

Environmental  
Report

2002

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## ■Note upon publishing MHI's Environmental Report

We had the pleasure of attracting many readers upon publishing the first issue of our Environmental Report last year.

We would like our readers to know about our efforts for the environment, through the publication of the 2002 Environmental Report, which can also be accessed on the web.

### 1.Coverage

Activities and efforts in the production plants and works in Japan are covered and reported. Headquarters, sales offices/branches, and subsidiaries in and out of Japan are not included.

### 2.Applicable term

Activities and efforts made from April 1, 2001 to March 31, 2002 are covered.

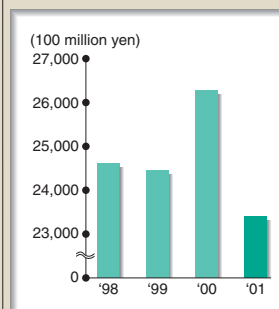
### 3.Editing policy

The 2002 Environmental Report was edited based on the "Guideline for Environmental Reports (issue of 2000)" by the Ministry of Environment.

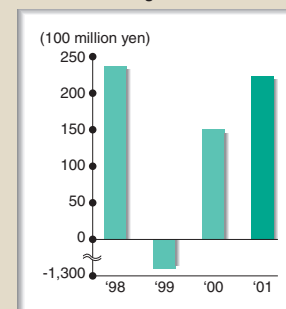
## ■Corporate Profile

Name of company: Mitsubishi Heavy Industries, Ltd.  
 Foundation: July 7, 1884  
 Establishment: January 11, 1950  
 Representative: Takashi Nishioka, President  
 Head office: 5-1, Marunouchi 2-chome, Chiyoda-ku, Tokyo JAPAN  
 Capital: 265.6 billion yen (as of March 31, 2002)  
 Outstanding Stocks: 3,374 million (as of April 1, 2002)  
 Sales: 2.3886 trillion yen (for the fiscal 2001)  
 Number of employees: 36,692 (as of March 31, 2002)  
 Headquarters and Works: 13  
 Research Centers: 6

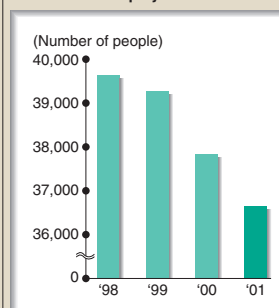
## ■Annual Sales



## ■After-tax Earnings



## ■Number of Employees



As of March 31 of the applicable year

## ■Main Business Operations

The company's main operations includes the manufacture, installation, sales, and repair of the following:

- Shipbuilding and Marine Products  
 Oil tankers, container ships, passenger ships, car ferries, special carriers such as LPG/LNG carriers, defense and patrol vessels, marine structures
- Power Systems  
 Boilers, turbines, gas turbine, diesel engine, water turbines, wind turbines, nuclear-power system/facility, auxiliary equipment/system for nuclear-power system, nuclear fuel, denitrification system, marine machinery
- Machinery and Steel Structures  
 Waste treatment, desulfurization system, various gas-scavenging/exhaust systems including fuel exhaust treatment system, traffic system, transportation vehicle, chemical plants including petrochemical plant, petroleum and gas production plants, machinery for chemical industry, seawater desalination systems, steel manufacturing plants, wind/hydraulic power-generation system, packaging machinery/system, steel bridges, hydraulic gates, cranes, smoke stack/funnel, sky parking system, tanks, sports/culture and leisure-related facilities, and other steel structures
- Aerospace  
 Various types of aerodyne including fighter airplanes; helicopters, airframe components for private transport airplanes, aircraft engines, missile guidance units, torpedoes, aircraft hydraulic equipment/systems, spacecraft and components
- Mass and Medium-Lot Manufactured Machinery  
 Forklifts trucks, construction machinery, machines for transportation and ground leveling, medium/compact-sized engines, superchargers, special vehicles/carrriages, air-conditioning systems for houses, business and industrial use, and vehicles, refrigerators, chillers, plastic-related machinery, food-related machinery, industrial robots, power transmission device, papermaking, paper converting machinery, printing machinery/systems, machine tools

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## GREETINGS



Mitsubishi Heavy Industries, Ltd.  
Takashi Nishioka, President

*T. Nishioka*

With the “Earth Summit” in Rio de Janeiro ten years ago as a milestone, various approaches and programs to cope with environmental pollution were announced.

Since then, initiatives and efforts made by those in diversified brackets and circles of the world have worked so well that people are more aware of and attentive to improving and preserving our natural environment than before.

However, as to the increase of industrial waste due to mass-consumption and mass-production of the countries of the world, including developing countries aggressively working toward economic expansion, and global warming due to CO<sub>2</sub>, any clue for solution has yet been found.

One of the important challenges Japan faces in this century is to achieve a “society with circulation system where the continuous development, the simplicity and the quality are thought much of,” that replaces the “society dependant on mass-production, mass-consumption, and mass-waste” of the last century. Thus, tackling environmental issues, for example, by recycling waste materials and controlling CO<sub>2</sub> emissions, is the obligation of corporate citizens and of the Japanese people.

Mitsubishi Heavy Industries, Ltd. has manufactured environment conscious products including waste treatment systems and CO<sub>2</sub> recovery systems, while fabricating ships, airplanes, and plant systems, as a general heavy-machinery manufacturer. We have always recognized “environmental preservation” as our essential agenda for management, and we have been committed to alleviating the burden on our environment for a cleaner and better society.

The twenty-first century is said to be “the century of the environment.” Our basic corporate policy is “to contribute to society through our operations” and we hope this report will help you understand our views on environmental protection and how we are involved in environmental activities.

We welcome your opinions and advice, and appreciate your continuous support.

Thank you,

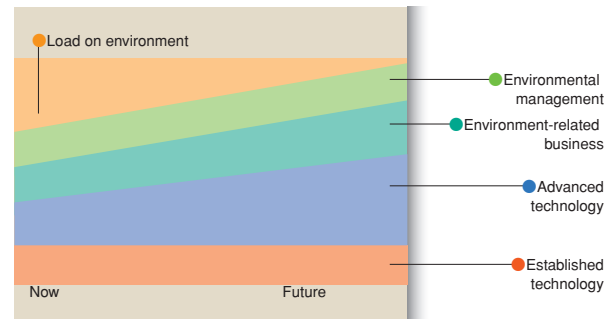
## Environmental protection as a contribution to society

Mitsubishi Heavy Industries, Ltd. (MHI) established a basic policy and conduct guideline for managing environmental matters, based on the corporate philosophy observed since its foundation and on its spirit emphasizing contribution to the society. The company is committed to tackling this assignment and contributing to the building of a society that allows sustainable development.

### Corporate Philosophy

Starting from shipbuilding business, the company has conducted various activities, following its corporate policy which obligates the company to contribute to the progress of society through its business operations. This philosophy is succeeded from the "Three Principles" (established in an early ages of Mitsubishi group) to the Company's Creed instituted in 1970, and sustained through the company's expansion and transformation to a leading manufacturer of general heavy-machinery.

Now, the company values this philosophy more than ever, and will continue its efforts not to leave the load upon the future environment by protecting the environment not only in areas related to its manufacturing, but also in a global view through development of new technology, thus contributing to society.



### Creed

1. We strongly believe that the customer comes first and that we are obligated to be an innovative partner to society.
2. We base our activities on honesty, harmony, and a clear distinction between public and private life.
3. We shall strive for innovative management and technological development from an international perspective.

### Reason for Instituting the Creed

In Japan there are many enterprises with their own "creeds" which simply represent their management concept. Mitsubishi Heavy Industries, Ltd. has a creed of this type, also. This creed was instituted in 1970 on the basis of the policy advocated by Koyata Iwasaki, president of Mitsubishi Goshi Kaisha in the 1920s, to indicate the essential attitude of the company, the mental attitude of the employees, and the future directions of the company. The reason for instituting the present creed is so that all of us can call to mind our one hundred years of tradition, and strive for further development in the future.

Issued June 1, 1970

**Basic Policy on Environmental Matters and Conduct Guidelines**

While rapid technological progress in various scenes make our daily life more and more convenient, protecting our environment has loomed up as an issue we should take seriously. In 1996, MHI established its Basic Policy on Environmental Matters and Conduct Guidelines to promote further activity for environmental protection, which has been a major concern ever since MHI's founding, while taking into consideration the compatibility between technological progress and reduction of load upon environment.

**Basic Policy on Environmental Matters**

Pursuant to the express provisions of Section 1 of its Creed that "We strongly believe that the customer comes first and that we are obligated to be an innovative partner to society," MHI shall, as a matter of primary importance, strive, through its R&D, manufacturing and other business activities, to play a useful role in the development of society.

