

Changes for the Better



Environmental Topics



▶ From the President



President & CEO Setsuhiro Shimomura addresses the principles and initiatives of Mitsubishi Electric Environmental Vision 2021.

▶ More

▶ Guide to Environmental Technologies



Introducing cutting-edge products and components that help prevent global warming.

▶ More

▶ Reducing CO₂ During Production



A goal of reducing CO₂ emissions from product use and production by 30% by 2021, through improving production efficiency and investing in energy-efficient facilities.

▶ More

▶ PV Power Generation



Introducing Mitsubishi Electric's photovoltaic power generation systems, the company's expertise in power electronics, and its efforts to further popularize and improve efficiency of the systems.

▶ More

▶ Recycling of Waste Plastics



Taking plastic from end-of-life appliances and turning it into new products, including recycling of mixed, pulverized plastic that was previously discarded.

▶ More

▶ Towards Zero Emissions



A coordinated inter-regional recycling program in Japan involving multiple production sites, which originated in a proposal made by some of our environmental managers.

▶ More

▶ Fostering an Environmental Mindset



Working to raise environmental awareness through outdoor educational programs and woodland conservation activities under the leadership of Mitsubishi Electric employees.

▶ More

▶ China and the Environment



Introducing our first overseas training program for key environmental personnel. Promoting energy efficiency to help bring about a more environmentally conscious society. Our exhibit at an environmental protection exhibition in China.

▶ More

From the President



Sharing this Irreplaceable Earth with Future Generations

Environmental problems are a major issue for the international community and require urgent action. We must absolutely avoid engaging in actions today that leave negative legacies for future generations, and we must recognize that we share the environment with all people who will be alive in the future.

At the same time, when companies engage in business activities they inevitably impact the environment in some way, such as expending energy through the consumption of resources and moving people from place to place. Minimizing this impact to the extent possible should be considered one of the

duties of anyone who engages in business. As a company with world-class technological capabilities, Mitsubishi Electric has the added responsibility of making positive contributions to society by demonstrating worldwide leadership in environmental technology.

The Mitsubishi Electric Group established its Environmental Vision 2021 in October 2007. The target year for this vision is 2021, the year we will celebrate our 100th anniversary. By continuing to improve our products and reduce the environmental impact of our business activities in line with this vision, we intend to create more products that benefit the environment while fulfilling our responsibilities to the Earth and future generations.

The Goals of Environmental Vision 2021

Environmental Vision 2021 reveals our commitment to not only lowering the environmental impact of business activities, by reducing carbon dioxide emissions from production, for example, but also help bring about a sustainable society through products and technologies that lead directly to environmental protection and energy conservation. Such products include energy-saving type key devices, factory automation equipment that helps factories save energy and raise production efficiency, products that help reduce carbon dioxide emissions in power generation, and recycling systems for various products. The range of our potential contribution is quite broad.

In the past, I was involved in the development of electric power steering for automobiles. Electric power steering is a key component for helping automobiles to save energy, because its energy efficiency is higher than that of hydraulic power steering, which was the mainstream at the time. Then in 1988 we became the first company in the world to successfully mass-produce electric power steering. The units were expensive and could not possibly contend with hydraulic steering in terms of cost but, with further improvements, we succeeded in bringing costs down and have now manufactured over 30 million of the units. Electric power steering has made a significant contribution to the energy-saving efforts of the automobile industry.

Sow the seeds of technologies in a variety of areas and foster the environmental improvements that sprout from them: I firmly believe that the repetition of this process is essential to efforts to bring about a sustainable society.

In addition to reducing carbon dioxide emissions, Environmental Vision 2021 also promotes the 3Rs (Reduce, Reuse, Recycle). Promoting the 3Rs from a variety of perspectives leads directly to effective resource utilization and reduced energy usage while also helping to prevent global warming. The 3Rs tend to be understood in the narrow sense as environmental measures to reduce waste, but they actually should be recognized as essentially connected to the problem of global warming.

I think we need to take another close look at the effectiveness of the 3Rs and take serious action, while also not forgetting the importance of making products lighter and minimizing material usage.

Fostering Environmental Awareness

Personnel development is another critical initiative because it constitutes the foundation for promoting our environmental vision.

A desire to protect the environment is fostered by getting out and experiencing nature. As one example, since 2003 Mitsubishi Electric employees and their families have looked after a fledgling forest at the foot of Mt. Fuji. The benefit to the environment brought about by this initiative may be small, but I think the exhilaration that people feel from being in the midst of nature and their direct experience of the role and importance of it are extremely meaningful.

We plan to continue raising environmental awareness among employees, their families and local community members through woodland preservation campaigns, environmental education for children on the importance of nature, and other social contribution activities. In this way we intend to further expand the scope of our activities.

A Corporate Group You Can Feel Good About

The Mitsubishi Electric Group is promoting environmental activities in China based on the slogan, Mastery of Energy Efficiency, Devotion to Environmental Protection. One such activity is our endeavoring to make the use of energy-efficient air conditioners that use inverter technology more widespread. Achieving this would reduce CO₂ to a substantial degree, even by global standards. There is still much that we can do, and much that we should do, in our business activities to help the environment.

Based on our commitment to make "Changes for the Better," we will do our best and continue being a company that all stakeholders can feel good about by directly addressing environmental challenges with advanced, wide-ranging technologies and proactive, ongoing actions.

President & CEO
Setsuhiro Shimomura

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

▶ Air Conditioners with Energy Conservation Sensors

Featuring cutting-edge sensor technology—the new "Human-Sensing Move-Eye"—as well as an automatic cleaning function and other innovations, the energy efficiency of these air conditioners is truly striking.

▶ More

▶ Photovoltaic (PV) Systems

Robust power generation is achieved with a high performance PV inverter and PV module.

▶ 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 (O₃), which is a powerful sterilizer and purifier.

▶ 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

Next-generation silicon carbide (SiC) power devices are drawing attention for their energy efficiency potential and as a replacement for silicon power devices, which have reached their limit for power loss reduction.

▶ 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

▶ Pumpsless Water Cooling System

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

▶ More

Guide to Environmental Technologies

Products

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

Cutting-Edge Technology

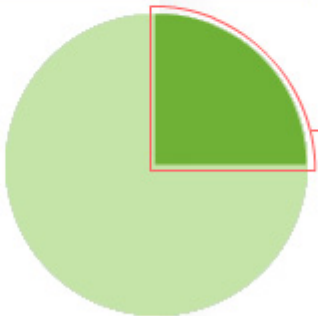
- ▶ Next Generation Power Capacitor ▶ SiC Power Device
- ▶ Gradationally Controlled Voltage Inverter ▶ Pumpless Water Cooling System



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.

Air Conditioners with Energy Conservation Sensors

Did you know?
Air conditioning accounts for around 25% of household power consumption, the most of any appliance.



A pie chart with a light green background and a darker green slice representing 25%. A red line points from the text 'Air conditioner' to this slice.

Air conditioner

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Air Conditioners with Energy Conservation Sensors

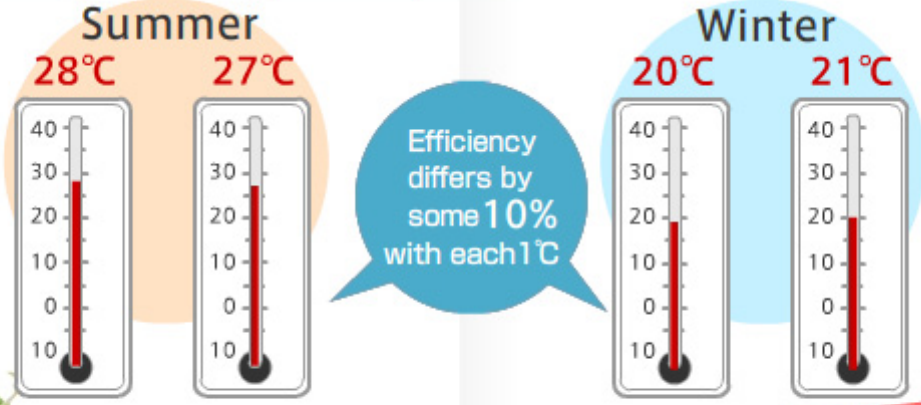
Energy efficiency changes by about 10% for each degree Celsius the preset temperature is raised or lowered, so the way in which an air conditioner is used can make great changes to energy consumption.

Summer

28°C 27°C

Winter

20°C 21°C



A diagram showing four thermometers. The left two are under a light orange 'Summer' header with temperatures 28°C and 27°C. The right two are under a light blue 'Winter' header with temperatures 20°C and 21°C. A blue speech bubble in the center says 'Efficiency differs by some 10% with each 1°C'.

Efficiency differs by some 10% with each 1°C


Next

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Air Conditioners with Energy Conservation Sensors

Normally, if you are concerned about energy efficiency, you have to set the temperature relatively high when cooling and relatively low when heating. In other words, the so-called "comfort" provided by air conditioning includes putting up with less than ideal temperatures.

It's hot, but I'll just have to put up with it.




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Air Conditioners with Energy Conservation Sensors

Normally, if you are concerned about energy efficiency, you have to set the temperature relatively high when cooling and relatively low when heating. In other words, the so-called "comfort" provided by air conditioning includes putting up with less than ideal temperatures.

It's cold, but I'll just have to endure it.




Next

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Air Conditioners with Energy Conservation Sensors

Mitsubishi Electric looked at how air conditioners are used.




New Human-Sensing Move-Eye

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Air Conditioners with Energy Conservation Sensors

How does Move-Eye see how the room is being used?




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Air Conditioners with Energy Conservation Sensors

The answer lies in Move-Eye's sensory ability.



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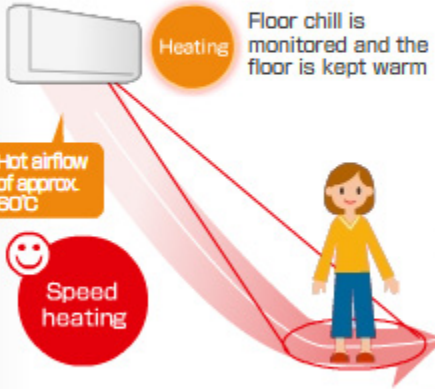
Air Conditioners with Energy Conservation Sensors

① Move-Eye Senses the Perceived Temperature

Move-Eye detects the perceived temperature based on the temperature of the floor and walls.

How Perceived Temperature is Determined (in the room)

Category	Percentage
Humidity	Approx. 20% (20.7%)
Temperature	Approx. 30% (30.9%)
Floor and wall temperature (radiant)	Approx. 50% (43.7%)



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Air Conditioners with Energy Conservation Sensors

① Move-Eye Senses the Perceived Temperature

Move-Eye detects the perceived temperature based on the temperature of the floor and walls.

How Perceived Temperature is Determined (in the room)

Factor	Percentage
Humidity	Approx. 20% (20.7%)
Temperature	Approx. 30% (30.9%)
Floor and wall temperature (radiant)	Approx. 50% (43.7%)

Next

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Air Conditioners with Energy Conservation Sensors

Controlling the perceived temperature means that the room remains comfortable even when the temperature is set relatively high when cooling and relatively low when heating.

In other words, energy is conserved without discomfort.

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Air Conditioners with Energy Conservation Sensors

② Move-Eye Senses Movement

The sensor finds people in the room and automatically air conditions where they are.
Move-Eye automatically air conditions the areas in the room where people actually are. What's more, the floor temperature is monitored to control the room temperature based on the temperature people actually perceive. When people leave the room, the unit automatically switches over to energy-savings mode.

Airflow is sent to where people are, not throughout the entire room

Switches to energy-savings mode when no one is present

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Air Conditioners with Energy Conservation Sensors

② Move-Eye Senses Movement

Move-Eye monitors human movement and learns patterns.
Eight sensors monitor the room in a grid made up of 94 subsections from left to right. The room is split up into a total of 752 areas, so the whereabouts of people in the room are quickly and automatically detected.

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Air Conditioners with Energy Conservation Sensors


② Move-Eye Senses Movement

Move-Eye monitors human movement and learns patterns.

Move-Eye learns where people tend to be in the room to efficiently deliver airflow, which makes the unit more energy efficient.

It learns where people actually spend time in the room and adjusts the scope of heating and cooling based on this

Living area is discovered and efficiently heated and cooled




Next

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Air Conditioners with Energy Conservation Sensors

② Move-Eye Senses Movement

Focusing on people's comfort has made it possible to save energy.



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Air Conditioners with Energy Conservation Sensors

② Move-Eye Senses Movement

Mitsubishi Electric air conditioners achieve **energy efficiency while maintaining comfort** thanks to the New Human-Sensing Move-Eye, which monitors how the room is actually used.

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Air Conditioners with Energy Conservation Sensors




Moreover, Kirigamine's Move-Eye lights up to let you know when you're saving energy

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Air Conditioners with Energy Conservation Sensors

**Visible energy savings
up to 50%**

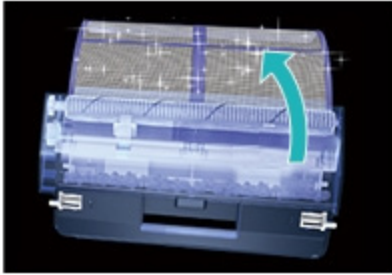
One Leaf	Two Leaves	Three Leaves
		
Floor temperature sensed for energy savings of approx. 30%	People's whereabouts sensed for energy savings of approx. 40%	People's movement sensed for energy savings of approx. 50%

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Air Conditioners with Energy Conservation Sensors

What's more, energy efficiency is maintained over the long run thanks to an automatic cleaning function.



Cleaning complete

The filter slides up and returns to its original position.

Cleaning time
Approx. 2 minutes

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Air Conditioners with Energy Conservation Sensors

The automatic cleaning function improves **energy efficiency by as much as 30%** compared to using the unit over an extended period of time without cleaning it.

Electric bill increases by 30%¹

Use Without Cleaning

Reduces waste by some 30%¹ by keeping the inside clean

With a Constantly Clean Filter, Airflow Fan and Heat Exchanger

¹. Compared to Mitsubishi Electric products from 12 years ago

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Air Conditioners with Energy Conservation Sensors

In addition to energy efficiency, Mitsubishi Electric also helps protect the environment by using **refrigerant that does not deplete the ozone layer.**

Ozone layer

Ozone layer

Previous refrigerant

Current refrigerant

Since 2003, Mitsubishi Electric has switched to a refrigerant that does not damage the ozone layer.

refrigerant

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Air Conditioners with Energy Conservation Sensors

Environmental impact is reduced by using recycled materials.

Outdoor unit panels

Breaking down materials for recycling

Refrigerator vegetable cases

Pulverized and remade as plastic

Used in outdoor unit

Vegetable cases from refrigerators are fully reused to make the panels on the outdoor unit.

Break down

Pulverize and clean

Reuse

Cosmetic piping panel

Move-Eye Top

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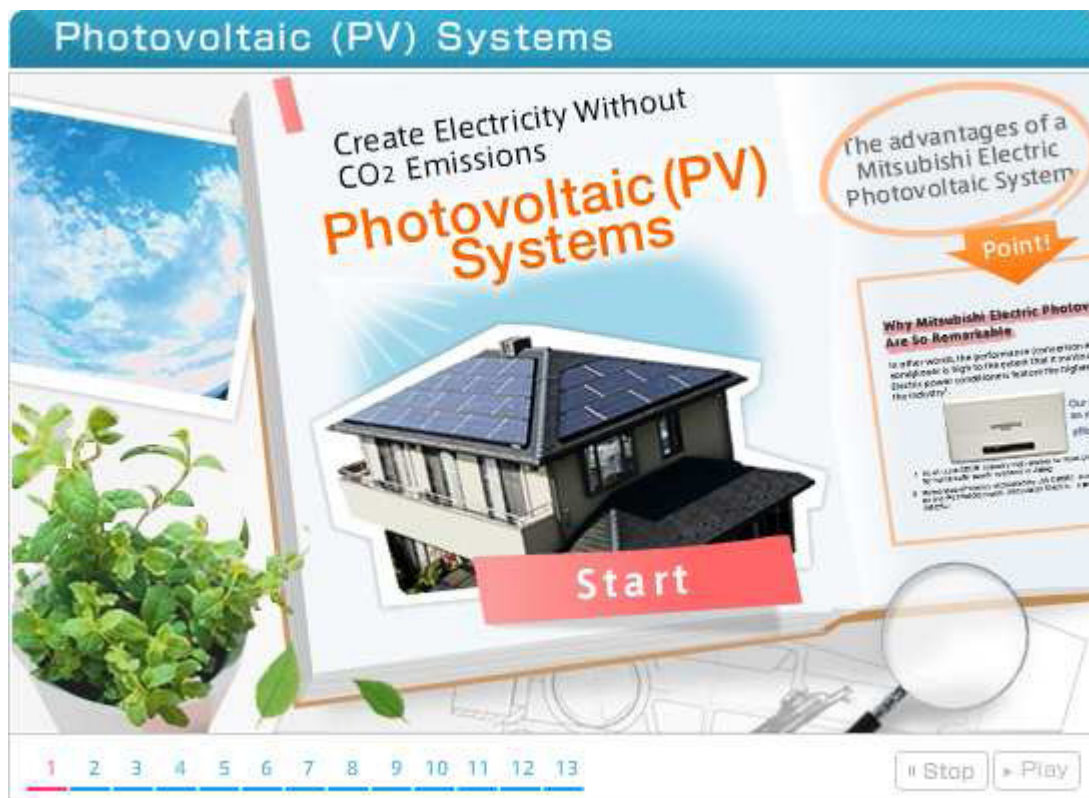
Guide to Environmental Technologies

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

Cutting-Edge Technology

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



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

Photovoltaic (PV) Systems

The amount of sunlight that showers the earth in just one hour is equivalent to all the energy consumed around the world in one year.

Photovoltaic power generation is the process of generating power by harnessing this enormous amount of energy that comes from the sun.



Features of Photovoltaic Systems

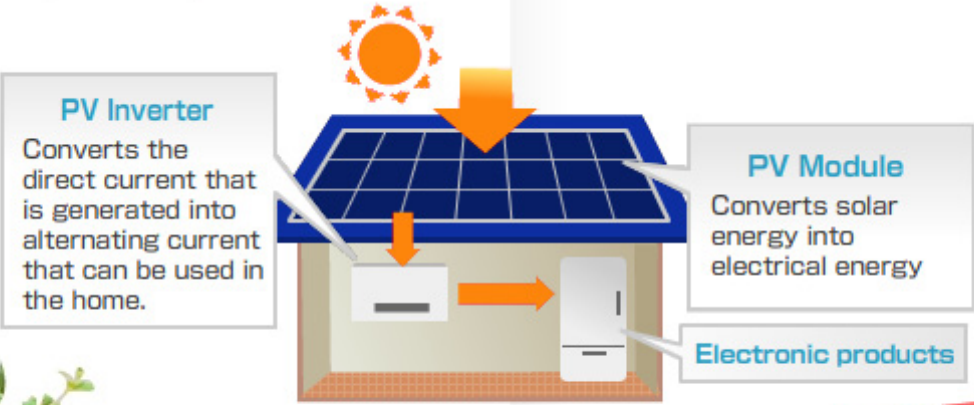
- Power is generated without CO₂ emissions
- Unlike fossil fuels, there is no concern over it being used up

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Photovoltaic (PV) Systems

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.



PV Inverter

Converts the direct current that is generated into alternating current that can be used in the home.

PV Module

Converts solar energy into electrical energy

Electronic products


Next

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Photovoltaic (PV) Systems

The performance of photovoltaic systems depends on the performance of the PV modules and PV inverter. The higher the performance of these two components, the higher the performance of the overall system.

PV module performance × **PV inverter performance** = **Photovoltaic system performance**




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Photovoltaic (PV) Systems

Features of Mitsubishi Electric's Photovoltaic Systems



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Photovoltaic (PV) Systems


The performance of photovoltaic systems depends on the performance of the PV modules and PV inverter. The higher the performance of these two components, the higher the performance of the overall system.

PV module performance




Maximum output of 185W

PV inverter performance



Extremely high conversion efficiency

Photovoltaic system performance



Mitsubishi Electric systems generate robust power


Next

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Photovoltaic (PV) Systems

Why Mitsubishi Electric Photovoltaic Systems Are So Remarkable

In other words, the performance (conversion efficiency) of a PV inverter is high to the extent that it minimizes power loss. Mitsubishi Electric PV inverters feature the highest conversion efficiency in the industry¹.



Our PV inverters offer an industry-leading conversion efficiency of **97.5%**²

- ¹ As of June 2008. Industry high applies to mass-produced PV inverters for home solar power systems in Japan.
- ² Rated load efficiency stipulated by JIS C8961. Actual measurement by Mitsubishi Electric on the PV-PN40G model. (Mitsubishi Electric's previous model, the PV-PN33G, was 95.5%.)

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Photovoltaic (PV) Systems

Why Mitsubishi Electric Photovoltaic Systems Are So Remarkable

Gradationally controlled inverter technology is what allows our PV inverters to boast industry-leading conversion efficiency. Normally, one inverter is used, but Mitsubishi Electric uses a combination of three inverters with different voltages in order to minimize loss.

