

# Measures to Reduce CO<sub>2</sub> Emissions and Energy-Saving Solutions for Plants and Offices

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## 1. Efforts in the Past and Achievements

Since the two oil shocks, Mitsubishi Electric has been conducting energy-saving activities in its production processes. This is done by organizing energy-saving promotion systems led by a general manager in each site, and includes such activities as energy-saving patrols once a month and energy-saving study meetings. Actual activities include washing the heat-exchange fins of air-conditioners before summer, turning off the entire power supply on premises during long holidays, and removing unnecessary fluorescent tubes. In 1997, Mitsubishi Electric drew up its voluntary action plan to reduce energy usage by 25% per unit sales compared with the level in fiscal 1991 by 2011 to help prevent global warming, in response to the Voluntary Action Plan by the Japan Federation of Economic Organizations. Energy-saving efforts were therefore stepped up and CO<sub>2</sub> emission reduction activities continued efficiently till fiscal 2001. However, Mitsubishi Electric's production decreased in a deflationary spiral starting in the latter half of 2000, and yet energy consumption did not decrease in proportion to the decrease in sales because air-conditioning and lighting energy requirements were fixed, independent of the production level. As a result, the energy requirement per unit sales actually worsened. To reduce fixed energy consumption,

Mitsubishi Electric investigated all energy-consuming equipment at all of its sites, to identify each installation year, rating, rate of operation, failure frequency, and the like of equipment. The results revealed that 50% of power transformers had been used for more than 30 years and 40% of air-conditioners had been used for more than 20 years. To reduce fixed energy, all old and inefficient equipment had to be replaced by state-of-the-art efficient (top runner) equipment. Mitsubishi Electric established four action plans in fiscal 2005 and set a target of reducing CO<sub>2</sub> emissions by 46,000 tons by 2011. The four action plans are: (1) replacement with equipment of higher efficiency (CO<sub>2</sub> reduction of 25,000 tons), (2) Energy-loss minimization (EM) activities (CO<sub>2</sub> reduction of 8,000 tons), (3) introduction of cogeneration system (CO<sub>2</sub> reduction of 9,000 tons), and (4) fuel conversion for boilers (CO<sub>2</sub> reduction of 4,000 tons). In fiscal 2005 and 2006, CO<sub>2</sub> emissions were successfully reduced by 12,700 tons, which is approximately twice the annual reduction achieved previously.

For the fifth three-year environmental plan beginning in fiscal 2007, Mitsubishi Electric decided to use the real energy requirement unit as the energy control indicator in line with the unit widely used in the electric and electronics industry, and changed its voluntary

Table 1 Progress of energy savings action plans

Action plan	Target of reduction by 2011 (tons of CO <sub>2</sub> )	Fiscal year 2005		Fiscal year 2006		Fiscal year 2007		Cumulative sum		Fiscal year 2008	
		Actual achievement		Actual achievement		Actual achievement		Actual achievement		Plan	
		Reduction (tons of CO <sub>2</sub> )	Investment (million yen)	Reduction (tons of CO <sub>2</sub> )	Investment (million yen)	Reduction (tons of CO <sub>2</sub> )	Investment (million yen)	Reduction (tons of CO <sub>2</sub> )	Investment (million yen)	Reduction (tons of CO <sub>2</sub> )	Investment (million yen)
Introduction of higher-efficiency equipment	34,800	4,091	1,439	5,910	1,468	8,842	2,481	18,843	5,388	9,389	2,590
EM activity	8,000	214	41	266	76	890	156	1,370	273	759	94
Introduction of cogeneration	0	7	4	0	0	0	0	7	4	0	0
Fuel conversion	3,200	1,872	48	334	49	320	25	2,526	122	52	40
Total	46,000	6,184	1,532	6,510	1,593	10,052	2,662	22,746	5,787	10,200	2,724
Cumulative sum	-	6,184	1,532	12,694	3,125	22,746	5,787				

