

# CSR | Corporate Social Responsibility 2010

Environmental Topics



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# Environmental Topics

**NEW**

## Environmental Topics: Respecting Biodiversity

The Mitsubishi Electric Group is focused on respecting biodiversity in all its business activities. Find out more about our policies, activities and achievements.

[More >>](#)

### ▶ From the President



"The global environment is at the root of all our activity. We shall continue our single-minded efforts to protect it for future generations." A message from President & CEO Kenichiro Yamanishi.

### ▶ Guide to Environmental Technologies



Products  
Cutting-edge Technology

### ▶ Respecting Biodiversity



Philosophy, Basic Policies and Initiatives for Preserving Biodiversity  
Exchanging Ideas with Experts  
"Living Creature Studies" at Factories  
Mitsubishi Electric Outdoor Classroom  
"Satoyama" Woodland Preservation

### ▶ A New Dimension in Eco Air Conditioning



Focusing on Perceived Temperature  
Secrets of Sensing & Analysis  
The Idea behind "Move-Eye Navi"  
An Industry First: A Navigation Function

### ▶ Intelligent Ways to Save Energy and Reduce CO<sub>2</sub> from Production



Goals and Merits of the Energy Conservation Expert Inspection  
On-site during an Energy Conservation Expert Inspection  
Experts Discuss Ways to Conserve Energy  
Close-up: The Air Conditioning & Refrigeration Systems Works

### ▶ Coordinated Regional Waste Recycling (Kyushu Area)



Mobilizing Managers from Seven Factories  
Mutual Inspections Uncover Areas for Improvement  
Sharing Information on Waste Processors  
Streamlining the Waste Material Flow  
Creating a Win-Win Relationship

### ▶ Recycling of Waste Plastics



Large-Scale, High-Purity Plastic Recycling  
Technology for Separating Plastics  
Technology for Improving Plastic Quality

### ▶ Archives



Innovative Products and Production  
Rebuilding and Developing Automotive Equipment  
Towards Zero Emissions

## From the President



**The global environment is at the root of all our activity. We shall continue our single-minded efforts to protect it for future generations.**

## Promoting Eco Changes as a Group Focused on the Future of the Global Environment

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The conservation of the global environment will undoubtedly continue to be one of the most critical common issues facing the world. For precisely this reason, our corporate environmental activities must be down-to-earth, sustainable and visionary over the long haul. Mindful of these prerequisites, Mitsubishi Electric formulated its Environmental Vision 2021 to promote environmental management from a long-term perspective.

The creation of a low-carbon society is one pillar supporting this vision. We have established the concrete objective of reducing total CO<sub>2</sub> emissions from production 30% by 2021 (compared with fiscal 1991\* levels). This is an ambitious target, but it is not merely an ideal; I am confident that it is achievable with a concerted groupwide effort. Mitsubishi Electric's 6th Environmental Plan, the directive that is steering our endeavors from fiscal 2010 through fiscal 2012, promotes production line improvements and the introduction of high-efficiency equipment at all sites in Japan and overseas. Results for fiscal 2010 indicate early gains in pursuit of these goals.

Creating a recycling-based society is another pillar of our environmental vision. One example is the closed-loop recycling and reuse of plastic from end-of-life products as materials for new products. We have established Japan's first technology for automatically separating three major types of plastic from mixed crushed plastic at high levels of purity. Large-scale, high-purity plastic recycling using this vanguard technology was employed at a new plant from fiscal 2011.

The environment also represents a foundation for further growth for the Mitsubishi Electric Group. We are incorporating environment- and energy-related businesses as a key element in the Company's future growth strategies by expanding sales of environmental products and services across a variety of fields.

Mitsubishi Electric's environmental statement, Eco Changes, which was announced in Japan last year, clarifies the Company's management stance on a variety of its environmental initiatives. "Change is progress" succinctly expresses my personal beliefs in this regard. The word "Eco Changes" represents two distinct aspects of our commitment: working together with our customers to change the global environment for the better; and, contributing to environmental conservation through our wide range of businesses.

## Respecting Biodiversity in All Our Business Activities

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Interest in biodiversity is on the rise, as evidenced by the 10th session of the Conference of the Parties (COP10), to be hosted in Nagoya in October 2010. However, conservation of ecosystems and biodiversity is far more than a passing topical theme; I believe it is the essence of solutions to global environmental problems. Human activity in its various forms is possible precisely because we are blessed with the Earth's rich ecosystems. The global environment was formed over hundreds of millions of years. We must use every means at our disposal to stem the degradation of the Earth's bountiful but fragile ground.

As specific action guidelines to steer us in this accord, in May 2010 we formulated the Mitsubishi Electric Group Biodiversity Action Guidelines. In accordance with this proclamation, we are raising the awareness of each employee regarding the relationship between their own business activities and ecosystems and biodiversity across all operational domains, from procurement, manufacturing, transportation and marketing, through recovery and recycling. In addition, we are committed to expanding such ongoing endeavors as the "Satoyama" Woodland Preservation Project and the Mitsubishi Electric Outdoor Classrooms, which aid us in fostering environmental awareness.

## Contributing to a Sustainable Society on a Global Level

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Looking toward tomorrow, all regions and countries worldwide will have to aim for sustainable development, with consideration for global environmental conservation. To avoid the negative aspects of economic growth that Japan experienced in the past, the Mitsubishi Electric Group views doing its utmost to provide the world with technologies, products and services that contribute to conservation of the environment worldwide as one of its primary obligations in the execution of its business. At the same time, we are aware of our responsibility to take extreme care that our resource procurement and production activities do not bring with them environmental destruction.

Currently, Mitsubishi Electric provides many products and services worldwide that contribute to global environmental conservation in a broad range of fields—from in the home to outer space. However, the technological development this involves requires long years of cumulative effort. For example, Mitsubishi Electric's water treatment technologies utilizing ozone have been adopted in numerous countries around the world as purification technologies that feature excellent energy savings and cause no environmental pollution. When I joined the Company more than 30 years ago, I was involved in the development of these and related technologies. Thereafter, thanks to the efforts of many employees, this work bore fruit. Such examples enable me to appreciate the importance of continuous, cumulative effort. In this way, looking ahead, I would like to contribute to the realization of a sustainable society on a global level through continuous and unflagging effort.

## Continuing our Persistent Efforts with a Workforce United in Intent

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Self-motivated, independent action by individuals taking responsibility upon themselves is indispensable if we are to continue the progress I have described into the future. Promotion of activities by top management can only provide momentum. Our ultimate objective is for all employees of the Mitsubishi Electric Group to share deep empathy for the natural environment and a proper awareness of biodiversity, and to advance step by step with a strong sense of their own role in helping protect the environment.

I am doing my utmost in my leadership role to build the company in this way. I hope to continue in these efforts to preserve our irreplaceable global environment through the concerted support of all employees.

\*NOTE: Fiscal years used on this page refer to the fiscal period starting on April 1 and ending on March 31 of the year shown.

President & CEO  
Kenichiro Yamanishi



## Environmental Topics

### Guide to Environmental Technologies

Through continued development of energy-saving technologies and energy-efficient products, Mitsubishi Electric is working towards its target of reducing carbon dioxide emissions from product usage by 30% by 2021. This section introduces and provides examples of some products with environmental features, using easy-to-understand animations.

## Products

### ▶ Photovoltaic (PV) Systems **NEW**

Using high-performance photovoltaic inverters and photovoltaic modules to achieve robust power generation.

[More](#)

### ▶ AXIEZ Machine-room-less Elevator

This advanced eco-elevator is machine-room-less to save resources; energy efficient thanks to an inverter motor; and effectively uses electricity that it stores itself.

[More](#)

### ▶ Ozone Generators

This device uses minimal power to efficiently generate ozone (O<sub>3</sub>), which is a powerful sterilizer and purifier.

[More](#)

### ▶ EGR Valve **NEW**

Contributing to the reduction of environmental impact through products that help clean automobile exhaust and improve fuel efficiency.

[More](#)

### ▶ Dry Air Insulated Switchgear

Rather than using a greenhouse gas (SF<sub>6</sub>), this switchgear is insulated with dry air.

[More](#)

## Cutting-Edge Technology

### ▶ Next Generation Power Capacitor

Capacitors last longer than condensers and provide more instantaneous power than batteries. This new storage device makes motors more energy efficient and is helping to popularize photovoltaic power systems.

[More](#)

### ▶ SiC Power Device **NEW**

Next-generation power devices that are getting closer to the practical application phase, and that offer significantly higher energy savings than power devices made from silicon (Si), which have reached their limit in terms of electric power loss reduction.

[More](#)

### ▶ Photovoltaic (PV) Systems **NEW**

While answering a series of questions, we introduce the various technologies involved in photovoltaic systems to be achieved in the near future.

[More](#)

### ▶ Gradationally Controlled Voltage Inverter

This next-generation technology accelerates energy efficiency by minimizing power conversion loss with a combination of three inverters that feature different voltages.

[More](#)

### ▶ Pumpless Water Cooling System

This heat exchanger is powered by heat generated by the electric device itself, so it does not use any electricity.

[More](#)

### ▶ Life Pattern Sensor

This technology contributes to the conservation of energy by capturing the current waveforms of electrical appliances that are switched on, making their power consumption visible.

[More](#)

### Products

- ▶ Air Conditioners with Energy Conservation Sensors
- ▶ Photovoltaic (PV) Systems
- ▶ AXIEZ Machine-room-less Elevator
- ▶ Ozone Generators
- ▶ Dry Air Insulated Switchgear

### Cutting-Edge Technology

- ▶ Next Generation Power Capacitor
- ▶ SiC Power Device
- ▶ Gradationally Controlled Voltage Inverter
- ▶ Pumpless Water Cooling System
- ▶ Life Pattern Sensor



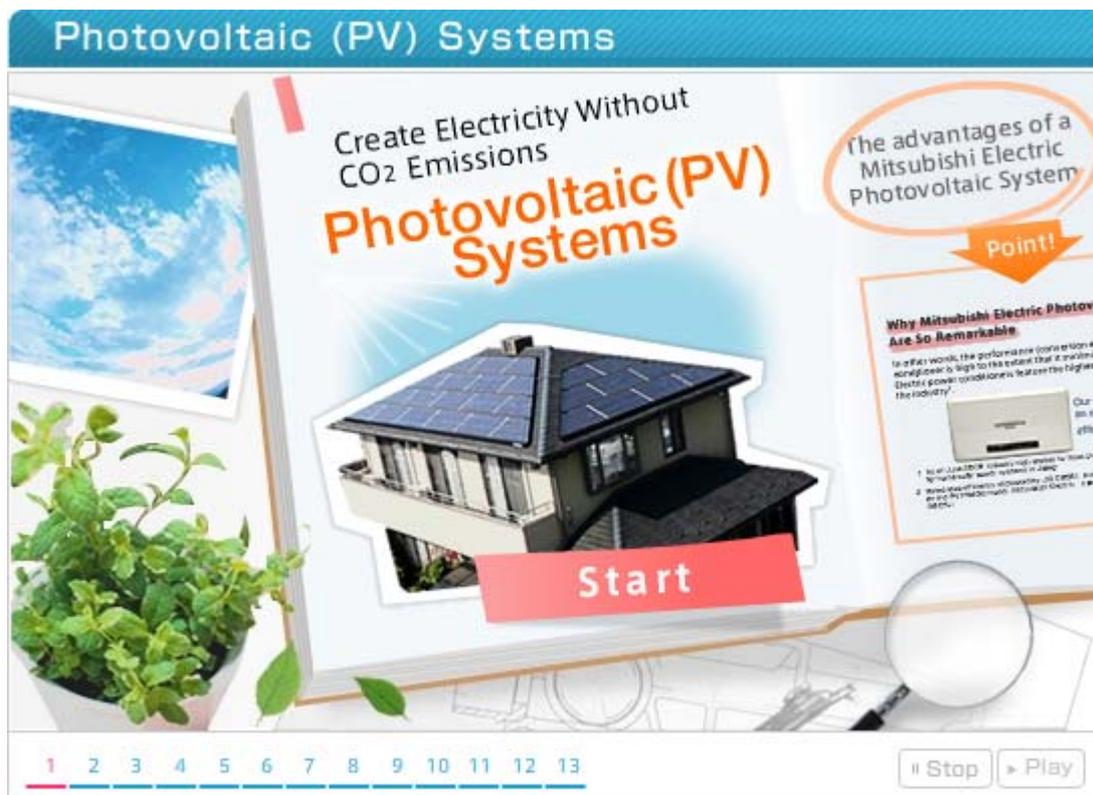
Air conditioning accounts for around 25% of household power consumption (in Japan). Mitsubishi Electric air conditioners conserve energy by up to 50% thanks to the inclusion of cutting-edge sensing technology ("New Human-Sensing Move-Eye"). Controlling perceived temperature by monitoring the temperature of the floor and walls keeps the room comfortable even when the temperature is set relatively high when cooling and relatively low when heating. This makes it possible to save energy without having to put up with any discomfort. Move-Eye also senses the whereabouts of people in the room and learns their movement patterns for even greater efficiency. There is also a display that lights up and shows the level of energy savings.

**Products**

- ▶ Air Conditioners with Energy Conservation Sensors ▶ **Photovoltaic (PV) Systems**
- ▶ AXIEZ Machine-room-less Elevator ▶ Ozone Generators ▶ Dry Air Insulated Switchgear

**Cutting-Edge Technology**

- ▶ Next Generation Power Capacitor ▶ SiC Power Device
- ▶ Gradationally Controlled Voltage Inverter ▶ Pumpless Water Cooling System
- ▶ Life Pattern Sensor



Photovoltaic power generation systems are primarily made up of two components: PV modules, which convert solar energy into electrical energy, and a PV inverter, which converts the power produced by the modules into a form that can be used in the home.

Photovoltaic system performance depends on the performance of these two components. Mitsubishi Electric has developed both components in-house. Our PV module offers industry-class performance (for a polycrystalline silicon-based, domestic mass-produced module) and our PV inverter provides the best conversion efficiency in the industry (as of June 2008), for a system that generates robust power.

- > Environmental Topics: PV Power Generation
- > Product Site

### Products

- ▶ Air Conditioners with Energy Conservation Sensors
- ▶ Photovoltaic (PV) Systems
- ▶ **AXIEZ Machine-room-less Elevator**
- ▶ Ozone Generators
- ▶ Dry Air Insulated Switchgear

### Cutting-Edge Technology

- ▶ Next Generation Power Capacitor
- ▶ SiC Power Device
- ▶ Gradationally Controlled Voltage Inverter
- ▶ Pumpless Water Cooling System
- ▶ Life Pattern Sensor



AXIEZ saves resources by reducing the thickness of the hoist and control panel, essential parts for elevators, by making them compact and eliminating the machine room previously required. Precise control of the motor rotary speed by the inverter also leads to a reduction of power loss; moreover, the electric power generated when applying the brake is also used efficiently.

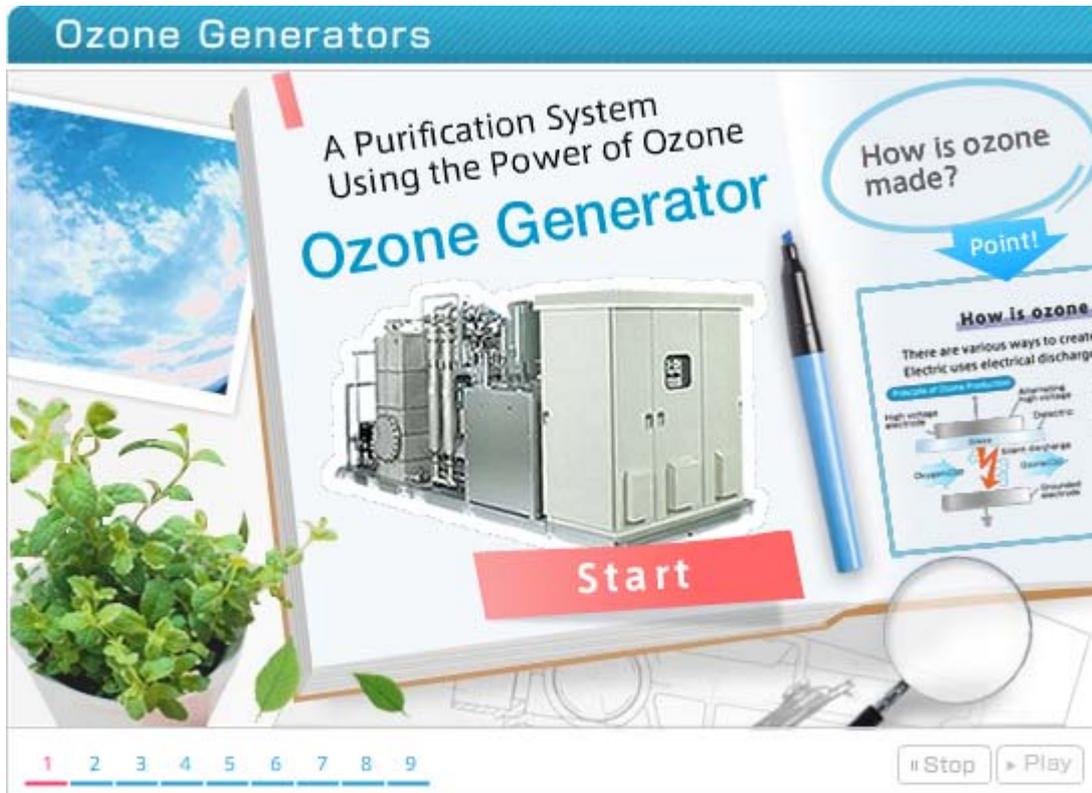
> [Product Site](#) 

### Products

- ▶ Air Conditioners with Energy Conservation Sensors
- ▶ Photovoltaic (PV) Systems
- ▶ AXIEZ Machine-room-less Elevator
- ▶ **Ozone Generators**
- ▶ Dry Air Insulated Switchgear

### Cutting-Edge Technology

- ▶ Next Generation Power Capacitor
- ▶ SiC Power Device
- ▶ Gradationally Controlled Voltage Inverter
- ▶ Pumpless Water Cooling System
- ▶ Life Pattern Sensor



Ozone is comprised of three oxygen atoms and is one of the gases that make up the air. It has the power to sterilize, deodorize, de-colorize and purify, so it is used in a wide variety of applications, including water purification and food sterilization. Mitsubishi Electric has developed technology capable of efficiently generating ozone using minimal electric power through a unique method that utilizes electrical discharge.

### Products

- ▶ Air Conditioners with Energy Conservation Sensors
- ▶ Photovoltaic (PV) Systems
- ▶ AXIEZ Machine-room-less Elevator
- ▶ Ozone Generators
- ▶ **Dry Air Insulated Switchgear**

### Cutting-Edge Technology

- ▶ Next Generation Power Capacitor
- ▶ SiC Power Device
- ▶ Gradationally Controlled Voltage Inverter
- ▶ Pumpless Water Cooling System
- ▶ Life Pattern Sensor



Switchgears are located in buildings and factories to control electricity flow from power plants, ensuring that it is distributed safely. Switchgears also minimize damage from sudden accidents due to electrical leaks or power outages. Internal switchgear insulation technology is essential to ensure safety along the electrical path. SF<sub>6</sub>, which is commonly used as an insulator, is also a greenhouse gas. As an alternative, we employ a proprietary insulating method using dry air, which has no greenhouse effect.

### Products

- ▶ Air Conditioners with Energy Conservation Sensors ▶ Photovoltaic (PV) Systems
- ▶ AXIEZ Machine-room-less Elevator ▶ Ozone Generators ▶ Dry Air Insulated Switchgear

### Cutting-Edge Technology

- ▶ **Next Generation Power Capacitor** ▶ SiC Power Device
- ▶ Gradationally Controlled Voltage Inverter ▶ Pumpless Water Cooling System
- ▶ Life Pattern Sensor



Capacitors have more lasting force than condensers, and more instantaneous force than batteries, making them an electric power storage device that has the advantages of both. The capacitors developed by Mitsubishi Electric are capable of charging and discharging in just one second, and are also capable of boosting storage energy with increased voltage endurance. They are new types of devices that serve to further energy-saving in motors and photovoltaic power generation systems.

### Products

- ▶ Air Conditioners with Energy Conservation Sensors ▶ Photovoltaic (PV) Systems
- ▶ AXIEZ Machine-room-less Elevator ▶ Ozone Generators ▶ Dry Air Insulated Switchgear

### Cutting-Edge Technology

- ▶ Next Generation Power Capacitor ▶ **SiC Power Device**
- ▶ Gradationally Controlled Voltage Inverter ▶ Pumpless Water Cooling System
- ▶ Life Pattern Sensor



Power devices widely used today are made from Si (silicon), and it is said that reductions in power loss from these devices has come close to reaching its limit. Now SiC (silicon carbide) is garnering attention due to its excellent physical and electrical performance, and is expected to reduce loss in power conversion far better than Si. Mitsubishi Electric has developed a power module that is composed of all power semiconductors made from SiC and has a prototype inverter with 3.7kW output. The SiC inverter prototype, a step closer to practical use, has successfully reduced power loss by over half compared to conventional inverters using silicon semiconductors.

> R&D Highlight: SiC Power Device

### Products

- ▶ Air Conditioners with Energy Conservation Sensors
- ▶ Photovoltaic (PV) Systems
- ▶ AXIEZ Machine-room-less Elevator
- ▶ Ozone Generators
- ▶ Dry Air Insulated Switchgear

### Cutting-Edge Technology

- ▶ Next Generation Power Capacitor
- ▶ SiC Power Device
- ▶ **Gradationally Controlled Voltage Inverter**
- ▶ Pumpless Water Cooling System
- ▶ Life Pattern Sensor



Gradationally controlled voltage inverters are devices designed so that three inverter units, each with a different voltage, are combined and the sum of each inverter's output voltage generates a pseudo sine wave. It has better response than conventional methods in that a single unit controls a whole voltage range, thus reducing power loss. Employing gradationally controlled voltage inverters will improve energy efficiency in a variety of equipment and systems.

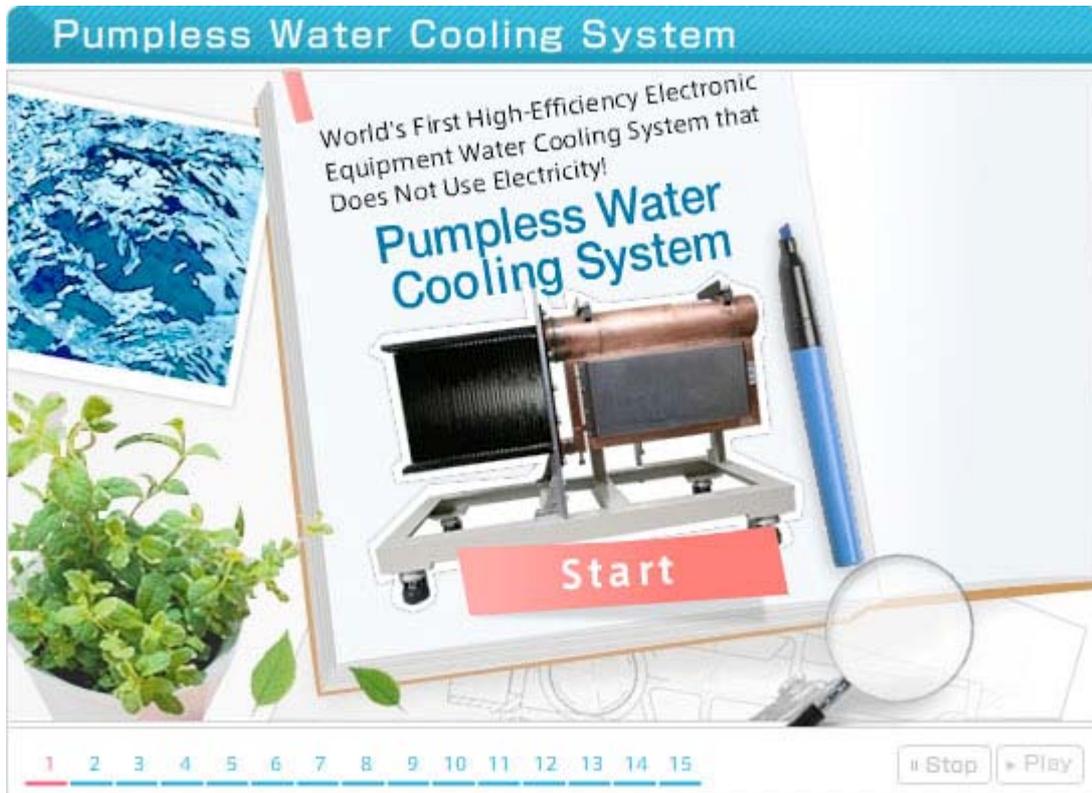
## Guide to Environmental Technologies

### Products

- ▶ Air Conditioners with Energy Conservation Sensors
- ▶ Photovoltaic (PV) Systems
- ▶ AXIEZ Machine-room-less Elevator
- ▶ Ozone Generators
- ▶ Dry Air Insulated Switchgear

### Cutting-Edge Technology

- ▶ Next Generation Power Capacitor
- ▶ SiC Power Device
- ▶ Gradationally Controlled Voltage Inverter
- ▶ **Pumpless Water Cooling System**
- ▶ Life Pattern Sensor



The parts inside electronic equipment generate heat when electricity flows through them. If nothing is done about this heat, it can cause the equipment to malfunction or breakdown. This is why all types of electronic equipment have cooling mechanisms. The Pumpless Water Cooling System is a heat exchanger that uses no electricity because it is powered by heat given off by the electronic equipment itself.

### Products

- ▶ Air Conditioners with Energy Conservation Sensors
- ▶ Photovoltaic (PV) Systems
- ▶ AXIEZ Machine-room-less Elevator
- ▶ Ozone Generators
- ▶ Dry Air Insulated Switchgear

### Cutting-Edge Technology

- ▶ Next Generation Power Capacitor
- ▶ SiC Power Device
- ▶ Gradationally Controlled Voltage Inverter
- ▶ Pumpless Water Cooling System
- ▶ **Life Pattern Sensor**



After simply installation onto a distribution board, the Life Pattern Sensor (LPS) detects the total power consumption in a home, as well as the usage status of individual electrical appliances. The LPS records the signals of each appliance and detects the current waveform of appliances that are in use, making their power consumption visible. If all a home's appliances are operating at the same time, for example, the LPS can show how long each appliance has been running. The ability to see home power consumption at a glance allows a homeowner to detect waste, playing an ongoing role in energy conservation.

## Environmental Topics



In fiscal 2010, the Kirigamine Move-Eye Navi room air conditioner (models on sale in Japan from winter of fiscal 2010) was the only major appliance to win the Japanese Energy Conservation Grand Prize in the white goods category. In addition to ease of use and the highest energy saving function in the industry, the Move-Eye Navi has received particularly high acclaim for its innovative approach to energy conservation. This product represents more than 10 years of Mitsubishi Electric development history and the pursuit of making maximum comfort = maximum ecology. This section gives an overview of the development concept and technology that makes the Move-Eye Navi second to none.

Note: The Kirigamine Move-Eye Navi room air conditioner is only sold in Japan.

### Contents

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- ▶ Focusing on Perceived Temperature
- ▶ Secrets of Sensing & Analysis
- ▶ The Idea behind "Move-Eye Navi"
- ▶ An Industry First: A Navigation Function

## Keywords: Perceived Temperature and Navigation Move Eye Navi, the Realization of Cutting-Edge Ecology

The pursuit of comfort is no less than the pursuit of energy conservation. So we created a system based on perceived temperature.

---

Of all home appliances, air conditioners consume the most electricity. Today there is a need for households to reduce CO<sub>2</sub> emissions in order to create a low-carbon society, as energy conservation becomes an increasingly critical priority in today's world.

