



Principles and Measures 2003–2004

The Federation of Electric Power Companies (FEPC)



Mitigation of Climate Change

Past Efforts

Achievements since the oil crises of the 1970s

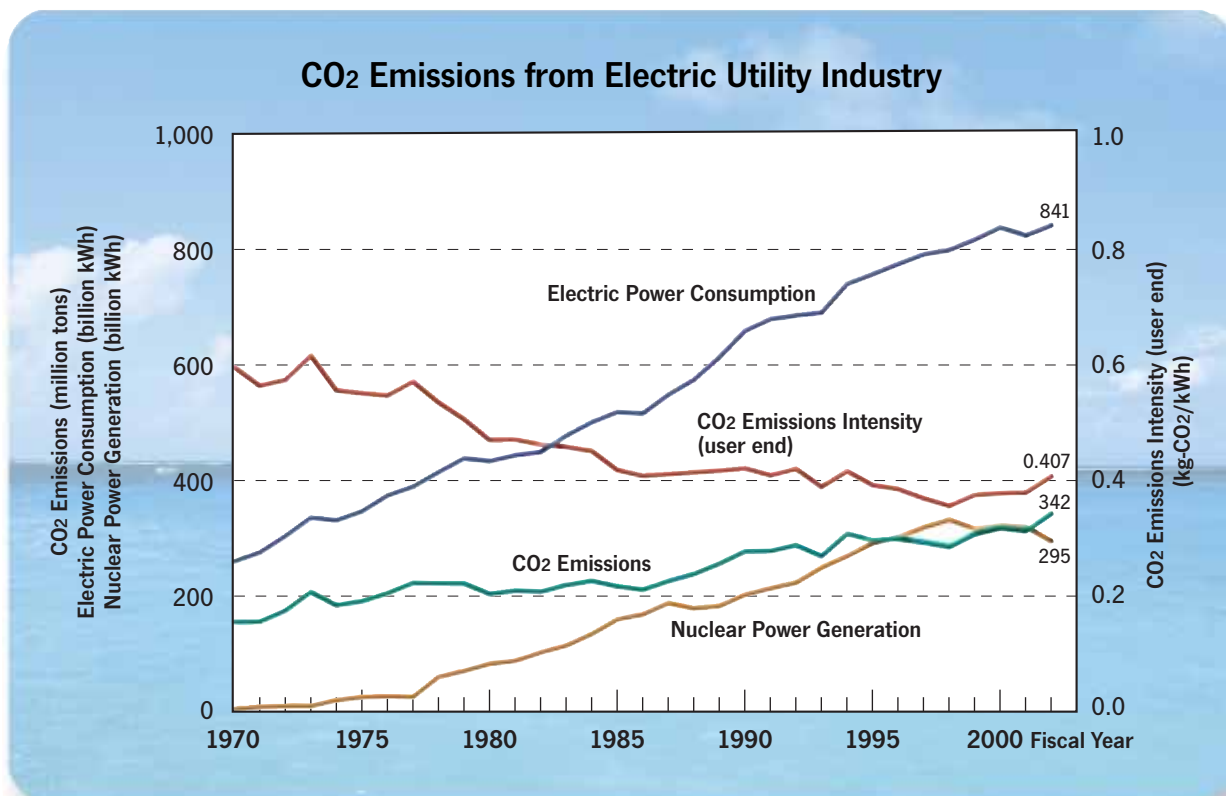
Although Japan's electric power consumption has tripled since the first oil crisis of the 1970s, emissions of CO₂ have merely doubled. This means a reduction in CO₂ emissions intensity (that is, CO₂ emissions per kWh of user end) of about two-thirds of the previous figure. This improvement is largely the result of expanded use of nuclear power and liquefied natural gas (LNG), as well as the enhanced efficiency of thermal power generation.

Environmental Action Plan of the Japanese electric utility industry

The Japanese electric utility industry announced its Environmental Action Plan, affecting twelve electric power companies*, in November 1996 to build on its voluntary and proactive efforts to mitigate climate change. The group follows up the Environmental Action Plan annually to ensure transparency and target achievement.

* The twelve affected 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.

The electric power utility industry has achieved about two-thirds reduction of the previous figure in intensity of CO₂ emissions since the first oil crisis.