(Single-phase INV: Single-phase inverter)
DC voltage ratio: binary or ternary

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Photovoltaic (PV) Systems

Why Mitsubishi Electric Photovoltaic Systems Are So Remarkable

Mitsubishi Electric is at the leading edge of development worldwide for PV modules as well. Our current PV module for the home generates 185 watts of power per module. This represents top-level output for a Japanese mass-produced polycrystalline silicon module.

PV modules provide a maximum output of **185W** per module


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Photovoltaic (PV) Systems

**How Much Power is Produced?
How Much is CO₂ Reduced?**



Next


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Photovoltaic (PV) Systems

Mitsubishi Electric's home 3.7 kW system generates
3,842 kWh per year on average

*Mitsubishi Electric simulation in Tokyo with a 3.7 kW system



**This amounts to a reduction in CO₂
equivalent to 48 18-liter barrels of oil per year.**

* Calculated using 0.227 liters per 1 kWh based on voluntary industry rules on JPEA labeling (FY2007 version)

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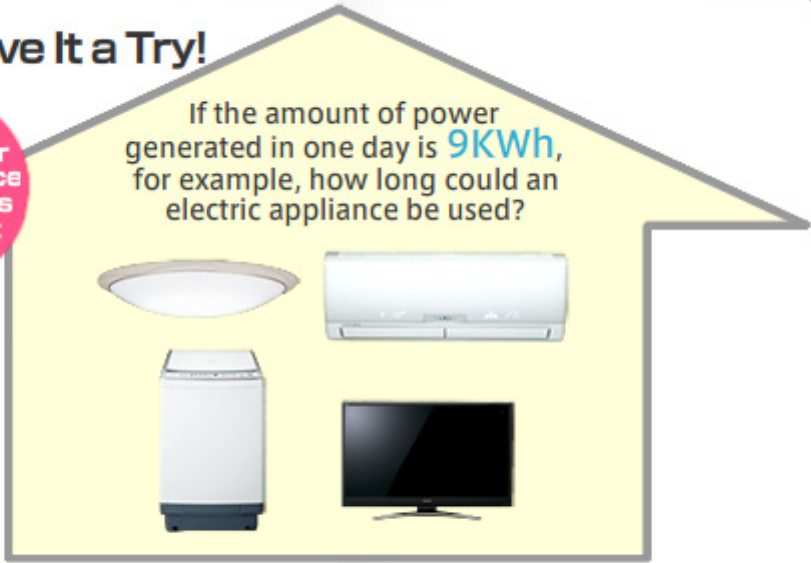
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Photovoltaic (PV) Systems

Let's Give It a Try!

Mouse over the appliance illustrations to find out

If the amount of power generated in one day is **9Kwh**, for example, how long could an electric appliance be used?



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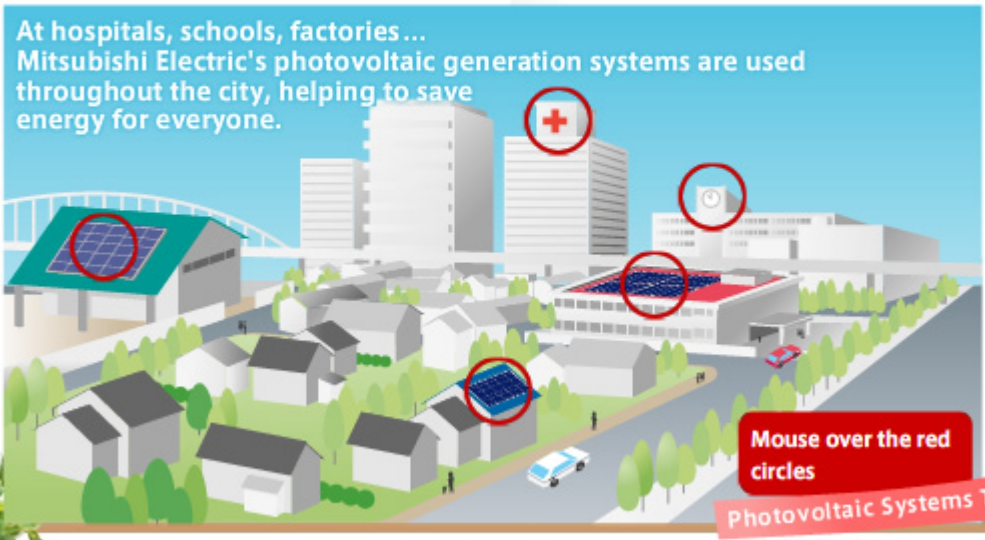
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Photovoltaic (PV) Systems

Where are Mitsubishi Electric solar systems used?

At hospitals, schools, factories...
Mitsubishi Electric's photovoltaic generation systems are used throughout the city, helping to save energy for everyone.



Mouse over the red circles

Photovoltaic Systems Top

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Guide to Environmental Technologies

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- ▶ Ozone Generators

Cutting-Edge Technology

- ▶ Next Generation Power Capacitor
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- ▶ Gradationally Controlled Voltage Inverter
- ▶ Pumpless Water Cooling System



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](#) 

AXIEZ Machine-room-less Elevators

The environment-conscious aspects of Mitsubishi Electric elevators are as follows:

- ① Resources are conserved by eliminating the machine room
- ② Energy is saved through use of an inverter
- ③ Electricity is stored and effectively reused

Next

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AXIEZ Machine-room-less Elevators

Machine-room-less elevators conserve resources

Conventional elevators require a penthouse containing the machine room that houses the hoist, control panel and other components that move the elevator car up and down. The machine room of a conventional elevator takes up a substantial amount of space at the top of the elevator shaft.

Elevator shaft

Machine room

- [Hoist] Moves the elevator up and down with cables
- [Control panel] Controls the elevator's operations

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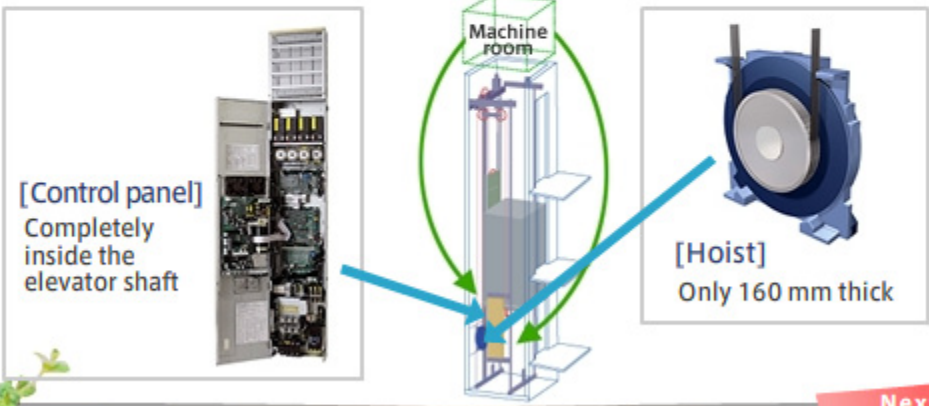
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AXIEZ Machine-room-less Elevators

Machine-room-less elevators conserve resources

Mitsubishi Electric succeeded in eliminating the machine room by making the hoist and control panel thin and compact, and locating them inside the elevator shaft.



[Control panel]
Completely inside the elevator shaft

[Hoist]
Only 160 mm thick

Next


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|| Stop ▶ Play

AXIEZ Machine-room-less Elevators

Machine-room-less elevators conserve resources

Mitsubishi Electric's joint-wrapped DC motor ("Poki Poki Motor") was what really allowed us to make the hoist so thin. Its unique structure facilitated greater design flexibility. The motor also significantly reduces power loss because the coil is wound at such a high density.



Poki Poki Motor

The motor's unique structure features a coiling core that is separated like a joint.

Next

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AXIEZ Machine-room-less Elevators

Machine-room-less elevators conserve resources

The elimination of a machine room **substantially reduces the amount of construction materials required.** Almost all elevators are now made without machine rooms.

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AXIEZ Machine-room-less Elevators

Use of an inverter saves energy

With elevators, saving energy means improving the efficiency of the hoist motor that lifts and lowers the elevator compartment carrying people or cargo. The key to raising efficiency lies with the inverter.

Year	Percentage
1970	100
1980	93
1990	74
2000	29

Hoist motor is controlled by the inverter to maximize efficiency and save energy

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|| Stop > Play

AXIEZ Machine-room-less Elevators

Use of an inverter saves energy

In simple terms, an inverter is a device for precisely controlling the speed at which a motor rotates. Being able to precisely control the motor rotary speed prevents the unnecessary use of excess electricity, thereby conserving energy. Mitsubishi Electric began using inverter motors in 1984, which has resulted in considerable energy savings over the years.

Year	Energy Consumption
1970	100
1980	93
1990	74
2000	37

60% reduction

Hoist motor is controlled by the inverter to maximize efficiency and save energy

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|| Stop ▶ Play

AXIEZ Machine-room-less Elevators

Use of an inverter saves energy

Power consumption is 70% less than it was 30 years ago.

Year	Energy Consumption
1970	100
1980	93
1990	74
2000	37

Energy savings of 70%

Hoist motor is controlled by the inverter to maximize efficiency and save energy

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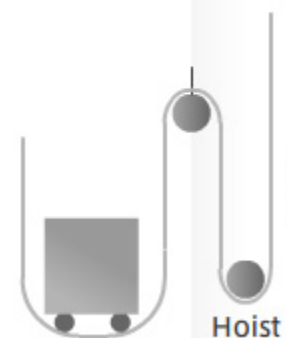
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AXIEZ Machine-room-less Elevators

Storing and effectively reusing electricity

When the brakes are applied to the elevator, energy is produced in the hoist. Conventionally, this energy had been consumed without purpose by being given off as heat.



The diagram shows a cross-section of an elevator shaft. On the left, an elevator car is positioned. On the right, a hoist mechanism is shown with a pulley and a counterweight. A vertical line represents the hoist rope. The text 'Energy given off as heat' is placed to the right of the hoist mechanism. A purple pen is visible on the right side of the slide.

Conventionally

Energy given off as heat

Hoist

Next

1 2 3 4 5 6 7 8 9 10 11 12

|| Stop > Play

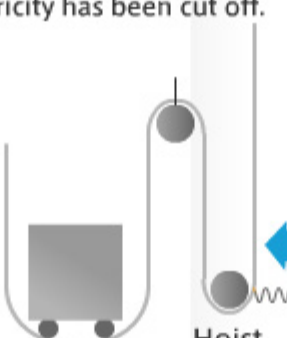
AXIEZ Machine-room-less Elevators

Storing and effectively reusing electricity

However, storing this heat as electricity in a nickel-metal hydride battery allows the electricity to be effectively put to use when the elevator is in operation.

* Option for additional price

This technology also plays an extremely important role during power outages. The elevator can be operated for around 10 minutes even when its supply of electricity has been cut off.



The diagram shows a cross-section of an elevator shaft similar to the previous slide. On the right, a hoist mechanism is shown. A blue arrow points from the hoist mechanism to a yellow battery icon. The text 'Electricity can be utilized during normal operations' is placed above the battery. Below the battery, it says 'Nickel-metal hydride battery (control panel)'. A purple pen is visible on the right side of the slide.

AXIEZ

Electricity can be utilized during normal operations

Nickel-metal hydride battery (control panel)

Hoist

Next

1 2 3 4 5 6 7 8 9 10 11 12

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AXIEZ Machine-room-less Elevators

Storing and effectively reusing electricity

Storing electricity and effectively reusing it is yet another feature of Mitsubishi Electric elevators. * Option for additional price

Conventionally

AXIEZ

Energy savings
Over 20% reduction in power consumption during normal operations

Nickel-metal hydride battery (control panel)

Hoist

Hoist

AXIEZ TOP

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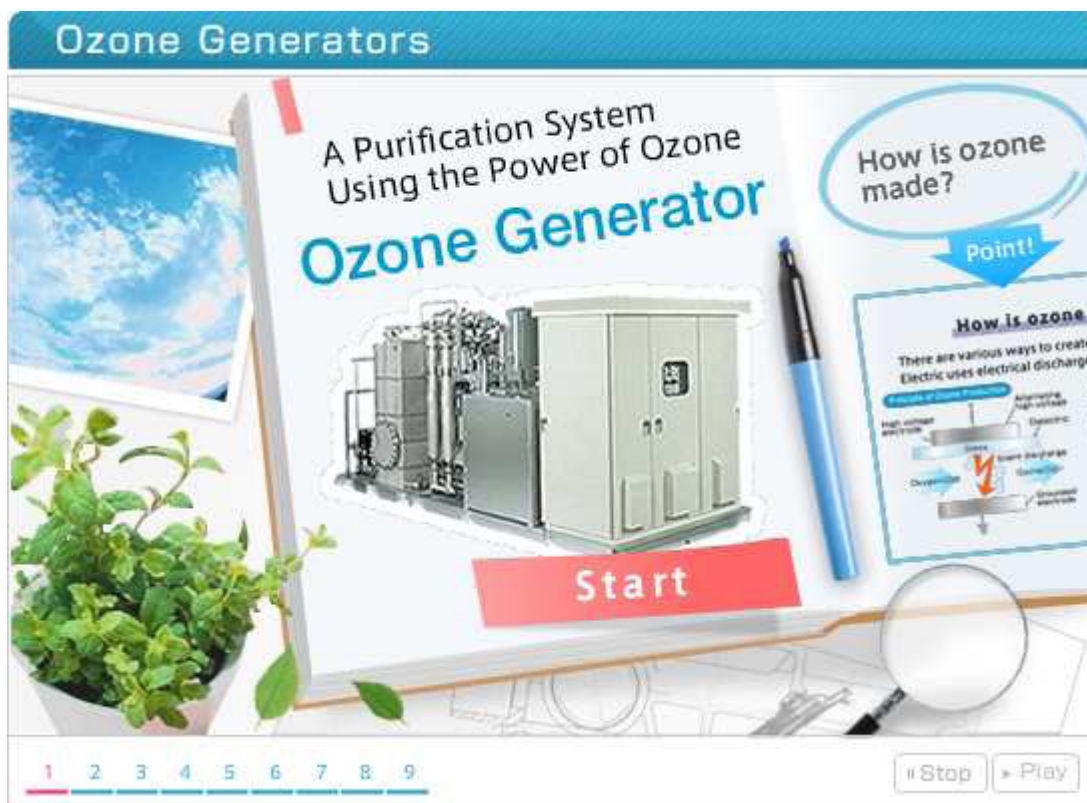
Guide to Environmental Technologies

Products

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

Cutting-Edge Technology


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



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.

Ozone Generators

What is ozone? What is its function?



Next

1 2 3 4 5 6 7 8 9


|| Stop ▶ Play

This slide is the first in a series of nine. It features a large blue circle with a white question mark in the center. The slide is titled 'Ozone Generators' and 'What is ozone? What is its function?'. At the bottom, there is a navigation bar with numbers 1 through 9, where '2' is highlighted in red. There are also 'Stop' and 'Play' buttons.

Ozone Generators

What is ozone? What is its function?

Ozone is comprised of three oxygen atoms and is one of the gases that make up the air.



Next

1 2 3 4 5 6 7 8 9

|| Stop ▶ Play

This slide is the second in a series of nine. It features the same title and question as the first slide. Below the question, it provides a definition: 'Ozone is comprised of three oxygen atoms and is one of the gases that make up the air.' A diagram shows three blue circles, each containing a white 'O', followed by an equals sign and the text 'Ozone O3'. At the bottom, there is a navigation bar with numbers 1 through 9, where '3' is highlighted in red. There are also 'Stop' and 'Play' buttons.

Ozone Generators

What is ozone? What is its function?

What are the properties of ozone, which has one more oxygen atom than oxygen?

The answer is:

- Sterilization
- De-colorization
- Deodorization
- Purification

Next

1 2 3 4 5 6 7 8 9

|| Stop ▶ Play

Ozone Generators

What is ozone? What is its function?

Here is how ozone accomplishes sterilization and deodorization.

Sterilization: Ozone (O_3) has a tendency to release one of its oxygen atoms (O) and revert to being an oxygen molecule (O_2). Sterilization takes advantage of this property.

The oxygen atom oxidizes the bacteria's cellular membrane and destroys it.

Next

1 2 3 4 5 6 7 8 9

|| Stop ▶ Play

Ozone Generators

What is ozone? What is its function?

Here is how ozone accomplishes sterilization and deodorization.

Deodorization: Taking the case of ammonia (NH₃), for example, the oxygen atom combines with a nitrogen atom (N) and hydrogen atom (H) and breaks down to form nitrogen (N₂) and water (H₂O). After breaking down, it returns to oxygen, so it is harmless.

Next

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▶ Play

Ozone Generators


What is ozone? What is its function?

Because of its properties, ozone is used in a variety of applications.


General Applications




For purifying and sterilizing water, sewage, and pool water




For sterilizing food products and cleaning containers



For purifying agricultural wastewater



For oxidation and cleaning in semiconductor manufacturing



For deodorizing and preventing infectious diseases in hospitals

Next

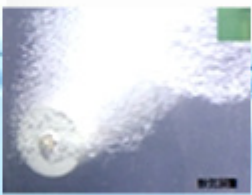

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Ozone Generators

What is ozone? What is its function?

Mitsubishi Electric's Ozone Generator is widely used in water and sewage applications in particular. It assists in advanced purification processes that remove bacteria and odors from water.



Sample installation at a purification facility

Generating ozone

Next

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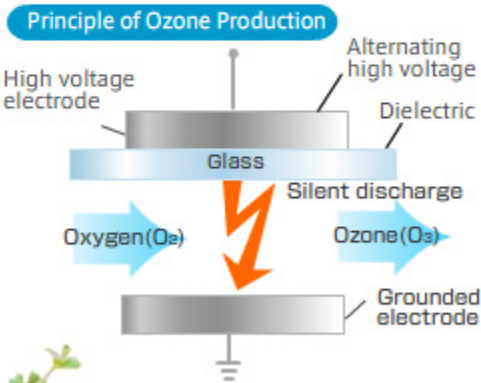
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Ozone Generators

How is ozone made?

There are various ways to create ozone, but Mitsubishi Electric uses electrical discharge.

Principle of Ozone Production



High voltage electrode

Alternating high voltage

Dielectric

Glass

Silent discharge

Oxygen(O₂)

Ozone(O₃)

Grounded electrode

The Ozone Generator creates ozone at a high density, 240g/m³ (N), which is twice that of conventional models, **making it about 30% more energy efficient.**

Ozonizer Generators Top

1 2 3 4 5 6 7 8 9

|| Stop > Play

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- ▶ Ozone Generators

Cutting-Edge Technology


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



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.

Capacitor

What is a capacitor?



Next

1 2 3 4 5 6 7 8 9 10 11 12 13 14


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Capacitor

What is a capacitor?

There are three basic types of devices that store electricity.

- Condensers
- Batteries
- Capacitors



Next

1 2 3 4 5 6 7 8 9 10 11 12 13 14

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Capacitor

What is a capacitor?

Instantaneous force (power)

Condensers

Condensers feature excellent instantaneous force. They are capable of instantly charging and discharging electricity in a fraction of a second.

Lasting force (energy)

Next

1 2 3 4 5 6 7 8 9 10 11 12 13 14

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Capacitor

What is a capacitor?

Instantaneous force (power)

Condensers

Batteries

Batteries feature exceptional lasting force. They are capable of charging and discharging over a long period of time.

Lasting force (energy)

Next

1 2 3 4 5 6 7 8 9 10 11 12 13 14

|| Stop ▶ Play

Capacitor

What is a capacitor?

Instantaneous force (power)

Condensers

Capacitors

Batteries

Capacitors have more lasting force than condensers and more instantaneous force than batteries, combining the strengths of both.

Lasting force (energy)

Next

1 2 3 4 5 6 7 8 9 10 11 12 13 14

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Capacitor

New capacitors developed by Mitsubishi Electric are the trump card for preventing global warming.

Next


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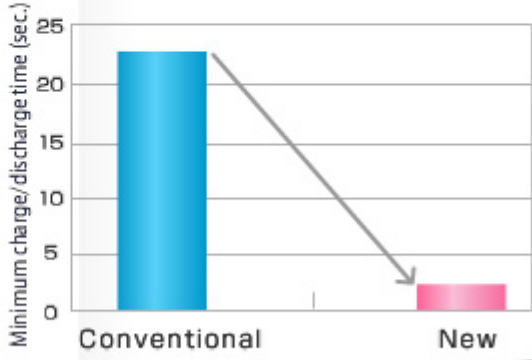
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Capacitor

Why Mitsubishi Electric capacitors are so remarkable

Mitsubishi Electric's new capacitors feature **the fastest charge/discharge time in the industry -- only one second!**





Capacitor Type	Minimum charge/discharge time (sec.)
Conventional	23
New	2

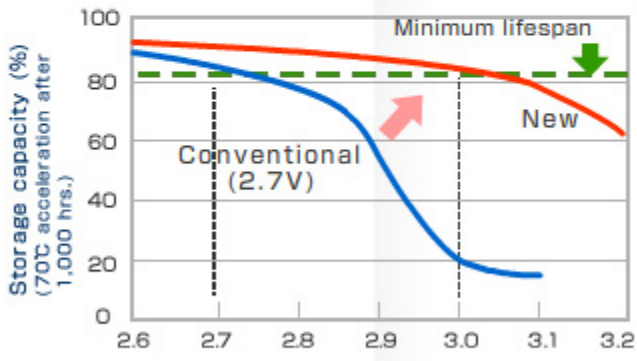
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Capacitor

Why Mitsubishi Electric capacitors are so remarkable

We succeeded in **raising electrical storage capacity by more than 20%**, giving the capacitors **industry-class voltage resistance (3V)**.



