

# 1998 Environmental Report





### **We choose to protect the environment.**

Both industry and the individual share the solemn responsibility of protecting the global environment. On this belief, the Mitsubishi Electric Group adopted an Environmental Plan in 1993 and since then we have been taking steps to protect the planet on our own. Until now, we have tried to lessen the burden placed on the environment by our business activities by, for example, saving energy in production processes and reducing waste. Environment management systems conforming to ISO14001 have also been introduced at all production centers. Moreover, we expect our entire workforce to uphold these environmental ideals as much in their private lives as in their corporate activities. We also are making efforts to develop energy-saving recyclable products.

### **Committed to the global environment**

As part of our contribution to the sustainable development of the planet, the Mitsubishi Electric Group is exploring possibilities yet to be discovered, tapped and harnessed in the vast amount of knowledge and technology we have built up over the years. This is simply our commitment to the global environment.

For a general appliance manufacturer, the high-tech infrastructure of tomorrow's cyclical socio-economic way of life is a test of strength and ability. Companies are already racing to develop energy-saving technologies, discover new sources of energy and improve resource productivity by effectively using and recycling the planet's irreplaceable resources. New business opportunities are being born and, at the same time, new ways of protecting the global environment are arising through business. The Mitsubishi Electric Group is developing the environment business in all of industries, from energy development and the space sciences to home appliances.

### **We want to establish communication channels.**

Today's environmental problems are far too serious for a single company or organization to solve on its own. Nevertheless, we are publishing this annual report about the progress of our environmental plan, not to simply release information, but in hope of receiving your thoughts and feedback. We want to establish communication channels that might possibly shed some light on how other problems may be solved.

**I am looking forward to hearing your thoughts and advice.**

A handwritten signature in black ink, reading "Ichiro Taniguchi". The signature is written in a cursive, flowing style.

Ichiro Taniguchi, President

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## Corporate Profile

• **Name**

Mitsubishi Electric Corporation

• **Number of employees**

46,440 (March 1998)

• **Head office address**

Mitsubishi Denki Bldg., 2-2-3  
Marunouchi, Chiyoda-ku, Tokyo, Japan  
100-8310  
Tel: +81 (3) 3218-2111

• **Operations**

Head office  
Design/Manufacturing centers...50  
Research & Development centers...13  
Sales offices...62  
Domestic subsidiaries...85  
Overseas subsidiaries...38  
(Overseas operations...139 centers in 37 countries)

• **Date established**

January 15, 1921

• **Capital**

175.8 billion yen (March 1998)

• **Sales** (April 1, 1997 to March 31, 1998)

Mitsubishi Electric: 2.8115 trillion yen  
Consolidated: 3.8013 trillion yen

# Challenges for the Environment



## Adopting an Environmental Plan

In March 1993, we adopted voluntary action plan for the environment to take us to 2000 and began undertaking various programs in this interest. Based on the progress we made and social changes, in May 1996 the plan was revised to develop activities across the entire Mitsubishi Electric Group. In the course of promoting this plan, products and technological processes are being modified to give greater efficiency in production and resource utilization, the essence of a cyclic socio-economic environment. Our environmental plan consists of the three pillars described below.

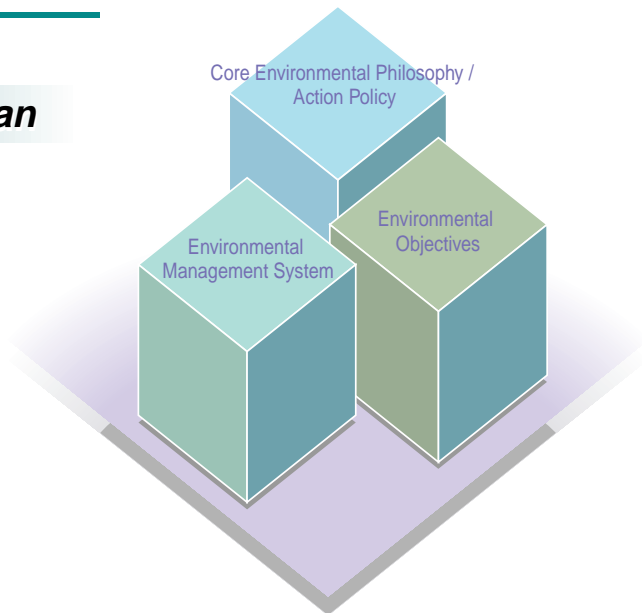


Fig. 1 Three pillars in Environmental Plan

1. Core Environmental philosophy and Action Policy clarifies our intention, corporate responsibility for reducing our negative environmental impact; promoting active, voluntary control activities; and contributing technologies and business operations that enhance environmental security to industry and society.
2. Environmental Management System is necessary to measure, monitor and reduce any negative impact of our transnational operations and facilities.
3. Environmental Objectives are our commitment on both our business activities and products with numerical targets in areas; "global warming prevention;" "resource saving, recycling and reduction of industrial waste;" and "control of chemical substances."

### Core Environmental Philosophy

Under the principle of "sustainable development," the Mitsubishi Electric Group is committed to protecting and improving the global environment through all business activities, using its accumulated knowledge and the technologies it will develop in the future.

### Action Policy

1. We will strive to reduce any negative environmental impact resulting from our products and activities. We will develop technologies and processes that are compatible with the environment. Products will be fully assessed over their entire life cycle, and our facilities will promote resource efficiency, conservation and recycling.
2. We will commit ourselves to improving our understanding of environmental problems and contributing to a universal awareness of the need for businesses to integrate their activities with the natural cycles of nature.
3. We will establish environmental management systems at all our business sites and operate them according to accepted standards. At the same time, we will continually improve environmental controls through environmental audits and similar methods.
4. We will educate, train and motivate employees to be good environmental stewards in their own right, as well as support employees and their families when they engage in activities that promote environmental protection.
5. We will foster active communication and cooperation regarding environmental protection worldwide.



## Organization for Corporate Environmental Management

According to the basic corporate principles and policy on global environmental problems decided by the environmental director, the Environmental and Quality Management Department (EQD) promotes practical activities with each of the business group. Mitsubishi Electric has 11 business groups that deal in areas ranging from power systems to semiconductors by assigning responsibility for everything. Environmental problems are considered a business management task in every group, and promotional systems like special committees are being set up and activities are being developed based on the characteristics of the business and the products.