Results of fiscal 2002 efforts to reduce CO₂ emissions

Electric power consumption stood at approximately 841 billion kWh in fiscal 2002, a roughly 17 billion kWh increase (2.1%) from the fiscal 2001 level.

At the same time, CO₂ emissions in fiscal 2002 stood at 342 million tons of CO₂, a 30 million ton CO₂ increase (9.7%) from the fiscal 2001 level.

As a result, CO₂ emissions intensity for fiscal 2002 was 0.407kg-CO₂/kWh, an increase (7.4%) over the fiscal 2001 figure of 0.028 kg-CO₂/kWh.

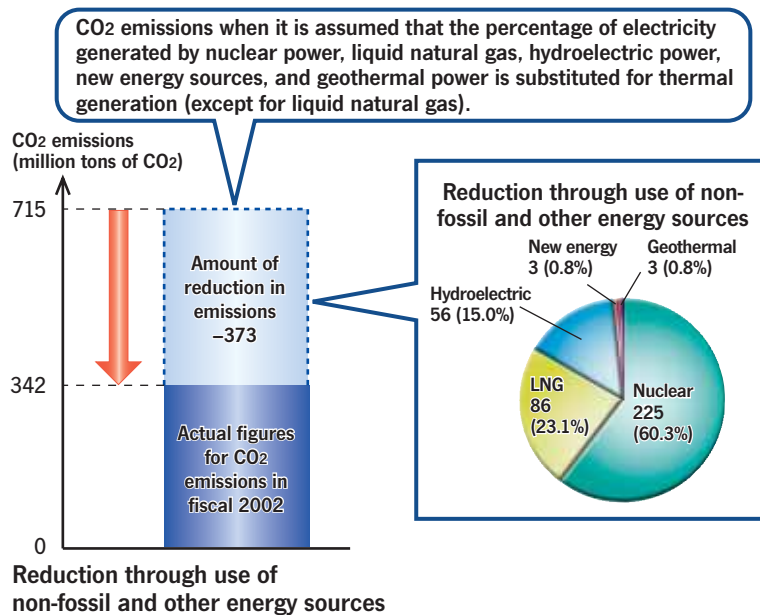
Note that electric power consumption is 28% higher than in fiscal 1990 (an annual average increase of 2.1%), and in that period, CO₂ emissions increased 24%. The result is a 3% reduction (0.014 kg-CO₂/kWh) in CO₂ emissions intensity.

CO₂ Reduction through Use of Non-Fossil and Other Energy Sources

- The result of reducing CO₂ emissions through the use of nuclear power, liquid natural gas, and hydroelectric power is provisionally estimated at 373 million tons of CO₂. This is a reduction effect equal to or greater than actual CO₂ emissions for fiscal 2002.
- The emissions savings from the use of nuclear power are especially significant: 225 million tons of CO₂. This corresponds to 19% of CO₂ emissions in Japan (1,214 million tons of CO₂) for fiscal 2001.
- The result of reducing CO₂ emissions through the use of liquid natural gas is provisionally estimated at 86 million tons of CO₂.

CO₂ Emissions and Reduction of Potential CO₂ Emissions in fiscal 2002

(preliminary calculation by FEPC)