Making air conditioners more energy efficient is a matter of course, but regardless of the equipment's energy-saving performance, if it is used in a wasteful, inefficient way, energy efficiency is reduced. However, such wasteful, inefficient use is actually the result of people's pursuit of comfort.

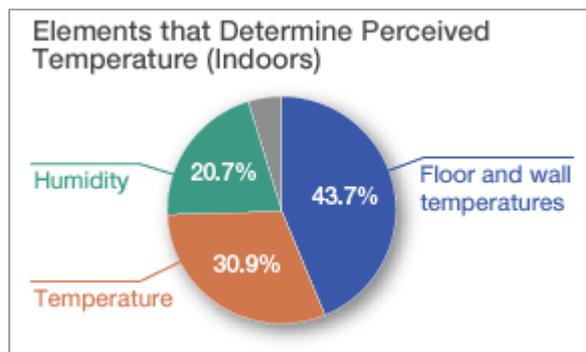
For more than 10 years, Mitsubishi Electric has been focused on this dilemma. Applying the innovative development concept of air conditioning based on user's perceived temperature, we have evolved our air conditioner technology. Air conditioning that self-adjusts based on perceived temperature—that is to say, air conditioning that delivers optimum comfort—dramatically reduces energy loss resulting from the method of use.

### Perceived temperature

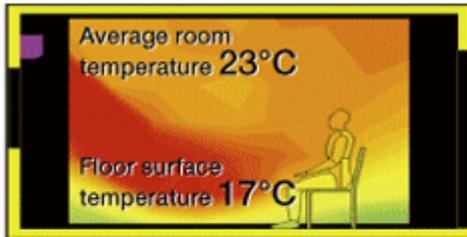
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"Perceived temperature" is not the absolute value of heat and humidity. It is a scale of comfort based on how the air conditioning user senses or feels the room's atmospheric environment.

For example, even at the same room temperature, if the floors and walls are cool, it feels cooler than the absolute room temperature value; conversely, if a person has been exercising and their body is hot, a lower room temperature will not feel all that cold to them.



■ Without Move Eye (Heater)

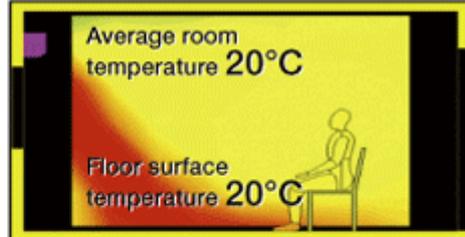


Temperature setting 23°C

Perceived temperature 20°C

3°C of waste

■ With Move Eye (Heater)



Temperature setting 20°C

Perceived temperature 20°C

No waste

Adjusting the air based on perceived temperature keeps the feet comfortably warm even when the temperature setting is low.

## Secrets of Sensing & Analysis

### Developer's Perspective

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**Technology that makes use of data analysis is an indispensable prerequisite to achieve maximum comfort and maximum ecology.**

---



**Takashi Matsumoto**  
Specialist Advanced Development  
Group Room Air Conditioning  
Manufacturing Department  
Shizuoka Works

The eight infrared sensors located at the center of the Move Eye Navi unit are constantly acquiring thermographic data, making a pass over the room every 30 seconds and dividing the scanned area into 752 quadrants. The thermographic data is then analyzed to find the position and surface temperature of the walls and floor, the position and state (open or closed) of the doors and windows, sunlight coming in from the windows, and the condition of the people in the room. More than simply ascertaining whether or not there are people in the room, their location and perceived temperature (hot or cold) measurements are also possible.

Mitsubishi Electric has spent the past 10 years developing this high-level thermographic data analysis technology. Recently, sensor-equipped air conditioners have become more common, but only Mitsubishi Electric's air conditioner is able to operate by simultaneously sensing the temperature both of people and their location. Technology that makes use of data analysis is an indispensable prerequisite to achieve maximum comfort and maximum ecology.

## The Idea behind "Move-Eye Navi"

### Planner's Perspective

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**Aiming for the realization of advanced energy conservation that would bring people and machines together as never before.**

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**Shin Harada**  
Specialist Room Air Conditioning  
Sales Planning Group Sales  
Department  
Shizuoka Works

Recently, improvements to the energy-saving functions of air conditioning units have been dramatic, making it difficult to hope for significant additional improvements. For this reason, Mitsubishi Electric has moved into the realm of energy-saving action, something which until now has been left up to the user.

Running the air conditioner with the doors or windows open, or with the curtains or blinds unclosed, or when the outside temperature is falling is clearly a waste of energy. Nevertheless, people all too frequently engage in this type of wasteful usage. Continually performing detailed checks of the room and persons within it, the Move Eye Navi sensor function identifies inefficient usage and informs the user. In this way, the air conditioner becomes one with the human user, realizing advanced energy efficiency that brings people and machines together as never before.

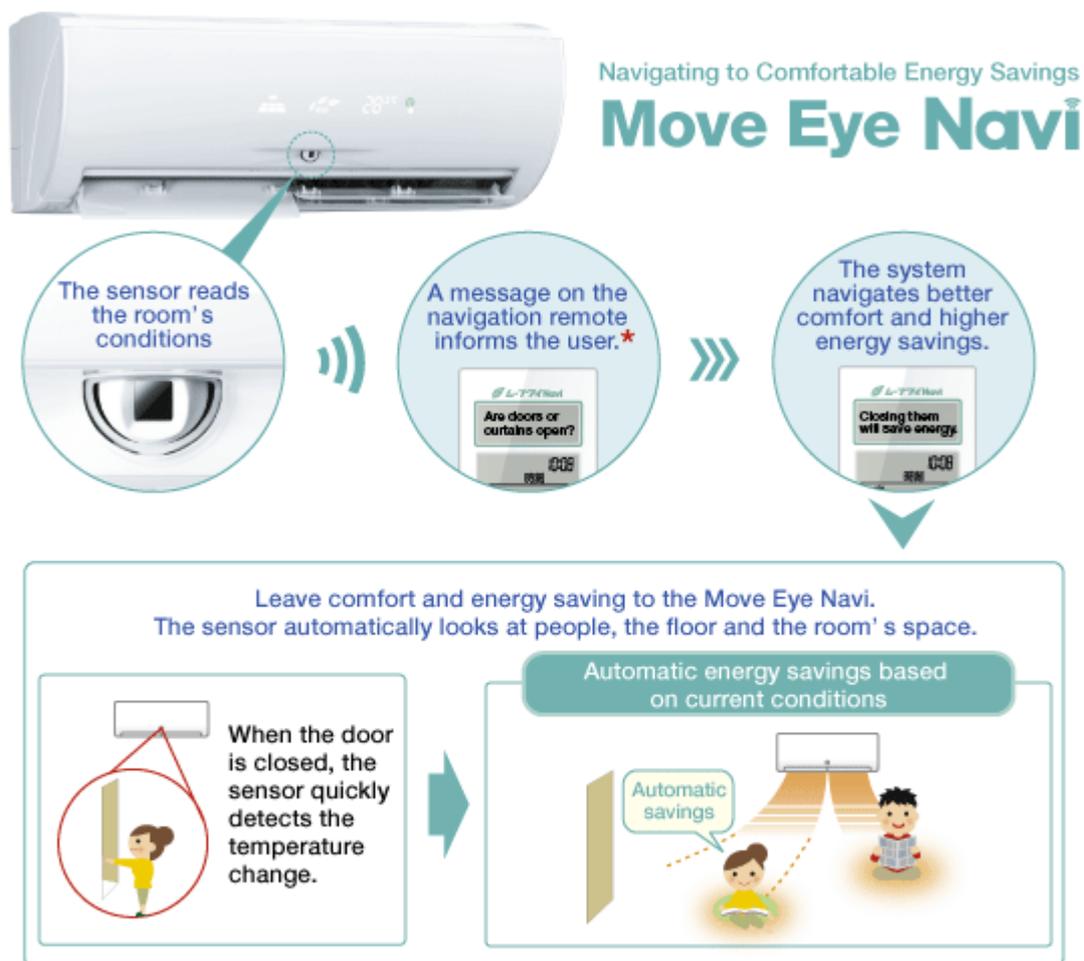
## An Industry First: A Navigation Function

### An Industry First\* —A Navigation Function that Informs People of Unnoticed Wastefulness

In addition to functionality that provides comfortable air conditioning based on perceived temperature, the Move Eye Navi is equipped with a smart function that informs the user of inefficient usage and navigates the user to information on how to get better air conditioner efficiency.

For example, if the door is left open while the air conditioner is running, the message "Is a door or window open? You can save energy by closing it" appears in the remote control window display. If the outside temperature is falling but the air conditioner is still cooling, the smart function will advise "The outside temperature is dropping. The air conditioner should be turned off."

This advanced energy efficiency that informs the user of unnoticed wastefulness is a special feature of the Move Eye Navi, a technology that is rewriting the pages of air conditioning history.



\* Move Eye detects floor, wall, window and door temperature differences. When temperature differences are small and there is little impact on energy savings, there are no alerts even if doors or windows are open.



### Forgetting to close the door is common

Are doors or curtains open?

Closing them will save energy.

The air conditioner seems to be working much better.



### If we open the window, it's probably cooler outside.

The outside temperature is dropping.

The air conditioner should be turned off.

Natural breezes are also comfortable.



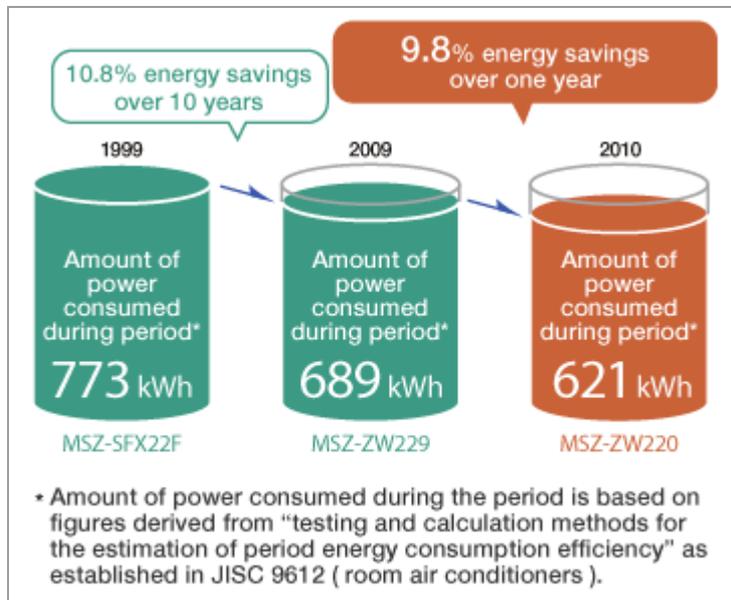
## TOPICS

### Ten years of energy efficiency improvements achieved in just one year Winner of the Energy Conservation Grand Prize

The Move Eye Navi has the highest energy-saving performance in the industry, boasting an annual performance factor (APF) of 7.1, the highest in the industry among 2.2kW class air conditioners. According to internal comparisons, this is approximately 9.8% higher than the APF of the 2009 model (2.2kW-class). This value achieved in one year, compares to the ten years of improvements leading up to 2009.

Such significant improvement in energy efficiency is the result of innovative technological developments applied to the compressor and fan motor, which are the main elements of air conditioners. A range of innovations in production and other aspects have contributed to the realization of an air conditioner with top-class energy-saving performance.

Note: Annual Performance Factor (APF) is the energy consumption efficiency during a given year. The operating efficiency of an air conditioner run for one year established as one of the Japanese Industrial Standards (JIS). The larger the number, the greater the energy savings.



## Environmental Topics



### Inspections by Intelligent Energy Conservation Experts Accelerate the Reduction of CO2 from Production

From fiscal 2010, Mitsubishi Electric Group is focusing on reducing CO2 from production under the 6th Environmental Plan (FY2010-2012). Up to now, we have made improvements at each factory by enhancing and promoting just-in-time activities in pursuit of improved productivity, and reducing energy waste through greater production efficiency. However, from the perspective of CO2 reduction and energy conservation, there are certain areas that remain unaffected by such activities. To resolve these issues, we have introduced energy conservation expert inspections to support production site improvement activities. Selected domestic and overseas employees who have participated in energy conservation improvement at various factories tour manufacturing sites to support the desire for vigorous improvements. By discovering and presenting many areas for improvement, further reduction of CO2 is possible. This special feature introduces intelligent ways the experts have found to reduce CO2 from production.



Is the boiler pressure too high?



What is happening during standby?

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- ▶ Experts Discuss Ways to Conserve Energy
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## Goals and Merits of the Energy Conservation Expert Inspections

### Experts Selected from Factories Across Japan to Support Energy Conservation through Production Line Improvements

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Energy conservation experts are employees who have been involved in energy conservation initiatives at factories across Japan, particularly those who possess considerable experience, have a track record of excellence in energy conservation activities and are highly skilled pioneers. Several experts are selected nationwide to be strong supporters of energy conservation through production line improvements promoted by the head office's Corporate Environmental Sustainability Group.

These experts constitute a team that tours factories in Japan and overseas, conducting inspections from multiple perspectives. At present, these inspections are focused on factories that emit a comparatively large volume of CO<sub>2</sub>, as well as factories that are models of energy conservation. In fiscal 2010, inspections were conducted at three domestic and one overseas factory. In addition to pointing out areas for improvement overlooked by factory staff, experts encourage staff to join them in taking a fresh look at the factory. Looking at their workplace from a different point of view, employees discover new perspectives and ways of thinking.

### Eyes Trained to Spot Areas for Improvement

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Experts visiting factories to conduct inspections observe every detail of the production site. From infrastructure such as electrical equipment, boilers, air compressors and ductwork, to the management of production equipment, experts make detailed observations of operations as well as people, checking for the smallest losses and inefficiencies.

Although each factory has traditionally engaged in energy conservation improvement initiatives under their respective environmental promotion managers, the experts possess experience cultivated at many production sites and are able to discover the need for improvement in a wide range of areas. With backgrounds that include personal involvement in the development of production equipment for the manufacturing technology department, the promotion of line energy visualization as the head of energy management and various other work histories, these experts have formulated their own theories on improvement based on visits to numerous factories and wealth of experience. They use this experience to discover areas for improvement from a fresh perspective.



Energy conservation experts conducting inspections.

## Supporting On-Site Improvements with a Detailed Inspection List

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After inspections have been conducted, each recommended improvement is explained to the factory manager and provided as a list of action items to the factory. In 2010, inspections conducted at the Shizuoka Works in January uncovered 120 action items, activities at the Nagoya Works in February found 70 items, and inspections at the Air Conditioning & Refrigeration Systems Works (Wakayama) in March discovered 170 items.

The action items are categorized into improvements that can be implemented immediately and those that require a certain amount of time and cost, so that each factory can determine the most efficient way to make improvements based on the inspection list and given their present situation. The energy conservation experts provide an excellent opportunity for promoting production line improvements at factories.



Setting up a venue to share inspection results. At this meeting, employees learn the expert's perspective to discover areas for improvement.

## Advice for Progress, Not an Audit

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Energy conservation expert inspections differ from audits and examinations in that they provide forward-looking suggestions and advice rather than evaluating past activity.

The inspections provide strong support for vigorous improvement activities at each factory. In this way, they are similar to the diagnosis a doctor would give their patient. Factory staff appreciate these diagnoses, which in turn inspires the experts to redouble their discovery efforts.

Experts encourage staff to take a fresh look at the factory with them. Looking at their workplace from a different point of view helps employees discover new perspectives and ways of thinking. The direct and indirect effects of these inspections combine to raise the overall level of improvements at each factory.

## Inheriting the Experience of Experts to Target Further Developments

In the past, we multiplied our production output by a 0.1% investment in energy-efficiency, but volatile business conditions have lowered our overall production output, making investment and capital expenditures difficult. As a result, production line improvements are conducted through "intelligent" energy conservation. Despite our inability to make large investments, each factory is finding intelligent ways to eliminate waste and inefficiency, and promote energy conservation and CO<sub>2</sub> reduction.

The production site is like a living entity, constantly changing in response to a variety of factors, including the movement of markets, the development of new products and the advancement of new technologies. In this sense, the need for improvements is endless. Likewise, for each factory, an energy conservation expert inspection is not the final goal, but a new starting point. By inheriting and further developing the experience of experts, factories in Japan and overseas are able to take their own steps toward the achievement of larger goals.

### A Promotional Leader Discusses Further CO<sub>2</sub> Reductions

#### Human Resource Cultivation Part of Ongoing Efforts to Improve Energy Conservation

We are seeing results beyond the inspections conducted by the energy conservation experts. Their accurate inspections and our own efforts are linked to significant improvements.

We plan on cultivating energy conservation promotion leaders to advance energy conservation improvements at each production site. We will cultivate these promotional leaders through training on energy conservation methods and improvement expertise, selecting employees from each production site to promote energy management and improvement activities. Promotional leaders will conduct inspections along with energy conservation experts to develop knowledge and skills firsthand, with the long-term goal of becoming energy conservation experts in their own right.



**Yoshio Kasuga**

Promotion Group Manager, Corporate Environmental Sustainability Group

## On-site during an Energy Conservation Expert Inspection

### More Than 100 Areas for Improvement at a Single Factory

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This section takes a closer look at an inspection conducted at Mitsubishi Electric's Air Conditioning & Refrigeration Systems Works (Wakayama) in March 2010.



I wonder...why was this temperature sensor installed? If the goal is to regulate drain temperature, just use a high-temperature pump.



This is a great power supply method, and it has very little start-up power loss. We should definitely make it a standard.



There is heat loss coming from this open steam pipe. You should put a flange and thermal insulation cover over it.



This steam heater is increasing the temperature, but it is inefficient due to significant steam loss. Since the temperature is low, you should be able to use a more efficient heat pump.



The outdoor unit on this laboratory air conditioning is above the ceiling, but its exhaust should be directed outside the factory to reduce the heat load.



The valve on this through-flow boiler is exposed. To eliminate heat loss, you should use a thermal insulation cover.



You are very thorough about switching off the power on machines that are not in operation. This is a great way to eliminate wasteful standby power.



What is the management range of this pressure gauge? What is the basis for that pressure reading? Can it be lowered?



One of the boilers has stopped. Isn't the pressure too high? Ah, yes, it is. Let's suggest lowering it after we check what the operating pressure is supposed to be.

## On Energy Conservation Expert Inspection

Although this factory has been engaged in thorough energy conservation initiatives for several years, we are very appreciative that the inspection identified 177 areas for improvement. I was present during the inspection, and realized that I had become lax in my view of what was considered normal at our factory. The experts were very good at pointing out how insufficiently prepared we were to respond to fluctuations in production, and how disparate and unorganized our efforts really were.

This inspection was different from environmental audits in that it also told what we are doing right. They acknowledged our efforts and ideas and responded with advice on how to further improve both. This provided much more incentive than simply being told what to do.

Going forward, we will complete a detailed investigation of every action item on the inspection list, creating keywords and prioritizing actions to realize improvements. We will determine new standards for the entire factory and promote further reductions in CO<sub>2</sub> and energy usage.



**Tsunenori Mori**

Deputy Manager, Air-Conditioning & Refrigeration Systems Works (Wakayama)

## Experts Discuss Ways to Conserve Energy

### A Careful Look at Current Processes Reveals All Kinds of Waste

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As I am in charge of developing equipment for the production line, I clearly understand the feelings and perspective of production site staff. This also enables me to easily recognize waste. When searching for waste, I begin by looking at the energy required for production and the energy required for the production environment, and then check to see if the energy being used is meeting those objectives. For example, if a machine used in processing is operational but idle, or if an air conditioner is running in an empty room, then energy is being wasted.

Taking a careful look at things taken for granted at the production site and questioning the usefulness and necessity of things will reveal all kinds of waste. This is the perspective I hope to impart through the inspection activities at each factory.

#### **Teruyuki Shibata**

Sanda Works

Mr. Shibata has been touring factories since 2003. In 2005, he received The METI Minister's Award for Excellent Energy Conservation Factory for his efforts as a front runner in factory energy conservation.

## Indicating Immediate Improvements through Discussions with Factory Staff

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I am a bit different from other members in that although my background is in architecture and building services, I conduct inspections that confirm the usage of air and boilers. I look at the use of energy based on the perspective of just-in-time production activities. If necessary items are not in their necessary place at the necessary times, loss occurs. I have visited many factories in the past where oil pressure pumps and exhaust fans were running even though nothing was being produced. This type of waste must be eliminated.

Employees who work at the production site play a leading role in the promotion of energy conservation. This is why I always try to talk with as many on-site staff as possible when conducting inspections. Offering my suggestions and then asking their opinions gets them started asking questions, so we can have a constructive dialogue. By indicating immediate improvements, I can convey my thoughts and ideas easily and directly.

### **Kazumi Kobayashi**

Fukuyama Works

Mr. Kobayashi has made significant achievements in the promotion of basic unit management. At present, he recommends energy-saving equipment and systems to customers across Japan as a consulting business based on his expertise. He also has considerable experience with improvements in non-Mitsubishi Electric factories.



My specialty is electronics, but my particular focus in the context of inspections is heat. Heat-related energy loss is common, and oftentimes more energy than necessary is used. One familiar example is heating a kettle to boil water. This process wastes considerable energy. I think that thorough heat-related improvements will have a major effect on energy conservation.

With energy conservation improvements at production sites, continuity is key. When on-site activities first began, many ideas were suggested, and people gradually began believing that nothing further could be accomplished. I think energy conservation inspections are crucial to ongoing improvements. This is why I make the utmost effort to discover areas for improvement at each factory I visit.

### **Michitoshi Takagi**

Power Distribution Systems Center

Mr. Takagi was a pioneer in the visualization of energy in on-site production, and has made notable achievements in this area. In 2008, he was awarded the METI Minister's Award for Excellent Energy Conservation Management.



As the member with the least amount of experience, I always try to add some of my own originality during inspection activities. My particular focus is the various components used in production equipment and the energy they use. In many cases, waste occurs because energy conservation was not taken into consideration when equipment was introduced. Such cases offer the potential for energy savings through changing the equipment controls. I check for waste by applying the experience I have cultivated in production equipment.

Being younger than the other experts, I benefit a lot from the knowledge of veteran employees. Their presence during inspections is helpful, and the feedback and communication they provide during and after inspections is particularly useful. I want to continue this process of inheriting knowledge and passing it on to the next generation.

### **Shinichi Ichikawa**

Nakatsugawa Works

Formerly a production technology manager developing production equipment, Mr. Ichikawa moved to the Environmental Department 11 years ago, where he began participating in factory inspection tours originally conducted for educational purposes. After gleaning knowledge from veteran employees, he began promoting improvements at his factory, and he is now the youngest energy conservation expert on the team.



The reliable energy conservation experts

## Close-up: The Air Conditioning & Refrigeration Systems Works

### Initiatives as a Factory That Excels in Environmental Improvements

Among Mitsubishi Electric's many production sites, the Air Conditioning & Refrigeration Systems Works is particularly focused on environmental conservation. From early on, they have incorporated energy conservation initiatives into just-in-time activities and promoted various improvements to ensure the necessary item is in the necessary place at the necessary time by conducting energy usage inspections from six perspectives (change, quit, stop, lower, fix and reuse). These activities produced remarkable results, which were recognized with two first prize awards for factory excellence at our internal improvement activities announcement, which is attended by representatives from each site.



#### Air Conditioning & Refrigeration System Works

Manufacturing large-scale air conditioning and refrigeration systems, including commercial cooling systems

#### Six Perspectives for Energy Conservation Activities

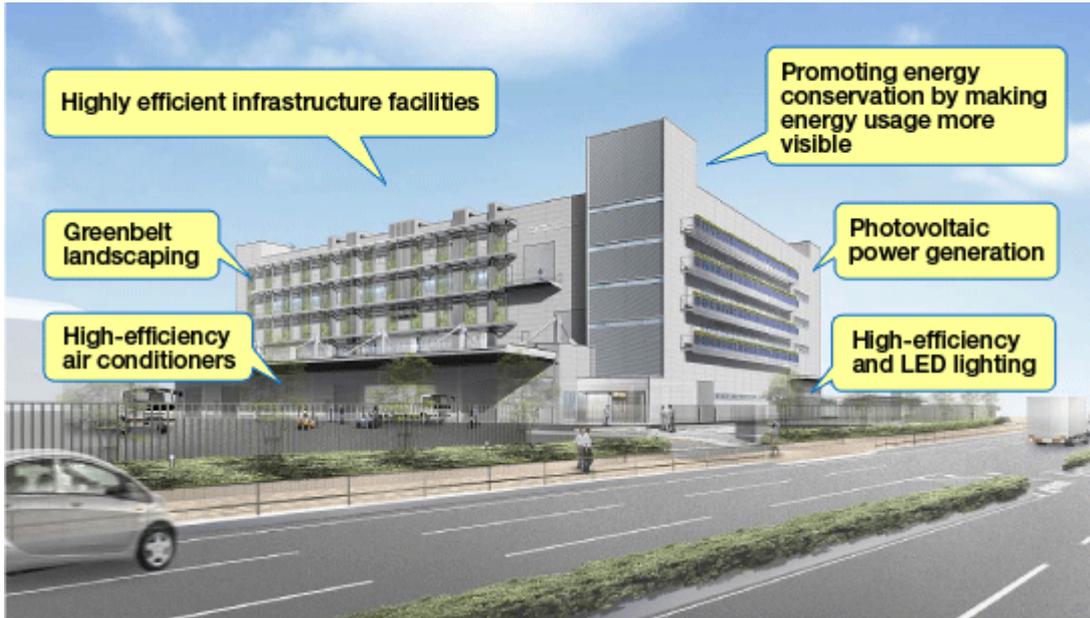


Also, the works independently created a booklet titled Factory Energy Conservation Initiatives that provides case studies and a summary of achievements at the Air Conditioning & Refrigeration Systems Works. This booklet is particularly popular with customers who are concerned with how to make their entire factory more energy efficient.

Furthermore, at present a new, environmentally compatible wing of the factory is under construction on the Works' premises. In addition to highly insulated facilities and energy-saving equipment, the facility will include a photovoltaic system and greenbelt landscaping on the roof and walls. And the factory's product display area is designed around the concept of factory-wide energy visualization, showcasing the energy visualization initiatives of the Air Conditioning & Refrigeration Systems Works.

## Factory Energy Conservation Initiatives

Presented in a series format, this publication is in its 12th edition, providing readers with energy conservation success stories and practical pointers.



The environment-themed wing is scheduled for completion in August 2010.

## Expanding the Scope of CO<sub>2</sub> Reduction Measures to Testing Facilities

The Air Conditioning & Refrigeration Systems Works has been engaged in initiatives to reduce the amount of CO<sub>2</sub> emissions from production in accordance with company-wide policy, but from fiscal 2010 the focus of these activities was expanded to incorporate testing facilities in energy conservation initiatives.

This factory, which mainly produces air conditioning equipment, must conduct tests under a variety of environmental conditions, and energy used during product testing makes up a large percentage of overall energy usage, which, at 20%, is second only to the 28% of overall energy usage during production. Of this 20%, a large amount is used in the testing facilities, where we promote various improvements.

We are promoting various measures, including the visualization of changes in electric power usage for each testing procedure and the change to inverter-based control to operate testing facilities. Furthermore, in noise measurement testing for indoor units with low heat loads, knowing that even setting wider tolerance for temperature conditions we can still meet our objective, we put into practice key measures that rigorously calculate the energy required to acquire valid data.