To this end, while remaining aware that a business enterprise is a member of society, MHI shall endeavor, in all aspects of its business activities, to reduce the burden on the environment and shall concentrate and fully utilize its technological capabilities for the development of technologies and products that will protect the environment, thus contributing to the establishment of a society in which sustainable development is possible.



**Conduct Guidelines**

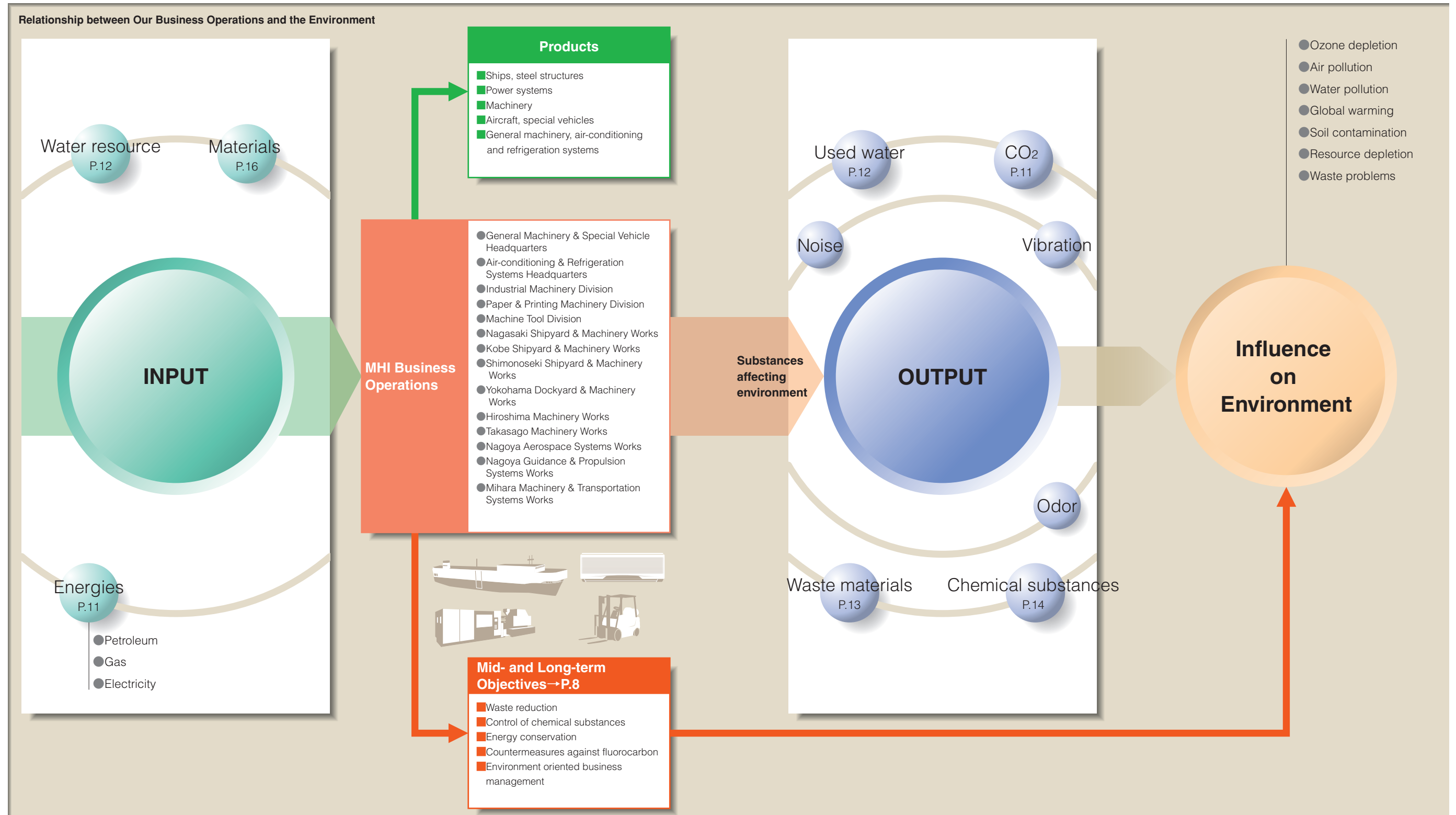
We are expected to:

- 1 Recognize that environmental protection is a matter of first priority in the Company's operations, and to encourage the entire Company in its endeavors to protect and improve the environment.
- 2 Define roles and responsibilities regarding environmental protection by developing and maintaining a corporate organization designated for environmental protection, and creating and implementing corporate policies and procedures on environmental matters.
- 3 Endeavor to reduce the burden on the environment by preventing pollution, saving resources, saving energy, reducing waste, reusing materials, and recycling, in all aspects of the Company's business activities entailing R&D, designing procurement of materials, manufacturing, transportation, use, service and disposal.
- 4 Endeavor to develop and provide advanced, highly reliable and unique technologies and products that contribute to the solution of environmental and energy problems.
- 5 Comply with national and local environmental laws and regulations, going beyond mere compliance by enacting, implementing, and evaluating voluntary standards where necessary, and to endeavor to improve and promote, on a continuing basis, environmental protection activities by establishing environmental goals and targets.
- 6 Endeavor to protect the environment of foreign countries by carefully examining the consequences of the Company's business operations in foreign countries and the exportation of its products to foreign countries upon the natural and social environment of such foreign countries, and to get actively involved in technological cooperation overseas in the area of environmental protection.
- 7 Provide environmental training and other programs to enhance environmental awareness of all employees of the Company, and take steps to expand public relations activities, such as providing environment-related information to the public and social contribution activities.

## Toward operations which allow sustainable development

We assess and verify the quantity of energies and resources used, and the resulting waste at the respective unit of headquarters, divisions, plants, and works.

With five mid- and long-term objectives, we aim to continuously decrease the burden on the environment in the entire range of our operations.



## Promoting Environmental Management

Under the leadership of our "Environment Committee" set up in 1996, the Works determine their own environmental policies and targets to promote activities related to environmental protection. In addition, we introduced an environmental accounting system in 2001, for the purpose of interpreting our "balance" in terms of environmental-soundness, in accordance with the guidelines specified by the Ministry of Environment.

### Environmental Protection Organization

MHI has been contributing to society through its manufacturing since the date of its founding. The spirit of "manufacturing" is reflected in the Creed, and is thoroughly understood in all of MHI's production sites. Some of the products we manufacture are small enough to hold in the palm of your hand. But most of our products are large structures such as airplanes, ships, and bridges. In order to keep on manufacturing these diversified products and offering them to the world, and to serve in the development of the society through such products, we should always bear in mind that the key is full-fledged environmental management and safety management.

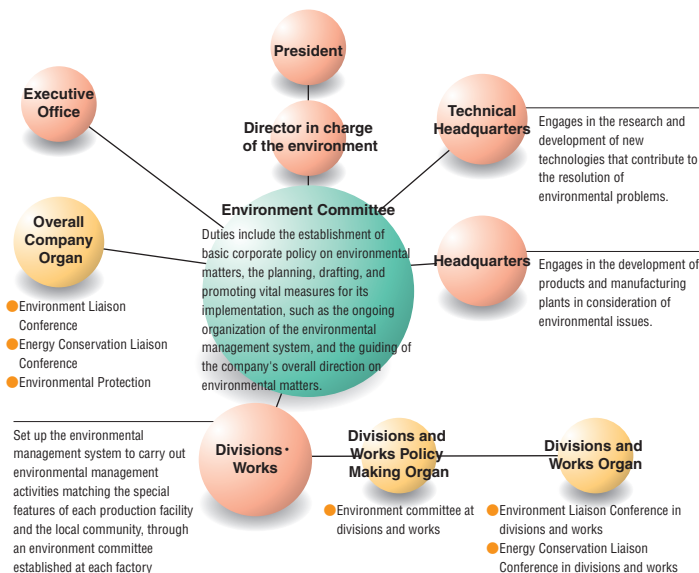
To clarify our stand on environmental protection to those both inside and outside the company, we have set up the "Environment Committee" in 1996.

The Environment Committee leads the company-wide environmental policy by generating annual environmental counter-measure plans each year, and regularly checking up on the execution of the annual plans made by all divisions and works.

In addition, the Committee has established the "Environment Liaison Conference", the "Energy Conservation Liaison Conference", and the "Environmental Protection Technology Liaison Conference". These conferences were established to employ effective energy supplies, promote energy-saving activities and to advance information and related know-how sharing regarding environmental protection.

