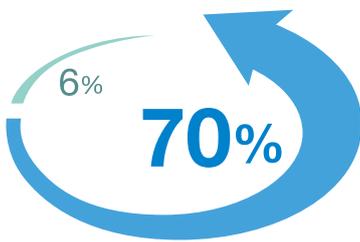


# ECO

# 2011



*Special Report*

## Perfecting Plastic Recycling Technology

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# Mitsubishi Electric will endeavor to make lasting contributions to society as it positions itself to become a leading green company.



### In the wake of catastrophe in Japan, we apply our wide-ranging strengths as a diversified electrical and electronics manufacturer to help with recovery.

First and foremost, I offer my sincerest condolences to those whose lives have been devastated by the Great East Japan Earthquake, and pledge the full support of the Mitsubishi Electric Group to aid the nation's recovery.

The cataclysm has shined a spotlight on the essentiality of public infrastructure, which includes the power grid, waterworks, gas lines, railways, and roads. As a diversified manufacturer of electrical and electronics products for power generation and power supply equipment, we are compelled to renew our awareness of the depths of our responsibility to society. Mitsubishi Electric Group companies must aid in Japan's recovery by placing emphasis on supporting restoration of social infrastructure. This includes restoring thermoelectric generation facilities, producing new power generation facilities, and restoring private use power generation equipment and elevators in disaster stricken areas. At the same time, we must focus on supplying industrial equipment and other products that have widespread social demand.

Japan's power supplies are expected to face challenges for some time to come, so we must lead in the conservation

of energy by accelerating our existing programs in manufacturing efficiency, and by controlling operations-related energy consumption. We must further develop and popularize LED lighting, highly efficient air conditioners, energy-saving refrigerators, and renewable energy systems and equipment such as photovoltaic power.

### Striving to consistently create value by strengthening our corporate constitution and contributing to society.

The Mitsubishi Electric Group optimizes its manufacturing activities and develops energy-saving products and renewable energy systems in accordance with our established Environmental Vision 2021. This Vision represents the company we aim to become by the 100th anniversary of our founding in 2021. However, 2021 doesn't represent an ending in any way. Our ultimate goal is ongoing—to be a company that consistently creates value, one that is relied upon for continually answering the call of society by perennially evolving in tune with its ever changing needs.

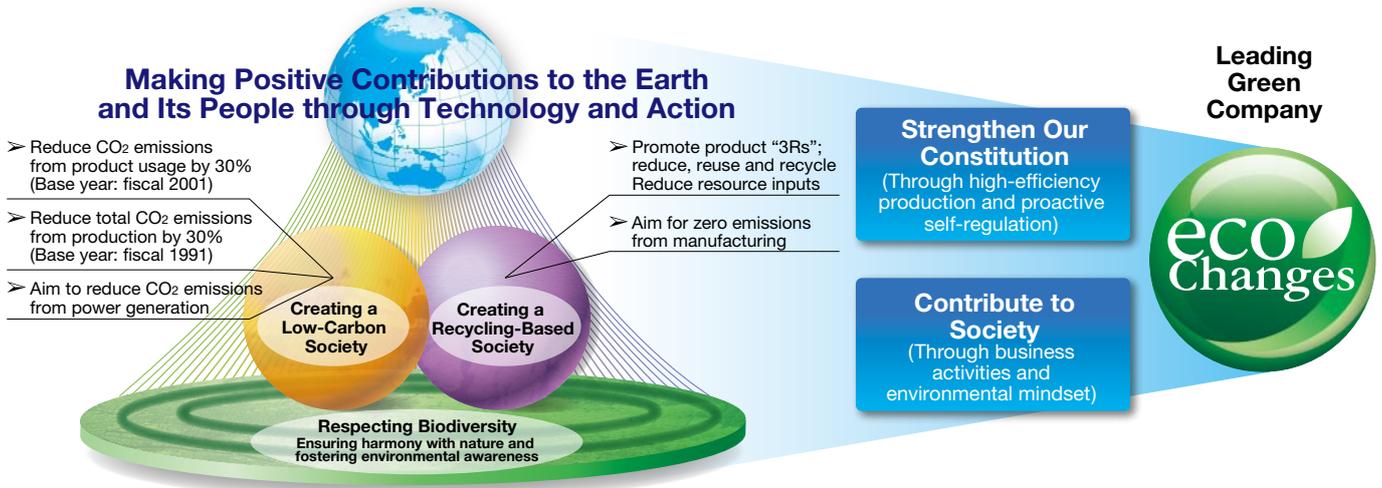
To this end, I believe it is essential for us to do two things at once: strengthen our corporate constitution and contribute to society.

By strengthening our corporate constitution, I mean disciplining ourselves to use less energy and fewer resources while manufacturing in a responsible, self-regulated manner, and increasing production efficiency to its highest level. This is a basic stance all manufacturers should maintain to help achieve a low-carbon and recycling-based society.

By contributing to society, on the other hand, I refer to striving to ensure that some sort of environmental benefit or improvement is delivered when people use our products and services. To this end, we are improving our technologies and knowhow, are thoroughly investing in the creation of products and services capable of providing such benefit, and offering them to society.

As a diversified electrical and electronics manufacturer, Mitsubishi Electric has an expansive base of products that have an immeasurable impact on society. It is imperative that we also contribute by taking on the challenges of the future, such as smart grid technology, which will make it possible to expand the use of renewable energies, and large-scale, high-purity plastic recycling operations, which Mitsubishi Electric began in 2010.

## Environmental Vision 2021



### Mitsubishi Electric is aiming to be a global leading green company that helps to enrich society locally and regionally.

As an entity with business facilities and expanding operations in countries all over the world, I believe the Mitsubishi Electric Group has an obligation to establish its position as a global leading green company. Clearly we must develop our operations with the interest of the entire world in mind, pursuing a strengthened corporate constitution and contributing to society while answering the call of society's needs.

Currently, close to 35% of the Mitsubishi Electric Group's sales comes from outside Japan, and we look to increase this to 40% as soon as possible. Moreover, I would like to boost the rate of overseas production, but this is different from pursuing a strategy of manufacturing in regions where the costs are lowest. What we are aiming for is advancing operations while contributing to various countries and regions through local production and consumption. That is, manufacturing in locations that are close to the end user.

Local production and consumption includes not only social contribution through promoting products with high environmental performance, but also contributing to the development of the local economy and society through local hiring and procurement. This also strengthens our corporate constitution because benefits such as lower transportation and procurement costs mean higher operating efficiency. I believe this is our reason for being: to become a leading green company in multiple countries and regions, and contribute to the local society and environment. This is the path to becoming a positive force that is essential to the world.

### Applying our unique resources and embracing local expertise worldwide to carry out Eco Changes.

The Mitsubishi Electric Group's corporate statement, “Changes for the Better,” was established on the 80th anniversary of our founding in 2001. It expresses our commitment to continuously adapt and evolve in the unwavering pursuit of excellence and improvement. It is also the seed from which grew our

environmental statement, “Eco Changes – from in the home to outer space,” which we introduced in Japan in 2009. This statement expresses our stance on environmental management, and our commitment to working together with customers to change the global environment for the better, and contribute to environmental conservation through our vast range of products. Outside Japan, we launched the environmental statement, “Eco Changes – for a greener tomorrow,” in 2010.

We have positioned Eco Changes on an equal footing with Changes for the Better to emphasize to those inside and outside of the company our determined conviction that any product or business activity that lacks the perspective of environmental performance or improvement should not exist. Moreover, activities carried out around the world must be grounded in local reality. I believe that across the globe it is natural for customers to choose products with low environmental impact and high functionality. Such products must be spread among society, which is a role Mitsubishi Electric seeks to fulfill, because Eco Changes represents not just a call to the world, but a petition upon us.

Japanese products are generally considered to be of high quality globally. However, I believe that advanced environmental technology and sincere environmental conservation initiatives are important and unique resources that Japan can offer to the world with pride. Likewise, each country has its own unique “resources,” from which we must learn. It is how we will further promote our Eco Changes concept.

Companies become stronger when they have a broad diversity of individualities, abilities, and knowhow. This also strengthens a company's constitution. The Mitsubishi Electric Group aims to be a global leading green company by combining the better resources of Japan, Asia, Europe, America, and elsewhere to continuously contribute to global society, now and into the future.

*K Yamanishi*  
**Kenichiro Yamanishi**  
President & CEO

## Dialog on Environmental Management Reducing CO<sub>2</sub> Emissions from Production

Mitsubishi Electric has established an Environmental Plan and is implementing wide-ranging energy conservation measures. The company calls on outside experts to assess whether its conservation efforts are adequate, which can help uncover issues previously overlooked, and provide important indicators for the future. On April 6, 2011, Professor Yoshihiko Takamura of Tokyo Denki University was invited to participate in a dialog on environmental management.

