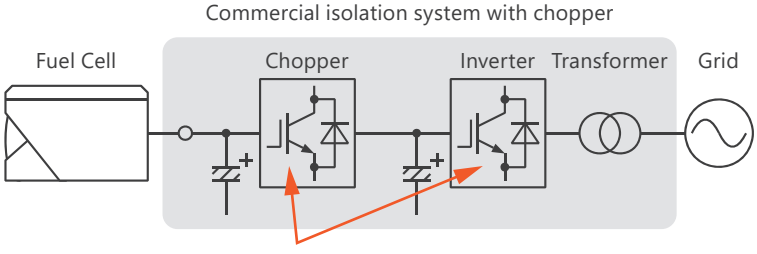
*2 Power cycle endurance is approximately 3 times higher than our conventional products

Our original SiC module

Techno Block series

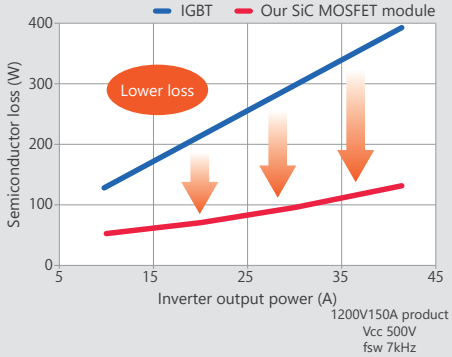
Our original semiconductor package uses transfer molding and both side solder process, achieving small footprint and excellent heat dissipation.

Inverter for fuel cell - Example of installation



For more information, visit our website!
https://www.sansha.co.jp/eng/products/sic-mosfet.html

Semiconductors' power loss comparison - 20kW inverter



STORE energy

Power storage system (Powered by Li-ion battery)

The power storage system charges and discharges energy by receiving commands from an EMS (Energy Management Systems), and is configured for storage batteries, PV panels, solar inverters, EMS, demand measuring devices, etc.

Electricity cost is reduced by leveling the power usage, thanks to the peak shift/peak cut functions used during power peak periods. Additionally, it helps reducing CO2 emissions by using solar panels' electricity for personal consumption, and acting as a backup power in case of emergency conditions.

Optimum use of energy by relying on a power storage system

- ¥ Electricity cost reduction
- Power outage backup system
- Reduction in greenhouse emissions (CO2)

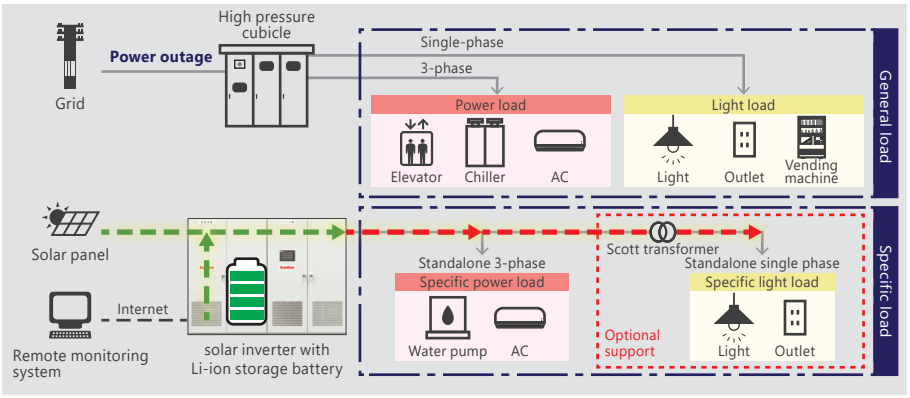
Features

- Parallel operation possible in independent operation mode
  Easily add power storage system as the capacity of the critical load increases.
- Frequency fluctuation support (smart inverter) option
  Supports system stabilization, a foreseen request from the market.
- Virtual power plant (VPP) option
  Can be used in the supply and demand adjustment market.

Typical operation pattern of storage battery system

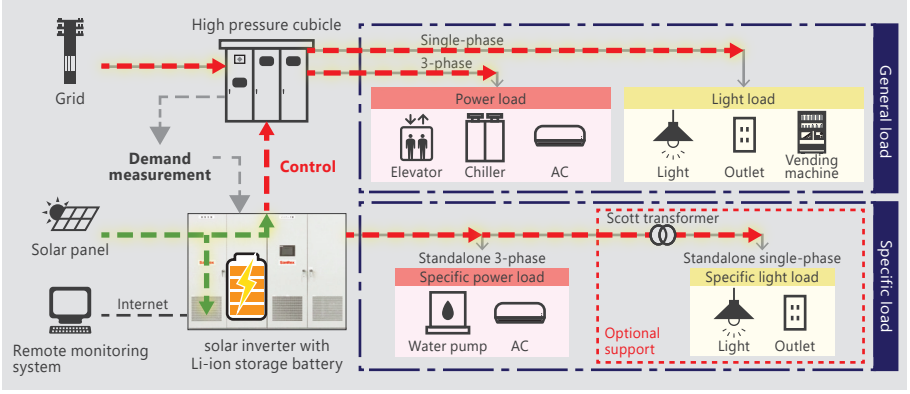
Standalone operation

Shifts automatically to standalone operation in case of power outage, and provides power to the specific load.
During that time, solar panel surplus is stored in the battery, and when there is not enough sun the storage battery assists automatically.
When power is resumed, it shifts to the grid connection.



