

# ECO

Mitsubishi Electric  
Group Environmental  
Sustainability Report

# 2009



## Racing Toward Our Environmental Vision

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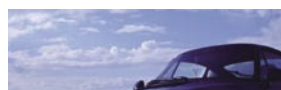
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# Sharing Our Precious Earth with Future Generations

## New Targets, New Challenges



### Initiatives to Date

In recent years, environmental issues such as climate change and resource depletion have become increasingly serious on a global scale. Last year also saw the arrival of a worldwide economic recession, which created a severe operating environment for companies. Even under conditions such as these, however, I believe the importance and urgency of environmental measures remain unchanged, and that immediate action continues to be required.

The Mitsubishi Electric Group has set contributing to the realization of a sustainable society as one of its most important management tenets. Accordingly, we have continued moving steadily along this path in our business operations and through efforts to reduce the environmental impact of our products and services. Specifically, since March 1993, we have formulated a mid-term environmental plan every three years. In the 5th Environmental Plan, which lasted from fiscal 2007 through fiscal 2009, Mitsubishi Electric achieved its goal of reducing CO<sub>2</sub> emissions from production per unit of real sales to 65% compared with fiscal 1991 levels, and reducing its final waste disposal rate to 0.15%.

### Setting New Targets, Taking on New Challenges

At the same time, recognizing the need to take a longer-term approach to environmental preservation, in October 2007 we established the Mitsubishi Electric Group Environmental Vision 2021. With the objectives of preventing global warming and creating a recycling-based society, we set targets such as reducing total CO<sub>2</sub> emissions from production by 30% by fiscal 2021 as a clear, long-term direction of environmental management for the Mitsubishi Electric Group.

Our first environmental plan after formulating this vision is the 6th Environmental Plan, which went into effect in April 2009 (fiscal 2010). Of primary concern were three perspectives: setting targets and action plans for environmental performance to realize Environmental Vision 2021; responding to social changes and imperatives surrounding environmental issues; and contributing to the creation of a sustainable society through the expansion of environment-related business. Building on the 5th Environmental Plan, we have defined the following points of emphasis for this new three-year period. One point is the setting of environmental performance targets in alignment with our Environmental Vision, such as changing the way of managing CO<sub>2</sub> emissions



From the Mitsubishi Electric Outdoor Classroom

during production from a per unit of net sales basis to total volume basis, as well as selecting products targeted for initiatives to reduce CO<sub>2</sub> from product usage and to reduce resource inputs, and then implementing planned reductions. Another point is the expansion of global environmental management—such as enhancing activities to reduce our environmental impact at overseas operations. A third point is the expansion of environment-related businesses such as the strengthening of businesses to counter global warming. Each of these points of emphasis makes for a higher standard of activity than in past environmental plans. They provide an opportunity for growth and help us meet the challenge of achieving our new targets.

### Helping Each Individual Appreciate the Importance of the Environment

Another key to environmental management is each individual's mindset regarding the environment—that is, environmental awareness. To this end, the Mitsubishi Electric Group has created a number of opportunities to put people in touch with nature, such as through the Mitsubishi Electric Outdoor Classroom and “Satoyama” Woodland Preservation activities. Such activities help cultivate environmental awareness by fostering an understanding of the importance of nature. Each year the number of participants increases at these activities, which are conducted on a voluntary basis.

I also participate in the Fuji Sanroku forestry cultivation program. Each time I do so, I am reminded of the magnificence of nature, and this compels me to renew my personal efforts towards environmental management. To my mind, what is important is not how many trees are planted, but the opportunity to interact with nature and for each participant to sense the wonders of the environment and experience its importance.

Participating in such activities helps participants arrive at new discoveries and insights. For example, taking a bus on the way to an afforestation activity might prompt a participant to wonder, “We’re planting trees to reduce CO<sub>2</sub>, but what about the CO<sub>2</sub> that this bus emits?” I believe that this mindset, these discoveries, build up a true environmental awareness that can be passed on through our work activities into product development, on-site improvements and proposals to clients.

### Earnestly Addressing Environmental Issues Important from Four Perspectives

From a company standpoint, I believe that earnestly addressing environmental issues is important from four perspectives.

First, it allows us to contribute directly to preserving the global environment and participate in establishing a sustainable society.

Second, it strengthens the company's constitution to build a strong operational foundation. Manufacturing that uses few resources and little energy is the epitome of improved productivity.

Third, it encourages the creation of even better products, services and technologies. These achievements raise corporate competitiveness, and contribute to the environment through the expansion of environment-related businesses.

Fourth, and I believe most importantly, it instills a major sense of satisfaction in each and every one of us.

This sense of contributing to environmental preservation drives the creativity to develop products and technologies that contribute to the environment, and the enthusiasm to encourage their use.

I wouldn't consider these perspectives the solitary domain of the Mitsubishi Electric Group. Rather, I suspect that they are shared by people throughout the world. We must broaden our horizons as much as we can, encouraging each other in contributing to the creation of a better society.

I have grandchildren. For better or for worse, the activities of our generation will impact their lives. Each time I look into my grandchildren's eyes, I realize that that we share our precious Earth with future generations, and I ask myself what we can do right now for their sake. When I imagine future generations living happily on this beautiful planet that we call the Earth, I think in terms of the phrase that we employ throughout the Mitsubishi Electric Group, “Changes for the Better.” I believe that step by step, we are making steady progress in that direction.

**Setsuhiro Shimomura**  
President & CEO  
Mitsubishi Electric Corporation



# 6th Environmental Plan Created to Help Achieve Environmental Vision 2021

Every approximately three years since fiscal 1994, the Mitsubishi Electric Group has formulated an environmental plan with specific targets. We have made many positive changes in the 15 years since the first plan went into action. In April 2009, we launched the 6th Environmental Plan (FY2010–2012, years ending March 31). This plan focuses on the achievement of Environmental Vision 2021, established in October 2007 to coincide with the 100th anniversary of our founding.

Targets for the prevention of global warming will not be based on per unit reductions but on the total amount of reductions, setting a higher target for the creation of a recycling-based society. To fulfill its responsibility as a corporate group with global operations, Mitsubishi Electric will raise the level of its environmental management and contribute to society through the expanded activities of its environment-related businesses.

### ■ The 6th Environmental Plan was established with a view toward:

1. Setting targets and action plans for environmental performance to realize Environmental Vision 2021
2. Responding to social changes and imperatives surrounding environmental issues
3. Contributing to the creation of a sustainable society through the expansion of environment-related business

### ■ Points of Emphasis in the 6th Environmental Plan

#### Improving Environmental Performance

##### Alignment with Environmental Vision 2021

###### Reduce CO<sub>2</sub> from Production

Shift from evaluation on a unit basis to an overall volume basis

###### Reduce CO<sub>2</sub> from Product Usage, Reduce Resource Inputs

Achieve steady reductions on selected products and expand number of products subject to reductions

###### Raise 3R Targets

Reduce final disposal rate for Mitsubishi Electric from 0.5% to 0.1%

##### Expansion to the Entire Group

Enhance performance improvements at affiliated companies in Japan and overseas

#### Expanding Global Environmental Management

##### Increase the Number of Companies Conforming with ISO 14001

Create system to obtain ISO 14001 certification for 34 affiliates in Japan and 32 overseas affiliates (total of 66 companies)

##### Designate and Train Key Environmental Personnel

Designate and train key environmental personnel at factories in China, Asia, Europe and the Americas

#### Strengthening of Businesses to Counter Global Warming

##### Businesses to Counter Global Warming

Aim for sales of more than ¥1.3 trillion in fiscal 2016  
(Strengthen photovoltaic systems business, heat pump-related business and power device business)

##### Increase Highly Efficient Power Generation Equipment and Clean Energy Generation Facilities

Projected effects: Reduction in CO<sub>2</sub> emissions of approximately 90 million tons (fiscal 2021)  
(Amount of reduction by fiscal 2021 of equipment delivered since fiscal 2001)

# Achievements on Our Way to Realizing Our Environmental Vision

## Preventing Global Warming

### Reducing CO<sub>2</sub> Emissions through Expanding Businesses to Counter Global Warming

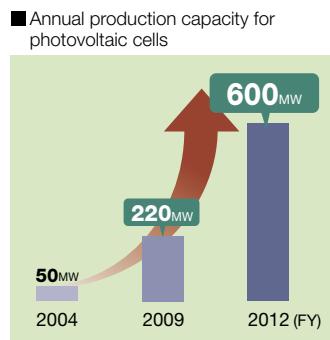
News Release • Mitsubishi Electric to Extend Sustainable Growth in Global Warming Prevention-related Business. (November 6, 2008)

#### Photovoltaic (PV) Systems Business

##### Improving Efficiency and Production Capacity

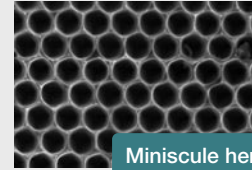
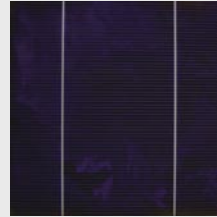
To improve power generation efficiency, in fiscal 2009 we developed a polycrystalline cell photovoltaic module with the world's highest conversion efficiency of 18.9%<sup>1</sup>, as well as a PV inverter with the world's highest power conversion efficiency of 97.5%<sup>2</sup>.