action plan target to reduce the real energy requirement per unit sales by 60% or more compared with the level in fiscal 1991 by 2011. To achieve this target, it was necessary to review the four action plans established in fiscal 2005 to reduce CO<sub>2</sub> emissions by 46,000 tons over seven years. A CO<sub>2</sub> reduction of 12,700 tons has already been achieved, so a further 33,000 tons must be reduced over the remaining five years. Of the four action plans, cogeneration systems have not been introduced since most of Mitsubishi Electric's plants do not need heat, resulting in a low level of energy efficiency. So the CO<sub>2</sub> reduction of 9,000 tons by introducing cogeneration systems was achieved by replacing equipment with higher-efficiency equipment. The CO<sub>2</sub> emission reduction expected in the action plan by introducing higher-efficiency equipment for the remaining five years was thus increased from 15,000 tons to 24,000 tons. As a guideline for introducing higher-efficiency equipment, we requested plants to invest 0.1% of production of the previous fiscal year for introducing energy-saving technologies in the next fiscal year. As a result, fiscal 2007 saw a CO<sub>2</sub> reduction of 10,052 tons throughout the company. In addition, the target of the voluntary action plan was achieved four years ahead of schedule.

The CO<sub>2</sub> emissions associated with production in fiscal 2007 were 45,900 tons. With a reduction of 10,052 tons by investing in energy-saving facilities, the energy consumption was limited to an increase of 12,000 tons of CO<sub>2</sub> (up 2.6%) compared with the previous year. On the other hand, sales rose 5.1% from the previous fiscal year, yielding a sharp improvement in real energy requirement per unit sales and achieving the target of the voluntary action plan. The real energy requirement per unit sales decreased by 63% compared with the level of fiscal 1991, achieving the original target ahead of schedule. Efforts to reduce CO<sub>2</sub> emis-

sions further will be continued from fiscal 2008.

## 2. Major Measures and Effects

Mitsubishi Electric's three measures for reducing CO<sub>2</sub> emissions in the past are described below.

[CO<sub>2</sub> emission reduction measures]

- Replacement with higher-efficiency equipment
- Energy-loss minimization activity
- Fuel conversion

### 2.1 Replacement with higher-efficiency equipment

Replacement with higher-efficiency equipment means replacing facilities such as power mechanisms, air-conditioners, and lighting facilities which are necessary for the operation of plants, with state-of-the-art equipment that is more energy-efficient.

Most of such facilities can be used for longer than 10 years and many have been used for more than 20 years. The power consumption of today's air-conditioners is around 60% of those produced 10 years ago. With transformers, the newest models offer about 40% less CO<sub>2</sub> emissions than older models. In short, replacing plant facilities with state-of-the-art energy-efficient equipment is extremely effective. Today, Mitsubishi Electric invests the equivalent of 0.1% of production for renewal of plant facilities.

### 2.2 Minimizing energy loss

Activities to minimize energy loss involve making improvements through detailed measurement of the energy consumed by respective production processes in plants, by using energy measurement tools and through the identification and elimination of wasteful use of energy. ECO Monitors developed by Mitsubishi Electric are installed in plants and offices throughout the company to continuously monitor the electricity