**Yoshihiko Takamura**  
Professor, Tokyo Denki University  
Councilor, Energy Conservation  
Center, Japan



Professor Takamura has participated in the process of revising the Act on the Rational Use of Energy on several occasions and is one of Japan's foremost experts in energy conservation research.

### Topic 1: Energy Conservation Activities

#### Measuring Energy Consumption and Discovering Waste

Mitsubishi Electric's product lineup includes the Eco-Monitor, an electric power measurement system that provides highly effective support for energy conservation. To minimize energy loss, Mitsubishi Electric has since 2004 been installing Eco-Monitors at production lines and facilities at its factories in Japan and engaged in activities to discover and eliminate waste using data collected on energy usage. Graphs displaying per-unit numbers that compare electricity use measured by Eco-Monitors and production volume, helped identify areas and time periods of electricity consumption during which no production was taking place, and link measurement results to production efficiency improvements.



**Mr. Takamura:** It is very good that Mitsubishi Electric has measurement devices developed in-house to conserve energy. I think that making measurement the starting point of energy conservation activities is one reason for these effective results.

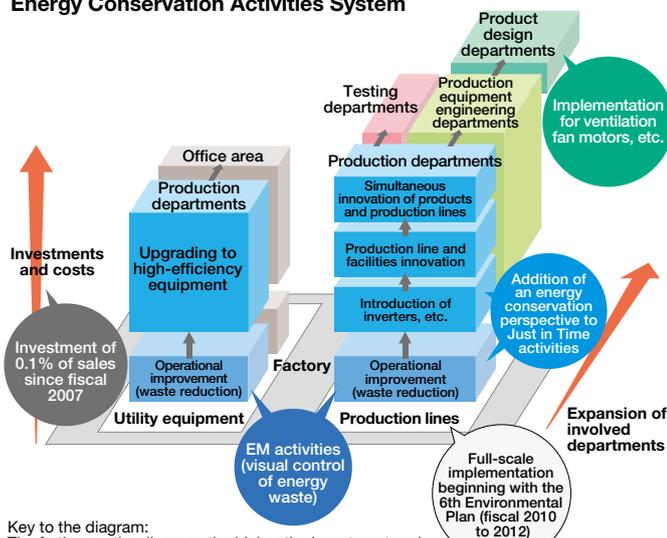
#### Deploying Effective Energy Conservation Practices and Introducing Different Perspectives

Mitsubishi Electric considers horizontal, or company-wide deployment of effective practices to be a critical and fundamental business function. Information sharing is ensured across organizational boundaries between business groups and factories. Companywide Environmental Promotion Managers' Conferences are attended by the environmental managers of each business group, and Energy Conservation Best Practice Presentations are attended by the persons responsible for energy conservation at all factories in Japan. Case files containing effective measures implemented at each factory are utilized in energy conservation activities.

Energy conservation inspections are performed by experts and mutual inspections are carried out between business sites. In the mutual inspections, a team of qualified energy managers drawn from the various factories spends an entire day visiting a worksite to make inspections and propose improvements. In the energy conservation inspections performed by experts, energy conservation pioneers, old hands and other experienced personnel make the rounds of factories in Japan and overseas. These activities are useful for expanding the scope and potential of energy conservation measures at our factories and contribute to the development of young employees.

**Mr. Takamura:** I sense that Mitsubishi Electric places importance on awareness attained through the introduction of different perspectives and actively engages in activities to promote this. With regard to the development of young employees, the issue of skills succession has become a hot management topic in recent years. I think this is a very positive trend, even with respect to energy conservation. I think it would be good to take this a step further by incorporating perspectives from different industries.

#### Mitsubishi Electric's Factory Energy Conservation Activities System



Key to the diagram:  
The farther up the diagram, the higher the investment and cost required and the greater the difficulty. The farther back, the higher the number of involved departments.



## Topic 2: Linkage with Management

### Management Involvement in Energy Conservation Activities

The ISO 14001 revision of 2004 compelled Mitsubishi Electric to integrate environmental management systems into its main business activities. In response to this, since the launch in fiscal 2007 of the company's 5th Environmental Plan, a full-scale environmental management plan, 0.1% of sales have been invested in energy conservation. In addition, in the current 6th Environmental Plan (covering the period of fiscal 2010 to 2012), we are focusing on reducing CO<sub>2</sub> from production by implementing two key measures: the replacement of utility equipment with high-efficiency equipment, which requires planned investment, and production line improvements involving the elimination of waste during production. To more vigorously promote production line improvements, on April 1, 2011, we launched the Productivity Promotion Group, an organization empowered to implement improvements, including technology development.

**Mr. Takamura:** I think that investing 0.1% of sales in energy conservation is a significant commitment. Recent years have brought a steady stream of introductions. For instance, insulation materials, LED lighting, nano-processing technologies, and measurement control technologies. I think that proactive inclusion of such new technologies in energy conservation investment will enable Mitsubishi Electric to continue to achieve wide-ranging innovations.

### Expanding the Scope of Energy Conservation Efforts

Even Mitsubishi Electric's facilities engineering departments participate in production line improvement activities. The scope of activities is being expanded to include a farther upstream product design process, and successes include shortened production lines and increased efficiency through size and weight reduction at the product design stage. Energy conservation at the quality control test stage was also enacted. Since this testing involves verification of whether products function under harsh conditions, the tendency has been to consider the testing process different from production lines, and

off-limits for energy reduction. However, actual measurement of electricity use showed that at some factories the testing departments account for 15% to 30% of total electricity use.

**Mr. Takamura:** It is important to initiate improvements at departments not previously covered by improvement efforts. By all means, I hope that you will carry on with this initiative.

## Topic 3: Per-Unit Target Management

Mitsubishi Electric's Environmental Vision 2021 initiative sets a target of 30% reduction in total CO<sub>2</sub> emissions from production, and the factories aim to achieve the target by the year 2021. At the same time, to pursue higher productivity at the factories, per-unit indicators are employed to manage energy use.

**Mr. Takamura:** Since per-unit management at production sites is desirable, I believe it necessary to use targets for both total volume and per unit as performance indicators.

## Topic 4: Energy Conservation at Offices

Mitsubishi Electric set up model areas in offices and conducts demonstration tests. In 2010, Eco-Monitors were used to monitor and analyze electricity consumption, and electricity reduction activities focused on lighting, which accounts for approximately 60% of energy consumption outside of air conditioning.

**Mr. Takamura:** I think that beginning with measurement and analysis and then devising efficient ways of using lighting is an excellent approach. If I may make a proposal, it would be effective to decide upon a person responsible for each model area and encourage all employees in the area to follow the lead of the person responsible and devote themselves to energy conservation activities.

**Read the Full Dialog on the Web**

[Dialog on Environmental Management](#)



**Masaharu Moriyasu**  
Executive Officer in Charge of  
Total Productivity Management  
& Environmental Programs  
Vice President  
Corporate Total Productivity  
Management & Environmental  
Programs Group

### We must incorporate energy conservation into management.

Professor Takamura's review confirms that our energy conservation activities to date have been on target. Our achievements stem from applying our experience and knowledge to the task and engaging in energy conservation as a management priority, investing 0.1% of sales in energy conservation and implementing measures as part of a group-wide environmental plan. However, we may not be able to keep on achieving such results. Now that we have taken energy conservation to the limit, we must increase the amount of investment to achieve further advances. To move beyond this limit, we must further incorporate energy conservation into management. We have been simultaneously pursuing strengthening of our corporate constitution involving production with less energy and fewer resources, and social contribution through providing products and services that contribute to environmental improvement. The dialog with Professor Takamura indicated that we have reached the stage where it has become necessary to integrate efforts to strengthen our corporate constitution and social contribution.

## Eco Changes in the Making

### Spreading the Message at EPIF 2011

In June 2010, Mitsubishi Electric launched its environmental statement, “Eco Changes – for a greener tomorrow” outside Japan. As a diversified electrical and electronics manufacturer with a commitment to make environmental contribution a priority in all countries in which it operates, Mitsubishi Electric is aiming to become a global, leading green company, and promoting its Eco Changes initiative on a global scale. India, a rapidly-growing powerhouse, is one example in which Eco Changes is playing a central role in the company’s business activities.

for a greener tomorrow



#### Environmental Changes for the Better

Mitsubishi Electric’s corporate statement, “Changes for the Better,” reflects a culture of seeking constant improvement, and making positive changes in the pursuit of excellence. It is the seed from which grew “Eco Changes – for a greener tomorrow,” the company’s environmental statement, which expresses Mitsubishi Electric’s stance on environmental management, and establishes a framework for creating a more sustainable future side-by-side with customers.

Eco Changes occur when all business activities—from design and development, to manufacturing and distribution, usage and ultimately to recycling of products—are carried out with environmental considerations first in mind. Such a mindset not only helps balance economic development and the pursuit of a comfortable lifestyle with preservation of the environment,

but also provides new insights into how to contribute to a sustainable society.