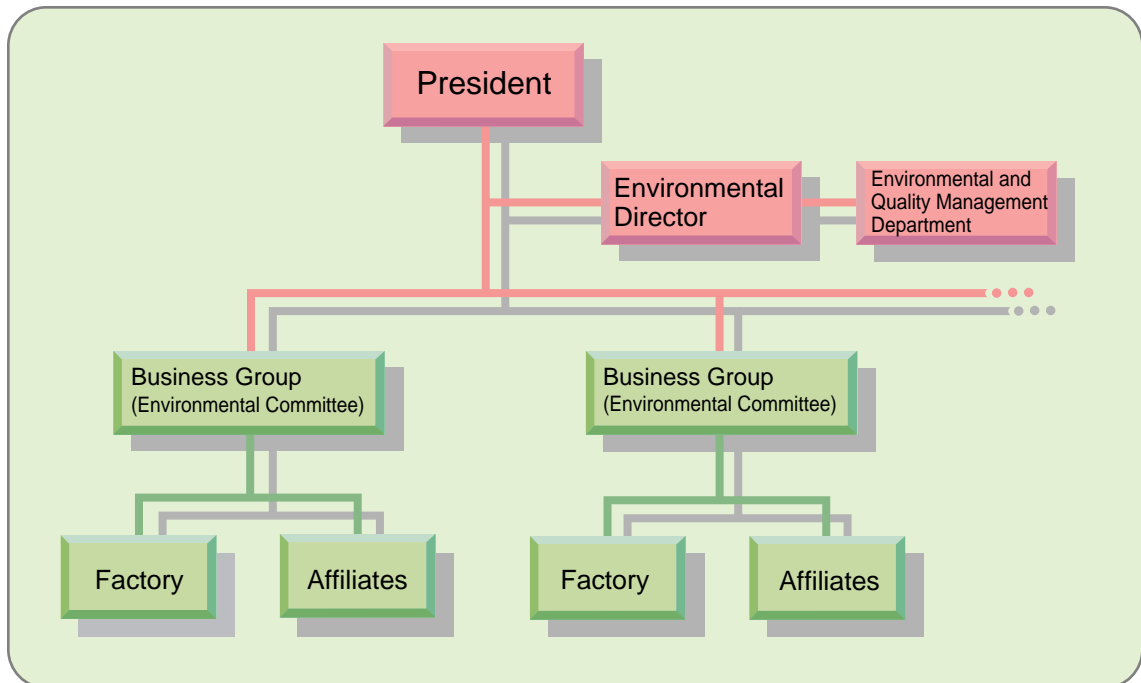


Fig. 2 Organization for Corporate Environmental Management

### Environmental Committee

The EQD established a regular environmental committee, which convenes environmental managers from all business groups and factories in order to confirm group policy and coordinate matters between business groups.



Environmental Committee

### Continual improvement

Plans and results are followed up every year by the entire Mitsubishi Electric group to check that progress is being made toward attaining targets set forth in the environmental plan. We are happy to report that improvements are being made continually.



Report form (Japanese/English)



## Environmental Management System

### Established EMS

EMS is the basic structure, and the basis of all activities to continually reduce the negative environmental impact in both production activities and products.

**Target:**  
Establishing ISO14001-registered EMS in all domestic factories in Mitsubishi Electric by 1998, and all manufacturing sites of domestic and overseas affiliates by fiscal year 2000.

By the end of fiscal 1997, 21 out of 25 Mitsubishi Electric domestic sites were ISO14001 registered, and remaining four sites were registered by June 1998.

### Results from Establishing EMS

- \* Environmental problems are the concern of all employees, and everyone needs to make a positive effort to reduce the negative environmental impact of each job. The established EMS made it clear to employees what they must do to protect the environment through their jobs.
- \* Any activities to reduce the negative environmental impact, and to develop competitive environmentally friendly products by using the continuous improvement structure contributes to improving the overall management of Mitsubishi Electric.

### Future Action

- \* Though environmental targets in ISO14001 will be set by each registered site, Mitsubishi Electric plans to ensure that no one can be satisfied with easy targets.
- \* Establishing ISO14001-registered EMS shall be further promoted for all manufacturing sites of domestic and overseas affiliates by the end of fiscal 2000. For the detailed activities taken by affiliates, see page 18.

Date	Registered site
Mar. 1996	Inazawa Works
Mar. 1997	Kumamoto Factory
June. 1997	Kochi Factory
July. 1997	Saijo Factory
Aug. 1997	Ako Site
Sep. 1997	Fukuoka Site
Oct. 1997	Kitaitami Site
Nov. 1997	Nagoya Site
	Itami Site (Communication Equipment Works, etc)
	Fukuyama Works
Dec. 1997	Shizuoka Works
	Nagasaki Site
Mar. 1998	Marugame Site
	Itami Site
	Sagami Site
	Kobe Site
	Wakayama Site
	Nakatsugawa Site
	Himeji Works
	Information System Engineering Center Sanda Works
Apr. 1998	Gunma Site
May. 1998	Kamakura Works
June. 1998	Koriyama Site
	Kyoto Site

Table 1 ISO14001 registration schedule



## Environmental Objectives

### Progress in Attaining Environmental Targets

Progress made for targets in fiscal 1997 are shown below. For detailed individual activities, see page 6 and beyond.

	Targets	Progress made in fiscal 1997
Activities	<b>Prevention of Global Warming</b> <ul style="list-style-type: none"> <li>Reduce emissions of greenhouse gases by 25% by fiscal 2010 (compared to the fiscal 1990 level of carbon-equivalent energy consumption to net sales*<sup>1</sup>).</li> </ul>	<ul style="list-style-type: none"> <li>The ratio of carbon-equivalent energy consumption to net sales was reduced by 5.7% with respect to 1990 levels.</li> <li>Efforts were made to save energy and to shift to other energy sources that generate low levels of carbon. As a result, absolute total amount of carbon emissions shrank compared to 1990 levels, despite increased turnover.</li> <li>Studies will be started on reducing emission of greenhouse gases other than CO<sub>2</sub>.</li> </ul>
	<b>Promotion of Resource Conservation, Recycling and Reduction of Industrial Waste</b> <ul style="list-style-type: none"> <li>Reduce the amount of waste disposed by waste haulers by 30% by the end of fiscal 2000 (using fiscal 1995 as a base).</li> </ul>	Waste water treatment was improved and separate collection of waste paper was increased. As planned, the amount of waste disposed was reduced by 10% with respect to the 1995 level. In the future, action will focus on waste plastics, waste oil, waste alkali, etc.
	<b>Control of Chemical Substance</b> <ul style="list-style-type: none"> <li>Identify the amounts of chemical substances used in production processes by the end of fiscal 1997 and set targets for reduction.</li> <li>Eliminate the use of organic chlorine solvents in open systems by the end of fiscal 2000.</li> <li>Reduce the use of volatile organic solvents in open systems and promote their recovery and recycling.</li> </ul>	<ul style="list-style-type: none"> <li>A system was built to identify the amount of chemical substances used in production (material balance*<sup>2</sup>) and how they are used.</li> <li>Organic chlorides will be eliminated in both closed and open systems by the end of fiscal 1999.</li> <li>Recovery systems were introduced in 16 factories.</li> </ul>
Products	<b>Prevention of Global Warming</b> <p>Set specific targets for reducing the energy consumption of individual products by the end of fiscal 1996.</p>	Targets were set to reduce energy consumption during use and idling with newly developed products, and action was started to achieve these targets. As a result, one of our air conditioners was awarded the Energy-Saving Vanguard 21 Award of the Ministry of International Trade and Industry, Japan.
	<b>Promotion of Resource Conservation, Recycling and Reduction of Industrial Waste</b> <ul style="list-style-type: none"> <li>Assessment of all products by the end of fiscal 1997.</li> <li>Establish targets to reduce the disassembly times and number of components for individual products.</li> <li>Increase the use of recycled materials by 30% by the end of fiscal 2000 (using fiscal 1995 as a base) excluding ordinary metal materials.</li> <li>Reduce packaging materials by 20% by the end of fiscal 2000 (using 1995 as a base).</li> </ul>	<ul style="list-style-type: none"> <li>Preparations for internal Rule of product assessment were completed at all 22 domestic MELCO factories. Product assessment with respect to life cycle has been applied mostly to newly developed products.</li> <li>The use of recycled materials is to be continued.</li> <li>Packaging materials were reduced by 6% with respect to 1995 levels.</li> </ul>
	<b>Control of Chemical Substances</b> <ul style="list-style-type: none"> <li>Identify and quantify the chemicals used in products by the end of fiscal 1997 and set targets for reduction or elimination.</li> <li>Phase out the use of HCFCs*<sup>3</sup> as refrigerants for refrigerators by 2010. Phase out the use of HCFCs as foaming agents for refrigerators by 2004.</li> </ul>	<ul style="list-style-type: none"> <li>The amount of chemical substances used in products and their material balance were identified.</li> <li>Studies are underway on using alternative refrigerants / foaming agents for air-conditioning equipment and refrigerators.</li> </ul>

Corporate reduction target was revised in August 1998 considering the adoption of Kyoto Protocol; "reduction of greenhouse gases emissions" at COP3\*<sup>4</sup>

\* 1. Carbon-equivalent energy consumption to net sales: Annual carbon-equivalent energy consumption / Annual net sales.

\* 2. Material balance: Quantitatively identifying how much chemical substances are used and chemical balance in the plant.