Self-consumption

It is possible to reduce electricity bill by managing electricity form the solar panels and the storage batteries. Batteries can be charged from PV energy or grid electricity. The demand is constantly measured and current is controlled so that there is no electricity return to the system.



For more information, visit our website!
https://www.sansha.co.jp/eng/products/solar.html

Power Supply for evaluation

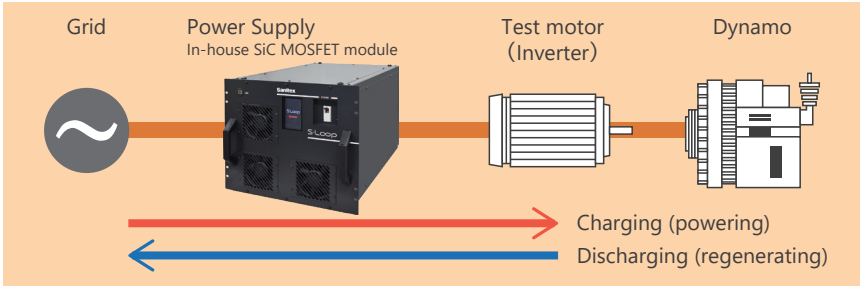
Power Supply for evaluation

Our charge/discharge control technology supports the development of the latest power storage devices and reliability testings!

In recent years, demand for power supplies for testing and simulation of in-vehicle batteries has been increasing as automakers seek to popularize electric vehicles and fuel cell vehicles. Our high-precision, fast-response power supplies for testing and evaluation support the development of power storage devices, inverters for automotive use, DC/DC converters, and so on.

