Global Warming Countermeasures of Japanese Electric Utiliy Industry

The Federation of Electric Power Companies of Japan

Electric Utility Industry's
CO_2 Emissions Suppression Targe ts and Achievements

Global Warming Countermeasures of Japanese Electric Utility Industry

Environmental Action Plan by the Japanese Electric Utility Industry

The Japanese electric utility industry has recognized environmental protection as one of its greatest concerns and has worked actively towards its support. The twelve electric power-related companies which comprise the Federation of Electric Power Companies (FEPC) formulated and made public in November 1996 the "Environmental Action Plan by the Japanese Electric Utility Industry."

The Federation has reviewed the action plan annually since 1998 to ensure its transparency and the achievement of its targets, and has recently completed the 13th review.

The twelve electric power-related companies include ten members of the Federation of Electric Power Companies (Hokkaido Electric Power Co., Tohoku Electric Power Co., Tokyo Electric Power Co., Chubu Electric Power Co., Hokuriku Electric Power Co., Kansai Electric Power Co., Chugoku Electric Power Co., Shikoku Electric Power Co., Kyushu Electric Power Co. and Okinawa Electric Power Co.) as well as Electric Power Development Co. and Japan Atomic Power Co.

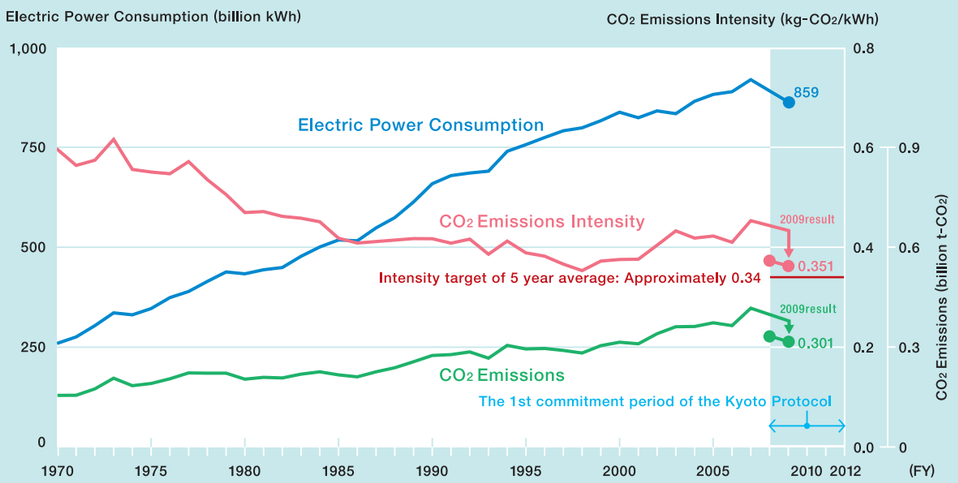
Basic Policy of the Japanese Electric Utility Industry for Global Warming

The electric utility industry is endeavoring to achieve the Environmental Action Plan on the basis of an optimal combination of power sources targeting simultaneous achievement of the 3Es: energy security, economy, and environmental conservation.

CO_2 Emissions Suppression Targets

From fiscal 2008 to fiscal 2012, we aim to further reduce CO_2 emissions intensity (emissions per unit of user-end electricity) by an average of approximately 20%, about 0.34kg-CO_2/kWh from the fiscal 1990 level.

Trends in Electric Power Consumption, CO_2 Emissions, and CO_2 Emissions Intensity



Sources: Environmental Action Plan by the Japanese Electric Utility Industry

*The marker indicates user-end CO_2 emissions intensity after the Kyoto Mechanism credit was reflected and CO_2 emissions after adjustment.

Result of Fiscal 2009 Efforts to suppress CO_2 Emissions

Electric power consumption in fiscal 2009 was approximately 859 billion kWh, a 30 billion kWh decrease from 2008, due to the severe economic recession. On the other hand, CO_2 emissions in fiscal 2009 stood at 301 million t-CO_2 because the share of nuclear and hydroelectric power generation among the overall generated power increased by a few operations restarting at the TEPCO Kashiwazaki Kariwa Nuclear Power Plants, and approximately 52 million t-CO_2 of Kyoto Mechanism credits were transferred to the governmental holding account free of cost. As a result, CO_2 emissions intensity in fiscal 2009 was 0.351kg-CO_2/kWh, a 0.022kg-CO_2/kWh (5.9%) decrease from the fiscal 2008 level. CO_2 emissions intensity per generated power in Japan is not as low as France, which has a high ratio of nuclear power generation, or Canada, which has a high ratio of hydroelectric power generation, but is low in comparison with other major countries in Europe and the US.