By combining the unique insights and specialized knowledge of multiple countries all over the world, Mitsubishi Electric aims to be a leading green company on a global scale, making lasting contributions in every society in which it operates.

India is one such society, and an important place for Mitsubishi Electric. In September 2010 a new comprehensive sales company, Mitsubishi Electric India Private Limited (MEI), was established to market and distribute a range of environmentally well-considered consumer and industrial products and devices, and also to support the infrastructure-related systems business in the rapidly-growing country. Mitsubishi Electric India possesses unique potential to demonstrate Eco Changes on a scale that shows how a leading green company operates in a globalized world.



Striking an “Eco Changes pose” at Eco-products International Fair 2011 in New Delhi.



“Eco Changes – for a greener tomorrow” demonstration in progress at the Mitsubishi Electric booth.



Air Conditioning



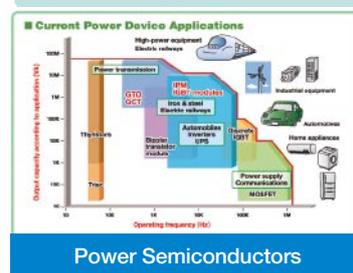
Factory Automation

## Eco Changes Takes Center Stage

The official corporate launch ceremony of Mitsubishi Electric India Pvt. Ltd., attended by some 200 customers and business partners, was held in New Delhi in February 2011. During the ceremony, Mitsubishi Electric announced its determination to promote the Eco Changes initiative, and its desire to work hand-in-hand with customers in India to create eco changes that help achieve environmentally responsible growth.

The message of Eco Changes was also the centerpiece of Mitsubishi Electric's booth at the 2011 Eco-products International Fair (EPIF)—Asia's largest international fair focusing on eco-related products and solutions—which was held simultaneously in New Delhi. The main theme of EPIF was "Green Productivity for Sustainable Energy and Environment," and some 80 organizations operated booths.

The occasion provided an ideal opportunity to celebrate the launch of Mitsubishi Electric India, and to communicate the concept of Eco Changes to both the company's workforce as



Power Semiconductors

well as India at large.

Mitsubishi Electric's presence at the fair included exciting visual presentations introducing the company's products and services. A staff of more than 70 actively engaged with EPIF visitors, which included business persons and government officials, as well as groups of students with a keen interest in creating a greener future.



At left, the popular photovoltaic energy display. At right, demonstrating Japan's first large-scale, high-purity plastic recycling system.

### Learn More About MEI and EPIF 2011 on the Web

Eco Changes in the Making



**Rajeev Sharma**  
Deputy General Manager  
Strategic Planning &  
Business Development  
Mitsubishi Electric India  
Pvt. Ltd.

I had a very productive dialog with many people I met at EPIF 2011, and I found it especially satisfying to spend time educating young students about Eco Changes, as they are the inheritors of the 21st century. I think India is showing a higher interest in environmentally responsible products and adopting them. Mitsubishi Electric is an environmental leader—a leading green company—eager to take on responsibilities related to the environment under the banner of "Eco Changes – for a greener tomorrow."



**Shinji Yamabe**  
Managing Director  
Mitsubishi Electric India Pvt. Ltd.

## Sustainable Growth with India

The great response from EPIF 2011 visitors to "Eco Changes – for a greener tomorrow" was a very encouraging signal to us, as we eagerly want to be part of India's pursuit to become one of the most environmentally responsible countries in the world, while maintaining steady and rapid economic growth that is inclusive of the entire nation. Our wide range of products with environmental technologies and features are well-suited to India's demand for energy conservation, and I'm proud to be able to say that Mitsubishi Electric's business growth in India itself will contribute to the preservation and improvement of the environment in India. To this end, Eco Changes is our clear message, which also inspires people to visualize and consciously create an environmentally responsible society. We look forward to growing together with India as a global, leading green company.

# Perfecting Plastic Recycling

Plastic is a way of modern life. It brings practical conveniences and benefits to individuals on a daily basis, and makes new ideas achievable in everything from product design and infrastructure engineering to manufacturing and construction. But its ready disposal can harm ecosystems. This makes an effective method of collecting old plastic and reprocessing it into new plastic material for industry a fundamental technological challenge of the 21st century. In Japan, the nation's Home Appliance Recycling Law, enacted in 1998 and enforced since 2001, compelled the country's home appliance manufacturers to set up processes and confront head-on the challenge of transforming Japan into a recycling-based society. Mitsubishi Electric responded by establishing in 1999 its first dedicated recycling operation,

## New Paradigm in Industrial Conservation

Soon after Mitsubishi Electric established Hyper Cycle Systems in 1999, the quest for the profitable recovery of high-purity plastics began in earnest. The goal was the mass scale recycling of plastic for reuse in the manufacture of new products capable of meeting the standards of durability and safety consumers demand.

Mitsubishi Electric perceives a recycling-based society as one where recycled materials are a manufacturing company's veins, which flow into its arteries of new products. Achieving such a society calls for a new type of "sustainable recycling" industry, where the maximum amount of marketable materials are reclaimed from old products and processed into new, industrial-grade "raw materials." This is a new paradigm in industrial conservation, capable of significantly offsetting the enormous consumption of petroleum and other resources, as well as the negative environmental impact of manufacturing products from completely new materials.

With the establishment in 2010 of Green Cycle Systems, Japan's first large-scale, high-purity plastic recycling system, Mitsubishi Electric put in place a fundamental pillar of the recycling-based society. Hyper Cycle Systems and Green Cycle Systems together demonstrate a model business that firmly positions the entire electrical home appliance industry at the forefront of recycling in Japan.

## Focused on the Future

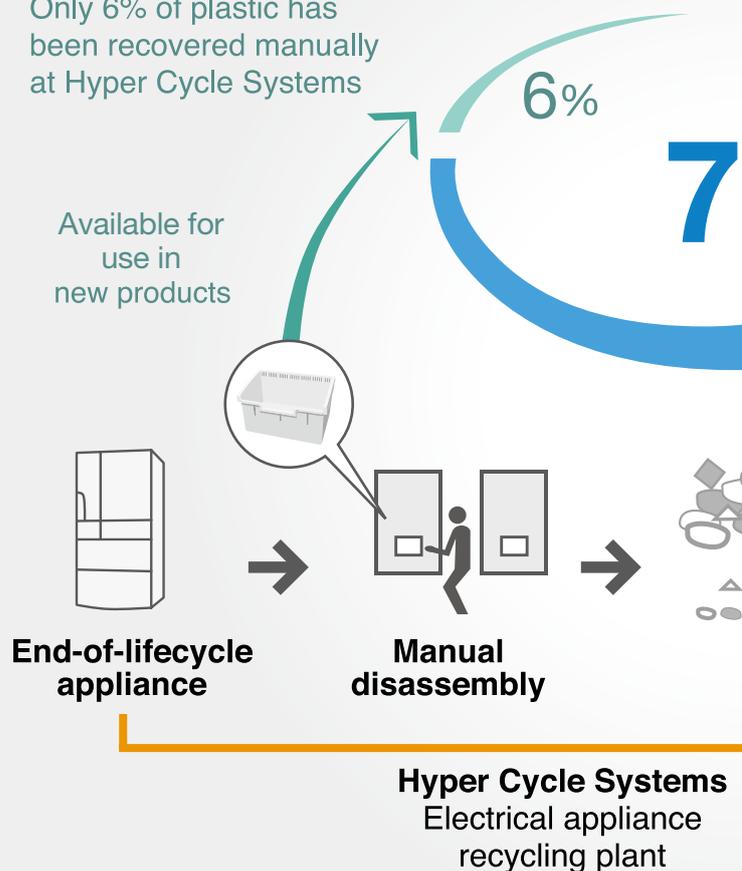
Making our facilities pleasant and inspiring places to work, as well as crucibles of innovation, is a fundamental principle at Hyper Cycle Systems. We have a clean, safe and efficient work environment, at which we turn materials from old products into valuable resources of benefit to society. Our advances in materials separation and other technologies enable us to say that we have laid down firm fundamentals for a successful recycled materials business. But we're really just scratching the surface, and will continue working to establish Mitsubishi Electric as the nucleus of a sustainable future.



**Takashi Hishi**  
Executive Corporate Adviser  
Hyper Cycle Systems Corporation

## Mitsubishi Electric's Large-scale,

**Breaking the 6% Barrier**  
Only 6% of plastic has been recovered manually at Hyper Cycle Systems



## Hyper Cycle Systems Corporation

Workers at Hyper Cycle Systems manually disassemble end-of-lifecycle home appliances in a clean, comfortable and spacious environment, which is critical for efficiency and productivity. Custom-developed automated processes, including proprietary Mitsubishi Electric machinery, do the rest; fine-crushing the products, separating metals and plastics, and further crushing them into mixed plastic flakes.