## Environmental Topics

### Coordinated Regional Waste Recycling (Kyushu Area)

Waste Recycling Innovations at Seven Factories

## Seven Different Factories Working Together to Promote Environmental Contribution and Cost Reductions

Since 2008, in the Mitsubishi Electric Group's Kyushu area (comprised of Nagasaki, Fukuoka and Kumamoto Prefectures), several factories have been working together across prefectural and regional boundaries to promote coordinated waste recycling activities. Such regional partnerships among Mitsubishi Electric Group companies originally began in the Kansai area. However, the Kyushu area efforts are noteworthy for their meticulous approach to collaboration and partnerships that discover and create win-win scenarios for Group affiliate companies and waste disposal partners. This section provides an overview of these unique initiatives.

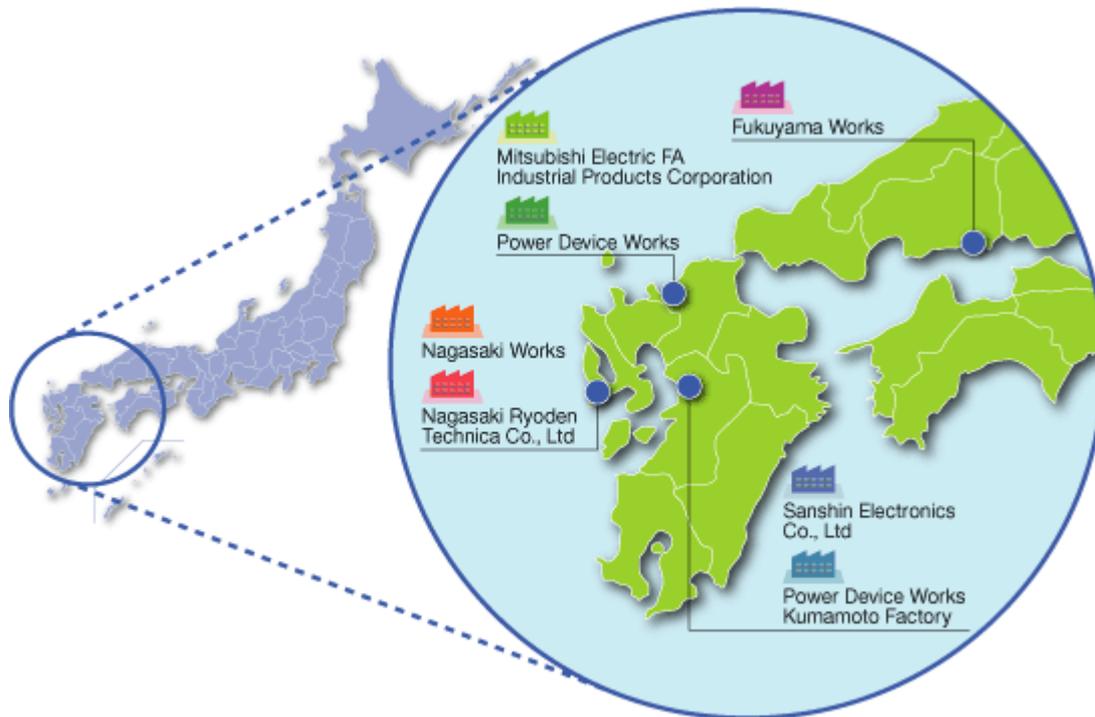
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- ▶ Mobilizing Managers from Seven Factories
- ▶ Mutual Inspections Uncover Areas for Improvement
- ▶ Sharing Information on Waste Processors
- ▶ Streamlining the Waste Material Flow
- ▶ Creating a Win-Win Relationship

## Mobilizing Managers from Seven Factories

The island of Kyushu, located in southern Japan, has an area of 13,761 square miles (35,640 km<sup>2</sup>) and is divided into seven different prefectures. Until recently, the seven Mitsubishi Electric factories, which are spread across a region including Hiroshima Prefecture and the entire Kyushu area, have promoted waste recycling initiatives individually. The processing of general industrial waste was carried out by each factory, usually without the involvement of factories outside the area. However, the major success of coordinated regional recycling activities in the Kansai area in 2007 led to the formation of a working group consisting of seven managers from four Mitsubishi Electric Factories and three affiliated companies in November 2008. The Nagasaki Works, which is passionate about reducing waste, spearheaded the establishment of this working group.



## Mutual Inspections Uncover Areas for Improvement at Each Factory

When the working group was created, the seven members began inspecting each of the seven factories, learning that "normal" practices at one site were not always viewed the same way at other sites. They ended up making several important discoveries.

One example was the discovery that the waste one factory paid to dispose of was viewed by another factory as a goldmine. By meticulously separating waste according to type and purity, some factories were able to convert as much as 40% of their waste into saleable materials.



Working Group Members (From left)

**Yuki Ono**, Nagasaki Works (Project Leader)

**Mitsuhiro Yano**, Power Device Works

**Masafumi Mino**, Sanshin Electronics

**Hideto Yoshizumi**, Power Device Works Kumamoto Factory

**Takahiro Hamachi**, Mitsubishi Electric FA Industrial Products

**Tomoyasu Sato**, Fukuyama Works

**Hajime Murata**, Nagasaki Ryoden Technica

## Sharing Information to Raise Level of Environmental Conservation

In the past, factories selected waste disposal partners based on in-house knowledge, but now they understand differences in processing technology, processing expenses, the purchase price of saleable materials and storage facilities. Based on this knowledge, factories are now able to switch to processing methods with lower environmental impact and select excellent partners, leading to a higher level of environmental conservation activities. In addition, in cases where multiple factories employ the same outsourced waste operators, the factories conduct inspections of these operators and their facilities on a rotating basis, sharing information about the inspections with other factories. This approach conserves energy and strengthens management.

### **Seven People Exchange Information on Waste Processors**

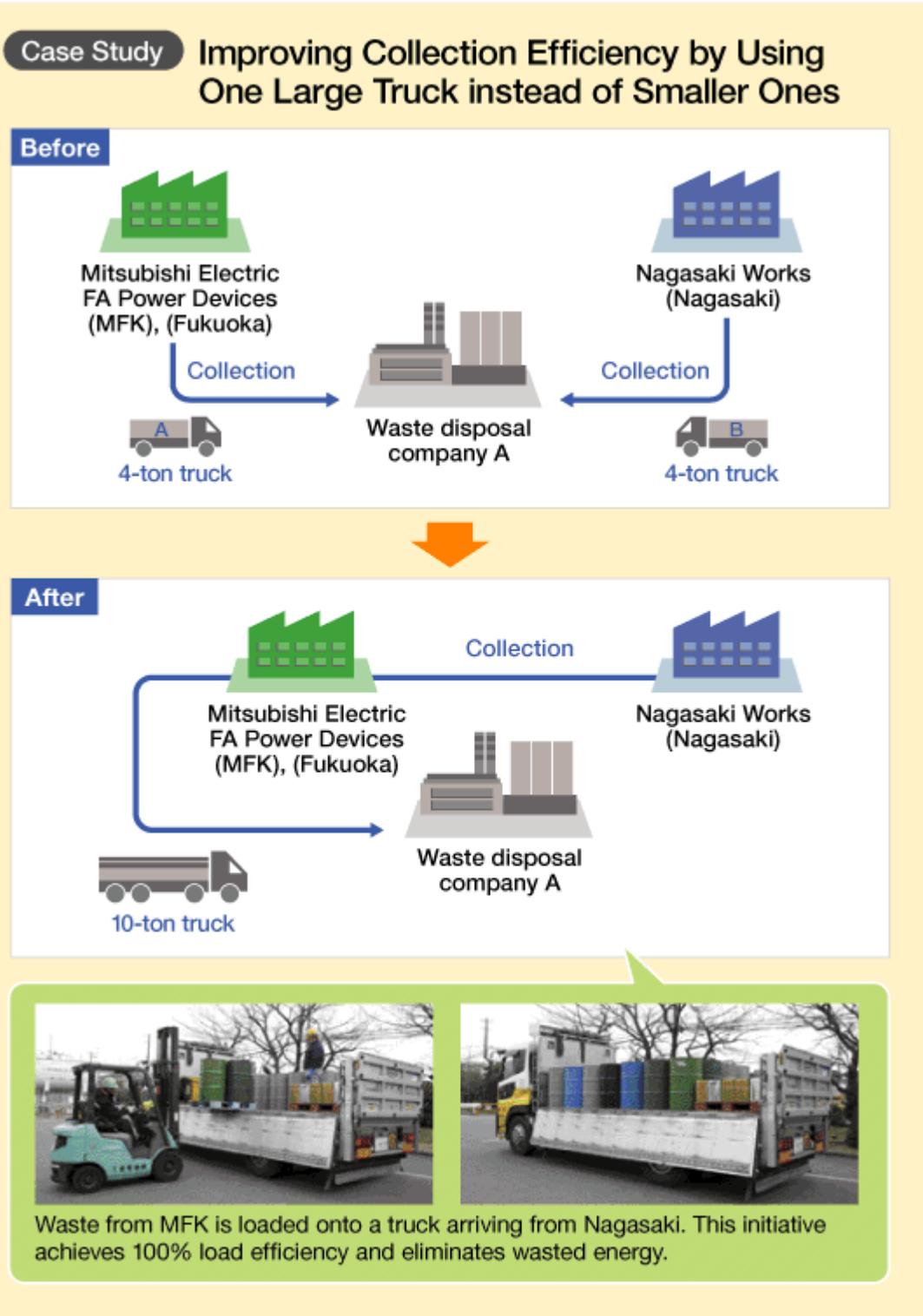
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- Company A has set up a compliance department, so from now on they should be even more legally observant.
- Did you know that Company B put in place an initiative to cut landfill waste to zero?
- Company C has expanded its facilities and has extra capacity, so they might be flexible on pricing.
- D waste disposal company respond quickly, and they're very reasonable.
- "Thanks for the tip! We'll give them a try!"



## Streamlining and Developing the Waste Material Flow

Before this initiative, multiple factories contracted the same waste disposal operator individually to collect factory waste. Now, waste is collected from those factories using one large truck, thereby eliminating wasted energy and achieving 100% load efficiency. The efficient use of large trucks, which have a comparatively low degree of capacity utilization, also benefit the waste disposal operators, who can now use smaller trucks—which have a higher turnover rate—for other uses. Furthermore, by abolishing weekly waste collection that took place regardless of the amount of accumulated waste, and establishing a system in which collection occurs only when a truckload of waste has accumulated at each factory, the number of required truck trips as well as CO2 emissions have been reduced.





## Creating a Win-Win Relationship

All these achievements could not have been accomplished by the factories working on their own. Cooperation among factories and with waste disposal partners was indispensable to the program's success. Through the development of a meticulous methodology and cooperation that contributed to factories and waste disposal operators alike, these efforts resulted in the creation of a win-win relationship. Although the working group is less than one year old, its members have already discovered that waste disposal can be interesting, and they are eager to achieve further success. In fiscal 2011, we plan on adding an affiliated company located in Kumamoto Prefecture to the Kyushu area working group. In coordination with activities in other areas, including those of the Kansai area, Mitsubishi Electric will continue to share information and find opportunities for collaboration, aiming to further enhance our level of activity.



## Environmental Topics

### Recycling of Waste Plastics



#### Technology for Large-scale High-purity Plastic Recycling

The home appliances industry is currently engaged in efforts to recover waste plastic from used home appliances and recycle the plastic in other products. Such initiatives seek to reduce the amount of new resources required by new products. Mitsubishi Electric aims to constantly be at the forefront of waste plastic recycling for its plastic recovery technologies, recovery volume and recycling quality. This section introduces our involvement in the large-scale recycling of high-purity plastic.

##### Large-Scale, High-Purity Plastic Recycling

An overview of our work to apply our original high-purity separation technology to shredded mixed plastic in order to achieve 100% closed-loop recycling.

[More](#)

##### Technology for Separating Plastics

An overview of our process for separating mixed plastic at high levels of purity.

[More](#)

##### Technology for Improving Plastic Quality

A discussion of technologies for improving the quality of recycled materials so that they are equivalent to new materials.

[More](#)

### Large-Scale, High-Purity Plastic Recycling

#### Aiming for 100% Closed-loop Recycling

When plastic that has been recovered from used home appliances is recycled, it is typically recycled into knick-knacks, imitation wood and other such products, a process called downgrading. However, this also means that resources must be continually consumed. What is really needed is closed-loop recycling—recovering plastics from old products and recycling it in new products.

#### Hyper Cycle Technology for Closed-loop Recycling

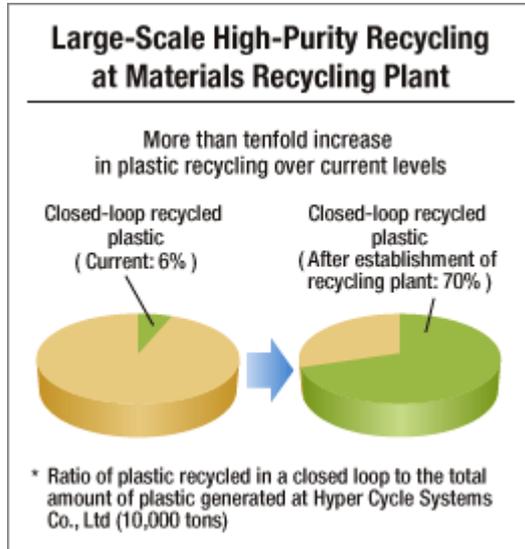


Conventional plastic recycling is usually limited to plastic parts made of a single material that is easy to separate out. Moreover, separating and recovery are conducted manually, so only around 10% of the plastic can be retrieved from the recycled product; the remainder is incinerated or landfilled.

Mitsubishi Electric is aiming to achieve 100% closed-loop recycling. By using recycled materials in its products, the Company reduced the amount of plastic that was incinerated or landfilled. The Company also conducted research and development into recycling technology to enable the creation of high-quality recycled plastics for reuse in home appliances. As a result of this research, Mitsubishi Electric succeeded in automatically separating, recovering and recycling recyclable materials taken from shredded mixed plastic, a material that had traditionally proven difficult to recycle.

## Japan's very first large-scale, high-purity plastic recycling system

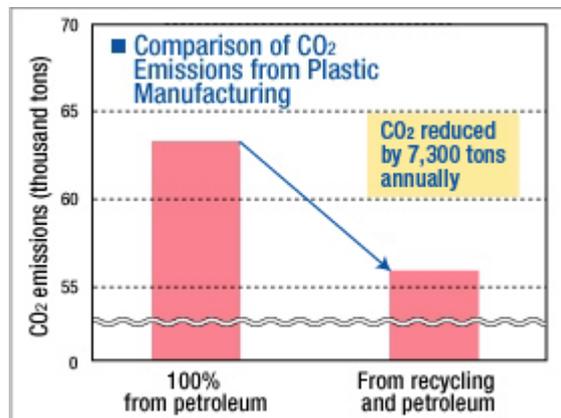
The main types of plastic used in home appliances are polypropylene (PP), polystyrene (PS) and acrylonitrile-butadiene-styrene (ABS). Mitsubishi Electric has succeeded in accurately separating mixtures of these plastics at purity levels exceeding 99%. This high degree of purity is made possible by proprietary technologies for separating different plastics by specific gravity and by electrostatic properties. PP, which is lighter than water, can be separated out using technology for separating by specific gravity, whereas ABS and PS, which are heavier than water and cannot be isolated in this way, are separated using differences in their electrostatic properties. (See the next page for details on these separating technologies.)



As of August 2008, each year we were recycling approximately 600 tons of plastic in Mitsubishi Electric home appliances, out of a total of approximately 10,000 tons generated by our home appliance recycling plant, Hyper Cycle Systems Co., Ltd., a ratio of just 6%. We augmented these efforts with Green Cycle Systems Corporation, a materials plant that employs new technology and that went on line in fiscal 2011. This facility adds 6,400 tons per year to our closed-loop recycling capacity, raising the total to 7,000 tons. This represents Japan's very first large-scale high-purity plastic recycling system.

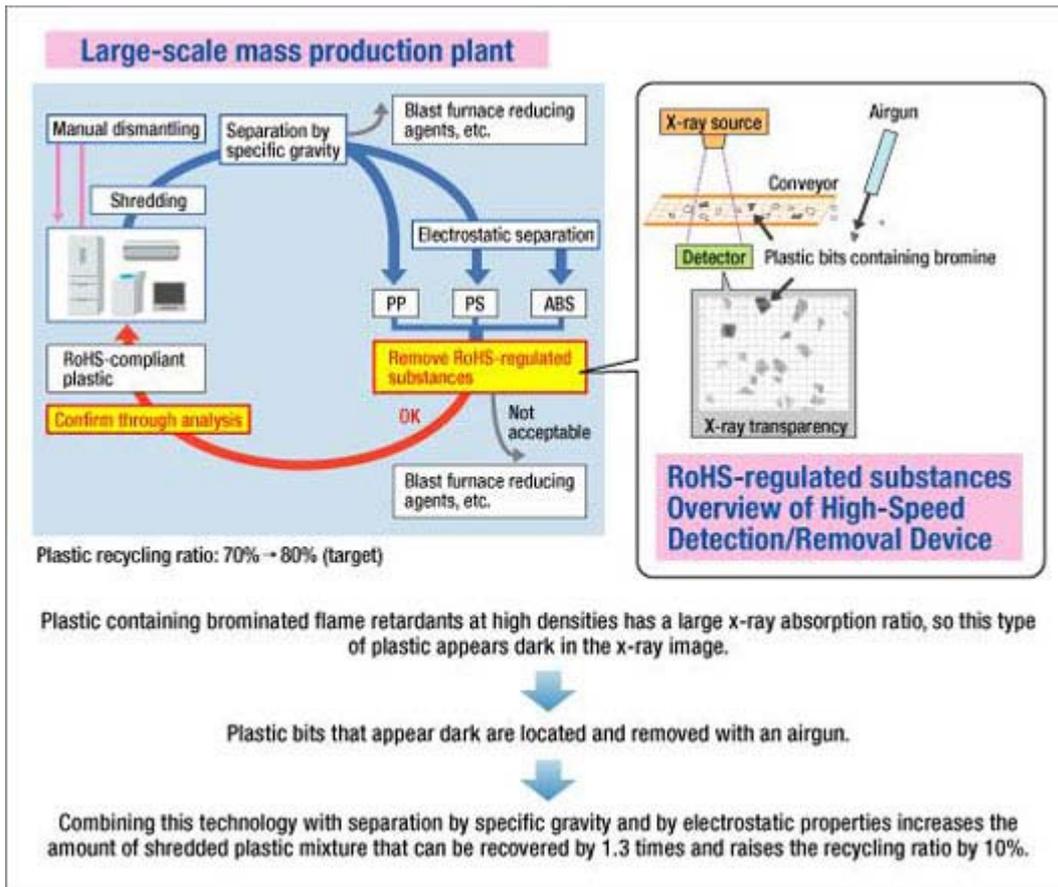
## Reducing CO<sub>2</sub> emissions by 7,300 tons annually

Promoting the "3Rs" (reduce, reuse and recycle) for home appliances is one of the pillars of Mitsubishi Electric's Environmental Vision 2021. Our large-scale high-purity plastic recycling system was designed to recycle the three major plastics in a closed loop from shredded mixed plastic. The system has enabled us to reduce use of these three major plastics by our home appliances business by around 18%. This translates into less new plastic produced, which in turn reduces carbon dioxide by 7,300 tons annually (Mitsubishi Electric estimate). The kind of closed-loop recycling pioneered by Mitsubishi Electric will help contribute to creating a low-carbon society.



### Successfully Developed Technology for Rapidly Removing a RoHS Regulated Substance from Shredded Mixed Plastic

Plastic mixtures being separated for recycling sometimes contain flame-retardant plastics with very small amounts of high-density bromine. However, compliance with the EU's RoHS Directive is a critical part of recycled plastics in home appliances. In the past, flame-retardant plastic was removed by utilizing its high specific gravity and setting a low specific gravity to separate out compliant varieties. With this method, however, it was difficult to increase the amount of plastic recovered. In February 2009, Mitsubishi Electric developed a new technology for rapidly and automatically detecting and removing PP, PS and ABS plastics containing brominated flame retardants. We are pilot testing large-scale, high-purity recycling at a materials plant in preparation for full deployment.



\* RoHS Directive: An EU directive on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment. Restricts use of six types of hazardous substances: lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls and polybrominated diphenyl ether.

## Recycling of Waste Plastics

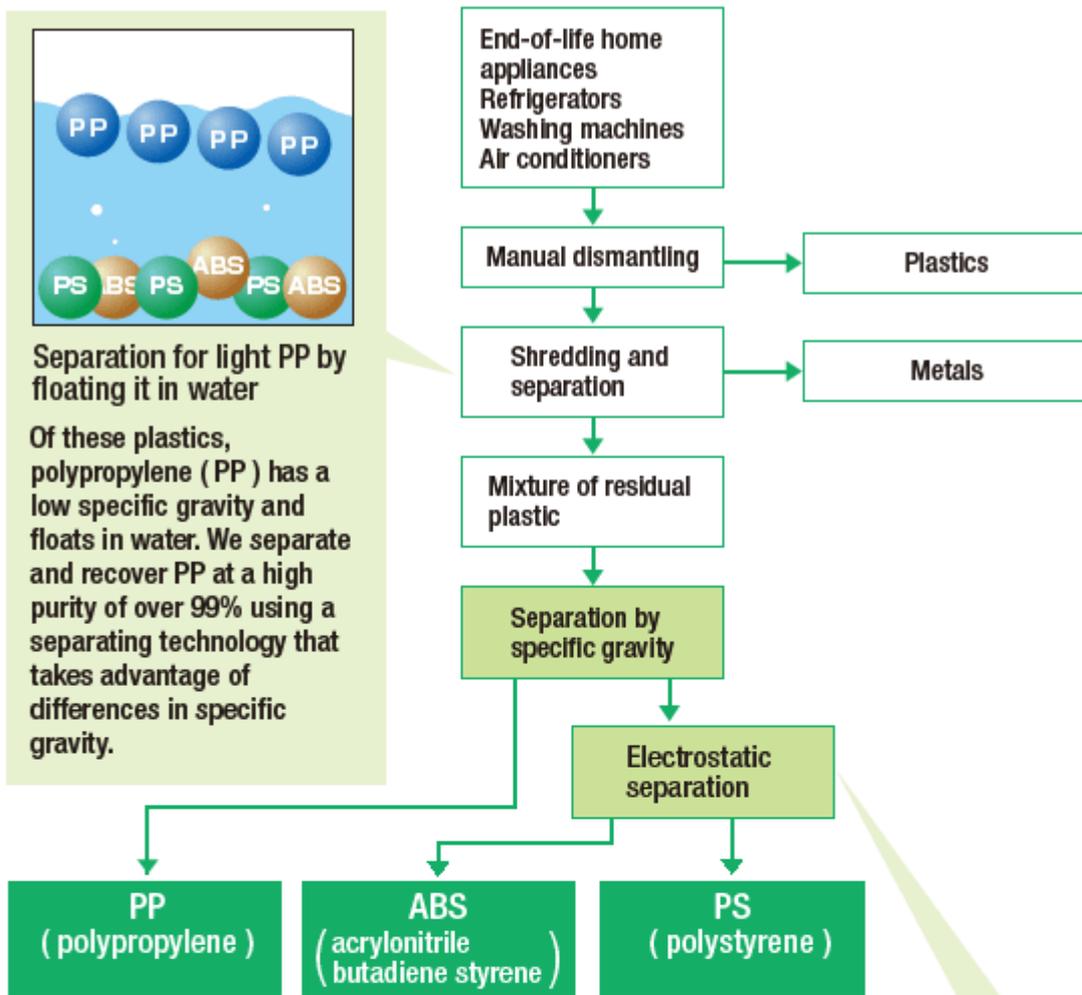
### Technology for Separating Plastics

#### Separating Plastics at High Levels of Purity and High Recovery Rates

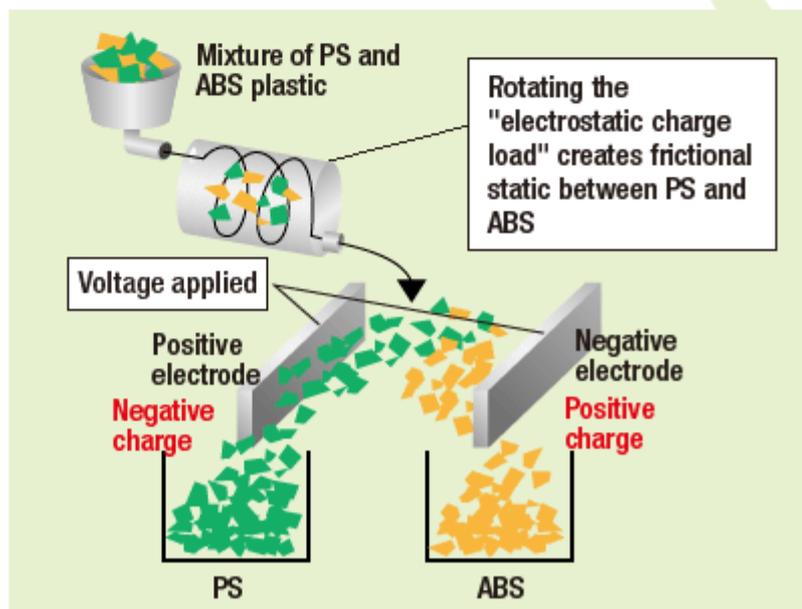
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To make closed-loop recycling a reality, it is first necessary to separate out usable plastics from the used home appliances that have been collected. Mixed, shredded plastic used to be exceedingly difficult to separate, but Mitsubishi Electric has developed a proprietary method for separating plastics based on their respective characteristics. This method enables plastics to be separated at high levels of purity and high recovery rates.

Process for Separating Mixed Plastic at High Levels of Purity



Each type of plastic is separated at a high purity of more than 99%

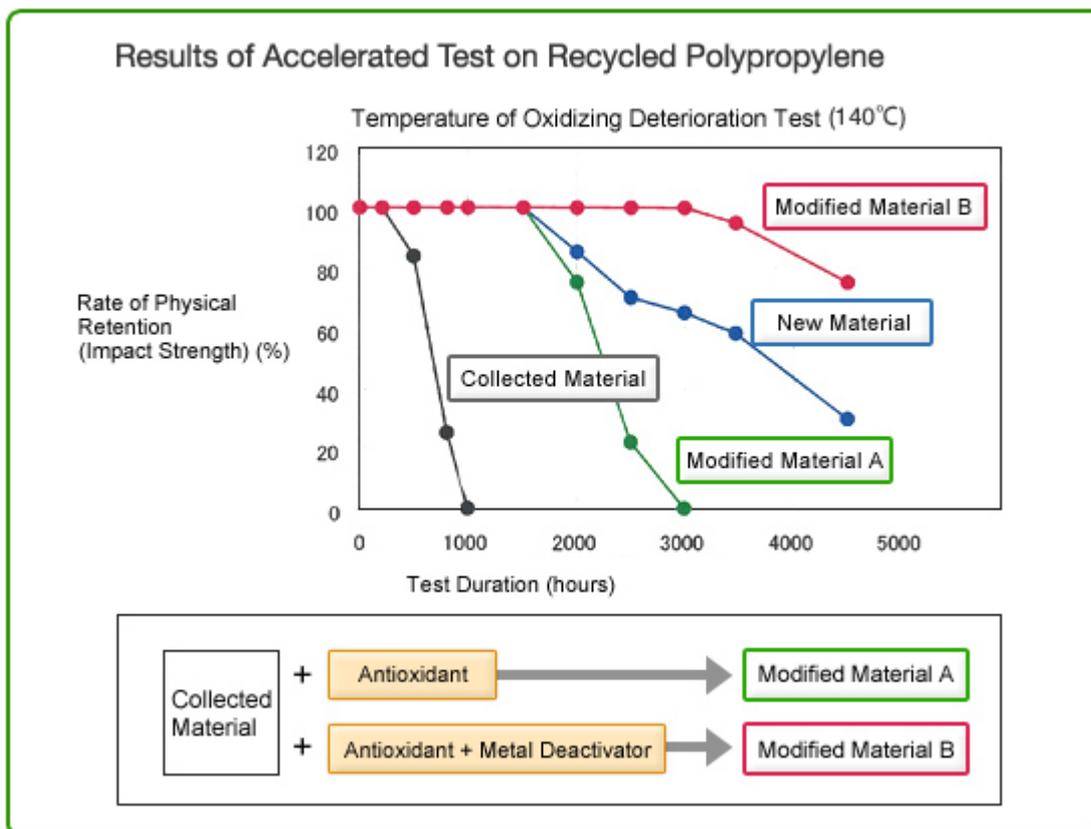


## Technology for Improving Plastic Quality

### Making Recycled Plastic Equivalent to New Materials

In order to be used in home appliance products, recycled plastic materials must be of high quality. High purity is one of the keys to ensuring quality. We have almost entirely resolved this issue through our separating technologies. However, the quality of plastic materials can deteriorate over time due to oxidation and other causes. For this reason, recycled plastics were not capable of being used in home appliances, which require long-term durability, and were generally only used in downgraded products.