\* 3. HCFC: Hydrochlorofluorocarbons, Alternative to CFC refrigerant.

\* 4. COP3: Conference of the Parties Third Session on United Nations Framework Convention on Climate Change. International conference on prevention of climate change held in Kyoto in December 1997. In the Kyoto Protocol adopted there, developed countries set reduction commitment on average emission of greenhouse gases for 2008 to 2012.

## Prevention of Global Warming

### ■ Activities in Fiscal 1997 (%)

Carbon-equivalent energy consumption in fiscal 1997 dropped only slightly from the previous year, and the sales were at the same level in 1996 because of Japan's recession. From this perspective, the ratio of carbon-equivalent energy consumption to net sales is about the same as fiscal 1996.

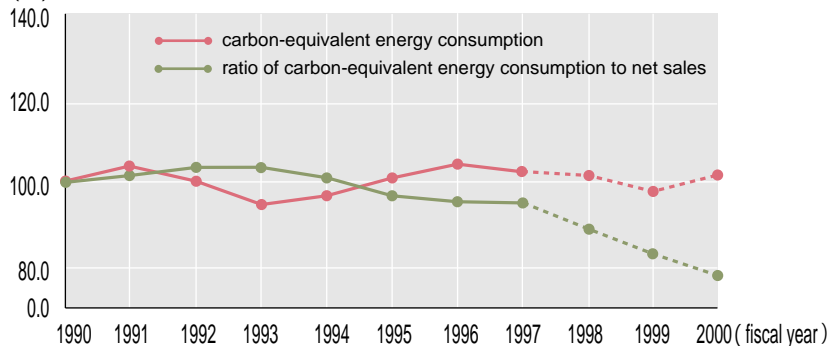


Fig. 3 Transition in energy consumption

As shown in Fig. 3, carbon-

equivalent energy consumption from 1990 to 1997 is almost the same level. This is because each factory has taken action to apply lower carbon energy sources and other measures to save energy.

In line with the reduction commitment of Kyoto Protocol, Mitsubishi Electric will be boosting efforts to reduce carbon dioxide emissions.

As a corporate measure, we will promote saving energy for production lines in factories by applying higher efficiently motors and testing equipment. With regard to air-conditioning, we will not only promote efficient use of energy by shifting to use of more efficient equipment, such as Lossnay and heat pumps, but will also cut energy consumption at peak times by introducing ice storage air-conditioners. As for the lighting, we will introduce more efficient equipment and systems (MELSAVE). At Mitsubishi Electric, almost half of the energy consumed is for semiconductor manufacturing. The key element of the energy saving in this area is reducing the energy consumption of air-conditioners in clean rooms. We will promote energy saving by switching to inverter air-conditioners and by dividing clean rooms into sub areas and managing air-conditioning for these areas independently.

### ■ Action Taken at Factories

#### Energy-Saving Model Factory / Fukuyama Works

Fukuyama Works manufactures power reception and control equipment, and tests its systems by installing them in-house before releasing as products. At the Fukuyama Works, attempts to save energy are started by measuring energy consumption of the utilities and equipment in the various manufacturing processes, and plant power utilization data is collected, monitored and controlled using our own energy management system B/NET. Efforts are being made to run compressors and molding machines only when they are needed. Energy management data is also listed on the intranet to raise employees awareness, and management makes periodic check and review.



Energy management system (B/NET)



## Energy-Saving Building / Nakatsugawa Works

Nakatsugawa Works manufactures products for the living environment. Our own state-of-the-art energy-saving system has been employed in a new office, and this system has reduced power consumption by 21%.



New office building in Nakatsugawa Works

< Main equipment >

Renewable energy: Photovoltaic power generation system (15kW)

Air conditioning / Ventilation: Ice storage air conditioning system, commercial / light commercial Lossnay

Lighting: MELSAVE system (Inverter lighting for daytime use)

Thermal insulation: Sandwich panel insulation for external walls, rooftop garden, energy-saving windows (high-performance, heat-reflecting glass, double-layered glass, roll screens, etc.), PERIMETER fan, reduced heat load in the afternoon by locating equipment at the west side.

Monitoring / Control: centralized hot water supply, energy monitoring with building management system

Also, in order to promote energy-saving in the entire building, our corporate in-house building codes adopted more severe requirements than existing laws & regulations. These requirements were also adopted to this new building.

## Other Greenhouse Gases

At the COP3 meeting, it was decided to reduce the release of other greenhouse gases such as HFCs, PFCs and SF<sub>6</sub>. Mitsubishi Electric is limiting use of these gases, uses closed systems where these gases are used, and performs recovery, elimination, and recycling, in addition trying to develop alternative substances and technology.

Greenhouse Gas	GWP *1	How used in Mitsubishi Electric
HFCs (Hydrofluorocarbons)	140 ~ 11,700	Refrigerant and heat insulator for air conditioners and refrigerators
PFCs (Perfluorocarbons)	6,500 ~ 9,200	Etching gas for semiconductors
SF <sub>6</sub> (Sulfur hexafluoride)	23,900	Insulation gas for power equipment

Table 2 Major greenhouse gases used by Mitsubishi Electric (Reference:IPCC \*2)

\* 1. GWP: Global Warming Potential

Relative effect that a substance has on global warming taking CO<sub>2</sub> to be 1. Greenhouse gases with higher GWP are regarded as having a more significant effect on global warming.

\* 2. IPCC: The Intergovernmental Panel on Climate Change. Organization created by the World Meteorological Organization (WMO) and the United Nations Environment Program (UNEP) to assess scientific, technological and socio-economic systems in the field of meteorology and to study future action. The IPCC is a venue for publicly debating the global warming problem. National governments must qualify to participate.

## Resource Saving / Recycling and Waste Reduction

### Waste Disposal

The amount of waste disposal in fiscal 1997 was 10% lower than in 1995. Waste generated in production processes is shown below. A total of 99,460 tons of waste were generated in fiscal 1997. Of this figure, 75.6% (75,230 tons) were recycled while the remaining 24.4% (24,230 tons) was disposed.

