Effective Action on Global Warming Prevention

by Japanese Electrical and Electronics Industries

Our Initiatives toward Creating a Low Carbon Society

Liaison Group of Japanese Electrical and Electronics Industries for Global Warming Prevention

1 Our Recognition of Urgent Challe

World Trends Surrounding Global Warming

The Paris Agreement came into effect in 2016 with the long-term goal of keeping the global average temperature rise well below 2°C above pre-industrial levels, aiming to achieve net zero greenhouse gas emissions during the second half of this century. Also, one of the UN's Sustainable Development Goals (SDGs), which came into effect in the same year, is to implement climate change measures.
Japan, under the "Plan for Global Warming Countermeasures" approved in a Cabinet meeting in 2016, has set a mid-term goal of reducing greenhouse gases by 26% from FY2013 levels by FY2030 , as well as emissions reduction targets for individual sectors (industry, business, household, transportation and energy conversion) by 2030, toward achieving that goal.
In accordance with these domestic and international trends, industries and companies in Japan are working to prevent global warming on a society-wide as well as a global level in cooperation with various sectors.

Missions of Electrical and Electronics (EE) Industries

Providing a wide range of products and services to all sectors

Japanese EE industries supply a variety of products and services (appliances, devices, solutions, etc.) to many sectors, including industrial, business, household, transportation and energy conversion sectors. With such characteristics in mind, we aim to contribute to the prevention of global warming, while having our sights set on the entire value chain.

Fig. 1 Results of amount of investment in energy savings and cumulative energy savings (CO_2 emission reduction)

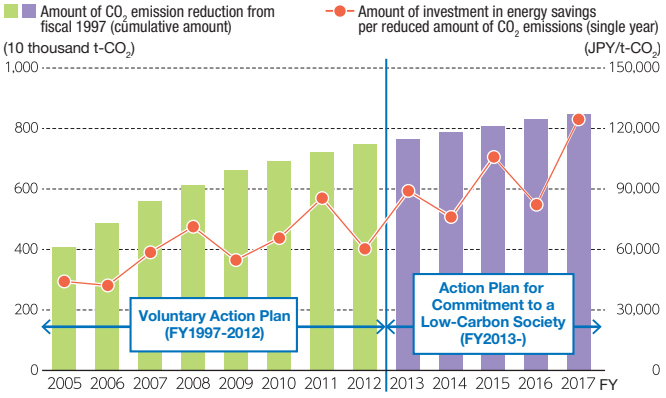
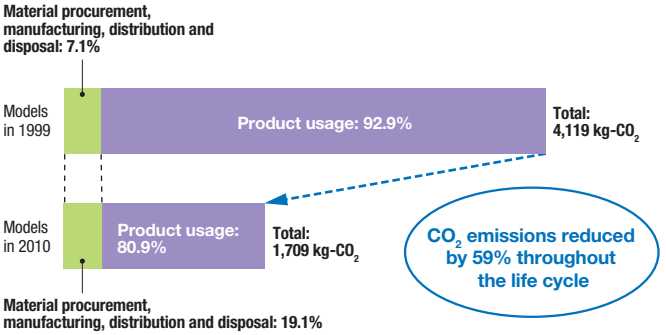


Fig. 2 Comparison of CO_2 emissions in a life cycle (e.g. refrigerators)

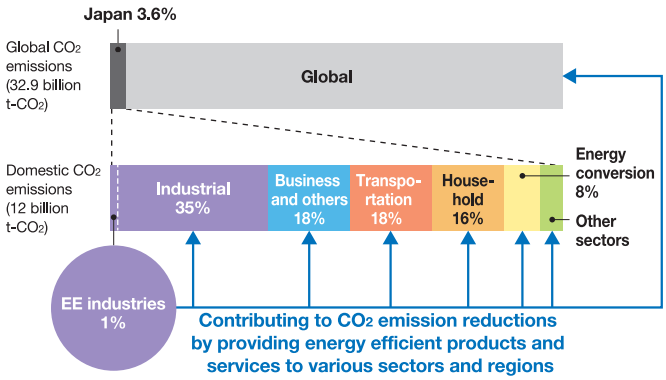


Source: The Japan Electrical Manufacturers' Association

Contribution throughout the value chain

Japanese EE industries have continued to implement energy-saving measures in the production stage and have strived to manufacture products in an energy-efficient manner while showing an increasing trend in investment amount per CO_2 reduction amount. (Fig. 1)
On the other hand, comparison of CO_2 emissions at each stage in the life cycle of products shows that some products such as household appliances and industrial equipment, in particular, tend to generate more CO_2 emissions in a product usage than production stage. (Fig. 2)
Therefore, we will contribute to the reduction of CO_2 emissions in the entire value chain by improving the energy efficiency of appliances and devices, advancing the development of IT/IoT solutions enabling more efficient energy usage, and spreading these improvements and development throughout society. (Fig. 3)