Improvements in production capacity include expanding our annual photovoltaic cell production capacity to 600MW by fiscal 2012 (annual production as of April 2009 was 220MW).



<sup>1</sup> Mitsubishi Electric data, as of June 1, 2009. Conversion efficiency based on Mitsubishi Electric's measurements.  
<sup>2</sup> Mitsubishi Electric data, as of June 1, 2009. The PV inverter was the industry's top model in mass production for household use in Japan.

#### Polycrystalline silicon photovoltaic cells with the world's highest conversion efficiency of 18.9%.



Miniscule hemispherical concaves arranged in a honeycomb pattern

Cells with an ultrafine honeycomb surface limit reflections to a substantial degree. In addition to innovating a way to increase the absorption of sunlight through the surface structure of the cell, we have also succeeded in developing technology that utilizes infrared rays reflected by the back surface to facilitate the absorption of even more sunlight.

#### News Releases

- Mitsubishi Electric to Build New Photovoltaic Cell Plant in Aim to Expand Annual Photovoltaic Production Capacity to 600MW by Fiscal 2012 (August 27, 2008)
- Mitsubishi Electric Breaks Own Record with World's Highest Conversion Efficiency Rate of 18.9% for Multi-crystalline Silicon Photovoltaic Cells (February 18, 2009)

#### Photovoltaic Power Generation

<http://global.mitsubishielectric.com/company/csr/ecotopics/pv/index.html>

#### Heat Pump-Related Business

##### Active Promotion in World Markets

Heat pumps deliver nearly three times more heat than the energy they consume, and they do so without combustion, greatly reducing CO<sub>2</sub> emissions.

In addition to the launch of our air-to-water heat pump boiler operations focused on Europe, we are also actively developing room air conditioners, package air conditioners and water heaters for the global market.

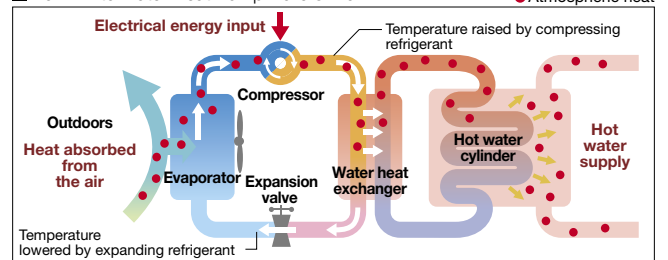
#### Power Device Business

##### Developing Next-Generation Power Device Technology

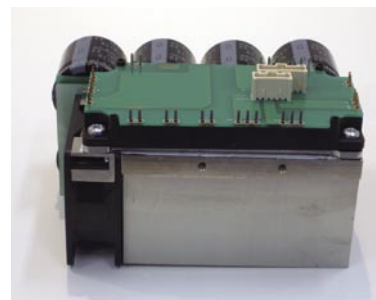
Power devices control the efficient use of electricity and are installed in all types of products from household electronics to industrial machinery. In our efforts to prevent global warming and meet demand for highly efficient and energy-saving products, Mitsubishi Electric is developing a next-generation silicon carbide (SiC) power module that will significantly reduce electrical power loss in power devices.

In fiscal 2009, we successfully demonstrated an 11kW inverter using a SiC power module that reduced power loss by approximately 70% compared with conventional silicon inverters.

#### How Air-to-water Heat Pump Boilers Work



A heat pump is a system that emits heat into the surrounding area when its refrigerant changes phase from a gas to a liquid (heating) and removes heat from its surroundings when the refrigerant changes phase from a liquid to a gas (cooling). Heat in the air is gathered and heat exchanged with the refrigerant, allowing cooling or superheating to occur.



11kW inverter using a SiC Power module

#### Guide to Environmental Technologies (SiC Power Device)

<http://global.mitsubishielectric.com/company/csr/ecotopics/technologies/sic/index.html>

Creating a Recycling-Based Society

## Recycling of Plastic from Home Appliances

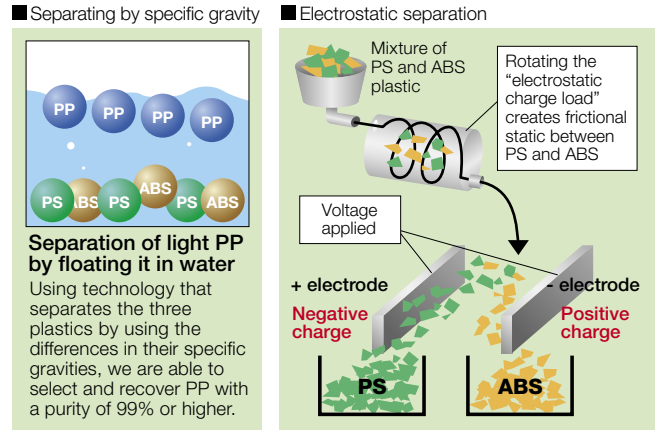
The main plastics used in household appliances are polypropylene, polystyrene and ABS resin. At recycling plants, large amounts of mixed plastic that are collected from home appliances are shredded in their mixed state.

In fiscal 2009, Mitsubishi Electric combined its exclusive specific gravity and electrostatic separation technologies to develop a high-purity recycling technology that extracts these three plastics from shredded mixed plastic at purity of more than 99%.

By applying this technology to the 10,000 tons of shredded mixed plastic generated each year, we could expand the scale of our closed-loop recycling from our current 600 tons to 7,000 tons per year.

The Company has also successfully developed a technology for the high-speed removal from shredded mixed plastics of a bromine flame retardant targeted by the RoHS directive.

### High-Purity Separation Technology for Shredded Mixed Plastic



■ Recycling of Waste Plastics

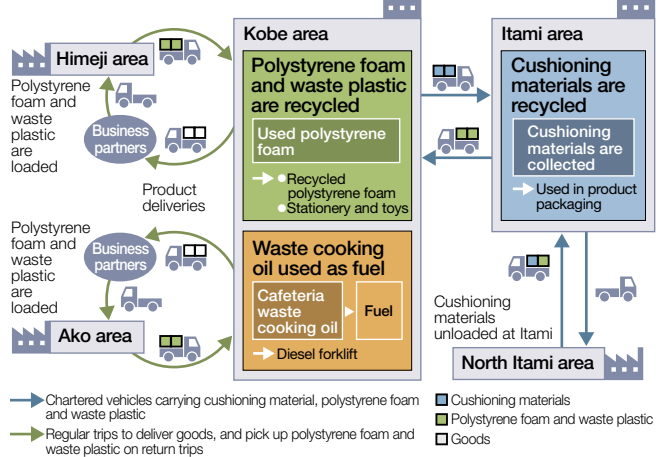
<http://global.mitsubishielectric.com/company/csr/ecotopics/plastics/index.html>

## New Developments in a Collaboration-Based Recycling Logistics System

Waste management and recycling used to be handled separately at each base of operations. In June 2007, the "Beyond Local" initiative was launched for collaboration between respective manufacturing works in the Kansai region in order to realize zero emissions. In recognition of this initiative, Mitsubishi Electric was presented with the 2008 3R Meritorious Recognition Chairman's Award.

In fiscal 2009, a committee was established in the Kyushu region to study the expansion of region-wide waste and recycling operations; a similar committee for the Kanto and Chubu regions was set up in fiscal 2010.

