

**Feature
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Environmental Technology of the Sanden Group

The Sanden Group Contributes to Society through Technology, Ideas, and Innovation

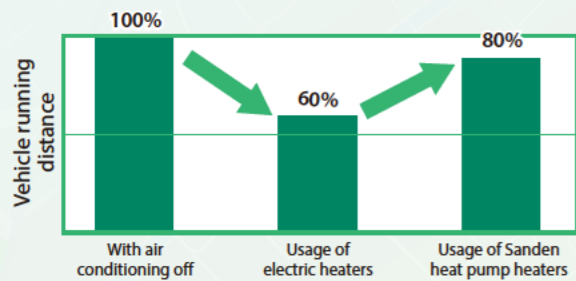
The environment is one of the material CSR domains in which the Sanden Group responds to the trust and expectations of stakeholders. Supporting Sanden's activities in this domain are its capabilities for deploying original environmental technologies, ideas, and innovativeness. In this second case study, we will introduce actual examples in several business domains.



1 Automotive Systems Business Car Air Conditioners

Heat Pump Systems for Car Air Conditioners
Along with the rising interest in the environment on a global scale, progress is being made in expanding the usage of environment-friendly vehicles, including hybrid cars and electric-powered automobiles. However, as a result of the shift to electric-powered systems, it is no longer possible, especially on electric-powered

■ Heat Pump Systems



vehicles, to use exhaust heat because they do not have internal combustion engines. As a consequence, heat sources for heating systems are insufficient. Normally, vehicles would make use of electric heaters for supplementary power, but, since this would make use of power from the drivetrain batteries, the problem is that the feasible vehicle running distance is reduced.

To solve this problem, Sanden's Automotive Systems Business makes use of the technology it has developed for automatic vending machines, for heat pump hot water systems, and other applications. This technology has also been applied in the development of Sanden's original Heat pump a/c system for automobile. Under this system, the heat in the air outside the vehicle is absorbed by the coolant, and, with relatively little energy usage, it is possible to use this limited energy efficiently for cooling.

Air-Conditioning Systems for Parked Trucks

Sanden's Automotive Systems Business has developed a new Integrated Parking Cooling (IPC) system that can be installed in vehicles during the assembly process for a European truck manufacturer.

In Europe, as a result of the environmental restrictions of countries in the region, when of the vehicle engine stops, the vehicle air-conditioning system is operated with an electric-powered compressor. This system thus contributes to reducing fuel consumption and increasing driver comfort.

- Maintain comfortable vehicle air-conditioning level while parked



2 Automotive Systems Business Compressors

Electric-Powered Compressors

To realize a society where automotive transportation is environment-friendly, the world's automobile manufacturers are developing and marketing vehicles that respond to the need to reduce the burden on the environment. These include hybrid cars, electric cars, fuel cell vehicles, and other automobiles.

Sanden's Automotive Systems Business has been developing and marketing Electric compressors for automobile air conditioner since 2009. In general, belt-driven compressors take power from the engine, and, when the engine stops, the air conditioner ceases to function, but electric-powered compressors, which do not depend on the engine for power, can maintain optimal



Electric Compressor

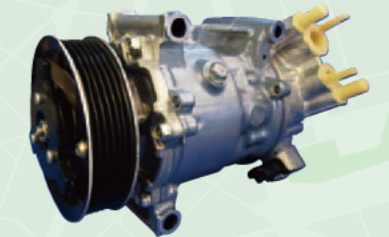
air-conditioning functions and comfort in the vehicle, while also showing superior fuel economy performance. Sanden's Electric compressors have been adopted by domestic and overseas customers, including Daimler AG.

Compact and Lightweight Compressors

In the Automotive Systems Business, Sanden has developed and sold compressors for automobile air conditioners that are 25% lighter than Sanden's previous models.

In the new compressors, Sanden has changed the material for the parts that transfer the motive power of the engine's rotation to internal equipment to a plastic material and changed the structure that controls the movement of the pistons. As a result, Sanden has succeeded in making the units more compact and lighter in weight.

Increasing fuel economy is an issue that all automobile manufacturers are addressing. Making compressors more compact and lighter will contribute to improving fuel economy as well as reduce the burden on the natural environment.



Compact and Lightweight Compressor

■ Sanden's Value Chain and CSR Activities

Column
● **Initiatives Related to Conflict Minerals**
In January 2013, Article 1502, which is related to conflict minerals, of the U.S. Financial Regulation Reform Law (Dodd-Frank Act) went into effect. Although the Sanden Group is not listed on U.S. securities exchanges, as a member of the supply chain providing goods to companies that are listed in the United States, we are aware that the issue of conflict minerals may be material. To enable customers to use Sanden products without concerns for this issue, Sanden cooperates with its business partners and has conducted investigations regarding the sources of conflict minerals in the Republic of the Congo and other neighboring countries and has given its response regarding this matter.