Fig. 3 Sectorial analysis of CO_2 emissions (FY2016) and contribution by EE industries to sectors



Source: Created by Liaison Group of Japanese Electrical and Electronics Industries for Global Warming Prevention based on "Japan's Greenhouse Gas Emissions Data in FY2016 (Final Figures)" by Greenhouse Gas Inventory Office of Japan, National Institute for Environmental Studies, and "Commitment to a Low Carbon Society FY 2017 Follow-up Results (Performance in FY2016)" by Keidanren (Japan Business Federation)

nges in View of Global Warming

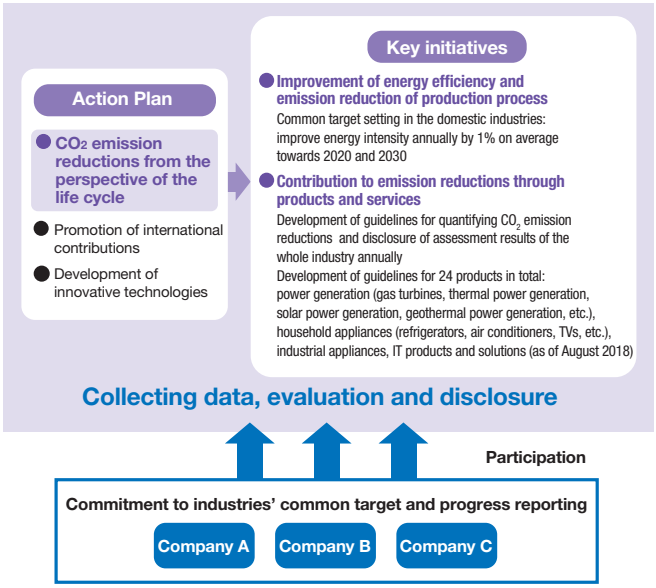
Electrical and Electronics Industries' "Action Plan for Commitment to a Low Carbon Society" (Reduction of Energy-oriented CO_2 Emissions)

Japanese EE industries have participated in the Action Plan for Commitment to a Low Carbon Society[*1] formulated by Keidanren toward 2020, and are aiming to improve energy efficiency of production processes by 1% annually on average. Also, for the purpose of contributing to CO_2 emission reductions in society through products and services, we have developed guidelines for quantifying CO_2 emission reductions and disclose the results of the whole industry annually.

Furthermore, we have formulated Phase II[*2] of the Action Plan for Commitment to a Low Carbon Society, and continue to make efforts toward achieving targets for 2030. (Figs. 4, 5 and 6)

We also support and participate in industry initiatives for quantifying contribution to avoided emissions, through the global value chain promoted by the Japanese government.

Fig. 4 Outline of EE industries' "Action Plan for Commitment to a Low Carbon Society"



*1 In December 2009, Keidanren declared the establishment and promotion of a plan for a new voluntary initiative with targets for 2020, called the "Commitment to a Low Carbon Society". Keidanren requested the participating industries to publicly announce and pursue a set of voluntary initiatives in line with the following four pillars in the interest of fostering the development of a global-scale low-carbon society: a) establishment of CO_2 emission reduction targets for domestic business operations up to the year 2020; b) promotion of CO_2 emission reductions through product and service life cycles; c) promotion of international cooperation and contributions; and d) promotion of mid-to-long term innovative technological development that contributes to the achievement of a low-carbon society. As of January 2013, 36 types of industries, including the EE industries, had announced their participation in the Commitment to a Low-Carbon Society.
http://www.keidanren.or.jp/policy/2013/003.html

*2 In April 2015, Keidanren announced the establishment of Phase II of the Commitment to a Low Carbon Society as part of further efforts by the Japanese business community for 2030.
http://www.keidanren.or.jp/policy/2015/031.html (Japanese text only)