Controlling Emissions of CO₂ Now through Fiscal 2010

Efforts to Achieve Target

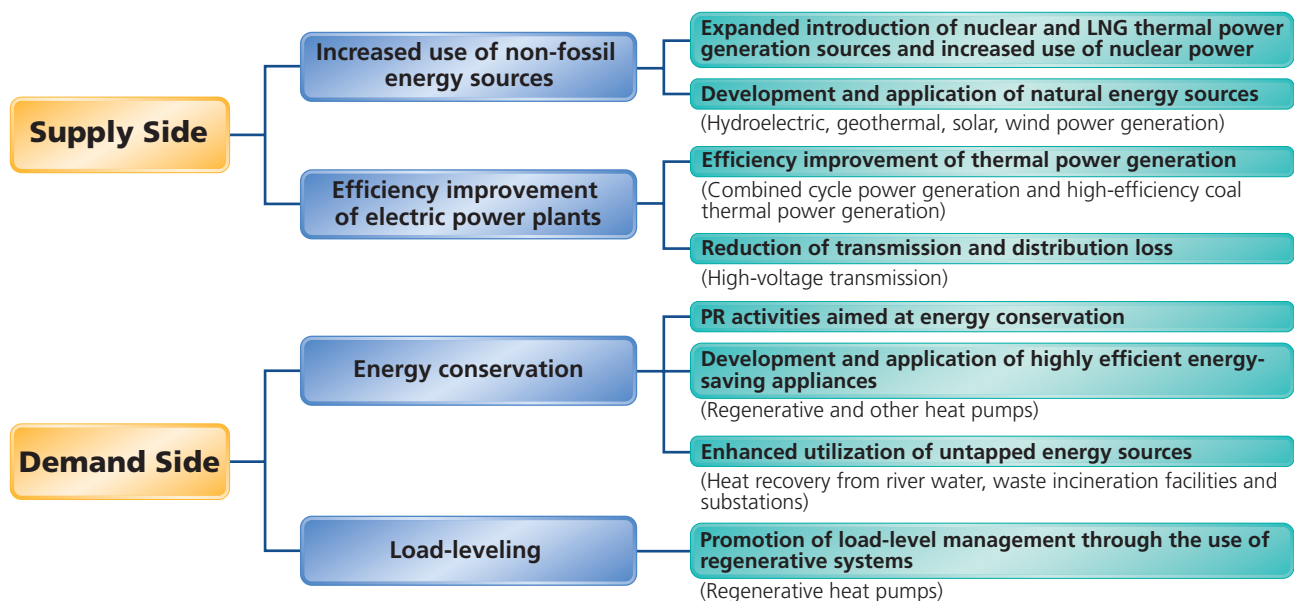
Target for fiscal 2010

By fiscal 2010, we aim to further reduce CO₂ emissions intensity (emissions per unit of user end electricity) by approximately 20% from the fiscal 1990 level, to about 0.34 kg-CO₂/kWh.

The increase in CO₂ emissions will be limited to about 12% even as power consumption rises by 40%.



Summary of CO₂ emissions reduction measures



Although the electric utility industry continues to take measures on both the supply and demand sides to achieve its CO₂ emissions reduction target, the outlook for meeting the Environmental Action Plan target has become more difficult because of the prolonged process for siting nuclear plants. Despite this adverse business climate, the industry is dedicated to meeting its targets by more closely examining the efforts it should make.

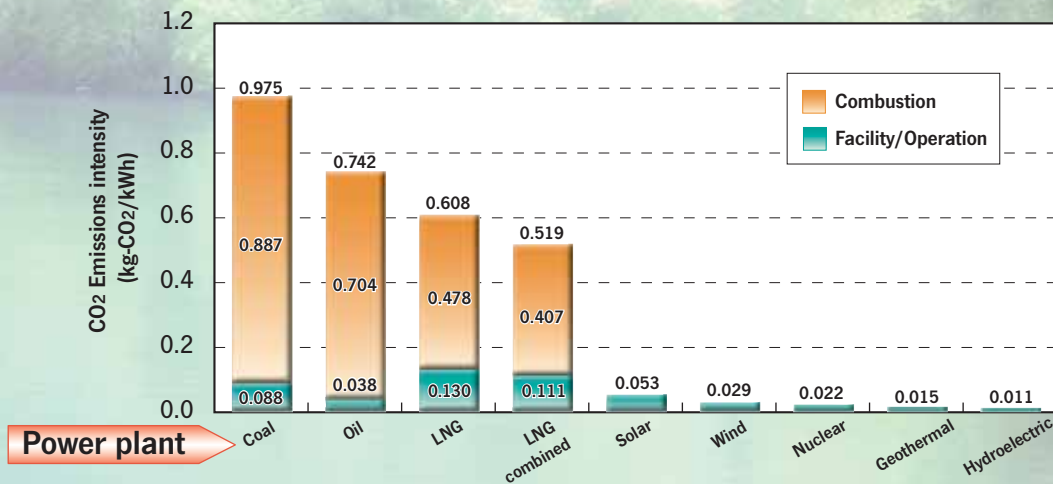
Efforts that are seen as particularly critical include:

- Stepping up the promotion of nuclear power
- Future increase in the efficiency of thermal power, and reviewing thermal power plant operating methods
- Approaches based on Kyoto Mechanisms, etc.