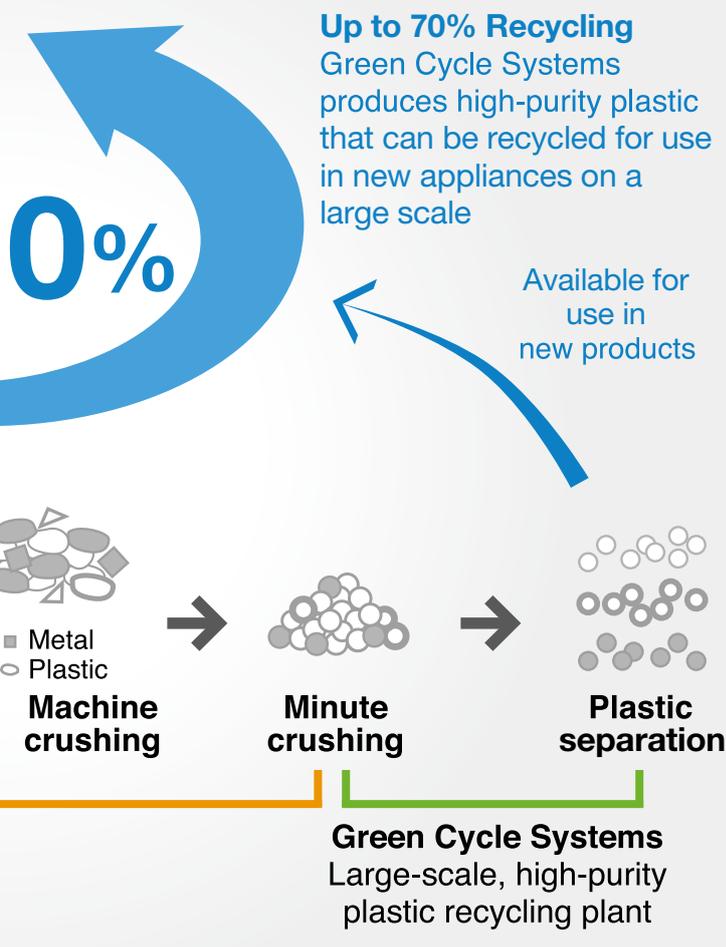
# Technology

Hyper Cycle Systems. Today the company is a leader, having successfully set up Japan's first large-scale, high-purity plastic recycling system, made possible in 2010 by the launch of its high-grade plastic recycling plant Green Cycle Systems. No other company has yet to achieve such scale. Mitsubishi Electric has created a new industry in Japan that is poised to make the recycling of plastics as conventional as the recovery and reuse of metals, which have long been recovered for industrial use.



<b>More on the Web</b>	<b>Environmental Topics "Plastic Recycling Comes of Age"</b>
	<a href="http://www.MitsubishiElectric.com/company/csr/ecotopics/plastic_sp/">http://www.MitsubishiElectric.com/company/csr/ecotopics/plastic_sp/</a>

## High-purity Plastic Recycling



## Major Tipping Point in Plastic Rejuvenation

Hyper Cycle Systems is a working laboratory at which engineers and technicians from across the Mitsubishi Electric Group convene to collaborate and develop the backbone of a sustainable future. The company's fine-crushing and advanced separation technologies have long been able to extract metals and plastics from end-of-lifecycle home appliances, but the amount of recovered plastic that could be reused in products still remained at the low rate of approximately 6%. The rest could only be used as ballast for fuel, or as low-grade plastic for non-durable items.

However, further innovation in separation technologies and chemical engineering to reinforce the durability and quality of recovered plastics has changed the equation. At Green Cycle Systems, the shredded mixed plastic recovered at Hyper Cycle Systems is separated into the three major types of plastic\* that can be recycled for reuse in home appliances, and processed on a large scale at purity levels exceeding 99%. Through this system, the recycling ratio of high-grade plastic that is available for use in new products has increased more than tenfold—from 6% to a maximum of 70%.

This achievement represents a major step towards establishing a completely new, sustainable plastic recycling industry.

\* Polypropylene (PP), polystyrene (PS) and acrylonitrile-butadiene-styrene (ABS)

### Green Cycle Systems Corporation

Hyper Cycle Systems supplies mixed plastic flakes to Green Cycle Systems, which separates the flakes into three major types of plastic at high levels of purity, and refines them into industrial-grade plastic material for recycling in the manufacture of new, safe and durable products. Moving forward, a proactive policy to expand the business will define Mitsubishi Electric's sustainable recycling commitment, by processing the plastic recovered by the recycling operations of other manufacturers.



### Sharing Expertise Nationwide

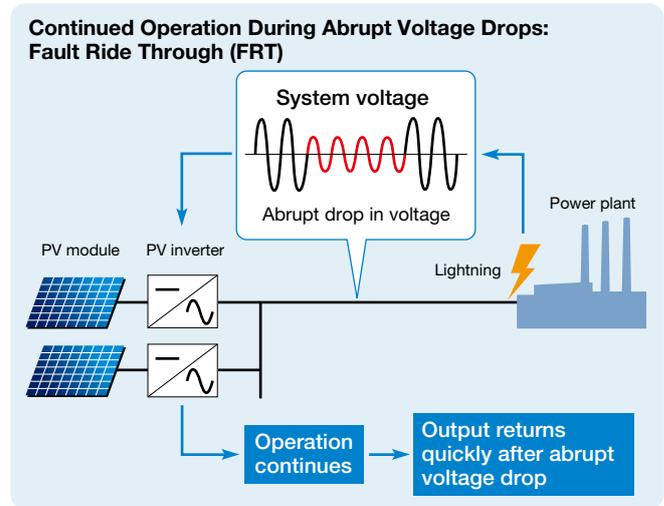
Green Cycle Systems produces an important commodity from old plastic recovered from home appliances made by a variety of manufacturers. Since we benefit from our competitors' end-of-lifecycle products, we figure we should give back to the industry accordingly. We aim to expand the scale of plastic recycling in all of Japan, so encourage other recyclers to make use of our unique expertise in large-scale, high-purity plastic recycling. We will also consider opening more plants at a feasible pace, which I believe is essential for the betterment of the industry and the future of Japanese society.



## Large-Scale Testing for Stable PV Power

Power generated by photovoltaic systems can be interrupted by abrupt drops in voltage due to lightning, which causes the PV inverter to stop automatically to protect the equipment, and restart simultaneously with the recovery of voltage. However, if the power generated during the five to ten seconds it takes to restart is not converted, the system may be negatively affected.

In February 2011 Mitsubishi Electric carried out a large-scale simulation test to examine the company's technologies. It consisted of rapidly controlling the output current as well as quickly detecting the generation of voltage in the electric power system. Findings confirmed that the output current of the PV inverter can be returned to over 80% of the value it had before the sudden voltage drop within 0.1 second, once the voltage level returns to a normal value.



## Verification Testing of Smart Grid Technology

Smart grids are electricity networks of the future, promising efficient delivery of a sustainable, economical and secure electricity supply: Making the smart grid practical requires development of core technologies for producing, distributing and using electricity. Mitsubishi Electric has set up experimental smart grid equipment at three of its sites in Japan. The objective of these smart grid trials is to operate a real system, in the field, to collect data and to validate fundamental technologies. Partial verification testing began in 2010.

### Producing Electricity: Optimizing Supply-Demand Balance

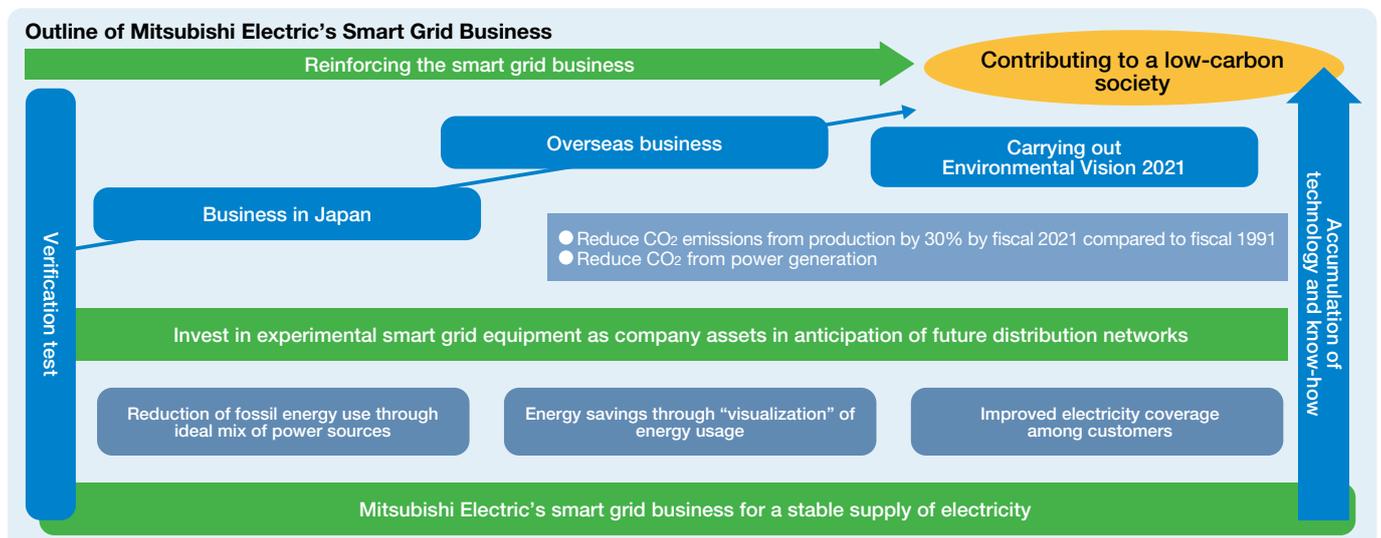
Control technology developed by Mitsubishi Electric looks to satisfy the needs of a future where PV power is widely popular. It is designed to ensure stable, low-cost power through the coordinated and combined use of thermoelectric generation, pumped-storage power generation and storage batteries.