Based on the company-wide policy, each division and works plans and promotes its own environmental activities according to the site-specific production and the characteristics of the local region.

Divisions and works also have their own Environment Committee, Environment Liaison Conference, and Energy Conservation Liaison Conference as the executive organizations for these activities.



### Environmental Accounting

In accordance with the Environment Agency (prior name) "Guidelines for introducing an environmental accounting system (2000 version)," MHI developed its own "Guidelines for Environmental Accounting" to analyze the effectiveness of investments and costs regarding environmental protection.

We started employing this environmental accounting system from fiscal 2001.

#### Investments and Costs for Environmental Protection

The investments for environmental protection totaled 3.4 billion yen, with 1.7 billion yen for investment on facilities within the compounds of production sites (for anti-air and water pollution, energy saving, and recycling of resources) and the same amount for R&D related facilities. The total costs stood at 11.5 billion yen, with 6.1 billion yen for R&D and 3.8 billion yen as operating budgets for the activities within the fields related to the productions.

#### Effectiveness of Investment/Cost in terms of Environmental Protection

An economic effect of 1.3 billion yen resulted as income from recycling, cost reduction due to energy saving, and so on. Avoidance of oil and chemical discharge, reduction of chemical substance emission and development of fuel cells and environmentally conscious products have qualitative effects that cannot be measured accurately in monetary value.

Environmental Accounting Balance for fiscal 2001 100 million yen

Category	Environmental Protection Cost		
	Description	Investments	Costs
Production Areas	Costs for pollution prevention, global environmental protection, resource recycling, etc.	17	38
Up/Down stream	Consignment fees for packaging and recycling of products	-	1
Management Activities	Operating costs of environmental management organs, Costs for configuration and maintenance of the environmental management system	-	11
R&D	Costs for research and development of environmentally friendly products	17	61
Public & Social Activities	Costs for disclosing environment-related information and placing such ads	-	3
Environmental damages	Dues and charges on pollution load, costs for underground water and soil purification	-	1
Total		34	115

#### Effects of Environmental Protection

Descriptions of Effects	Amount
Avoidance of oil/chemical substances discharge	67.2 billion yen
Reduction in emitting water/air pollutants	115.9 billion yen
Development of various types of environment-conscious products	
Total Investment in Facility	67.2 billion yen
Total Cost for R&D	115.9 billion yen

#### Economic Effects of Environmental Protection Measures

Monetary Effect Item	Amount
Income from recycling	4
Cost reduction due to energy saving	4
Waste treatment cost reduction due to recycling	1
Reductions in supply water purchase and waste water treatment cost	4
Total	13

Note: Items indicated in the table are limited to those that can be quantitatively measured in monetary value. So-called "deemed effects" are not included in the calculation.

## Mid- and Long-term Objectives with a Clear Vision of the Future

To promote the issues described in our Basic Policy on Environmental Matters, we have set up plans for reducing environmental burden, and determined detailed items the company should reduce to specific levels. Every member of the company will work extensively towards the achievement of these under the mid- and long-term objectives for the years 2005 to 2010.

### Mid- and Long-term Environmental Objectives

Thirteen domestic production sites and one engineering division have already obtained ISO14001 certification, and they are renewing their certificates.

As for waste materials, we are promoting recycling of metal chips and waste plastics.

Approximately half of the Works are involved in activities for zero waste land-reclamation and landfill, which Yokohama Dockyard & Machinery Works has already accomplished. Many works are eagerly trying to follow this achievement by Yokohama Works.

In the field of chemical substance reduction, we plan to finish replacing PCB-containing lighting ballasts with those that are PCB-free, by 2010. In comparison to 1996 levels, we will reduce the amount of organic chloride chemical substances by 95% by 2005, and 100 % by 2010.

Our energy conservation program for the prevention of global warming aims to cut CO<sub>2</sub> emission by 6% in comparison to 1990 levels by 2010 (the numerical target stipulated in the Kyoto Protocol for Japan).

Our plans also include the development and introduction of an integrated management system for environmental management data by 2005.

### Mid- and Long-term Objectives

No.	Category	Item	Objective	Reference page
1	Waste reduction	Controlling generation and emission of waste materials	Limiting the total amount of waste materials in 2010 to 170,000 tons, a minimum 20% cut compared with the amount in 1992 by promoting resource savings and controlling material purchases	P.13
		Reducing waste land-reclamation and landfill	Zero waste land-reclamation and landfill to be achieved by more than half of the Works by 2005, and by all the Works by 2010, through promotion of reuse and recycle	P.13
2	Control of chemical substances	Total disuse of equipment using PCB	Disuse of ballasts for lighting fixture and high voltage equipment using PCB by 2010	P.13
		Reducing emission of organic chloride chemical substances	By thoroughly controlling organic chloride chemical substances and their emissions, atmosphere releases of dichloromethane, trichloroethylene, and tetrachloro-ethylene to be reduced by 95 % by 2005, and by 100% by 2010, compared with 1996 levels	P.14
3	Energy conservation	Reducing CO <sub>2</sub> emission	Reduction of CO <sub>2</sub> emission by 6% by 2010, compared with 1990 level, through strict control of CO <sub>2</sub> emission at production plants. Introduction of solar power generating systems by 2005.	P.11
4	Counter-measures against fluorocarbon	Reducing use of fluorocarbon	Switching from HCFC that can destroy the ozone layer to HFC whose ozone destruction factor is zero, by 2010	P.15
5	Environment oriented business management	Environmental management system	Continuation of renewal of ISO14001 certification for the Works in Japan	P.9
		Database system for environment-based corporate management	Developing a database system for the data of environmental burden by 2005	—
		Promoting environmental accounting	Continuous work on environmental accounting, and completing the on-line summary system by 2005	P.7
		Issuing Environmental Reports	Further upgrading of the contents for the following issues	—
		Purchase of environmentally friendly products	Encouraging the purchase of environmentally friendly goods based on the in-house guideline for purchasing "Green goods"	P.16
		Advancing environment-conforming designs	Setting up and promoting working groups for designs conforming to environmental requirements	P.17



## ISO14001 Certification Acquisition and Continuous Improvements

We have obtained the ISO 14001 certification, an international environmental management standard, for all the production sites in Japan. We make the best use of the standard with our PDCA cycle, and conduct education training on environmental matters.

### Efforts for an Environmental Management System

Beginning with the Yokohama Dockyard & Machinery Works, the first recipient of ISO certification in Japan among heavy industry facilities, MHI obtained ISO14001 certification for all 13 domestic production sites. Adding to this, MCEC recently obtained the certification in the field of engineering for its on-site engineering work.

Many of these Works are already renewing their certifications, and we have been intensifying our efforts to continuously improve our environmental management system, applying the spiral cycle of "PLAN-DO-CHECK-ACTION (PDCA)." Such daily efforts bring about many positive results. As the environments of the production sites are being improved greatly year-by-year, examiners from external organizations are rarely left unsatisfied.



Examination by external organizations

### PDCA Cycle



### Status of ISO14001 Certificate

Issue date (Registration date)	Production site
Oct. 31, 1997	Yokohama Dockyard & Machinery Works
May. 22, 1998	Nagasaki Shipyard & Machinery Works
Jun. 26, 1998	Takasago Machinery Works
Nov. 20, 1998	Air-Conditioning & Refrigeration Systems Headquarters
May. 21, 1999	General Machinery & Special Vehicle Headquarters
Sep. 3, 1999	Paper & Printing Machinery Division*
Sep. 30, 1999	Hiroshima Machinery Works
Nov. 24, 1999	Shimonoseki Shipyard & Machinery Works
Dec. 18, 1999	Nagoya Guidance & Propulsion Systems Works
Feb. 18, 2000	Kobe Shipyard & Machinery Works
Mar. 27, 2000	Nagoya Aerospace System Works (Tobishima)
Apr. 1, 2000	Industrial Machinery Division
Aug. 8, 2000	Nagoya Aerospace Systems Works (Oe, Komakiminami)
Dec. 28, 2000	Machine Tool Division
Jun. 29, 2001	MCEC (Engineering & Construction Center)

\*Includes Mihara Machinery & Transportation Systems Works.

### Education and Training on Environmental Matters

In order to enhance environmental awareness of all employees of the company and broaden their understanding of environmental protection and energy conservation, the company not only provides following training programs but issue a special message from the President to all its employees, emphasizing the importance of a cleaner environment, in a specified 'Environment Month.'

In addition to these, the company encourages its employees to participate in clean-up programs for local community and tours of environmental protection facilities.

So that they may pay attention to the preservation of environmental facilities.