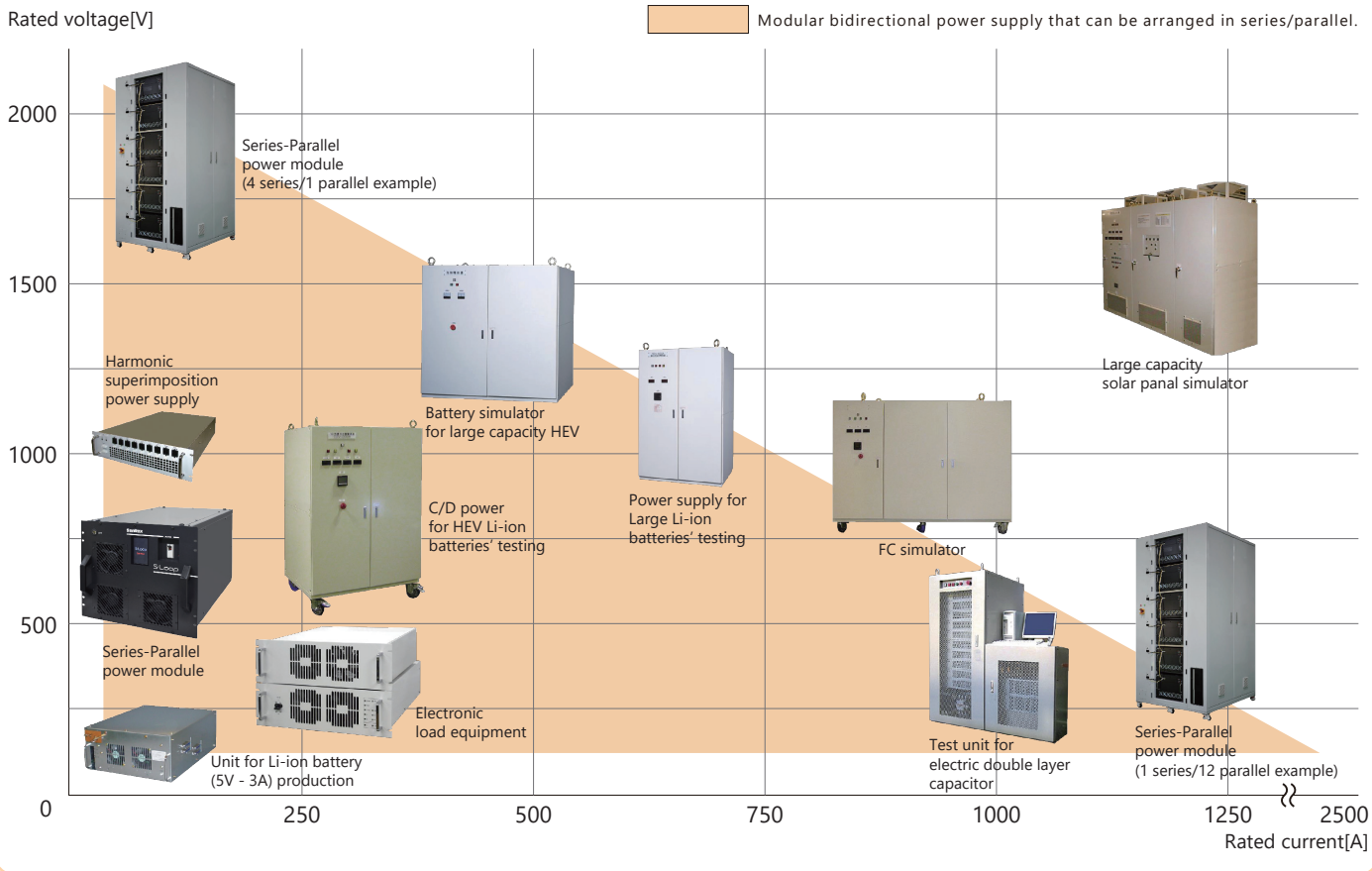
Features

- Supports high-standard requests for accuracy, speedy response, and stability
- Highly efficient operation with minimum power loss thanks to the regenerative bidirectional function
- Small unit thanks to the high-frequency switching method
- Various capacities from a few kW to large products equivalent to 5 MW
- Modular type supports various outputs by series-parallel combination
  30kW 500V 180A : up to 4 series 2000V, 12 parallel 2160A can be provided as desired



Example of use in inverter and motor testing

We also have a wide variety of other power supply equipment for testing and evaluation of storage batteries and inverters.



For more information, visit our website!
https://www.sansha.co.jp/eng/products/evaluation/

Industrial power supply

Installations that fully use proprietary power semiconductors (modular type, large capacity flat type) to convert grid power into direct current, alternating current, at high voltage, large current, etc. Our power electronics technology has been used for many years in various industrial scenes and applications.

Functions

■ Stable control of generated power

Converter or inverter function to convert to either AC or DC

■ High efficiency

With our know-how, we also produce built-in components such as semiconductors and transformers

■ Harmonic suppression

Equipped with multi-phase rectification system and high power factor converter

CREATE & **STORE** energy

Power supply for hydrogen generation

Help building a hydrogen society with a wide range of water electrolysis power sources, from small on-site units to large scale projects!

Hydrogen, which is considered essential for decarbonization, is produced by supplying a stable current to a water electrolysis system. From research applications to large sites, we can offer many solutions ranging from general-purpose power supplies in direct/parallel to megawatt-class power supplies.

Features

- ■ Supports large currents
  50,000A track record (current increase with parallel connection)
- ■ Robustness
  Sealed structure, container enclosure to protect from environmental elements
- ■ High efficiency
  Unique circuit configuration for the best results
- ■ General-purpose module power supplies can support various outputs by series-parallel combination
  15V500A : Up to 4 series 60V, 8 parallel 4000A can be provided as desired
- ■ Control method
  We select the most suitable method (thyristor or switching type) according to the project

For more information, visit our website!
https://www.sansha.co.jp/eng/products/high-capacity.html

CREATE & **STORE** energy

Power supply for copper foil

High-current power supply unit contributes to the popularization of lithium-ion batteries!

We have developed a high-efficiency, high-current power supply system for the creation of electrodeposited copper foil used in the anode material of lithium-ion batteries, contributing to the widespread use of electric vehicles and energy storage facilities.

Features

- ■ High current capability
  120V 50,000A track record (20kV input available)
- ■ Robustness
  Seal structure with closed circulation ventilation and water cooling system
- ■ High efficiency
  Unique circuit configuration for the best results

For more information, visit our website!
https://www.sansha.co.jp/eng/products/high-capacity.html

STORE energy

Uninterruptible Power Supply (UPS)

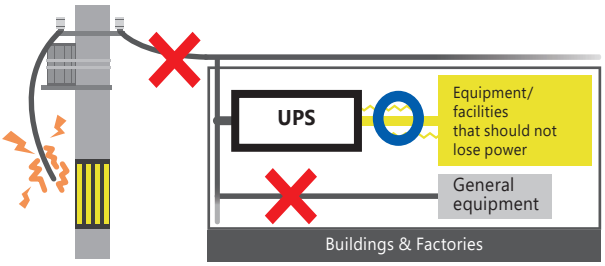
Backup for voltage sag or power outages in increasingly sophisticated industrial installations

The damage caused by the power outages of data servers and various communication devices that support the ever-expanding advanced information society is immeasurable. Highly reliable UPS that backup the power supply for these systems are used as a BCP (Business Continuity Plan) measure.