Voltage (V)	Conventional (2.7V)	New (3.0V)
2.6	~90	~95
2.7	~85	~92
2.8	~75	~88
2.9	~55	~82
3.0	~20	~75
3.1	~15	~70
3.2	~10	~65

Next

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Capacitor

Why Mitsubishi Electric capacitors are so remarkable

Capacitors had been limited to applications such as memory backup in electronic devices, but these breakthroughs have opened up the possibility of capacitors becoming a key device in the fight against global warming through their use in **photovoltaic power generation** and **motors**.

Next

|| Stop
▶ Play

Capacitor

Photovoltaic Power Generation



There is a great deal of variance in the output of photovoltaic power systems depending on climate conditions, and this variance does damage to the power grid (i.e., system of facilities that supply electric power). This problem will have to be resolved as photovoltaic systems become more widespread.

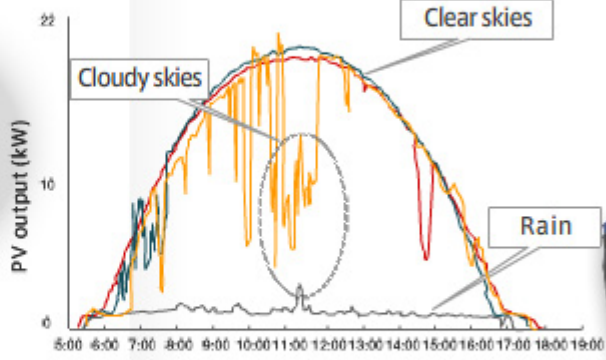
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Capacitor

Photovoltaic Power Generation



When the output is down, equalizing through capacitors that can make "rapid charge/discharge in just one second" as a buffer can eliminate resulting damage, making the widespread use of photovoltaic systems practical.


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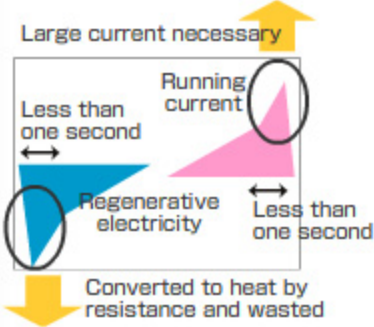
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Capacitor

Motors





The conventional wisdom holds that motors have just about reached their limit in terms of energy efficiency. However, most of the electrical energy that is produced when a motor starts and stops (regenerative electricity) goes to waste as heat.

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Capacitor

Motors

In the case of elevators, for example, in which the motor stops and starts frequently, energy loss is as high as 30%.

Energy is lost every time the motor stops

Energy is stored when stopping

Stored electricity is used when accelerating

Possibility of recycling electricity

Next

1 2 3 4 5 6 7 8 9 10 11 12 13 14

|| Stop > Play

Capacitor

Motors

However, using capacitors capable of charge/discharge in just one second together with the motor makes it possible to eliminate wasted electrical energy. Motors are used in all devices and equipment that move by electricity, so there is little doubt that these capacitors have the potential to save a great deal of energy.

Motor + Capacitor

Eliminates wasted electrical energy!

Capacitor TOP

1 2 3 4 5 6 7 8 9 10 11 12 13 14

|| Stop > Play

Guide to Environmental Technologies

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Cutting-Edge Technology

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




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

SiC Power Device

**What does SiC stand for?
What is a power device?**



Next


1 2 3 4 5 6 7 8 9 10

|| Stop ▶ Play

SiC Power Device

**What does SiC stand for?
What is a power device?**

Silicon, widely known as a semiconductor material, is written as "Si", atomic number 14 on the periodic table of elements.



"SiC" stands for silicon carbide, a compound made up of carbon bound to silicon in a one-to-one ratio.

Si
Silicon

SiC
Silicon + Carbon

Next

1 2 3 4 5 6 7 8 9 10

|| Stop ▶ Play

SiC Power Device

What does SiC stand for? What is a power device?

Power devices are a type of semiconductor device used to control electric power. They are used in every single type of power system.

Power devices are indispensable to **power systems**

Next

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SiC Power Device

What does SiC stand for? What is a power device?

Mainstream power devices are made from silicon, but their capacity to reduce energy loss is limited. Expectations are therefore high for devices using SiC that feature reduced energy loss.

Output (kW)	Si Loss (W)	SiC Loss (W)
1	~40	~20
2	~60	~30
3	~80	~40
4	~100	~50
5	~120	~60

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SiC Power Device

Mitsubishi Electric has developed a highly energy and resource efficient inverter by utilizing SiC power device technology.

Next

1 2 3 4 5 6 7 8 9 10

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SiC Power Device

Why Mitsubishi Electric's SiC inverter is so remarkable

Power devices include transistors that run switches and diodes that regulate electrical current traffic. Mitsubishi Electric has developed an inverter module that uses SiC in all of its devices and, based on this module, has designed and developed a prototype of an inverter with 3.7 kW output.

SiC power module

SiC inverter

Next

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|| Stop ▶ Play

SiC Power Device

Why Mitsubishi Electric's SiC inverter is so remarkable

This newly designed SiC inverter successfully reduces power loss by over half compared to traditional inverters that use silicon power devices. This inverter opens up new possibilities for energy savings.

Continuing to leverage the potential of SiC will make it possible, in the near future, to reduce energy loss to just 10% of conventional levels.

Device	Energy Loss
Si inverter	100
SiC inverter	46 (54% reduction)

Next

|| Stop
▶ Play

SiC Power Device

Why Mitsubishi Electric's SiC inverter is so remarkable

When an inverter module is made entirely out of SiC, heat given off due to energy loss is reduced, so the module can be compact in size. This helps to conserve resources.

Inverters with High Power Density (Compact)

Conventional inverter

Inverter using SiC power devices

➔

SiC inverter

Inverter using SiC inverter devices

One-fourth the cubic volume


Next

|| Stop
▶ Play

SiC Power Device

Why Mitsubishi Electric's SiC inverter is so remarkable

Just think of the possibilities.
If all the inverters used in air conditioners, automobiles, industrial equipment, railway cars and more were to be switched over to SiC inverters, the energy and resource savings would be truly immense.



The diagram illustrates the benefits of SiC inverters. On the left, a solid grey cloud labeled 'CO2 emissions' has a blue arrow pointing to a smaller, dashed grey cloud, indicating a reduction in emissions. On the right, a stack of grey rectangular blocks labeled 'Resources' has a blue arrow pointing to a smaller stack of blocks, indicating a reduction in resource usage.

CO2 emissions

Resources

SiC Power Devices TOP

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|| Stop ▶ Play

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- ▶ SiC Power Device
- ▶ **Gradationally Controlled Voltage Inverter**
- ▶ Pumpless Water Cooling System



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.

Gradationally Controlled Voltage Inverter

What causes energy loss to occur?



Next

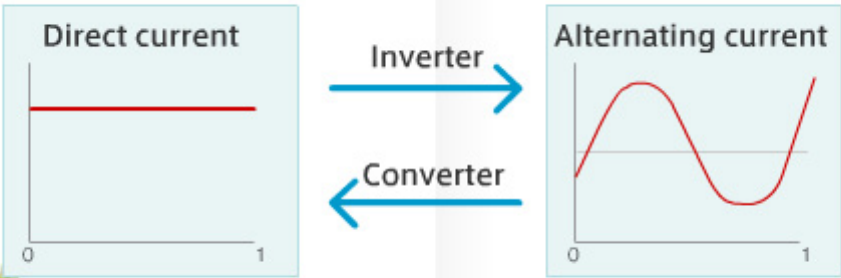
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Gradationally Controlled Voltage Inverter

What causes energy loss to occur?

There are two forms of electricity, direct current and alternating current.
In order to power all the various electrical products and machinery, systems are needed that convert electricity into a form that can be used by the product.



Next

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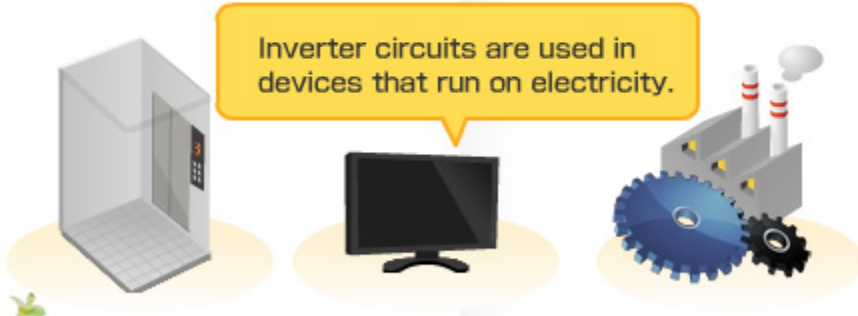
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Gradationally Controlled Voltage Inverter

What causes energy loss to occur?

Most things that run on electricity take alternating current, including cars, elevators and factory machinery, so they have inverter circuits. However, when electricity is converted, loss inevitably occurs.

Inverter circuits are used in devices that run on electricity.



Next

1 2 3 4 5 6 7 8 9 10 11 12


|| Stop ▶ Play

Gradationally Controlled Voltage Inverter


What causes energy loss to occur?

Why then does energy loss occur?
The reason has to do with the waveform.

This is the waveform of alternating current, which we have shown above.



This is the inverter waveform.



Next

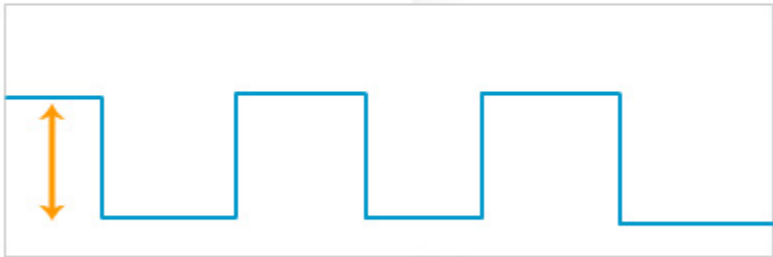
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Gradationally Controlled Voltage Inverter

What causes energy loss to occur?

The inverter waveform has peaks and valleys. Generally, the larger the wave's amplitude, the larger the loss.



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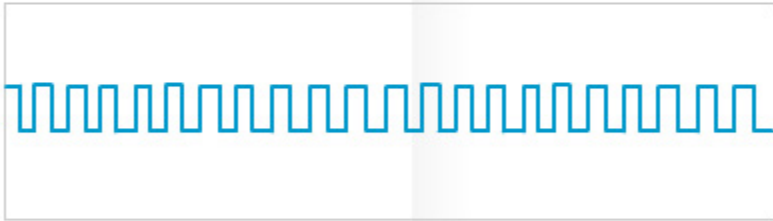
|| Stop ▶ Play

This slide features a blue header with the title 'Gradationally Controlled Voltage Inverter'. Below the header, the question 'What causes energy loss to occur?' is displayed in a light blue box. The text explains that larger amplitude waves result in greater energy loss. A square wave graph is shown with a vertical double-headed arrow indicating its amplitude. A red 'Next' button is located at the bottom right. At the bottom, there is a navigation bar with numbers 1 through 12, where '6' is highlighted in red, and 'Stop' and 'Play' buttons.

Gradationally Controlled Voltage Inverter

What causes energy loss to occur?

The converse is also true: the smaller the wave's amplitude, the smaller the energy loss.



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1 2 3 4 5 6 7 8 9 10 11 12

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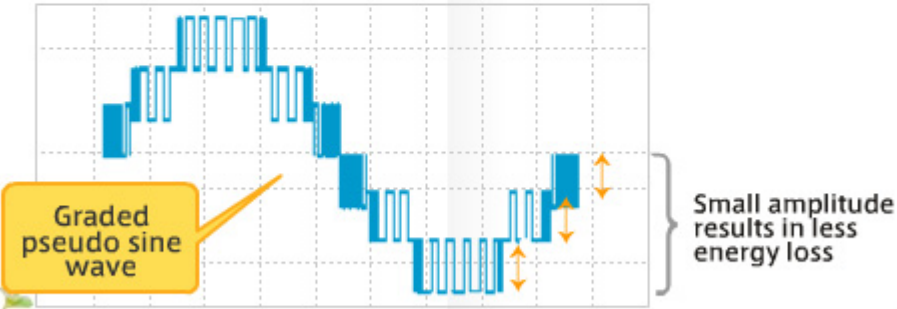
This slide features a blue header with the title 'Gradationally Controlled Voltage Inverter'. Below the header, the question 'What causes energy loss to occur?' is displayed in a light blue box. The text explains that smaller amplitude waves result in smaller energy loss. A high-frequency square wave graph is shown with a vertical double-headed arrow indicating its amplitude. A red 'Next' button is located at the bottom right. At the bottom, there is a navigation bar with numbers 1 through 12, where '7' is highlighted in red, and 'Stop' and 'Play' buttons.

Gradationally Controlled Voltage Inverter

What is gradational voltage control?

By applying this principle, Mitsubishi Electric developed a technology for minimizing energy loss: the gradationally controlled voltage inverter.

Waveform outputted by a gradationally controlled voltage inverter




Next

1 2 3 4 5 6 7 8 9 10 11 12

|| Stop ▶ Play

Gradationally Controlled Voltage Inverter

What makes gradational control better?



Next

1 2 3 4 5 6 7 8 9 10 11 12

|| Stop ▶ Play

Gradationally Controlled Voltage Inverter

Why Mitsubishi Electric's gradationally controlled voltage inverters are so amazing

Gradationally controlled voltage inverters connect three types of inverters, each one with double the voltage, in a series, and combine their outputs to create a pseudo sine wave.

(Single phase INV: Single phase inverter)
Direct current voltage ratio will be in multiples of 2 or 3.

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Gradationally Controlled Voltage Inverter

Why Mitsubishi Electric's gradationally controlled voltage inverters are so amazing

Unlike pulse width modulation (PWM), which alters the voltage by turning the semiconductor on and off to change the output time without changing the size of the source DC voltage, gradational voltage control provides extremely high power conversion efficiency. This is why it has garnered attention as a next-generation technology capable of accelerating energy conservation efforts.

Next


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Gradationally Controlled Voltage Inverter

Why Mitsubishi Electric's gradationally controlled voltage inverters are so amazing

Mitsubishi Electric has applied this new groundbreaking technology to develop uninterruptible power systems (systems that prevent voltage from dropping when lightening strikes) and power conditioners, which convert electricity generated by photovoltaic power systems for household use. These devices provide society with a higher level of energy efficiency.



Uninterruptible power supply



Power conditioner

To Gradually controlled voltage inverter TOP

1 2 3 4 5 6 7 8 9 10 11 12

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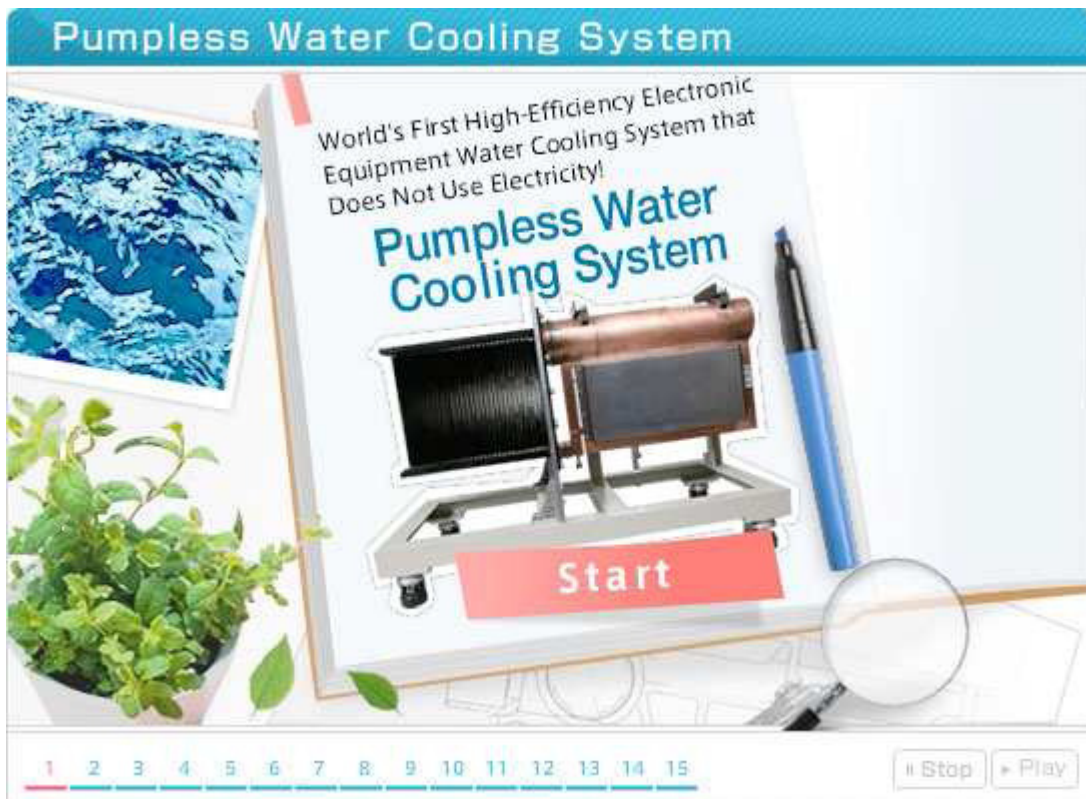
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- ▶ **Pumpless Water Cooling System**



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.

Pumpless Water Cooling System

The parts inside electronic equipment generate heat and become warm when electricity flows through them. In particular, in recent years, such equipment has become more compact, more highly functional and inverter-based, so more heat is being generated. If nothing is done about that heat, it can lead to malfunction or breakdown.



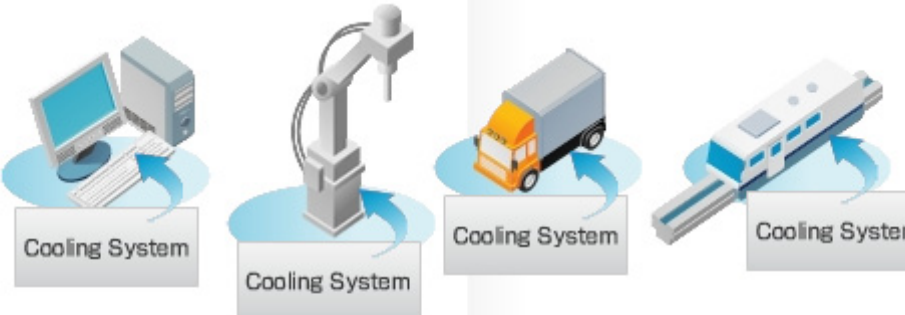
Next

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

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Pumpless Water Cooling System

That is why all types of electronic equipment have cooling mechanisms.



Next


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

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Pumpless Water Cooling System

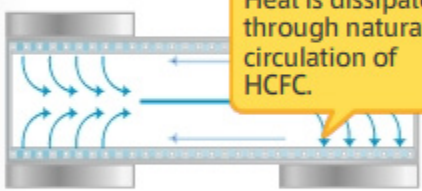
There are various mechanisms for cooling electronic equipment, but two especially powerful systems are water cooling systems and heat pipe systems.

Heat is dissipated through forced water circulation.



Pump-based Water Cooling System

Heat is dissipated through natural circulation of HCFC.



Heat Pipe System


Next

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Pumpless Water Cooling System

Water cooling systems circulate water, which is environmentally responsible and provides exceptional heat dissipation. Heat that is captured from the equipment is released in the cooling device, so heat is dissipated efficiently. For these reasons, water cooling systems are highly efficient.



Electronic equipment

Water-cooled heat sink

Next

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

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Pumpless Water Cooling System

However, water cooling systems use a pump to circulate the water, are large, and consume a lot of power -- all of which have been problems.

The diagram shows a closed-loop system. On the right, 'Electronic equipment (heat producing)' is connected to a 'Heat receptor'. The pipe then goes down to a 'Reservoir Tank' at the bottom. From the tank, the pipe goes left to a 'Radiator' where 'Cooling airflow' is shown. The pipe then goes up through a 'Filter' and a 'Pump' (circled in blue) back to the 'Heat receptor'. Callouts include: 'Power is needed to make it run.' pointing to the pump; 'Regular maintenance is required' pointing to the radiator; 'Equipment is large' pointing to the overall system; and 'Leaks are also an issue' pointing to the pipe between the heat receptors. A 'Next' button is at the bottom right.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

|| Stop > Play

Pumpless Water Cooling System

With heat pipe systems, a sealed pipe is filled with water, HCFC or some other substance. The liquid evaporates from the heat given off by the equipment and the difference in steam pressure moves the liquid through the pipe to dissipate the heat, so no pump is needed. It is an environmentally conscious system because no electric power is used.

The diagram shows a horizontal sealed pipe. On the left, 'Electronic equipment (heating element)' is shown with 'Heat reception' arrows pointing into the pipe. Inside the pipe, 'Liquid' is on the bottom and 'Steam' is on the top, with arrows showing the liquid moving right and steam moving left. On the right, the pipe is connected to a 'Radiator' with 'Cooling airflow' arrows pointing into it. 'Heat dissipation' arrows point out from the radiator. A 'Porous substance' is shown at the bottom of the pipe. A callout 'It does not require maintenance' points to the pipe. Another callout 'No electricity used' points to the heating element. A 'Next' button is at the bottom right.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

|| Stop > Play

Pumpless Water Cooling System

However, even though heat pipe systems don't use electricity, they still have weaknesses. They are unable to handle large volumes because of how they work, and a radiator has to be placed on top of the electronic equipment.