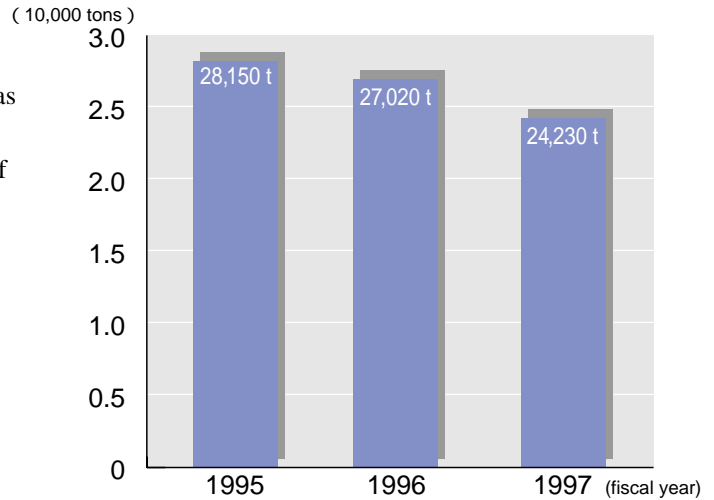


Fig. 4 Transition in waste disposed

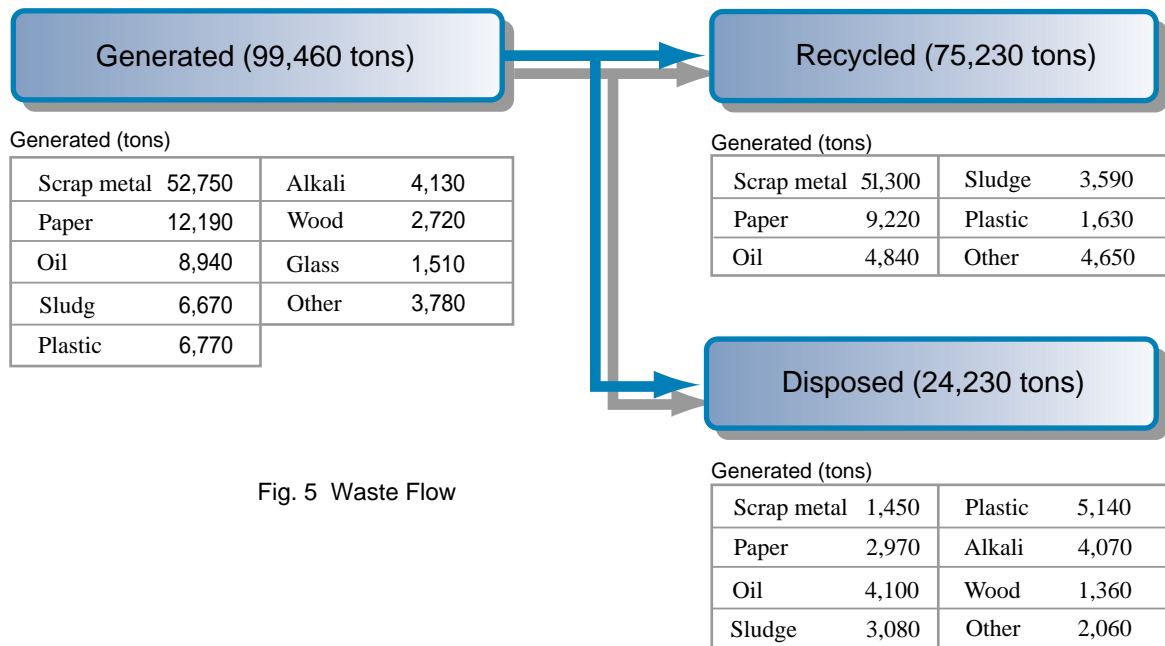


Fig. 5 Waste Flow

### Sorting of Waste and Future Reduction Activities

Waste plastics are difficult to recycled for technical and economic reasons, and for this reason, their disposal amount is higher than that of others (5,140 tons / year). However, waste plastics have been recently recycled as reducing agents for blast furnaces and fuels. As a result, the recycled amount has increased by 500 tons over previous years. Waste oil, however, is still difficult to recycle for economic reasons. Since waste alkali is also difficult to recycle, we will reduce usage by reviewing production process.

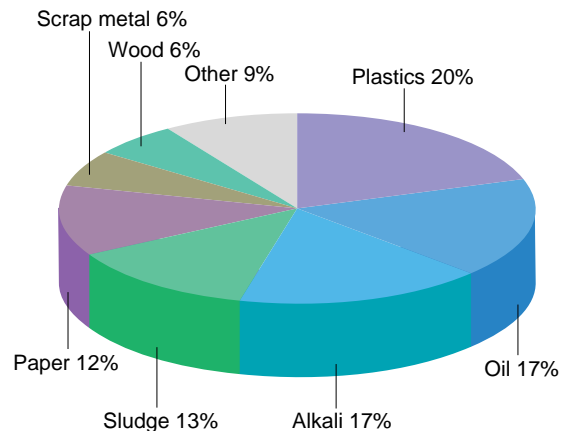


Fig. 6 Composition of waste disposed in fiscal 1997

## Action Taken at Factories



Isopropyl alcohol recovery equipment

### Aiming at Zero Emission of Wastes / Semiconductor Factory

Twenty years ago, our semiconductor factories started recycling the calcium fluoride sludge generated from waste process water as a raw material for cement. Today, 100% of the sludge is recycled.

We are aiming at zero emission of waste in accordance with ISO14001-registered EMS. Manufacturing technology is being used to improve production processes that recycle waste oil. In fiscal 1997, chemical solvents used in cleaning, waste process water and waste isopropyl alcohol (IPA) were also recycled, so not only was the amount of disposal reduced, but also cost reduction was achieved.

### Recycling / Nagoya Works

At Nagoya Works, scrap metal generated in processes is carefully separated, large amount of waste plastics is recycled, and treatment techniques for waste acid and alkali have been improved. Moreover, they are recycling packaging materials, work gloves, office paper and rubbish from the canteen. From 1995 to 1997, waste was cut by approximately 200 tons.



Waste recovery and separating center



Award ceremony

### Chairman's Award for Recycling Efforts / Kamakura Works & Information Systems Engineering Center

Kamakura Works manufactures satellites, control and communication equipment. Information Systems Engineering Center manufactures computers, network equipment and systems. To educate the employees concerning separation of waste for recycling, they issued a brochure entitled "How to Separate and Dump Trash" and raised awareness of employees through in-house seminars. In fiscal 1997, the recycle rate was 55.5% and their recycling efforts were recognized in October 1997 with the Chairman's Award for Recycling Efforts, sponsored by the Recycle Promotion Council of Japan.

## Control of Chemical Substances

### Hazard Classification and Material Balance

Mitsubishi Electric has prohibited the use of 27 chemical substances. Some other 488 substances, used in manufacturing processes or included in products, are categorized into four classes and material balance has been identified, as shown below. Efforts are underway to reduce release of more environmentally risky substances and to substitute them with less risky ones.

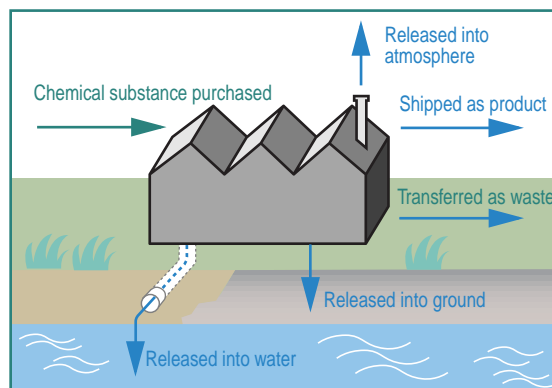


Fig. 7 Material balance concept

Class	Qty	Example	Management
S	27	PCB and specified ozone-depleting substances, some asbestos, etc.	Use prohibited in production and products.
A	13	Organic chloride compounds, trichloroethylene, dichloromethane, etc.	Release into the air to be reduced with quantitative targets.
B C1 C2	144 255 76	Chemical substance is subjected to PRTR* system, alternative CFC, Sulfur hexafluoride (SF <sub>6</sub> ).	Material balance to be recorded. Discharge / Use reduction is being encouraged where possible. Detailed management conditions as set according to environmental relevance.

Table 3 Chemical substance classifications

### Voluntary Management

At Mitsubishi Electric, quantitative reduction targets have been set for class A substances, trichloroethylene and dichloromethane, which are released in relatively large amount into the atmosphere. Other targets are to eliminate all organic chloride compounds including the two substances mentioned above by the end of fiscal 1999 (zero use in fiscal 2000).