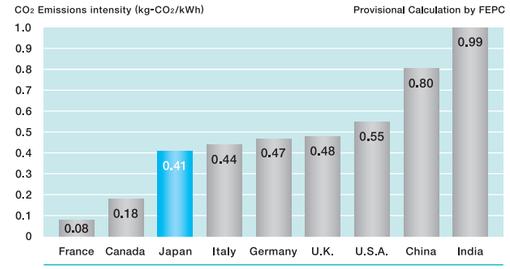
CO_2 Emissions Intensity in Fiscal 2009

Item \ Fiscal Year	1990	2008	2009
Electric Power Consumption*1 (billion kWh)	659	889	859
CO_2 emissions (million t-CO_2)	275	332 [395]*2	301 [353]*2
CO_2 emissions intensity user end electricity (kg-CO_2/kWh)	0.417	0.373 [0.444]*2	0.351 [0.412]*2

*1 Electric power consumption includes power purchased from cooperative thermal power plants, IPPs (independent power producers), and household generators and then sold.

*2 Figures in the brackets [ ] were the amount of CO_2 emissions and user end CO_2 emission intensity that Kyoto Mechanism credit is not reflected. Those figures were stated as a reference.

Comparison of CO_2 Emissions Intensity in Major Countries 2008



*Source: IEA Energy Balances of OECD Countries / Energy Balances of Non-OECD Countries (2010 Edition)

*Including household power generating installation in Japan *Including CHP plant (combine heat and power)

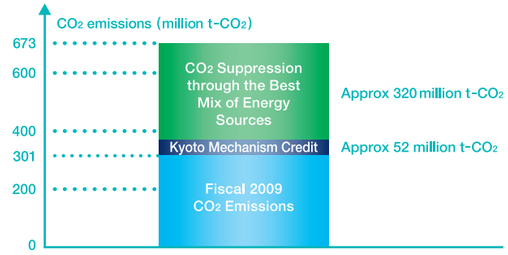
Results of Efforts to Suppress CO_2 Emissions through the "Best Mix" of Energy Sources and Kyoto Mechanism Credit

The electric utility industry is working on achieving the best mix of energy sources, balancing the use of nuclear power as the primary energy source, thermal power, and hydroelectric power etc. The result of suppression of CO_2 emissions by these activities is estimated at 320 million t-CO_2. The result of CO_2 suppression by Kyoto Mechanism credit is estimated at approximately 52 million t-CO_2.

Major Results of Suppression

- Result of CO_2 suppression by nuclear power generation: 185 million t-CO_2
- Result of CO_2 suppression by LNG power generation: 74 million t-CO_2
- Result of CO_2 suppression by hydroelectric power generation: 59 million t-CO_2
- Result of CO_2 suppression by Kyoto Mechanism credit: 52 million t-CO_2

CO_2 Emissions and Suppression Effect of CO_2 Emissions in Fiscal 2009



Electric Utility Industry's
CO_2 Emissions Suppression Targe ts and Initiatives

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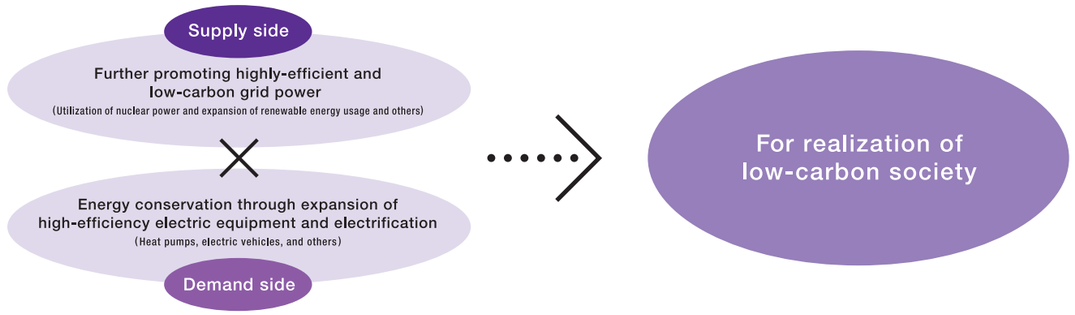
Summary of CO_2 Emissions Suppression Measures

It is important for both the government and private sectors to cooperate with each other and take effective measures for CO_2 emissions suppression in both the power supply side and demand side from a long-term perspective.