■ Recycling Logistics System



■ Towards Zero Emissions

<http://global.mitsubishielectric.com/company/csr/ecotopics/zeroemissions/index.html>

Fostering Environmental Awareness

## Twenty-Seven Outdoor Classroom Sessions Attract 700 Participants

To foster environmental awareness among employees, their families and regional communities, we conduct Mitsubishi Electric Outdoor Classroom sessions. Employees serve as nature conservation leaders, helping participants use their five senses to enjoy nature at fields and hills, parks and oceans. The ring of activity has extended into 10 regions, and a total of 27 sessions for 700 participants have been held.

In the future, we plan to increase the number of project leaders and the number of regions in which these sessions take place, and to expand the scope of activity.



Children observing living things



Outdoor classroom leader training lecture

■ Mitsubishi Electric Outdoor Classroom

<http://global.mitsubishielectric.com/company/csr/environment/nature/index.html>

## TOPICS

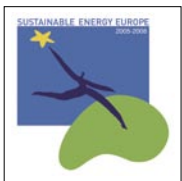


UK

### Promoting the "Green Gateway Initiative," a Response to Reducing CO<sub>2</sub> Emissions

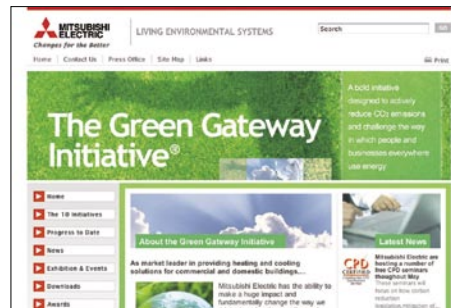
In November 2007, the UK put into effect the world's first climate change law. The law establishes the goals of reducing CO<sub>2</sub> emissions 26% by 2020 and 60% by 2050. Since that law took effect, various needs for reducing energy consumption and holding down CO<sub>2</sub> emissions have emerged.

Mitsubishi Electric Europe, B.V. (MEU)'s response to this challenge to reduce CO<sub>2</sub> emissions is called the "Green Gateway Initiative." In the UK, buildings account for approximately 40% of all energy consumption, so MEU have put forth specific plans based on ideas and approaches for reducing CO<sub>2</sub> produced by heating, air conditioning, and ventilation equipment.



MEU is recognized as a partner of the EC's Sustainable Energy Europe Campaign

The contributions of the Green Gateway Initiative activities have drawn positive responses, and MEU is now the only air conditioning equipment manufacturer certified as a partner of the European Commission's Sustainable Energy Europe Campaign, which aims to promote and develop markets for energy technologies for sustainable development.



Green Gateway Initiative Official Website  
<http://www.greengatewayinitiative.co.uk/>



MEU promotion of the Green Gateway Initiative advocates 10 initiatives, including the "replacement of old facilities" and the "utilization of heat pumps for heating."



China

### Reducing CO<sub>2</sub> from Production by Making Energy Consumption More Visible

Energy conservation is becoming a key policy theme in China, as is evident from the introduction of such recent legislation as the Energy Conservation Law and the Recycling Economy Promotion Law.

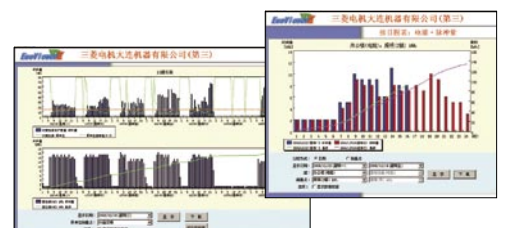
Mitsubishi Electric Dalian Industrial Products Co., Ltd. (MDI), which manufactures such products as inverters and power distribution and control equipment, is introducing its own energy-saving support equipment. MDI is making its energy consumption more visible, as part of its efforts to reduce CO<sub>2</sub> from production. In fiscal 2010, the company

plans to reduce power consumption by 15%, compared with the previous year's level. To help its customers benefit from MDI's forward-looking efforts in their own plants, the company has set up a model factory for energy conservation, which welcomes many visitors.

The increasing use of this system should contribute to energy conservation activities in Dalian, which experiences power supply fluctuations.



Mitsubishi Electric's EcoMonitorPro energy measurement unit (left) and the EcoWebServer II energy conservation data storage server (right)



MDI provides a good case study of how making energy consumption more visible can clarify the amount of energy consumed by individual equipment, allowing energy loss to be detected during real-time operation.



# A Pioneering Initiative for the Environmental Age: MINIMO® Ventilation Motors

Preventing Global Warming

Creating a Recycling-Based Society

## Product Innovations

### The minimo utilizes energy and resources efficiently

Pipe fans used for ventilation are powered by motors in the fan's airflow channel. Smaller motors provide less wind resistance and greater airflow. However, smaller motors also have lower power efficiency, resulting in reduced ventilator performance.

Our efforts to create a product that will not only be used in numerous households, but that will be the first choice of customers for its superior performance has led to the creation of the world's smallest fan motor<sup>1</sup>—one that generates 25% more airflow while using 22% less energy than previous models.

<sup>1</sup> Among AC capacitor start motors for compact ventilators. As of Feb. 2008, Mitsubishi Electric survey.

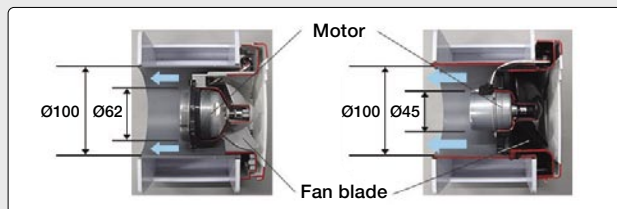


minimo: The world's smallest capacitor start motor for compact ventilators.

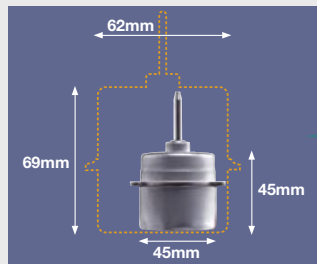
### The minimo's environmental features

#### Higher airflow and lower energy consumption

Conventional pipe fan motors take up 56% of the cross-sectional area, reducing efficiency and blocking airflow. The minimo takes up only 28% of the cross-sectional area, increasing efficiency and reducing air resistance.



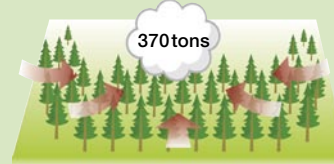
#### Compact size saves resources



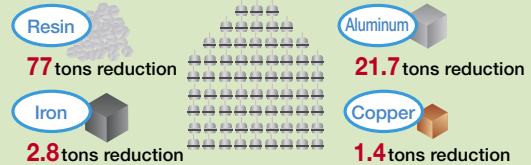
volume  
**68% less**  
weight  
**73% lighter**

#### How does the minimo contribute to the environment?

Saves the equivalent of the amount of CO<sub>2</sub> absorbed by 26,000 cedar trees in one year



Saves materials equivalent to around 200,000 conventional models



If all the pipe fans sold by Mitsubishi Electric were equipped with the minimo, the energy saved would equal approximately 370 tons<sup>1</sup> of CO<sub>2</sub> per year. The minimo would also save 77 tons of plastic, 21.7 tons of aluminum, 2.8 tons of iron and 1.4 tons of copper.

<sup>1</sup> Assuming half of the pipe fans sold by Mitsubishi Electric were run 24 hours a day and the other half for 5 hours a day.

### Engineers' Perspectives

The minimo project achieved the objectives of developing the ultimate fan motor and creating the best ventilation fan motor production line ever built. The Nakatsugawa Works' positive development atmosphere helped generate innovative ideas, which arose from open discussions.



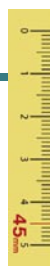
**Haruo Kinoshita**  
Project Leader,  
Nakatsugawa Works,  
Iida Factory

Ordinary projects often end in compromise as a result of the limitations of the various departments involved, but this project—both in terms of manufacturing technology and equipment development—required no compromises. Through the sharing of ideas we were able to overcome all obstacles and achieve our goal.