### Distributing Electricity: Maintaining Adequate Voltage Levels

Mitsubishi Electric has developed voltage control system integration software that, by estimating the voltage using high-speed current analysis, calculates the optimal power flow and determines the control variable to keep voltage at an adequate level.

### Using Electricity: Wireless Mesh Networks and Automated Services

Electric companies are accelerating efforts to develop an advanced meter infrastructure (AMI) to improve customer services. Mitsubishi Electric has developed AMI technologies and systems that enable electric power consumption to be remotely and automatically measured every thirty minutes through wireless mesh networking of up to 500 next-generation electricity meters.



## Leading the Way in SiC Power Devices

### World's First Room Air Conditioners Equipped with SiC Diodes

SiC power devices are semiconductors that use silicon carbide for higher performance, lower power consumption and miniaturization of inverters used in electrical appliances and other equipment. Mitsubishi Electric, a leader in research and development of the technology, developed a Dual-In-Line Package Intelligent Power Module (DIPIPM) that utilizes SiC diodes, and incorporated it into two models of household air conditioner marketed in Japan. The module has improved performance by reducing seasonal power loss from inverter operation by about 15%, compared to the conventional model (previous year's model with rated cooling capacity of 3.6kW).

### SiC Power Devices Enable Higher Conversion Efficiency in PV Inverter

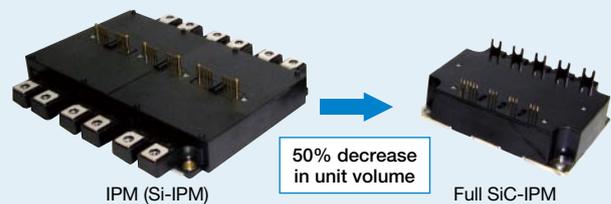
Silicon carbide (SiC) has an excellent low-loss nature and high CO<sub>2</sub>-reduction effect, while enabling size and weight reduction in devices. Testing for energy conversion efficiency in a photovoltaic (PV) inverter equipped with SiC power devices, Mitsubishi Electric measured an energy conversion efficiency rate of 98%, the highest ever achieved in Japan. The prototype power module (rated 1200V/75A) was equipped with SiC transistors (SiC-MOSFET\*) and SiC diodes, and was tested in a single-phase 200V/5kW PV inverter for photovoltaic power generation.

\* Metal Oxide Semiconductor Field Effect Transistor

### Development of High-Performance Full SiC Intelligent Power Modules

Mitsubishi Electric has developed the world's first intelligent power module (IPM) featuring power semiconductor elements composed entirely of SiC materials and with built-in drive and protection circuits. In February 2011 the Full SiC-IPM succeeded in reducing power loss by 70% and decreasing the module volume by 50% compared with conventional IPMs equipped with Si devices (Mitsubishi Electric PM300CLA120 IPM (Si-IPM); 172 mm x 150 mm x 24 mm).

#### New Full SiC-IPM is Half the Size of Existing Si-IPM



\* Research conducted in part for NEDO (New Energy and Industrial Technology Development Organization).

## Recycling Water in Manufacturing Operations

Mitsubishi Electric is strengthening its corporate constitution by increasing production efficiency to its highest level, which requires efficient utilization of water resources at company factories. In fiscal 2011, a new water treatment facility and system for a metal plating operation came on line that achieves utilization of 100% recycled water.

The Mitsubishi Electric Transmission and Distribution System Center in Japan develops and manufactures equipment that ensures a stable supply of high voltage and electrical current. To do so, the equipment requires plated metal parts for optimum conductivity. A massive amount of water is required to clean the parts during the metal plating process and ensure quality. During plant refurbishment operations, a goal was set to encourage water conservation and to recycle 100% of the water used in the process.

Previously the used water was detoxified and discharged as wastewater. A new membrane separation system was installed at the metal plating facility, which drastically reduced water consumption. As much as 70% of the water is now recycled back into the production process while the remaining 30% is reused in the plant's toilets.



Water detoxification equipment at metal plating facility. Vat at left is for heavy metals; vat at right holds water containing fluorine.



Microfilter module. One square column contains 640 hollow filamentous membranes that absorb and filter impurities.



Water detoxified by microfiltration. Further filtration by reverse osmosis (RO) eliminates impurities like soluble salt. The water is reused for parts cleaning at the metal plating factory.

### Water Recycling Online

Water for Life, Water for Industry

# Performance Data

**Period Covered:** April 1, 2010 to March 31, 2011

**Scope of Report:** Mitsubishi Electric Group (Mitsubishi Electric Corporation and 167 affiliates in Japan and overseas)

\* Up to fiscal 2009, the scope of our report was limited to those companies that had drawn up an environmental plan for governance from an environmental conservation perspective. But under the policy of expanding global environmental management, we have broadened the scope of the report to cover Mitsubishi Electric, and its major affiliates.

**Note on aggregate values:** Data from the Communication Network Center, Koriyama Factory, which incurred damage due to the Great East Japan Earthquake of 2011, is not included in these figures. Applicable data will be incorporated and published on the Mitsubishi Electric website at a later date.

## Material Balance

### IN

Materials for Manufacturing			
	Mitsubishi Electric	Affiliates (Japan)	Affiliates (Overseas)
Materials <sup>1</sup>	2,540,000 tons	240,000 tons	320,000 tons
Manufacturing			
Electricity	1,049 million kWh	363 million kWh	332 million kWh
Natural gas	21,860,000 m <sup>3</sup>	2,050,000 m <sup>3</sup>	9,590,000 m <sup>3</sup>
LPG	2,314 tons	3,004 tons	1,555 tons
Oil (crude oil equivalent)	7,004 kl	3,387 kl	674 kl
Water	6,860,000 m <sup>3</sup>	2,070,000 m <sup>3</sup>	1,860,000 m <sup>3</sup>
Public water	1,270,000 m <sup>3</sup>	470,000 m <sup>3</sup>	550,000 m <sup>3</sup>
Industrial water	2,260,000 m <sup>3</sup>	310,000 m <sup>3</sup>	1,090,000 m <sup>3</sup>
Groundwater	3,330,000 m <sup>3</sup>	1,290,000 m <sup>3</sup>	40,000 m <sup>3</sup>
Others	0 m <sup>3</sup>	0 m <sup>3</sup>	180,000 m <sup>3</sup>
Reuse of water	3,490,000 m <sup>3</sup>	1,720,000 m <sup>3</sup>	120,000 m <sup>3</sup>
Controlled chemical substances (amounts handled)	6,840.0 tons	1,686.0 tons	2,700 tons
Ozone depleting substances (amounts handled)	1.5 tons	168.5 tons	1,150 tons
Greenhouse gases (amounts handled)	3,499.5 tons	49.2 tons	1,135 tons
Volatile organic compounds (amounts handled)	1,877.1 tons	1,435.9 tons	237 tons

<sup>1</sup> **Materials:** Sum of shipping weight of "Design for Environment" (DFE) products, plus amount of product packaging materials used, plus total amount of waste

Sales and Logistics <sup>3</sup>			
	Mitsubishi Electric	Affiliates (Japan)	Affiliates (Overseas)
Fuel for trucks (gasoline)	12,200 kl	1,300 kl	320 kl
Fuel for trucks (diesel)	25,200 kl	6,200 kl	21,000 kl
Fuel for rail (electricity)	2,150 MWh	450 MWh	0 MWh
Fuel for marine transport (bunker oil)	340 kl	10 kl	49,000 kl
Fuel for air transport (jet fuel)	480 kl	160 kl	16,000 kl