Fig. 5 Improvement target of energy efficiency in production processes

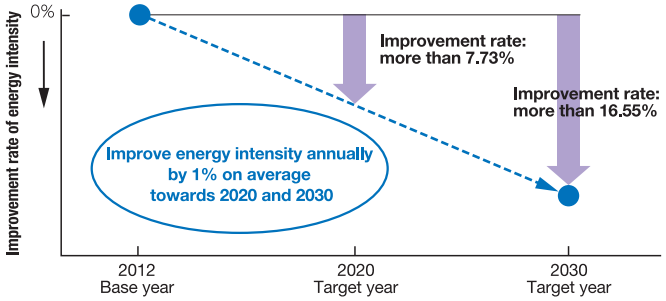
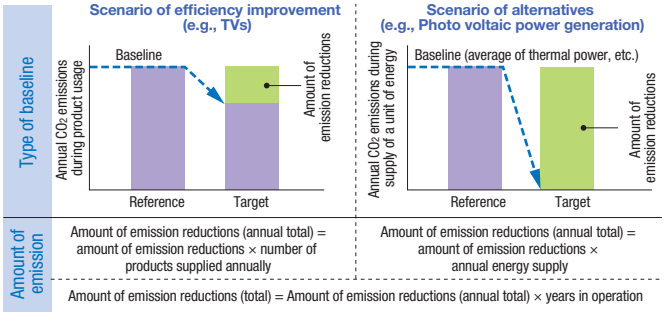


Fig. 6 Calculation methods for the amount of emission reductions



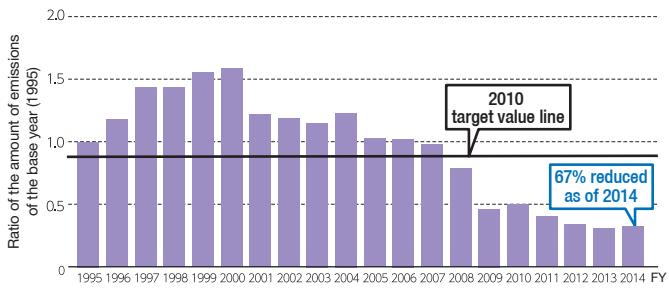
Initiatives for the Reduction of Greenhouse Gases Other than Energy-oriented CO_2

Japanese EE industries are working on the reduction of not only energy-oriented CO_2 but also other various greenhouse gases.

For example, greenhouse gases (HFC, PFC, SF_6, NF_3, etc.) are used in the manufacturing process of semiconductors and liquid crystal displays, for cleaning agents and solvents[*3] of electronic components, and for electrically insulating gases for power equipment. We have set voluntary emission reduction targets for each product area and are aiming to achieve them. (Fig. 7)

*3 Due to being volatile, cleaning agents and solvents are included in greenhouse gases.

Fig. 7 Changes in the amount of PFC emissions (CO_2 equivalent) in the semiconductor field



Source: Japan Electronics and Information Technology Industries Association

2 Our Contribution to Energy Saving and

Society-wide Energy Saving and Low Carbonization through Products and Services

Companies in Japanese EE industries promote cooperation between various interested groups by providing a variety of technologies, products and services to domestic and international sectors, including industrial, business, household, transportation and energy conversion sectors, and contribute to energy saving and low carbonization on a global scale.

Examples of contribution in each sector

Renewable energy

Energy conversion sector

Renewable energy is spreading at an impressive rate around the world, and Japan's 5th Strategic Energy Plan states that renewable energy is to become a major power source. Companies in Japanese EE industries are promoting the use of renewable energy on a global scale.

Photovoltaic power generation

Companies in Japanese EE industries have proceeded with efficiency improvement and cost reduction of large-scale photovoltaic power generation (mega solar), and worked on its promotion domestically and internationally.

In Mongolia, companies are promoting a project that utilizes the Joint Crediting Mechanism (JCM), in which the introduction of 10 MW photovoltaic power generation is expected to reduce CO_2 emissions by approximately 18,000 tons per year.

Mega solar photovoltaic power plant (Mongolia)

Geothermal power generation

Geothermal power generation can generate large energy stably. Especially in the Middle East and East Africa regions, where power demand is expected to grow in the future, plans for the construction of many new geothermal power plants are scheduled to be built.

For example, Kenya has set a development target to expand its geothermal power generation capacity to 5,000 MW by 2030. Companies in Japanese EE industries are participating in the plan by supplying equipment such as steam turbines and generators to geothermal power plants built there.

Olkaria Geothermal Power Plant (Kenya)

Wind power generation

Development of offshore wind power generation, which is expected to generate electricity from stable and strong winds, is in progress worldwide.

In Fukushima Prefecture, Japan, demonstration projects (2 MW, 5 MW and 7 MW) are being conducted for the commercialization of the large floating offshore wind turbine system developed particularly for places with steep submarine topography.