Space is required to install the radiator because it is fairly tall.

Can only be installed on top of the equipment

Heat dissipation

Heat reception

Electronic equipment (heating element)

Radiator

Cooling airflow

Next

-
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|| Stop

▶ Play

Pumpless Water Cooling System

Mitsubishi Electric has created an extremely energy efficient system that solves the problems inherent in water cooling and heat pipe systems while retaining the positive qualities of both.

Next

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|| Stop

▶ Play

Pumpless Water Cooling System

We call this system the Pumpless Water Cooling System.

Heat dissipation
Cooling airflow
Radiator
Cold liquid
Heat exchanger
Heat exchange
Hot liquid
Boiling
Heat reception
Electronic equipment
Evaporator
Condensing
Hot liquid

Next

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

|| Stop > Play

Pumpless Water Cooling System

How did Mitsubishi Electric accomplish this?

Next

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

|| Stop > Play

Pumpless Water Cooling System

Developing the Pumpless Water Cooling System

The principles of heat pipe systems are sound, but ...

When a sub-radiator is added at the bottom...

When heat is conveyed to the heat receptor, the liquid boils and rises by utilizing this buoyancy. The radiator takes the heat from the steam bubbles and the liquid circulates at a high temperature. The radiator must be positioned on top of the equipment, but by adding a sub-radiator, heat can be dissipated anywhere.

Next

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

|| Stop ▶ Play

Pumpless Water Cooling System

Developing the Pumpless Water Cooling System

When a preheater is installed at the bottom ...

When pipe is added ...

The liquid circulates well, but an inefficient heat exchange area has to be created to cool the upper part and heat the lower part, making the equipment quite large. Mitsubishi Electric used a heat exchanger to resolve this issue.

Next

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

|| Stop ▶ Play

Pumpless Water Cooling System

Developing the Pumpless Water Cooling System

Heat exchanger, Vapor bubbles, Heat reception, Evaporator, Cooling airflow, Radiator, Heat dissipation

When the position of water evaporation is changed...
The equipment can be compact and there is more flexibility in where it can be installed.

Next

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

|| Stop > Play

Pumpless Water Cooling System

This development process gave rise to the Pumpless Water Cooling System. It is **driven by heat given off by the equipment itself**, so there is **no need for a pump**. This means it uses **no electricity**, there is **less chance of breakdown** and it does not require maintenance.

No pump needed

No electricity used

No CO2 emissions

Next

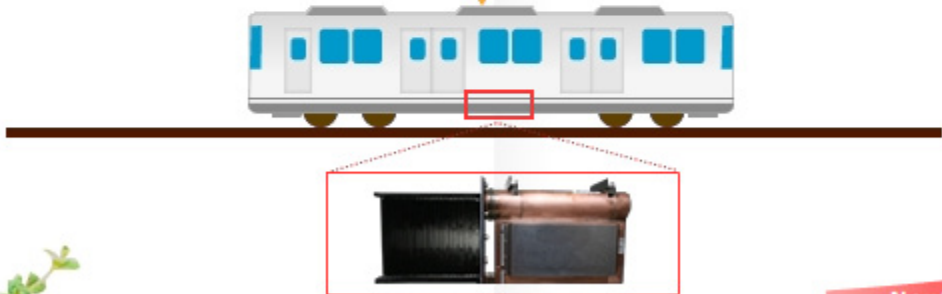
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Pumpless Water Cooling System

Mitsubishi Electric's pumpless system is lightweight and 20% smaller than conventional pump-based water cooling systems, but features large-capacity cooling performance of 10 kW. It can be installed almost anywhere.

Cooling an inverter on a railroad car



Next


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

|| Stop > Play

Pumpless Water Cooling System

The Pumpless Water Cooling System is currently garnering attention for infrastructure applications like railroads and power plants, but in the future, if it continues to get smaller and lighter, it could eventually be used with computers, home appliances and other consumer products.

Mitsubishi Electric will continue to refine this system, a truly remarkable energy-saving device, for the prevention of global warming.



Pumpless Water Cooling System Top

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

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Environmental Topics

Reducing CO₂ During Production



▶ Reducing CO₂ from Product Usage

Carbon dioxide emissions during the period a product is used far exceed emissions given off when it is produced. Our goal is to improve the energy efficiency of our products in order to cut CO₂ emissions from product usage by 30% by 2021.

▶ More

▶ Reducing CO₂ Emissions during Production

We have successfully met our voluntary targets thanks to energy conservation initiatives on the production floor and proactive investment in energy-efficient facilities. Starting in fiscal 2009, we will strive to cut total CO₂ emissions from production by 30%.

▶ More

▶ Example 1: Fukuyama Works

Introducing Fukuyama Works as a case study in energy conservation. The plant has generated results by fully utilizing Mitsubishi Electric's energy efficiency support devices and by making energy use highly visible in order to manage specific energy consumption.

▶ More

▶ Example 2: Raising Production Efficiency

Introducing Air Conditioning and Refrigeration Systems Works as another case study in energy efficiency. The plant has achieved considerable efficiency by eliminating over-committing, inconsistency and inefficiencies in all production processes and improving productivity.

▶ More

Reducing CO2 during Production

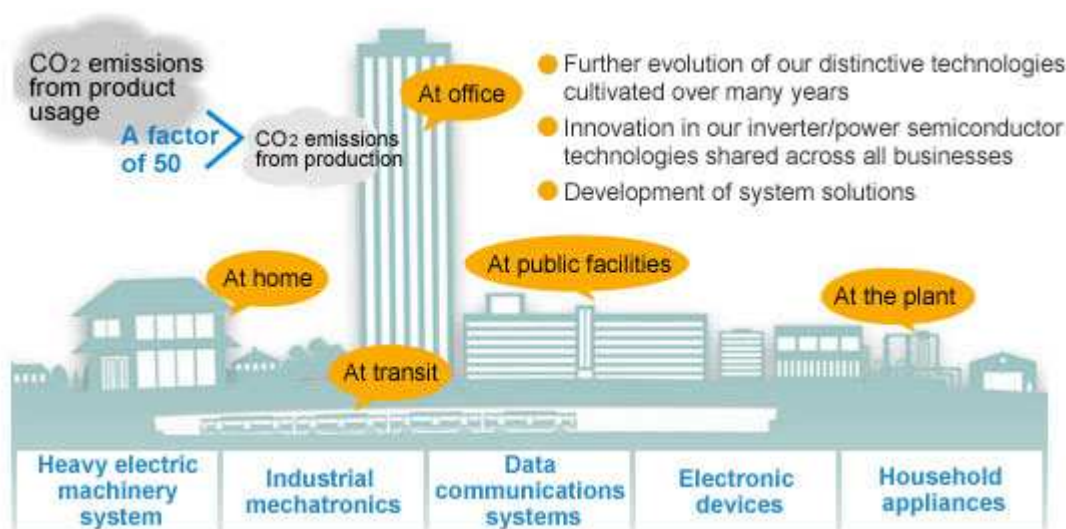
Reducing CO2 from Product Usage

From Improving the Energy Efficiency of Production to Raising the Energy Efficiency of Products

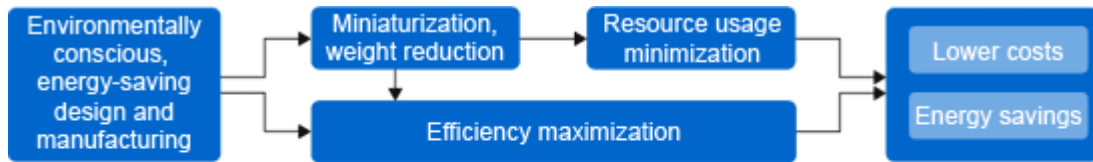
Mitsubishi Electric's Environmental Vision 2021 calls not only for reducing CO2 emissions from production but also for lowering emissions from product usage. Our approach is to focus on improving the energy efficiency of products while continuing to raise the energy efficiency of production. This is because many, many times more CO2 is emitted during product usage than production.

We currently emit around 474,000 tons of carbon dioxide (based on fiscal 2008 levels) a year. Reducing this figure by 10% requires that we lower emissions by 47,000 tons. Improving the energy efficiency of products while they are in use by just 1%, however, would cut CO2 by tens of thousands of tons.

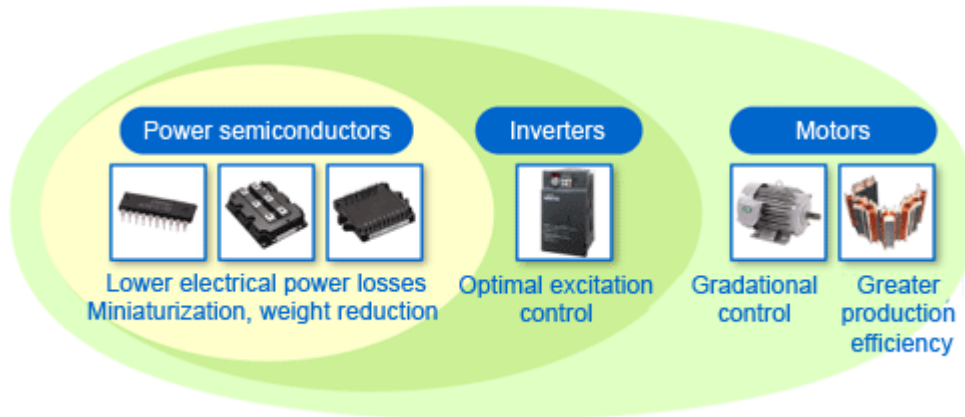
Mitsubishi Electric is fully committed to helping prevent global warming, so we have set a target of reducing CO2 emissions from product usage by 30% by 2021. We intend to accomplish this by continuing to develop innovative technologies for energy efficiency and delivering a range of energy-saving products to the market.



Basic Technologies Supporting Energy-Saving Products



Environmentally conscious initiatives lead to both energy savings and lower costs.



Reducing CO₂ during Production

Reducing CO₂ Emissions during Production

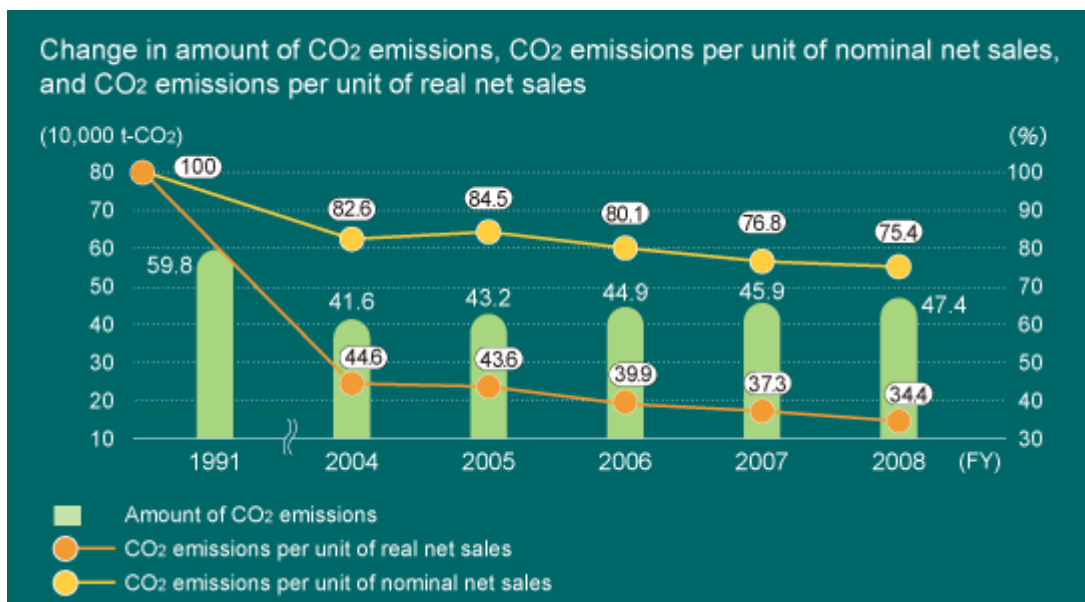
Achieved Targets for 3 Consecutive Years for Reducing CO₂ Emissions Per Unit of Real Net Sales

Mitsubishi Electric has set a voluntary target of reducing CO₂ emissions per unit of real net sales¹ by at least 60% by fiscal 2011, compared to fiscal 1991 levels.

In fiscal 2008, CO₂ emissions per unit of real net sales were 65.6% less than in fiscal 1991, so we have successfully met our target for three consecutive years. CO₂ emissions for fiscal 2008 were estimated to be 28,000 tons higher than the previous year because of increased production, but were curbed by 13,000 tons due a ¥3.37 billion investment² in energy-savings. As a result, CO₂ emissions for fiscal 2008 increased by 15,000 tons, bringing the total to 474,000 tons. We are endeavoring to lower this figure in accordance with our Environmental Vision 2021 program.

1: CO₂ emissions per unit of real net sales: The basis adjusts product prices based on the corporate goods price index, so it is a more precise indicator than CO₂ emissions per unit of production volume.

2: Details of energy-saving investment: Curbed 8000 tons of CO₂ emissions by investing in the "Energy-saving action plan" at ¥2.91 billion, approx. 0.1% of production output, and 5000 tons by investing ¥460 million in productivity improvement activities.



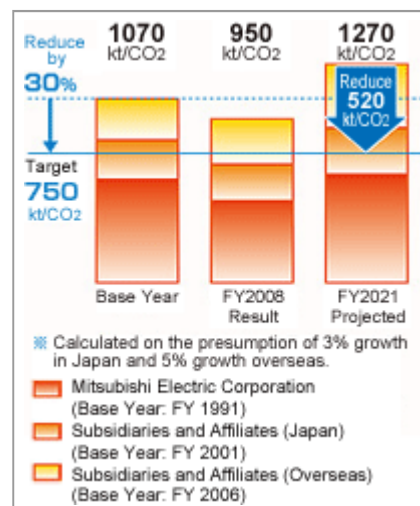
Launching Initiatives from FY2009 Aimed at Reducing CO₂ Emissions from Production by 30%

The Mitsubishi Electric Group's Environmental Vision 2021 calls for total CO₂ emissions from production to be reduced by 30% by 2021.

In order to achieve this vision, our energy conservation action plan¹ targeting our energy efficiency diagnostics program, in which production sites check on the status of one another's energy conservation activities, will be extended to group companies, and we will continue to promote the 3R's (reduce, reuse, recycle) to help prevent global warming, as well as encourage the use of energy-efficient IT devices throughout the Group.

1: The action plan is comprised of three initiatives for reducing CO₂ emissions: installing high-efficiency devices, conducting energy loss minimization activities² and converting to alternative fuels. As of fiscal 2008, Mitsubishi Electric (non-consolidated) has invested a total of ¥8,695 million since fiscal 2005 and has reduced CO₂ by 30,718 tons (see table for details).

2: Energy loss minimization activities: Measures where the amount of factory emissions from production and equipment are monitored in real-time to reduce the wasteful use of energy.



Energy Conservation Action Plan Progress

Action Plan	FY2011 Reduction Target (tons-CO ₂)	FY2006		FY2007		FY2008	
		Result		Result		Result	
		Reduction (t-CO ₂)	Investment (Millions of yen)	Reduction (t-CO ₂)	Investment (Millions of yen)	Reduction (t-CO ₂)	Investment (Millions of yen)
Installation of highly energy-efficient equipment	34,800	5,910	1,468	8,842	2,481	7,514	2,753
Energy-loss minimizing project	8,000	266	76	890	156	454	153
Conservation to alternative fuels	3,200	334	49	320	25	4	2
Total	46,000	6,510	1,593	10,052	2,662	7,972	2,908
Cumulative	-	12,694	3,125	22,746	5,787	30,718	8,695



Kanji Ota,
Corporate
Environmental
Sustainability Group

Investing in highly energy efficient facilities also raises energy profitability. Promoting energy efficiency is not a painful process; it is actually a great activity because it benefits corporate performance as well.

Using the metaphor of dieting to illustrate this point, purchasing emissions credits is like losing weight by using supplements. Investing in environmental facilities and making improvements is more like losing weight by exercising. Exercise requires a certain amount of effort, but your health and vitality are bound to improve as a result.

Mitsubishi Electric will continue to invest in environmental facilities while making steady efforts to reduce emissions in order to do our part in preventing global warming.

Reducing CO₂ during Production

Example 1: Fukuyama Works

Proactive Energy Conservation by Managing Specific Consumption

Demonstrating the Benefits of Energy Efficient Products Using Our Own Factory

Fukuyama Works began full-fledged energy loss minimization (EM) activities in 1997. The aims of the activities were to give consideration to the environment and pursue economic efficiency, while at the same time demonstrating the benefits of support devices and systems for energy efficiency developed and manufactured by Mitsubishi Electric.

At that time, the sales division of Fukuyama Works listened to the concerns of many of our customers, who said that energy efficiency was definitely an important issue for them, but that greater energy efficiency would be meaningless if it caused decreased productivity. We were also asked what the actual benefits would be of installing support systems for energy efficiency, and customers would tell us that they would not be able to take the plunge without knowing what those benefits would be.

We were able to immediately show customers test data on the performance of individual energy efficiency support products. But the benefits of operating these products as a system cannot be demonstrated except on an actual production floor. We decided to conduct this demonstration on the floor of one of our own factories. It was a strategy with dual significance: we would work for environmental consideration and improved productivity by promoting energy conservation using Mitsubishi Electric products, and we would show customers the effectiveness of our products on an actual production floor.



Managing Specific Energy Consumption for Each Facility

The basis of energy conservation activities is tracking the current state of affairs on the production floor, which means measuring energy usage. At Fukuyama Works, we moved ahead by first clarifying power consumption by each division, then further refining the process to measure each shop (group) and each facility. We then made improvements, prioritizing shops and facilities that consumed the most power.

It is not effective to make improvements on the basis of simple measurements of power consumption alone. Almost like a living organism, a production line is in constant state of flux. When production volume increases, energy consumption also naturally goes up. However, this increase alone does not necessarily amount to energy loss. Rather, it was crucial to discover when and where energy was being used inefficiently.

To do this we began tracking specific energy consumption. This involves managing energy usage using energy consumption per unit of production volume as an indicator. Detailed measurements of specific energy consumption for each division and each facility enable inefficiency and loss to be identified.

As a result of fully implementing improvement activities based on specific consumption in each division in accordance with ISO 14001 management techniques, we were successful in greatly improving energy efficiency and raising production efficiency over a short period of time. In 1998, the year after the project was launched, we were awarded the Energy Conservation Center, Japan Chairman's Award for Excellence in Energy Conservation. We also started a factory tour to actually show customers the benefits of energy conservation on the production floor.

Based on know-how acquired through promoting EM activities at our own factories, Fukuyama Works subsequently began developing devices and systems for efficiently and effectively supporting energy conservation.



Graph shows specific consumption

Fukuyama Works Employees Work Together to Develop Devices and Systems

In 1998 we developed the EMU Power Meter, which efficiently measures power consumption by individual facilities, and in 2000, we advanced the technology and developed the EcoMonitor, a multi-circuit power meter that simultaneously measures power over multiple circuits. We subsequently developed a series of industry-leading new device and software products designed to support energy conservation from novel perspectives. In 2002, we created EcoServer II, an energy efficient data collection server that handles everything from collecting energy efficiency data to transmitting it over the web. In 2003, we developed E-Energy, an energy efficient demand-monitoring server that monitors and controls power demand.



In developing these products, we had employees in the factory's various divisions serve as monitors to verify their usability and workability from the customer's perspective, and provide valuable advice to the development division. All employees of Fukuyama Works truly came together to create these highly practical devices and systems.



EcoMonitor II
- A multi-circuit power meter



EcoServer II
- An energy efficient data collection server



E-Energy
- An energy efficient demand-monitoring server

Clarifying Areas of Improvement with Real-Time Measurement of Specific Consumption

These Mitsubishi Electric products are currently in operation all around Fukuyama Works. EcoMonitors have been installed on the power distribution boards of each facility to measure power consumption and production volume. This measurement data is sent to EcoServer II, which instantly calculates specific energy consumption. Trends in power consumption and specific consumption are graphed in an easy-to-understand manner so that they can be checked in real time via a LAN by the plant manager and division managers as well as by all other employees at their own computers.

On the basis of these efforts to make energy usage readily apparent, we have set targets for the factory as a whole, for each division, and at the production floor level for each product. We have also established systems for making specific improvements. In this way the entire process can be readily grasped.

If specific consumption worsens for some reason, the situation is checked against actual conditions on the production floor, which allows the causes, whether a setup mistake, equipment failure or idling machinery, to be immediately uncovered and appropriate improvement measures taken. Thoroughly eliminating energy loss in this way makes it possible to use the necessary energy for production at the necessary time, in the necessary places and in the necessary amounts -- a "just-in-time energy" system.