**Manabu Deguchi**  
Design Leader,  
Nakatsugawa Works

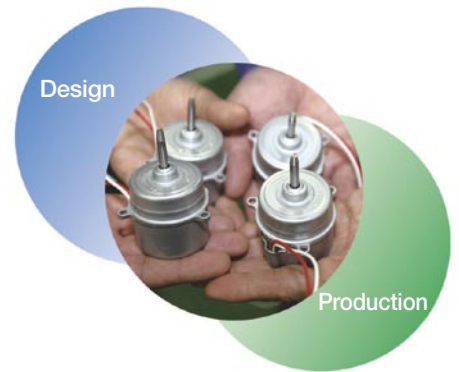




## Production Process Innovations

# Motor innovation through complete integration of design and production

The minimo was developed at the Nakatsugawa Works by a project team from the Iida Factory. Engineers specializing in motor design, manufacturing technology and facility development collaborated on the development of this product. The on-site integration of design and production helped to achieve several technological innovations and save energy and resources. The minimo is an important step in the realization of Mitsubishi Electric's Environmental Vision, and a model case for manufacturing in the environmental age.

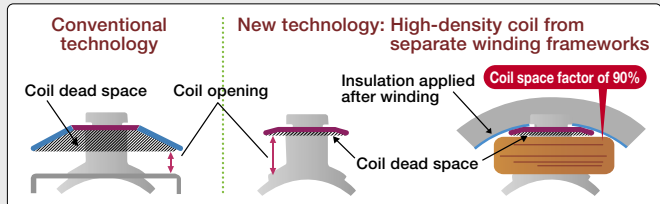
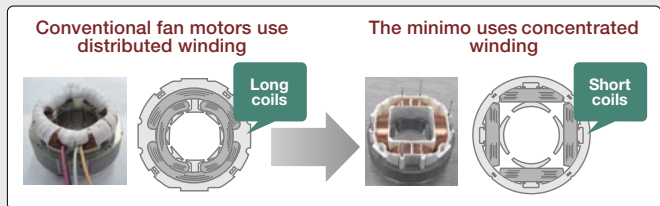


## Ingenuity born from the integration of design and production

### Primary loss significantly reduced

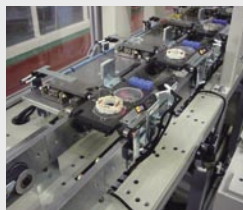
Primary loss is the power lost due to heat from electrical resistance when current flows through the coils connected to the power source. It accounts for 40% of power loss in compact capacitor start motors. The minimo uses concentrated winding, in which copper wire is coiled directly on the stator, reducing primary loss by 50%.

Furthermore, by insulating parts, the coil space factor (the ratio of space occupied by copper wire to the slot area) was increased 12%, reducing primary loss by an additional 20%.



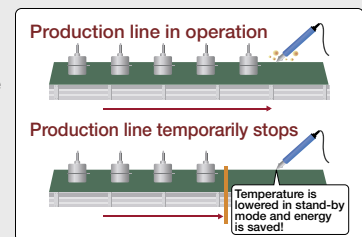
### High-speed, low-shock conveyor

To ensure the high precision required for the minimo, the Manufacturing Engineering Center and Facility Development Division collaborated on the on-site development of a conveyor that is smooth, fast and does not joggle parts.



### Solder idling stop

The soldering trowel features a new mechanism that lowers the temperature in stand-by mode when the line stops temporarily.



On this project, I had the opportunity to move from the Motor Design Department to manufacturing technology and put together a team of people from different departments who exchanged various ideas and perspectives. My biggest learning experience was the efficacy of a diverse group working together to overcome challenges.



**Hideya Yamaguchi**  
Manufacturing Technology Leader,  
Nakatsugawa Works,  
Iida Factory

The younger team members embraced the concepts of production design and automation, debated actively with other engineers at the plant and in the end, helped create a unique new motor and production line. Working from the perspective of integrated design and production was the critical factor that enabled us to make a superior product that also saves energy and resources.



**Nobuaki Miyake**  
Production Technology Development Assistance,  
Manufacturing Engineering Center

# Reducing the Environmental Impact of Automobiles

## Creating a Recycling-Based Society

### Reducing resource use by recycling electrical components

Mitsubishi Electric Automotive America, in Orange County (MEAA-OC), California, rebuilds automotive components such as alternators and starters. In this process, Mitsubishi Electric parts are added to Mitsubishi Electric alternators that have been recovered from automakers to create “genuine rebuilt parts.” Guaranteed to have the same high quality as new parts, genuine rebuilt parts have gained the confidence of automakers for their performance and quality.

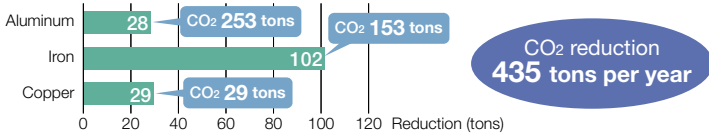
Rebuilding is in high demand, particularly in the United States, where the effective use of resources in business to create a recycling-based society is gaining attention. Mitsubishi Electric is also establishing rebuilding operations in Japan, with plans to conduct these operations in both regions.



**Thomas Mulholland**  
Assistant General Manager  
MEAA-OC

Unlike Japan, most drivers in the United States repair vehicles themselves. The market for rebuilt parts is growing because rebuilt parts perform better than used parts but are less expensive than new parts. Mitsubishi Electric began producing automotive components in the United States by rebuilding parts, so this business has a special significance for the company.

#### CO<sub>2</sub> reduction through resource reuse when rebuilding (MEAA-OC from fiscal 2009 production)



#### Rebuilding process



## Voice



**Katsumi Adachi**  
President & CEO  
Mitsubishi Electric  
Automotive America

The U.S. automotive industry is shifting to the development of fuel-efficient, hybrid and electric vehicles. Mitsubishi Electric’s Automotive Equipment business makes it one of the few suppliers that can deliver highly efficient, high-output alternators to reduce fuel consumption, and compact, lightweight starters for a wide range of vehicles. We are working with automakers to develop a full range of services, from development, production and supply, to spare parts and rebuilds.

MEAA (-Detroit, -Mason, -Maysville) expands America-wide sales of automotive equipment that contributes to a lower environmental burden; MEAA-OC carries out rebuilding operations to reduce resource use; and the Himeji Works acts as the focal point for development.

Through the cooperation of these businesses, Mitsubishi Electric will continue to supply both OEM products and recycled components to help reduce the environmental impact of automobiles in the USA.

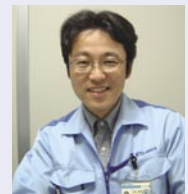
## Column

### EGR Valve: Contributing to cleaner exhaust and reduced CO<sub>2</sub> emissions

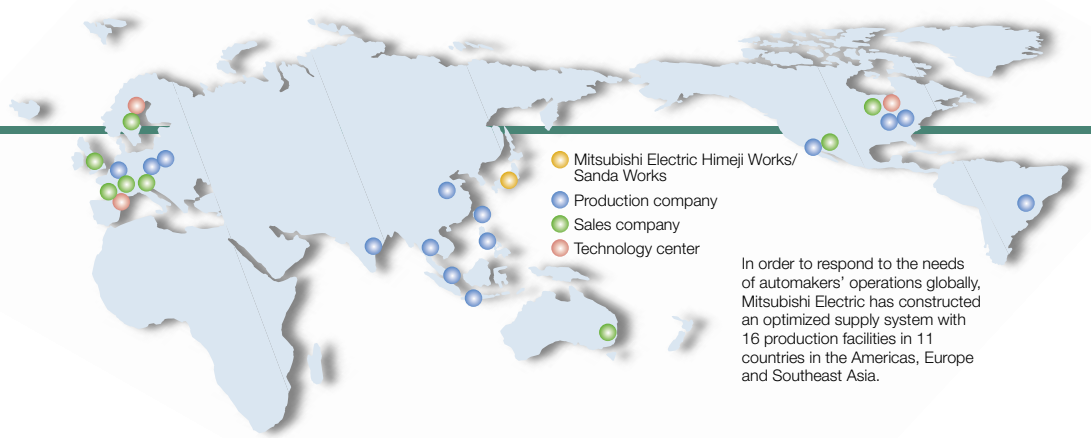
Most vehicles run on either diesel or gasoline engines. In diesel vehicles, the emission of nitrogen oxides (NO<sub>x</sub>), a cause of acid rain, is particularly problematic. NO<sub>x</sub> are rapidly produced when the engine combustion temperature exceeds roughly 1,700 degrees Celsius (approximately 3,100 degrees Fahrenheit), so lower temperatures must be maintained. The EGR valve reduces an engine’s combustion temperature and helps reduce the formation of NO<sub>x</sub> by governing the amount of exhaust that is returned to the combustion chamber.