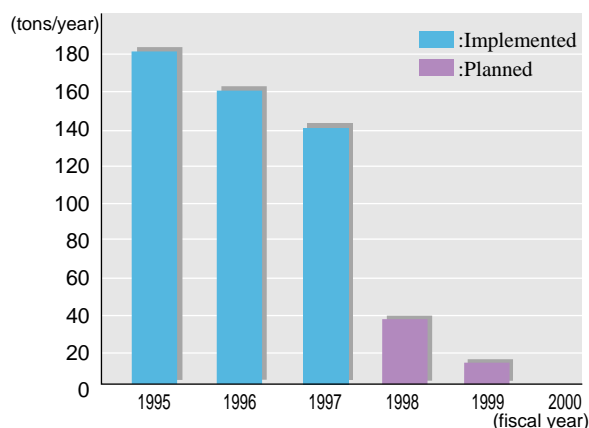


Fig. 8 Transition in atmospheric release of trichloroethylene

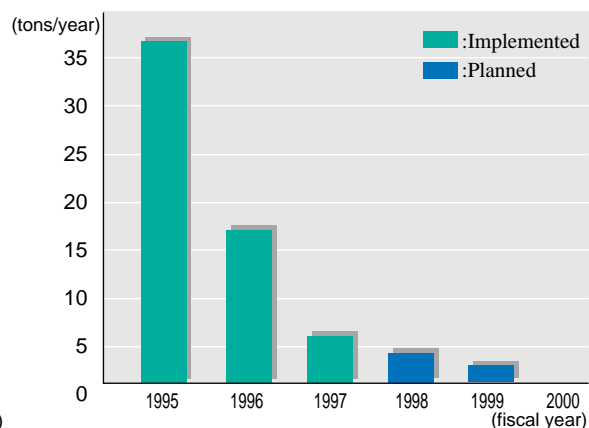


Fig. 9 Transition in atmospheric release of dichloromethane

## Chemical Substances Control System

To control chemical substances accurately and efficiently, data is gathered automatically as shown in the diagram on the right. This system will actually be started up at the end of fiscal 1998. It is designed so that only approved chemicals can be purchased, and that material balance data on chemical substances can be efficiently gathered.

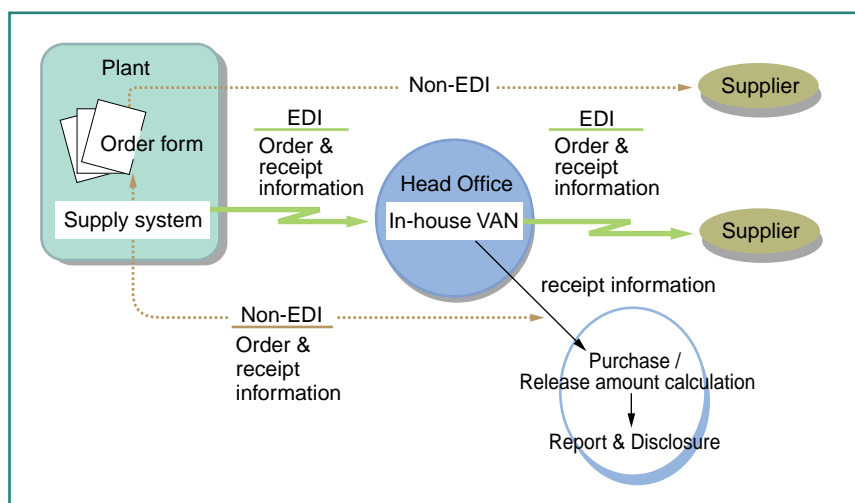


Fig. 10 Chemical substances control system

## Action Taken at Factories

### Trichloroethylene Elimination / Fukuyama Works

Fukuyama Works once used trichloroethylene in their cleaning processes, but it was completely eliminated in March 1997 following a review of production processes. Not only was an alternative cleaning technique introduced, but productivity was also improved by changes in processes and equipment integration.

Previous	Current
Lubricant oil cleaning after metal machining	Converted to a hydrocarbon wash or aqueous alkali cleaning
Removal of dust and contamination	Reviewed material handling processes. Eliminated cleaning by installation of dust proof area, etc.
Resin mixing tank cleaning	Cleaned tank with process resin and its recycling
Resin concentration dilution	High and low viscosity resins were mixed to enable processing without dilution

Table 4 Measures for trichloroethylene elimination

### Dichloromethane Elimination / Shinshiro Factory (Nagoya Works)

Shinshiro Factory manufactures small- and medium-size motors. In August 1996, dichloromethane used in cleaning processes of the motor steel frame was entirely abolished to prevent air pollution. As an alternative cleaning technique, a spray cleaning system using aqueous surfactants that ensures sufficient degreasing and paint adhesion was introduced. Also, the entire circulation system is closed in order to prevent water pollution.

\*. PRTR : Pollutant Release and Transfer Register

Public system for registration of release and waste transfer amounts of chemical substances that have risk of environmental pollution. In 1992, OECD recommended member countries to introduce that system. As of 1997, Japan's Environmental Agency and Keidanren (Japan Federation of Economic Organizations ) have been running pilot programs.

# Actions to Reduce Negative Environmental Impact of Products

## Product Assessment and LCA & DFE

Mitsubishi Electric instituted product assessment rules for all 22 domestic design centers by fiscal 1997. Within our established EMS, efforts are being made to reduce negative environmental impact of products over their entire life cycle. DFE (Design For Environment) is defined as the product design that reduces the negative environmental impact of the product in its life cycle. We have completely reviewed design and development work from the perspective of "M.E.T." (Material, Energy and Toxic). Current programs include the development of a DFE design system and training for design engineers.

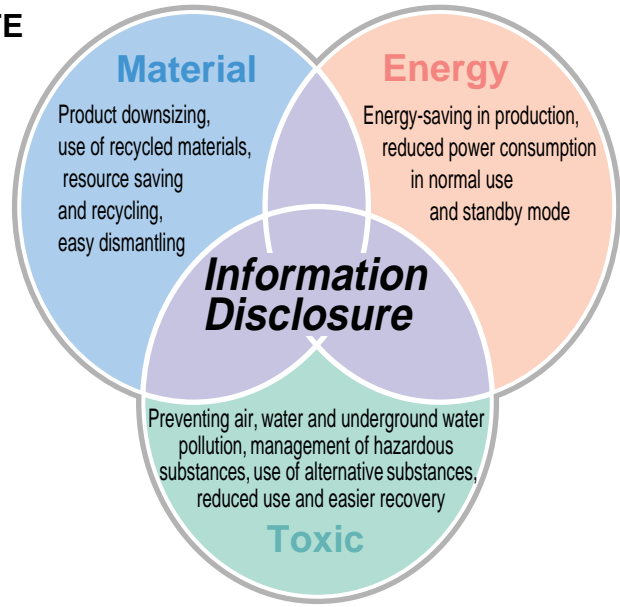


Fig. 11 Concept of DFE

## Reduced Power Consumption

Numerical targets have been set and action taken to reduce power consumption of products. In fiscal 1997, action was taken for 21 selected products, achieving maximums of 81% power reduction in normal use and 71% power reduction in standby mode.

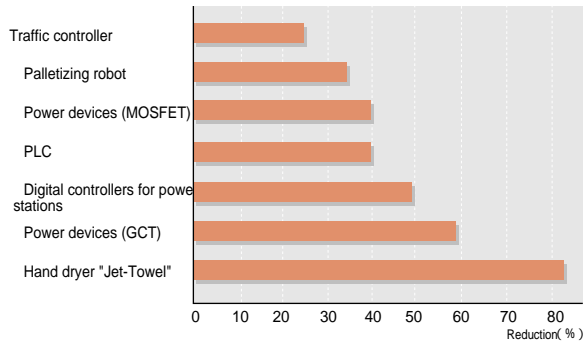


Fig. 12 Power consumption reduction rate for normal use (Fiscal 1997)

## Effective Resource Utilization

Compared to previous models, weight was reduced by a maximum of 57% in 21 selected products, volume was also reduced by a maximum of 70% in 11 selected products, and finally the number of parts were reduced by a maximum of 35% in 9 selected products.

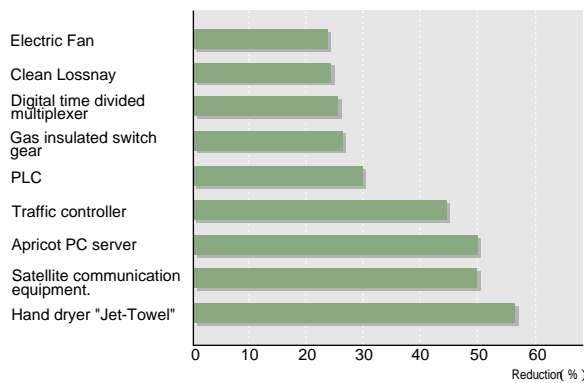


Fig. 13 Resource utilization rate: Weight reduction (Fiscal 1997)

## Control of Chemical Substances

The material balance of chemical substances used in products was pinpointed and those substances that present an environmental risk are being abolished, replaced with alternative substances or their emissions reduced. In fiscal 1997, we stopped using cobalt solder in GCT (Gate Commuted Turn-off Thyristers).