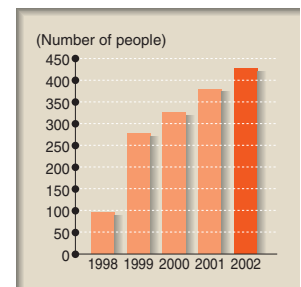
### Internal Auditor

The role of internal auditors is essential for the effective operation of our environmental management system. We have adopted a program from an outer organization to train such internal auditors, where only those that have passed the test are registered as auditors for the company. The growth in the number of the qualified personnel is as shown in the chart below.



Environmental training (Checking waste recycle)

### Internal Auditor Registration based on ISO 14001



As of April 1, each year

### Training Employees

Understanding that continuous education on environmental protection is a prerequisite, we offer a diversified range of training programs for our employees. The regular programs include basic training for all the new employees, level-specific courses covering general to managerial-level staff, and programs highlighting the target of the 'Environment Month.'

On the other hand, education and training for specific work such as paint spraying and handling of hazardous materials have much to do with our company's business and operations. Therefore, training programs for personnel assigned to the above works are regularly provided so that they can learn about the influence of their work on the environment, daily management methods, proper methods of monitoring and measurement, and emergency procedures.

Works and plants of the company extensively carry out educational activities such as publishing in serial form the article explaining environmental terminology or article on efforts for acquisition of ISO 14001 certificate in in-house brochures, or announcing in the premises of the Works the policies of the head of the Works to realize the target of 'Environment Month', in order to promote a deeper appreciation of environmentally sound operations in the employees and those in subsidiaries.

## Managing and Coping with Risks

We actively encourage our employees to obtain officially recognized certifications and qualifications in addition to compliance with the environment-related laws and regulations, while individual production sites regularly hold training and drills for better reaction to emergency situations.

### Regulations and Compliance

We give our uppermost effort to comply with environment-related laws and regulations, as we comply with other relevant legal requirements. For the achievement of an effective environmental management, and to deliver more reliable products to our customers, we are active in obtaining official qualifications and certification. The qualification holders of our company, as shown in the list at the right, are working to protect our environment.



Measuring noise level

### Emergency Drill

Half of our domestic Works are located facing the sea. The sea will be polluted in an instant if any trouble leading to oil leak occur during operations at these locations. In preparation for such emergencies, all the Works regularly repeat emergency drills, for example, to practice quick recovery with oil fences to minimize the spreading of oil, or to train for effective counter-measures in the event of leaking of chemical substances.



Oil recovery training on sea

### List of qualification holders

No.	Qualification Type	Category/Class	Number of holders
1	Environmental measurement	Density, Noise, and Vibration	9
2	Fire extinguishing and detecting facilities	A (1 - 7 grade) B (1 - 7 grade)	289
3	Fire prevention management		149
4	Management and handling of radiation	Class 1 and Class 2g	202
5	Management and handling of poisonous and toxic substances		27
6	Health supervisor	Class 1	688
7	X-ray operation		270
8	γ-ray radiograph operation		25
9	Handling and safety management of explosives		82
10	Safety management in high pressure gas manufacturing		836
11	Energy control	Thermal, Electric	104
12	Gas engineer	Class A, B, and C	209
13	Handling of hazardous materials	Class A, Class B (1 - 6 grade), and Class C	4,312
14	Supervisor for operation dealing with lead		115
15	Management in preventing pollution	Atmosphere water quality class 1 to class 4, Noise, Vibration	531
16	Chief manager for preventing pollution		17
17	Boiler technician	Special grade, and grade 1 and 2	1,457
18	Boiler installation work management		111
19	Boiler welding	Special and general	289
20	Boiler servicing		155
21	Handling of small-type boiler	(small-type boiler handling)	37
22	Supervisor for operations dealing with drying facilities		328
23	Supervisor for handling of specified chemical substances		951
24	Supervisor for operations dealing with organic solvents		1,979
25	Supervisor for refrigeration (Technician for refrigeration /air-condition safety)	Class 1	18
26	Management for sanitation and environment of buildings		21
27	Diagnostic X-ray technologies (Medical X-ray technician)		25
28	Management for engineering waste disposal facilities	(Waste disposal engineering manager)	54
29	Management for specially designated industrial wastes		111
			13,401

As of Jan. 1, 2002

## Protecting the Global Environment and Limited Resources

To preserve finite energy resources for future generations, MHI is working towards the conservation of energy and efficient use of resources, primarily at its production sites that consume large amounts of fossil fuel, electric power and resources.

### Energy conservation and prevention of global warming

The protocol of the 3rd Conference of the Parties to the United Nations Framework Convention on Climate Change (COP3), so-called Kyoto Protocol, was adopted in Kyoto in 1997 to control the emission of greenhouse gases such as CO<sub>2</sub>, one of the main causes of global warming. Under this protocol Japan is to reduce its emission levels by 6%, compared to the 1990 level, by 2010.

Following this, the Japanese Government's Headquarters for Promotion of Measures to Cope with Global Warming decided, in March 2002, to review the Platform for Promotion of Measures to Cope with Global Warming. This resulted in the incorporation of fundamental policies into the platform, to devise step-by-step approaches for the sectors of household, transportation, and industries.

In accordance with these policies, MHI promotes activities that are effective towards preventing global warming as well as saving energy, such as aggressively introducing energy saving equipment in our production processes.

### Energy saving at our plants and works

Efforts for reduction in electricity consumption varies depending on the ways of production at each of our Works. However, through the following activities, we reduced the use of electricity by 4% in 2001, compared to the 1998 level.

Actual efforts at production sites include drastic decrease of electricity used for production by introducing energy-saving facilities, constant check and control of energy in individual buildings by installing smaller boilers and installation of windows as a source of natural light on no-window factories built in early days.

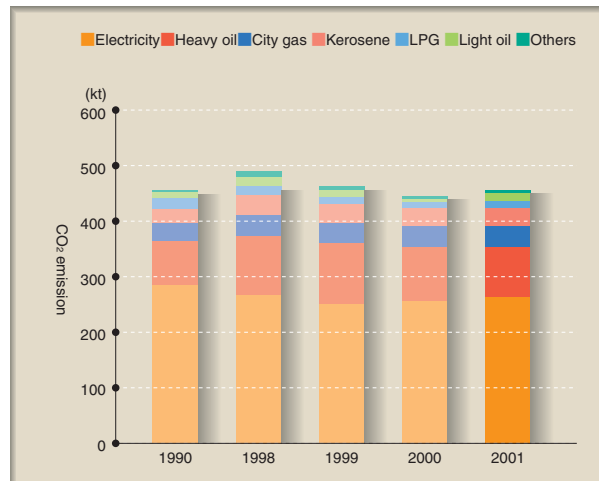
At offices, lighting fixtures with inverters are replacing conventional lights equipment with the international energy star program is purchased with priority, air-conditioning systems are regularly monitored for proper levels, and unnecessary lights are switched off during early morning and lunch time.

As a step towards further energy saving, we plan to introduce solar power-generation systems in 2002, and maintain the company-wide energy conservation efforts.

### Emission Trading

The right to trade emissions, stipulated in the Kyoto Protocol, has drawn wide attention from business circles both in and out of Japan. Viewing this trading system as a complementary scheme, we are determined to strive for further energy saving and CO<sub>2</sub> reduction, adhering to the original intent for the prevention of global warming.

### Status of CO<sub>2</sub> Emission



	Energy-saving promotion activities	Energy-saving operations	Production equipment
1	Energy-saving patrols	Improved methods for operating compressors	Placement of higher priority on introduction of energy-saving equipment for new facilities
2	Frequent energy-saving controls on lighting and air-conditioning	Installation of windows on factory roofs for natural light	Furnishing energy-saving inverters
3	Energy-saving controls during vacation periods	Frequent changes in the electric power supply	Introduction of use of fuel cells
4	Energy-saving controls during lunch time	PC controlled boiler operations	Introduction of solar power-generation systems
5	Patrol checks for leaks on air pipes		Introduction of compressor for individual use
6	Stricter controls regarding air usage		Introduction of energy-saving PC displays
7	More efficient use of heat		Promotion of use of compact boilers



Cogeneration

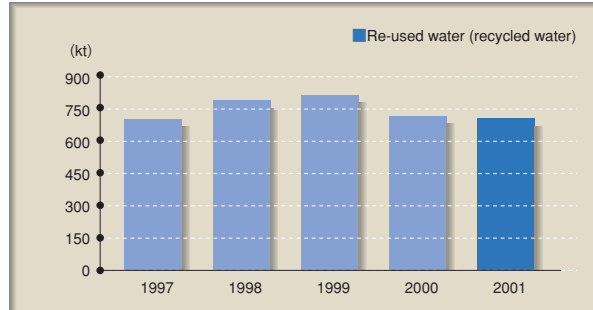


Natural light windows on factory roof

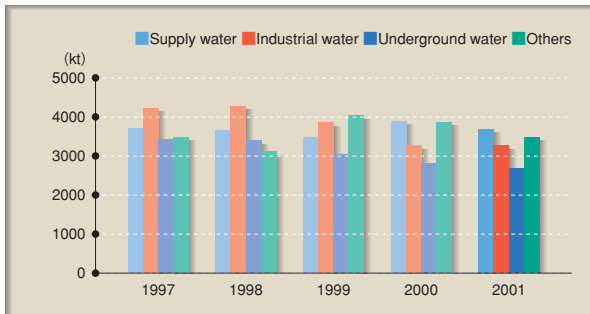
**Effective Use of Water**

At our factories, water is needed in large amounts and a combination of supply water, industrial water and underground water is used. To reduce the use of underground water, which can cause ground subsidence, we collect and recycle our used water, doing our best to recycle so as to conserve this precious resource.