In gasoline-powered vehicles, the EGR valve helps prevent the energy loss (pumping loss) that occurs as the pistons move up and down, improving fuel efficiency.

Mitsubishi Electric provides a DC motor-based EGR valve with superior output and responsiveness for diesel vehicles, and a compact and inexpensive stepper motor-based EGR valve for gasoline-powered vehicles, helping address the major issues of air pollution and global warming.



**Sotsuo Miyoshi**  
Manager  
Car Mechatronics  
Manufacturing Dept.  
Sanda Works

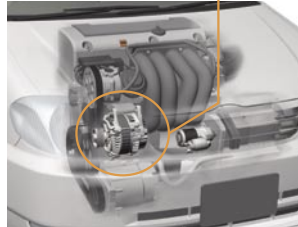


Preventing Global Warming

# Improving fuel efficiency through high-performance alternators

With advances in electric-powered automotive components, greater emphasis is being placed on high-efficiency alternators. The Himeiji Works will be at the center of development activities to ensure optimal designs with the necessary power supply for each vehicle type.

Alternators currently in use are sixth- and eighth-generation models. The ninth generation was developed in 2006 in response to the need for more power in a smaller package, in line with advances in compactness. Employing the improved coil density methods used in Mitsubishi Electric's unique *pokipoki*<sup>1</sup> motors, we optimized generator size, output and efficiency. The realization of high output combined with silent operation is an example of the technological capabilities developed throughout Mitsubishi Electric's manufacturing history, and its ability to create products that accurately meet the needs of the times.



<sup>1</sup> Pokipoki motor: a high-density electric motor in which the coil is wrapped around an extended iron core



**Shingo Tanimoto**  
Senior Manager  
Rotating Electric Products  
Dept. A  
Himeiji Works

The Himeiji Works has been developing alternators since the 1960s. Our consistent efforts to meet customer needs on all counts have enhanced our technological prowess and become the source of our dependable and highly competitive electrical components. As we pursue higher efficiencies going forward, we will aim to apply our expertise in fundamental technology development and manufacturing technology to achieve new breakthroughs.

Alternator output evolution



## Voice

When considering how we as a manufacturer of automotive equipment can contribute to society, we think about the development and supply of products that can efficiently draw output energy from the engine, and can use that energy efficiently. This approach satisfies automakers, and by extension the end purchaser.

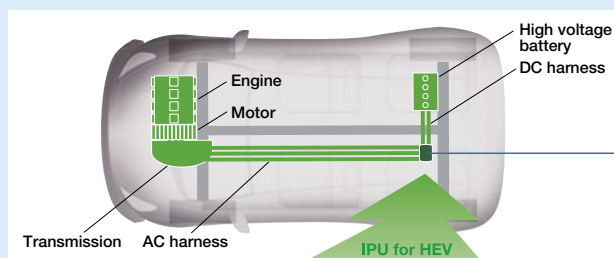
In recent years, hybrid electric vehicles (HEV) are gaining a lot of attention, providing an opportunity to showcase Mitsubishi Electric's strength in power electronics technology. Our ability to optimize our semiconductor device, circuitry, structural design and other capabilities to suit automobiles will become increasingly important.



**Yutaka Ohashi**  
Group Vice President,  
General Manager  
Himeiji Works

## Topics

Mitsubishi Electric provides automakers with its Intelligent Power Unit (IPU)<sup>1</sup>, a DC/AC inverter positioned between the battery and the motor that converts battery power from DC to AC in hybrid electric vehicles (HEVs). Recently, this unit has been employed in the *Insight*, made by Honda Motor Co., Ltd., which has earned a great deal of attention. We will continue to use our automotive equipment and semiconductor technologies to drive environmental advances in the automotive field.



Mitsubishi Electric's IPU



<sup>1</sup> Mitsubishi Electric's Intelligent Power Unit (IPU) is referred to as an "Intelligent Inverter Unit (IIU)" by the Honda Motor Co., Ltd.

# Material Balance

Period: April 1, 2008 – March 31, 2009

Scope of Data Compilation: Mitsubishi Electric Group (Mitsubishi Electric Corporation's production facilities in Japan, 76 affiliates in Japan, and 24 affiliates overseas)

## IN

Materials for Manufacturing			
	Mitsubishi Electric	Affiliates (Japan)	Affiliates (Overseas)
Materials <sup>1</sup>	600,000 tons	90,000 tons	510,000 tons
Manufacturing			
Electricity	1,040 million kWh	357 million kWh	299 million kWh
Natural gas	21,590,000 m <sup>3</sup>	3,320,000 m <sup>3</sup>	10,130,000 m <sup>3</sup>
LPG	2,142 tons	4,838 tons	1,633 tons
Oil (crude oil equivalent)	7,118 kl	8,106 kl	252 kl
Water	7,300,000 m <sup>3</sup>	2,630,000 m <sup>3</sup>	1,730,000 m <sup>3</sup>
Public water	1,350,000 m <sup>3</sup>	650,000 m <sup>3</sup>	480,000 m <sup>3</sup>
Industrial water	2,430,000 m <sup>3</sup>	390,000 m <sup>3</sup>	1,110,000 m <sup>3</sup>
Groundwater	3,520,000 m <sup>3</sup>	1,590,000 m <sup>3</sup>	40,000 m <sup>3</sup>
Others	0 m <sup>3</sup>	0 m <sup>3</sup>	90,000 m <sup>3</sup>
Reuse of water	3,560,000 m <sup>3</sup>	1,740,000 m <sup>3</sup>	80,000 m <sup>3</sup>
Controlled chemical substances (amounts handled)	5,811.8 tons	2,037.7 tons	4,763.6 tons
Ozone depleting substances (amounts handled)	9.9 tons	310.8 tons	648.9 tons
Greenhouse gases (amounts handled)	3,303.8 tons	66.4 tons	936.9 tons
Volatile organic compounds (amounts handled)	1,578.5 tons	951 tons	246.0 tons

<sup>1</sup> **Materials:** Sum of shipping weight of Eco-Products, plus amount of product packaging materials used, plus total amount of waste

Selling and Distribution <sup>3</sup>			
	Mitsubishi Electric	Affiliates (Japan)	Affiliates (Overseas)
Fuel for trucks (gasoline)	45 kl	2,700 kl	110 kl
Fuel for trucks (diesel)	23,900 kl	5,300 kl	24,750 kl
Fuel for rail (electricity)	1,520 MWh	280 MWh	0 MWh
Fuel for marine transport (bunker oil)	410 kl	60 kl	53,000 kl
Fuel for air transport (jet fuel)	400 kl	90 kl	5,000 kl

<sup>3</sup> **Sales and logistics:** Includes 11 sales companies in Japan  
Figures for overseas affiliated companies include transportation between countries.

Energy Consumption <sup>5</sup>			
	Mitsubishi Electric	Affiliates (Japan)	Affiliates (Overseas)
Electricity <sup>5</sup>	7,860 million kWh	840 million kWh	12,060 million kWh

<sup>5</sup> **Energy Consumption, Electricity:** Amount related to Eco-Products

End-of-Life Products <sup>7</sup>	
	Mitsubishi Electric
Air conditioners	11,193 tons
Televisions	10,407 tons
Refrigerators	18,424 tons
Washing machines	6,085 tons
Personal computers	56 tons

<sup>7</sup> **End-of-Life Products:** Weight of products taken back and weight of recovered resources of four types of appliances subject to Japan's Home Appliance Recycling Law, plus personal computers