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

Energy Consumption <sup>5</sup>			
	Mitsubishi Electric	Affiliates (Japan)	Affiliates (Overseas)
Electricity <sup>5</sup>	7,050 million kWh	310 million kWh	11,700 million kWh

<sup>5</sup> **Energy Consumption:** Amount related to "Design for Environment" (DFE) products

End-of-Life Products <sup>7</sup>	
	Mitsubishi Electric
Air conditioners	17,587 tons
Televisions	35,605 tons
Refrigerators	23,753 tons
Washing machines/Clothes dryers	7,135 tons
Personal computers	69 tons

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

### OUT

Emissions ( From Manufacturing )			
	Mitsubishi Electric	Affiliates (Japan)	Affiliates (Overseas)
Water	7,300,000 m <sup>3</sup>	1,260,000 m <sup>3</sup>	1,190,000 m <sup>3</sup>
Controlled chemical substances	10.0 tons	0.0 tons	44.2 tons
BOD (biological oxygen demand)	51.0 tons	6.4 tons	18.2 tons
COD (chemical oxygen demand)	52.7 tons	6.0 tons	45.2 tons
Nitrogen	87.9 tons	14.2 tons	0.1 tons
Phosphorus	3.9 tons	0.1 tons	0.0 tons
Suspended solids	54.7 tons	8.2 tons	24.0 tons
n-hexane extracts (mineral)	1.5 tons	0.4 tons	3.1 tons
n-hexane extracts (active)	1.0 tons	0.1 tons	0.1 tons
Total emissions of zinc	0.5 tons	0.1 tons	0.0 tons
Carbon dioxide (CO <sub>2</sub> )	508,000 tons-CO <sub>2</sub>	191,000 tons-CO <sub>2</sub>	267,000 tons-CO <sub>2</sub>
Controlled chemical substances (excluding amounts contained in other waste)	582.0 tons	130.9 tons	217.4 tons
Ozone depleting substances	0.29 ODP t	0.27 ODP t	0.45 ODP t
Greenhouse gases	114,000 tons-CO <sub>2</sub>	73,000 tons-CO <sub>2</sub>	33,000 tons-CO <sub>2</sub>
Volatile organic compounds	548.0 tons	285.8 tons	39.7 tons
Sulfur oxide (SO <sub>x</sub> )	3.8 tons	1.08 tons	4.50 tons
Nitrogen oxide (NO <sub>x</sub> )	10.0 tons	17.9 tons	11.1 tons
Fly ash	0.9 tons	1.7 tons	53.2 tons
Amount of fluorocarbon recovered	1.2 tons	239.1 tons	-
Waste			
Total waste emissions	84,887 tons	54,708 tons	54,130 tons
Amount recycled	76,356 tons	45,509 tons	44,067 tons
Waste treatment subcontracted out	17,675 tons	31,610 tons	7,480 tons
Final disposal	2 tons	24 tons	954 tons
In-house weight reduction	1,369 tons	0 tons	0 tons
Products <sup>2</sup>			
Weight of all "DFE" sold	2,410,000 tons	180,000 tons	210,000 tons
Weight of packaging materials	47,000 tons	8,000 tons	56,000 tons

<sup>2</sup> **Products:** Weight related to "Design for Environment" (DFE) products

Emissions <sup>4</sup>			
	Mitsubishi Electric	Affiliates (Japan)	Affiliates (Overseas)
Carbon dioxide (CO <sub>2</sub> )	97,000 tons-CO <sub>2</sub>	19,000 tons-CO <sub>2</sub>	235,000 tons-CO <sub>2</sub>

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

Emissions <sup>5</sup>		
	Mitsubishi Electric	Affiliates (Japan)
Carbon dioxide (CO <sub>2</sub> )	2,975,000 tons-CO <sub>2</sub>	131,000 tons-CO <sub>2</sub>

<sup>6</sup> **Emissions:** Amount related to "Design for Environment" (DFE) products

Resources Recovered <sup>8</sup>	
	Mitsubishi Electric
Metals	36,607 tons
Glass	18,482 tons
Fluorocarbon	367 tons
Others	17,542 tons

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

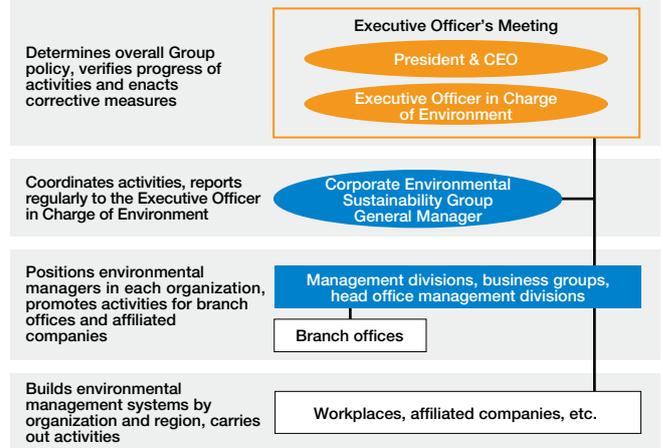


## Environmental Management

Mitsubishi Electric's 6th Environmental Plan (fiscal 2010-2012) aims to establish a uniformly high level of quality in environmental management across all organizations within the Mitsubishi Electric Group of companies, and to make continuous improvement accordingly.

Environmental governance and corporate governance are key links in the business management of the Mitsubishi Electric Group, and are applicable to the company, its consolidated subsidiaries, and its affiliated companies. All levels of the organization—from head office management divisions to management and business groups, workplaces, and affiliated companies—work within the scope of their responsibilities to ensure due execution of environmental conservation activities, through the establishment of a system to manage and monitor the plans, progress, and environmental performance of each downstream organization.

### Environmental Management Promotion Structure



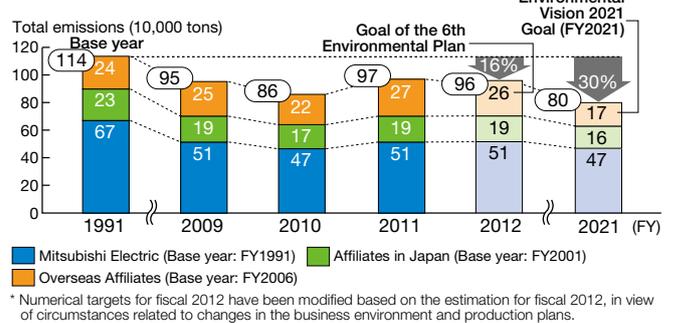
## Reducing CO<sub>2</sub> from Production

The Mitsubishi Electric Group's 6th Environmental Plan has established total CO<sub>2</sub> emissions targets for fiscal 2012 of 510,000 tons for Mitsubishi Electric Corporation, 190,000 tons for affiliates in Japan and 260,000 tons for overseas affiliates.

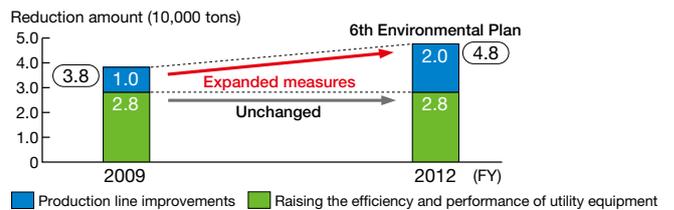
Production divisions are working to reveal hidden energy wastage in the production process and address those areas through production line improvements. Initiatives are also in progress to conserve energy through installation of more efficient utility equipment and through improvements in operational methods. In offices, energy conservation measures, such as turning off lights in areas with no people and using energy-saving settings on office equipment, are underway to further the improvement of facilities in cooperation with building management.

Due to an increase in production both within Japan and overseas, CO<sub>2</sub> emissions in fiscal 2011 totaled 966,000 tons, compared to the Group's overall expected total of 873,000 tons for the year. However, the Group surpassed its CO<sub>2</sub> emissions reduction target of 33,000 tons with a total of 35,000 tons of CO<sub>2</sub> reduced Group-wide.

### Groupwide Plan to Reduce CO<sub>2</sub> from Production



### Breakdown of CO<sub>2</sub> Reduction Plan through Expansion of Production Line Improvement Measures (Mitsubishi Electric)



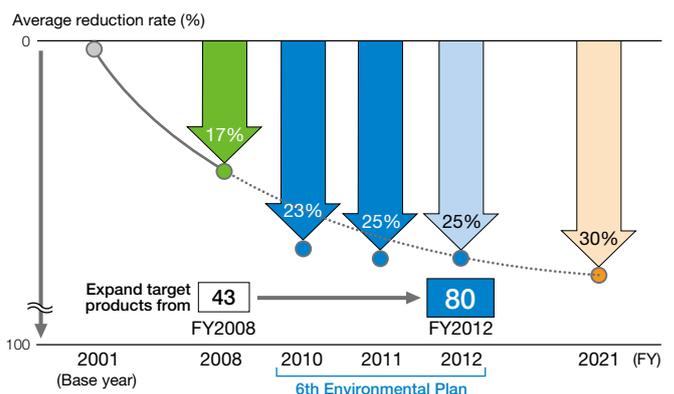
## Reducing CO<sub>2</sub> from Product Usage

The Mitsubishi Electric Group conducts product Life Cycle Assessment (LCA) evaluations, based on the Product Assessment Guidelines, which reflect the following perspectives: effective use of resources, efficient energy use, and avoidance of substances with potential environmental risk.