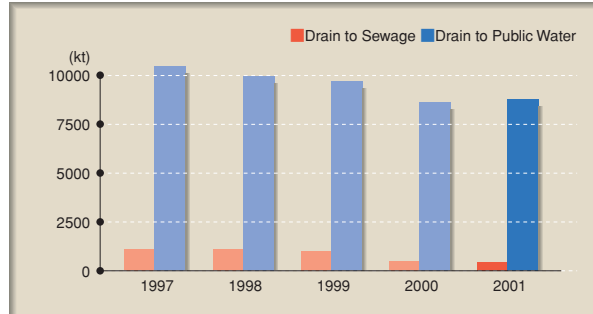
**Water Recycling Status**



**Source of Water Used**



**Draining Status**

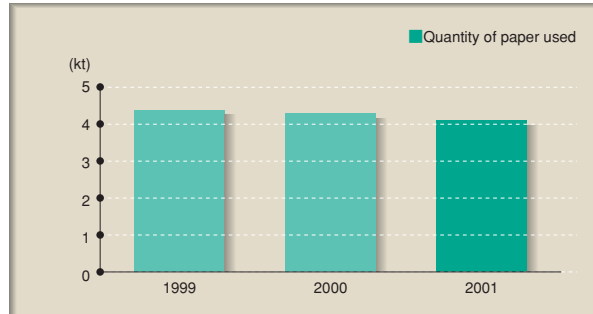







**Effective Use of Paper**

In 2001, our company used a total of 4,100 tons of paper as office supply for OA machines, documents, catalogs, and name/business cards, most of which was recycled paper.

Fully understanding that the prime source of waste from offices is wasted paper, we are trying to reduce the amount of paper used, either made from virgin pulp or recycled paper. Further, we promote recycling of used paper.

**Amount of Paper Used**



Topic	Commended Activity
<p><b>Activity for zero waste land-reclamation and landfill at the Yokohama Dockyard &amp; Machinery Works</b></p> <p>Activity for zero waste land-reclamation and landfill at the Yokohama Dockyard &amp; Machinery Works was highly evaluated and received commendations from the Recycling Promotion Council and Yokohama City. This is the fruit of</p>	<p>strict separation of waste materials by the whole factory members including production departments. We will continue to search for ways of recycling, and of reduction of waste materials. Other divisions and works are also trying hard to reduce the amount of wastes, following Yokohama's example.</p>
 <p>Waste materials separation on carrier ship repairing site</p>	 <p>Sludge carbonizing oven</p>
 <p>A waste separating station</p>	 <p>Certificate of commendation from Yokohama City</p>
	 <p>Certificate of commendation from the Recycling Promotion Council</p>

## Daily Efforts for the Prevention of Environmental Pollution

With increasingly fewer landfill sites left, reducing waste is one of the top priority agendas for corporate citizens. MHI is stepping up its efforts to control chemical substances more strictly, at the same time promoting waste recycling to achieve the goal of zero waste land-reclamation and landfill.

### Waste Material Management and Recycling

Our diversified production and repair activities produce various types of waste materials. However, 81% of the 190,000 tons produced by the company in 2001 was recycled. We aim for an even higher recycling rate for the future.

#### Challenge of Zero Waste Land-reclamation and Landfill

The Yokohama Dockyard & Machinery Works achieved zero waste land-reclamation and landfill in March 2001 and is still maintaining this achievement.

The Yokohama Works implemented separation of waste materials thoroughly and strictly, collaborating with recycling businesses for effective recycling. As a result, various methods of recycling waste material have been found, such as recycling paper, turning waste pieces of wood into fuel chips or plywood, making pet bottles into RDF and recycled bottles, turning glass objects such as bottles into roadbed material, waste oil into supplemental burning fuel, and so on. Our aim is to reduce the total volume of waste that has to be disposed of as landfill. These activities will be expanded to the whole company.

#### Waste Processing

For processing waste generated inside our company, we utilize the businesses specialized in this field and manage thoroughly the processing by way of 'industrial waste management slips' (manifest slips).

#### Incineration Facilities for Industrial Waste

Our incineration facilities conform to the stricter regulations to be effected in December 2002.

#### Status of Recycling of Used Appliances

Electric Appliance Recycling Law requires that 60% of air-conditioning units be recycled. Our company recycled 3,070 tons of such units out of 3,810 tons to be processed in total, achieving recycle rate of approximately 80%. Our focus now is set on the realization of better recycling rates in the future.

#### Striving for Total Ban on the Use of PCB-containing Equipment

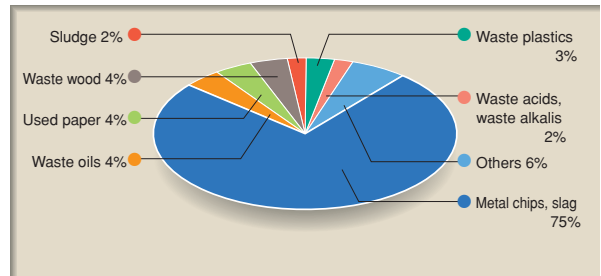
Our plants and works in Japan still have electrical equipment using PCB. Such equipment will be totally replaced with non-PCB devices and facilities step by step before 2010.

Accordingly with the Special Provision Law Concerning PCB, in 2001, we registered 24,000 pieces of disposed PCB-containing ballasts for lighting fixtures and 17,000 pieces of lighting devices using PCB to the relevant authorities.

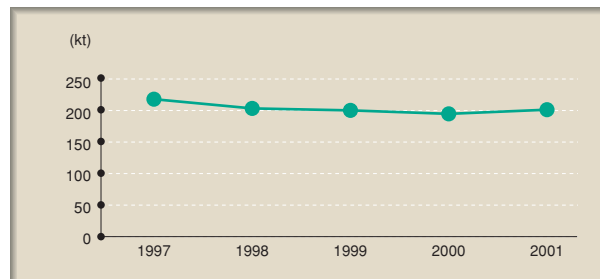


Checking storage condition of PCB

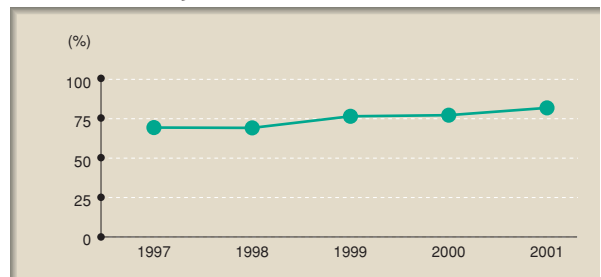
### Generation Status of Waste Materials by Type



### Transition of Amount of Generated Waste



### Transition of Recycle Rate



### Waste and Recycling Usage

Category	Use
Paper	Recycled paper
Waste wood	Fuel chips, plywood chips
Rages	Reused after cleaning
PET bottle	RDF, material for PET bottles
Vinyl chloride	Roadbed material, gas fuel
Bottle, glass	Roadbed material
Waste oil	Recycled fuel
Waste paint	Recycled fuel, pavement bricks
Sludge	Charcoal, roadbed material
Garbage	Fertilizer
Concrete clod	Roadbed material
Ash	Roadbed material, cement material

### Chemical Substances Control (PRTR)

MHI strictly controls the safe use and storage of necessary chemical substances. We have been collecting and managing data of such chemical substances since 1997, through our participation in the PRTR pilot project initiated by the Environment Agency (prior name), and promotion of the guidelines of the Keidanren (Japan Federation of Economic Organizations) Voluntary Action Plan on the Environment. Each of our plants and works manages its own MSDS (Material Safety Data Sheet)

to ensure the safety of customers and employees.