Floating offshore wind turbine system (off the coast of Fukushima Prefecture)
(Photo courtesy of Fukushima Offshore Wind Consortium)

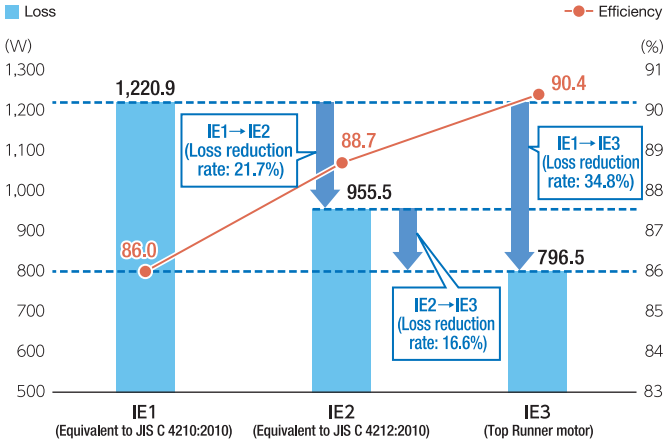
High efficiency motors

Industrial sector

High-efficiency motors (top runner motors) specified as target products for the Top Runner Progra[*4] are expected to reduce power loss by approximately 35% compared to the conventional JIS C 4210: 2010 standard values. According to the Ministry of Economy, Trade and Industry's estimation, the amount of power reduction expected when all conventional-type motors are replaced by IE3 motors (premium efficiency) will be about 15.5 billion kWh per year, which is equivalent to about 1.5% of Japan's total power consumption. Thus, Top Runner motors are expected to bring about an extremely great energy-saving effect. (Fig. 8)

*4 This requires standards of energy-saving performance of home electric appliances and fuel economy performance of automobiles to be higher than or equal to those of products with highest performance currently on the market.

Fig. 8 Efficiency of motors and their loss reduction rates (e.g., motors with 50Hz, 4 magnetic poles and 7.5kW)



Source: Japan Electrical Manufacturers' Association

FEMS

Industrial sector

To reduce energy consumption in an entire factory, companies in Japanese EE industries are promoting the spread of FEMS[*5], a factory energy management system that monitors energy consumption, conditions peak power, and controls the operation of air conditioning, lighting equipment and production lines depending on the situation.

These companies are also developing IT/IoT solutions to improve production efficiency through total visualization of data from watt-hour meters and water meters as well as data on the operational status of production lines within a factory.

*5 FEMS: Factory Energy Management System

Low Carbonization with Various Technologies

BEMS

Business sector

Companies in Japanese EE industries are promoting the spread of BEMS[*6], a building energy management system that supports optimum energy operation by visualizing energy usage status in office buildings and by controlling air conditioning, lighting, storage batteries, and so on.

Initial costs can be reduced by using cloud technologies, which has led to an increase in its introduction in small and medium-sized buildings. Depending on the facility and the manner of operation, the introduction of a BEMS is expected to reduce energy consumption by approximately 10%. (Figs. 9 and 10)

*6 BEMS: Building Energy Management System

Fig. 9 Energy management by means of cloud technologies

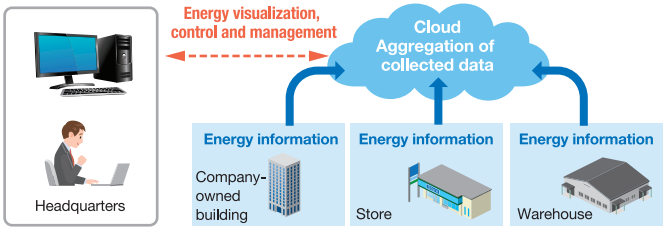
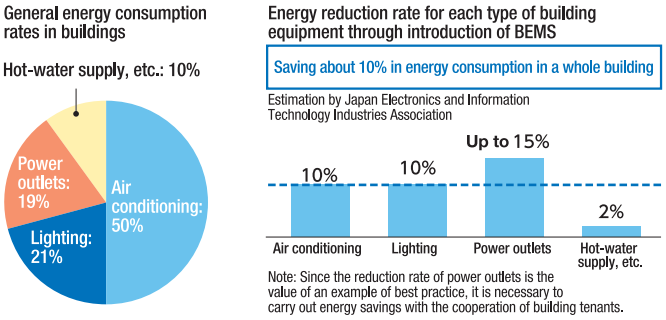


Fig. 10 Rates of energy reduction by BEMS



Source: Japan Electronics and Information Technology Industry Association

LED lighting

Business sector

Use of high-efficiency LED lighting that has high energy-saving performance and adoption of lighting design appropriate for each usage are enabling acceleration of energy savings in the entire office building.

There is a case in which an office that had full LED installation in its ceiling lighting successfully reduced the expense of lighting up to almost one-third of that of fluorescent lighting, with a combination of personal control, motion sensors and daylight sensors.