## OUT

Emissions			
	Mitsubishi Electric	Affiliates (Japan)	Affiliates (Overseas)
Water	6,770,000 m <sup>3</sup>	1,660,000 m <sup>3</sup>	1,100,000 m <sup>3</sup>
Controlled chemical substances	13.4 tons	1.5 tons	59.9 tons
BOD (biological oxygen demand)	112.1 tons	7.8 tons	15.5 tons
COD (chemical oxygen demand)	32.5 tons	5.2 tons	37.2 tons
Nitrogen	96.7 tons	13.0 tons	0.4 tons
Phosphorus	6.8 tons	0.2 tons	0.0 tons
Suspended solids	80.0 tons	4.4 tons	25.7 tons
n-hexane extracts (mineral)	1.2 tons	0.4 tons	1.0 tons
n-hexane extracts (active)	2.0 tons	0.2 tons	0.5 tons
Total emissions of zinc	0.2 tons	0.1 tons	0.0 tons
Carbon dioxide (CO <sub>2</sub> )	514,000 tons-CO <sub>2</sub>	189,000 tons-CO <sub>2</sub>	245,000 tons-CO <sub>2</sub>
Controlled chemical substances (excluding amounts contained in other waste)	701.5 tons	82.2 tons	153.1 tons
Volatile organic compounds (toluene, xylene, styrene)	667.9 tons	80.3 tons	124.1 tons
Greenhouse gases	255,000 tons-CO <sub>2</sub>	126,000 tons-CO <sub>2</sub>	55,000 tons-CO <sub>2</sub>
Ozone depleting substances	0.01 ODP t	0.00 ODP t	0.40 ODP t
Sulfur oxide (SO <sub>x</sub> )	1.2 tons	4.7 tons	4.8 tons
Nitrogen oxide (NO <sub>x</sub> )	13.2 tons	11.3 tons	32.1 tons
Dust	1.0 tons	2.2 tons	8.5 tons
Amount of CFCs recovered	31.4 tons	421.4 tons	—

Waste			
	Mitsubishi Electric	Affiliates (Japan)	Affiliates (Overseas)
Total waste emissions	81,801 tons	45,397 tons	43,498 tons
Volume recycled	69,851 tons	73,832 tons	41,154 tons
Waste treatment subcontracted out	22,459 tons	39,844 tons	7,318 tons
Final disposal	121 tons	451 tons	2,368 tons
In-house weight reduction	2,036 tons	0 tons	0 tons

Products <sup>2</sup>			
	Mitsubishi Electric	Affiliates (Japan)	Affiliates (Overseas)
Weight of all Eco-Products sold	477,000 tons	37,000 tons	401,000 tons
Weight of packaging materials	41,000 tons	8,000 tons	63,000 tons

<sup>2</sup> **Products:** Weight related to products designed for the environment

Emissions <sup>4</sup>			
	Mitsubishi Electric	Affiliates (Japan)	Affiliates (Overseas)
Carbon dioxide (CO <sub>2</sub> )	63,000 tons-CO <sub>2</sub>	29,000 tons-CO <sub>2</sub>	225,000 tons-CO <sub>2</sub>

<sup>4</sup> **Emissions:** Includes 11 sales companies in Japan  
Figures for overseas affiliated companies include transportation between countries.

Emissions <sup>6</sup>		
	Mitsubishi Electric	Affiliates (Japan)
Carbon dioxide (CO <sub>2</sub> )	3,316,000 tons-CO <sub>2</sub>	355,000 tons-CO <sub>2</sub>

<sup>6</sup> **Emissions:** Amount related to Eco-Products

Resources Recovered <sup>8</sup>	
	Mitsubishi Electric
Metals	24,815 tons
Glass	5,999 tons
CFCs	259 tons
Others	9,568 tons

<sup>8</sup> **Resources Recovered:** Weight of products taken back and weight of recovered resources of four types of appliances subject to Japan's Home Appliance Recycling Law, plus personal computers





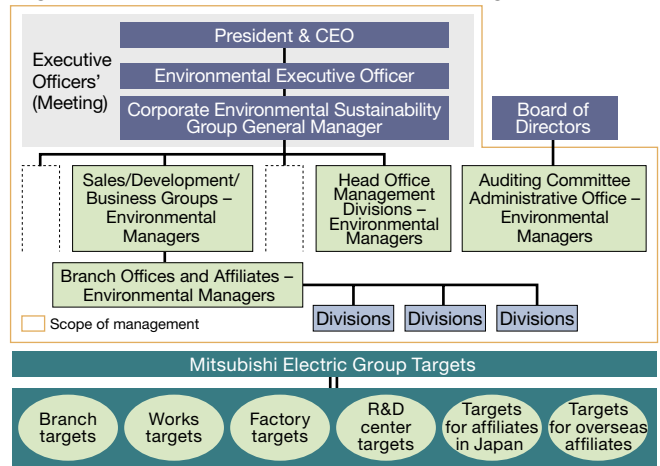
## Environmental Management

In fiscal 2007, the Mitsubishi Electric Group commenced activities aimed at the integrated operation of environmental management systems (EMS). Under this initiative, the targets of environmental management programs at each EMS organization (works, R&D centers, etc.) of companies with specified environmental plans<sup>1</sup> were amalgamated into the Mitsubishi Electric Group's environmental plan. From fiscal 2009, this plan was adopted by all companies with specified environmental plans.

In addition, we share case studies about organizations in Japan, Europe, China, other parts of Asia and the Americas to raise their environmental management levels.

<sup>1</sup> Company with the same scope of environmental reporting

### Organizational Structure for Environmental Management

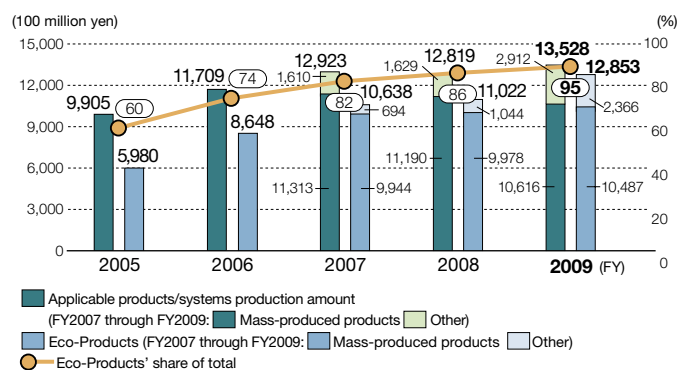


## Design for the Environment

In evaluating design for the environment, the Mitsubishi Electric Group sets Factor X as an indicator of eco-efficiency improvement, and recognizes products that drive environmental advances as “eco-products” or “hyper eco-products.” In fiscal 2009, 83 of the company's 163 product groups were selected as incorporating design for the environment. Within these groups, 90 items were recognized as hyper eco-products.

To achieve Environmental Vision 2021, we will strive to reduce CO<sub>2</sub> emissions from product usage and reduce resource inputs. We will also consider more appropriate methods of calculating and making use of Factor X.

### Eco-Products Share of Mitsubishi Electric's Total Production



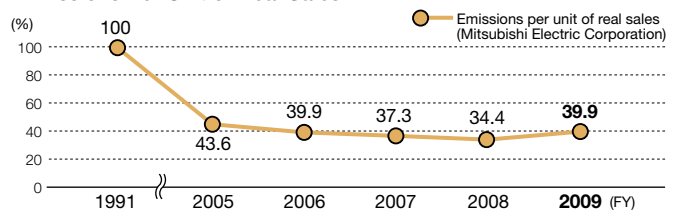
## Preventing Global Warming

In 1997, Mitsubishi Electric set CO<sub>2</sub> reduction targets for its manufacturing works in Japan (including research centers) of 60% or more per unit of real sales<sup>1</sup> by fiscal 2011, compared with fiscal 1991 levels. We reached these voluntary environmental targets ahead of schedule in fiscal 2006. This marked the success of the Energy Conservation Action Plan that we had formulated in fiscal 2005.

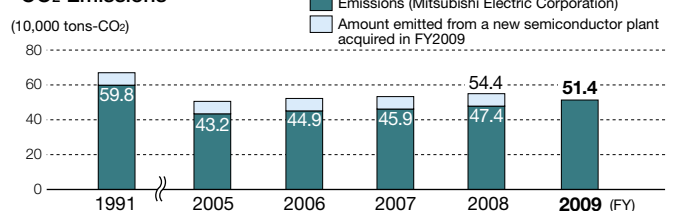
This Energy Conservation Action Plan promoted CO<sub>2</sub> reduction effects in three ways: the introduction of highly energy efficient equipment, Energy Loss Minimum Activities<sup>2</sup> and fuel conversion. In fiscal 2009, we invested a total of ¥2.85 billion in these three measures, reducing 11,000 tons of CO<sub>2</sub>. An investment of ¥220 million in other productivity improvements reduced another 3,000 tons of CO<sub>2</sub>, for a total reduction of 14,000 tons.