Chemical substances we handle in large volumes are solvents contained in paints such as xylene, toluene, ethylbenzene, and epoxy resins of type A bisphenol. To reduce the volumes of these substances, we are devising improved methods of painting and are using more amounts of organic solvent-free paints.

### PRTR: Release and Transfer Volumes of Environmental Pollutants (2001)

Unit: tons

Substance No.	Name of Substance	Emission Amount	Transfer Amount
16	2-aminoethanol	0	0
30	Bisphenol A Type epoxy resin	0.4	50.0
40	Ethylbenzene	268.0	16.4
43	Ethylene glycol	0	1.4
63	Xylene	1296.6	93.2
68	Chromium and chromium (III) compounds	2.4	116.3
69 *	Chromium (VI) compounds	0	3.4
85	Chlorodifluoromethane (HCFC-22)	9.7	0
100	Cobalt and its compounds	4.5	0
132	1,1 dichloro-1-fluoroethane(HCFC-141b)	24.3	1.6
145	Dichloromethane	14.0	0
177	Styrene	21.7	0
179 *	Dioxins	121.5	1,058.1
200	Tetrachloroethylene	0.5	9.5
211	Trichloroethylene	0.6	13.0
227	Toluene	535.9	34.2
231	Nickel	7.0	1.0
299 *	Benzene	0	0
311	Manganese and its compounds	0	18.9
346	Molybdenum and its compounds	0	0

Notes 1: \* shows class 1 specified chemical substances.

2: The total emission and transfer volume is recorded for more than 0.5 tons of designated class 1 specified chemical substances, and more than 5 tons of other class 1 specified chemical substances.

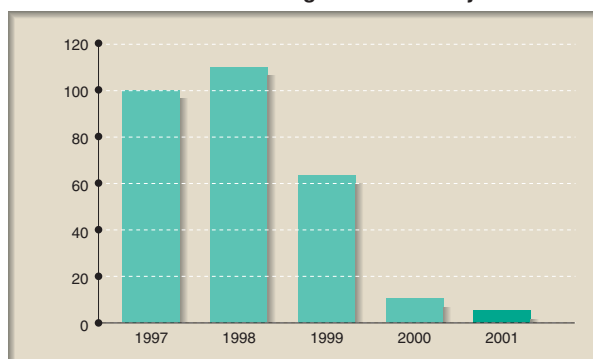
3: The unit for dioxins is mg-TEQ.

### Measures for Organic Chlorine Substances

We aim to control the emissions of organic chlorine compounds, focusing especially on the emissions of dichloromethane, trichloroethylene, and tetrachloroethylene. We have been doing our utmost to minimize emissions of these organic chlorine substances by changing cleaning facilities and processes, and by switching to alternative washing products.

The chlorine solvent, dichloromethane, was used for stripping off paint films and coatings, but we changed the method for this process to the shot-blast method using plastic media, in order to decrease the amount of dichloromethane used. We will keep on conducting extensive research and study for alternative substances and alternative methods.

### Emission of Substances of Organic Chlorine by Year



\* Calculated with the 1997 level as 100



A process of shipbuilding

# Global Environmental Protection through Countermeasures against Fluorocarbons(\*)

We, as a manufacturer of air-conditioning & refrigeration systems, are urged to take strict countermeasures to reduce fluorocarbons to protect the ozone layer. We are putting more efforts than ever to switching to HFCs, and to establishing a system to recover fluorocarbons.

## Countermeasures against Fluorocarbons

Fluorocarbon was developed in 1930, as the "miracle gas" for its safety (low toxicity and inflammability) and notably good characteristics (cost effective, reliable, durable, and serviceable) as a product. It has been used for a wide range of applications such as refrigerants for air-conditioning & refrigeration systems, cleaning media for precision devices, atomizing media for aerosols, and as foaming agents for urethane foams.

However, at the beginning of the 1980's, the following facts were proved:

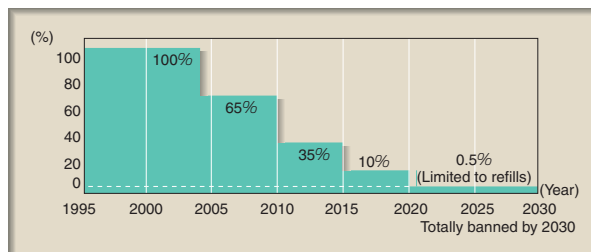
1. The ozone layer protecting the earth's surface from the sun's ultraviolet rays is destroyed by the chlorine contained in CFCs and HCFCs.
2. The green-house effect of fluorocarbons is several-hundreds to several-thousands times as strong as that of carbon dioxide.

These findings triggered the restrictions of fluorocarbons.

It takes a considerably long time (ten years as the unit) to see the correlation between the causes and the results of ozone depletion and global warming. The material currently destroying the ozone layer is fluorocarbons that were released more than ten years ago. It is said that, even if the use of fluorocarbons were completely banned and stopped at the present point, the effects of this would only appear in ten or more years.

In 1987, with the adoption of the "Montreal Protocol on substances that deplete the Ozone Layer," CFCs were to be totally banned by 1995. HCFCs are scheduled to be phased out by 2020, except for those used as refills, as illustrated below.

## Phase-out Schedule for HCFCs



## Promoting Use of Alternative HFCs at an Earlier Stage

We are putting our efforts into replacing the traditional refrigerants for refrigeration and our air-conditioning units with the HFCs, which are said to be the best possible solution in modern chemistry, setting our sights on an early completion of the replacement.



Residential Use Split Air-conditioner SRK 28SD

## Establishing a Fluorocarbon Recovery System

We have been holding technical training courses for recovery of fluorocarbons in our servicing sections of the air-conditioning & refrigeration divisions, aimed at providing the staff members of the related sections with updated information and skills on this. Other subsidiaries and affiliates, including Mitsubishi Heavy Industries East Japan Sales Co. Ltd. (Herein called East Japan Sales Company) have also been actively involved in such education and training, working hard to strengthen their fluorocarbons recovery systems in accordance with the enactment of the "Law Concerning Recovery and Disposal of fluorocarbons" in April 2002.

In particular, the East Japan Sales Company, collects fluorocarbons from used air-conditioning and refrigeration systems for businesses, as a registered "Category 1 Recovery Company of Fluorocarbons." It is aggressively engaged in providing the service for the use of "Collection and Storage Center for Recovered Refrigerant," where the refrigerants collected by its affiliates and service shops are collected for storage. The recovered fluorocarbons are handed over to businesses specialized in disposing of such materials and are put through the destruction process. We plan to set up similar centers for the collection and storage of refrigerants in key locations across Japan to establish routes and channels of integrated processing from collection to destruction of fluorocarbons.

\* Fluorocarbons : include Chlorofluorocarbons(CFCs), Hydrochlorofluorocarbons(HCFCs) and Hydrofluorocarbons(HFCs)

## Topic

## Air-conditioning System Using CO<sub>2</sub>

### Development of CO<sub>2</sub> Air-conditioning System for Automobiles

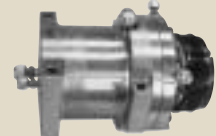
We have developed an air-conditioning system for cars, which does not use substances harmful to the ozone layer, by making use of CO<sub>2</sub> in the atmosphere. The new system realizes excellent performance, higher than that of the conventional system using HFC-134a. We are in the merchandising and product planning stage, completing the development of actual size prototypes for commercial use, hoping to offer the first car air-conditioning systems utilizing CO<sub>2</sub> in the world at an early point.



Evaporator



Gas cooler



Compressor

## Development of new environmentally friendly manufacturing methods

As production processes of each division and works cover a wide range of operations, development and introduction of new manufacturing methods that are environmentally friendly is the key challenge for the whole company. In addition, we have been working proactively to purchase environmentally friendly 'green goods' with reduced impact on the environment.

### Nagasaki Shipyard & Machinery Works

Coating paints to prevent rusting on the body of a ship is an important process for a longer service life. Among such processes operations such as surface treatment of decks before applying paints, often cause dust. With the conventional method, we had to perform this process while calculating wind direction to avoid spreading the dust to the areas surrounding the site.

Due to this, we have adopted the vacuum blast method, with which paint operators can do their jobs regardless of the wind direction, making the process period shorter and avoiding environmental pollution.

Rust-preventing paints are also applied even onto products like boilers, which have somewhat complicated shapes. As such paint application work is performed outdoors and is influenced by wind, the level of wasted paint used to be relatively high. By introducing a new spray gun system using an air curtain, the painting process can now be performed smoothly without wind interference, and waste paint was reduced by 45%, a 3% energy saving.