To resolve this problem, Mitsubishi Electric quantified the remaining lifespan of collected plastic and designed a new quality improvement formula with the optimal formulation of additives to prevent the deterioration of recycled materials. We succeeded in creating recycled materials with quality that is equivalent to new materials. We also made it possible to give recycled materials the same durability as new materials and added properties like fire resistance. Through this proprietary quality improvement technology, we not only eliminated concern over the quality of recycled products but also opened up major new frontiers for recycled materials.



Note: Accelerated testing is a testing method in which a product is placed under extreme conditions that simulate actual usage and intentionally degraded in order to verify its lifespan.

## Environmental Topics



### First Understanding, Then Action

**The Mitsubishi Electric Group strives to respect biodiversity in all its business activities.**

To maintain biodiversity, human beings must accept that they are but one of a countless number of living organisms on the planet and develop an awareness of the importance of maintaining the great blessing that is the natural environment. Respecting biodiversity is one of the pillars of our Environmental Vision 2021, which was established in October 2007, and we formulated the Mitsubishi Electric Group Biodiversity Action Guidelines in May 2010. All employees of the Mitsubishi Electric Group have pledged to understand the relationship between business activities and biodiversity in an effort to have all companies in the Mitsubishi Electric Group respect biodiversity in all their business activities. This feature provides an overview of our efforts to preserve biodiversity, from our philosophy and basic policies to awareness-raising activities and our most recent initiatives and achievements.

### Contents

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A Living Creature Study conducted at a factory

A field guide created based on the study's findings

A poster and booklet also created

A larger view of the *Mitsubishi Electric and Water Map* (poster)  (4.58 MB)

▶ Mitsubishi Electric Outdoor Classroom

For five consecutive years, Mitsubishi Electric has conducted outdoor classrooms, created and led by our employees, to convey the magnificence of nature. This section presents the merits and progress of this program.



▶ "Satoyama" Woodland Preservation

The "Satoyama" Woodland Preservation project is a participatory social contribution program for employees that involves working together with local community members to restore local natural areas like parks, woodlands and rivers. The project fosters a volunteer spirit that encourages giving back to nature, which nurtures life in all its diversity, and to the local community.



## Philosophy, Basic Policies and Initiatives for Preserving Biodiversity

### Biodiversity Action Guidelines Formulated in Accordance with the Product Life Cycle

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As part of our efforts to help preserve the natural environment, Mitsubishi Electric has initiated numerous ongoing regional contribution activities. In 2003, we began our Fuji Sanroku forest cultivation activities. In 2006 we launched the Mitsubishi Electric Outdoor Classroom program to cultivate nature conservation leaders. And from 2007, we have been conducting "Satoyama" woodland preservation activities with local residents.

Environmental Vision 2021, formulated in October 2007, defines respecting biodiversity as one of Mitsubishi Electric's basic policies. The policy stems from the strong desire to protect the natural environment and realize a sustainable society through cultivating environmental awareness among our employees.

As one activity designed to help increase awareness, we commissioned photographer Mitsuaki Iwago to photograph animals in their natural environment and write a column, which has been posted on our Japanese corporate website under the title *The Beauty of NATURE* since June 2008.

Ahead of the Convention on Biological Diversity (COP10) held in October 2010, we formulated the Mitsubishi Electric Group Biodiversity Action Guidelines in May 2010. In addition to helping foster the "emotional" aspects that form the basis for respecting biodiversity and cherishing living things, these guidelines also provide a "logical" foundation upon which to establish activities that help fulfill our corporate roles and responsibilities.

Our Biodiversity Action Guidelines have two main characteristics: (1) they include the pledge of every Mitsubishi Electric Group employee to understand the relationship between business activities and biodiversity; (2) they are structured according to each stage of the product lifecycle. We have also created a relational chart that makes these guidelines more visual.

In this way, we can understand how the products we make impact biodiversity, and use this knowledge as a guide in formulating the actions necessary to help preserve the environment and create a sustainable society.

Mitsubishi Electric Outdoor Classroom  
"Satoyama" Woodland Preservation Activities

### Resources & Procurement

Recognizing that we utilize globally procured natural resources such as minerals, fuels, and plants, we shall aim to preserve biodiversity in Japan and around the world by carrying out green procurement activities.

### Product Design

In designing our products and services, we shall promote the effective utilization of resources and the efficient use of energy, as well as aim to prevent the emission of substances that pose a risk to the environment.

### Manufacturing & Transportation

When commencing or making changes to land use such as when constructing factories or warehouses, we will give due consideration to protecting the biodiversity of the land in question. And In manufacturing and transportation, we aim to minimize energy use, waste generation, and the emission of chemical substances.

### Sales, Usage & Maintenance

In our sales activities, we will work to promote better understanding among our customers of the impact that product/service usage and maintenance can have on biodiversity.

### Collection & Recycling

We will actively develop recycling technologies and apply them to collected end-of-life products.

### Understanding & Action

We will deepen our understanding of the importance of biodiversity and our relationship to it, and will actively and voluntarily take actions necessary to coexist in harmony with nature.

### Cooperation

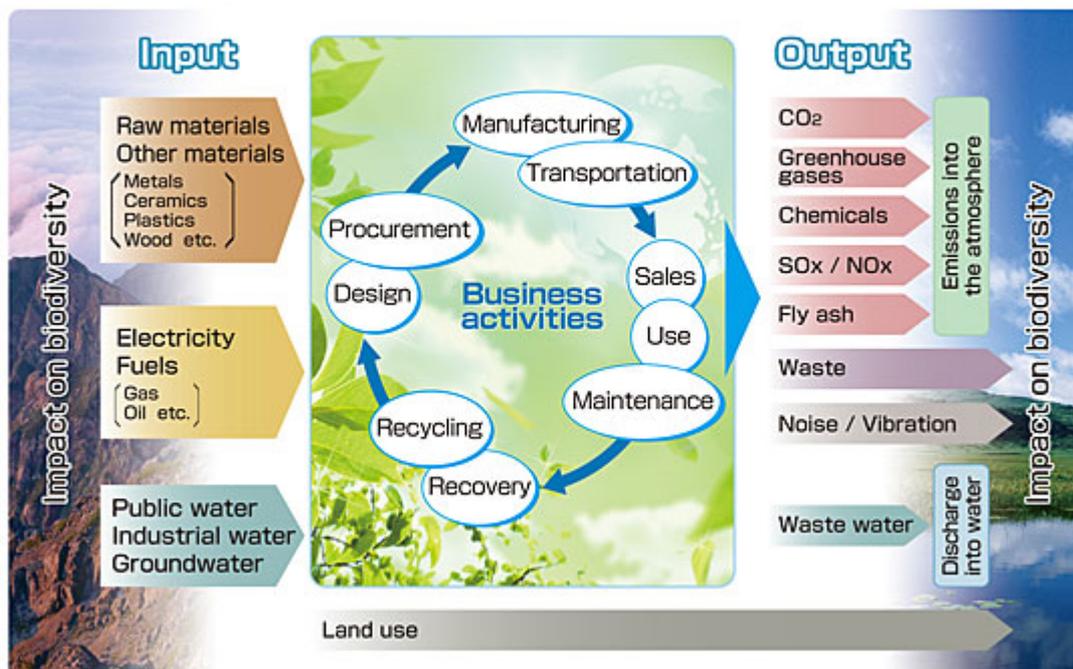
All companies in the Mitsubishi Electric Group, including overseas affiliates, will act as one, in cooperation with local communities, NGOs, and governments.

## News Releases

May 18, 2010

Mitsubishi Electric Group Establishes Biodiversity Action Guidelines  (26KB)

## Relationship between Business Activities and Biodiversity



## Ensuring Compliance in Procurement, and Conducting "Living Creature Studies" at Production Sites

The product lifecycle has many stages. However, as a manufacturer that purchases and procures the materials used to assemble and manufacture our products, the one stage at which it is difficult for us to directly control impact on biodiversity is the procurement stage.

To promote the global procurement of materials with minimal environmental impact, the Mitsubishi Electric Group has positioned green procurement as a priority to ensure the regulatory compliance of our suppliers. Since April 2006 Mitsubishi Electric has been creating partnerships based on the Green Accreditation System, which requires that suppliers carry out environmental management. In September 2009, we also added an appendix specifically related to protecting biodiversity to our Green Procurement Standards Guide.

In the meantime, focusing on production—a lifecycle stage that we can control directly—we have begun activities to help see the relationship between our factories and their surrounding environment. These activities are not only one of the simplest ways to understand the relationship between our business activities and biodiversity, but also the point at which the "emotional" and "logical" aspects of respecting biodiversity converge.

Japan's Chubu Area is a region of rich natural beauty, where nature preservation activities are popular. In August 2010, Mitsubishi Electric's Chubu Branch Office along with three of our production sites in the area conducted "living creature studies" and aquatic nature observation around the factories, and put together field guides to the living creatures they found. The *Mitsubishi Electric Experience of Life* booklet has also been created based on the findings gained from these studies. The content of this booklet demonstrates the value of focusing on production.

The Mitsubishi Electric Group is developing additional activities designed to renew awareness regarding our relationship to surrounding ecosystems and the environment. These activities are scheduled for implementation in 2011 within each environmental management organization. We believe the initiative in the Chubu Area will serve as a model for future activities.

Living Creature Studies and Field Guides to Living Creatures  
*Mitsubishi Electric Experience of Life* booklet (Japanese only)



Living creature study



Living creature relationships map

### Themes of Field Guides to Living Creatures

Inazawa Works:  
Coexisting with life

Nakatsugawa Works:  
Feeling the abundance of life

Nagoya Works:  
History felt through life

Living creature studies were conducted with the cooperation of local experts and NPO members. The experiences and discoveries made by employees during these studies are organized into relational maps themed around regional natural features. Through these activities, we not only helped individual employees realize what they can do to help protect the environment, but we have also gained a more systematic and structured understanding.

*The Mitsubishi Electric Experience of Life* booklet is used by local citizens, visitors to the area, and a wide range of age groups.



## Exchanging Ideas with Experts

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In creating Mitsubishi Electric's Biodiversity Action Guidelines and the Relationship between Business Activities and Biodiversity chart, we invited Dr. Ryo Kohsaka, Associate Professor at Nagoya City University, to exchange ideas regarding biodiversity. His feedback on our efforts is summarized as follows:

1. Activities are based first upon the emotional desire to cherish living things. The next step is action based on logic.
2. Using indices for management can be effective; however, focusing on the effect of manufacturing on the ecosystem is more important.
3. As a company that procures resources globally, a focus on procurement is vital; begin first by confirming legal compliance.
4. Collaborative relationships with regional communities are essential.

Based on this feedback, we created our guidelines and relational chart, which were announced on May 18, 2010.

[Click here for details of the discussion](#)



**Dr. Ryo Kohsaka**

Associate Professor, Nagoya City University

Executive Committee Advisor, The 10th Conference of the Parties to the Convention on Biological Diversity (COP10) Guest Researcher, United Nations University Institute of Advanced Studies

### Exchanging Ideas with Experts (In March 2010)

To strengthen and promote the Company's initiatives to respect biodiversity, we established the Mitsubishi Electric Group Biodiversity Action Guidelines and created a chart to help understand the impact and consequences of our business activities on biodiversity. We are also considering whether or not it would be appropriate to establish special indices that numerically evaluate product environmental performance, the impact of the supply chain and other activities. We invited Ryo Kohsaka, Associate Professor at Nagoya City University and advisor to the executive committee of the 10th Conference of the Parties to the Convention on Biological Diversity (COP10), to exchange ideas with respect to these initiatives. The following is an overview our discussion with Mr. Kohsaka.



#### Activities Are Based on Feelings, and upon those Are Actions Based on Logic

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**Mr. Kohsaka:** I would like say something before discussion begins. I believe there are two levels from which we can approach the preservation of biodiversity.

The first level is feelings, the feeling of being connected to other living things. Many people feel that living things are cute or that they should be taken care of or protected. These feelings link us to these living things. The feeling that living things should be taken care of is itself a first step toward respecting biodiversity. Starting out with an awareness of these feelings will result in a much deeper understanding of the need to reduce CO<sub>2</sub> and waste.

The second level is logic. We objectively recognize that businesses and everyday people receive various benefits from the ecosystem, and at the same time business and people impact the ecosystem in various ways. Based on this awareness, changing our actions on a person-by-person basis is linked to highly effective activities. It is from these two perspectives that I want to discuss the many initiatives you are engaged in here at Mitsubishi Electric.

**Mitsubishi Electric: We are currently formulating biodiversity action guidelines. What advice can you give us?**

**Mr. Kohsaka:** The basic principles of management, actions and business contributions proposed in your plan represent the basic elements necessary for corporate biodiversity initiatives, and I think you are headed in the right direction. In particular, I commend you highly for your actions in terms of fostering environmental awareness and communicating the importance of protecting the ecosystem. These actions reflect feeling, which is the basis of respecting biodiversity.

Taking this idea a step further, I think it would be even better to promote these activities with the cooperation of regional communities. The cooperation of knowledgeable specialists and local citizens is indispensable to understanding the impact of your efforts on biodiversity. Based on your guidelines, for example, collaboration with an NPO engaged in environmental protection in each region would be a good way to develop a solid base for regional activities.

- ▶ In May 2010, the Mitsubishi Electric Group Biodiversity Action Guidelines were announced.

### Advice Regarding the "Impact on Biodiversity" Chart

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**Mitsubishi Electric: We are in the process of creating a chart entitled "Relationship between Business Activities and Biodiversity". What advice can you give us?**

**Mr. Kohsaka:** I think looking at the overall relationship between business activities and biodiversity is an excellent idea. However, looking at the basic chart, it appears that you have given equal weight to the procurement, design & production, shipping & sales, use & storage and recycle & product waste stages of the lifecycle. You should probably give more weight to raw materials procurement in the manufacturing supply chain. The reason is because many people are concerned about the kinds of materials products are made from, and how they might impact biodiversity. This has to do with the feelings I mentioned previously.

For example, if you asked the average person how they would want Mitsubishi Electric to contribute to environmental conservation, they would probably say that they want you to make products that don't use a lot of electricity. However, if you asked the same question in respect to biodiversity, I think they would say that they want you to carefully consider materials procurement. This is because their image of Mitsubishi Electric is a large corporation that manufactures products from materials and resources procured from around the world. Manufacturers place a lot of emphasis on design and production when considering biodiversity, but the average person approaches this issue from a logical level. It is important that actual activities begin at the feeling level in order to create understanding.

- ▶ In May 2010, the Impact on Biodiversity Chart was published.

## Supply Chain Considerations

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**Mitsubishi Electric:** With respect to the supply chain, specifically, the acquisition of resources and materials, how far back do we need to go in considering impact on the ecosystem?

**Mr. Kohsaka:** All products have parts that are interconnected with the ecosystem. The questions of how far back you should go and what actions you should take are critical, but I think a visual awareness that our lifestyles have an impact in this area on the environment in other countries is an important first step.

Using the paper industry as an example, many European companies have their own forests and they use wood from their own trees, making the connection easy to see. With Japanese companies, that connection is difficult to see. However, with the destruction of ecosystems in various places around the world, there are definitely connections with the activities of Japanese companies. It is important that we understand the limits and impact of those connections.

One other perspective, the contribution to other people, is important. This is missing from discussions about biodiversity across the globe. Although we have protections for orangutans and gorillas, little thought is given to the people who live in those same areas. However, education, hygiene and poverty levels are all an extremely important element of respecting biodiversity. When these conditions worsen, slash and burn and other detrimental types of farming have a higher probability of occurring. It is important to view contributions to biodiversity as critical to providing a stable and sustainable lifestyle to people in these regions.

## Regarding the Establishment of Numerical Indices

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**Mitsubishi Electric:** Do you think indices quantifying life cycle assessment\* and voluntary standards are effective for respecting biodiversity?

**Mr. Kohsaka:** It is easy for companies to promote initiatives when they are represented numerically in indices, and I think it is an effective method in terms of creating objectives and measuring improvements. However, there are more than a few cases where the creation of indices is actually done simply as a means of disclosure. At present, there are various indices created by various countries, and I think these should be viewed with caution. Also, with respect to individual indices, there is a possibility that only certain numbers are presented. I don't think this type of activity is an appropriate methodology. For example, by focusing only on the reduction of CO<sub>2</sub>, the degree to which resources are being used effectively might get ignored. I think it is necessary to position the various activities from the perspective of sustainable corporate management.

For this reason, I don't believe it is necessary to create more indices in support of biodiversity initiatives. Indices established for improvement efforts toward the creation of a low-carbon society are frequently a plus for biodiversity. Rather than creating a new index, I think it is more important, for example, to conduct manufacturing with consideration for the impact of resource extraction.

\* Life cycle assessment is a method of quantitatively and comprehensively evaluating a product's environmental impact as it passes through the product lifecycle, from resource extraction, design, production, shipping to use and disposal.

### Mitsubishi Electric: What are your expectations for us in terms of realizing a sustainable society?

**Mr. Kohsaka:** The top page on your [Japanese] corporate website uses photographs from The Beauty of Nature taken by Mitsuaki Iwago, and conveying the beauty of nature to the visitors to your website is a highly effective means of inculcating positive feelings about biodiversity. I think the next step will be critical in terms of how you will connect that feeling to the next level, which is logic. I think making that connection successfully is both an action item and an opportunity for Mitsubishi Electric.

For example, if you do create an index, making the objectives clear both within and outside the company, employees and consumers alike will see the link between your corporate activities and biodiversity. I would like to see you promote initiatives that make people aware of your efforts in this area. On this point, your strength lies in making products with a wide range of everyday uses. I hope that you will maximize on this strength and lead Japan in biodiversity-related efforts.

### Idea Exchange Participants

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#### Advisor



**Ryo Kohsaka**

Associate Professor, Nagoya City University  
Executive Committee Advisor, The 10th Conference of the Parties to the Convention on Biological Diversity (COP10) Guest Researcher, United Nations University Institute of Advanced Studies

#### Mitsubishi Electric Corporation



**Tsuneo Hiruta**  
General Manager,  
Corporate Environmental  
Sustainability Group



**Kanji Ota (Energy-Saving Specialist)**  
Chief Engineer,  
Corporate Environmental  
Sustainability Group



**Motohiro Tanaka (Eco-Design Products Specialist)**  
Strategic Planning,  
Corporate Environmental  
Sustainability Group



**Hiroko Higuma (Chemical  
Substance Regulations  
Specialist)**  
Strategic Planning,  
Corporate Environmental  
Sustainability Group

**Yasuro Toba (Procurement  
Specialist)**  
Planning Group,  
Corporate Purchasing Division

**Junko Tawada (Social  
Contribution Specialist)**  
Philanthropy Promotion Section,  
Corporate Administration Division

## **After the Idea Exchange Meeting**

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From a corporate perspective, biodiversity is a difficult topic to grasp. We of course understand its importance, but how to go about addressing it was a bit elusive until our meeting with Dr. Kohsaka. Thanks to his insight and ideas, we have a deeper understanding of biodiversity. It is very helpful to understand the two levels of initiatives in respecting biodiversity, and how to apply them to our own activities.

The Mitsubishi Electric Group aims to foster environmental awareness among all employees through initiatives such as the Mitsubishi Electric Outdoor Classroom and woodland preservation activities, and recognizes the importance of feeling with respect to all living things. Also, through making the link between business activities and the ecosystem more visible, we felt that it is possible to help each employee better understand our activities focused on creating a low-carbon and recycling-based society as promoted by Environmental Vision 2021; this is an important step in helping each employee change their actions.

We will take Dr. Kohsaka's ideas to heart and continue to promote Mitsubishi Electric Group initiatives to respect biodiversity.



**Tsuneo Hiruta**  
General Manager,  
Corporate Environmental  
Sustainability Group

## Environmental Topics



## "Living Creature Studies" at Factories – Field Guides, Posters & Booklets

### Living Creature Studies and Field Guides

This section introduces living creature studies and field guides to living creatures. These were conducted and created by our Chubu Branch Office, together with our three production sites in the Chubu Area.

[More](#)

### Our Relationship with Water and Living Creatures

This section introduces the objectives and editorial policies of the poster and booklet we created to go with the field guides to living creatures.

[More](#)

## Living Creature Studies and Field Guides

### Experiencing the Blessings of Nature and Learning About the Relationship Between Business Activities and Biodiversity

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The Mitsubishi Electric Group Biodiversity Action Guidelines were formulated in May 2010 to help each and every employee understand the relationship between business activities and biodiversity, and incorporate this understanding into their day-to-day activities. Beginning in fiscal 2012 each environmental management organization will renew awareness of our relationship to surrounding ecosystems and the environment, review their own activities and identify new issues to tackle. To start things off, in August 2010 the Chubu Branch Office, Inazawa Works, Nakatsugawa Works and Nagoya Works—all of which are located in the Chubu region—conducted studies to identify living organisms inhabiting the grounds of their factories and surrounding areas. The objective was to provide employees with the direct experience of the richness and blessings of nature in their immediate surroundings. After completing the studies, their various findings were compiled into field guides.

In order to help employees understand and respect biodiversity in their own business activities we are focused on providing employees with the actual experience of nature. Rather than simply making employees listen to people speak or look at a presentation, we believe that having them get out of the office, move around and learn for themselves effectively deepens their thinking on nature and biodiversity.

#### **Themes of Field Guides to Living Creatures**

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Inazawa Works: Coexisting with life

Nakatsugawa Works: Feeling the abundance of life

Nagoya Works: History felt through life

## Inazawa Works' Field Guide to Living Creatures

Inazawa Works is surrounded by rice paddies without a mountain in sight, and the area is laced with irrigation ditches for agriculture. The factory conducted a study of its premises and these waterways and found killifish, frogs and crawfish living in the water, grasshoppers, other insects, skylarks, spot-billed ducks and wagtails in the fields, and starlings and bulbuls in the woods on the site. A common kestrel, which is a type of small raptor, was also found. Kestrels tend to build nests on sheer cliffs; this one was living in a 173-meter high tower used for testing elevators, which it saw as a cliff.



Common kestrel

Raptors are at the top of the food chain in open field habitats, so the area around Inazawa Works contains all the components of this particular ecosystem pyramid. Inazawa Works selected approximately 30 types of representative living creatures from among the organisms found by the study, based on the theme "Coexisting with life." A field guide was created that shows the respective positions of the various organisms in the ecosystem pyramid.



A larger view of the Field Guide to Living Creatures (Japanese only)  (1.18MB)

Since participating in the study I have begun routinely thinking about the importance of coexisting with other living creatures. I was relieved to realize that even though I held grasshoppers and crickets in my hands when I was in elementary school and looked at their differences, at some point I starting thinking of them all as just types of bugs and began thinking of the environment while on the job only in terms of preventing pollution.

It was a very valuable experience to actually touch these living creatures again and experience life directly. And, in talking with the experts who helped us with the study, I learned that non-profit organizations have the ability to provide specialized knowledge, but lack manpower. This led me to think that one thing companies could do to help protect the environment was provide human support. Looking ahead, I plan to think of ways to give back to the community by holding science classes or putting my work knowledge and experience to use.



**Takamasa Kuroki**  
Environmental Engineering  
Works Section  
Productivity Promotion  
Division  
Inazawa Works

## Nakatsugawa Works' Field Guide to Living Creatures

Nakatsugawa Works, which is located close to Nenoue-kogen—voted as one of the top 33 places in Gifu Prefecture for viewing fall foliage—is surrounded by nature and truly coexists with extensive natural areas on its own grounds. What this living creature study found in particular was diversity within single species. For example, even among longheaded locusts, the ones inhabiting green grass are green, the ones in dry grass are brown and the ones in areas with both green and dry grass feature green and brown patches. The same was the case with black-spotted pond frogs. Green, brown and patched varieties were all found, drawing attention to the variety that exists even within a single species.



Longheaded locust

The study turned up over 70 varieties of plants, insects, birds, reptiles, amphibians and other living creatures. Of them, frogs occupy the very middle of the ecosystem pyramid, and the presence of many frogs is indicative of a healthy ecosystem. This was explained by the professional naturalist who helped with the study. Living creatures selected based on the perspective of species diversity, which was directly experienced, as well as the added perspective of intra-species diversity, were compiled into a field guide for "Feeling the abundance of life."



A larger view of the Field Guide to Living Creatures (Japanese only)  (1.33MB)

The study renewed my awareness of the importance and power of nature, which I had not noticed previously despite nature being so close at hand in our surroundings. Actually, before the study, I never thought there would be so many living creatures on the factory grounds. However, I listened closely to the explanation from the professional naturalist on how to find the creatures, looked around, and actually discovered a lot. It was really a pleasant surprise for everyone participating in the study. Even now that the study is over, when I see places that I used to just look at as part of the scenery, I think of all the organisms that probably live there, and if something moves, it really catches my eye. Even in a small greenbelt, there are plants and animals living there that have adapted to the surrounding environment. They have provided the opportunity for me to think about ecosystems and our own future activities. I am very appreciative of the expert naturalists and everyone else who helped out with the study.



**Shingo Hayakawa**  
Environmental Promotion  
Section  
Manufacturing Management  
Division  
Nakatsugawa Works

## Nagoya Works' Field Guide to Living Creatures

Nagoya Works has planted and grown a total of 28,000 trees comprising over 100 species on its premises. The study found a Japanese walnut tree that nobody remembered planting. The tree was estimated to be around 50 years old based on the diameter of its trunk. According to a professional arborist, this species of tree is native to marshland, and further investigation revealed three other species of trees that grow in marshlands.



Japanese walnut tree

The presence of these trees provides a reminder of the history of the area, which used to be marshlands. Nagoya Works highlighted this discovery by making the theme of its field guide "History felt through life." Looking at history as time, the guide focuses on the area's indigenous species and rare species that are now limited in number. Of the 100 species of plants, insects, birds and other organisms found by the study, around 30 representatives were chosen and summarized in the field guide.



A larger view of the Field Guide to Living Creatures (Japanese only)  (1.32MB)

Encountering all the living creatures through this study, I gained a strong sense of their continuation, and the continuation of humanity, and I realized that because of this we must all coexist in harmony. Along with the factory grounds, we also conducted a field study at the nearby mountain, Togokusan, with children of employees joining in. Togokusan is 198 meters in elevation and located close to Nagoya Works, around 15 kilometers. It has been designated by the Prefecture as an environmental preserve. Getting in touch with nature provides a great opportunity for employees and their children to think about the environment. The study was conducted in summer this time, but it would be interesting to conduct studies every season. According to the specialist who helped with the study, living creatures are most plentiful in spring and fall, so I'm looking forward to future studies.