Owing to the results of these activities and production cutbacks, fiscal 2009 CO<sub>2</sub> emissions totaled 514,000 tons, down 30,000 tons<sup>3</sup> from the preceding year.

### Emissions Per Unit of Real Sales



### CO<sub>2</sub> Emissions



### Energy Conservation Action Plan

Action Plan	FY2011 Reduction Target (tons-CO <sub>2</sub> )	FY2007		FY2008		FY2009	
		Reduction (tons-CO <sub>2</sub> )	Investment (Millions of yen)	Reduction (tons-CO <sub>2</sub> )	Investment (Millions of yen)	Reduction (tons-CO <sub>2</sub> )	Investment (Millions of yen)
Install high efficiency equipment	34,800	8,842	2,481	7,514	2,753	10,213	2,769
Energy-loss minimum (EM) activities	8,000	890	156	454	153	605	50
Shift to alternative fuels	3,200	320	25	4	2	136	28
Total	46,000	10,052	2,662	7,972	2,908	10,954	2,847
Cumulative (from FY2005)	—	22,746	5,787	30,718	8,695	41,672	11,542

<sup>1</sup> Per unit of real sales: This indicator, which uses a price index to adjust the selling price of products, is considered a more accurate indicator than CO<sub>2</sub> emissions per volume of production.

<sup>2</sup> The objective of Energy Loss Minimum (EM) activities is to make energy usage visible at the production site, production process, or facility level and reduce losses.

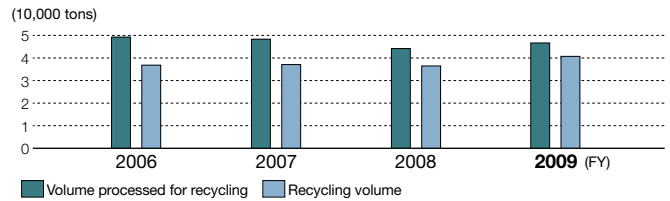
<sup>3</sup> The calculation of this figure takes into account the fiscal 2009 acquisition of a new semiconductor plant, which increased emissions 70,000 tons compared with the previous year.

## Recycling End-of-Life Products

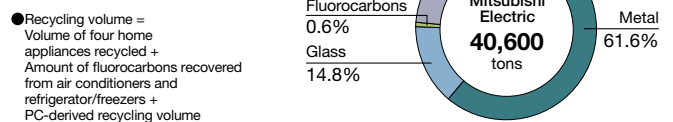
In fiscal 2009, we recycled a total of 1.16 million of four types of home appliances (air conditioners, televisions, refrigerator/freezers, and washing machines), 7% more than in the previous fiscal year, for a home appliance recycling ratio of 86%. For plastics considered difficult to recycle, Mitsubishi Electric created a technology to automatically separate—with purities of 99% or higher—polypropylene (PP), polystyrene (PS) and acrylonitrile-butadiene-styrene (ABS) from a shredded mixed plastic and micro-metal mixture.

From a collection of 4,291 home and business computers, we achieved a recycling ratio of 76%.

### Recycling of Four Home Appliances



### Breakdown of Amount Processed for Recycling

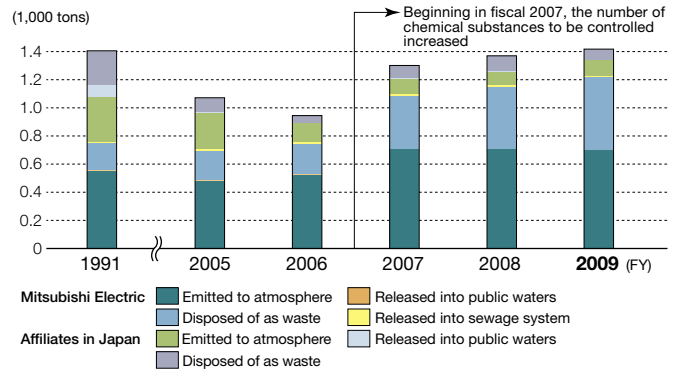


## Managing Chemical Substances

Chemical substances controlled by the Mitsubishi Electric Group (manufacturing sites in Japan) include 580 substances—Pollutant Release and Transfer Register (PRTR) controlled substances (354 substances) and 226 voluntarily controlled substances. Voluntarily controlled substances include fluorocarbons used as coolants in air conditioning and freezing equipment, volatile organic compounds (VOCs) and six RoHS-designated substances.

Once the revised PRTR Law goes into effect in 2010, we will review the substances to be controlled. In addition, we will work to reduce further emissions of such VOCs as styrene and xylene, which are major topics of discussion.

### Chemical Substance Releases and Transfers

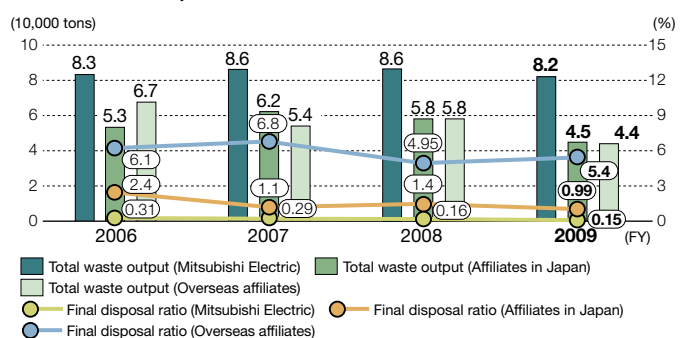


## Waste Reduction and Zero Emission Activities

The 5th Environmental Plan set a target percentage for volume of direct landfill waste per total waste output of 0.5% or less for Mitsubishi Electric's manufacturing sites in Japan and 1% or less for its manufacturing affiliates in Japan.

In fiscal 2009, we achieved a ratio of 0.15% at the company's manufacturing sites in Japan, falling at or below 0.5% for the fifth consecutive year. Within Japan, manufacturing affiliates substantially reduced their final disposal volumes by recycling glass waste and recovering heat from waste plastic, bringing down their ratio to 0.99%.

### Total Waste Output

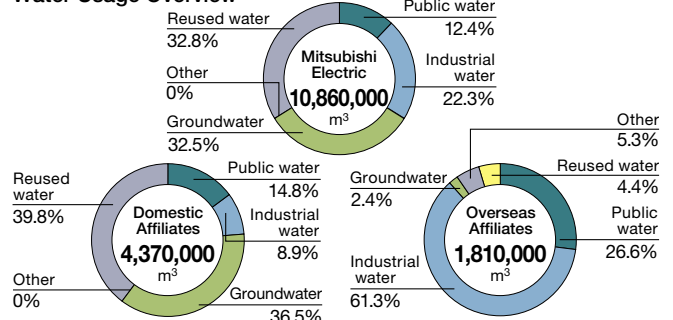


## Using Water Effectively

Mitsubishi Electric's water usage amounted to 10.86 million m<sup>3</sup>, up 18.8% from the preceding fiscal year. This figure amounts to a slight year-on-year reduction, if the newly acquired semiconductor factory (2.21 million m<sup>3</sup>) is excluded. Principal reasons for this reduction were water conservation at factories and offices, as well as lower production levels.

The amount of water used at affiliates in Japan was up 13.5%, to 4.37 million m<sup>3</sup>. Major reasons include the addition of companies to the scope of reporting, and an increase in the production of liquid crystal displays in the semiconductor field.