Traffic monitoring system

Transportation sector

Increase in CO_2 emissions due to traffic congestion poses environmental problems, particularly in developing countries. To resolve this, companies in Japanese EE industries are promoting the spread of a traffic monitoring system that effectively limits environmental load and traffic congestion by detecting traffic congestion and accidents on a real-time basis with a high degree of accuracy, and by optimally controlling traffic lights by utilizing AI and IoT technologies. This system has been introduced in various countries, including Indonesia and the Philippines.

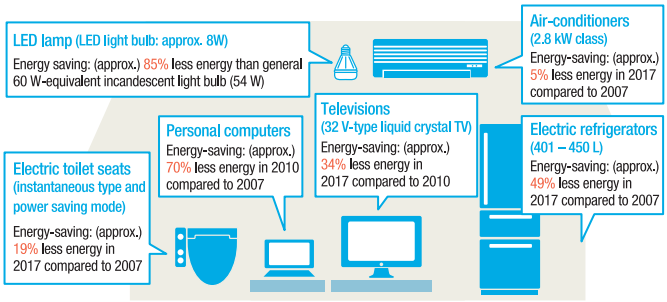
Image of traffic monitoring system

Energy-saving household appliances

Household sector

Many household appliances and office equipment are specified as target products for the Top Runner Program under Japan's Energy Conservation Act. Companies in Japanese EE industries have realized significant enhancement of energy-saving performance by steadily making progress in the improvement of energy efficiency and the reduction of standby power consumption through development and introduction of innovative technologies. (Fig. 11)

Fig. 11 Improvement of energy efficiency of home electric appliances



Source: Created by Liaison Group of Japanese Electrical and Electronics Industries for Global Warming Prevention based on document distributed at the 9th meeting held by the Energy Efficiency and Conservation Subcommittee of the Committee on Energy Efficiency and Renewable Energy under the Advisory Committee for Natural Resources and Energy, as well as on estimation data included in "Fiscal 2018 Smart Life Recommendations Book" published by the Association for Electric Home Appliances

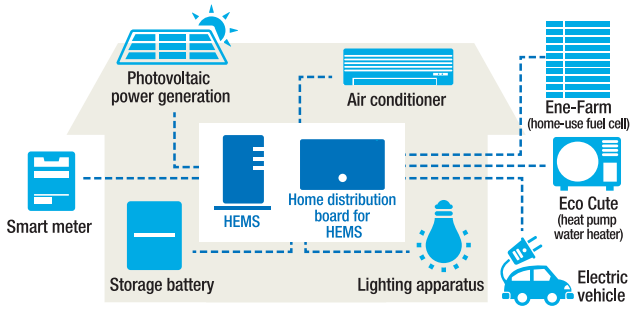
HEMS

Household sector

Companies in Japanese EE industries are promoting the spread of HEMS[*7], a household energy management system that realizes energy saving by visualizing the usage status of household appliances and electrical facilities as well as electricity and gas consumption by using a monitor screen and automatically controlling energy usage. (Fig. 12)

*7 HEMS: Home Energy Management System

Fig. 12 Image of HEMS



HV, PHV and EV

Transportation sector

With the tightening of environmental regulations in each country, HVs, PHVs and EVs[*8] have already started to spread around the world.

HVs, PHVs and EVs are loaded with many electronic devices such as batteries and motors instead of conventional engines. It is also necessary to construct charging facilities. Companies in Japanese EE industries are proceeding with the development of electronic devices and charging facilities for HVs, PHVs and EVs, contributing to their spread.

*8 HV: Hybrid vehicle, PHV: Plug-in hybrid vehicle, EV: Electric vehicle

3 Our Efforts toward Further Reduction

Innovative Technologies on Both Energy Supply and Demand Sides

Companies in Japanese EE industries are striving to advance existing technologies and to develop innovative technologies on both energy supply and demand sides, and are working on spreading these technologies. (Fig. 13)

Fig. 13 Examples of innovative technologies related to Japanese EE industries

		Efficiency improvement			Low-carbonization		
Energy supply side	Power generation, transmission and distribution	High-efficiency LNG-fired thermal power generation	High-efficiency coal-fired thermal power generation	High-efficiency Superconducting power transmission	Innovative photovoltaic power generation	Advanced nuclear power generation	Carbon dioxide capture and storage (CCS)
Energy demand side	Transportation	Intelligent transportation system	Automated driving system	Batteries, charging facilities, electronic devices for HVs, PHVs and EVs	Hydrogen refueling stations		Biomass fuel plants for transportation
	Industries	Innovative materials, manufacturing and processing technologies (semiconductors and nanotechnology)		Energy management system (CEMS, FEMS, BEMS and HEMS)			
	Household and business	Energy-saving household appliances, IT products	Super-high-efficiency heat pumps	Stationary fuel cells			
Cross-cutting issues			High-performance power storage	Power electronics	IT/IoT solutions	Smart Grid and Smart Community	