**Masami Imai**  
General Affairs Section,  
General Affairs Division  
Nagoya Works

Mitsubishi Electric was the first company accredited under Aichi Prefecture's corporate forestry \* agreement, which loans prefectural forestland to private companies. We started the "Satoyama" Woodland Preservation project at Togokusan under the agreement in 2007. Efforts to restore nature on Prefectural forestland provide lessons on the importance and enjoyment of living with nature, and facilitate greater understanding of the environment and society.

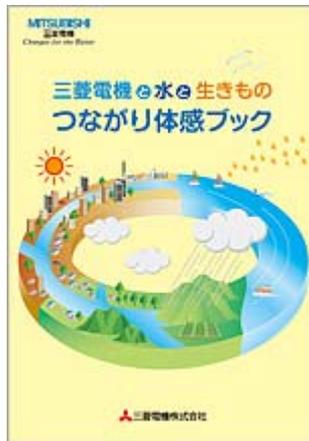
## Poster and Booklet Illustrate Our Relationship with Water and Living Creatures

### Thinking with Community Members About the Importance of Protecting the Ecosystem

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In addition to conducting living creature studies and creating field guides based on them, we also created the *Mitsubishi Electric and Water Map* (a poster) and the *Mitsubishi Electric Experience of Life* booklet.

The poster and booklet are the product of working in a region with an abundance of water. They introduce mountains and highlands as places rich with water, how they relate to factories as places where water is used, the relationship between water and people, and the role of tidal wetlands as places where water becomes ocean. The booklet describes the field studies, summarizes their findings and reports the experiences of employees along with comments from members of participating environmental protection organizations. The booklet is filled with tips for thinking together with the community about the importance of maintaining ecosystems.



### ***Mitsubishi Electric Experience of Life* booklet \***

The *Mitsubishi Electric Experience of Life* booklet is used by local citizens, visitors to the area, and a wide range of age groups.

\* Japanese only

[Click for the Japanese website](#)

A larger view of the *Mitsubishi Electric and Water Map* (poster)  (4.58 MB)

## Environmental Topics



## Mitsubishi Electric Outdoor Classroom

### ▶ Outdoor Classroom Objectives

This program is designed to bring participants together with their colleagues and families to spend time in a natural setting while working toward a common goal in classrooms that are created by employees themselves. Find out more about the concept behind the Mitsubishi Electric Outdoor Classrooms program.

[More](#)

### ▶ A Handmade Virtuous Circle

The hands-on creation of classrooms by employee leaders represents an integral aspect of the Mitsubishi Electric approach. Through trial and innovation, the classrooms have become increasingly appealing. Find out more about the growing number of employee leaders and how the program has evolved.

[More](#)

### ▶ Reports from the Field

Mitsubishi Electric aims to provide an enjoyable and rich experience to program participants. Learn more about how program leader ingenuity is driving the further development of the outdoor classrooms.

[More](#)

### ▶ Mountains, Seaside and Parks: Outdoor Classroom Case Studies

Learn more about unique outdoor classroom activities to date.

[More](#)

### ▶ Nature Conservation Leader Perspectives

Novice and veteran leaders discuss their innovative approaches and share what they have learned so far. Read more about their experiences and future aspirations.

[More](#)

## **Outdoor Classroom Objectives**

**The everyday lives of employees and their families can be transformed by experiencing nature together.**

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Mitsubishi Electric Outdoor Classrooms represent an effort to foster environmental awareness oriented toward respecting biodiversity, within the broader context of the company's Environmental Vision 2021. The classrooms themselves are natural settings such as woodlands and waterways, parks and seacoasts where participants and employees who take on the role of teacher (leader) can experience nature together. The ultimate objective of each outdoor classroom is to cultivate behaviors that positively impact the environment while fostering an awareness of our symbiotic relationship with nature.

We believe that providing participants with a chance to share experiences outside their daily work or home lives can change the way they think about the environment, which in turn will positively impact their actions in the workplace and at home. For example, by encouraging program participants to consider how the disposal of a certain product might negatively affect the ecosystem, or whether there might be alternative methods of production that utilize resources more effectively, both knowledge and understanding are enhanced. With this enhanced knowledge and understanding, we hope that each family member will approach daily activities such as electricity use from a more environmental perspective.

In recent years, respect for biodiversity has become an increasingly prominent environmental theme. Becoming acquainted with various forms of wildlife in our outdoor classrooms cultivates empathy with nature. This is the basis for respecting biodiversity.

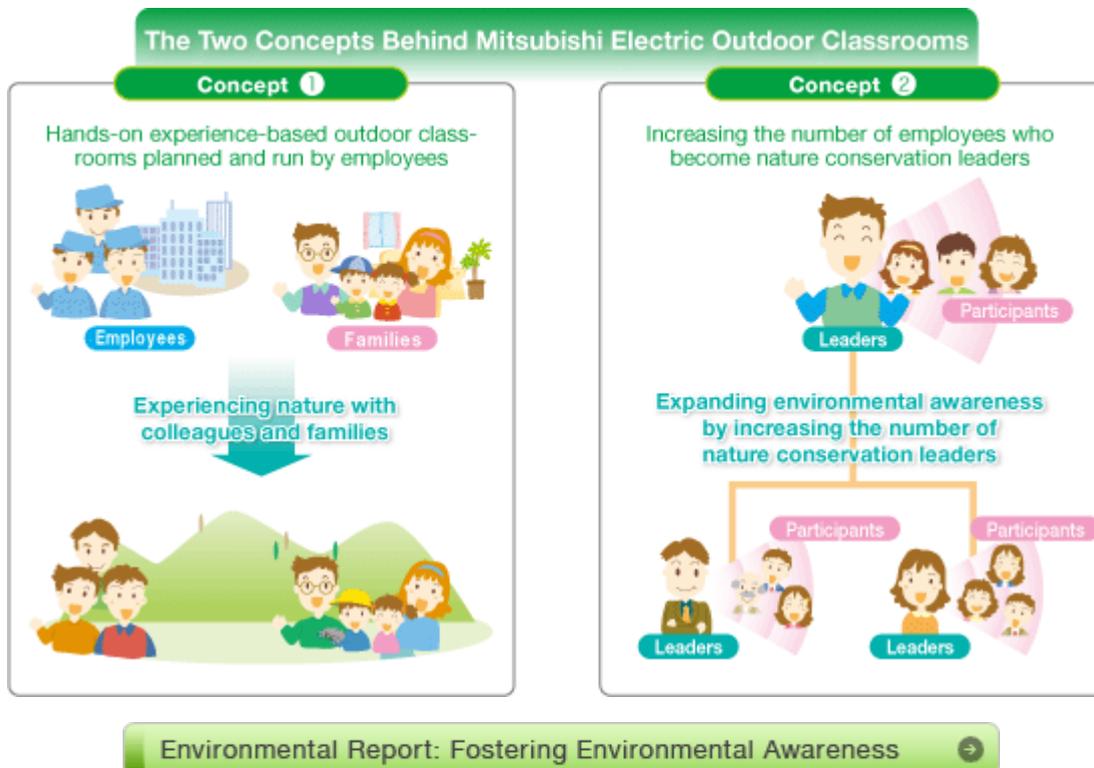
(See Concept 1 in below diagram)

## Steadily Increasing the Number of Employees Who Become Leaders and Create Classrooms

Another integral aspect of Mitsubishi Electric Outdoor Classrooms is the role of employees as teachers (nature conservation leaders), who are responsible for planning and managing the program. Twice a year, in spring and fall, leader candidates from all over Japan attend a two-day training seminar where they learn how to become nature conservation leaders. The seminar involves practical training and fieldwork fully utilizing all five senses in a mountain setting, and the cultivation of the knowledge and skills required to lead in the classroom, including how to communicate with children, emergency first-aid procedures and other critical subjects. Upon completion of the seminar, the new leaders return to their respective workplaces and apply their training toward the creation of their own outdoor classrooms.

In this way, by increasing the number of leaders who actively communicate the importance of environmental issues, we are able inculcate environmental awareness among our employees and their families in Japan and throughout the world, spreading the message outward in an ever-widening circle. Despite this seemingly diminutive gesture by a single enterprise, we nevertheless believe that we can contribute to raising environmental awareness throughout society.

(See Concept 2 in below diagram)



## Our Perspective on Biodiversity

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We recognize that our business activities involve the use of a variety of raw materials, and our chemical substance emissions and waste place a burden on biodiversity. We believe it is the responsibility of humans—merely one constituent of nature's vastly diverse offerings—to understand, sustain and respect our natural environment. To our minds, this is the true meaning of "environmental awareness." Accordingly, we take an active role in fostering environmental awareness, both as a corporate entity and from the standpoint of the individuals that make up the company, as we strive to protect biodiversity. Coming into contact with living things through environmental preservation activities is a starting point of fostering environmental awareness.

Based on the belief that the environment is an asset we share with future generations, we consider environmentally conscious management a topmost priority. To the extent that their activities interact with society and the natural environment, we believe companies are duty-bound to be proactive in maintaining harmony with their surroundings. We take these responsibilities to heart through our ongoing initiatives to preserve biodiversity.

Mitsubishi Electric Group Biodiversity Action Guidelines



## A Handmade Virtuous Circle

### Leaders Create Outdoor Classrooms through Ingenuity Based on Their Personal Experiences

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Based on the experience gained at training seminars, outdoor classroom leaders give free range to their creativity in planning nature classrooms. The duration, type of participants and targeted nature field of the classroom are all left freely up to the leader, with no predetermined constraints. Plans for the precise impressions they wish to give to participants by encountering nature through the five senses, what they wish to communicate amid their selected natural settings and other parameters are prepared individually by each leader.

The rationale behind this approach stems from utilizing the ingenuity of leaders by making optimal use of the impressions and discoveries that they themselves gained through actual experience. This is the essence of Mitsubishi Electric Outdoor Classrooms. Of course, outdoor classrooms created by amateurs are not always guaranteed to progress according to plans. However, we believe that there are also opportunities for learning that arise precisely because they are not veterans. During outdoor classrooms, there are unexpected instances where children show enthusiasm for some aspect of the session not foreseen by the leader, and the entire group begins focusing on that facet. This, too, is an important aspect of learning. Through such opportunities, the leaders themselves are able to develop even greater environmental awareness.



Classroom-based leader training seminars cover how to communicate with children, emergency first-aid procedures for onsite accidents and program creation.



Knowledge-based leader training seminars involve observing fauna and flora with interest and respect.



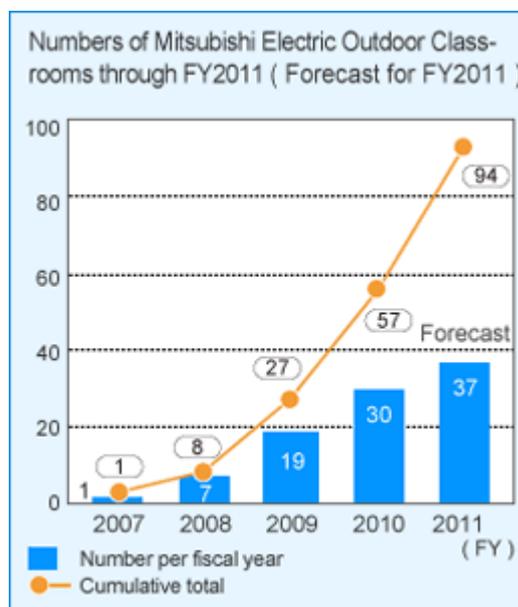
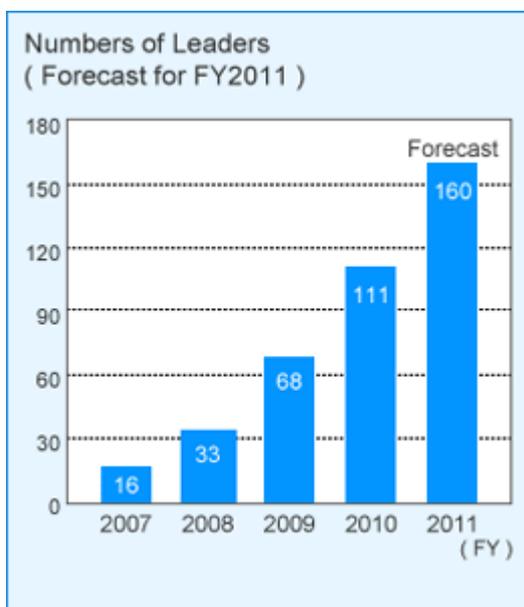
Practical training incorporating all five senses is also indispensable.

## The Succession of New Leaders Results in the Development of Many New Outdoor Classrooms.

The number of leaders involved in the Mitsubishi Electric Outdoor Classroom program expanded from 16 when the program began in October 2006 to 111 in 2009. The number of employees participating in the program on their own initiative is increasing, demonstrating the potential for further growth in the future.

The variation in classroom plans has also become more replete. There has been enthusiasm for greater specialist knowledge that could lead to even more interesting discoveries and repeat attendance to gain an even deeper understanding. In response, an increasing number of plans are made in cooperation with the Japan Outdoor Lifestyle Promotion Association, the Wild Bird Society of Japan, local experts and other external specialist sources, in addition to plans that interweave nature observation with handicraft workshops and programs that combine environmental themes with aspects of dietary education. By reflecting on previous activities, some classrooms have enhanced the program by providing improved goods. The classrooms continue to develop as the number of leaders grows. In addition, we now see some cases inspired by outdoor classrooms held in other areas.

These developments represent a welcome phenomenon that was not anticipated at the outset of the program. This virtuous cycle is a unique feature of Mitsubishi Electric Outdoor Classrooms. We wait with anticipation for further changes the future will bring.



## Reports from the Field

### Report 1: Taking Part in Rice Planting and Observing Waterside Wildlife in Motegi (May 16, 2009)

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Motegimachi, in the southeast of Tochigi Prefecture and home to scenic rice paddies, was the stage for our rice planting experience. This was the second rice planting workshop, and it began on the bus en route to Motegimachi. The purpose of the exercise is planting rice, which is inextricably linked with food. At the suggestion of the leader, a little workshop was held with a discussion about rice paddies, under the theme of dietary life. The leader conducted an ongoing quiz, with such questions as "How many grains of rice in a rice bowl?" while explaining various facts about the crop, its yield and the role of rice paddies. Any related subjects can be freely incorporated into outdoor classrooms: this, too, contributes to making them interesting. (By the way, the answer is 3,300 grains of rice in a 75g rice bowl!)

Once we finally began the actual rice planting, we realized the difficulty of getting the rice stalks to stand up straight. The children had the same difficulty, but they were taught the art of planting stalks straight by their fathers, who were setting a fine example themselves. Spending time in this way is an important experience for both parents and children.

Having gotten used to planting, the conversation naturally shifted to the harvest in the fall. As we progressed with sowing of the individual stalks, we wished for a bountiful crop. Completing a sweep of the paddy made us painfully aware of how demanding it is to work in that crouching position. Although you can buy rice in a shop, you can't buy a challenging experience like this. One of the messages of the outdoor classroom was intended to be gratitude—to farmers and for food.



And now, some discussion about rice paddies.



In the paddies together...Walking is difficult.



Looking good...



No, no. Don't pull up the ones you've already planted.



Croak! Croak!



Here's the frog I caught.



Standing up straight and gazing out over the rice paddies, enthusiastically searching for wildlife.



I'll be back to see you again.



In silence: Almost finished planting.



Finished! A heartfelt day's work.

The smaller children were intrigued by the living creatures in the paddies. Under the guidance of the leader, they caught frogs, tadpoles and diving beetles for more thorough observation. The leader had brought along magnifying glasses, which proved to be extremely popular. These had been overlooked at the previous event, which was one case of reflecting on former activities and learning from them.

On the way home some of the participants mentioned that it had been an enjoyable day and they would like to come back again. Another theme of the outdoor classroom was experiencing the cycle of nature: we are planning a return trip for the fall to see the harvest. By then, perhaps new leaders will have emerged from among the participants at this outing.

The venue was Aburayama Nature Sanctuary, which is a forest plentiful with wildlife amid wetlands formed from spring water. Our guests for the lecture were a group of cute and lively children who attend a preschool near the Kyushu Branch.

Looking back on last year's outdoor classroom, there was something to learn and apply to this year's classroom: principally to take things on a case by case basis; to keep the lessons moving, and to remember that children simply cannot be hurried. If there are too many predetermined observation points to be taken in, we tend to hasten through, leaving the children unsatisfied, which was an important lesson learned last year. Children are fascinated by so many things, and they respond differently, some wanting to forge ahead, others to take their time and look at their leisure. It is important to maintain a flexible frame of mind, allowing the children to become absorbed in something of interest that they stumble upon, and conversely to skip over any points that do not grab their attention.

Plunging into the forest with their magnifying glasses in one hand, the children soon found plenty of interest—particularly small insects and other little discoveries. In addition, we shared in studying things that they had heard of but never seen in their everyday lives, such as ant-lions, and in playing with bamboo-leaf boats and carrying out other activities. Another new experience during this event was making things from natural materials with their own hands.



Starting a lively day by getting to know each other.



At the start of the orientation, even the leader looked a bit nervous.



Look at the ragged edge where the slugs have been eating...



The rocks in the water hide great things.



Look for doodlebugs!



Hand-made bamboo-leaf boats. And they're off...!



Rotten tree stumps—highlight of the nature walk!



There are lots of different river crabs.



Items that proved to be very popular.



Memories of an enjoyable day—playing bingo!

Touching the mossy tree stumps was a definite highlight of the day. The rotten parts of the trees break down and return to the Earth, and fallen seeds sprout and grow once more into trees. These were valuable points gleaned from the day's activities. Mitsubishi Electric, working in the manufacturing sector, is necessarily involved in the resource recycling. It is our fervent hope that Mitsubishi Electric Outdoor Classrooms make it easy to communicate the patterns and cycles of nature, which provides valuable assistance in the growth and development of children. This was a strong focal point for the event.

Previously, leaders had all been drawn from general affairs departments, but from this fiscal year there will be new leaders from the personnel, accounting and sales departments. With this enhanced project team, we should be able to offer activities to various local residents that only Mitsubishi Electric is in a position to deliver.

## Message from the Secretariat

When the activities began in 2006, we were really just finding our way. Our starting point was fraught with uncertainties: whether the site would accept the project as an approach to environmental measures, whether enough people would be interested in attending and whether we could get our intended message across. I remember that we, as novices, were unsure about the feasibility of the philosophy of the Japan Outdoor Lifestyle Promotion Association—the organization that we externally contracted for leader training seminars— "to find the impact that humanity has on the environment and cultivate people who will act."

Looking back, the staff who participated in leader training seminars translated this philosophy into practice by finding distinctive themes in a variety of areas to communicate the transience of the cycles of nature and life, and our symbiotic relationship with nature. General employees then emerged to support the lectures, influenced by the devotion and energy of the leaders. Knowing how interesting lectures can be when properly conducted, leaders ingeniously cultivate enjoyment for other participants as well as for themselves.

One of the most inspiring things about holding outdoor classrooms has been to hear from the kindergarten teachers of the children who participated, now in their third year of elementary school, that along with their parents they are separating garbage and thinking about conserving resources. This trend can be traced back to their participation in Mitsubishi Electric Outdoor Classrooms. Although the event itself may have occupied only a couple of hours, the activities undoubtedly play a part in cultivating people who consider the environment.

Mitsubishi Electric Outdoor Classroom activities bring a smile to the face of so many people, not only participants and organizers. In the future, we plan to extend the program at a rate of five sites per year. We shall continue with these endeavors within reason and look forward to the understanding and support of many people who can share this enjoyment through nature across a wider area.



**Yoshio Isogai**  
Corporate Environmental Sustainability Group,  
Strategic Planning

Looking for water stick insects with the children for the first time in 20 or 30 years reminded me of Japan's abundant nature.



## Mountains, Seaside and Parks: Outdoor Classroom Case Studies

In October 2006, we held the first Mitsubishi Electric Outdoor Classroom in the locality of the Mitsubishi Electric head office. These activities have spread nationwide, with the total number of events reaching 57 as of March 31, 2010, to the benefit of a total of 1,700 participants. Some examples from this unique program are outlined below.

### 26th Mitsubishi Electric Outdoor Classroom: Rediscovering Acorns! (Chugoku Branch)

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November 29, 2008

Location: Peace Boulevard, Naka-ku, Hiroshima

The Chugoku Branch planned a Mitsubishi Electric Outdoor Classroom as a subsidiary event to its ongoing Flowerbed Promotion Activities (known locally as Kapora) for employees and their children. The only materials required were the fallen acorns around the flowerbeds. The gathered acorns were named according to their different roles: "insect food" for those that were already eaten by worms, "leaf shoots" for those that had begun to sprout, and "kids toys" for the ones that were intact. Each acorn was examined thoroughly by the children, who listened intently to explanations of the role of acorns in the wild. Furthermore, we made acorn cookies, which everyone tried while offering additional thoughts on the subject of food. Younger employees from the branch also participated in the event as candidates for wildlife conservation leaders, raising their awareness of the program and its contents.



Studying acorns retrieved from beneath the fallen leaves and wondering where the roots will sprout from.

(Answer: The roots always sprout from the pointed end.)



Baking acorn cookies...surprisingly good to eat!

## 23rd Mitsubishi Electric Outdoor Classroom: Learning about Nature through Games (Sagami Site)

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November 22, 2008

Location: Kanazawa Shizen Park, Yokohama

"A quiz rally in the forest!" "Let's look at things through a magnifying glass." "Found an acorn!" "Let's pick up leaves." These were some of the comments that were heard when the Sagami site held a Mitsubishi Electric Outdoor Classroom, which featured an elaborate game format. For example, "Let's pick up leaves" meant clearing the fallen leaves until we could see the soil and then learning about such things as the role in nature of millipedes, wood louses and other insects that live beneath the fallen leaves and how the leaves are broken down and restored to the soil by mushrooms and other fungi. The participants ranged from nursery and kindergarten through elementary school pupils. The consensus of the elementary school students was that the lecture gave them the opportunity to make new discoveries through hands-on experience as opposed to from learning in a classroom.



Raking over leaves and finding an unexpectedly good smell—Even a casual stroll can lead to a wealth of opportunities for observing nature.



Learning from a textbook then experiencing through nature brings knowledge to life.

## 23rd Mitsubishi Electric Outdoor Classroom: Making Dolls from Twigs after Nature Observation Workshop (Nagoya Site)

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November 22, 2008

Location: Togokusan Prefectural Forest, Moriyama-ku, Nagoya

We planned a Nature Observation Workshop for Parents and Children to enjoy with the aim of experiencing natural beauty and the importance of conservation, and at the same time working up a refreshing sweat in a rich natural environment. A total of 33 employees and their family members participated in the event. A forestry instructor from the Aichi Moriyama Shizen no Kai (Aichi Natural Woods and Mountains Nature Group) came along to help out by telling us plant names and characteristics, turning the event into a full-blown nature workshop. The children took renewed interest in the familiar trees and wild flowers, forging ahead to forage nuts from the trees and gather up fallen leaves. Later, we had a go at making twig dolls with guidance from the Aichi Moriyama Shizen no Kai. The children proudly took the completed dolls home to show their parents after struggling with the unfamiliar tools.



An exhilarating walk along autumn forest paths, with rich variation among the mixed trees and a fascinating world to examine through a magnifying glass constantly attracting children's interests.



The forestry instructor's explanations stimulate thinking about nature, and children and adults alike take the opportunity for spiritual growth.

## 31st Mitsubishi Electric Outdoor Classroom: Bringing Parents and Children Together for a Day by the Sea (Eastern Research Institute Area, Ofuna)

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May 23, 2009

Location: Katase-Enoshima coast

We planned this outdoor classroom at the Katase-Enoshima coast with the idea of promoting a deeper understanding of aquatic life in the surrounding seas through hands-on experience. This outdoor classroom was held as part of an annual seining event sponsored by the local fishing cooperative. Held this year for the second time, the outdoor classroom drew 235 participants, including employees and their families. As in the previous year, we invited guides from the nearby Enoshima Aquarium to explain the characteristics of various aquatic life caught in the net that day, as well as other fish selected beforehand. Following these explanations, a short cooking class was held as the fish caught that day were prepared for eating. After the meal, participants experimented with recycling the oil used in frying the tempura into soap.

▶ With the cooperation of the Enoshima Aquarium 



At the fisherman's call, participants heave on the rope connected to the fishing net. The catch contains an unexpected variety of fish and shellfish.



Curious children becoming acquainted with many new varieties of fish: "What's that? And that one? Why is that fish shaped that way?"

## Nature Conservation Leader Perspectives

The role of the wildlife conservation leader is to make each and every participant feel how precious, interesting and surprising nature is and help them make to new discoveries. There are both novice and highly experienced wildlife conservation leaders in attendance. Some examples of ingenuity in planning and experience gained from Mitsubishi Electric Outdoor Classrooms are given below, along with aspirations for the future.

### Aiming to provide a forum for family communications

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**Jun Takahashi**

**Mitsubishi Electric Trade Union, Head Office Branch**

The Creatures of the Sea Observation Workshop held in May 2009, was my first opportunity to act as a classroom leader. What I was most conscious of at the planning stage was the large number of young children who would participate. Concerns were expressed that: "of course they will learn about the environment. What we need to do is to create an effective forum for enjoyable communications between parents and children." Accordingly, protection of safety was made a major premise. I drew up provisions covering all the foreseeable eventualities to guard against accidents and injuries and to avoid any children going astray, calling for the cooperation of parents to ensure an event free from incidents.



Before starting, I was unsure as to whether my commentary could hold the interest of the children, but on actually starting to speak I realized that you do not actually need to talk about very much. Simply expressing the minimum to get your point across allows the children to think for themselves and to notice how interesting and important the living creatures are. Learning to guide the kids in this way was an important lesson for me.

### Manae Furukawa, Kyushu Branch

A participant at a leader training seminar said how much fun it looked and how much they wanted to give it a try that it got me interested in becoming an outdoor classroom leader as well. I myself am a parent, so empathize with the philosophy of the Mitsubishi Electric Outdoor Classrooms. At first, just talking was the best I could do, but as I gained experience with successive events, I progressed smoothly as I began to enjoy myself more and felt that this was infectious for the children, too.



The Kyushu Branch's Mitsubishi Electric Outdoor Classroom has always been held at the Aburayama Nature Sanctuary. The abundant nature of this locale cannot be exhausted in one or two events, so interweaving explanations for the children attending for the first time with general knowledge that will appeal to their parents to ensure that both parents and children can enjoy lectures time and time again is a skill in itself. Even when handling insects, the children fluctuated between being timid and being boisterous at first. But through the Mitsubishi Electric Outdoor Classroom, we teach them to touch insects gently. Through these methods of teaching, I would like to become a leader who can communicate respect for life to children.

## The Knowledge Required to Deliver Lectures Changed My Own Perspectives

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### Shinichi Sato, Sagami Plant

As an outdoor classroom leader, I try to take in a vast quantity of information. As a result of the influence of television and school lessons, children today are far more knowledgeable about nature than adults expect. Accordingly, they do not necessarily react to what is said to them as expected. And if the conversation moves off at a tangent, we will have to respond flexibly. It means we can never have enough material.



Perhaps because my antennae are always trying to collect information, these days I naturally pay attention to flowers and trees in my daily life. If you take a new look around, nature is never far from everyday life. Just taking a walk in the neighborhood brings you into contact with a surprising amount of vegetation.

In addition to wanting to be popular with students, one of the attractions of the job is that by boosting knowledge and experience I can become the sort of person who notices things that I used to overlook.

### Noboru Sakamaki, Nakatsugawa Works

The significance of Mitsubishi Electric Outdoor Classrooms lies in children experiencing nature as it really is and noticing how precious and alluring nature is. This is even the case in Nakatsugawa City, surrounded by pure streams and deep forests.