This initiative at Fukuyama Works has earned high praise from various quarters in Japan. In 2004 we received the Chugoku Bureau of Economy, Trade and Industry Director-General's Award for Excellence in Energy Conservation, in 2006 we were honored with the Chugoku Bureau of Economy, Trade and Industry Director-General's Award for Outstanding Energy Conservation at Factories, and in 2007 we were honored with the ECCJ Chairman's Award for Outstanding Energy Conservation Programs.



Contributing to Society with Best-in-Class Energy Efficiency Support Devices

The challenge continues at Fukuyama Works. Since fiscal 2006, we have worked to more thoroughly and appropriately manage demand by linking E-Energy, our energy efficient demand monitoring server, with the G50, a web-compatible centralized controller for air conditioning developed by Wakayama Works. In addition, we have upgraded to high efficiency air conditioners in administrative buildings and made operational improvements that include automatic operational curtailment (rotation control), preset temperature restrictions, and prevention of shutoff oversights.



Fukuyama Works

As a result of these initiatives, in fiscal 2008, we successfully reduced energy consumption per unit of production output by 27% from fiscal 1991 levels. We have also been converting from fuel oil and LPG to electricity and city gas, and in fiscal 2007, we replaced heating equipment used for steam from models powered with fuel oil to models run on electricity. This served to substantially reduce fuel oil usage.

We intend to continue to make improvements and ramp up energy loss minimization activities in order to make all forms of energy, not just electricity, readily apparent and easily understood, including fuel oil, steam, gas, air and water. Our goal is to have our production floors lead the way in Japan. We hope that the initiatives taking place at Fukuyama Works will serve as a reference for many customers and that our expertise in this area will help customers promote energy efficiency at their own factories. This is another social contribution that Mitsubishi Electric can make.



A showroom at Fukuyama Works presents features of energy efficiency support and system outlines in an easy-to-understand manner.

Reducing CO2 during Production

**Example 2: Raising Production Efficiency
Air Conditioning and Refrigeration Systems Works**

Environmental JIT (E-JIT) as a Symbol for Energy Conservation

The Air Conditioning and Refrigeration Systems Works has goals of reducing energy consumption per unit of production value by 25% from fiscal 1991 levels and reducing carbon dioxide emissions derived from energy by 2% every year. To achieve these goals the plant is engaged in energy conservation initiatives that center on saving energy with high-efficiency equipment, expanding the scope of JIT to include energy conservation activities, and installing energy efficiency support devices.

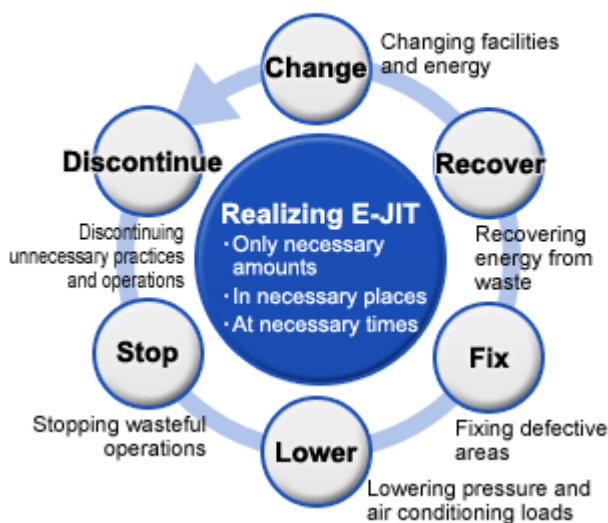
Of these initiatives, the plant is putting particular emphasis on expanding the scope of JIT to include energy conservation activities, an effort being promoted by each and every employee involved in production. The term JIT, short for "just in time," is normally used to mean having the necessary things in the necessary amounts at the necessary times. The Air Conditioning and Refrigeration Systems Works was the first of all our manufacturing plants to use Environmental JIT (E-JIT) as a Symbol for Energy Conservation activities. Saving energy does not mean not using energy; it means using it in the necessary amounts at the necessary times in the necessary places. Based on this thinking, the plant has adopted six perspectives--Change, Discontinue, Stop, Lower, Fix, Recover--that it uses to verify energy usage and carry out specific improvement initiatives.



Air Conditioning and Refrigeration Systems Works

Six Perspectives

— Practicing Energy Conservation from Six Perspectives —



Case Example 1: Change

Practicing "Change," means changing facilities and energy. This section introduces three examples.

Updating to High-Efficiency Lighting

We replaced conventional rapid-start fluorescent lighting (40W) with highly efficient high-frequency (HF) fluorescent lighting (32W). HF fluorescent lights provide bright light while consuming less power, so we were able to reduce the number of lighting fixtures used. As an example, at our two-storey administrative office, lighting fixtures were reduced by 32%, from 377 to 256. The resulting energy savings exceeds 6,884 kWh per month. Changing the fixtures to pull-switch models also succeeded in making employees more diligent about turning off the lights.



Before: 377 fixtures → After: 256 fixtures
32% reduction

Installing High-Efficiency Transformers

We replaced the transformers at onsite transformer substations with super high-efficiency models. We also installed automatic power factor adjustment devices that adjust the power factor in line with load fluctuations. This served to reduce power loss by 11.4%, from 257,653 kWh to 228,530 kWh.



Before: 257,653 kWh → After: 228,530 kWh
Power loss reduced by 11.4%

Converting to Alternative Fuels

Converting from fuel oil A and LPG, which have large CO₂ emissions coefficients, to city gas (13A), has enabled us to reduce CO₂ by 443 tons per year.



Ichiro Oka, Compressor Group Manager

Identifying and making as many improvements as possible eventually leads to major energy savings. For example, on the compressor processing line there are some 100 processors. Changing the indicator lights on the machines, which are green, orange and red, from incandescent lights to LED alone allowed us to save around ¥300,000 a year in electricity charges.



Kanji Nakano, Unit Group Manager

E-JIT not only saves energy but also helps reduce waste and improve productivity. For example, as a part of our packaging improvement efforts, we stopped packaging with cardboard and polypropylene bands and began just loading the products on a specialized truck (supplying just the actual product). This simple change raised assembly productivity and improved quality. It also helped reduce packaging at our partner factories, which in turn lowered processing costs.

Case Example 2: Discontinue

"Discontinue" refers to discontinuing unnecessary practices and operations. Two examples are introduced here.

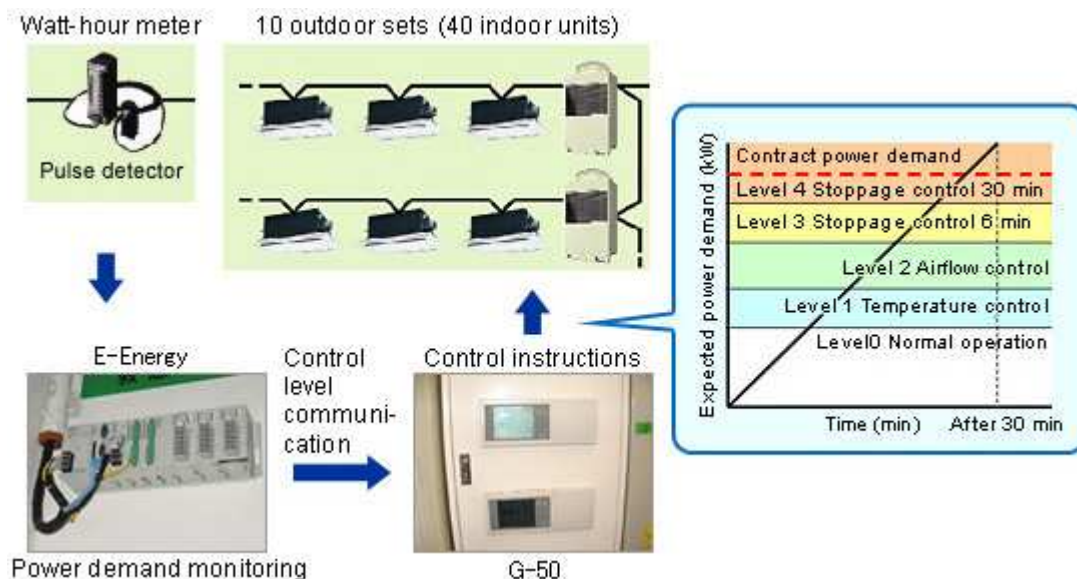
Thinning Out Onsite Lighting

Surveying the plant surprisingly turned up areas where lighting was unnecessary. We thinned out fluorescent lighting in places where people are not engaged in work and limited lighting to only places where it is necessary. We removed 433 of the four factories 1979 total lights, saving some ¥935,000.



Conserving Energy through Automatic Air Conditioning Control

We use a centralized air conditioning controller, G-50, and a demand monitoring server, E-Energy, which are both made by Mitsubishi Electric. They allow us to remotely monitor air conditioning with use of a computer and preset an operating schedule. Air conditioning is automatically controlled, including heating and cooling, airflow and stoppage, in line with the level of demand. This enables us to limit power usage and lowers our basic electricity bill.





Nobuyoshi Miyamoto, Stock Management Group Manager Waryo Technica Co., Ltd.

We store a wide variety of parts in the parts warehouse. Before, we stored these parts on automated racks, but in order to comply with a short schedule, multi-cycle production and reduce excess stock through greater transparency, we eliminated the automated racks and switched to fixed shelves.

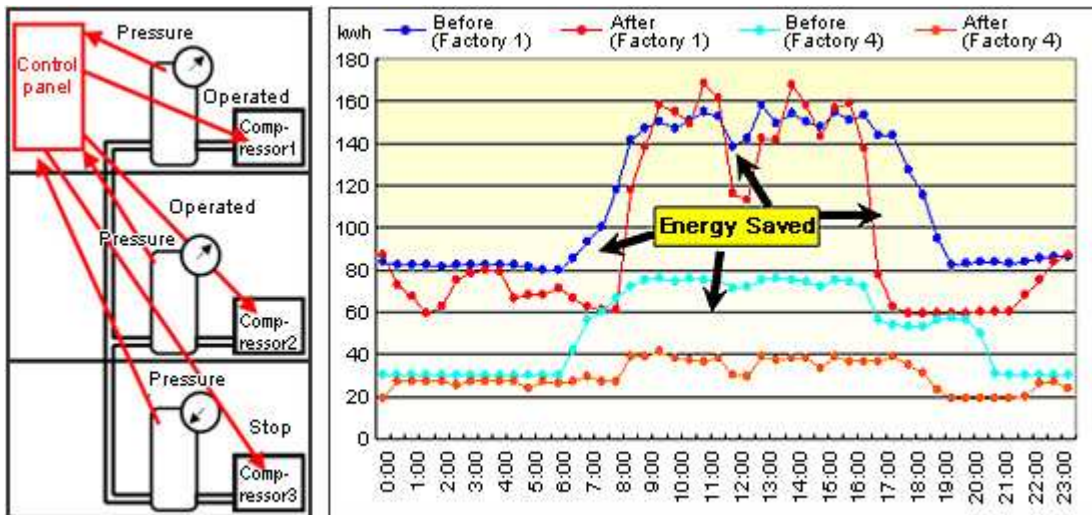
The shelves are currently laid out to make everything easy to see and we work to keep things organized, orderly and clean. If the workplace is clean and well organized, abnormalities are readily spotted. When abnormalities are known, improvements can be made.

Case Example 3: Stop

"Stop" refers to stopping wasteful operations. Two case examples are introduced here.

Limiting Numbers of Air Compressors in Operation

We linked air compressors on each level through a control panel in an effort to save energy by automatically turning the compressors on or off depending on pressure standards. At Factory 1 and Factory 4, which use the control system, we succeeded in reducing annual energy consumption by 452,745 kWh, producing economic benefits of ¥6.97 million.



Before: 2,117,610 kWh After: 1,664,865 kWh Reduction of 452,745 kWh

Energy Savings Day on Second Saturday of Every Month



On the second Saturday of every month, we cut the electricity to circuits for which it is possible to do so.

Breakers that have been turned off are labeled as such to indicate energy savings.



Osamu Ueno, Parts Production Section Manager

The Parts Production Section is responsible for production of key parts for air conditioners, including metal parts, molded plastic parts, heat exchangers, and refrigerant valves. These parts are made via a series of processes, but we are working to consolidate the processes to shorten lead times and reduce tasks under a policy of only using the necessary amounts of the necessary items at the necessary times. Connecting the processes should eliminate intermediate tasks like reloading and conveyance and thereby raise productivity and save energy.

In fiscal 2008 we made it possible to track electric furnace production volumes and power consumption. We plan to carry out additional energy efficiency measures by analyzing correlations between the two.

Case Example 4: Lower

"Lower" refers to our efforts to lower pressure and air conditioning loads. Three examples of this initiative are introduced here.

Changing the Hydraulic Oil Used in Resin Molding Equipment

At the Air Conditioning and Refrigeration Systems Works, we switched to a low viscosity, low specific gravity hydraulic oil (in consultation with the oil manufacturer) in order to reduce the amount of power consumed by resin molding processes. Switching to a different oil reduced pressure loss in the equipment piping as well as power consumption when starting up the equipment. In terms of energy savings, we reduced power consumption by 13% on a per-hour basis. Switching oils has benefited us in another way as well. The previous oil was classified as a hazardous substance, but the new type is non-hazardous, so its handling is more straightforward.



Coating Roofs with a Reflective Paint

We coated our factory roofs with a reflective paint in order to reduce the air conditioning load and confirmed a drop in room temperatures directly below the roof of around two to three degrees. In terms of outdoor temperature, this would be equivalent to moving the factory from Wakayama north to Aomori. Based on our estimates, the power load from cooling has been reduced by around 7%.



Shortening Assembly Conveyors and Instituting a Dolly-Based Production System

The workflow for parts and product assembly normally involves the use of conveyors. At the Air Conditioning and Refrigeration Systems Works we substantially shortened conveyor length by closing gaps between work processes. This was a part of our E-JIT reform initiative and involved having the necessary things in the necessary places at the necessary times. We also introduced a dolly-based production system in which assembly takes place on top of moving platforms without the use of conveyors. The system was introduced in order to make it easier to accommodate changes in production volume, to better balance the burden among workers, and to shorten manufacturing lead times. These productivity improvements also make a substantial contribution to energy conservation.





Yutaka Maeda, Cooling Group Assistant Manager Waryo Technica Co., Ltd.

Waryo Technica, which is contracted to produce some of the product lines at Mitsubishi Electric's Air Conditioning and Refrigeration Systems Works, is actively involved in E-JIT. Improving productivity and closing gaps between processes to shorten assembly conveyors has lessened power costs, reduced onsite lighting and otherwise helped save substantial amounts of energy. We are currently working to have parts delivered from suppliers without packaging to save resources and reduce waste.

Case Example 5: Fix

"Fix" involves working to conserve energy by fixing defective areas.

Replacing Worn Out Steam Piping

At the Air Conditioning and Refrigeration Systems Works, we replaced and reinstalled worn out steam piping and steam headers, which reduced the amount of city gas used by steam boilers by 2%.

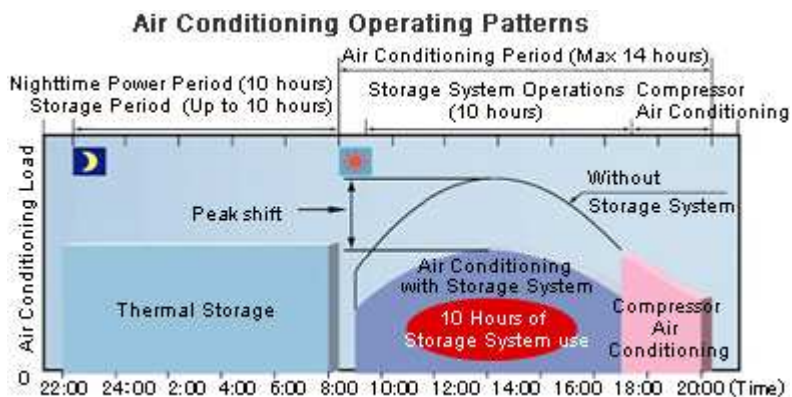


Case Example 6: Recover

"Recover" refers to activities to recover energy from waste. Three examples of these activities are introduced here.

Installing Ice-Thermal Storage Air Conditioning Units

We installed ice-thermal storage air conditioning units to shift and reduce peak power usage. The units use inexpensive power at night to make ice and hot water that is used in the daytime for cooling and heating.



Heating Soft Water for Boilers by Recovering Steam Drain

We recover heat trapped in condensation from saturated vapor after production process work has been completed and reuse it to heat soft water used in city gas through-flow boilers. Doing so reduces the amount of city gas used by the boilers by 3% and raises the soft water temperature from 40-45° C, what it was before installation of the system, to 57-83° C.



Active Promotion of E-JIT

The Air Conditioning and Refrigeration Systems Works is progressively conserving more energy by steadily carrying out activities on the basis of six perspectives. In fiscal 2008, we reduced energy consumption per unit of production value to 59.5% of fiscal 1991 levels (for a 40.5% reduction). The plant is not only involved in energy conservation but also in promoting E-JIT activities for the environment more broadly.

To reduce releases of harmful substances, we have begun using coatings with low solvent content. We developed a specialized thinner for use in solvent coatings and reduced the volume of toluene and xylene, both of which are classified as harmful substances, by half. Completely eliminating harmful substances would be ideal, but inadequate coating performance (rust resistance) would be problematic. So, we opted for low-solvent coatings instead of seeking to completely eliminate the chemicals. This has reduced our use of toluene and xylene by 1,300 kg annually.

Also, in an effort to reduce waste, we switched to translucent waste receptacles to make it possible for people to see what has been thrown out and made sorting waste more straightforward. We are also working to eliminate cardboard by switching to reusable pallets to transport a variety of materials.

Our watchword will continue to be E-JIT, and we will continue to make improvements, with every employee acutely aware of environmental issues, in order to conserve energy and help protect the environment.

Comments of Environment Control Section Members Responsible for Promoting Environmental E-JIT



Yasushi Takeda

The key to JIT activities is participation by all employees. It is essential that everyone try to eliminate waste immediately, even if the result is not perfect. Air Conditioning and Refrigeration Systems Works is a production plant for energy efficient products, so we have a special responsibility to promote energy conservation in manufacturing as well. We will continue to innovate and experiment in various ways in order to help protect the environment.



Mikio Hisamura

Making large capital investments is one way of bringing about energy savings, but steady, everyday improvement efforts are also important. Making steady improvements day to day also fosters an environmental mindset.



Shusei Tsumori

The six perspectives of Change, Discontinue, Stop, Lower, Fix and Recover are important in promoting greater energy conservation. Constantly thinking about which perspectives apply will inevitably lead to innovations.



One of the three initiatives for preventing global warming laid out in Mitsubishi Electric's Environmental Vision 2021 program, announced in October of 2007, is the goal of promoting photovoltaic (PV) systems and increasing their efficiency. Here we introduce the features of Mitsubishi Electric's photovoltaic power generation systems and the various ways we are working to achieve these goals.

Mitsubishi Electric is the only maker that can develop and manufacture photovoltaic systems entirely in-house.



Photovoltaic (PV) power generation systems are made up of two basic devices: a PV module that converts solar energy into electrical energy, and a PV inverter that converts the generated electricity into a form that can be used in the home.

Generally, most manufacturers involved in photovoltaic power generation only make the PV module themselves. They usually either assemble systems by using PV inverters from other companies or sell systems while marketing PV inverters purchased from other companies under their own brand. Mitsubishi Electric develops and produces every system component in-house, including PV modules and PV inverters. One of the main features of our photovoltaic power generation business is that we are able to provide total systems made entirely out of Mitsubishi Electric products.

We are able to develop everything in-house thanks to our extensive experience, long track record and outstanding technologies in the area of power electronics (equipment and facilities for receiving and distributing electricity). In fact, creating high-performance photovoltaic systems depends not only on cutting-edge semiconductor technology for the PV cells but also on power electronics technology for making the system function well. Our strength in power electronics shows up everywhere in Mitsubishi Electric photovoltaic systems.



Nakatsugawa Works Iida Factory is home to our photovoltaic power generation systems business

- ▶ Aug 27, 2008:
Mitsubishi Electric Announces Shipment of Small-size Photovoltaic Module for Non-electrified Areas.  (65KB)
- ▶ Aug 27, 2008:
Mitsubishi Electric to Build New Photovoltaic Cell Plant in Aim to Expand Annual Photovoltaic Production Capacity to 600MW by Fiscal 2012.  (30KB)

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Increasing Efficiency

Mitsubishi Electric PV inverters deliver an industry-leading power conversion rated load efficiency of 97.5%¹



A major difference between Mitsubishi Electric's photovoltaic (PV) systems and systems made by other companies is the PV inverter. Electricity produced from solar energy by photovoltaic cells must be converted from direct current to alternating current, the type of electricity used by electrical appliances. Converting electricity from D.C. to A.C. is the role of the PV inverter. However, energy is inevitably lost when this conversion takes place. The extent to which this

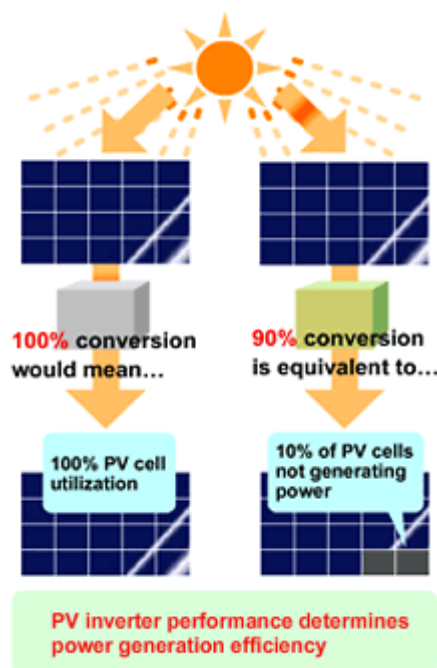
loss can be minimized rests entirely on the performance (power conversion efficiency) of the PV inverter.