Features

- Industry-leading overload capacity
- Auto return function to continue operation in the event of overload
- Meticulous service life management of parts
- Supports lithium-ion batteries (peak shift function, etc. can be installed)
- Outstanding integrated domestic production
- In addition to the standard model, other systems with features such as reliable redundant operation and efficient continuous transmission system are available

UPS is a safe bet in an emergency situation



Install UPS in installations for which power continuity is critical

- Elevator
- Water pump
- General lighting
- Transport machines, robots
- Kitchen appliances (refrigerator, freezer)
- General equipment (TVs, vending machines, etc.)
- Information equipment (servers, telecommunications, etc.)
- Surveillance equipment (cameras, auto locks, audio equipment)

■ Praised for its reliability, our UPS are installed in various industrial scenes.

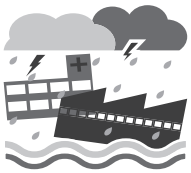
Traffic control | Production line | Broadcast | Hospital | Bank

Gas | OA | Data center | Public facilities Water and sewage treatment | Power generation plant Electricity

For more information, visit our website!
https://www.sansha.co.jp/eng/products/ups.html

What is BCP?

Short for "Business Continuity Plan", this plan defines the activities that should be carried out under normal circumstances and the methods and means for business continuity in emergency situations, in order to minimize damage to business assets and enable the continuation or early recovery of core businesses. These emergency situations encompass natural disaster, major fire, terrorist attack, or other emergency situations.



Contribution to environmental protection

Ozone generating power supply

Ozone sterilization by high-voltage, high-frequency power supply helps maintain the water environment!

Ozone has a strong oxidizing power and decomposes organic substances (musty odor substances, substances that cause color, pesticides, etc.) in the water, so it has effects such as sterilization, decolorization, and deodorization. Ozone is generated by applying a high frequency high voltage to the discharge tube. By developing a power source for that purpose, we are contributing to the improvement of the water environment.

Customer: Sumitomo Precision Products Co., Ltd.

Features

- From small products for pools (several kW) to large products for waterworks and sewage plants (several hundred kW)
- Stable high-frequency, high-voltage AC output
- Highly efficient operation through automatic control of resonance frequency
- Small unit thanks to the high-frequency switching method

Applications

It is used to maintain the water quality environment at public facilities such as water purification plants and sewage plants throughout Japan, as well as at private chemical plants. In addition, we have delivered our products not only in Japan but also to China and other Asian countries and North America, where environmental problems are becoming more apparent.

For more information, visit our website!
https://www.sansha.co.jp/eng/products/high-capacity.html

Power supply for plasma arc generation

Detoxify waste including heavy metals and PCBs (polychlorinated biphenyls)!

By melting the incinerated ash after incinerating waste using a higher temperature plasma arc, the generation of dioxins and the like is suppressed, and the detoxified grains called "slag" are used as civil engineering and building materials. Will be reused. It is also used to detoxify waste such as heavy metals and PCBs.

Features

- Stabilize plasma arc by high-speed control
- Small unit thanks to the high-frequency switching method
- Full digital control simplifies operation and maintenance and brings high-precision control

Applications

We have a large number of deliveries to general waste incinerators nationwide, such as the Chiba Prefecture Shinko Cleaning Factory. We also delivered it not only this system to a waste disposal site in Jiangsu Province, China, where environmental problems are increasingly problematic.

For more information, visit our website!
https://www.sansha.co.jp/eng/introduce/waste-plant.html

Track Records

CREATE & **STORE** energy

Storage battery/fuel cell/water electrolyzer combined system

Customer

Iki City, Nagasaki
Solar + Hydrogen Storage System Demonstration

System breakdown

1. DC/DC converter for solar cell 200kW
2. DC/DC converter for storage batteries 20kW
3. DC/DC converter for fuel cell 8kW x 2
4. DC/AC inverter for load 20kW
5. DC/DC converter for water electrolysis 80kW