Because CO<sub>2</sub> emissions from product usage can total between 40 to 50 times more than the amount emitted during the production process (by Mitsubishi Electric calculations), the company actively pursues greater reductions. The 6th Environmental Plan establishes the goal of improving the average CO<sub>2</sub> reduction rate in fiscal 2012 by 25% compared to fiscal 2001, and Mitsubishi Electric is systematically proceeding with the selection of products that have the highest potential for CO<sub>2</sub> reduction.

The selection of target products expanded from 70 in fiscal 2010 to 84 in fiscal 2011, while average CO<sub>2</sub> reduction rate for these products reached the target of 25%.

### Plans to Reduce CO<sub>2</sub> from Product Usage under Environmental Vision 2021



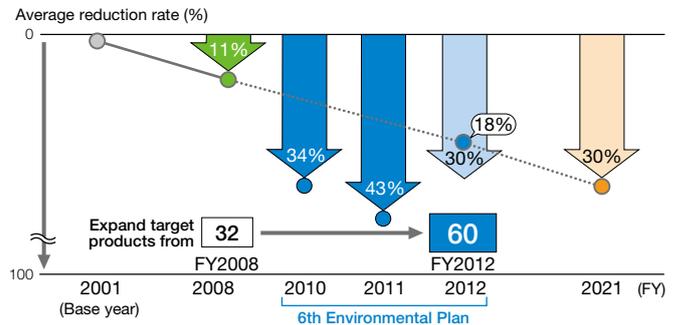
**Note on aggregate values:** Data from the Communication Network Center, Koriyama Factory, which incurred damage due to the Great East Japan Earthquake of 2011, is not included in these figures. Applicable data will be incorporated and published on the Mitsubishi Electric website at a later date. The factory data is included in the number of target products.

## Reducing Resource Inputs and Recycling End-of-Life Products

Mitsubishi Electric is reducing resource inputs through the promotion of product recycling and through designing its products to be more compact and lightweight. Plans call for an increase in the number of target products that promote reduced resource inputs to 60 or more by fiscal 2012, and aim to improve the company's resource input reduction ratio by 30% compared to fiscal 2001 levels. In fiscal 2011 the number of such products reached 64, exceeding the target and achieving an average 43% reduction ratio.

In fiscal 2011, Mitsubishi Electric recycled 84,000 tons of four kinds of home appliances, achieving a recycling rate of 87%. Computers and monitors totaled 6,396 units with an average recycle rate of 76%. The four kinds of home appliances are: air conditioners; televisions (CRT, LCD, and plasma models); refrigerators/freezers; and washing machines/clothes dryers.

### Reduction of Resource Inputs under Environmental Vision 2021



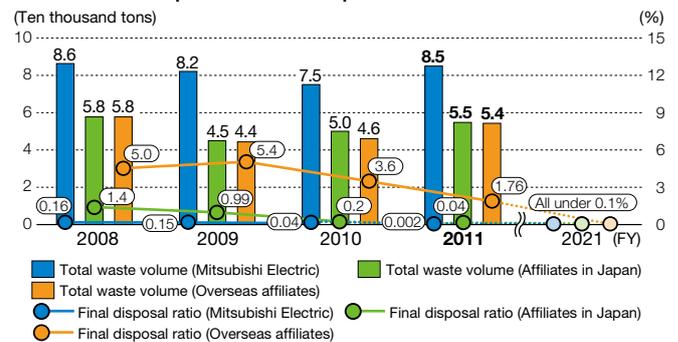
**Note on aggregate values:** Data from the Communication Network Center, Koriyama Factory, which incurred damage due to the Great East Japan Earthquake of 2011, is not included in these figures. Applicable data will be incorporated and published on the Mitsubishi Electric website at a later date. The factory data is included in the number of target products.

## Zero Emissions

The 6th Environmental Plan establishes a final waste disposal ratio target of less than 0.1% for Mitsubishi Electric, less than 0.5% for affiliates in Japan, and less than 3.0% for overseas affiliates for fiscal 2012.

To this end, initiatives implemented according to waste generation and processing status at each production site resulted in achievements far beyond expectations, including a final disposal ratio for fiscal 2011 of 0.002% at Mitsubishi Electric, 0.04% at affiliates in Japan, and 1.76% at overseas affiliates. In particular, activity levels in Japan were heightened with initiatives such as waste management collaborations among multiple production sites.

### Total Waste Output and Final Disposal Ratio



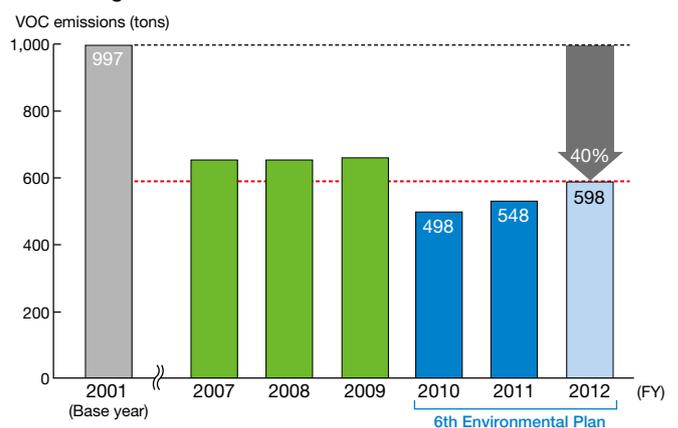
## Managing Chemical Substances

In addition to the 462 substances designated under the revised PRTR (Pollutant Release and Transfer Register) law of Japan, Mitsubishi Electric and affiliates in Japan make use of a comprehensive Chemical Substance Management System for voluntary management of 2,097 substances, including refrigerant fluorocarbons used in air conditioners and refrigerators, VOCs (volatile organic compounds) as well as six RoHS substances.

In fiscal 2011, Mitsubishi Electric used 6,840 tons of 142 different chemical substances; affiliates in Japan used 1,686 tons of 49 different substances.

In fiscal 2011, VOC emissions totaled 548 tons, 50 more tons than the previous year, due to increased production volume; however, the company maintained emissions at less than 40% of fiscal 2001 results, still within 6th Environmental Plan targets.

### Controlling VOC Emissions

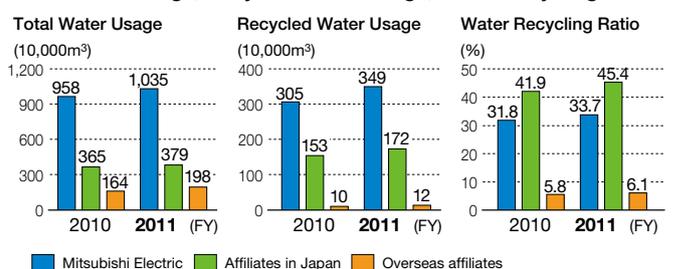


## Effective Water Usage

The Mitsubishi Electric Group works toward the effective use of vital water resources, including public water, industrial water, and groundwater, from the perspective of the "3Rs": reduce, reuse and recycle.

In fiscal 2011, Mitsubishi Electric, as well as affiliates in Japan and overseas, used more water than in the previous fiscal year as a result of increased production. At the same time, the Group-wide application of reused water increased compared to the last fiscal year, showing effective progress in water usage.

### Total Water Usage, Recycled Water Usage, Water Recycling Ratio



## Environmental Accounting

Period: April 1, 2010 – March 31, 2011

Scope of Data Compilation: Mitsubishi Electric Group (Mitsubishi Electric Corporation and 167 affiliates in Japan and overseas)

Note on aggregate values: Data from the Communication Network Center, Koriyama Factory, which incurred damage due to the Great East Japan Earthquake of 2011, is not included in these figures. Applicable data will be incorporated and published on the Mitsubishi Electric website at a later date.