If the power conversion efficiency of the PV inverter changes, the amount of power that can actually be used also changes, even if the PV module is producing the same amount of power. For example, if the conversion efficiency of the PV inverter is 90% (10% loss), then 10% of the PV cells on the roof are essentially being wasted. Whether or not valuable PV cells are wasted in this way depends entirely on the PV inverter.

Mitsubishi Electric has developed a high-performance PV inverter that leverages power electronics technology, one of our traditional strengths. The most recent model released in January 2008 applies new proprietary technology to achieve a conversion efficiency of 97.5%, a two percentage point improvement over our previous model, which held the former industry high of 95.5%.

Note

1: As of July 2008. The industry high is for mass produced PV inverters for Japanese domestic-use PV systems. Rated load efficiency is stipulated by JIS C8961. Actual measurement of 97.5% was by Mitsubishi Electric on the PV-PN40G model. (Mitsubishi Electric's previous model, the PV-PN33G, was 95.5%)

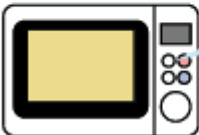


The Significance of 2%

To grasp what is so special about raising conversion efficiency by a mere 2%, from 95.5% to 97.5%, it's necessary to begin looking at it in terms of loss, which was reduced from 4.5% to 2.5%. This is close to half. And actually, when we accomplished this feat it was met with a good deal of surprise and admiration.

Increasing efficiency by 2% is equivalent to reducing loss by nearly half

The amount of loss recovered on a 4 kW photovoltaic system is equivalent to enough



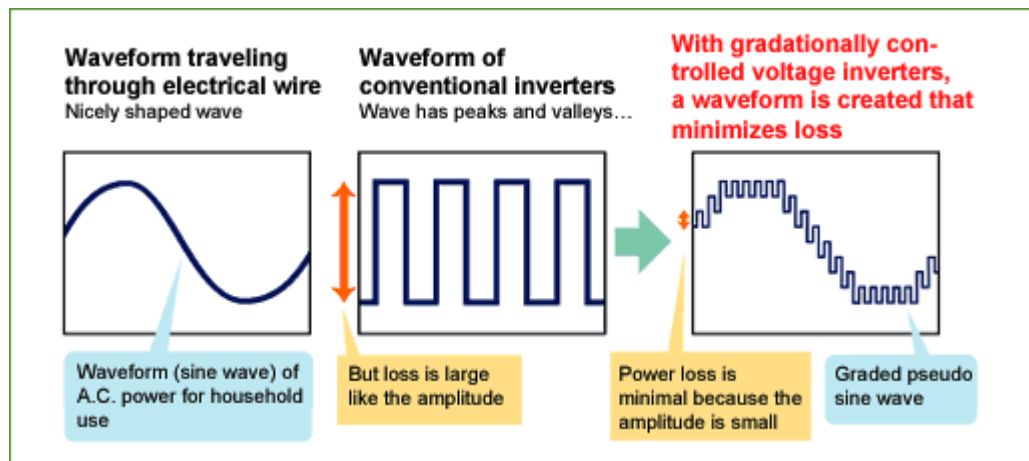
electricity to cook for **80 hours** with a microwave oven that consumes 1 kW.

Control technology comprising three separate inverters is the key to higher efficiency

Power loss occurs in a number of areas, but the part where power loss is especially large is the inverter. There is a close relationship between electricity loss and the waveform output by the inverter. Normally, the larger the wave's amplitude is, and the slower it changes, the larger the loss.

Conventional PV inverters were controlled with one inverter. The wave amplitude was large, so loss was also substantial. With the new technology, however, three inverters with differing voltages are skillfully combined to make the amplitude output by the inverter extremely small. Moreover, the on/off speed was increased several times over to come close to a form offering minimal loss. This technology, which we developed ourselves, is called gradationally controlled voltage inverter technology and it is the secret behind our achieving an industry-leading power conversion efficiency of 97.5%.

For more information, please see the Guide to Environmental Technologies



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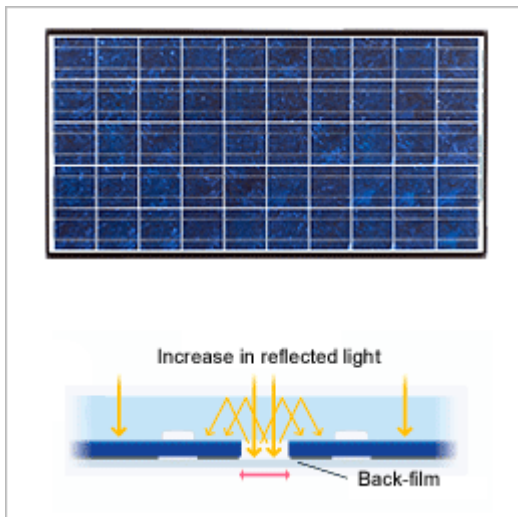
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Increasing Efficiency

Mitsubishi Electric Photovoltaic (PV) Modules Offer a Maximum Output of 185 Watts



Mitsubishi Electric is at the leading edge of photovoltaic module development worldwide. Our current product for the home generates 185 watts of power per module. This is the top level of output provided by a polycrystalline silicon module made in Japan.

Two innovations have made this high output possible. The first is the module's large size. We increased the number of PV cells, which feature industry-class conversion efficiency, and increased their size from 150 to 156 millimeters. The other innovation involves the design of the cell. The space between each cell was widened so that the cells could absorb more of the light reflected off the backing film between the cells.

Photovoltaic system performance equals PV inverter performance times PV module performance

No matter how much the PV inverter minimizes loss when converting from direct current to alternating current, if the performance of the PV module that makes the electricity in the first place is not up to par, the amount of power that is obtained is diminished. At the same time, no matter how much power is generated, if significant loss occurs when converting to A.C., the result is less power that can actually be used. To put it another way, the higher the performance of both is, the higher the performance of the photovoltaic system overall. Mitsubishi Electric's PV modules and PV inverters both deliver industry-leading performance, so our photovoltaic systems permit use of ample amounts of electricity made from the sun in daily life.



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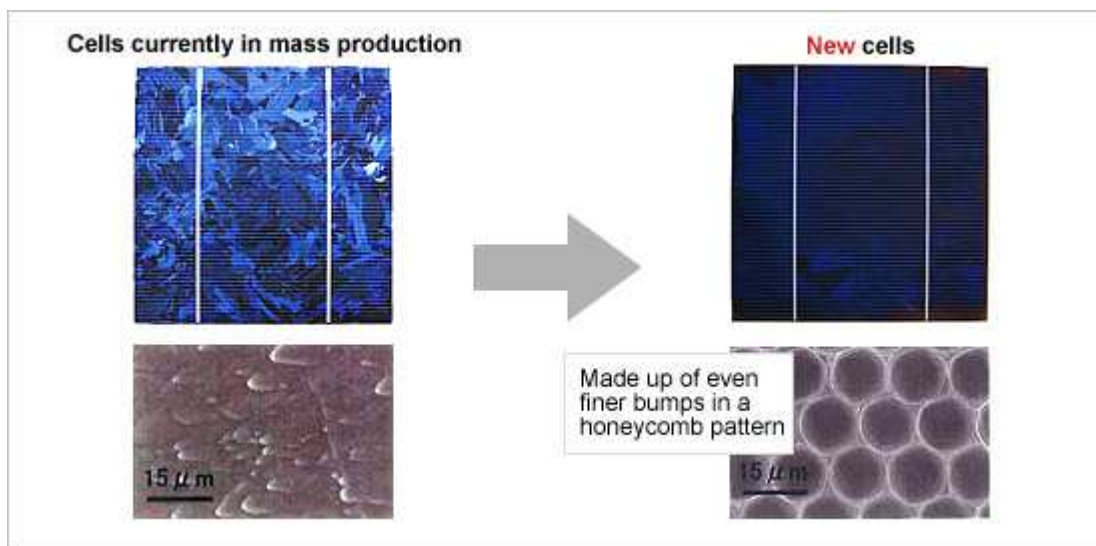
Successfully Developing PV Cells with the World's Highest Conversion Efficiency of 18.6%¹

The amount of power generated by a photovoltaic module depends on the output of its PV cells, so raising the conversion efficiency of the cells leads directly to more power generated. To raise the conversion efficiency of PV cells there is a need to capture as much sunlight as possible by limiting the amount of sunlight that reflects off the surface of the cell.

Mitsubishi Electric achieved a conversion efficiency of 18.6%, the best in the world, in March 2008 using 150-millimeter polycrystalline silicon PV cells with an ultra-fine honeycomb surface that limits reflection to a substantial degree. We are currently developing technology for mass production of these high-efficiency cells and plan to gradually incorporate them into cells for PV modules starting in fiscal 2011.

Note:

1. As evaluated by the National Institute of Advanced Science and Technology (AIST), a public certification body for conversion efficiency.

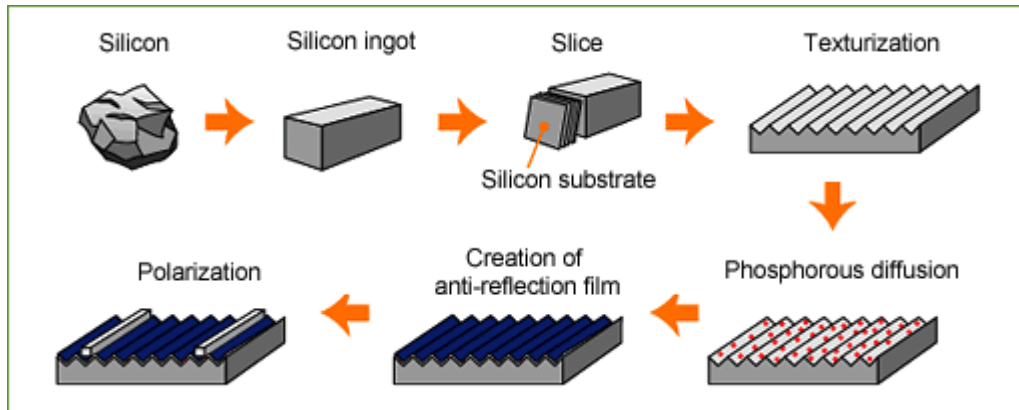


Value of Polycrystalline Silicon Photovoltaic Cells

There are two varieties of crystalline silicon PV cells: monocrystalline and polycrystalline. Monocrystals generate more electricity than polycrystals, but they are used in a range of semiconductors and so are relatively expensive. In contrast, polycrystals can only be used in PV cells and are relatively inexpensive. Mitsubishi Electric believes that one of the keys to further popularizing photovoltaic power generation will be to take inexpensive polycrystals and raise their generating efficiency to the level of monocrystals through technological innovation, and then provide systems to the market with exceptional cost performance.

Polycrystals are actually quite difficult to use effectively. But the converse is that if technology for creating high efficiency systems with polycrystals can be established, polycrystalline systems would be a match for monocrystalline systems. Even if the price of monocrystalline silicon were to go down and it became easier to use, there would be no concern, because the technology used for polycrystals would be at a high level.

Making a Polycrystalline Photovoltaic Cell



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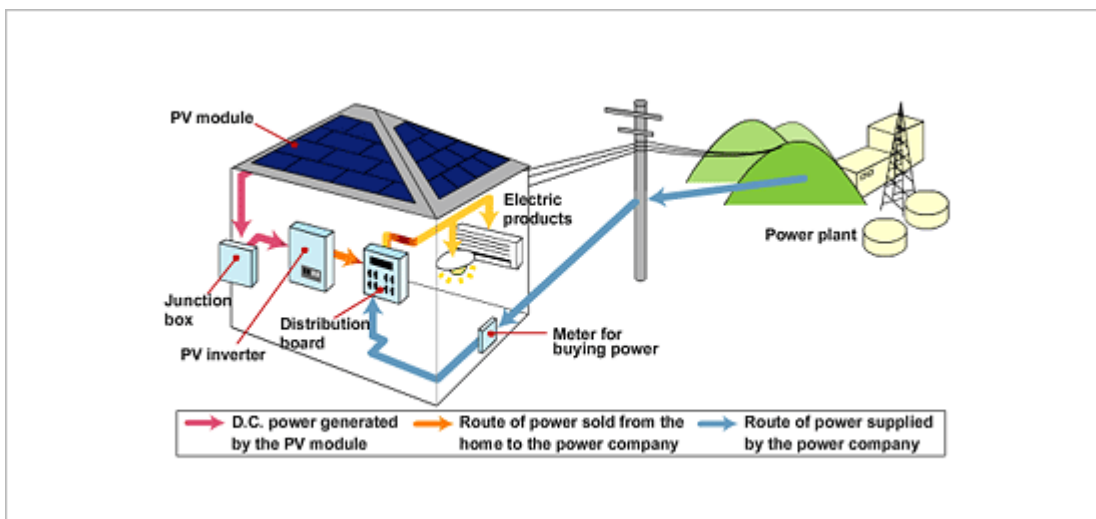
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Research on Preventing Disturbances to Power Grid Quality When Selling Power

Power produced by photovoltaic power generation systems is sent on a priority basis to electrical devices through the distribution board. If any power is left over, it is returned to the power grid owned by the utility companies and sold to them (reverse power flow). The ability to sell power is one of the benefits of installing a photovoltaic system. However, power grids have not been designed for reverse power flow; they are more like one-way streets. In order to reverse the flow, the power must be sent at a voltage that is slightly higher than the grid and there exists the possibility that the grid could be negatively impacted by distorted waveforms and other phenomena specific to photovoltaic power.

With small systems for the home (3kW), this is not particularly a problem, but if the medium- and large-scale systems used by buildings and factories become more widespread, the impact of reverse power flow on the grid emerges as a problem that cannot be ignored. It is from this standpoint that Mitsubishi Electric is conducting research and testing, in partnership with the government and other companies in the industry, aimed at developing systems that minimize disturbance to the grid's power quality.



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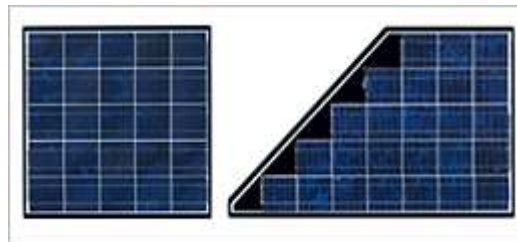
PV Popularization

Expanding the Range of Installations to Areas with Heavy Snowfall or Salty Air

Mitsubishi Electric is committed to further popularizing photovoltaic power generation systems. We are therefore also devoted to research and development aimed at improving module performance and minimizing installation restrictions. In 2007, we improved the load-bearing capacity of our PV modules via a newly developed protection bar, which eases the installation restriction on snow accumulation from less than one meter to less than 1.5 meters. This has made it possible to install the systems in nearly half the 4.36 million households in Japan located in regions with heavy snowfall - something that had been prohibitively difficult before. In addition, a three-layer backing film with exceptional weather-resistance, humidity-resistance and sealing performance has been adopted for use on the underside of the modules, which makes it possible to use the systems in areas where salty air is a concern, like along the coast.



As we expand the scope of potential installations, we are also working to diversify module shapes. Mitsubishi Electric offers a lineup that includes rectangular modules with a 1:2 width-to-length ratio, square modules and trapezoidal modules. This diversity of shapes allows our photovoltaic systems to be installed on a broad range of Japanese houses with various roof shapes, including homes with gabled, hipped or flat roofs.



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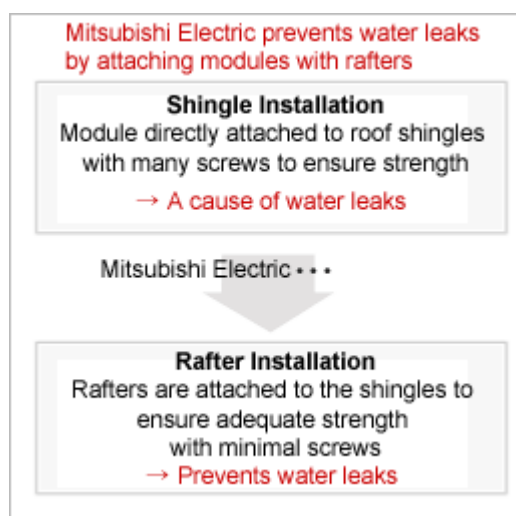
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PV Popularization

Entire Range of Products, Sales, Installation, and Support: Pursuing the Highest Possible Quality to Earn the Trust of Customers

Photovoltaic systems are not cheap, which means that customers expect a system to effectively generate electricity, be trouble free and come with robust post-installation support. In other words, customers want a system that includes the product, installation and service in one package. In order to further promote photovoltaic systems, we are pursuing not only better product quality but also the absolute best quality in sales, installation and support.

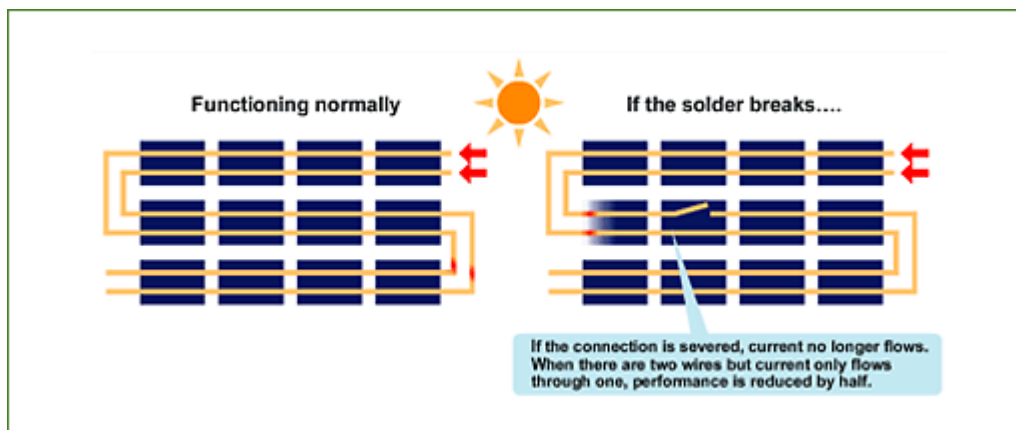
For sales and installation in Japan, we hold presentations and research sessions for dealers and installers around the country, provide appropriate information to help customers properly understand the systems, and direct installations to make sure they are highly reliable. For installations in particular, we attach modules to the roof with rafters in order to prevent leaks, and only certified installers who have passed our training course are contracted for system installation. We also provide installers with free online software we developed ourselves to help custom design the optimal system based on each customer's installation requirements and specific needs. We provide a 10-year warranty on Mitsubishi Electric photovoltaic systems designed and installed using this system. There are some 1,200 registered MPS companies nationwide, a network that we continue to expand.



In addition, Mitsubishi Electric has opened the industry's only photovoltaic system technology help center for dealers and installers in Japan. Through this center we provide precise answers to all sorts of inquiries. In the area of post-installation support as well, we have a dedicated toll-free line for questions and concerns, and at least one service center in every prefecture. These centers enable us to provide thoroughgoing service, starting with regular inspections.

Soldering Technology Substantially Increases Reliability of Photovoltaic Modules

Photovoltaic modules are used on rooftops over a long period of time, for 20 years or more. If a module malfunctions, the time and cost for repairs and new parts can be significant. This is why Mitsubishi Electric works extremely hard to create a highly reliable product that will not break down over the long term. Soldering technology is one of the keys to improving reliability. PV modules are made up of around 40 to 50 photovoltaic cells that are linked together in a series with fine copper wire. If a connection breaks, those cells will cease to function. In fact, soldering problems are the most common cause of malfunctions in photovoltaic systems. Mitsubishi Electric has developed its own original automated soldering machine to help resolve this problem. Nakatsugawa Works, which manufactures the photovoltaic modules, leverages its unique production know-how, cultivated over many years in motor manufacturing, and uses highly reliable soldering to produce modules that can be used with peace of mind over many years.