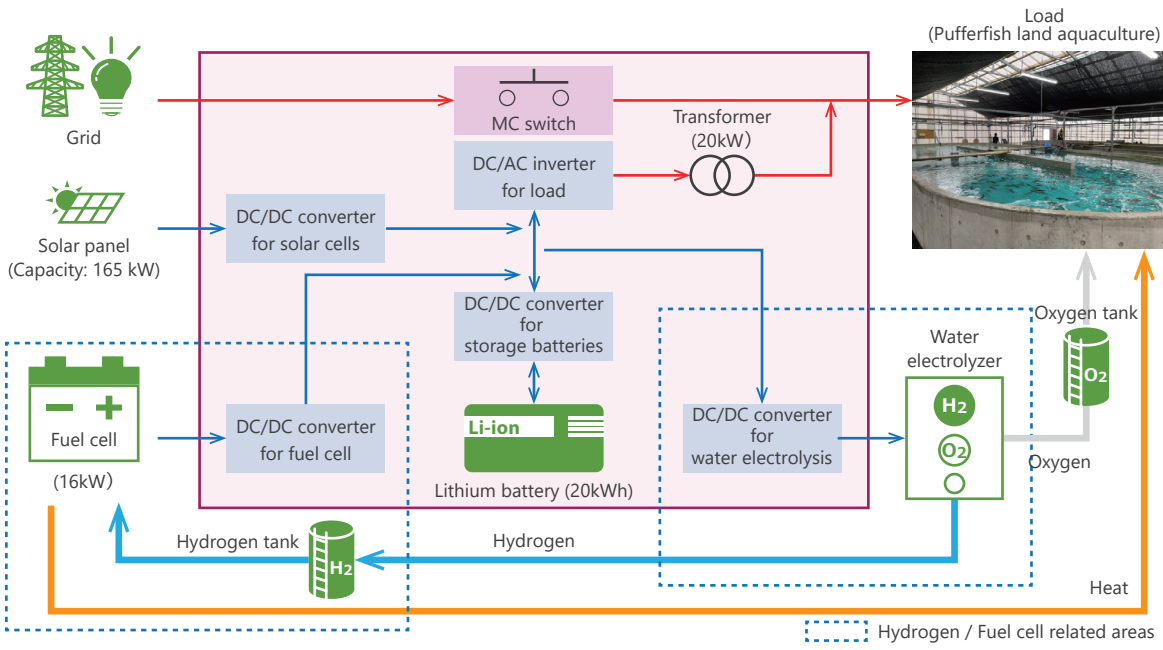
Project scope

In September 2019, Iki City declared a climate emergency for the first time in Japan in a context of serious impact of climate change on the fishing industry, which is one of the city's main industries. As one of the efforts, we have been conducting a demonstration of a system that uses hydrogen produced using solar energy as fuel to generate electricity from FY 2020. The project is set at the onshore farm of Fugu. We used several equipment necessary to this experiment: converter for solar cell, converter for fuel cell, converter for water electrolysis, etc.

Outcome

Electricity generated by the solar panels and the power conversion from storage batteries and fuel cells is used to drive the water tank circulation pumps, maintain the oxygen concentration in the water tank with oxygen derived from renewable energy, and maintain the water temperature with the heat generated as a byproduct.

Power consumption stabilization system (equipment supplied by SanRex)



- DC / DC converter for solar cells: Performs photovoltaic power generation by maximum power point tracking control (MPPT).
- DC / DC converter for fuel cell: The power from the fuel cell generated by hydrogen and oxygen is supplied to the DC / AC inverter by this DC / DC converter.
- DC / DC converter for storage battery: The photovoltaic as surplus is charged to the storage battery, and power is supplied to the DC / AC inverter that powers aquaculture ponds when there is little sunlight.
- DC / AC inverter for load: Generates AC power to supply electricity to the circulation pump of the aquarium even in the event of a power failure.
- MC switch: Under normal conditions, solar power, fuel cell, and storage battery power are used to supply electricity to the farming equipment, and when bad weather continues and hydrogen and storage battery power are depleted, it switches to use power from the grid.
- DC / DC converter for water electrolysis: Photovoltaic power surplus is used to generate power (voltage) to supply to the water electrolyzer.