Column
● **Material Flow-Cost Accounting (MFCA) Activities**
The Sanden Group has adopted MFCA accounting standards for its business locations and parts manufacturing subsidiaries and affiliates since fiscal 2005 and has implemented initiatives to reduce the burden their activities place on the natural environment. The expenses related to losses arising from product manufacturing are analyzed as negative product costs. Negative product costs that arise from reductions in materials and changes in blueprints as well as cuts in manufacturing wastes in the production processes are restrained, and efforts are made to use assets efficiently and lower the usage of waste materials and energy.



3 Commercial Store Systems Business Automatic Vending Machines



The automatic vending machines developed and manufactured by Sanden's Commercial Store Systems Business use CO₂ refrigerant in virtually all models in the product lineup. These machines achieve top-class energy conservation and environmental performance in the industry. In addition, by incorporating unique features, the products contribute to society.

Vending Machines with Digital Signage

Sanden's "Smart Vendor" incorporates digital signage systems that were developed jointly by V-Sync Co., Ltd. and Intel Corporation. This machine also display information, including text and voice data, in multiple languages, on traffic conditions, events, tourist attractions, shopping, and other topics. In addition, this machine can also offer Wi-Fi free of charge and have high-level security system, including face recognition capabilities.

Vending Machines with Features for Times of Disasters

Sanden's "Eneranger" vending machines have lifeline features for times of emergency, and can dispense products during power outages and other disaster-related conditions. Eneranger units have power generation and power storage devices, and, during power outages, users can turn the handle to generate electric power, store it, and obtain products from the machines. Since these units can generate power at any time, they can be used without concern even if power outages last several days. By using a high-capacity double-layered capacitor, the units can generate and provide electricity quickly; this restrains deterioration caused by generating and discharging electricity and enables the machines to provide services over a long useful lifetime. These units remain usable even in times of disaster, thus providing peace of mind for users.

Sanden began to display these Eneranger vending machines in 2011, and, today, more than 10,000 units have been installed and are in use. At the time of the heavy snows in the Kanto region in 2014 and following the Kumamoto earthquakes in 2016, these Eneranger vending machines installed in inns and government offices proved themselves useful to everyone during times of such natural disasters.

Vending machines with radio features provide disaster-related information and instructions on places to go for refuge via the radios installed inside. These units were developed to lend a helping hand in providing security in regional areas when needed.

4 Commercial Store Systems Business Retail Store Showcases



Showcases that Use Natural Refrigerant CO₂

The Commercial Store Systems Business is promoting product development and customer support with the objective of adapting to the recycling society. Sanden is promoting the use of its retail store showcases that employ its energy-conserving, high-efficiency compressors that use CO₂ as a natural, environment-friendly refrigerant.

The image of CO₂ as the cause of global warming is strong, but when used as a refrigerant, CO₂ does not destroy the ozone layer but has the least effect on global warming and is environment-friendly.

However, CO₂ used as a refrigerant has relatively low heat exchange ratios compared with other alternative refrigerants in general use. Nevertheless, Sanden has been able to develop systems that have efficient cooling properties through a combination of its technologies. These include a high-efficiency compressing system and heat exchange using Sanden's original technology, its original compressing control technology used for a separate system, and other technologies.



Digital Signage Vendor "Smart Vendor"



Emergency Lifeline Defense Featured Vending machine "Eneranger"



Vending machine with radio features for times of disaster



Multi-shelf open showcase



Island Open Case



Sanden Receives Minister of the Environment Award

19th Annual Award for Protection of the Ozone Layer and Preventing Climate Change

In September 2016, Sanden received one of the highest level awards, the Minister of the Environment Award, among the Awards for Protection of the Ozone Layer and Preventing Climate Change in a contest sponsored by *Nikkan Kogyo Shimbun*. The award recognized Sanden for its "Development and Commercialization of CO₂ System for Compressor Built-in Type and Separate Type" for use in convenience stores, drugstores, and other applications.

Showcases that display beverages, dairy products, and other items are divided into two categories: namely, those where the freezer unit is inside the showcase and those where it is separate. Sanden was recognized for commercializing systems that can be used in either of these applications and also employ CO₂ as a refrigerant.

Under Japan's Freon Discharge Restraint Law, the usage of non-freon cooling equipment has spread among convenience stores, beverage manufacturers, and other enterprises. As of fiscal 2015, the number of stores adopting showcases with such cooling systems had exceeded 100. Also, the number of such units delivered in Japan on an accumulated basis has reached 2,000.



Column 3R Activities

In the Commercial Store Systems Business, Sanden is taking initiatives under its "3R Activities," with the aim of adapting to the recycling society. The 3R Activities aim at facilitating Reducing, Reusing, and Recycling Sanden products.

Through the periodic maintenance of store equipment and fixtures, it is possible to "reduce" breakdowns and lower energy usage through more-efficient operation.

Similarly, in many cases, such as the opening of new stores, remodeling, and store closure, Sanden works to "reduce" gas emissions and waste disposal volume through joint deliveries and simultaneous removal.

In addition, "reusing" equipment and fixtures, which are assets of retail stores, after restoration to near their original condition, lowers the initial costs of the next store. Through these 3R Activities, Sanden is working to realize simultaneously reductions in the burden on the natural environment and make economical operations possible.

Sanden's Value Chain and CSR Activities