Decarbonization of energy on the supply-side

- **Expanding use of non-fossil energy sources**
  - Promotion of nuclear power generation based on the premise of safety assurance
  - Development and expansion of use of renewable energy sources
- **Improving efficiency of electric power equipment**
  - Further improvement of thermal efficiency of thermal power plants
  - Reduction of transmission and distribution loss
- **International efforts**
  - Active utilization of the Kyoto Mechanisms
  - Sectoral approaches

Improvement of the energy usage efficiency on the demand-side

- **Energy conservation**
  - Electrification promotion, energy conservation and expansion of High efficiency electric equipment
  - Utilization of untapped energy sources
  - PR-activities and provision of information aimed at energy conservation and CO_2 reduction
  - Load leveling promotion such as heat pump & thermal storage systems
- **Efforts by electric utility industry as users**
  - Efforts in office-use energy conservation and in the use of company-owned vehicles

Research and Development

- **Low carbon technology**
  - Clean coal technology, next-generation electric power transmission and distribution technology (Smart Grid), CO_2 capture and storage technologies
  - CO_2 refrigerant heat pump hot water heater, electric vehicles, and others

In order to achieve the target of the Environmental Action Plan, the electric utility industry will actively evaluate and carry out various measures such as decarbonization of energy at supply-side and improvement of energy usage efficiency at demand-side. The above measures include improvement of capacity factor of nuclear power plants, electrification and popularization of energy-saving facilities, and utilization of the Kyoto Mechanisms by participation in CO_2 reduction projects. The industry is fully committed to achieving its objective by further strengthening the following initiatives.

- **Promotion of nuclear power generation based on the premise of safety assurance**
- **Further improvement of the thermal efficiency of thermal power generation**
- **Development and expansion of the use of renewable energy**
- **Active utilization of the Kyoto Mechanisms, etc.**

Promotion of Nuclear Power Generation based on the Premise of Safety Assurance

Nuclear power generation, which does not emit CO_2 in the course of generating electricity, is extremely important to the electric utility industry. We believe that it will play a central role in Japan's effort to mitigate global warming in the future. Nuclear power generation also is extremely important in the Kyoto Protocol Target Attainment Plan for promoting measures to mitigate global warming. It is positioned as the core energy source which the public and private sectors are cooperatively promoting. In addition to the importance of nuclear power generation in contributing to a stable supply of energy and measures to mitigate global warming, it is noted in the strategic energy plan of Japan as important for raising the zero-emission power source ratio. The plan was revised and approved by the Cabinet in June 2010 and states that with increased power plant capacity utilization rates, nuclear power can contribute to the fight against global warming. Thus, nuclear power generation plays an essential role in Japan's measures to mitigate global warming. The electric utility industry is making every effort to make the promotion of nuclear power its most important management issue. We will cooperate with the government to gain the understanding of local communities, local governments, and the Japanese people based on a policy of ensuring safety. Thus, we exert great effort on the following issues: promoting the construction of new nuclear power plants, raising the capacity factor, building nuclear fuel cycle, and nuclear fuel cycle backend measures.

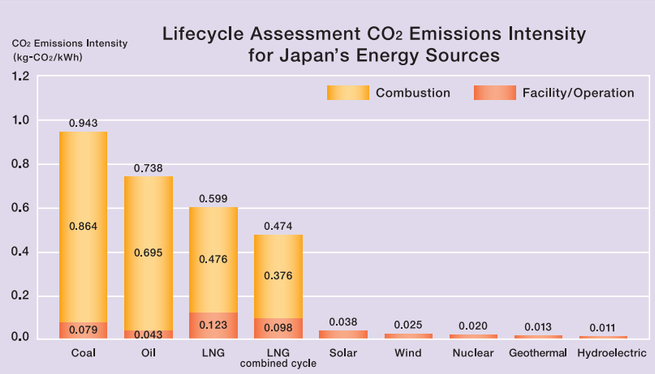
Nuclear power for lower CO_2 emission

Nuclear power is an ideal source of energy for mitigating climate change as it emits significantly less CO_2 over the entire lifecycle of a plant, including plant construction, operation and disposal.