Track Records

CREATE & **STORE** energy

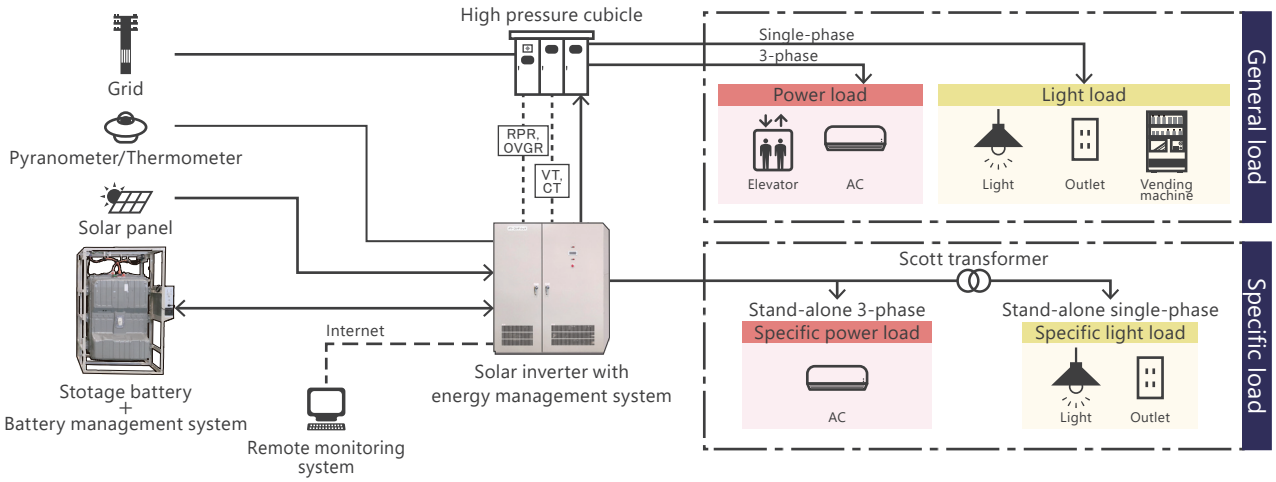
Inverter for storage battery - 49.9 kW Li-ion battery 24kWh

Customer DAI-DAN CO., LTD. (Construction company)

Project scope Under the ZEB (Zero Emission Building) policy set in cold regions, Dai-Dan Co., Ltd. decided to rebuild its aged Hokkaido office branch and selected our power storage system (equipped with lithium-ion batteries) for the following points it could fulfill:

1. Selling excess power
2. Automatic switching to self-consumption when output suppression is working
3. Environmentally friendly system using reuse storage batteries

Outcome Efficient charging of solar panels power with the direct connection of storage batteries and solar panels.



For more information, visit our website!
https://www.sansha.co.jp/eng/case/case04.html

CREATE energy

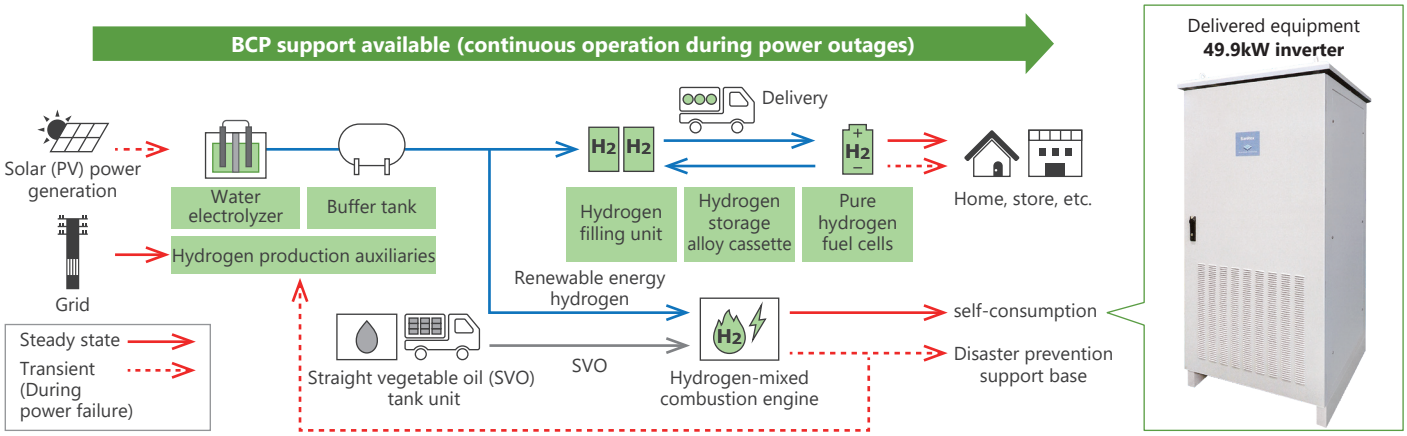
Rectifier + inverter for biogas power generation 49.9 kW

Customer Tomiya City, Miyagi Prefecture: additional low-carbon hydrogen supply chain demonstration plant

Equipment Rectifier and power inverter for stationary operation

Project scope Tomiya City has been promoting a low-carbon hydrogen supply chain demonstration project since FY2017. in FY2021 they added another equipment: a hydrogen co-firing generator that produces electricity by mixing hydrogen with a combination of waste cooking oil and light oil. In order to consume the electricity generated from this hydrogen co-firing generator in-house, we supplied a rectifier and an inverter.

Outcome The system interconnection is not possible with the hydrogen co-firing generator alone. In order to consume the power of the generator in-house, we introduced our rectifier and inverter, and converted the power to direct current, which enabled grid interconnection operation.