#### Vacuum Blaster



**Conventional:**

Surface treatment of exposed decks requires use of disc sanders and wire wheels. With this method, dusts and particles are generated and spread around.

**New:**

With vacuum blasters to treat exposed deck surfaces, blasted sands and particles are automatically collected.

#### Spray Gun System with Air Curtain

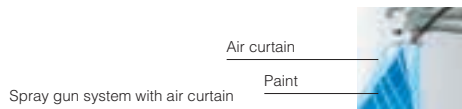


**Conventional:**

Spray guns are used outdoors to apply paint onto boiler components. Mist drifting is caused by wind, and lowers the paint spreading efficiency rate.

**New:**

The spray gun system with air curtain is adopted, resulting in decreased mist drifting, and a shorter time for finishing the work.



### Topic

### Purchasing "Green goods"

#### The Basic Policy on Green Purchase outlined

The MHI 2002 Environment Committee decided on basic issues to promote the purchase of raw materials, parts, and supply goods that work to reduce the burden on our environment on a planned basis, in order to build an ecologically-oriented society.

#### Green Purchase of Non-production Goods

We have launched a company-wide movement to promote purchasing of environmentally friendly goods, mainly of non-production goods. Emphasis is given not only to purchasing goods which are labeled

"environmentally friendly," but also to always planning well for the purchase of goods bearing in mind the importance of the three R's, "Reduce, Reuse, and Recycle."



Nagasaki Shipyard & Machinery Works House Journal (on green purchase)

Nagasaki Shipyard &

Machinery Works issues "News release on green purchase" to raise awareness among employees. The company plans to spread these efforts by individual divisions or plants horizontally across the company to eventually expand the range of green purchase to industrial goods.

#### Purchasing Green Electricity

In support for the scheme of "Green Power Certification System" proposed by Japan Natural Energy Co. Ltd., MHI will annually purchase one million kWh of wind generated power for 15 years starting from April 2002.



Green Power Label Indicates "Part of electricity we use is green power."



Wind Power Generation



## Design and Development Based on the Spirit of Craftsmanship

MHI has been putting its energy into design and development of products that are environmentally compatible, for a better environment and higher quality of life in the 21st century.

### Guideline for Environmentally Compatible Development and Design

MHI has been striving, through its business activities, to play a useful role in the development of society and making the life of people better. The understanding that this is the original intent of manufacturing and craftsmanship has been unchanged since the founding of the company.

Up until now, we have constructed power-generation plants bringing affluence to society, and have developed products forming social infrastructure such as bridges and ships, taking environmental matters into consideration. We are ready to develop and manufacture products which are really hoped for and which conform to environmental requirements, by applying designs and development methods incorporating the latest technologies, toward the building of an environmentally friendly society.

### Working Group for Environmentally Compatible Design

Our Environment Committee has set up a Working Group for Environmentally Compatible Design as a company-wide organ which will highlight the activities related to the “three R’s” (Reduce, Reuse, and Recycle.), to further promote traditional activities of environmentally compatible design.

### Major Efforts Made

MHI has devised many technologies that take environmental protection into consideration in various fields.

For example, we have developed new power generating systems using fuel cells and biomass in the area of power generating equipment and facilities. This has been done based on the concept of finding the best mix of resources to lessen the burden on the environment based on the national policy. We also seek ways to develop ultimate environmentally friendly ships in accordance with the changing needs of time.

Our scope of development includes transportation systems, which alleviate traffic jams and reduce CO<sub>2</sub> emissions, such as the Integrated Transportation System (ITS) and Electronic Toll Collection System (ETC). We design and develop many of our other products, seeking further saving of energy, resources, and reduction of CO<sub>2</sub>. Some examples of these products are listed below.

### Environmentally Friendly Products

Category	Product name	Type/Model	Description of environmental cares	Page
Pure car carrier	Eco-ship	-	CO <sub>2</sub> reduction by reducing in-ship driving distance by 20%; Use of solar generated power; 25% fuel cost reduction by improved propulsion performance and weight reduction	P.19
Gas engine for power generation	Gas-engine	MACH-30G	Reduced NOx	P.20
Waste processing system	Oxygen-rich combustion system	-	Exhaust emission reduced by 35%	P.21
Forklift trucks	CNG forklift trucks	-	HC reduced by 98%, NOx by 13%, CO by 84%, and CO <sub>2</sub> by 20% compared to vehicles running on gasoline	P.22
Air-conditioning system	Centrifugal liquid chiller	NART series	COP6.1/using HFC-134a	P.23
	Gas-heat pump air-conditioner	GHCP560	COP1.34/NOx reduced by 40% compared to conventional model/using HFC (R407C)	P.23
Injection molding machine	Electric injection molding machine	“em” series	Power consumption cut by 60% compared to the hydraulic model; Unit size made smaller by 15%	P.24
Machine tool	Dry-cut gear shaping machine	SN25A	No cutting oil wastes; 37% save in energy compared to conventional models	P.25

## Products of MHI Serving for a Better Global Environment

Supporting industries, making our life happier, and changing waste into new useful materials, the environment-related products manufactured with our technologies and expertise are found in various scenes in our everyday life.

### Supporting industries

#### 1. Cogeneration system

The cogeneration system, using gas fuel, realizes an overall efficiency of 77.4%. With greatly improved performances in terms of economy and environment, this product of compact design can be installed into small buildings, where previously installation was deemed difficult, and also can be applied to industrial use.

<http://www.mhi.co.jp/gsh/frame136.htm>

#### 2. Gas cleansing system

Exhaust gas from boilers in power plants and factories contain SO<sub>2</sub> which causes air pollution by forming sulphuric acid mists when released in the atmosphere. This system efficiently removes sulphuric acid mists in a compact way with the electrostatic processing.

[http://www.mhi.co.jp/machine/product/enviro/env\\_00.htm/](http://www.mhi.co.jp/machine/product/enviro/env_00.htm/)

#### 3. CNG forklift trucks

**Refer to page 22 for more information.**

<http://www.mhi.co.jp/gsh/frame128.htm>

#### 4. Electric injection molding machine

**Refer to page 24 for more information.**

[http://www.mhi.co.jp/sanki/injection/injec\\_j/products/me/memerit.htm](http://www.mhi.co.jp/sanki/injection/injec_j/products/me/memerit.htm)

#### 5. Dry hob cutting system

**Refer to page 25 for more information.**

[http://www.mhi.co.jp/kousaku/index\\_j.html](http://www.mhi.co.jp/kousaku/index_j.html)

### Recycling waste materials

#### 6. Recycling system for raw materials

Municipal governments and autonomous bodies across Japan are trying hard to cope with separation, recycling, and reduction of wastes. Our recycling facility and equipment propose an optimum system for waste recycling.

[http://www.mhi.co.jp/machine/product/enviro/env\\_03.htm](http://www.mhi.co.jp/machine/product/enviro/env_03.htm)

#### 7. Food residue dryer

We have developed a food residue dryer in line with the "Law for Promotion of Recycling of Food Residue." The dryer uses heated air and microwave to dry cooked rice and similar residue, effectively turning them into animal feed.

<http://www.mhi.co.jp/machine/haiki/index.htm>

#### 8. Soil remediation system

We provide an integrated service for soil remediation system assessing the degree of contamination, delivering the system and devices, and processing for purification. Our approaches are to prevent contamination and promote purification of air, water, waste-containing landfills, and underground water.

[http://www.mhi.co.jp/machine/product/enviro/env\\_00.htm](http://www.mhi.co.jp/machine/product/enviro/env_00.htm)



### In our everyday life

#### 9. Electronic Toll Collection System (ETC)

The ETC system has started operation across Japan, and is contributing to the reduction of CO<sub>2</sub> and NO<sub>x</sub> emissions caused by congestion at toll gates. We delivered the world's first Electronic Road Pricing (ERP) system in Singapore. This system controls traffic volume in urban areas, also contributing to environmental improvements.

[http://www.mhi.co.jp/machine/product/trans/tra\\_05.htm](http://www.mhi.co.jp/machine/product/trans/tra_05.htm)

#### 10. Ozonizer

Generating ozone through water electrolysis, this device purifies water in large swimming pools or public baths. Water quality can be maintained at a clean level as the device uses special ceramic reactors developed by us.

<http://www.mhi.co.jp/gsh/pict171.htm>

#### 11. Electron beam irradiator

The electron beam is safer than gases or radiation, and has no effect on the environment. Our electronic sterilization system is frequently used in medical device manufacture for its high reliability.