* Based on total CO_2 emissions from all energy consumed inenergy extraction, plant construction, transportation, refining, plant operation and maintenance, etc., in addition to burning of the fuel.

* Data for nuclear power: 1) includes spent fuel reprocessing in Japan (under development), MOX fuel use in thermal reactors (assuming recycling once) and disposal of high level radioactive waste, and 2) is based on the capacity weightedaverage of CO_2 emissions intensities of existing BWR and PWR plants in Japan.

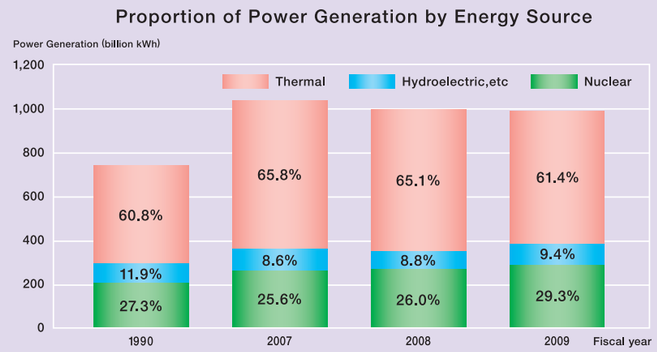
Source: the Report of the Central Research Institute of Electric Power Industry



Nuclear power as core of best mix of energy sources

Nuclear power is excellent due to its stable energy supply, economic efficiency, and environmental performance, and it is indispensable as an energy supply from a long-term perspective. In fiscal 2009, approximately 29% of total generated electricity was nuclear power generation. The electric utility industry will make efforts to increase the non-fossil energy ratio up to 50% by 2020 using mainly nuclear power.

Research by FEPC



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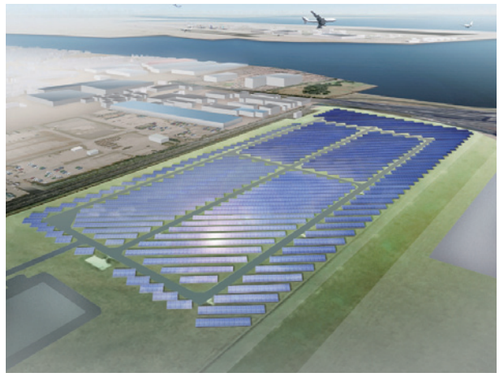
Development and expansion of the use of renewable energy sources

The electric utility industry continues to live up to our obligations under the Renewable Portfolio Standard (RPS) Law* and is proceeding with the development of mega solar power generation, planning to build approximately 140 thousand kW of solar power plants across about 30 sites by fiscal 2020. The electric utility industry has been promoting renewable energy such as through purchasing excess electricity produced by customers' solar power generation equipment. Furthermore, a new purchase system of power generated by solar power generation started in November 2009. The electric utility industry will also cooperate with this system with the hope of expanding the use of solar power generation and thereby reducing costs.



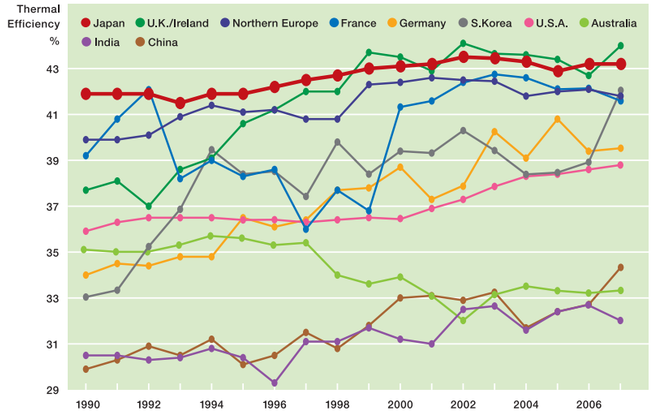
Ukishima Solar Power station (tentative name) 〈Tokyo Electric Power Co.〉
*Act on Special Measures Concerning New Energy Use by Operators of Electric Utilities

Further Improvement of Thermal Efficiency of Thermal Power Plants

- The electric utility industry has realized approximately 59% thermal efficiency in state-of-the-art power plants, which is the highest level in the world. This was made possible by introducing the latest combined cycle power generation in which steam and gas turbines are combined.
- We are aiming to secure a long-term stable energy supply and are also taking countermeasures to mitigate global warming by developing high efficiency coal-fired thermal power technology including the Integrated Coal Gasification Combined Cycle (IGCC).