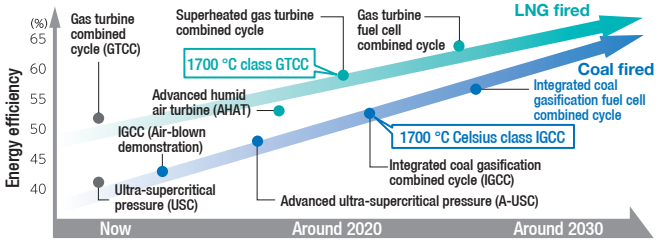
Source: Created by the Liaison Group of Japanese Electrical and Electronics Industries for Global Warming Prevention based on updated abstract of an explanatory material for the "Cool Earth-Energy Innovative Technology Plan (2008)" by the Ministry of Economy, Trade and Industry

Development and Promotion of Innovative Technologies

High-efficiency thermal power generation

In the field of thermal power generation (coal, oil, and natural gas), which supplies almost 70% of the electricity consumed in the world, companies in Japanese EE industries are working on the improvement of power generation efficiency by using new technologies such as higher steam temperature and pressure, pulverized-coal combustion, and combined operation of gas turbines and steam turbines.
As a result, efficiency of domestic thermal power generation is currently top class in the world. Furthermore, these companies are working on technological development to improve efficiency by integrating solid oxide fuel cells with combined gas turbine systems (triple combined cycle system). (Fig. 14)

Fig. 14 Roadmap of high-efficiency technologies for thermal power generation



Source: Created by Liaison Group of Japanese Electrical and Electronics Industries for Global Warming Prevention based on materials from the Ministry of Economy, Trade and Industry

CCS

CCS[*9] is a technology to capture and store CO_2 emitted from factories and power plants. It can be introduced to existing thermal power plants, and it is expected that this technology will contribute to the prevention of global warming. (Fig. 16)

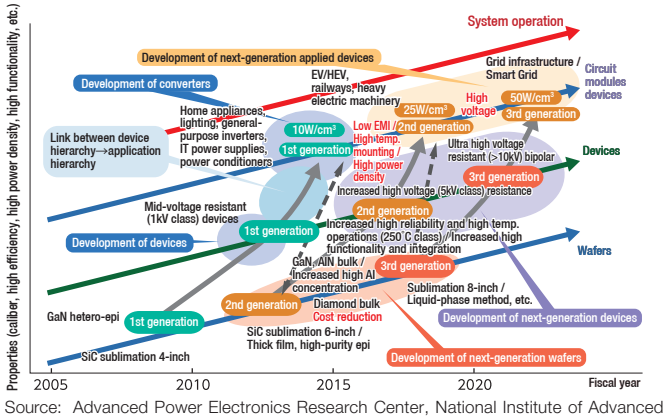
In Fukuoka Prefecture, a pilot plant with a capacity of capturing 10 tons of CO_2 per day is under construction. It will verify its performance, operability and maintainability along with the development and refinement of thermal power plants.

*9 CCS: Carbon dioxide Capture and Storage

Power electronics

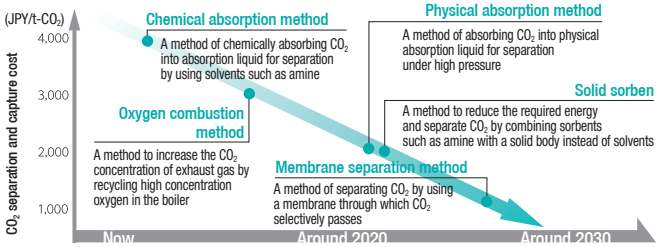
Power electronics products are key devices that play a crucial role in power conversion and control. They contribute to the realization of a low-carbon society by advancing energy-savings for home electric appliances, electric vehicles and railways, as well as for power supplies. (Fig. 15)

Fig. 15 Roadmap of wide-bandgap semiconductor power electronics



Source: Advanced Power Electronics Research Center, National Institute of Advanced Industrial Science and Technology

Fig. 16 CO_2 capture technology expected to be developed by around 2030



Source: Created by Liaison Group of Japanese Electrical and Electronics Industries for Global Warming Prevention based on materials from the Ministry of Economy, Trade and Industry