Evaluation system for inverters

Customer

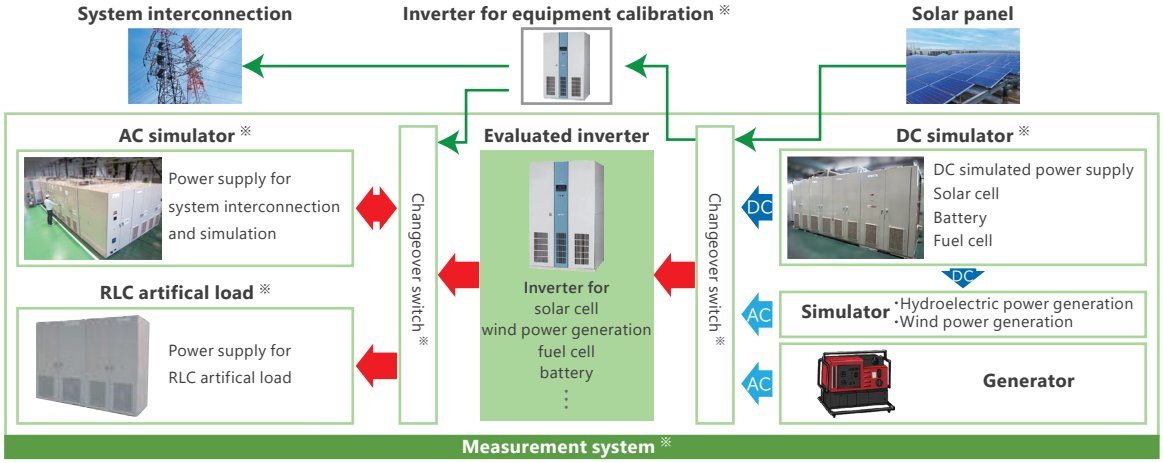
The National Institute of Advanced Industrial Science and Technology (AIST)
Fukushima Renewable Energy Institute (FREA)

Project scope

To promote the roll out of renewable energies in Japan and overseas, the FREA develops solar and wind power generation, hydrogen usage and geothermal energy management, as well as peripheral technologies. We have installed our 5MVA simulator system, fruit of our technological know-how, to accurately reproduce the characteristics and behavior of each energy source towards inverters.

Outcome

Simulator systems are essential for testing and evaluating grid-connected inverters. We now also offer verification and evaluation tests of large-capacity grid-connected inverters of the 3 MW class.



※ Equipment manufactured by SanRex.

For more information, visit our website!
https://www.sansha.co.jp/eng/case/case02.html

STORE energy

Virtual power plant

Since July 2016, the company is participating in the Virtual Power Plant Construction Demonstration Project, subsidized by the Ministry of Economy, Trade and Industry's Agency for Natural Resources and Energy, in collaboration with 14 other companies. The aim of the project is to come up with a new, unconventional energy management system and build an energy infrastructure that contributes to efficient energy use in our societies.

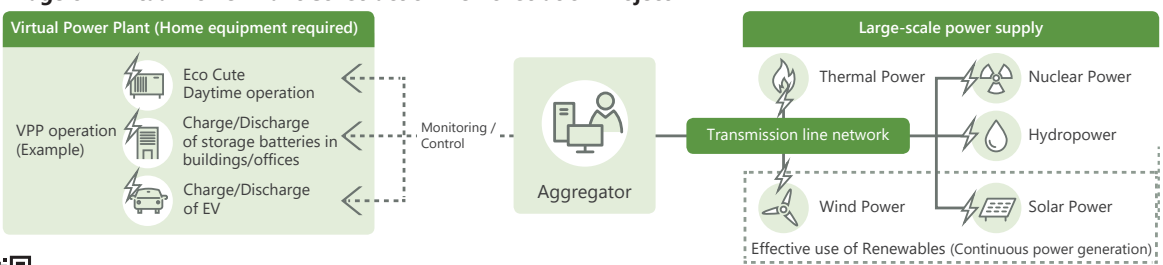
Shiga plant

Headquarters

What is a Virtual Power Plant?

The virtual power plant is a system that functions like a single power plant by using new information technologies such as IoT to integrate and remotely control multiple small-scale power generation and storage facilities scattered around homes, buildings, factories, etc., instead of large-scale power plants.