For children accustomed to the sight of forests and rivers, perfunctory talk is likely to be met with an expression of boredom. Experiences via the sense of taste have the power to change that expression. Tasting a nut gathered from the forest can instantly light up a child's eyes and get a thrilled "delicious!" from his or her mouth. I feel that any Mitsubishi Electric Outdoor Classroom will go successfully if experience using the sense of taste is called into play, bringing a response akin to the surprise of discovering something new.

In addition, the leader's job is to prepare thoroughly to teach because there are so many things that children do not know about on top of taste. Occasionally you will see children putting into practice something they have just been taught. The younger of two brothers who had participated in the Creatures of the Mudflats Observation Workshop, on touching a fish with his bare hands, was warned by the elder that "human hands are hot, so they can give fish burns!" It brought me great joy and I felt the classroom I held was worth something.

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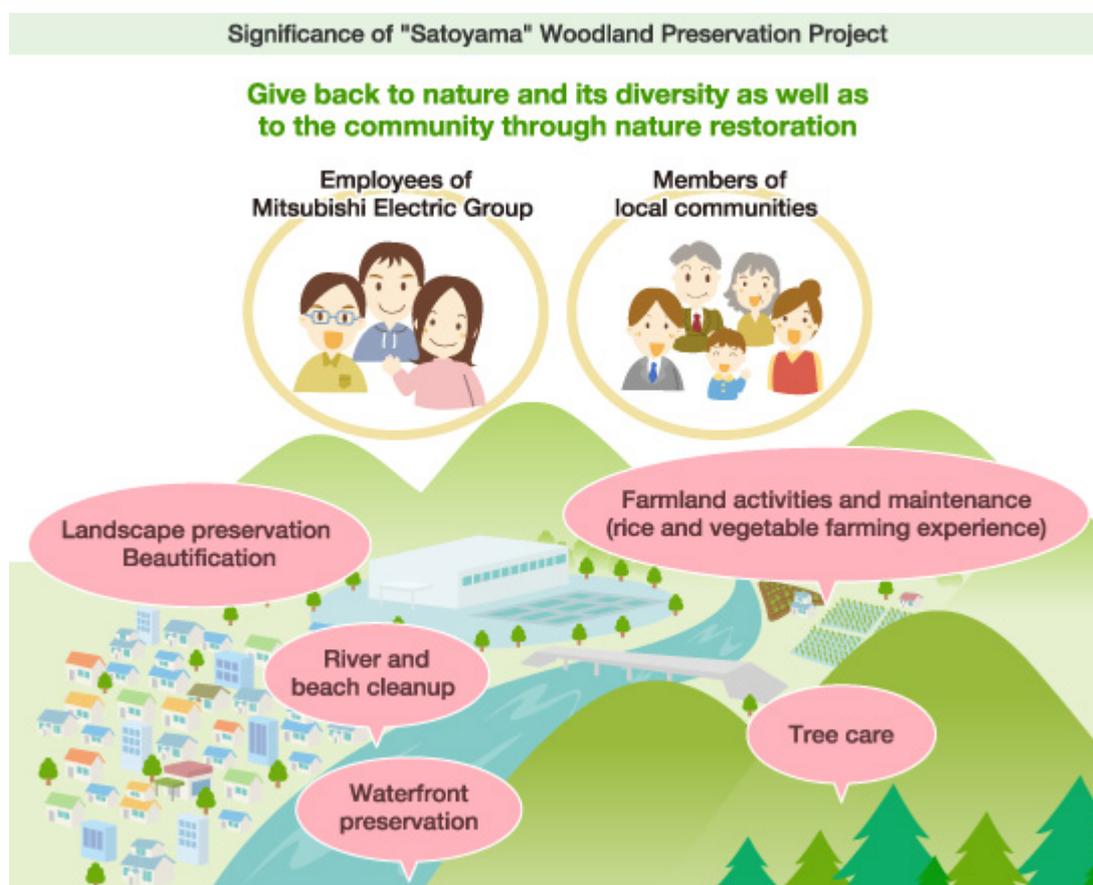
## Restoring Nature as a Philanthropic Activity

### Giving Back to Nature and the Community through Nature Restoration

The "Satoyama" Woodland Preservation Project involves employees working to restore parks, woodlands, rivers and other natural areas located close to our business sites while soliciting the understanding of the government and local community members.

According to Japan's Ministry of the Environment, "satoyama" woodlands are defined as natural environments formed through mutual activity by humans and nature over many years. They are important as habitats for diverse living organisms, as unique local landscapes and as places for traditional culture. However, human contribution to such areas is diminishing due to population declines and aging, which is adversely affecting the landscape and biodiversity as plants and animals inhabiting the woodlands decline. Preserving and restoring these "satoyama" woodlands has become an urgent task.

The goal of the project is to give back to nature, which nurtures a diverse array of living organisms and provides people with many benefits, and to contribute to communities where our business sites are located.



The Mitsubishi Electric Group works to reduce environmental impact through business activities, efforts that include cutting CO<sub>2</sub> emissions, reducing waste and recycling resources. We are further involved in activities to raise awareness, including the Mitsubishi Electric Outdoor Classroom, which is held to foster awareness and respect for nature. Since 2007, we have also carried out the "Satoyama" Woodland Preservation Project, a nature restoration initiative.

## Continuation as a Philanthropic Activity

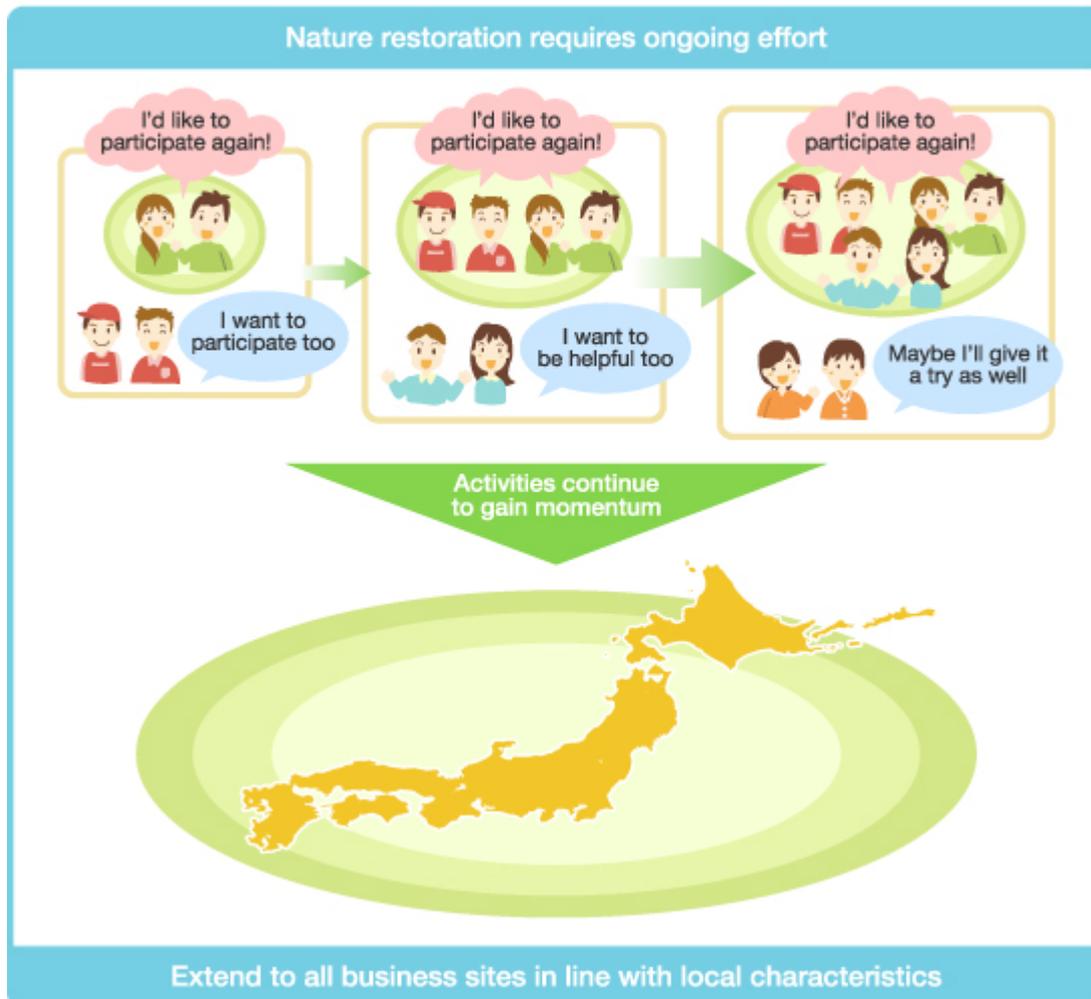
The Mitsubishi Electric Group positions its "Satoyama" Woodland Preservation Project as a philanthropic activity. Nature restoration is only meaningful when activities are carried out over a long period of time. The project was started with the intention of being conducted steadily and continuously while relying on the volunteering spirit of our employees.

In order to ensure the project continues, it is essential that participants are motivated not by a sense of obligation but by a desire to help, so the choice to participate is completely up to the individual. The company provides information to get employees interested in volunteer activities and offers support that draws on the volunteer spirit, but all that we provide is the opportunity to participate. When employees volunteer on their own, it makes the experience feel worthwhile and inspires them to keep participating in woodland preservation. A volunteer spirit grows and more and more employees repeatedly get involved. Our aim is to continue having the project invigorated in this way.

As of October 2010, we are involved in woodland preservation in seven areas around the country, and we have plans to begin the project in another area in the immediate future. Ultimately, we would like to extend the project to all business sites in line with local characteristics.

### Features of "Satoyama" Woodland Preservation Project

#### Continue as philanthropic activity built on a volunteer spirit



Philanthropic Activities: "Satoyama" Woodland Preservation Project →

## Cultivating a Volunteer Spirit

### The Key to Repeat Participation: Having Fun

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It is actually quite difficult to bring about continued involvement in an activity even when people are inclined to volunteer. For this reason we put emphasis on activities that are fun for volunteers. If the participants themselves sense that they get something out of the experience, they naturally feel that it was an enjoyable experience that they would like to have again. In this way, motivation remains high.

The following are some of the keys to ensuring that activities are enjoyable:

- Create opportunities for employees to rejuvenate themselves and communicate with their families.
- Make it possible for participants to communicate and deepen understanding of each other and local community members.
- Make it possible to simultaneously participate in other activities, like the Mitsubishi Electric Outdoor Classroom, and have a variety of experiences.

For example, with the [Mt. Fuji Forest Cultivation Project](#), which is conducted near our head office together with Sumitomo Forestry Co., Ltd., participants develop a fondness for the saplings they plant and look forward to caring for the trees as they grow, which increases repeat participation. The project also promotes communication among employees because everyone takes part in the same work regardless of their position back at the office.

In the [Nakatsugawa Region](#), the [Mitsubishi Electric Outdoor Classroom](#) and fun, hands-on activities are held in conjunction with preservation activities at the prefectural Nenoue-kogen Azalea Park, allowing both adults and children to have fun while learning about nature.

In order to build on these successes, we are working to develop activities that encourage repeat participation, with the head office providing ideas and information and employees—the actual participants in the activities—also coming up with their own creative ideas.

## Head Office Area

When participants plant saplings they are motivated to take care of them. Everyone takes part while having a good time.



A dozen or so years ago, I participated in company-organized trips to climb Mt. Fuji five years in a row. When I learned about the opportunity to go back to Mt. Fuji to volunteer with my co-workers I thought it would also be a chance to start what I should have done earlier, so I participated in the initiative with great enthusiasm. In the approximately three years since, I have enjoyed demanding but fun activities in the midst of nature, planting saplings, clearing underbrush and pruning trees. I call on everyone to support the blessings of nature, which need to be passed on to the next generation, while cleansing body and mind in the pure air of Mt. Fuji.

### **Ryuichi Yamaguchi**

Corporate Total Productivity  
Management & Environmental Programs Group



At first I participated simply because I liked Mt. Fuji. But, as I participated I really got into it, so much so that I became a member of the organization and promotion committee. We are working to enhance the program while incorporating the views of participants, for example by chartering more environmentally compatible eco buses and creating our own orientation video.

### **Masakatsu Yokota (left)**

Mitsubishi Electric Call Center  
Customer Satisfaction Promotion Dept.  
Living Digital Media Division

### **Taketoshi Ito (right)**

Government & External Relations Office

## Nakatsugawa Region

In addition to clearing brush, trimming trees and conducting vegetation studies, we hold the Mitsubishi Electric Outdoor Classroom and the "Mori no Megumi" Contest, which are fun activities for both children and adults. Employees and their families get to experience nature close up, together with members of the local community.



The team in the Nakatsugawa Region works for around two hours each session, but after we're done Azalea Park is noticeably different. It's not only employees; community members are also involved, so there is a sense of unity that goes beyond the company. Also, eating lunch after working up a sweat is the best!

**Noboru Sakamaki**  
General Affairs and Welfare Section  
General Affairs Department  
Nakatsugawa Works

# Planning Successful Projects

The "Satoyama" Woodland Preservation Project involves restoration of natural areas near our business sites. Emphasis is placed on easy-to-do activities depending on the desires and number of staff available at each site.

This is because no matter how motivated the participants are, if the initiative is unrealistically ambitious for that business site, it will not be sustainable. And, if the initiative is not something that will please community members, it does not end up contributing to society. For this reason, in planning, from the very start we consider activities that are ideally suited to each business site and give something back to nature and the local community.

### Keys to Planning Good Projects

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1. Develop new nature restoration activities that meet local needs.
2. Participate in local activities.
3. Consider future potential.

### Key #1: Develop new nature restoration activities that meet local needs

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Normally, in starting a woodland preservation initiative at a business site, we first start by asking what the nature preservation needs are in the region. That is to say, we survey what is needed to protect nature locally, what is currently insufficient and what local residents want. After that we consider whether what the business site is actually capable of providing will meet these various needs, and, finally, we select an activity that is fairly easy for the business site to conduct. In matching needs and capabilities in this way we create a new nature restoration initiative that had not existed in the local area. The following points are of particular importance.

- **Would employees support the principles behind the activity and would the activities be representative of Mitsubishi Electric? Is there any discrepancy between what is needed locally and what we would actually be capable of providing?**

Notable examples of activities based on this thinking are forest maintenance activities at Sumiyoshi-Nagabuchi Forest in the Kobe Region and cherry blossom restoration activities at Itami Zugaik Park in the Kita-Itami Region. In both cases, the local community had specific needs that they wanted met, and the business sites determined that they would be capable of performing the activities, so the activities were started in line with actual needs.

### Kobe Region

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Activities are being conducted in response to an SOS issued by the local forestry cooperative indicating that they were no longer able to maintain the forest due to the aging population of the community.



## Kita-Itami Region

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Activities to rescue cherry blossoms that were started in 1986 serve as the original model for the program. Since becoming a part of the Satoyama Woodland Preservation Project, participation continues to grow.



## Key #2: Participate in local activities

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Creating a new program to maintain or restore natural environments in line with local needs is the ideal of the Satoyama Woodland Preservation Project. Another format for the project, however, is actively participating in programs already being conducted by the local government, an environmental protection organization or other group. This approach is one way for a business site to become involved on a flexible basis regardless of its size.

For example, in the Shizuoka Region, which has many participants, we participate in the City of Shizuoka's "Adopt-a-River Program" and conduct activities to restore beauty to the banks of rivers we have adopted. At business sites like branch offices staffed by a small number of people, another format is also possible. Employees actively participate in environmental protection activities already being conducted locally.

## Shizuoka Region

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The program starts by holding the Mitsubishi Electric Outdoor Classroom to deepen understanding of natural cycles and harmony with nature, and then moves on to the actual work of restoring beauty to the riverbanks.



### Key #3: Consider future potential

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For the Satoyama Woodland Preservation Project, the next step after starting an activity is to consider the future of the activity. This is because thinking about the activity's future enables long-term, sustainable contribution to nature and the local community. For this reason, when starting an activity, the following points are emphasized to ensure in advance that there is some depth to the activity and that it can be further developed in the future.

- **Is the activity capable of garnering the support of local community members and local government bodies as collaborative partners? Are there experts that can provide leadership from a neutral standpoint?**

Activities in the Nagoya Region, the first Satoyama Woodland Preservation Project (started in 2007), were commenced after becoming the first project to be accredited under an Aichi Prefecture agreement that loans prefectural forestland to private companies. The activities involve preservation of prefectural forestland at Togokusan. Since this was the first case of an agreement being concluded for prefectural forestland, a substantial amount of time was spent before activities were commenced in order to sufficiently earn the understanding of the local government and local residents. The project is currently actively carried out with the participation and support of the local government, local residents and nature protection groups. In addition to forest maintenance and beautification, we hold the Mitsubishi Electric Outdoor Classroom to teach respect for nature through its observation, and conduct woodworking courses using tree trimmings and other resources found on the mountain.

#### **Nagoya Region**

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Outdoor classes, woodworking classes and other activities are conducted in addition to forest maintenance and beautification efforts.



- **Are there future potential, flexibility and options in the activities at the targeted site?**

In the Fukuyama Region, we started an initiative at the Kannabe Four Seasons Forest that involves planting pine trees capable of withstanding natural disasters to regenerate a once verdant forest. Together with local residents we plant "super pine" tree saplings, which are less prone to withering, and take care of the saplings over a long period of time. Birdhouses have also been put out to encourage many birds to return to the forest. In the future we hope to hold outdoor classes in this pine forest.

#### **Fukuyama Region**

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We worked with local residents to plant some 1,000 saplings in an effort to regenerate a forest of pine trees that had deteriorated.



## Our Goal is Participation by All Business Sites

### Gradually Expand Regionally with the Goal of Participation by All Business Sites

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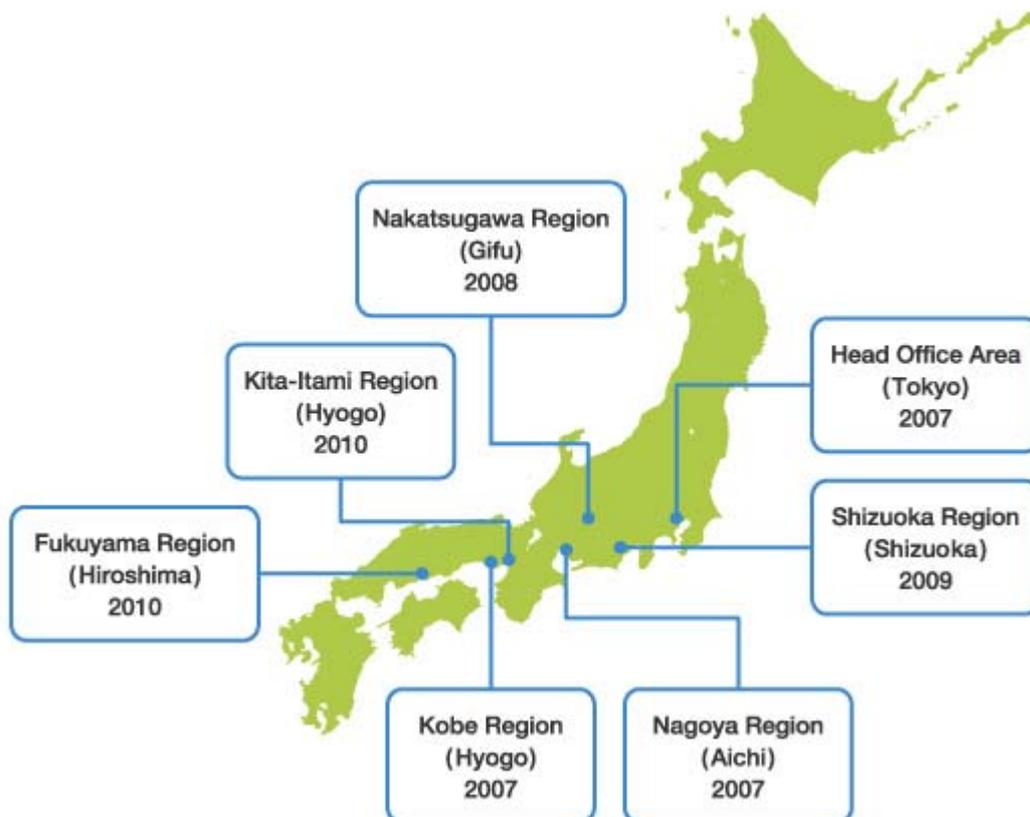
The organization and promotion committee at the head office provides our business sites with information on initiatives already underway to stimulate interest in the "Satoyama" Woodland Preservation Project.

The project has been growing at a moderate pace because the onus is on employees to volunteer themselves and because programs need to be created that suit the business site and meet local needs. But steady progress is being made as the importance of environmental protection activities has come to be widely recognized in recent years.

#### **Satoyama Woodland Preservation Project Expansion**

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As of October 2010, activities are being conducted in seven regions around the country. There are plans to start a new project in an additional region within Japan in fiscal 2011.



## Comments from the Woodland Preservation Project Organization and Promotion Committee

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The job of the organization and promotion committee is to build momentum for woodland preservation among employees and provide support until a project starts. The projects depend on the volunteer spirit of employees.

With a focus on the sustainability of the program, we try to start realistic projects after carefully considering whether there is adequate human resources and whether we can earn the understanding of local government officials and local community members. It takes time to get a project off the ground, but this serves as a chance to deepen communication with local residents. We promote the project in order to give back in even a small way.

Participants make comments about being rejuvenated by the experience, spending quality time with their families, and making various observations and discoveries. I am the most happy though when I hear participants say they are truly glad they participated. Our ultimate goal for the Satoyama Woodland Preservation Project is to expand it on a national level. It may take some time, but we plan to make progress one step at a time.

### **Junko Tawada**

Philanthropy Department,  
Corporate Administration Division

## Comments from a Project Promoter at a Business Site

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We cooperate with one another and help one another, doing what we can realistically do. We share in our accomplishments and applaud one another's efforts. I was able to reaffirm, along with the other members, the ability to feel this way thanks to the Satoyama Woodland Preservation Project. I plan to continue promoting the project together with employees, members of our affiliates, and local residents.

### **Hirokazu Hirao**

Environmental Protection & Component Evaluation Section  
Engineering, Manufacturing & Information Systems  
Department  
Energy Systems Center

# Environmental Topics

## Archives

Published May 2009

### ▶ Innovative Products and Production



- Product Innovations
- Production Process Innovations
- Engineers' Perspectives
- Working with the Community for the Environment

Published Aug 2009

### ▶ Rebuilding and Developing Automotive Equipment



- Rebuild Operations:
- Recycling in Action
- Providing Cutting-Edge Alternators
- Initiatives to Reduce Waste

Published Sep 2008

### ▶ Towards Zero Emissions



- Birth of a Recycling System
- Recycling Examples
- Future Development

Innovative Products and Production:  
The Eco-Compatible minimo



The minimo motor for compact ventilators meets Mitsubishi Electric's goals of energy efficiency and resource conservation. The motor is the result of concurrent engineering, which refers to various engineers cooperating on design, manufacturing technology and facilities development to make the best product. This section introduces the eco-compatible minimo.

**45-mm minimo® — The World's Smallest\* Fan Motor**  
**A little package full of ingenuity and innovation**

\* Among AC capacitor start motors for compact ventilators.  
As of Feb. 2009, Mitsubishi Electric survey.

ENVIRONMENTAL VISION  
**2021**  
TECHNOLOGY & ACTION

Environmental Manufacturing Ideals

▶ Product Features

▲ Closeup 01 ▲ Closeup 02 ▲ Closeup 03

The graphic features a hand holding the motor next to a ruler. The background includes a blue sky with birds, green trees, and a city skyline at the bottom. Navigation buttons for 'Closeup 01', 'Closeup 02', and 'Closeup 03' are located at the bottom.

## Contents

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▶ Product Innovations

**minimo—the world's smallest\* fan motor—greatly reduces the environmental impact of housing.**

- minimo is energy efficient and conserves resources
- minimo provides outstanding environmental performance

\*According to a Mitsubishi Electric survey, minimo was the world's smallest fan motor as of 2009, among fully automatic capacitor start motors for compact ventilators.

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▶ Production Process Innovations

**Superior process pooling Mitsubishi Electric's strengths in motor design, manufacturing technology and facility development**

- Concurrent engineering is the DNA of the Nakatsugawa Works
  - The development stage combines the Company's technologies, knowledge and experience
  - Concurrent engineering evolves in the Iida Creation Lab
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▶ Engineers' Perspectives

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▶ Working with the Community for the Environment

## World's smallest fan motor greatly reduces the environmental impact of housing

### "minimo" is energy efficient and eco-compatible

Motors in pipe fans used to ventilate living rooms, bathrooms and other rooms are installed in the airflow channel. So a smaller motor provides less wind resistance and greater airflow. However, as the size of the motor is reduced, the power efficiency declines, as does the ventilator's performance.

Mitsubishi Electric solved this problem with minimo, a substantially smaller yet high-performance motor. minimo's outer diameter is 43 millimeters, making it the world's smallest motor of its kind. Compared with similar conventional motors, the compact minimo has 68% less volume and is 73% lighter. Pipe fans that employ a minimo use around 22% less power yet still provide 25% more airflow than typical models. Being compact, minimo saves valuable limited resources by substantially reducing the plastic, iron, copper and other raw materials needed to produce it.

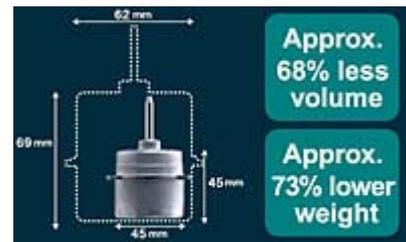


The world's smallest capacitor start motor for compact ventilators: minimo

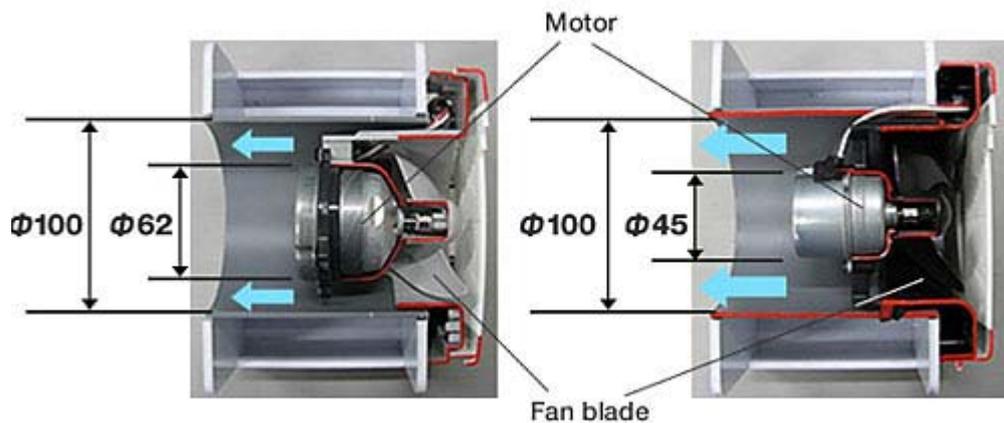
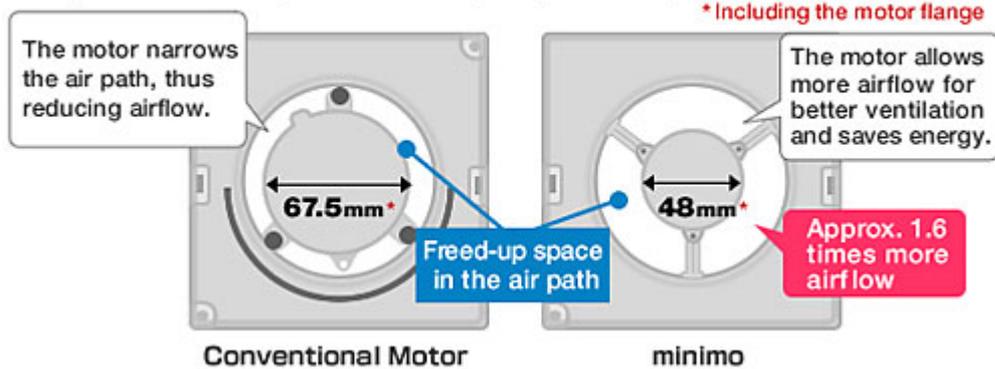
## Higher airflow and less energy consumption

In conventional motors with a diameter of 67.5 millimeters, including the flange, part of the motor blocks the airflow. This part takes up 56% of the cross-sectional area, compared to only 28% for fans equipped with the minimo. Moreover, minimo fans reduce air resistance (boosting airflow by 25%), yet at the same time lower power consumption by 22%.