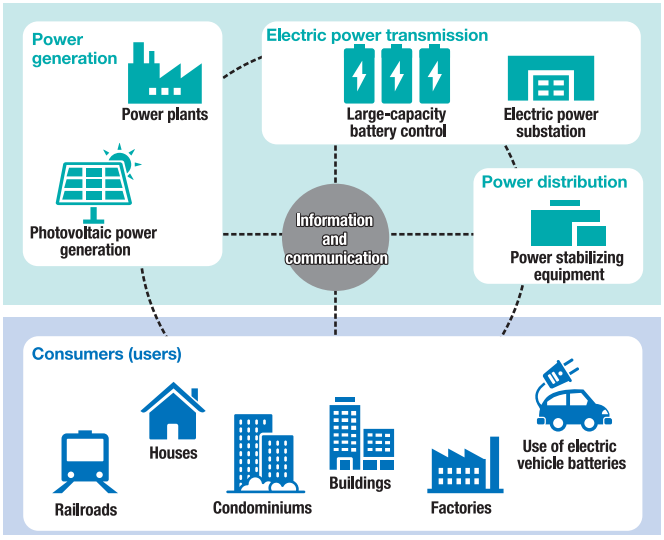
# of Emissions through Innovation

Smart Grid and Smart Community

Companies in Japanese EE industries are developing “Smart Grid” which is a next-generation power transmission network which provides stable supply of power under optimal control of both supply and demand sides by combining renewable energy such as wind and photovoltaic power generation with conventional power generation methods and large-capacity batteries. They are also developing “Smart Community”, which realizes energy savings based on the Smart Grid.
These companies have been proactively participating in demonstration projects[*10] for Smart Community development in Japan and overseas. (Fig. 17)

*10 Implemented in various countries including Japan, USA, Spain, UK, France, Italy, Bulgaria, China, Vietnam, Thailand, Malaysia and India

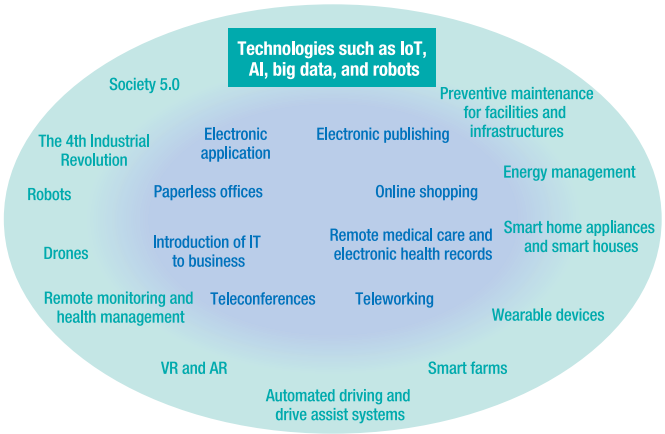
Fig. 17 Image of Smart Grid and Smart Community



IT/IoT solutions

Much attention is being given to IT/IoT solutions that take advantage of technologies such as IoT, AI, big data and robots.
IT/IoT solutions extract knowledge for solving problems by analyzing real-world data collected by sensors using AI and big data, which is utilized for optimal control and automatization by robots. This will make it possible to realize not only labor savings and efficiency improvement of factories and distribution but also new services such as sharing, contributing to the improvement of energy and resource efficiency throughout society as a whole. Companies in Japanese EE industries are working on the development and promotion of innovative IT/IoT solutions. (Fig. 18)

Fig. 18 Image of the expansion of IT/IoT solutions



Source: Created by Liaison Group of Japanese Electrical and Electronics Industries for Global Warming Prevention based on materials from the Japan Electronics and Information Technology Industries Association

Adaptation

Companies in Japanese EE industries are proactively working not only on mitigation to take measures for the reduction of emissions and absorption of greenhouse gases, but also on adaptation to take measures to minimize economic loss and human damages of natural disasters caused by the effects of climate change, by actively utilizing technologies such as IT/IoT solutions.

Example: Flood simulation

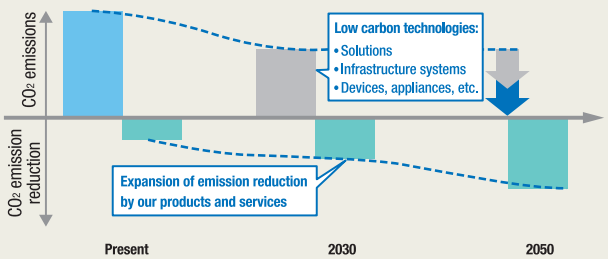
Companies in Japanese EE industries are supporting the provision of early warnings to residents and the creation of hazard maps by predicting floods based on geological data, water levels, observed/predicted rainfall data, sensor data, and so on.