## ■ Product Assessment Examples

### Motor Propulsion Controller

As a result of product assessment of a semiconductor power module (IPM: Intelligent Power Module) used in motor propulsion controllers for railway stock, the product was downsized and a 22% reduction of power consumption was achieved. Furthermore, the adoption of a panel construction for cooling the modular semiconductor resulted in a 30% reduction of PFC refrigerant.



### Color TV, Video Cassette Recorder

By changing the standby power circuit of the color TV and using a switch mode power supply in the VCR, it has been possible to reduce power consumption. Reductions are as follows.

	Power consumption in use	Power consumption when on standby
CTV	8% reduction	71% reduction
VTR	21% reduction	33% reduction

Table 5 In-house product comparison



### Energy-Saving Product Award

The following products received awards in fiscal 1997 for their reduced power consumption.

#### Energy-Saving Vanguard 21 Award: Air Conditioners, Washing Machines, Chiller Units and Fans

In fiscal 1997, our room air conditioner "Kirigamine MSZ-LX32A" was awarded the Energy-Saving Vanguard 21 Award from the Ministry of International Trade and Industry (sponsored by the Energy Conservation Center) due to its being 13% more energy efficient than the previous year's model. It has been heralded as a consumer product that offers good energy and resource savings for the 21st century. Another products awarded in 1997 were as follows.

- Agency of Natural Resources and Energy Award:
  - Natural refrigerant circulation air conditioning system
- Energy Conservation Centers Chairman's Award:
  - Fully automatic washing machine "MAW-70LP"
  - Chilling machine for air conditioning
  - Electric Fan (for commercial use)

#### Energy-Saving Product Award for Excellence : Power Supply for Die Sinking EDM

Using a reactor switching power unit developed by Mitsubishi Electric, power consumption during full use was half that of before. Not only was power consumption reduced but waste heat from the power supply was reduced about 20%, which helped reduce power consumption of the air conditioner. As a result, this product was awarded the Energy-Saving Product Award for Excellence by the Japan Machinery Manufacturers Federation.



## ■ Use of Recycled Material (Recycled raw materials other than metals.)

Mitsubishi Electric has just started using recycled materials with some products. We plan to increase usage in the future as the recycled material market grows.

### Recycled Plastics for Refrigerators / Shizuoka Works

The current model of refrigerator uses not only new materials but also some recycled plastic parts. The drain pan, casters and adjuster bolts are made of recycled materials from battery cases. A leftover fragment from another molding process is recycled for use as the door wedges.



Refrigerator drain pan

## ■ Packing Materials Reduction

In fiscal 1995, Mitsubishi Electric used about 50,000 tons of packaging materials. This was reduced to 46,000 tons in fiscal 1997.

### Package of Air-conditioners (outdoor unit) for Building Use / Air-conditioning & Refrigeration System Works

The outdoor units of industrial-use air-conditioners are large and heavy, so they are usually transported and stored in wooded crates. To improve this, simplified packaging has been developed with the aim of reducing the use of wood by one half, and streamlining the use of physical distribution facilities. This packaging was awarded the "Japan Packaging Contest '97 Logistics Award" (promoted by the Japan Packaging Association.)

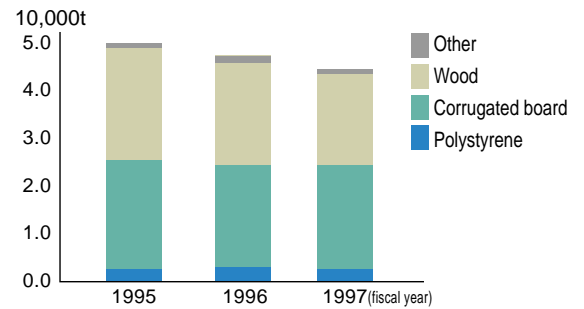


Fig. 14 Transition in total packaging material use



Outdoor units of industrial-use air-conditioners



## Water and Natural Environment Protection

### ■ Use of Water Resources

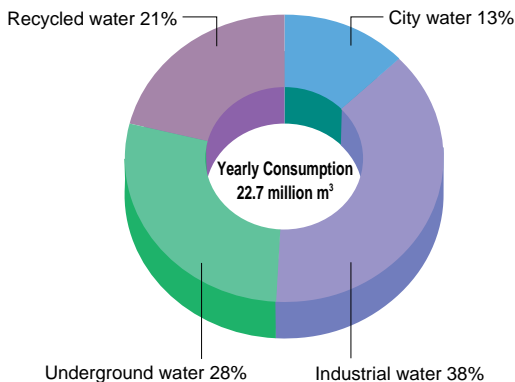


Fig. 15 Composition of water source

In fiscal 1997, Mitsubishi Electric used approximately 22.7 million cubic meters of water. This amount, excluding recycled water, is about 4% less than that of 1992.

**Award of "Foundation for the preservation of water resources in the province of Higo" / Kumamoto Factory**  
 Recycling of process water is common practice at our Kumamoto Factory. Cooling water is circulated in high capacity coolers as well as in production equipment. Moreover, in-house waste water piping standards have been set above and beyond public codes. There are also three rain water catches on the site that protect underground water stocks by allowing rain water to seep down from the surface. The catches are 90 cm across and channel 2,100 tons / year of rainwater underground.





Personnel from Kumamoto Plant with award



Rain water catch

Because of these efforts, the Kumamoto Factory was commended with the award in fiscal 1997.

## ■ Protection of the Natural Environment

By using e-mail, intranets and the Internet, Mitsubishi Electric is reducing the use of paper. As our first attempt, we decided to use environmentally friendly office paper that has 70% brightness. Used paper is also sorted and collected, and some 9,000 tons was recovered in fiscal 1997. This volume of paper is equivalent to approximately 180,000 trees of 14 cm diameter and 8 m high.



Collection boxes for papers

### Greenery on Plant Grounds Urban Beauty Award 1997 and 14th Aichi Prefectural Governor's Award for Forestation by Industry / Nagoya Works

Our Nagoya Works is constructively involved in urban beautification and gardening projects in the inner-city. Because of the efforts made in a city where there are many restrictions, the plant was commended by the Governor of Aichi Prefecture.



Scenery- outside the plant

Class	Species	Qty.	Popular species
Trees	57	4558	White oak, cherry, maple, camellia, olive, etc.
Species	34	24520	Azalea, rhododendron, hydrangea, oleander, wisteria, etc

Table 6 Vegetation on plant grounds

Also, for the Nagoya Dome Opening, the perimeter of the plant was carefully gardened to make it look spacious and immersed in greenery. As a result, the plant was commended with the Nagoya Dome Surrounding Neighborhood Award.



Awards and trophies



## Education and Awareness

Environmental problems are a concern for all company employees. The foundation of any sort of environmental action is to properly and sufficiently educate and enlighten the workforce.

### Education

#### Engineering Program

An engineering program is open to all personnel. The employee has the opportunity to mix with others and develop his / her skills. As of fiscal 1997, a special course on environmental engineering has been added to the program. In March, DFE experts from Fraunhofer Institute\*<sup>1</sup> were invited as speakers to share their experience and to talk on the latest trends on recycling technology and social systems in Germany. It was a very active session.



Special course on environmental engineering

#### Technical Seminars

A variety of technical seminars are held at Mitsubishi Electric from lectures at our training center with guest speakers, to TV conferencing using our in-house satellite communications network. Not only have seminars addressed ISO14001, but as of fiscal 1997, lectures have been held on DFE as well. Participants actually dismantled products while discussing ways to reduce the product's negative impact on the environment. Ideas were compiled into an improvement proposal.