Full View of IGCC pilot plant　　Source: Clean Coal Power R&D CO.,LTD.

Comparison of Thermal Power Plant Efficiency in Japan with Other Countries



Sources: International Comparison of Fossil Power Efficiency and CO_2 Intensity, 2010 (ECOFYS)

* Thermal efficiency is the gross generating efficiency based on the weighted averages of efficiencies for coal, petroleum and gas (lower heating value standard).

Active utilization of the Kyoto Mechanisms

The electric utility industry is actively pursuing overseas projects through Kyoto mechanisms to take countermeasures to mitigate global warming. The overseas projects include CO_2 reduction by using hydroelectric, wind, and biomass power generation and non-CO_2 greenhouse gas reduction. We expect to reduce around 260 million t-CO_2 of greenhouse gases by 2012 utilizing such Kyoto Mechanisms, etc.

Overseas GHG Reduction/Absorption Projects by the Japanese Electric Utility Industry

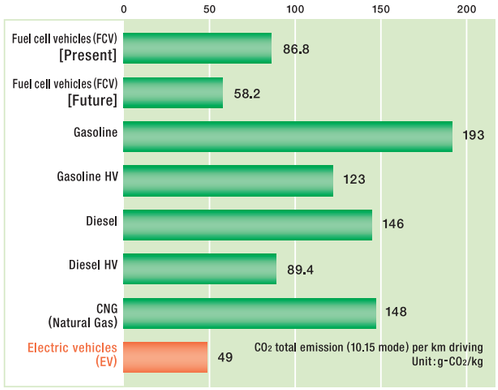
Sectoral Approach Concerning Electric Utility Industry

The electric utility industry has made efforts in reducing CO_2 emissions on a global basis through participation in the Asian Pacific Partnership on Clean Development and Climate (APP) and the International Electricity Partnership (IEP). It cooperates by sharing the best practices with power companies in developed and developing countries.

Electric Vehicles

Electric vehicles and plug-in hybrid their vehicles have environmental advantages due to their great suppression of CO_2 emissions compared to that of gasoline vehicles. The government is making every effort to expand the use of those vehicles. The electric utility industry is engaged in driving verification tests and the development of quick chargers, and aims to introduce about 10,000 electric vehicles into its fleet for commercial use by fiscal 2020 to support EV use expansion.

Comparison of CO_2 Emission per km (well to wheel)



Source: JHFC combined efficiency study result (March 2006)
Japan Automobile Research Institute

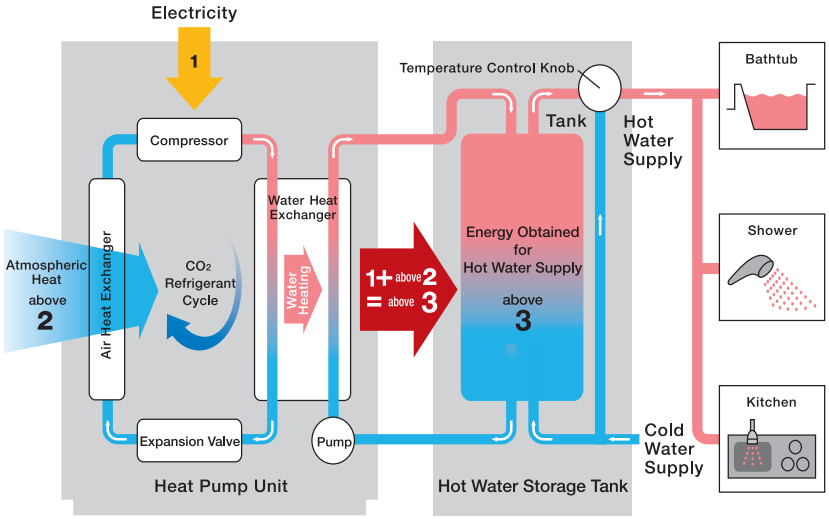
Improvement of the energy usage efficiency on the demand-side

Along with helping customers use electricity efficiently, conserve energy and reduce CO_2 emissions, the electric utility industry is actively involved in developing and promoting the spread of CO_2 refrigerant heat pump water heaters, high efficiency office air conditioners that use heat pump technology, and storage heat systems.