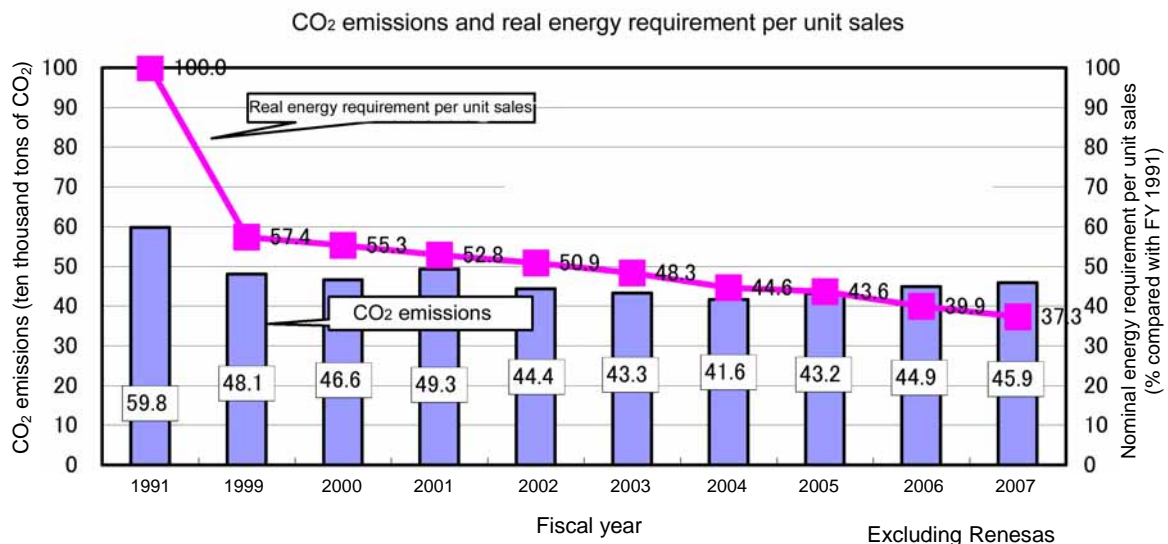


Fig. 1 Changes in CO<sub>2</sub> emissions and real energy requirement per unit sales

consumption and the like. In addition, the monitored data can be viewed by Internet browser via the network and so the data is made available to a wide range of people, including managers as well as site operators.

The measurement data shows the energy consumption at measurement intervals of five minutes. Graphic representation of the data clearly reveals wasteful use of electricity, such as consumption during rest periods or at night. The reasons for such wasteful operation of facilities are then analyzed and necessary action is taken, such as suspension of power to the facilities. By repeating this process, wasteful consumption of power and costs are reduced.

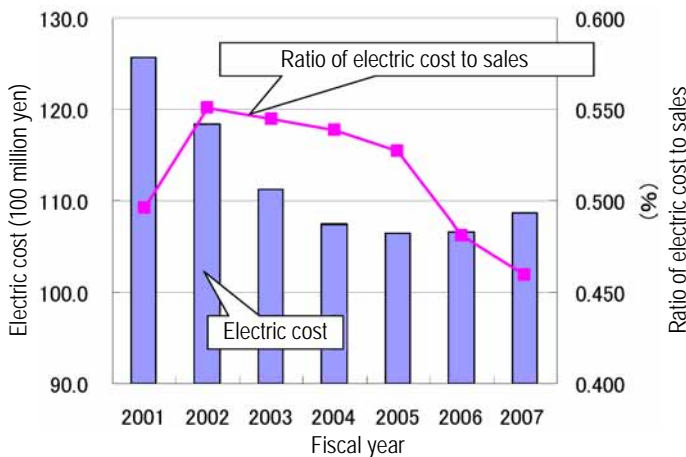


Fig. 2 Changes in electric cost and ratio of electric cost to sales

### 2.3 Fuel conversion

Fuel conversion means switching from fuels that emit a large amount of CO<sub>2</sub> to other fuels that emit less CO<sub>2</sub>. An example is switching from boilers that use heavy oil to boilers fueled by city gas. In one such case, CO<sub>2</sub> emissions were successfully reduced by about 1,769 tons per annum. Mitsubishi Electric aims to reduce CO<sub>2</sub> emissions by approximately 40% by changing the water heaters from the conventional combustion method to the heat-pump method from now on.

### 2.4 Effect of the reduction of fixed energy

Reduction of fixed energy, which started in fiscal 2005 as mentioned above, has led to a decrease in the ratio of electric energy cost to sales.

It is necessary to continuously reduce the fixed energy since this improves management vitality. Therefore, even though the target of the voluntary action plan was achieved, we will continue the policy of investing 0.1% of the production of the previous fiscal year in energy-saving facilities in the next fiscal year.

We have witnessed our own potential for reducing fixed energy as a result of investigating all energy consuming equipment in fiscal 2005. On the basis of the results, we may be able to reduce CO<sub>2</sub> emissions by a total of 30% through production in accordance with Environmental Vision 2021.