#### Training for In-House Environmental Auditors

Mitsubishi Electric has a training course for in-house environmental auditors. Those who complete the course are awarded a certificate of completion from the Environmental Director. In fiscal 1997, the course was held 12 times. Since 1995, 1,460 persons from Mitsubishi Electric and 598 from subsidiaries have completed training for a total of 2,058 persons.



Lecture given by Dr. Lovins

### Awareness

#### Environmental Seminars with Guest Speakers

Mitsubishi Electric also invites environmental experts from the outside to give lectures to our workforce. In June 1997, Dr. Amory Lovins from the Rocky Mountain Institute\*<sup>2</sup> spoke about "Factor of 4" (Double Wealth, Halving Resource Use).

#### Environment Posters in the Company

Environmental posters have been produced and hung up throughout the company reminding employees about the environment plan while at work.

#### Environmental Slogan Contest / Transmission and Distribution Transportation Systems Center (Itami)

An environment slogan contest was opened to all personnel including plant managers and subsidiaries. Entries were received from about 2,950 persons which was approximately 90% of the entire Itami plant. All entries were posted throughout the plant grounds and the best five were posted in every workplace.



Posters for the environmental slogan contest

\* 1. Fraunhofer Institute is a German think-tank that focuses on productivity.

\* 2. Rocky Mountain Institute is an American think-tank that focuses on resources and the environment.



## Social Contributions

We have various activities directed at making a broad contribution to society as a company.

### ■ Participation in Environmental Organizations

Mitsubishi Electric is a member of various environmental organizations. We believe that diverse new ways of addressing environmental problems can be discovered when various organizations, such as nonprofit organizations, governmental organizations and non-governmental organizations, work together.



Future 500  
<http://www.globalff.org>



WBCSD: the World Business Council for Sustainable Development  
<http://www.wbcsd.ch/>



Keidanren Nature Conservation Fund



The Supporting Committee for the APEC Virtual Center for Environmental Technology  
<http://www.apec-vc.or.jp/>

Fig. 16 Major environmental organizations of which Mitsubishi Electric is a member

### ■ Social Contributions

Besides various environmental activities, Mitsubishi Electric contributes to society by supporting the promotion of scientific technology, cultural and sports events.

#### Sakura Gardening Club in Zugaike Park / Kitaitami

As part of an urban parks protection project in Itami City, Mitsubishi Electric started caring (cleaning, weeding, etc.) for 700 cherry trees in 1986. The club has 34 volunteers, and is led by veterans from Mitsubishi Electric.



Sakura Gardening Club in Zugaike Park

### ■ Communication

#### Participation in the Eco Japan 97 Trade Show

Mitsubishi Electric participated in the Eco Japan 97 environmental technology exhibition that coincided with COP3 in Kyoto. As an electric and electronics equipment manufacturer, we introduced CO<sub>2</sub> emission control and energy-saving efforts taken with technology and products.

#### Environment Pamphlets and Technical Reports

Mitsubishi Electric publishes Japanese and English versions of brochures that explain environmental activities, such as the environmental plan. A special edition of "ADVANCE" that is a technical report for outside Mitsubishi Electric was dedicated to the environment in September 1997.

#### Information on the Internet

This environmental report and other information are available on the Internet at

<http://www.melco.co.jp/kankyo/index.htm>.



Environment pamphlet, Mitsubishi Technical Report and ADVANCE



## Action Taken by Affiliates

The environment plan is undertaken by the entire Mitsubishi Electric Group, so it is being promoted in cooperation with our subsidiaries and a vast number of affiliates with whom we share business relations. Manufacturing sites of subsidiaries all over the world should be ISO14001 registered by the end of fiscal year 2000.

### Establishing EMS

#### Domestic Affiliates

37 domestic affiliates plan to be ISO14001 registered by the end of the year 2000, but in fiscal 1997, the following company achieved this target.

Company	Line of Business	Date of Register	Registered by
OSRAM Melco Ltd.Kakegawa Plant	Lamp production	September. 29, 1997	JACO *1

Table 7 Domestic affiliates with ISO14001 registration (Fiscal 1997)

#### Overseas Affiliates

By the end of fiscal year 2000, 20 overseas affiliates plan to be ISO14001 registered. In addition to the registration at Mitsubishi Semiconductor Europe,GmbH (MSE) in 1996, the two registrations shown in Table 8 were achieved in fiscal 1997. This makes three affiliates to be registered under ISO14001. At Siam Compressor Industry (SCI), ISO14001 registered EMS was established as a part of its total quality control (TQC) activities. As a result, standardization and improvement of productivity were achieved in its environmental management operation.



Campaign for ISO 14001 inspection at SCI

Company	Line of Business	Date of Register	Registered by
Mitsubishi Electric UK Ltd. Livingston Plant	VTR production	April 16, 1997	BSI *2
Siam Compressor Industry CO.,Ltd.	Compressor production	September 30, 1997	TÜV *3

Table 8 Overseas affiliates with ISO14001 registration (Fiscal 1997)

### Future Schedule for ISO14001 Registration

The future ISO14001 registration schedule of affiliates of each area is shown below. In fiscal 1998, seven domestic affiliates and seven overseas affiliates plan to be registered. By the end of fiscal year 2000, it is planned for 37 domestic companies and 20 overseas companies.

Area	By 1998	FY 1998	FY 1999	FY 2000	Total
Japan	1	7	20	9	37
North America	0	1	2	2	5
Europe	2	1	2	0	5
Asia	1	5	2	2	10
Total	4	14	26	13	57

Table 9 ISO14001 registration schedule by area

\*1. JACO : Japan Audit and Certification Organization for Environment and Quality

\*2. BSI : The British Standards Institution

\*3. TÜV : Vereinigung der Technischen Überwachungs-Vereine

## ■ Topics

### Environmental Committee / USA

Headed by Mitsubishi Electric America (MEA), our holding company in North America, the Environmental Committee was formed with other affiliate companies from North America. Research institutes and sales divisions also participate. A wide range of activities are being promoted through a Plant Committee, Office Committee and Product Committee.



MEA Environmental Committee

### The Natural Step Training / USA

MEA introduced the general principles of "The Natural Step" (<http://www.naturalstep.org>) to top management and environmental managers of MEA Group companies in order to help them understand the environment and the concept of sustainable development better.

FY 1995 : introduction of TNS at a meeting of MEA Group presidents

FY 1996 : application of TNS training to members of MEA Environmental Committee

FY 1997 : introduction of TNS at Mitsubishi Consumer Electronics America, INC

### FUTURE 500 / USA

FUTURE500 (<http://www.globalff.org>) is a unique forum for enterprises that are practicing industrial ecology and improvement of resource productivity. Industrial ecology is the concept of pursuing desirable technologies, industries and social systems that are in harmony with the principles of ecology and life systems. MEA supports the activity of FUTURE 500.

### Team Green Diamond / USA

Staff members of MEA have formed a group called "Team Green Diamond" to pursue activities such as reducing paper consumption in the office. The group tries to contribute to the environment through enjoyable projects, and on April 22, "Earth Day," they held an auction for used IT equipment.

### Water Recycling / Air Conditioner Plant in UK

Once, cooling water used in both pipe expanding and spot welding processes went straight into the drain. In 1997, recirculating water coolers made from heat exchangers of air-conditioners were introduced, and now more than 95% of the water can be successfully saved.



Water Recirculating Equipment

### Energy-Saving / Semiconductor Plant in Germany

Taking advantage of the cold winter climate in middle Europe, the chilled water used in this factory is generated using special chillers. Water pumped through the heat exchanger is exposed to the fresh air. By switching to this special chiller during the winter period, we are now saving 1,000 MWh of energy a year.

### Energy Conservation Award / Semiconductor Plant in Taiwan

In April 1997, Powerchip Semiconductor Corp. was given the Energy Conservation Award by the Taiwan Economy Agency. It was commended for recovering and reusing isopropyl alcohol, improving water treatment processes and saving energy in clean room air conditioners.