Nuclear power for lower CO2 emission

Nuclear power is the preferred option to mitigate climate change as it emits significantly less CO₂ over the entire lifecycle of a plant, including plant construction, operation and disposal.

Lifecycle Assessment of CO₂ Emissions Intensity for Japan's Energy Sources



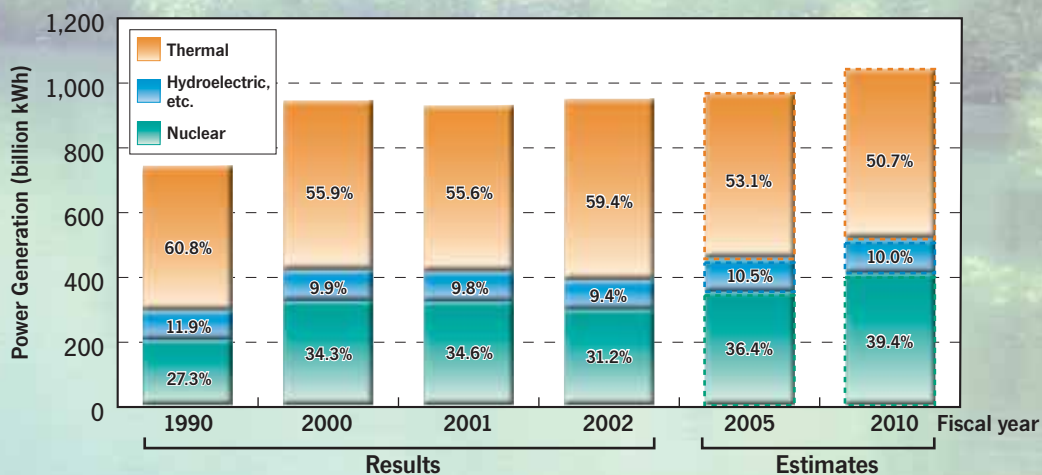
(Source: the Report of the Central Research Institute of Electric Power Industry)

* Based on total CO₂ emissions from all energy consumed in energy extraction, plant construction, transportation, refining, plant operation and maintenance, etc., in addition to burning of the fuel.

Nuclear power as core of best energy mix

- Nuclear power offers supply stability that is superior to other forms of energy. It also has economic and environmental advantages, and together these make it indispensable for maintaining energy security on a long-term basis.
- Nuclear power accounted for more than one-third of the electricity generated in Japan for fiscal 2002.

Breakdown of Power Generation by Energy Source



(Research by FEPC)

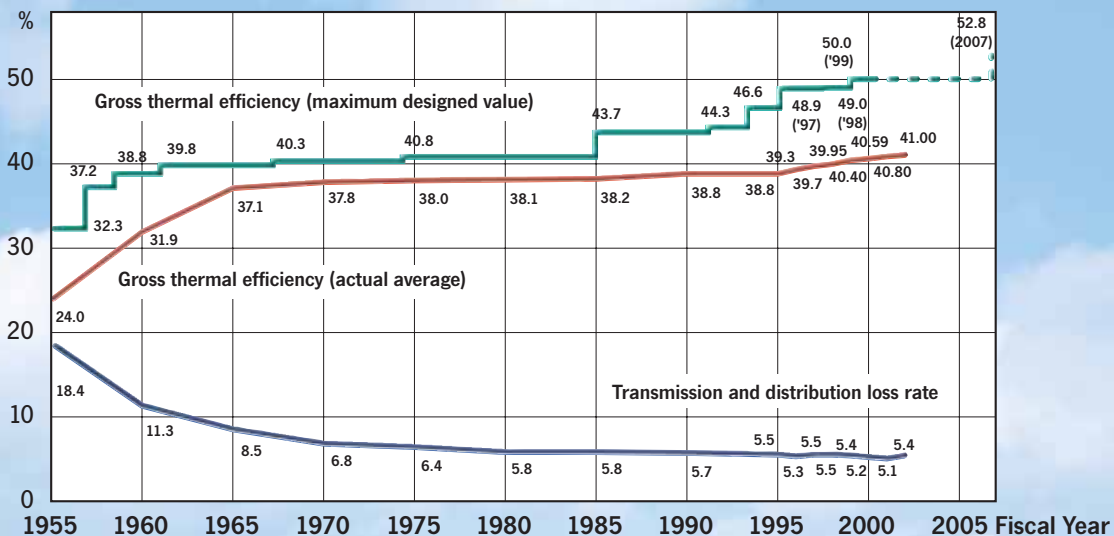
* Figures do not add up to 100% for some fiscal years due to the rounding up of numerical data.