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

Environmental Conservation Costs				Main Costs
Item	Capital Investment	Cost <sup>1</sup>	Year-on-Year Change	
Business area activities	85.8	111.0	9.4	
	32.1	65.4	3.3	
Pollution prevention	38.6	7.4	(12.2)	Installation and maintenance of wastewater treatment facilities
	17.5	(1.0)	(6.5)	
Global environmental conservation	42.1	6.1	3.6	Implementation of energy-conservation and global-warming prevention measures, such as replacement of cooling and heating sources, conversion to high-efficiency air conditioning and lighting, and installation of photovoltaic systems and low-emission vehicles
	29.9	5.3	2.3	
Resource recycling	30.3	(4.1)	6.0	Outsourcing of recycling center operations; renewal of public water and industrial water piping to prevent leakage, etc.
	18.0	(1.0)	1.9	
Green purchasing/procurement and product-related activities upstream and downstream from production	0.6	8.6	(2.3)	Examination of chemical substances contained in procured products, procurement of products that support energy conservation
	0.3	5.7	(2.3)	
Management activities	1.1	33.1	0.9	EMS activities, development and operation of waste management system and management system for chemical substances in products, environmental education, etc.
	1.1	23.2	(0.3)	
R&D activities for reducing environmental impact	28.1	55.5	(6.4)	Development of energy conservation equipment and technologies, photovoltaic cells, etc.
	27.9	52.2	(8.1)	
Community activities	0.1	1.3	0.1	Greening of facility rooftops, premises, etc.
	0.0	1.0	0.0	
Environmental damage	0.1	4.6	1.5	Water quality surveys on soil and groundwater, etc.
	0.1	4.6	1.5	
Total	115.8	214.1	3.2	
	61.5	152.1	(5.9)	
Year-on-year change	66.0	3.2		
	29.5	(5.9)		

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

### Environmental Conservation Benefits (Environmental Performance)

Item	Unit	Fiscal 2011	Year-on-Year Change	Year-on-Year Per Net Sales
Total energy used	10,000 GJ	1,916	248	106%
		1,151	97	96%
Total water used	10,000 m <sup>3</sup>	1,079	59	97%
		686	33	92%
Total greenhouse gas emissions	10,000 tons-CO <sub>2</sub>	119	6	97%
		62	(0)	88%
CO <sub>2</sub> (Energy consumption)	10,000 tons-CO <sub>2</sub>	97	11	104%
		51	4	95%
HFC, PFC, SF <sub>6</sub>	10,000 tons-CO <sub>2</sub>	22	(5)	75%
		11	(4)	67%
Total releases and transfers of chemical substances into the atmosphere	tons	930	126	106%
		582	(63)	79%
Total wastewater discharged	10,000 m <sup>3</sup>	975	118	105%
		730	101	102%
Total releases and transfers of chemical substances into the water and soil	tons	54	(4)	86%
		10	(3)	68%
Total waste discharged	tons	193,725	22,273	104%
		84,887	9,907	100%
Final disposal	tons	980	(654)	55%
		2	(30)	6%

### Economic Benefits from Environmental Conservation Activities (Real Benefits)

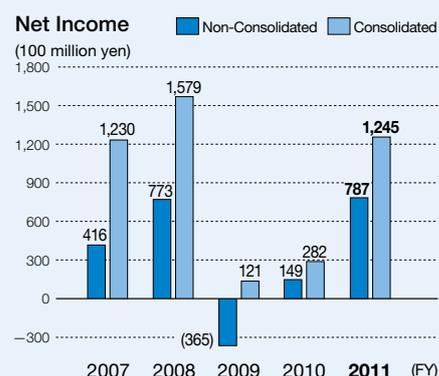
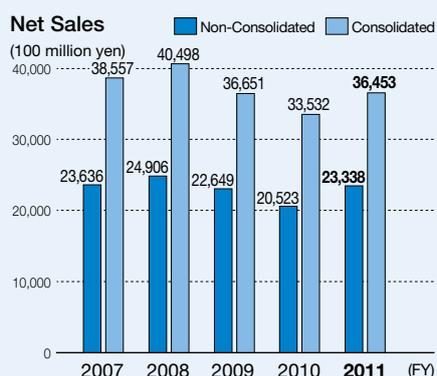
Item	Amount	Year-on-Year Change	Main Benefits
Earnings	34.9	10.6	Profit from the sale of saleable materials resulting from recycling of scrap metal, paper waste, etc.
	18.3	8.1	
Savings	116.8	42.3	Lower electricity costs due to introduction of high-efficiency equipment, reuse of waste materials, and productivity improvements; reduction in the use of wood packaging materials through use of returnable packaging materials.
	88.0	39.6	
Total	151.7	52.9	
	106.3	47.7	

### Economic Benefits from Environmental Consideration in Products and Services

Item	Amount	Main Products
Economic benefits to customers	2,616.7	Combined cycle thermoelectric generation stations, low-consumption power supply modules (CE power supply), photovoltaic systems, industrial-use total heat exchange ventilators (Lossnay), energy-saving air conditioners, LED lighting and elevators, etc.
	2,561.2	
Environmental improvement effects	68.3	
	67.5	

## Corporate Profile (As of March 31, 2011)

Company Name: Mitsubishi Electric Corporation  
 Head Office Location: Tokyo Building, 2-7-3, Marunouchi, Chiyoda-ku, Tokyo 100-8310, Japan  
 Established: January 15, 1921  
 Paid-in Capital: ¥175,800 million  
 President: Kenichiro Yamanishi  
 Number of Employees:  
 Consolidated: 114,443  
 Non-consolidated: 28,450  
 Number of Affiliated Companies:  
 Subsidiaries: 157 Affiliates: 40  
 Business Segments:  
 Energy and Electric Systems, Industrial Automation Systems, Information and Communication Systems, Electronic Devices, Home Appliances, Others



# Mitsubishi Electric Group Environmental Information

Mitsubishi Electric's Global Website contains information about the Mitsubishi Electric Group's activities related to corporate social responsibility (CSR). Within the Corporate Social Responsibility section, the Environmental Report outlines the Group's environmental policies and vision, as well as environmental plans and achievements of fiscal 2011, while the Environmental Topics portion outlines the Group's activities designed to achieve the goals of Environmental Vision 2021 as a global, leading green company.

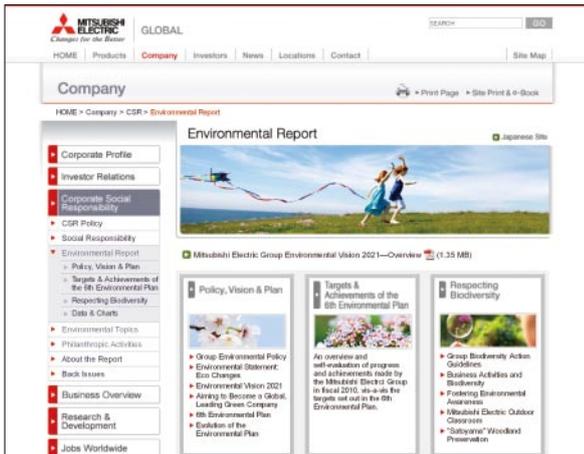
**Corporate Social Responsibility**

<http://www.MitsubishiElectric.com/company/csr/>

## Environmental Report

<http://www.MitsubishiElectric.com/company/csr/environment/>

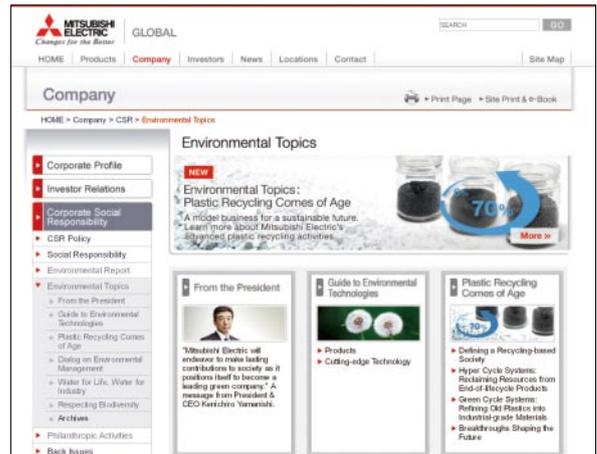
Provides the complete contents of the 6th Environmental Plan (fiscal years 2010-2012), along with initiatives and achievements in fiscal 2011, and future plans.



## Environmental Topics

<http://www.MitsubishiElectric.com/company/csr/ecotopics/>

Highlights a number of prominent achievements and initiatives to contribute to a sustainable society and address environmental concerns through products and technology.



## Other Mitsubishi Electric Group Environment-Related Websites

### Global Environmental Portal

<http://www.MitsubishiElectric.com/eco/>

Provides information about environmental initiatives by Mitsubishi Electric Group companies around the world.



### Eco Changes Website

<http://www.MitsubishiElectric.com/ecochanges/>

Provides an overview of Eco Changes, and information on Eco Changes-related initiatives.



**Aiming to become a global, leading green company, enriching society with technology.**

Looking ahead to its 100th anniversary, the Mitsubishi Electric Group will continue to leverage its leading-edge technologies and wide range of businesses around the world to help enrich society.

## MITSUBISHI ELECTRIC CORPORATION

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