Image of flood simulation

Examination of long-term initiatives and future vision

To draw a vision of the future aimed for 2050 through global warming prevention measures, Japanese EE industries have started to examine long-term initiatives toward emission reduction throughout the value chain, including the formulation of measures to expand emission reduction by our products and services and the identification of themes to develop innovative technologies in order to realize low carbonization across the whole of society. (Fig. 19)

Fig. 19 Image of our vision of the future



4 Our Future Facing Global Warming Prevention

Initiatives for International Cooperation

International Cooperation in Promoting Low-carbon and Energy-efficient Products

Currently, policy introduction to promote high-efficiency products and the methods to appropriately evaluate energy-saving performance are under discussion in various ways in Japan while considering international frameworks. Japanese EE industries are proactively participating in these frameworks and making efforts to promote low-carbon and energy-efficient products on a global scale.

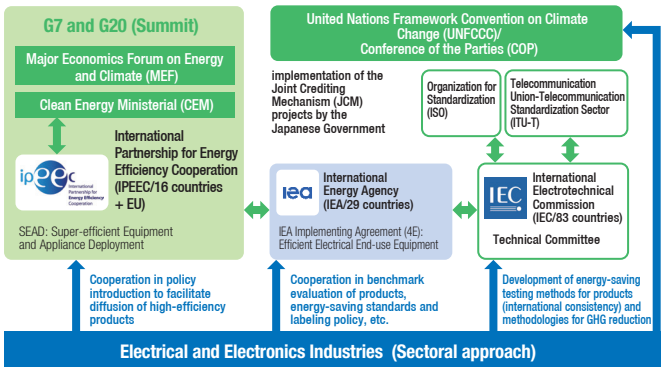
Initiatives for international standardization in the electric and electronic products sector

Regarding international standardization of quantification, reporting, and verification of greenhouse gas emissions, Japanese EE industries are advancing development of rational and transparent methodologies appropriate for the electric and electronic products sector (IEC[*11], etc.).

Also, through participation in activities to promote high-efficiency products under IPEEC[*12] and in the implementation agreement for energy-saving evaluation by IEA[*13], we are making various proposals globally for greenhouse gas emission reduction while also promoting the excellent energy-saving performance of Japanese electric and electronic products. (Fig. 20)

*11 IEC: International Electrotechnical Commission
*12 IPEEC: International Partnership for Energy Efficiency Cooperation
*13 IEA: International Energy Agency

Fig. 20 International standardization in EE industries



Energy Performance Evaluation on Data Centers (DPPE)

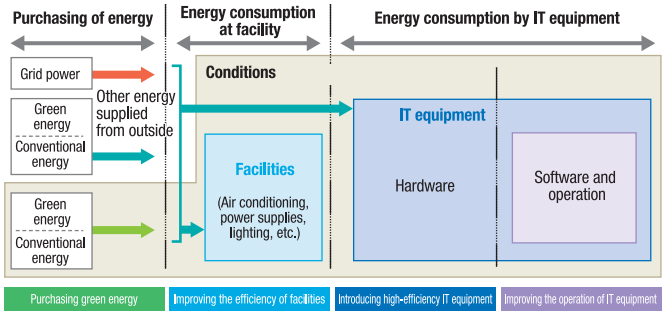
The amount of information that data centers handle has been growing exponentially due to the spread of cloud-type services and IoT, and it has drastically increased energy consumption.

Under such circumstances, Japan, the United States and Europe collaborated to develop a set of metrics (DPPE*14) that evaluate energy efficiency of data centers using four elements. DPPE is the world's first successful holistic framework which includes a metric evaluating the usage of green energies and an index to express energy efficiency of facility and IT equipment.

The four metrics which constitute DPPE were proposed to ISO/IEC JTC1/SC39 as new work items (three of them were proposed by Japan) and approved in 2014, and all of them had been issued as international standards by 2017. (Fig. 21)

*14 DPPE: Datacenter Performance Per Energy

Fig. 21 Overview of DPPE



Source: Japan Electronics and Information Technology Industries Association

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Japan Electronics and Information Technology Industries Association (JEITA)
http://www.jeita.or.jp/english/

Japan Business Machine and Information System Industries Association (JBMIA)
http://www.jbmia.or.jp/english/

Japan Lighting Manufacturers Association (JLMA)
http://www.jlma.or.jp/en/

The Japan Electrical Manufacturers' Association (JEMA)
http://www.jema-net.or.jp/English/

Communications and Information Network Association of Japan (CIAJ) http://www.ciaj.or.jp/en/

Association for Electric Home Appliances (AEHA)
The Japan Refrigeration and Air Conditioning Industry Association (JRAIA)
Battery Association of Japan (BAJ)
Japan Photovoltaic Energy Association (JPEA)

Published
September 2019