Efforts to Achieve Target

Make thermal power plants and substations more efficient

- By developing and introducing advanced combined-cycle (ACC) power generation, which combines steam and gas turbines, we aim to improve the gross efficiency of thermal power plants to more than 52% (high heat value).
- High-efficiency coal-fired thermal power generation technologies, such as pressurized fluid-bed boiled combined cycle (PFBC) and integrated coal gasification combined cycle (IGCC), are being developed.
- We work to reduce transmission and distribution losses, as well as undertake research and development on large-capacity transmission, such as ultrahigh-voltage transmission lines of one million volts.

Thermal Efficiency and Transmission/Distribution Losses



(Research by FEPC)

Working to increase the use of natural energy sources

- Power generation from natural energy sources, such as solar and wind power, does not emit CO₂ and is therefore viewed as an effective means of mitigating climate change.
- However, natural energy sources have low power density, are easily influenced by weather and require high initial costs. Issues remain in connection with windpower, such as the need to set up systematic links, so we have to move toward solving these problems as well.
- Electric utilities are performing the R&D to solve these problems and also working to enhance the use of natural energy sources, such as by purchasing surplus power.

Present status of natural energy sources in the electric utility industry

(end of 2002)

Type	Capacity (kW)
Solar power generation	Approx. 4,511
Wind power generation	Approx. 17,761

The industry is promoting the use of natural energy sources by offering our customers the chance to buy surplus power from solar or other natural energy sources at cost, and by newly offering the Green Electric Power System, wherein customers, power generators and power companies work together to advance power from natural sources.



Tappi Wind Park, Tohoku Electric Power Co.

Approaching CO₂ reduction activities through international cooperation

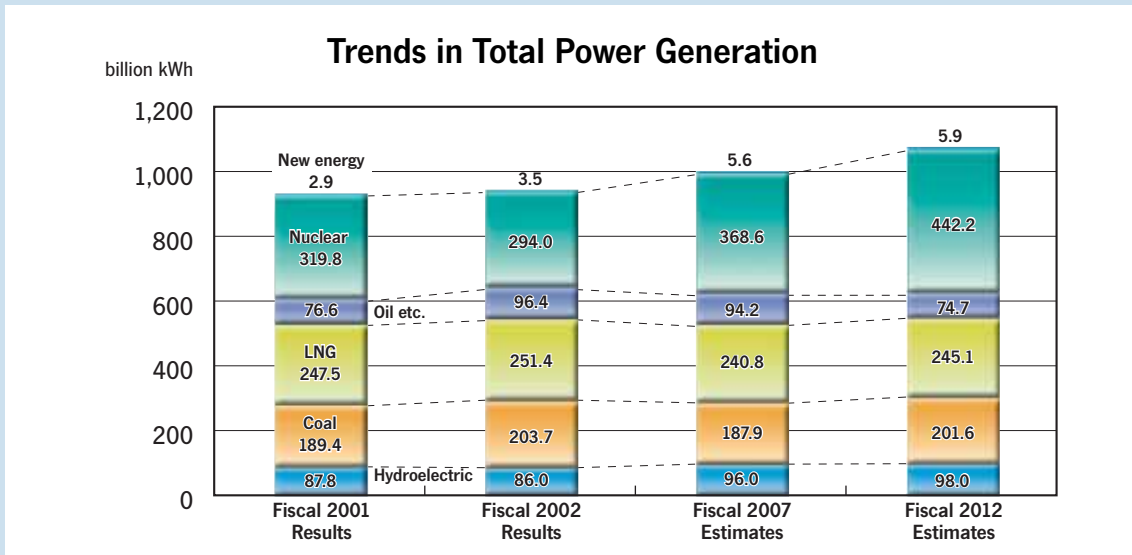
The Japanese electric power industry promotes promising projects for reducing CO₂ emissions as called for by the Kyoto Mechanisms, as well as joint research through international cooperation. Major projects are shown in the table below.