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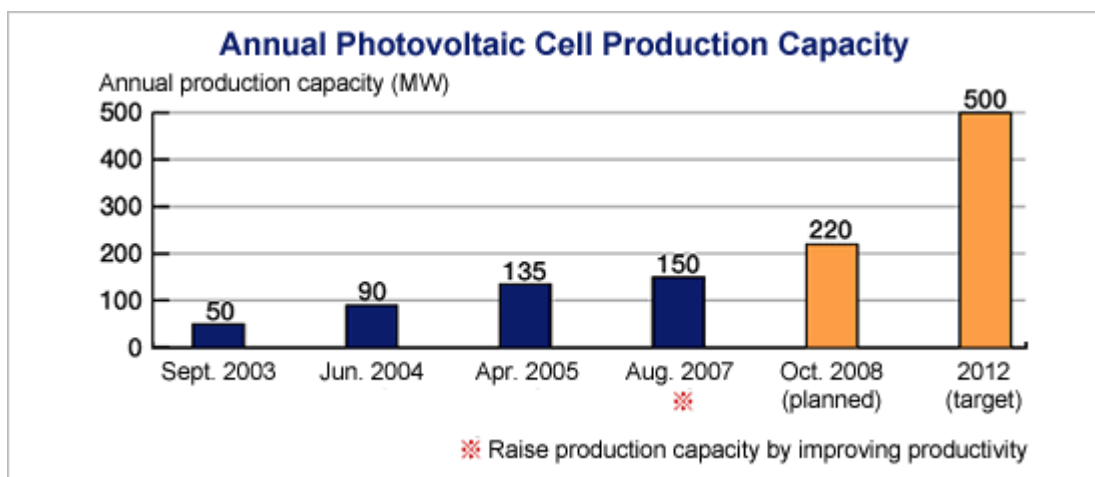
PV Popularization



Expanding Production Scale to Meet Rapidly Growing Demand

Against a backdrop of increasing environmental awareness and skyrocketing oil prices, demand is rapidly growing worldwide for photovoltaic power generation systems. Mitsubishi Electric expects the global market to be 1,950 MW in the current fiscal year, 126% of the previous year. Moreover, worldwide demand is expected to increase in the future.

In order to meet such voracious demand, Mitsubishi Electric is committing around ¥7 billion in capital investment to augment solar cell production lines at Nakatsugawa Works' Iida Plant (Iida, Nagano Prefecture) and solar module production lines at the Kyoto Works (Nagaokakyo, Kyoto Prefecture). We plan to expand annual production capacity from its current level of 150 MW to 220 MW by October 2008. Though we'll keep a close watch on global demand trends, we hope to have a system in place with an annual capacity of 500 MW by fiscal 2012.

In an effort to help prevent global warming, Mitsubishi Electric also intends to further pursue even higher efficiency for its photovoltaic systems. At the same time, we plan to work to facilitate popularization of the systems around the world. Through these initiatives we hope to help protect the environment and bring about a sustainable society.



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Perspective of an Engineering Manager



Mitsubishi Electric is one of the few companies in the world that possesses the total package of photovoltaic power system technologies.

Satoshi Arimoto,
General Manager, Photovoltaic System Department
Nakatsugawa Works

Mitsubishi Electric is one of the few companies in the world that has total mastery of electricity's ins and outs, pathways and key components, and is one of the few companies that possesses the total package of photovoltaic system technologies, from PV cells to PV inverters and power systems. Our photovoltaic systems aren't too well known because they get such little exposure in commercials and the like, but they always earn rave reviews from customers that use them. It may seem a little strange for me to



say this, but Mitsubishi Electric is a sincere, honest company. When making a product that meets a certain rated standard, some companies tend to think that it is good enough to just meet the prescribed standard. Mitsubishi Electric, on the other hand, has a culture that thinks it is never enough to just meet the standard. Whether in development or in manufacturing, we create our own "Mitsubishi Electric standard" and implement it. During our over 10 years of experience with PV modules and PV inverters, we have revised our own testing and production ratings over and over again and have tackled development under stringent standards. Whether or not we achieve exceptional levels of quality depends on the level of our own company standards.

Perspective of a Sales Manager

<p>Our goals are to widely publicize how solar power benefits the environment and to further popularize photovoltaic systems.</p> <p>Toshihide Sugimoto Section Manager, Photovoltaic System Marketing Section Nakatsugawa Works</p>	
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Demand for photovoltaic systems is growing around the world, but this demand differs somewhat from country to country and region to region. In European countries that subsidize photovoltaic power, especially Germany, many people are interested in taking advantage of the economic benefits offered by photovoltaic systems. In Asia, on the other hand, there is growing demand for such systems as a means of providing electric power to regions not yet on the power grid. Japan's subsidy program ended in

2005 and you frequently hear debate about whether there really are economic benefits to installing a photovoltaic system. However, I think the biggest contribution these systems make are to the environment. In terms of carbon dioxide reduction, an installed system reduces CO₂ emissions by 330 kg per kilowatt. The reduction provided by just one system may not be very large, but if all homes in Japan had photovoltaic power systems, the Ministry of the Environment's target of reducing emissions one kilogram per person per day would be achievable. Our goal is to further popularize photovoltaic systems by continuing to provide information on their high quality, and widely publicize their benefits in helping to prevent global warming.

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As a semiconductor manufacturer, our company consumes a comparatively large amount of energy during the production process, and uses PFC (perfluoro compound) gases that have a high global warming potential. As a result of this, from the very beginning we have been aggressively enacting environmental measures. Industry goals for the reduction of PFC emissions were achieved four years ahead of schedule and we are now aiming to push them even lower.



As these environmental activities offer a solid platform from which to demonstrate symbolically to those inside and outside of our company the steps being taken, we have collaborated on a project being promoted by Japan's Environment Ministry and Kochi Prefecture, the LLP Yosakoi Mega Solar project. This is a joint usage megawatt photovoltaic model project being undertaken within the prefecture. As part of this, we installed a Mitsubishi Electric 100kW photovoltaic generation system at our Kochi Plant.

We chose the Mitsubishi Electric photovoltaic generation system over those of other manufacturers due to various factors, such as generation efficiency, installation cost, reliability and service. Even though it was difficult from a cost perspective, PV panels were installed and timber was laid around the area to prevent pebbles from being kicked up by the wind. The proposal was appropriate for the site, and also resulted in more beautiful scenery. We are also very grateful that our requests regarding PR electronic display panels were taken into consideration as much as possible.



Since it began operating in March 2008, employees have been seeing the photovoltaic panels and power generation display monitor on a daily basis, and this clearly seems to have boosted their awareness about saving energy and the environment. Moreover, the story surrounding the installation of the main system has become a topic in the area, having been covered by a local news program and four local newspapers. This has led to environmental PR that has made great contributions to our

business.

I am sure that Mitsubishi Electric will continue to offer the best in terms of management and maintenance. I expect that continuing advances in the research of photovoltaic systems will lead to greater efficiency and lower cost, making it more cost efficient, and I hope the technology becomes more mainstream in society.

Environmental Topics

Recycling of Waste Plastics



▶ Aiming for Closed-loop Recycling at Mitsubishi Electric

An introduction to our closed-loop recycling program, which involves recovering plastic from used home appliances and recycling it into new products.

▶ More

▶ Technology for Sorting Plastics

An overview of our process for sorting 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 in no way inferior to new materials.

▶ More

▶ Using Recycled Plastic in Products

Examples of products made completely with materials recycled from used home appliances and commentary by the engineers involved.

▶ More

Recycling of Waste Plastics

Aiming for Closed-Loop Recycling at Mitsubishi Electric

Reusing Plastic Materials Recovered from Used Home Appliances in Mitsubishi Electric Products

Mitsubishi Electric's goal is closed-loop recycling, which involves using old home appliance products to make new ones. The recycling of plastic collected from used home appliances for reuse in various knick-knacks, imitation wood and other products, a practice called downgrading, is commonplace. With this approach, however, limited natural resources have to be consumed in order to create new home appliance products.

Closed-loop recycling involves using plastic, a valuable resource, collected from our old products to make our new products. We are currently making progress in research and development on plastic recycling technologies to this end.

Setting High Targets Based on an Original Level-Based Scheme

Mitsubishi Electric has introduced its own level-based scheme in connection with the development of recycling technologies (see the list below). Most conventional plastic recycling is Level 2 recycling -- the reuse of single plastic materials easily removed from used products through manual dismantling. However, only about 10% of plastic can be removed from recovered products via manual dismantling. The rest ends up being burned or buried after being mixed and pulverized.

We are currently tackling Level 4, which means we are working to collect and automatically sort recyclable materials from a mixture of residual plastic, which has long proven difficult to recycle, and use these materials in products.

Levels of Recycling Technology Difficulty

Level 1	Reusing only parts that are easy to manually dismantle, differentiate the types of plastics and remove impurities
Level 2	Reusing only parts that are easy to manually dismantle and differentiate the types of plastics
Level 3	Reusing after manually dismantling and individually analyzing the types of plastics
Level 4	Reusing after automatically sorting plastics that have been mixed and pulverized

Making Products Out of 100% Recycled Materials

What is normally referred to as recycled plastic actually contains a certain percentage of new material. Our goal however is 100% recycled plastic materials. We are currently engaged in research and development to produce high-quality, recycled plastic in order to stop using new materials entirely and make 100% recycled plastic materials a reality.

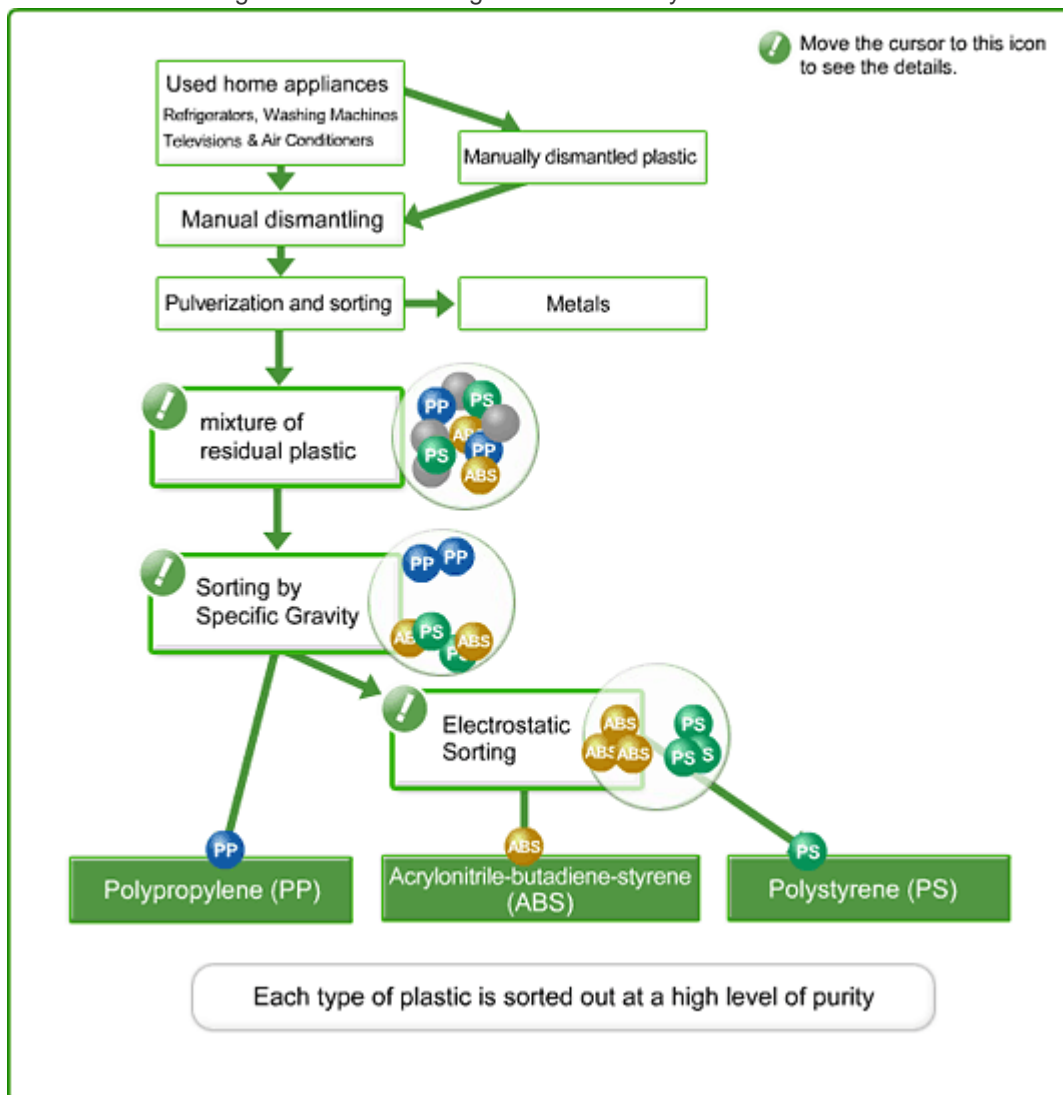
Recycling of Waste Plastics

Technology for Sorting Plastics

Sorting Plastics at High Levels of Purity and High Recovery Rates

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

■ Process for Sorting Mixed Plastic at High Levels of Purity



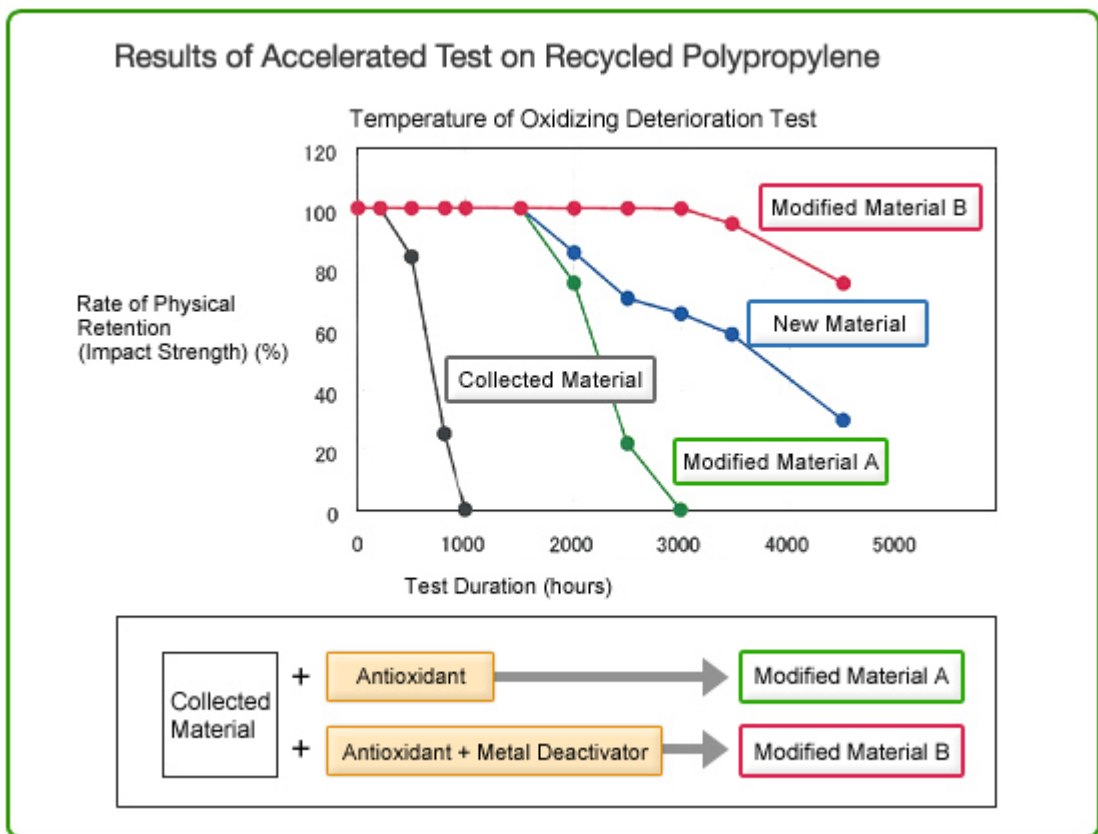
Recycling of Waste Plastics

Technology for Improving Plastic Quality

Making Recycled Plastic Even Better Than 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 sorting 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 by no means inferior to new materials. We also made it possible to give recycled materials durability that exceeds 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.

Recycling of Waste Plastics

Using Recycled Plastic in Products

Providing the Market with Reliable, 100% Recycled Materials

In May 2006, Mitsubishi Electric launched a washing machine with a pump holder made entirely from polypropylene (PP) recycled from mixture of residual plastic (Level 4). The pump holder is a 100% recycled PP part that has passed stringent evaluation trials on actual machines.

In addition, we developed a quality improvement formula that can be applied to refrigerator drain pans, which require durability at high temperatures. In December 2006, we started mass production of refrigerators that include this drain pan.

We intend to continue pursuing the possibilities of recycled plastics, work to expand their scope of use, and develop even more advanced sorting and quality improvement technologies. Through making closed-loop recycling systems a reality, we hope to contribute to the realization of a recycling-based society.



Recycling Technology is Cutting-Edge Technology

Material recycling involves collecting waste materials and reusing them to make new products. This form of recycling has far less environmental impact than chemical recycling (reusing materials after chemically processing them) and thermal recycling (burning the materials and recovering their thermal energy). Our goal is closed-loop recycling, which requires an extremely high level of technology. We intend to continue pursuing even higher purity and higher recovery ratios, as we take on the challenge of developing new technologies.



Yuichi Matsuo
Senior Researcher
Plastics Engineering Group
Ecomaterials & Material Analysis Department
Advanced Technology R&D Center



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. 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.

<p>▶ Birth of a Recycling System</p> <p>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.</p> <p style="text-align: right;">▶ More</p>	<p>▶ Recycling Example</p> <p>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.</p> <p style="text-align: right;">▶ More</p>
<p>▶ Future Development</p> <p>Key environmental personnel discuss their thoughts on recycling and their future ambitions.</p> <p style="text-align: right;">▶ More</p>	

Towards Zero Emissions

Birth of a Recycling System

Collaboration Begins with Environmental Training

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

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 optimized logistics system involving the coordinated efforts of our five manufacturing works in the Kansai region. The system was successfully created thanks to the active communication and sincere efforts of key environmental personnel. It is now attracting attention for pioneering new possibilities in recycling.



Towards Zero Emissions

Recycling Examples



Recycling Cushioning Materials

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. I think that if our production sites continue to work together, we'll come up with even more new and beneficial ideas.



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. What I worried about in regards to establishing a recycling center at Kobe was how big to make the facility. A larger facility would be more efficient, but if capacity utilization were low, costs would go up. We ended up taking many things into consideration in order to determine the optimal size, including the results of a survey of overall waste volumes.

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.

Towards Zero Emissions

Future Development

Raising Awareness of Waste and Developing Waste-Free Product Designs and Manufacturing Processes



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

elimination of waste products.

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.

What we were secretly hoping for with this project was that it would raise the awareness of product designers and manufacturing managers by serving as feedback for Mitsubishi Electric's core manufacturing business. Most of the time, waste processing is a job that takes place behind the scenes. Most people who throw things away don't know where it all ends up going. Having our own waste processing facility within the plant makes people intimately familiar with waste recycling. I hope it lead us to think about the waste we produce, gives us a strong sense for the importance of recycling and inspires us to develop waste-free product designs and manufacturing processes. This is because the ideal we are pursuing is not increased recycling but the

Scaling Up Activities and Developing the Entire Company's Potential

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, Environmental Facilities Section
Production Systems Department
Itami Works

Environmental Topics



▶ Nature Conservation Lectures

Mitsubishi Electric employees lead an "outdoor classroom," or educational program on nature. Local children and other participants experience and learn about natural cycles through observation of nature and experiences outdoors. The program seeks to foster a spirit of caring for and protecting the environment.

▶ More

▶ Woodland Conservation

Mitsubishi Electric works to protect woodlands near its business sites, defining "woodlands" broadly as natural environments near areas inhabited by people, including shorelines, rivers, fields and wooded areas. Through these activities we hope to further raise environmental awareness.

▶ More



Mitsubishi Electric Outdoor Classroom

Mitsubishi Electric Outdoor Classroom

The Mitsubishi Electric Group exerts a not insignificant impact on the environment through its corporate activities. We are involved in ongoing efforts to make a less negative impact on the environment, but it is not possible to completely eliminate our impact on it. For this reason, we make efforts to give something back to nature. Since fiscal 2007, we have trained environmental leaders and promoted environmental education at the local level. The Mitsubishi Electric Outdoor Classroom of Nature Conservation Lectures is committed to raising awareness of the environment among employees and their families, and cultivating children's interest in science by enabling them to experience nature firsthand.



Outdoor Classes

First Class: Monday, October 30, 2006
Learning About Nature's Cycle (Hibiya Park, Tokyo)

Second Class: Saturday, April 21, 2007
Observing Marine Life (Utsumi Beach, Minamichita, Aichi Prefecture)

Third Class: Saturday, May 12, 2007
Observing Fields in Springtime (Sanda Woody Town Park, Hyogo Prefecture)

Fourth Class: Tuesday, May 15, 2007
Learning About Nature's Cycle (Hibiya Park, Tokyo)



First Class

There are many things living around dead plants, and that teaches us about nature's cycle.

Children from Taimei Kindergarten

First Class: Monday, October 30, 2006

Learning About Nature's Cycle (Hibiya Park, Tokyo)

The class was conducted for 19 children from Tamei Kindergarten, with the participation of 13 outdoor school leaders from Mitsubishi Electric who assisted in nature observation. The principal and teachers from the kindergarten also participated, along with parents and members of the Japan Outdoor Life Promotion Society.

Class Activities

Orientation

Three promises; how to use a magnifying glass

Nature observation

Ginkgo tree trunk, ginkgo nuts, lilac oxalis flowers, the scent of jasmine flowers, maple tree seeds, scent of camphor tree leaves, decaying plant stubble (mold, mushrooms, snails, earthworms, fungi, ants, etc.), dandelion leaves/flowers/seed globes, pale grass blue butterflies, and creeping lady's sorrel

Game to sharpen the senses

"Bag of Secrets"

Appearance of Mullay, the Fairy

The fictitious fairy Mullay appears to serve as a bridge between nature and the children, and conveys the words of plants and animals.

*"Mullay" is from the Swedish word mullen, meaning earth or soil.