### You Tell Us Campaign / Thailand

In an attempt to enhance awareness of environmental problems, the Mitsubishi Electric Asia Coordination Center (MACC) held a contest in which middle-school to university students entered promotional slogans for environmental protection activities. Fiscal 1997 was the third year of the contest. It is hoped that this campaign will raise awareness of environmental problems in younger people.



Award Ceremony



# Environmental Project Development

Mitsubishi Electric manages environmental projects and does R & D. Those projects that produced particularly good results in fiscal 1997 are as follows.

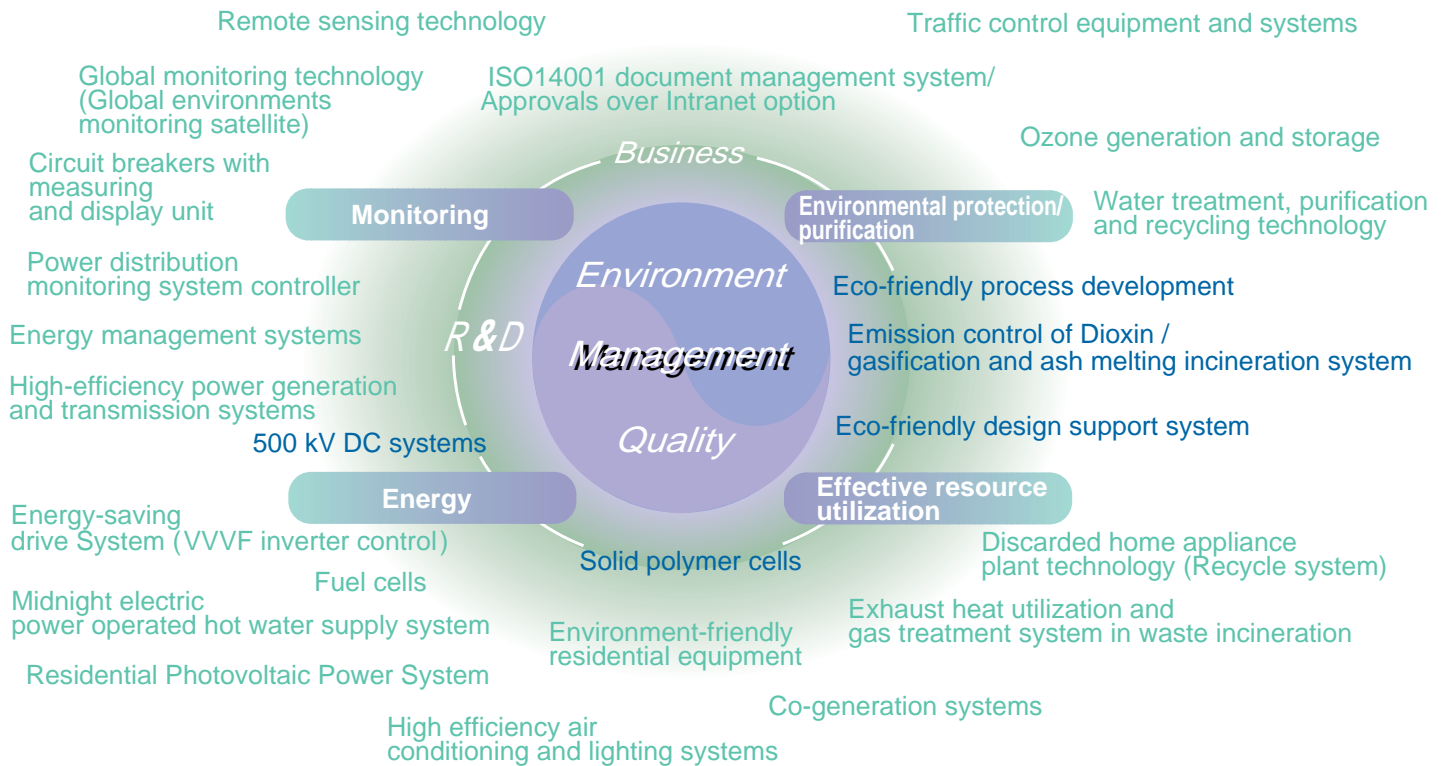


Fig. 17 Environment projects

## Residential Photovoltaic (PV) Power System



The Residential Photovoltaic (PV) power system consists of PV modules, a power conditioner, and mounting structure. PV modules installed on the roof generate DC power from sunlight. The power conditioner converts the DC power to AC power to supply the grid of house. The Mitsubishi power conditioner (PV-PN04B2) is one of the most efficient products on the market and uses new power modules (trench-structured IGBT chips). Its efficiency is 95% at rated power and the maximum efficiency is 96%.

The mounting structure is for installation of PV modules on the roof. Improvement of the mounting structure has made it possible to install PV module easily and securely.

## Breaker with Measuring and Display Unit [MDU Breaker]



With a measuring and display unit incorporated into this breaker, it is possible to measure and display load current, voltage, power, integrated power and leakage current. The breaker has signal relay capabilities (B/NET power distribution monitoring system controller), so data can be collected automatically by connecting to a PC or programmable logic controller.

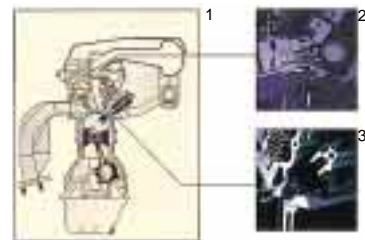
### Mitsubishi Clean Ozonizer (High-concentration ozone generator)

Ozone is readily oxidized and decomposed. After reacting, it returns to oxygen so none is left in the environment. It is used for a variety of purposes, such as removing environmental pollutants. Mitsubishi Electric developed a unit that generates the highest concentration of ozone in the world (Max. 300g/Nm<sup>3</sup> at 0°C and 1 atm) with approximately 40% less the power consumption than previous products. In addition, Mitsubishi Electric has been able to make it more compact and reduce production costs, so it is now selling well in industries that use ozone. In semiconductor and liquid crystal manufacture, it can be used to deposit oxidized films (insulation) or for washing, because of its oxidation power. It has already been introduced on our own semiconductor production lines and results show that process efficiency has been greatly improved, as well as the environment.



### Gasoline Direct Injection System Key Components

Mitsubishi Motors' gasoline direct injection (GDI) engine greatly improves fuel consumption (30% over earlier models), reduces emissions (30% less than earlier models) and improves output (10% more than earlier models). Mitsubishi Electric has developed and produced key components and controllers for this new generation engine. Great efforts have been made to make the fuel pump lighter and improve manufacturing efficiency, including reducing the number of parts.



1. Gasoline injection system
2. Fuel pump
3. Injector

### Energy-Saving Drive (VVVF Inverter) Trolley Bus

The New Energy and Industrial Technology Development Organization (NEDO) makes international contributions by transferring energy-saving technology. For the feasibility study of joint implementation project of Japan in fiscal 1997, our proposal for an energy-saving trolley bus was adopted in Mexico City. Our energy-saving drive system, VVVF inverter control system, was applied to 200 buses running in the city and has helped reduce energy consumption by about 25% compared with the conventional drive system.



### Complete Recycle System for Discarded Home Appliances: TV and Refrigerator Primary Dismantling Line

At the request of the Home Appliance Manufacturer's Association, Mitsubishi Electric developed a system that automatically disassembles home appliances such as TVs and refrigerators and sorts valuable parts, hazardous parts and non-crushable parts. As of April 1998, test-runs have been underway at the association's pilot plant. A database was built using model names and products are dismantled automatically. There is also an artificial intelligence system in it that feeds back problems in the dismantling process and learns as disassembly progresses. The stress placed on the operator has been alleviated because transportation and dangerous jobs are automated, dirty work has been reduced and remote operation is possible using a TV image.



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