Image of "Virtual Power Plant Construction Demonstration Project"



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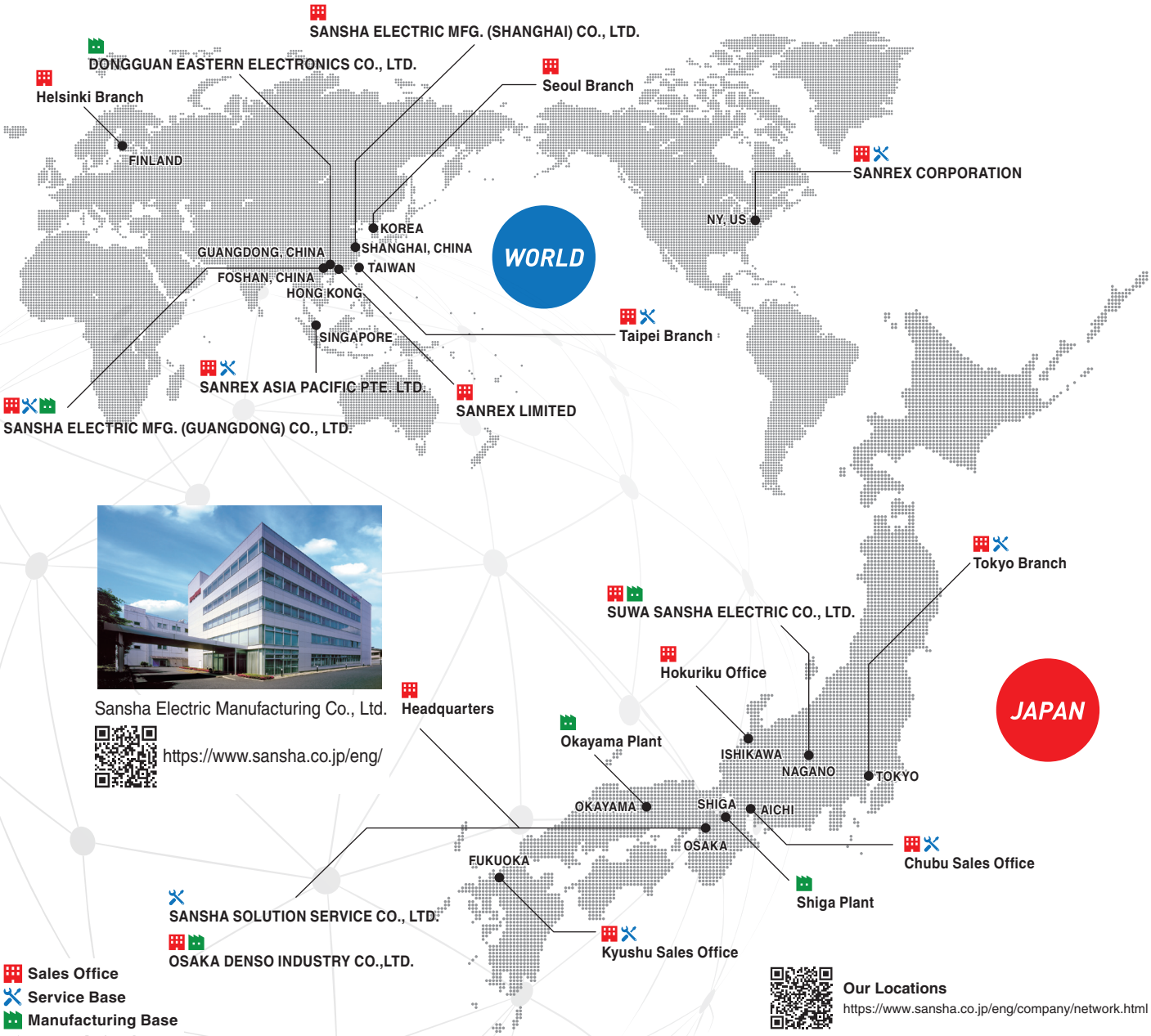
SanRex



Sansha Electric Manufacturing Co., Ltd. **Headquarters**

https://www.sansha.co.jp/eng/

Our Locations
https://www.sansha.co.jp/eng/company/network.html

We can also customize to your requirements. Please feel free to contact us.

Inquiry
https://www.sansha.co.jp/eng/contact/

Attention Read and understand the entire Operating Manual and your employer's safety practices before installing, or using the equipment. Do not install the equipment in an area where water, high humidity, steam, dust or oil are located. It may cause damage to the equipment or result in a fire or electrical shock.

If the product is intended to be used for any of the following applications, consult us in advance.
a. Use for medical devices, systems, etc. directly influence human lives
b. Use for transportation systems such as electric trains, elevators, etc. that can lead to damage to human bodies
c. Use for trunk systems that play important roles socially and publicly
d. Devices and systems that are similar to any of the above

For devices and systems that are involved in the safety of people and have serious influence on the maintaining of public functions, special considerations are required to be given to their operation, maintenance, and management, such as multiplexing of systems, installation of power generation equipment for emergency use, and the like.
Even in the case of an accident caused by our product, we are not in a position to make compensation for any and all damages including damages related to abnormality and failure of devices, connected equipment, and software as well as other secondary and consequential damages.