## Compactness saves resources



## Comparison of free space in the air path (Back view)



[Watch a video of minimo](#)

## Environmental Vision 2021 and minimo

Environmental Vision 2021 sets targets to be achieved by the year Mitsubishi Electric celebrates its 100th anniversary. Major objectives include reducing CO<sub>2</sub> emissions from production and product usage to prevent global warming, and actively promoting 3R (reduce, reuse, recycle) initiatives to bring about a recycling-based society. The innovative minimo, which is energy efficient and eco-compatible, contributes to these objectives. minimo is a model for Mitsubishi Electric's product development efforts.



## Excellent environmental performance possible because ventilators generally not seen

Customers are not usually aware of the performance of the pipe fans preinstalled in the homes they purchase. However, the energy they consume is significant.

Pipe fans account for about 30% of the ventilators used in Japan, according to a 2007 survey by the Japan Electrical Manufacturers' Association. Following revisions to the Japanese building code in 2003, full-time ventilation has become a requirement for most new dwellings, and pipe fan installations are expected to increase.

Pipe fans are used in most houses, but they are seldom chosen directly by consumers. For this reason, Mitsubishi Electric has accepted responsibility for providing products with exceptional environmental performance. Our minimo-equipped pipe fan received the 2007 Energy Conservation Grand Prize from the Director-General of the Agency of Natural Resources and Energy.

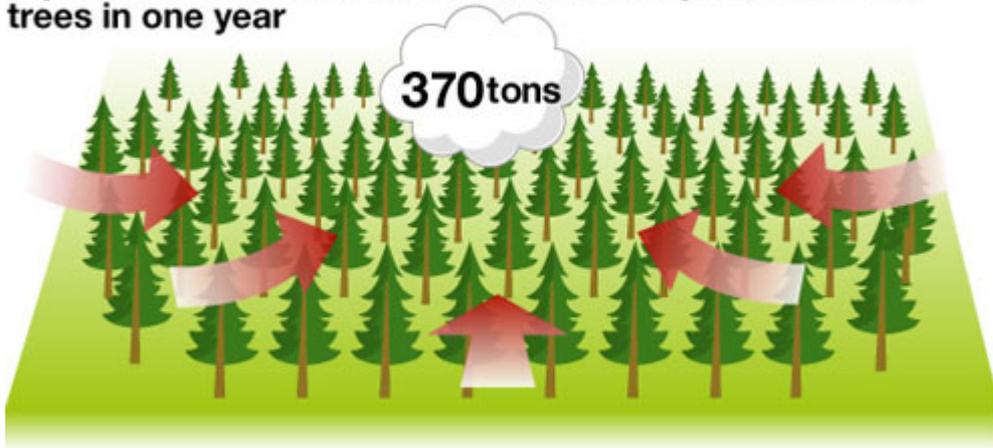


### How much does minimo benefit the environment?

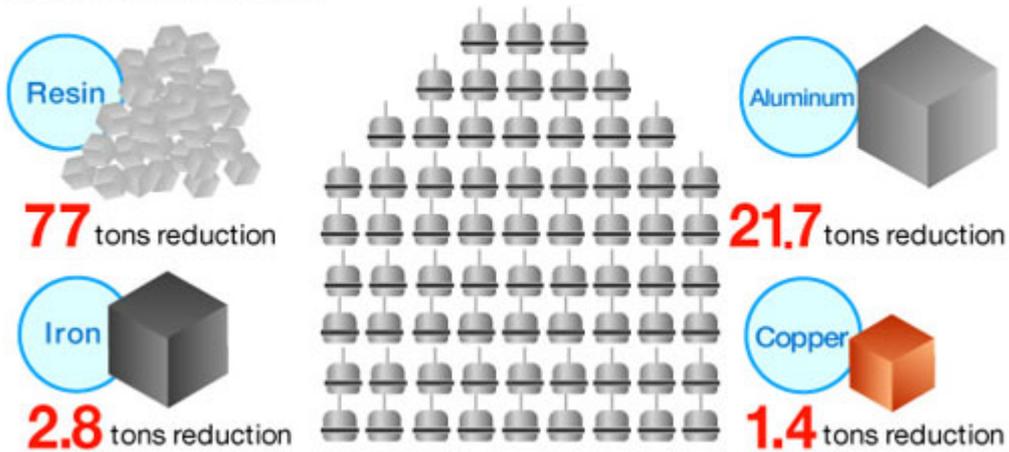
If all the pipe fans sold by Mitsubishi Electric were equipped with minimo, the energy saving would equal some 370 tons of CO<sub>2</sub> a year. Using minimos would also reduce resource usage: plastics by 77 tons, aluminum by 21.7 tons, iron by 2.8 tons and copper by 1.4 tons. These savings by minimo would make a significant contribution to preserving the environment.

\* Assuming half of the pipe fans sold by Mitsubishi Electric are run 24 hours a day and the other half five hours a day.

### Equivalent to amount of CO<sub>2</sub> absorbed by 26,000 cedar trees in one year



### Materials equivalent to around 200,000 conventional models are saved



## Superior production process combining the strengths of motor design, manufacturing technology and facility development

### Concurrent engineering: the DNA of Nakatsugawa Works

minimo was developed by a project team from the Iida Factory at the Nakatsugawa Works. For the project, engineers specializing in motor design, manufacturing technology and facility development gathered at the factory. This concurrent engineering resulted in the development of this product.

The Iida Factory is one of Japan's leading facilities for ventilator production. It manufactures duct ventilators, pipe fans and other models. As competitors shift production overseas, the Nakatsugawa Works has remained focused on production in Japan while pursuing a high market share and customer satisfaction through high-quality products matched to the needs of the Japanese market.

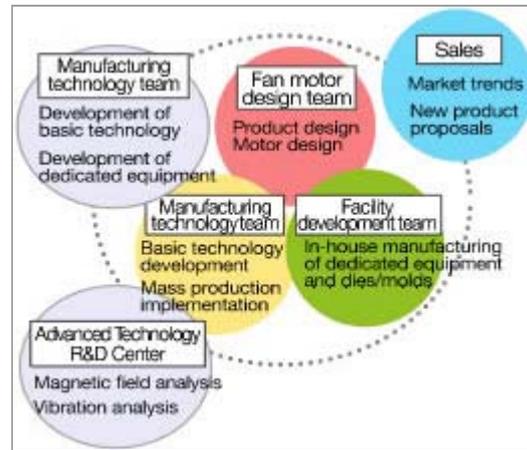
The Iida Factory makes highly competitive products because of its ongoing factory automation. The Nakatsugawa Works can handle production from line design to the design and development of automation equipment and molds. The factory combines these technologies to build automated, high-efficiency, high-precision production lines that cannot be imitated. Product development does not follow a typical pattern of design production. Instead, an automated production line is a prerequisite, and so divisions collaborate to create the optimal motor design, production line configuration and equipment molds. The Company has used this development process for many years. Long before concurrent engineering became widespread, the Nakatsugawa Works applied this approach to product development, a process it terms its DNA.



Motors produced at the Nakatsugawa Works. At front, a motor produced at the Iida Factory. The Nakatsugawa Works has produced ventilators since 1943 and made its 100 millionth product in 2006. The Iida Factory had manufactured more than 40 million as of 2005. The high-quality, highly reliable products that come off these facilities' automated production lines have made Mitsubishi Electric the No. 1 manufacturer for four straight years, as chosen by material and equipment manufacturers, according to a survey by Nikkei Architecture.

## Combined technologies, knowledge and experience at the development stage

The Nakatsugawa Works' DNA was evident in the development of minimo. To create the ultimate fan motor, top staff members from sales, motor design, manufacturing technologies, facility development and other divisions participated. Also enlisted was the Manufacturing Engineering Center, which provides technical support for all of Mitsubishi Electric's production sites around the country. Highly experienced employees were invited to the Iida Factory. This new team pursued the best product development process by combining and fusing technologies, knowledge, and experience cultivated on the production floor, the front line of product manufacturing.



Technology Development System for minimo

As the team developed concurrent technology, a key was technical innovations related to integrating design with manufacturing. For example, the motor coil was separated from the insulating framework and insulated after winding the copper wire as densely as possible and inserting other parts. This new technology shattered conventional views about fan motors and is why minimo is compact and efficient. The minimo is the direct result of combining a new manufacturing perspective with motor design. The Nakatsugawa Works is well known for this type of innovation.

Technical innovations went beyond designs. Concurrent engineering resulted in many manufacturing innovations as well. An experienced employee in fan motor design was put in charge of production technology, a move that infused a new perspective. Similarly, staff from the Manufacturing Engineering Center worked closely with team members in charge of facility development and combined their respective expertise. Efforts were made to reduce loss in every process, including the development of a work conveyance system. The team constantly innovated to ensure the best product was manufactured with high-precision efficiency.



minimo: a product of concurrent engineering



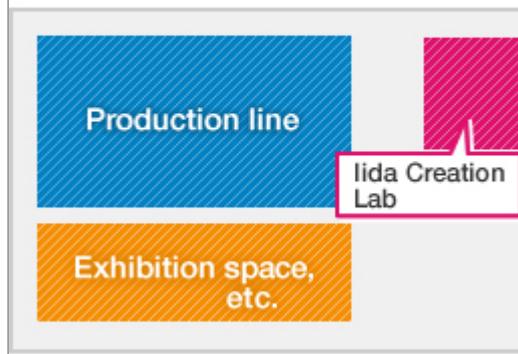
Project Members for minimo  
From left: Deguchi (design leader), Yamaguchi (production technology leader), Kinoshita (project leader), Miyake (production technology development assistance)

## **lida Creation Lab: Source of concurrent engineering**

The lida Creation Lab at the lida Factory was a key element in the concurrent engineering used to develop minimo. This lab houses parts and components for experiments and product development. It also hosts meetings at which project members exchange ideas.

The lida Factory is a production site without a formal development division. At the start of the project, space was created next to the factory entrance of the where all development team members could meet. The development site was located within a few steps of the production line to aid in fusing design and production.

### **lida Factory: manufacturing factory for motors and ventilators**



Creation Lab located next to the production line

Many manufacturing facilities aspire to concurrent engineering, but their actual development process typically involves technology developed separately because of the high degree of specialization required, with regular meetings to coordinate these disparate efforts. In contrast, all team members gather at the lida Creation Lab to inspect the manufacturing line that will be used and debate how to improve mechanisms and processes. Rather than trying to coordinate their efforts in a meeting room at a later date, the team members meet at the actual production site, making the lab an essential tool for effective concurrent engineering.



Engineers gather in the Creation Lab.



All team discuss ways to create the best product.

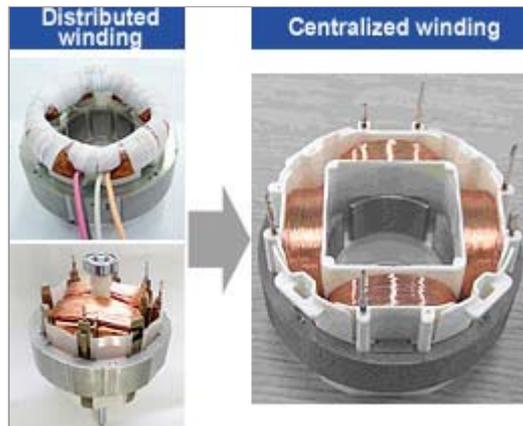
## New technology born from concurrent engineering – the minimo innovation

### Reducing primary loss, which accounts for 40% of power loss

#### Centralized winding used to reduce coil resistance by half

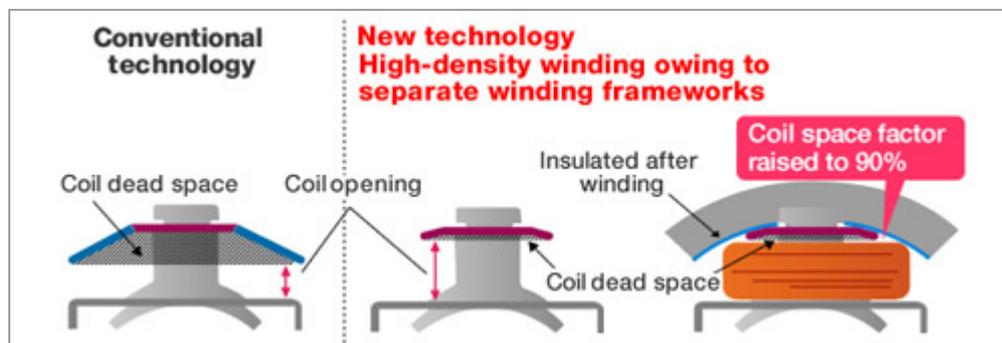
Reducing the size of a motor typically reduces its output and power efficiency. Coil innovations provide a way to make a motor compact while maintaining its efficiency.

Primary loss, the major power loss by a motor, refers to power lost due to heat from electrical resistance when current flows through the coil connected to the power source. This loss accounts for around 40% of losses in compact capacitor start motors. To reduce this primary loss, minimo uses concentrated winding in which the copper wire is directly coiled on the stator (the part of the fan motor that does not revolve), which differs from regular distributed winding. As a result, primary power loss from coil resistance is reduced by about half.



#### Coil space factor increased to reduce coil resistance 20%

A problem with centralized winding, which involves few slots, is that the amount of dead space increases. Dead space is where the copper wire cannot be wound because it is blocked by the framework that insulates the coil. To solve this problem, the framework was separated and the wire was wound around a portion that could not be used previously. Other insulating parts were inserted on the portion that juts out after the coil was wound. The coil space factor (ratio of the space occupied by the copper wire to the area of the slots) was increased 12% over conventional models, which enabled primary loss to be successfully reduced another 20%.



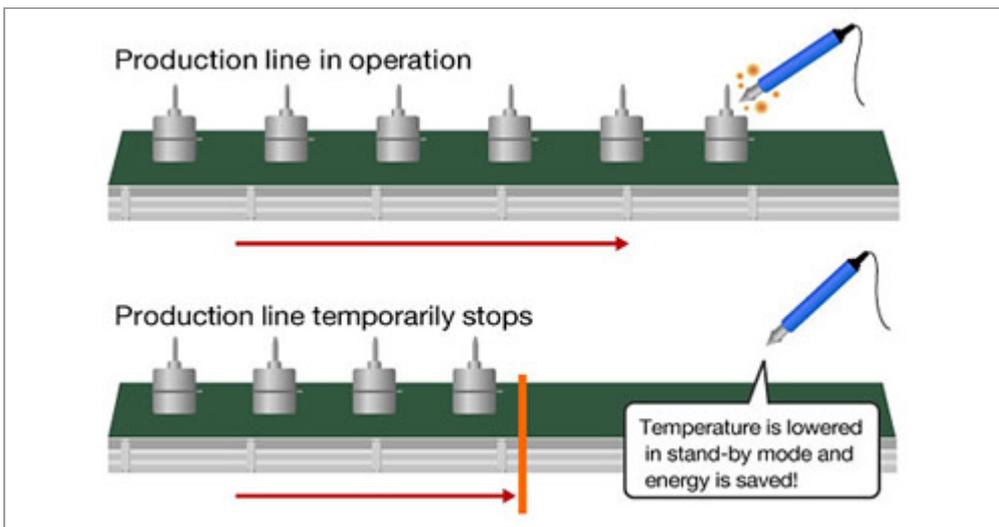
[Watch a video of minimo](#)



A high-speed, low-shock conveyor. To ensure the high precision required by minimo, the Manufacturing Engineering Center and Facility Development Division worked to develop a conveyor that is smooth, fast and does not jolt parts. Development of this equipment was not outsourced; instead, the production line was built concurrently with the design of minimo.



With conventional models, parts are supplied to the line by a robot that lays them out on a pallet. Switching to a direct-parts supply system made possible by a parts feeder manufactured in-house eliminated the manual laying out process upstream on the line.



The soldering trowel features a new mechanism that lowers the temperature in stand-by mode when the line stops temporarily. Thorough efforts were made to totally rationalize energy efficiency.

### Engineers' Perspectives

Concurrent engineering that integrates development and manufacturing is one ideal pursued by Mitsubishi Electric. This section presents the comments of the engineers who put concurrent engineering into practice to develop minimo, the ultimate fan motor.

#### **Building the best-ever production line for fan motors**

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Over the past 20 years, the Nakatsugawa Works has developed many exceptional fan motors, thanks to across-the-board automation. We have always engaged in concurrent engineering, which involves all divisions—sales, fan motor design, production technology and facility development—working to tackle challenges. When I was assigned to lead this project, I wanted to pass on the Nakatsugawa DNA to a younger generation. Moreover, I wanted to keep Japanese manufacturing alive. The goals of this project were to develop the "ultimate fan motor" while at the same time creating the best-ever production line for fan motors. I was confident that if we maximized the power of our concurrent engineering we would build the best production line, not only in terms of quality but also delivery times, cost and environmental factors.



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

#### **Passing on concurrent engineering to the next generation**

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We established the Creation Lab with a great view of the production floor as a place where team members could exchange ideas. This lab was created to put concurrent engineering into practice. The team members met for discussions almost daily, which resulted in innovations in motor design and manufacturing. Using this lab, we created minimo, but the biggest achievement for me was passing down the Nakatsugawa DNA to the younger generation. The Creation Lab concept is now not only at the production site, but at the Manufacturing Engineering Center. The lab will continue to be used for projects such as the development of elemental technologies.

I expect our younger employees to practice concurrent engineering and advance product development and manufacturing in a way that contributes to society and the environment.

## Objectives achieved without compromises

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On this project, I was most pleased that we made exactly what we intended to make—minimo. Normally in the development process, compromises are dictated by circumstances faced by each division, but on this project, all team members—fan motor design, manufacturing technology and facility development—did not compromise.

By not compromising, we achieved the project's objectives. Also, as team members with different specialties discussed issues in the Creation Lab they shared a common awareness of the goal. They developed minimo by working together at the Iida Factory. Design leaders tend to focus solely on product performance, but through this experience I learned that developing products that benefit society is done best with our approach.

In future projects, I plan to engage in development from a wide range of viewpoints, including those from the production floor and market identified by the sales team, and develop products with less environmental impact.



**Manabu Deguchi**  
Design Leader  
Nakatsugawa Works

## Think of products from design and manufacturing perspectives

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

I had been in the Motor Design Division for many years, but when this project started I was transferred to the Production Technology Department and put in charge of developing manufacturing-related technologies. I learned many things when I considered the product from the vantage point of manufacturing technology and asked the question: What does a motor need? I also deepened my awareness of the connection between products and the environment, something I did not give extensive thought to before.

I also came away with an appreciation for the effectiveness of people with different specialties forming a team and working to solve problems while exchanging ideas and opinions. As a result of constant discussions with other team members and pursuing the best product and manufacturing process, I now realize that Nakatsugawa's automated lines are the realization of concurrent engineering. This experience is not easily gained, even when desired. I am grateful for this valuable experience and hope to spread what I have learned throughout the Company and help raise the global competitiveness of Nakatsugawa Works.

## I would like to spread the DNA of motor development throughout the Company



**Nobuaki Miyake**

Production Technology  
Development Assistance  
Manufacturing Engineering  
Center

When Project Leader Haruo Kinoshita came to the Manufacturing Engineering Center in Amagasaki, he expressed his conviction that we must build an exceptional production line on par with overseas production to keep Japanese manufacturing alive. I empathized with his conviction and remember feeling that we must succeed.

The Nakatsugawa Works and the Manufacturing Engineering Center have made motors for 20 years. Our predecessors focused on ease of winding and proposed a structure with a split core, which made it possible to raise motor performance and automate its production. This led to the birth of Mitsubishi Electric's Poki-Poki motor. This DNA was passed on to the younger team members on this project, and after discussions that included engineers from other production sites, a one-of-a-kind motor and production line were created.

This basic integration of design and manufacturing is essential not only to producing exceptional products but also to protecting the environment. The Manufacturing Engineering Center intends to stay true to this DNA and work with all motor team members to make Mitsubishi Electric the world's No.1 motor manufacturer.

## Innovative Products and Production

### Working with the Community for the Environment

#### Environmental JIT activities by all employees

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The Nakatsugawa Works' Iida Factory, which began operations in 1974 as a ventilator factory, established a production floor for home photovoltaic systems in 1998. Together with the Nakatsugawa Works, the plant has made many products that benefit the environment. The Iida Factory reduces its environmental impact through such initiatives as Environmental JIT (just in time), which involves saving energy resources (electric power, gas and fuel oil), protecting river ecosystems by purifying wastewater and recycling coolant water, and promoting zero emissions by reducing waste volume and recycling.

The Iida Factory converts all the resources it uses, not just electricity and gas, but also iron, copper, aluminum and plastics, to carbon dioxide emissions so that each and every employee maintains a strong awareness of the environment during the course of their day-to-day work. For example, saving one ton of iron is equivalent to reducing carbon dioxide by 1.5 tons. Efforts are made to raise awareness of the fact that all improvement activities not only reduce costs but also are directly linked to environmental benefits. This serves to encourage all employees to participate in improvement activities (efforts to eliminate waste of all kinds).

#### Example of Environmental JIT

##### Delivery truck trips from parts supplier reduced by improving packing and raising loading efficiency



#### Working with government and citizens as a community environmental leader

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Iida, located in Japan's Central Alps, is involved in initiatives based on its own Environmental Plan in an effort to bring sustainability to the region. A leading initiative is using more photovoltaic power systems. Since fiscal 1997, Iida has carried out measures to encourage greater use of these systems, offering financial intermediation and interest payment subsidies to citizens who install them. Iida has been selected as an "Environmental Cultural City" for its efforts to become a low-carbon city that produces energy from the sun and forest. The city's efforts are expected to significantly expand Mitsubishi Electric's photovoltaic power system business.

Mitsubishi Electric participates in the Research Group for Regional Environmental ISO launched in Iida in 2000. This group has developed into an organization that is critical to the region's environmental and cultural progress. Its members are 29 local businesses, including the Iida Factory. As the deputy representative of the research group, factory employees give lectures at environmental forums held by local administrative bodies and participate in local environmental activities conducted by the private and public sectors and private citizens.

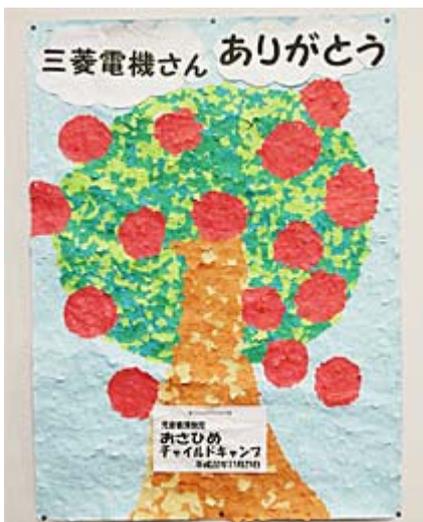
### Apple trees symbolic of a factory open to the community

The Iida Factory has 78 apple trees near its entrance that symbolize its environmental activities with the community. The trees were planted 35 years ago when the factory was established and express its basic stance of being open to the community, as the trees contribute to the environment by providing green space and replacing other types of fences.

Many employees have painstakingly cared for the trees. In the fall, they produce 35,000 apples, a local specialty of Iida. Every red apple is stenciled with the Mitsubishi logo, and these apples are one of the factory's celebrated products. They are given as souvenirs to people who tour the factory and are donated to local senior citizen centers and care facilities. In December, children from local care facilities are invited for an apple-picking event. The children express their appreciation in letters, often commenting on the great-tasting apples.



The Iida Factory has a row of apple trees instead of a traditional fence. The apples have the Mitsubishi Electric logo. There was a special version in 2008 to commemorate 40 years of producing duct ventilators.



A poster received from children who participated in the apple-picking event. The factory receives letters from children expressing their thoughts about the day.





**Yoshiyasu Shirokane**  
Plant Manager  
Nakatsukawa Works,  
Iida Factory

### **Valuing all resources and letting nothing go to waste**

These days, business must be discussed along with the environment. However, if environmental contributions are separated as a special activity, then progress becomes difficult. What is important is not letting anything go to waste. When every person is dedicated to avoiding waste—whether of energy resources like electricity and gas, materials like iron and copper, or things used at the office like paper—this will lead to everyday environmental activities. Based on this idea, the Nakatsugawa Works promotes its environmental activities as a "war against waste" with full employee participation. Reducing costs and expenses are essential, but it is also important that we use natural resources wisely.

Companies must also conduct activities with their communities. Environmental activities do not make much of an impact when conducted by a single company. I give lectures on the regional activities being promoted by Iida, and in my talks with people with a variety of local perspectives I have learned many things. I hope to deepen ties to the community and promote environmental contributions at the regional level based on a spirit of letting nothing go to waste.



### Automotive Equipment Initiatives in the United States

As a leading global automotive equipment manufacturer, Mitsubishi Electric has an obligation to reduce the environmental impact of automobiles.

This special feature focuses on two new Mitsubishi Electric initiatives in the United States, which is one of the most automobile-oriented countries in the world.

#### Rebuild Operations: Recycling in Action



Our Rebuild Operations in California.

[Click for details](#)

#### Providing Cutting-Edge Alternators



The forefront of alternator development and production is in the United States.

[Click for details](#)

#### Initiatives to Reduce Waste

Nearing the achievement of zero emissions, our U.S. facility turns waste into a saleable materials.

[Click for details](#)

## Rebuilding and Developing Automotive Equipment

### Rebuild Operations: Recycling in Action

#### Contributing to the Creation of a Recycling-based Society

Mitsubishi Electric Automotive America - Orange County (MEAA-OC) in California rebuilds starters and alternators.

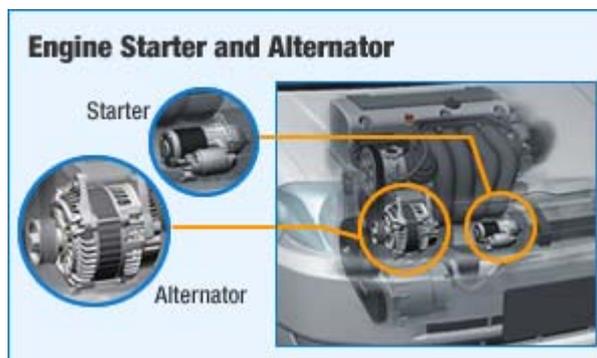
The starter, the first part of the engine to turn over, is the small motor that starts the engine.

The alternator is the power generator. The battery cannot supply a sufficient amount of power to all of the electrical components in an automobile, so the alternator is indispensable.

The alternator and the starter may fail if they are exposed to excessive severe environmental conditions or if they are subjected to excessive severe operating conditions. However, when it does, often only one part within the alternator has a problem, such as corroded electrodes or sliding parts worn from exposure to water. The alternator can be made to work like new simply by replacing just the parts that are broken or worn—this is the idea behind rebuilt components.