Examples of CO₂ Reduction and Absorption by Electric Utilities Overseas

Project	Outline
Upgrading thermal efficiency by improving operational levels of an existing thermal power plant in Thailand	Project implemented to improve/recover the thermal efficiency of an existing thermal power plant in cooperation with The Electricity Generation Association of Thailand (EGAT)
Technical cooperation in China to improve thermal efficiency of an existing thermal power plants	Project to improve the thermal efficiency of an existing thermal power plant of the electric company, Zhongguo Shandong Dianli
Installing solar power systems and small-scale hydroelectric power systems in Indonesia	Cooperative project with the government for local electrification and utilization of renewable energy in Indonesia by installing solar power generation systems and small-scale hydroelectric power systems
Joint development of tropical forest regenerating technology with Gadjah Mada University in Indonesia	Joint research project on technologies based on the symbiotic relationship between lauan trees and mycorrhizal fungi that are applicable to large-scale afforestation
Development of afforestation technology for reviving mangrove ecosystems by the Thai Office of Marine and Coastal Resources	Experimental afforestation project in damaged mangrove forests (such as former sites of shrimp-raising ponds), seeking to restore these potentially effective carbon sinks
Afforestation business projects in Australia	Afforestation projects designed to preserve the world's forest resources and fix atmospheric CO ₂
Joint research on afforestation in Australia	Afforestation experiment that examines environmental planting on coal mine sites Afforestation experiment to improve the soil with gypsum from the desulfurization process of coal-fired thermal power plants
Participation in the World Bank Prototype Carbon Fund and the European Bank for Reconstruction and Development (EBRD) Fund	The Prototype Carbon Fund established and operated by the World Bank and other institutions designed to provide accommodate for and invest in projects to reduce greenhouse gases in developing countries <ul style="list-style-type: none"> • World Bank Carbon Fund (PCF) • World Bank Community Development Carbon Fund (CDCF) • Eastern Europe Energy Efficiency Reserve Fund (EEERF)

Power Supply Concept

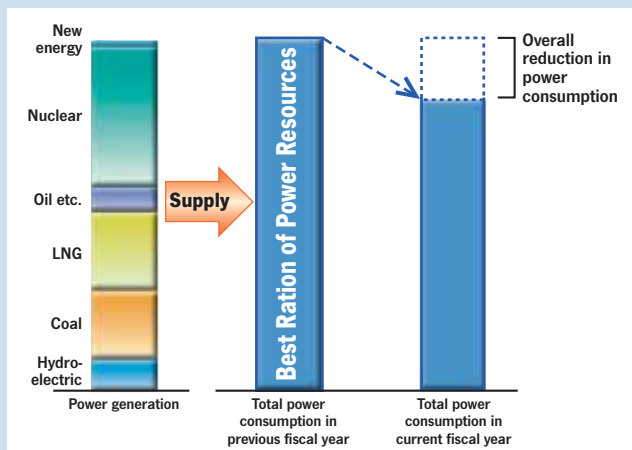
Electric power companies strive to maintain a proper balance among power sources in consideration of stabilizing fuel supplies and the economies, and develop power sources and supply power in the face of future fluctuations in power demand.



Based on the Outline of Fiscal 2002 Power Supply Plans (Agency of Natural Resources and Energy)

Concept of CO₂ Reduction by Cutting Total Customer Power Consumption

General electricity utilities supply customers with the best ration of hydroelectric, thermal and nuclear power resources. Accordingly, the following form represents the appropriate formula to use in calculating the overall reduction of CO₂ emissions when efforts to save energy on the part of users cut total power consumption.



Average CO₂ emissions intensity for all power sources
(0.407 kg-CO₂/kWh at user end in fiscal 2002)

$$\frac{[\text{total CO}_2 \text{ emitted in generation of electricity supplied by general electricity utilities (kg-CO}_2\text{)]}}{[\text{total electricity supplied by general electricity utilities (kWh)]}$$

Total reduction in CO₂ emissions (kg-CO₂)

$$= [\text{total CO}_2 \text{ emissions in previous fiscal year}] - [\text{total CO}_2 \text{ emissions in current fiscal year}]$$

$$= [\text{total power used in previous fiscal year}] \times [\text{CO}_2 \text{ emissions intensity for all power sources in previous fiscal year}] - [\text{total power used in current fiscal year}] \times [\text{CO}_2 \text{ emissions intensity for all power sources in current fiscal year}]$$