EcoCute (CO_2 Refrigerant Heat Pump Hot Water Heater)

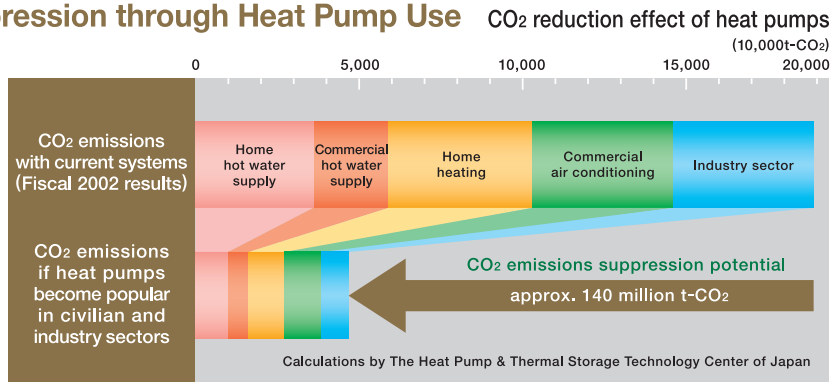
EcoCute is a hot water heater system that uses a CO_2 refrigerant heat pump to effectively gather heat from the air and use it as energy to heat water. The system is exceptional at conserving energy; for example, if one unit of electric energy is inputted, produced hot-water supply energy will be more than three times that of the input energy in yearly average. "EcoCute" can greatly reduce CO_2 emissions compared to conventional combustion-type hot-water supply equipment. Cumulative use of EcoCute has reached 2.25 million units as of the end of March 2010. The CO_2 emissions control effect by using EcoCute is estimated to be approximately 1.6 million t-CO_2. We will aim to introduce approximately 10 million units of EcoCute in fiscal 2020 as the goal for the electric utility industry.

Diagram of Hot Water Supply System (EcoCute)



Possibility for CO_2 Emission Suppression through Heat Pump Use

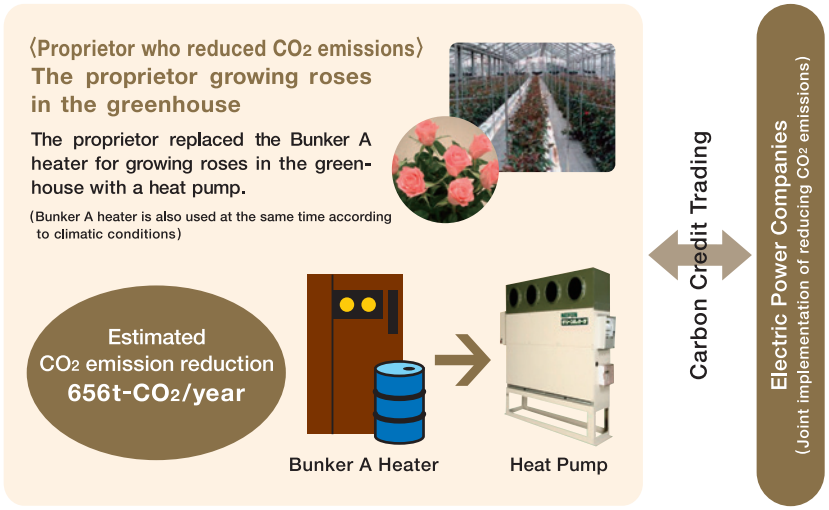
If heat pump system use becomes widespread through air conditioning and hot water supplies in the civilian sector (homes and businesses), and for heating & ventilation purposes such as warming and drying in the industrial sector, it would suppress CO_2 emissions by approx. 140 million t-CO_2 per year. This is equivalent to approx. 10% of Japan's CO_2 emissions (1.2 billion t-CO_2).



Participation in Energy Saving and CO_2 Saving Activities Using Domestic Credit System

The domestic credit system started in fiscal 2008. In this system, large companies receive credits for providing technology and financial resources for CO_2 emission control activities by small- and medium-sized companies. The large companies then use the credits to achieve their own targets of voluntary action plan, etc. With this credit system, energy saving and CO_2 emission reduction activities are expected to be promoted in small-and medium-sized companies that used to struggle to deal with measures for CO_2 emission reduction due to financial and technological obstacles. Therefore, we are also actively participating in the domestic credit system.

(As of December 2010, The number of application is 84)



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