Treasure hunt



There are many things living around dead plants, and that teaches us about nature's cycle.



Earthworms make a creepy-crawly sound. They eat and breakdown the soil for us.



Practice using a magnifying glass. What did it look like?



We tried smelling different flowers, like jasmine and lilac oxalis flowers.

Discovering the Power of Nature

Ways of dispersing seeds

Nature's cycle

Pale grass blue larva primarily eat creepy
lady's sorrel leaves

Ways camphor tree leaves prevent being
eaten by insects
(powerful odor)

All around Hibiya Park, where the children often come to play, nature is full of surprises that they had never noticed before. I hope that the children will come to love nature more and more as they combine all that they've learned about nature in picture books with the things they first noticed today about the way nature works.



Kanji Ota
Outdoor Classroom Leader

Second Class: Saturday, April 21, 2007

Observing Marine Life (Utsumi Beach, Minamichita, Aichi Prefecture)

This outdoor school class was held in conjunction with a clam digging event put on by Mitsubishi Electric's Inazawa Works, and 49 children of employees age three to ten got the chance to experience marine life close up. Nine leaders assisted in nature observation.

Class Activities

Environment quiz

A quiz on the environment, starting with the issue of garbage, was held on the bus on the way there for children and adults

Orientation

Cautions when using a magnifying glass (don't look at the sun), cautions when engaging in the activities (don't do the activities alone; we will go into the ocean but not far)

Clam digging

Catching marine life

Observing living things on the sand (tideland)

What kind of creatures live in the water and in, or on top of, the sand?

Learn about the diversity of life while collecting garbage and raise awareness of environmental preservation



The first quiz question was how many tons of domestic garbage are produced by one person in a year. The answer is 0.4 tons. Many people got it right.



A total 119 people participated in clam digging. It was an enjoyable day.



I wonder what things we'll catch? Almost everyone ended up catching shrimp.

Discovering the Power of Nature

Marine life caught
Shrimp, goby, eels, crabs, sea slugs,
hermit crabs
Observation and explanation of living
things
Observation of all the marine life caught in
the containers



Children looking intently at a sea slug. Afterward they learned about ecological wonders while touching and holding marine life.

All the children were very serious about observing marine life, probably because they had caught the animals themselves. When the class was over, many parents asked us to hold outdoor school again. Given this enthusiastic reaction, I felt that the class was a hit.



Junichi Yamamura
Outdoor Classroom Leader

Third Class: Saturday, May 12, 2007

Observing Fields in Springtime (Sanda Woody Town Park, Hyogo Prefecture)

Mitsubishi Electric's Sanda Works held a nature class by way of a family hiking excursion. Nineteen employees and members of their families participated. Seven outdoor classroom leaders participated and assisted in nature observations.

Class Activities

Orientation

How to use a magnifying glass; three promises

Nature observation

White clover, Philadelphia daisy, mock strawberry, Miguel's mazus, Japanese cherry, decaying plants (mushrooms, fungi, ants, etc.)

Hanaoni

Discovering the Power of Nature

The fact that even unassuming weeds have names and characteristics

Nature's cycle



Families immersed in observing nature. When you look closely at fields in springtime, you discover many flowering plants and living creatures.



A child and his father use a microscope to observe nature. I wonder if they remembered the name of the plant.



If you spread out a white sheet and wait for a moment, small creatures will gather on it.

The time we spent on preparations, like making flip cards and other educational materials and doing repeated preliminary checks, ended up making the class run smoothly. I'm happy that we provided everyone with a meaningful experience and that there were no accidents or injuries. There were many times when the parents also took an interest in what was going on and I think the class provided good motivation for students to continue their learning.



Leaves that have fallen from trees gradually return to the soil over time. I wonder what the soil smelled like?



Teruyuki Shibata
Outdoor Classroom Leader

Fourth Class: Tuesday, May 15, 2007

Learning About Nature's Cycle (Hibiya Park, Tokyo)

The class was conducted for 17 children from Tamei Kindergarten, with the participation of 7 outdoor school leaders from Mitsubishi Electric who assisted in nature observation. The kindergarten principal also participated, along with parents and people connected with the school.

Class Activities

Game of tag after splitting up into elephants, cats and mice

Orientation

How to use a magnifying glass; three promises

Nature observation

White clover, dandelion, mock strawberry, tree trunks, scent of camphor tree leaves, smell of chameleon plant, decaying plants (mushrooms, snails, earthworms, fungi, ants, etc.), spiders and ants, find the same flower game

Listening closely

Discovering the Power of Nature

New discoveries in a park the children often visit; the small world on the other side of a magnifying glass

Nature's cycle

Ways camphor tree leaves prevent being eaten by insects
(camphor=smell of insecticide)

Sound of an earthworm as it crawls



Children listening to an explanation being given by an outdoor school leader. When orientation is over, it's time for nature observation!



A very familiar park. What did you see on the other side of the magnifying glass?



There are a lot of creatures around dead plants. Children get excited about all their discoveries.

We got to know the children right away by playing a game of tag. Having the children gain a sense for nature's cycle is difficult, but it is an important theme. I want to improve my own skill level with each class. I think I was successful at motivating the children to compete with one another to find something new.



If you listen closely, you'll hear birds chirping and the sound of the wind.



Yoichiro Kawamoto
Outdoor Classroom Leader

Environmental Topics

China and the Environment



Energy and environmental pollution have emerged as serious challenges in China, where the economy continues to grow at a rapid pace. With concern over the environment also mounting, Mitsubishi Electric has committed itself to sowing the seeds of technology in a wide range of areas and fostering initiatives for energy efficiency and environmental protection that sprout from them. Our slogan in this endeavor is, "Mastery of Energy Efficiency, Devotion to Environmental Protection." Here we present a special report that introduces our efforts to foster personnel devoted to solving environmental problems as well as some of our energy-saving solutions aimed at helping bring about a recycling-based society.

▶ Personnel Training

Mitsubishi Electric has conducted its first training course overseas for key environmental personnel. The course was a participation-oriented program for environmental managers in China and it proved to be extremely productive. Learn more about the two-day program.

▶ More

▶ Changes for Global Warming Prevention

Promoting the widespread use of inverter air conditioners is a way of helping to save energy. Learn more about air conditioning solutions developed by Mitsubishi Electric for China, where environmental awareness is on the rise.

▶ More

▶ International Exhibition Report

In April 2008, environmentally considerate products and technologies were introduced at an environmental expo in Shanghai, the largest in China.

▶ More

China and the Environment

Personnel Training

Environmental Managers from 11 Sites in China Gather for Training



On March 17 and 18, 2008, Mitsubishi Electric held a training program for key environmental personnel in China, the first such program held outside Japan. The venue was Mitsubishi Electric (Guangzhou) Compressor Co., Ltd. (MGC), the Mitsubishi Electric Group's largest production site for compressors. MGC acquired ISO 14001 certification back in 1999, and we selected it as the venue because of its highly advanced environmental management system and environmental facilities. In total, 23 people involved in environmental management were selected from 11 sites around China to attend the training. It was the first time the course had been held, so emphasis was placed on complying with environmental laws and regulations and reducing environmental risk. On the first day of the program, trainees learned about the Mitsubishi Group's environmental initiatives and related Chinese laws and regulations. On the second day, we introduced examples of risk management at our plants in Japan and toured the MGC factory. Group discussions were also held to broaden the participants' knowledge.



Yoshimitsu
Ikemura
Corporate
Environmental
Sustainability
Group

A Participation-Oriented Program

We started this specialized training program in Japan in 2004 to train the next generation of key personnel because of the impending retirement of a large number of environmental management experts who helped meet the pollution challenges in Japan during the 1970's. The original impetus for holding training in China came from requests that were voiced at a regional environmental conference, which Mitsubishi Electric holds on an annual basis. The company has a good number of production sites in China and environmentally conscious manufacturing is becoming more and more important in Chinese society. Given these considerations, we made the decision to hold the first training program this year to raise overall awareness with regard to protecting the environment.

One of the innovative ideas for the program was making it participation-oriented. Understanding the law is an important prerequisite for environmental management, but reading over documents alone does not really provide a clear picture of how to actually go about environmental management. What's more, a course composed entirely of lectures would be much too passive. We therefore decided to provide ample opportunities for discussion, take the trainees on a tour of the plant and give them the chance to present their observations. One of our goals was to create mutually supportive relationships by encouraging participants to draw on their own knowledge and share their opinions.

Key Environmental Personnel from Japan Serve as Instructors

By presenting case studies of environmental management at Japanese sites the instructors could help disseminating expertise on risk management and provide helpful hints for day-to-day management activities. The instructors were employees serving on the frontlines of environmental management who had already attended key environmental personnel training in Japan. They presented the various challenges they themselves had experienced and how the challenges were handled.

The first case study was from Nakatsugawa Works and involved how the plant dealt with the problem of leaking chemical substances and fuel oil. We introduced the mechanism used to shut off equipment when a leak is detected and the idea of incorporating redundancy into the sensors that detect when tanks are full. The second case study was from the Power Distribution Systems Center. To prepare for the possibility of liquid waste leaking out from its water treatment facility, the center has worked to prevent potential leaks from spreading by installing a dike of adequate height around the facility. It also manages the pH of the wastewater at the last discharge outlet in order to be able to quickly detect irregularities. In both examples, we emphasized the importance of imagining various potential scenarios and being ready for them. During the question-and-answer session that followed, the participants asked many questions about how to apply these ideas at their own factories. The strong sense of responsibility of the participants was readily apparent.



Presenting a case study



An animated Q&A session with local key environmental personnel



Yoji Sasaki
Power
Distribution
Systems Center

A Worksite Tour Is the First Step to Risk Management

I gave a presentation on how we dealt with leaks of wastewater containing chemicals used in paint and coatings. I have had direct experience with a leakage accident that ended up leading to better management, so I tried to convey all the details of this experience. I think my presentation really went over well given the great number of questions I received during the Q&A.

I try to frequently tour the worksite directly as a part of my day-to-day environmental management activities. I walk around the factory everyday, which allows me to notice subtle changes, in the way the pumps sound, for example. Even if you don't discover any irregularities, being able to perceive changes and differences allows you to be ready to act immediately if anything does occur. Taking measures ahead of time helps prevent major accidents before they can occur, so I would encourage environmental managers to do this.



Masahiro
Takagi
Nakatsugawa
Works

Thoroughly Investigating Causes Leads to Effective Countermeasures

I have experienced two leakage accidents since I have been at Nakatsugawa Works. Luckily, the accidents were confined to inside the plant. I want the process we undertook, from investigating the causes to applying countermeasures, to benefit future risk management efforts, which is why these accidents were included as a case study. I introduced our analysis technique called, "Why? Why?" We first ask, "Why did that occur?" Then, for each reason that is given, we ask, "Why did it come to be like that?" We use this technique to thoroughly investigate an accident until we arrive at concrete countermeasures. Specifically putting the event into words makes it possible to identify the true causes of irregularities as well as their latent causes. This also leads to greater observation by others and more effective solutions.

The presentation gave rise to many questions from the trainees. I was glad to see that they were keen to utilize my ideas in management activities at their own sites.

Training Ends with an Inspection Tour of the Factory and Discussion

The training course ended with an inspection tour of the factory that involved all trainees using a checklist to actually go around and verify environmental protection facilities and displays within the factory. They looked at each area very carefully while utilizing what they had learned up to that point. After the inspection tour, the trainees split up into three groups and presented their observations. The lively discussions brought out dozens of comments and opinions, including the following: "Everything was labeled really well and highly visible. It will be a good reference for me"; "I think it would be a good idea to label the routes of the pipes"; and, "Water was leaking out of one of the wastewater treatment pipes, so inspections should probably be improved."

This final part of the course proved to be a valuable, stimulating experience for all the participants. It was also a meaningful experience that led to new discoveries for the members from Japan that participated as instructors.



Inspecting the factory with a checklist



Presentation and discussion following the inspection tour



He Jin Hua
Chairman,
Management
Planning
Committee,
Manager,
Manufacturing
Control Dept.
Mitsubishi
Electric
(Guangzhou)
Compressor
Co., Ltd.

Drawing on the Observations of Others to Make Improvements

Learning Mitsubishi Electric's environmental ideals, systematically studying China's laws, having varied discussions with environmental specialists from every Chinese site, and making connections for the future all proved to be invaluable experiences for me. In particular, taking the inspection tour of the factory and looking at it objectively brought to light insufficiencies and taught me that there are still areas that can be improved. The various things that were pointed out by everyone will serve as useful reference for me. I'm excited about upping the level of environmental management at the factory.

I would like to see the next training course cover various topics in detail, like water, air, oil and so on.



Huang Li Juan
Manager,
Engineering
Department
Production
Management
Division
Mitsubishi
Electric
(Guangzhou)
Compressor
Co., Ltd.

Human Interaction was Most Valuable

The training course gave me the opportunity to interact with other environmental managers, and this is what was most valuable to me. I had not had the opportunity to speak with people from other sites until the training, but our communication during the course was great: we revealed various everyday innovations and techniques to each other, talked about concerns and gave each other advice.

As manager of the Engineering Works Department at MGC, I am responsible for managing and improving facilities from the perspective of energy management. The discussions we had after the inspection tour produced many opinions that I'll be able to draw on in the future and gave me a keen sense for the importance of other people's ideas. The lectures also did not just involve listening; they were designed to provoke thought, which helped facilitate understanding.

China and the Environment

Changes for Global Warming Prevention



Inverter Air Conditioners as an Energy-savings Solution

China is currently promoting its 11th five-year plan (2006-2010), which includes a focus on improving energy efficiency and protecting the environment. The country plans to invest in excess of 1.4 trillion Yuan in environmental conservation over the five-year period. The National People's Congress convened in 2006 and set a goal of reducing energy consumption by 20% per unit of GDP by the year 2010. Energy efficiency standards for consumer electronics products are currently being revised to meet this goal.

In the area of room air conditioners, standards for highly popular fixed speed models are being elevated, and authorities are considering introducing new standards for inverter air conditioners as well.

With fixed speed models, the compressor motor runs at a fixed speed. In order to control the temperature in the room, the unit is automatically shut off when the room rises above the preset temperature, and it goes on again when the room temperature falls. The unit repeatedly cycles through this process to control the room temperature. A great deal of energy is consumed by repeatedly turning the power on and off, so the standard is being raised in an effort to reduce environmental impact. In contrast, inverter air conditioners achieve energy efficiency by controlling the motor's rpm in line with the temperature of the room. These air conditioners currently only account for around 8% of the market (according to Air Conditioning Trade Journal, October 2007), but they are expected to become more widespread in the future.

It is said that around 30% of the carbon dioxide emitted by a home comes from its air conditioning system. Given this reality, Mitsubishi Electric believes that it is important for inverter air conditioners to be promoted to the general public. All the air conditioners we sell in Japan are inverter models, but we want to increase the percentage of inverter models in China as well.



One of our air conditioner showrooms in Shanghai. The showroom is divided into household and commercial zones, and the latest models are always on display.



An average of about 20 groups of people come and see the home air conditioners every day during normal times, and around 50 groups visit during the high season before the start of summer and in early fall.

Environmental Solutions for Industrial Air Conditioners

Mitsubishi Electric also proactively proposes energy efficient solutions for industrial air conditioners. We work to raise customer awareness through our Air Conditioning Catalog, which contains a wealth of examples of problems and solutions related to different applications, such as schools, offices and hospitals.

In addition to air conditioners, we are also focused on promoting total heat exchange ventilators. Even though Chinese cities face serious air pollution challenges, there is minimal awareness of the importance of ventilation. Ventilation is essential in high-rise buildings whose windows do not open. Against this backdrop, China enacted national regulations in February 2008 for total heat exchange ventilators. We quickly responded by promoting our Lossnay line of energy efficient ventilators, which can ventilate without any loss of thermal energy from heating and cooling. We provide a solution that saves energy and ensures comfort.



Catalog for commercial air conditioning solutions

Using Environmentally Friendly Refrigerant and Alternative Chemical Substances

There is another important factor when considering how to prevent global warming besides energy efficiency. That factor is the refrigerant, an essential ingredient of air conditioning. The type of refrigerant currently in widespread use in China is an HCFC (R22, which has small but significant ozone depletion potential, so its use is restricted in Japan). Ahead of other companies, Mitsubishi Electric has introduced models to the Chinese market that use an HFC (R410A) refrigerant, which has zero ozone depletion potential.

In addition, our models no longer use any of the six substances restricted by the RoHS Directive, which include lead and cadmium. Air conditioners sold in China are not subject to RoHS restrictions, but since 2007 our units comply with the directive, just like models sold in Europe. We accomplished this before any other company in the industry. Mitsubishi Electric continues to be a leader in not only energy efficiency but also in other areas that benefit the environment as a whole.

Word-of-mouth Reputation is Proof of our Reliability

Our air conditioners are at the cutting edge in terms of environmental features, but in China, the Mitsubishi Electric brand has become more closely associated with high quality, high performance and high grade. Even though we do very little major advertising, such as television commercials on national broadcasts, the quality of Mitsubishi Electric has become well known thanks to word-of-mouth recommendations.

We ranked first in customer satisfaction for air conditioners, according to a survey announced by the Shanghai Quantitative and Qualitative Technology Bureau in September 2007. We were recognized not only for our quality but for our commitment to quality in customer service and after-sales service. We intend to remain committed to quality in every area and provide top value in order to meet the high expectations of customers.



A stylish stand-up air conditioner first marketed in 2007. The Mitsubishi Electric brand has also earned a strong reputation for its quality of design.



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We Must First Understand a Product Ourselves in Order to be Able to Explain it to Customers

I am in charge of training the sales staff that interacts with customers. Recently, more and more customers check the rank of the product in terms of its energy efficiency before making a purchase because they care about its energy-savings performance. When explaining a product's characteristics and performance, energy savings is extremely important.

However, if you give a difficult, technical explanation when explaining why inverter models are more energy efficient than fixed speed models, you won't be understood. This is why we always use easy-to-understand comparative data and convey the difference by using illustrative examples. When sales staff have a firm understanding of the product, they are able explain the product to customers in a way that is natural and easy to follow.



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Taking on Even Loftier Goals for the Greater Good

I firmly believe that Mitsubishi Electric air conditioners have gained such a strong reputation for quality because they are founded on outstanding, integrated development and manufacturing technologies, from the power conductors and inverter to the finished product.

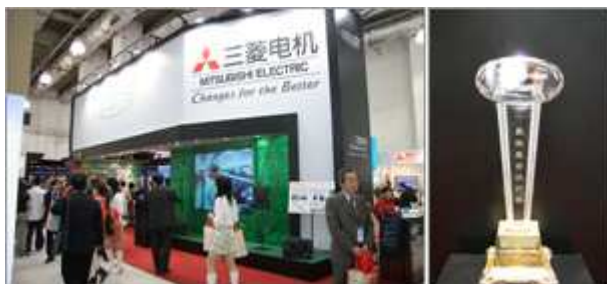
I am in charge of air conditioner development and also participate in developing regulatory standards for China. Because these standards will truly help in China's environmental protection efforts, I believe they should be placed at an even higher level. Even though I'm not sure we will be able to meet the standards immediately, taking on the challenge of stringent regulations leads to technological innovation, which ends up benefiting society as a whole. It will still take some time before the standards are settled, but as an engineer, I will certainly enjoy the challenge and will keep at it until we achieve the highest possible level.

China and the Environment

International Exhibition Report

Comprehensive Exhibit of a Broad Range of Energy Efficient and Environmentally Conscious Products

At the 9th China International Environmental Protection Exhibition held in Shanghai in April 2008, the Mitsubishi Electric Group exhibited a comprehensive lineup of energy efficient and environmentally conscious products, introducing products and technologies for four different applications: factories, public facilities, offices and residential homes. Our ozone generator, which purifies water through the power of ozone, and energy efficiency support devices, which enable energy consumption to be monitored in real time, drew considerable interest. Over 4,000 business professionals and members of the public visited our booth over the course of the three-day show.



Mitsubishi Electric's booth was one of the largest at the show. It even won the Best Design Award.



A constant stream of people visited the section for Citi Multi variable refrigerant flow zoning system, our air conditioning system that provides air conditioning only to rooms where it is needed.



A demonstration of the ozone generator's water treatment capabilities drew considerable interest.



A display device that allows energy consumption to be monitored in real time (left). Data is stored on a computer for analysis and assessment.

From the Perspective of the Exhibition Staff



Tan Qiang
Manager
Energy Saving Department
Mitsubishi Electric Automation
(Shanghai) Ltd.

Striving to Make the Exhibit and Demonstrations Concrete and Easy to Understand

The government is currently encouraging energy conservation, but I get the real sense that the public doesn't really know specifically how this should be done. The booth provided us with a good opportunity to introduce our factory automation equipment and energy efficient devices while also providing added value and proposing total solutions. We therefore created a demo device using CC-Link (a communications technology developed by Mitsubishi Electric) that actually showed visitors the energy performance of the overall booth and each of its sections. All in all, we designed the booth around the concepts of making energy savings transparent and making management energy efficient. This time, the focus of the exhibition was on hardware, but next time we will also introduce software and have wide-ranging proposals with our other business units.

In fact, we received tremendous responses from visitors to the booth and effectively communicated with them. We were able not only to show products but also to introduce the effects of energy conservation, various management methods and a number of concrete applications.