### Water Usage Overview



## Environmental Accounting

Period: April 1, 2008 – March 31, 2009

Scope of Data Compilation: Mitsubishi Electric Corporation and 100 of its affiliates and subsidiaries in Japan and overseas (76 in Japan, 24 overseas)

□ Mitsubishi Electric Group □ Mitsubishi Electric (100 million yen)

Environmental Conservation Costs				
Item	Capital Investment	Cost <sup>1</sup>	Year-on-Year Change	Main Costs
Business area activities	45.4	104.2	3.1	
	28.2	64.4	(0.7)	
Pollution prevention	7.4	43.4	4.9	Maintenance cost of the renewal of exhaust and water treatment equipment, vehicle replacement (investment), etc.
	4.9	25.0	1.7	
Global environmental protection	33.3	32.4	4.5	Changing of high-efficiency type air conditioner, refrigerator and lighting equipment, introduction of photovoltaic generation and energy measurement system, etc.
	22.5	22.3	2.7	
Resource recycling	4.7	28.4	(6.3)	Expenditure on waste processing, paper/cardboard/product scrap recycling, etc.
	0.8	17.1	(5.1)	
Green purchasing/procurement and product-related activities of upstream and downstream production	0.6	13.3	(0.2)	Testing to determine the existence of environmentally impactful substances in products, testing and evaluation of alternative substances, etc.
	0.2	11.0	0.0	
Management activities	0.1	38.0	3.2	Expenditure on environmental education, EMS activities, environmental exhibition, greening business sites, etc.
	0.0	30.9	6.4	
Environmental impact reduction and R&D activities	0.5	51.3	11.4	Development of heat pump with natural HC refrigerant, development of technology to increase photovoltaic cell efficiency, development of high-purity plastic recycling and other technologies, etc.
	0.5	49.5	11.9	
Community activities	0.0	1.2	0.0	Offsite cleanup activities, management of greenery at factory sites, etc.
	0.0	1.0	(0.1)	
Environmental damage	0.3	9.7	7.0	Expense related to the survey and cleaning of contaminated soil and underground water
	0.3	9.7	7.0	
Total	46.9	217.7	24.5	
	29.2	166.5	24.5	
Year-on-year change	(10.1)	24.5		
	(8.9)	24.5		

<sup>1</sup> Includes depreciation of capital investment over the past five years.

Environmental Conservation Benefits (Environmental Performance) <sup>2</sup>				
Item	Unit	Fiscal 2008	Year-on-Year Change	Year-on-Year Per Net Sales
Total energy used	10,000 GJ	1,558	32	113%
		1,141	81	118%
Total water used	10,000 m <sup>3</sup>	993	140	129%
		730	101	128%
Total greenhouse gas emissions	10,000 tons-CO <sub>2</sub>	108	(0.3)	110%
		77	6	120%
Total atmospheric emissions of chemical substances	tons	783	(39)	105%
		701	(18)	107%
Total water discharged	10,000 m <sup>3</sup>	841	184	141%
		677	183	151%
Total discharge of chemical substances in the water and soil	tons	15	(0.3)	108%
		13	0.2	112%
Total waste discharged	tons	127,198	(16,802)	98%
		81,801	(4,399)	104%
Final disposal	tons	572	(393)	65%
		121	(14)	99%

<sup>2</sup> Excluding overseas affiliates

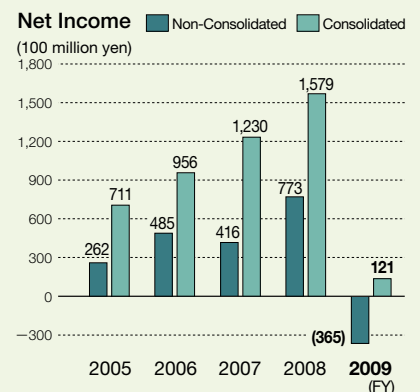
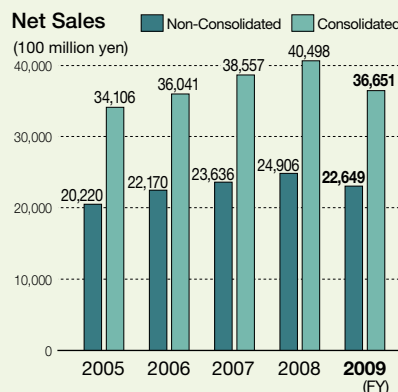
Economic Benefits from Environmental Conservation Activities (Real Benefits)			
Item	Amount	Year-on-Year Change	Main Benefits
Earnings	43.5	2.8	Profit from the sale of saleable materials accompanying the recycling of scrap metal, paper waste, etc.
	24.4	(0.8)	
Savings	40.0	2.1	Highly energy efficient equipment, measures to prevent plant area leakage, reduction of electricity costs through productivity improvements, cutting the consumption of packaging wood through its return, etc.
	18.9	0.2	
Total	83.5	4.9	
	43.3	(0.6)	

Economic Benefits from Environmental Consideration in Products and Services <sup>3</sup>		
Item	Amount	Main Products
Customer economic benefits	789.7	Energy heat recovery system (Lossnay), photovoltaic systems, hydroelectric power plants, etc.
Environmental improvement effects	765.4	
	26.3	
	26.1	

<sup>3</sup> Excluding overseas affiliates

## Corporate Profile (As of March 31, 2009)

Company Name: Mitsubishi Electric Corporation  
 Headquarters Location: Tokyo Building, 2-7-3, Marunouchi, Chiyoda-ku, Tokyo 100-8310, Japan  
 Established: January 15, 1921  
 Paid-in Capital: ¥175,800 million  
 President: Setsuhiro Shimomura  
 Number of Employees: Consolidated: 106,931  
 Non-consolidated: 28,476  
 Number of Affiliated Companies: Subsidiaries: 147  
 Affiliates: 42  
 Business Segments: Energy and Electric Systems, Industrial Automation Systems, Information and Communication Systems, Electronic Devices, and Home Appliances



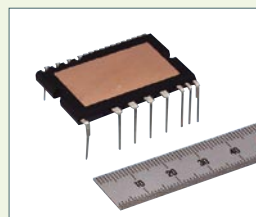
AXIEZ  
Machine-room-less elevators



MELSEC system  
Programmable logic controllers



DS2000  
Standard satellite platform



DIPIPM Ver.4 Series  
Dual-in-line package intelligent power modules



Eco-Cute  
CO<sub>2</sub> heat pump-type boilers

# Mitsubishi Electric Group Environmental Information

Mitsubishi Electric's Global Website contains information about the Mitsubishi Electric Group's corporate social responsibility (CSR) activities. Within the "Corporate Social Responsibility" section, the "Environmental Report" describes our environmental activities and achievements in fiscal 2009 (year ended March 31, 2009), while the "Environmental Topics" section outlines activities designed to achieve the goals of Environmental Vision 2021. The special features are presented in an easy-to-understand format, incorporating animated content that makes the most of online technologies.

## CSR Initiatives

<http://global.mitsubishielectric.com/company/csr/environment/index.html>

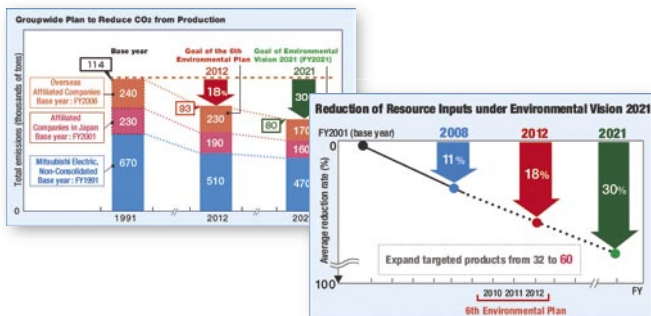
## Environmental Report

<http://global.mitsubishielectric.com/company/csr/environment/index.html>

This section includes information about the Mitsubishi Electric Group's environmental activities and achievements during fiscal 2009, including the Group's environmental policy and vision. It also outlines future plans.

### Environmental Report Overview

- Group Environmental Policy
- Environmental Vision 2021
- Targets of the 6th Environmental Plan
- Evolution of the Environmental Plan
- Summary of the 5th Environmental Plan
- Fiscal 2009 Achievements
- Product Information



### Targets of the 6th Environmental Plan

We launched a new plan in fiscal 2010 to realize the goals of Environmental Vision 2021.

## Environmental Topics

<http://global.mitsubishielectric.com/company/csr/ecotopics/index.html>

This section introduces Mitsubishi Electric initiatives to achieve the goals of Environmental Vision 2021—preventing global warming, creating a recycling-based society and fostering environmental awareness.

### Overview of Environmental Topics

- From the President
- Guide to Environmental Technologies
- Reducing CO<sub>2</sub> during Production
- Innovative Products and Production
- PV Power Generation
- Rebuilding and Developing Automotive Equipment
- Recycling of Waste Plastics
- Towards Zero Emissions
- Fostering Environmental Awareness



### Guide to Environmental Technologies

Here, we use animated content to introduce leading-edge environmental technologies, from products to devices, in an easy-to-understand format.

 **MITSUBISHI ELECTRIC CORPORATION**  
<http://Global.MitsubishiElectric.com>

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