MEAA -OC in California



Mitsubishi Electric manufactures and sells automotive equipment at four U.S. locations. The first location was established in 1979 in California, where rebuild operations have been conducted for 30 years. The number of rebuilt products has increased and are now available for a wide range of vehicles, from standard and compact to large and heavy-duty. To improve our products, information from recovered core\* products is regularly provided to the development center in Japan.

The rebuild business reduces resource input and helps create a recycling-based society.

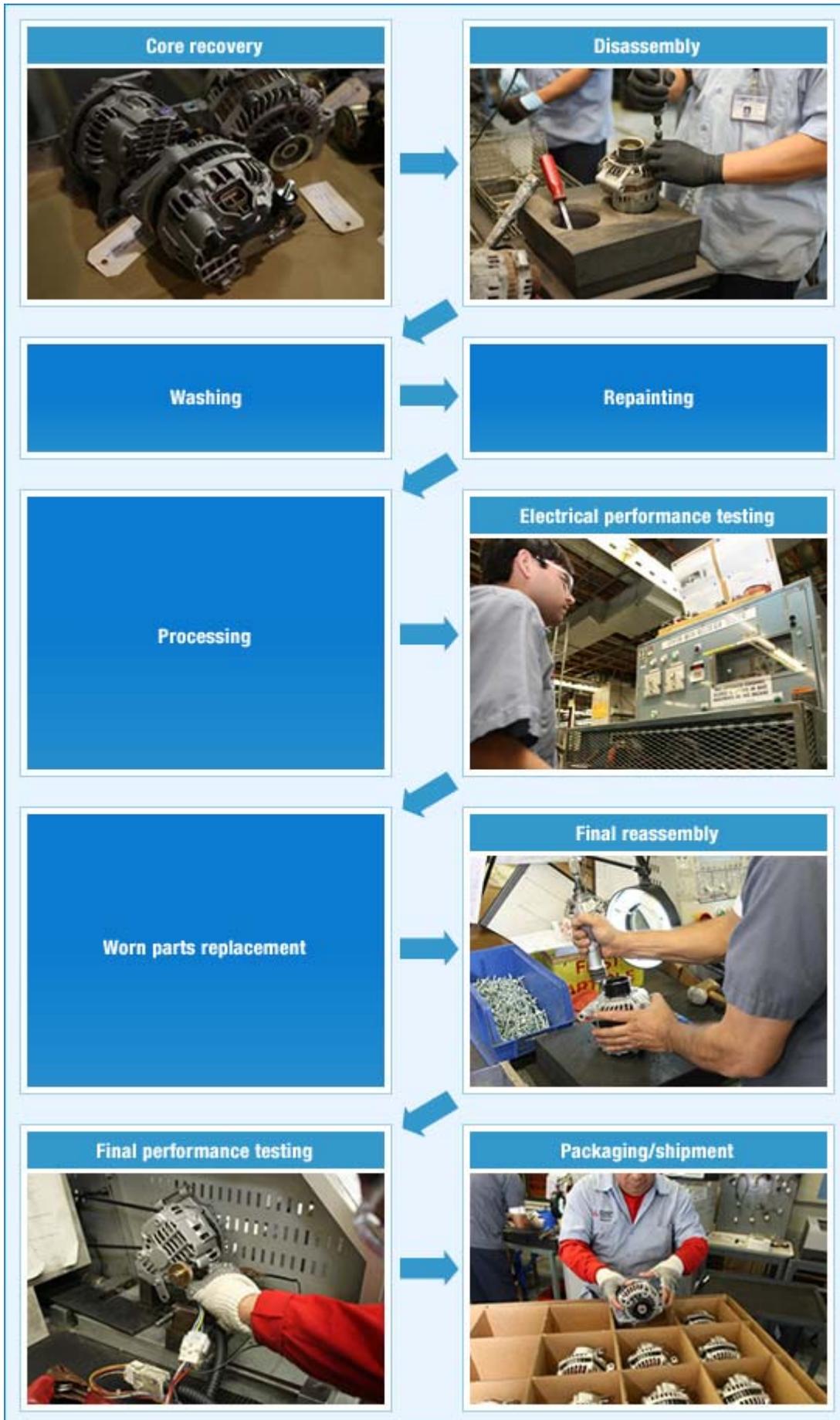
Mitsubishi Electric's alternators and starters recovered from automakers are used to create genuine rebuilt parts. Trusted by automakers, we will continue to expand our rebuild operations.

\*Core: Used alternators and starters that have broken down and need to be replaced.

	Wt. Per Unit (kg)			Monthly Core Build Qty.	Annual Resource Saved (tons)		
	Aluminum	Steel	Copper		Aluminum	Steel	Copper
<b>Starter</b>	0.50	2.25	0.57	1,822	10.93	49.17	12.39
<b>Alternator</b>	0.94	2.96	0.90	1,484	16.68	52.77	16.11
<b>Annual Grand Totals (tons) =</b>					<b>27.6</b>	<b>101.9</b>	<b>28.5</b>

#### Rebuilding Alternators

Alternators recovered from automakers are rebuilt as follows:



## Enthusiastic MEAA Orange County Employees

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Tadashi Katashima  
General Manager  
MEAA-OC

Five years ago, I was assigned to the MEAA-OC (OC) factory. At present, the factory's rebuild operations are growing steadily. Productivity has greatly improved, with stable supply capacity and quality. Our highly motivated local employees, who show great pride in their work, are supporting these activities.

For example, at our regular morning meetings, factory managers offer ground-breaking ideas to improve productivity and quality. This proactive attitude is evident in recycling, energy-saving and other activities designed to reduce our environmental impact.

At one time, California suffered from much air pollution, and beginning with the landmark Clean Air Act of 1970 (also known as the Muskie Act), various exhaust countermeasures have been implemented. Now, following the environmental countermeasures of the Obama Administration, California leads the nation in environment-related regulatory and aid policies, enabling OC and its employees to more fully develop their environmental awareness and engage in related activities.

I consider it my mission to make the most of my employees' motivation and awareness. By listening to everyone's opinions and ideas, and with the employees' help in expanding our rebuild operations, I will raise the level of satisfaction among our workers. I would like to continue our win-win relationship.



The upbeat California staff at MEAA show their power

## Providing Cutting-Edge Alternators through Japan-U.S. Cooperation

### Automotive Equipment R&D: Preventing Global Warming through Improved Environmental Performance

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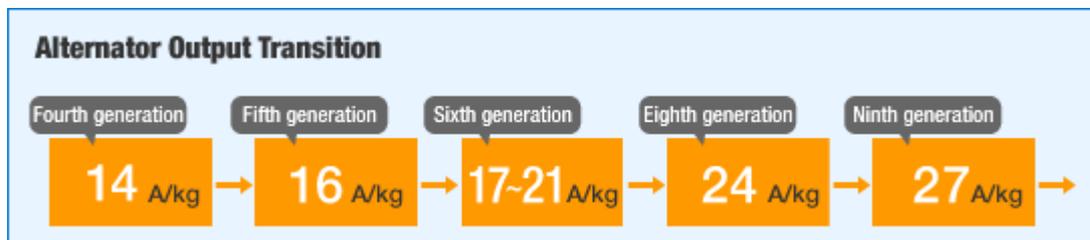
With advances in motors, the emphasis on high-efficiency alternators is growing. The Himeji Works is at the center of development activities to ensure optimal designs with the power supply necessary for each vehicle.

The Himeji Works began developing alternators in the 1960s in pursuit of high efficiency and high power output.

In addition to the sixth-generation and eighth-generation alternators currently in use, ninth-generation models were developed in 2006 (see below).

Ninth-generation models employ improved coil density through use of the pokipoki\* motor with optimized generator size, output and efficiency. This high output, combined with quiet operation, is an example of a product that accurately meets the needs of the times.

\*Pokipoki motor: motor densification achieved by wrapping coils around the extended core



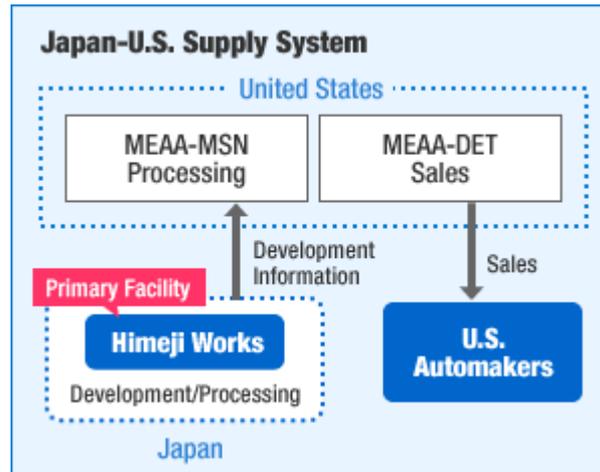
## Expanding Eco Products through Japan-U.S. Cooperation

Alternators and starters for the U.S. market are developed at the Himeji Works and manufactured at Mitsubishi Electric Automotive America—Mason (MEAA -MSN) in Ohio.

Despite being slow to respond to environmental needs, U.S. automakers are now shifting to the development of smaller, fuel-efficient, hybrid and electric vehicles under the Obama Administration's "Green New Deal." Mitsubishi Electric's automotive equipment business has expanded distribution of its high-efficiency, high-output alternators, which reduce fuel consumption. The Company has also increased the distribution of its small, lightweight starters. We are working with automakers to develop a full range of services, from development, production and supply, to spare parts and rebuilds. MEAA (-DET<sup>1</sup>, -MSN, -MVL<sup>2</sup>) is expanding America-wide sales of automotive equipment that contributes to lower environmental burden, while MEAA-OC carries out rebuild operations that reduce resource use.



MEAA-MSN(Ohio)



Mitsubishi Electric will continue to supply both OEM products and recycled parts to help reduce the environmental impact of the operation of automobiles in the USA.

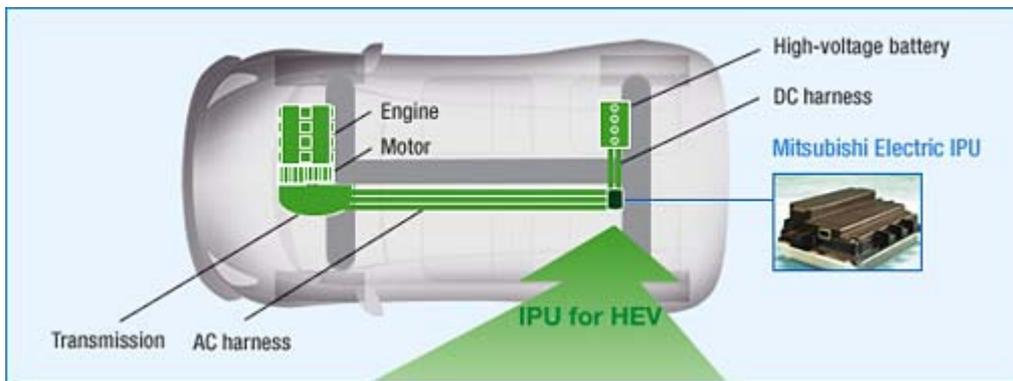
- 1 MEAA-DET: Mitsubishi Electric Automotive America—Detroit, in Detroit, Michigan
- 2 MEAA-MVL: Mitsubishi Electric Automotive America— Maysville, in Maysville, Kentucky

## Mitsubishi Electric's Contribution to the Use of Hybrid Vehicles

Hybrid electric vehicles (HEV) are becoming a realistic environmental option. These vehicles use Mitsubishi Electric's inverters, which convert battery power from DC to AC. These inverters also regulate optimal engine RPMs to contribute to energy savings. The HEV, which has an electric motor to reduce gasoline usage, also has a large-capacity gasoline-powered motor and battery. The necessity for an adjustable range and the demand for smaller, more efficient components are increasing rapidly.

Automakers use Mitsubishi Electric's Intelligent Power Unit\* (IPU), a DC/AC inverter unit between the battery and the motor that switches battery power from DC to AC. Recently, this unit has been employed in the Insight, made by Honda Motor Co., Ltd. Mitsubishi Electric plans on developing this product for automakers around the world, continuing to use its vehicle components and semiconductor technologies to meet the needs of automakers and contribute to vehicle-related environmental considerations.

\* Mitsubishi Electric's IPUs are referred to by Honda Motor Co., Ltd., as Intelligent Inverter Units (IIUs).



## **EGR Valve: Contributing to cleaner exhaust and reduced CO2 emissions**

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Most vehicles run on either diesel or gasoline engines. In diesel vehicles, the emission of nitrous oxides (NOx), a cause of acid rain, is particularly problematic. NOx is 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 NOx 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.



DC motor-based model

Stepper motor-based model

## From the Forefront of Alternator Development and Manufacturing

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Yutaka Ohashi  
Group Vice President,  
General Manager  
Himeji Works

When considering how we 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, circuit, structural design and other capabilities to suit automobiles will become increasingly important. We will continue to develop our technical capabilities and contribute to the creation of a 21st century automotive society that benefits consumers as well as the environment.



Shingo Tanimoto  
Senior Manager  
Rotating Electric Products Dept. A  
Himeji Works

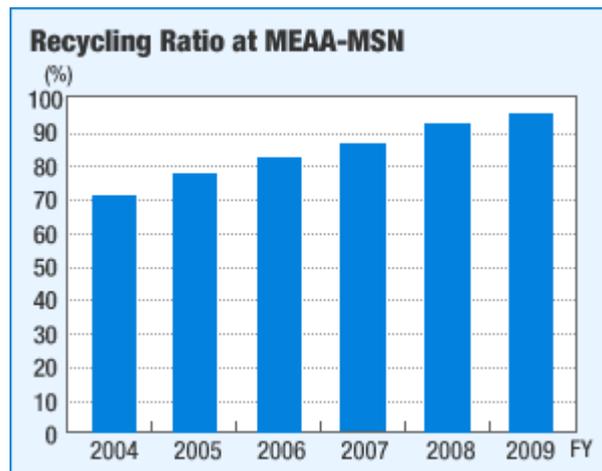
The Himeji Works has been developing alternators since the 1960s. Our consistent efforts to meet customer needs on all counts have enhanced our technological prowess and become the source of our dependable and highly competitive electrical components. As we pursue higher efficiencies going forward, we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

## Initiatives to Reduce Waste

### Just One Step Away from Zero Emissions

MEAA-MSN\* manufactures alternators and starters. Many of the parts it receives from Japan, as well as those procured locally, are all cushioned and packaged in cardboard boxes. The company also uses coils and other metal parts in its manufacturing processes. For the past 10 years, MEAA-MSN has been working to reduce the amount of cardboard, expanded polystyrene, metal shavings and other materials that ended up as landfill waste.

In the past, such waste was simply considered trash that companies paid to dispose of, but in addition to costing money, this method did not facilitate the reduction of landfill waste. MEAA-MSN began focusing on converting waste into something that could be sold—resources and products rather than trash. The company created a system whereby recyclers picked up these materials, and they introduced a number of ingenious processes along the way. Through these methods, the company promoted the complete recycling of everything from used work gloves to documents and memoranda. As a result of these efforts, in 2010 MEAA-MSN expects to achieve "zero emissions, zero waste" status.



\*MEAA-MSN: Mitsubishi Electric Automotive America — Mason, in Mason, Ohio

## Case study of Initiatives at MEAA-MSN

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Recycling box



EPS densification



Metal scrap separation



Cardboard baler

## Fostering Environmental Awareness: "Ecology = Economy"



Scott Stephenson  
Corporate Manager of  
Environmental, Safety and Quality  
Systems, MEAA-MSN

Including environmental ISO activities, for more than 10 years I have been working to reduce MEAA-MSN's environmental impact. During this period, the biggest issue that MEAA-MSN faced was reducing final landfill waste. We introduced a number of creative recycling initiatives, but found that the most important factor in putting them into practice was raising the environmental awareness of local staff. Our Environment, Health & Safety and Hygiene Department holds staff environmental training sessions once a year, themed on generating revenue by reducing the environmental impact of our everyday operations. In other words, in our training we adopted the bottom-line approach that "ecology equals economy" as we worked to instill the importance of recycling. Staff awareness changed as a result. Now the question "Can't this be recycled, too?" has become much more frequent.

I believe that this question describes in simple words the concept behind the priority themes of Environmental Vision 2021. At present, MEAA-MSN and MEAA-MVL\* hold quarterly management reviews and other activities that are designed to reduce our environmental impact companywide. Going

forward, we will work to encourage associates to share the concepts of the environmental vision as we take the next step along the path to our goal of zero emissions.

\* MEAA-MVL: Mitsubishi Electric Automotive America — Maysville, in Maysville, Kentucky



### Environmental Calendar

This calendar features environmentally themed pictures drawn by the children of MEAA-MSN employees.



### Plastic Tubes into a Calculator

An employee came up with this idea of turning scrap into a calculator, which is used at local elementary schools. This is considered reuse activity



### Scrap Wood into Bird Houses

Birdhouses made of scrap wood from incoming packaging. The first houses are being built for purple martins. The next step will be bat houses. This is also considered reuse activity.



## Towards Zero Emissions

The Environmental Vision 2021 program is a demonstration of the Mitsubishi Electric Group's commitment to achieving zero emissions status and promoting the 3Rs (reduce, reuse, recycle) in order to help bring about a recycling-based society. Completely eliminating waste that goes directly to landfills requires that waste be efficiently reused and recycled. Based on proposals made by local area environmental managers, Mitsubishi Electric has initiated a recycling system involving the coordinated efforts of multiple local production areas in June 2007. This type of system is actually quite rare in this industry, so it has garnered the wider attention of the industry as a leading example of progressive cross-regional waste recycling.

### ▶ Birth of a Recycling System

A group of environmental managers that met while attending a training course have successfully developed a completely unprecedented recycling system. Learn about the system and how it was developed.

[More](#)

### ▶ Recycling Examples

Learn about the coordinated efforts of local production areas involved in recycling cushioning materials, polystyrene foam and waste cooking oil and provides details on our recycling logistics.

[More](#)

### ▶ Future Development

Key environmental personnel discuss their thoughts on recycling and their future ambitions.

[More](#)

### Birth of a Recycling System

#### **Collaboration Begins with Environmental Training**

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In 2004 Mitsubishi Electric was faced with the retirement of a considerable number of experts who had long been involved in environmental management. So we initiated a training program for key environmental personnel with the aim of training a group of employees to play a leading role in our environmental management activities. This training program proved to be the genesis of recycling activities that cut across our local production areas.

Until the training program, key environmental personnel at our various manufacturing works had little opportunity to get to know one another. Through their conversations while attending the training course they learned that they shared many of the same challenges. This led a group of key personnel who worked close to one another in the Kansai region of Japan to form the Environmental Managers Committee with the aim of facilitating communication on environmental matters. The first committee meeting was held in April 2005. The participants discussed their various activities and shared their own expertise with one another. Talk centered on the problem of waste disposal. What began with how to make the management of waste disposal contractors more efficient ended up shifting to the fundamental problem of how to reduce waste.

#### **The Kansai Waste Recycling Working Group**

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At the time, the company's manufacturing works already had established processing methods for dealing with various types of waste and it was thought that there was little room for improvement. The committee, however, soon discovered that waste categories and amounts differed at each site and that things classified as waste at one site were being bought as supplies at another. As these discoveries were made they came to appreciate the importance of working together. So in April 2005 the Kansai Waste Recycling Working Group was established under the committee. The working group was Mitsubishi Electric's first project team dedicated to recycling that encompassed multiple production sites.

## From Reuse of Cushioning Materials to Recycling of Waste Products

The working group felt that reusing cushioning materials would be feasible right away. A considerable volume of cushioning materials used to package parts is generated as waste every month at the company's Kobe area sites, where large products like plant equipment for social and public institutions are manufactured. Itami Works, which makes electric components for automobiles, requires a large volume of cushioning materials to ship its products. In June 2006 we began supplying cushioning materials from Kobe to Itami, and the company took its first step toward coordinated recycling.



The project to reuse cushioning materials was eventually expanded into a recycling program for waste plastic sheeting and polystyrene foam that involves coordination among the Kita-Itami, Himeji and Ako Works. This has been further developed into a system by which waste from the various production sites is consolidated at one site, compacted and provided to an outside contractor that turns it into recycled plastic products. In addition, using waste cooking oil from employee cafeterias to manufacture bio-diesel and then using it to fuel forklifts was another idea that we successfully made a reality.

## A Recycling Logistics System that Eliminates Waste

A key question we sought to answer was, where should we bring waste and where should it be processed in order to improve efficiency? After an overall picture of waste reduction and recycling emerged, we next considered how to reduce carbon dioxide emissions in transportation. After considering various proposals, the Kobe, Itami and Kita-Itami Works inked a chartered delivery contract with one of the Kobe Works waste haulers and designed a transport route that would keep trucks fully loaded when moving between Kobe, Itami and Kita-Itami. For trips to the Ako and Himeji Works, which don't require anything from Kobe to be delivered to them, we made a request to the transport company that makes deliveries to customers in Himeji and Ako to stop by Ako and Himeji Works and load the truck with waste plastic sheeting and waste polystyrene foam for the return trip to Kobe.

Through this process, in June 2007, we completed a recycling system that promotes effective resource utilization via an environmentally conscious logistics system involving the coordinated efforts of our five manufacturing works in the Kansai region. The system was very well received outside the company as well, so much so that it was honored with the Chairman's Prize by the 2008 3R Promotion Persons of Merit Awards. We are also proactively providing information on the initiative in order to widely publicize it. These efforts have included exhibiting at the 2008 Environmental Fair in Ako and presenting recycling examples in the Kansai region to visitors as a part of the "City Factory Quiz Bus Tour" put on by the city of Kobe.

Our recycling logistics system has garnered attention for pioneering new possibilities in recycling. In November 2008, we launched a working group for the Kyushu region to move towards further expanding the scope of the system.





## Recycling Examples



## Recycling Cushioning Materials

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Cushioning materials that are no longer needed at Kobe and Kita-Itami are collected at Itami Works and reused as packaging material for product shipments. A specially chartered delivery truck is used to deliver the materials from Kobe to Itami. On its return trip, the truck is loaded with waste plastic sheets and waste polystyrene foam produced by Itami. When the route passes through Kita-Itami, the truck is loaded with cushioning materials, waste plastic sheets and waste polystyrene foam at Kita-Itami, the cushioning materials are dropped off at Itami, and the truck returns to Kobe Works after being loaded with Itami's waste plastic sheets and waste polystyrene foam. The system has reduced cushioning material purchases by Itami Works by around half, saving both costs and resources.



Genichiro Sasaki

Environmental Promotion Section, Production System Department, Semiconductor and Device Management Division  
Semiconductor and Device Group

At Kita-Itami Works, in the past we had only thought of waste in terms of semiconductor waste, but thanks to this experience I have realized the importance of everyone aligning their thinking, and not just thinking in terms of the narrow world of semiconductors. This recycling system has captured the wider attention of the semiconductor industry. We reported on the system in February 2008 at an international conference of the Japan Electronics and Information Technology Industries Association, and it was quite well received as a novel approach to resource recycling.

## Recycling Polystyrene Foam and Polyethylene Sheets

Waste polystyrene foam and waste polyethylene sheets are processed at a recycling center that has been established on the premises of Kobe Works. The waste plastic sheets and waste polystyrene foam produced by five of our manufacturing works, including Kobe Works, is collected together and processed all at once via compaction. The waste plastic sheets and waste polystyrene foam are collected from the Itami and Kita-Itami area on return trips from delivering cushioning materials. They are collected from the Himeji and Ako Works on return trips from making deliveries to customers. After the waste polystyrene foam and sheets have been compacted, the material is sent to a recycling contractor and turned into recycled plastic products.



Yasuo Kugimoto  
Environmental Management Group  
Production Management Department  
Himeji Works

In actuality it is more economical to thermally process polystyrene foam than it is to recycle it. In the past at Himeji we had it thermally processed by a vendor, but since this recycling method impacts the environment, we thought that it would be better to utilize material recycling even though it costs more. By consolidating recycling at Kobe, we've created an even more efficient, economical system. We plan to continue to expand by drawing on initiatives taking place at our various sites.



Kenichi Yoshioka  
Ako Production Management Section  
Production Systems Department  
Transmission & Distribution Systems Center

At the Ako Works, we formerly had an outside company thermally process polystyrene foam as a part of our ISO 14001 initiatives. However, I felt that integrated recycling at Kobe Works would be more effective in terms of reducing environmental impact.

At the Satoumi Symposium held recently in Ako, there was a presentation on participating in a project to have elementary school students grow eel grass and help make the local marine habitat suitable as a home for porpoises. I think this activity speaks to the fact that we as a company are engaging in these recycling initiatives out of respect for the earth's limited resources.

## Recycling Waste Cooking Oil

Equipment for producing bio-diesel was installed at Kobe Works' recycling center in June 2007. Waste cooking oil, which is produced in large volumes everyday by employee cafeterias, is collected and turned into bio-diesel using the equipment. The bio-diesel is then used to fuel forklifts and other vehicles at Kobe Works. Currently, all of the applicable work vehicles at Kobe Works run on bio-diesel, which helps to reduce the plant's environmental impact. We are also considering collecting waste cooking oil from local residents and cafeterias at other sites in order to further the environmental benefit of this program.



Yuji Ouchi

Environmental Promotion Group  
Production Systems Department  
Energy & Systems Center

Himeji and Kita-Itami Works handle smaller sized products, so they use electric forklifts to haul things around onsite. At Kobe Works, however, the products are larger, so they require vehicles with diesel-powered engines. We have cafeterias almost everywhere and they all produce waste cooking oil, so by adjusting output of waste cooking oil based on whether or not diesel is needed, we have improved the situation both in terms of waste and fuel.

## Future Development

### Building a Recycling System Helps Foster Environmental Awareness Looking Forward to the Challenge of New Initiatives

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Yuji Ouchi  
Environmental Promotion Group  
Production Systems Department  
Energy & Systems Center

With everyone thinking as a team about waste we were able to view the company as a whole from various perspectives. We realized that logistics is extremely important in building a recycling system, and we learned that judgments have to be made on whether it is better to haul something far away to recycle it or dispose of it at a nearby location instead.

I secretly hoped that this new initiative would raise the environmental awareness of equipment designers and manufacturing managers by providing feedback for their primary jobs. I felt that knowing how much waste we produce and directly experiencing the importance of recycling would inspire more designs and manufacturing processes that do not produce waste. As soon as the project got underway, environmental awareness increased dramatically at Kobe area sites. Mitsubishi Electric acquired its first Type III Eco Mark (part of Eco Leaf labeling, a program for evaluating a product's environmental performance). Other manufacturing divisions are currently developing similar systems. Moreover, in the Kyushu region, work has begun on building a recycling

governance system that encompasses our affiliates. I'm always happy to hear this kind of news. I look forward to taking on the challenge of new initiatives and continuing to help foster an environmental mindset within the company.

### Scaling Up Activities and Developing the Entire Company's Potential

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I think it is important that we think about the cost of waste when manufacturing products. We need to calculate the cost of waste that is generated and think about what can be improved to eliminate things that aren't necessary. If we do this, waste volume will go down while productivity goes up. Whether waste is sold or recycled, ultimately, it consists of things that aren't needed. Thinking about how to stop generating things that aren't needed is itself environmental management.

The working group's next goal is to scale up. We want to increase the types of waste handled by the system and increase the range of people involved. We also want to expand geographically to other regions. The system we built centers on the Kobe Works, but one can also imagine a system centering on the Ako Works that coordinates with Himeji Works and Fukuyama Works or one centering on the Kita-Itami Works that coordinates with Itami Works and Kyoto Works. Our goal is to have all domestic manufacturing works coordinate with one another so that each site is participating in various systems. We hope to develop the potential of the entire company, including the head office.



Tetsuji Nishino  
Manager, Environment & Infrastructure  
Maintenance Section  
Production Systems Department  
Itami Works