[http://www.mhi.co.jp/machine/product/general/gen\\_17.htm](http://www.mhi.co.jp/machine/product/general/gen_17.htm)

#### 12. Energy-saving type air-conditioner

**Refer to page 15 for more information.**

<http://www.mhi.co.jp/aircon/cs/products/home/index.html>

#### 13. Centrifugal liquid chiller

**Refer to page 23 for more information.**

<http://www.mhi.co.jp/aircon/cs/products/big/product/index.html>

#### 14. Wind power generation system

**Refer to page 26 for more information.**

<http://www.mhi.co.jp/power/product/index10.htm/>

#### 15. Amorphous type solar cell

**Refer to page 27 for more information.**

<http://www.mhi.co.jp/power/techno/index01.htm>

## Pure Car Carrier

Eco-ship. A typical example of MHI achievements in marine engineering by the sophisticated technologies based on our long tradition in the industry. This achieves innovative energy efficiency and economy.

### Eco-ship

MHI has built a highly energy-saving ship named "NEW CENTURY 1" (operated by Toyofuji Shipping Co., Ltd.). This is one of the largest car carriers in the world. Its improved propulsion performance, better vehicle-loading efficiency, and body weight reduction have reduced the fuel necessary for transportation per vehicle by around 25% compared to our conventional car carriers. At the same time, to shorten the average travel distance for vehicle loading and improve the vehicle-loading efficiency for the purpose of vehicle CO<sub>2</sub> emission reduction, a stern-to-shore wide ramp way (8 m width) is adopted and the ramp ways inside the ship are 8.1 m width and laid out straight wherever possible. These designs provide some 20% reduction in vehicle travel distance inside the ship compared to the conventional turn-around ramp way layout. This also significantly contributes to reduction in emission from vehicles that are driven to their storage positions in the ship. The power unit is a Mitsubishi UE engine that exhibits low fuel consumption and includes an NO<sub>x</sub> reduction device. An optimum selection in consideration of CO<sub>2</sub> and NO<sub>x</sub> reduction. Other technologies adopted include IBS (Integrated Bridge System) that ensures safe navigation, ship/land communication and navigation control system that transmits the navigation data and engine operation data of the ship for the purpose of better navigation economy, and the Mitsubishi stator fin, and an energy-saving device that reduces the engine power requirement and thus the fuel consumption. Environmentally-friendly technologies are also adopted. For example, solar batteries are used to provide electric power for some lighting devices in the ship, and the air-conditioner system uses ammonia which is a non-artificial refrigerant. As described, MHI has made as much effort as possible for environmental preservation.



Solar Energy Generation System

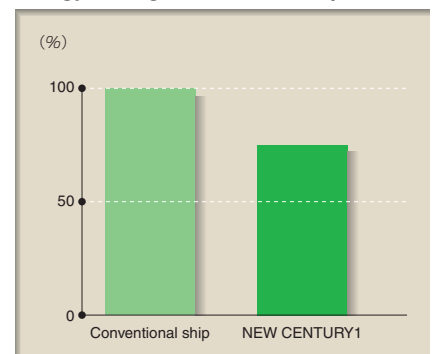


Straight Layout Ramp Way



NEW CENTURY 1

### Energy-Saving Effect of Eco-ship



\* Condition: Fuel consumption per carried vehicle of the same model at the same ship speed.

## Gas Engine for Power Generation

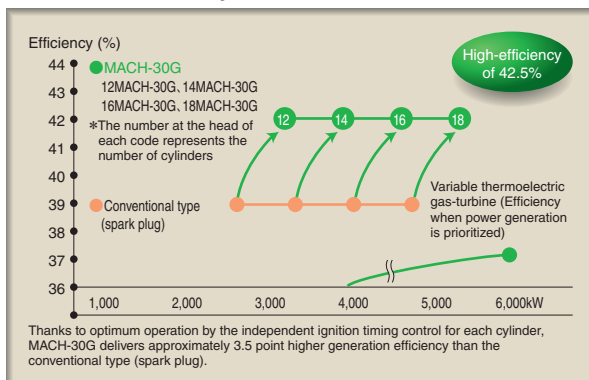
MHI is promoting energy-saving power-generation technologies in consideration of environment preservation, and developing higher efficiency engines that are friendly to the environment.

### Gas Engine MACH-30G

The MACH-30G is a series of V-type 4-cycle, supercharged engines with line-up of 12 to 18 cylinders, providing 3.7 to 5.8 MW output power. They adopt the pilot ignition system with an electronically controlled common rail injection device instead of conventional spark plugs and thus have improved combustion condition. In addition, the independent electronic control of individual cylinders, in combination with the advanced pilot injection ignition, offers the world's highest level generation efficiency of 42.5%. The above pilot injection ignition has also solved one of the conventional demerits of a gas engine, that is, its lower output power compared to diesel engines. The system delivers a comparable output power to current diesel

engines. Furthermore, the NOx emission of 0.5 g/kWh or less is realized by the optimum combustion in lean burning condition. Another environmentally friendly technology is here. Of course, they contribute to CO<sub>2</sub> emission reduction through their improved energy efficiency.

### Combustion Efficiency



Gas Engine MACH-30G



### Topic

### Our Awarded Products

#### Combined-cycle power plants utilizing high-efficiency large-capacity gas-turbines

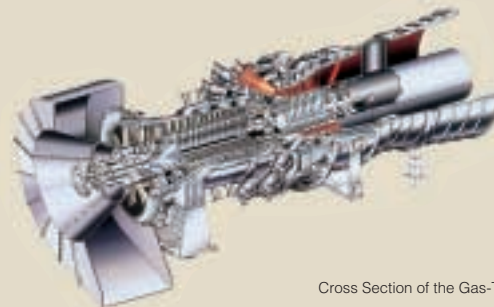
The conventional wisdom that power generation causes increases in CO<sub>2</sub> emissions is beginning to change.

We are urged to take strict countermeasures to reduce carbon dioxide (CO<sub>2</sub>), the cause of global warming, while also achieving reasonable cost effectiveness. Therefore, the majority of new thermal power systems are combined-cycle power plants, which can attain higher thermal efficiencies. Such systems combine gas turbine generation, which uses natural gas for fuel, and steam turbine generation, which uses recovered heat energy from the gas turbine's exhaust. Twelve years ago, MHI, Tohoku Electric Power Company, and Mitsubishi Electric Corporation began joint research and development towards realizing the dream to attain a thermal efficiency of more than 50% using this method. In July 1999, for the first time worldwide, a facility with this original domestic technology started operation at the Tohoku Electric Power Higashi Niigata Thermal Power Station with a thermal efficiency of 50.6% and power output of 805 MW.

The improvement in thermal efficiency enabled a reduction in CO<sub>2</sub> emissions by as much as 22% compared to the con-

ventional type thermal power system.

In addition, an increased gas temperature at the inlet of the gas-turbine is necessary for higher efficiency. Under normal working conditions, this increase of flame temperature causes an increase in NOx emissions. However, we have achieved reduction in NOx emissions by cooling the wall of the combustion chamber with steam instead of air, and by increasing the gas-turbine inlet temperature without increasing the flame temperature. For these excellent results, we received both "The 29th Japan Industrial Technology Award" and the "Japan Society of Mechanical Engineers Award."



Cross Section of the Gas-Turbine

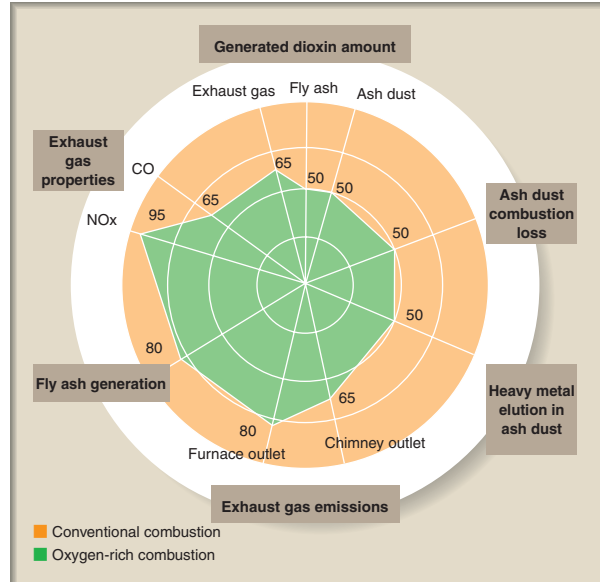
## Waste Processing System

Our waste processing systems are the result of the sophisticated technologies endorsed by MHI's long experience and performance. The systems constitute an essential component of modern social infrastructure.

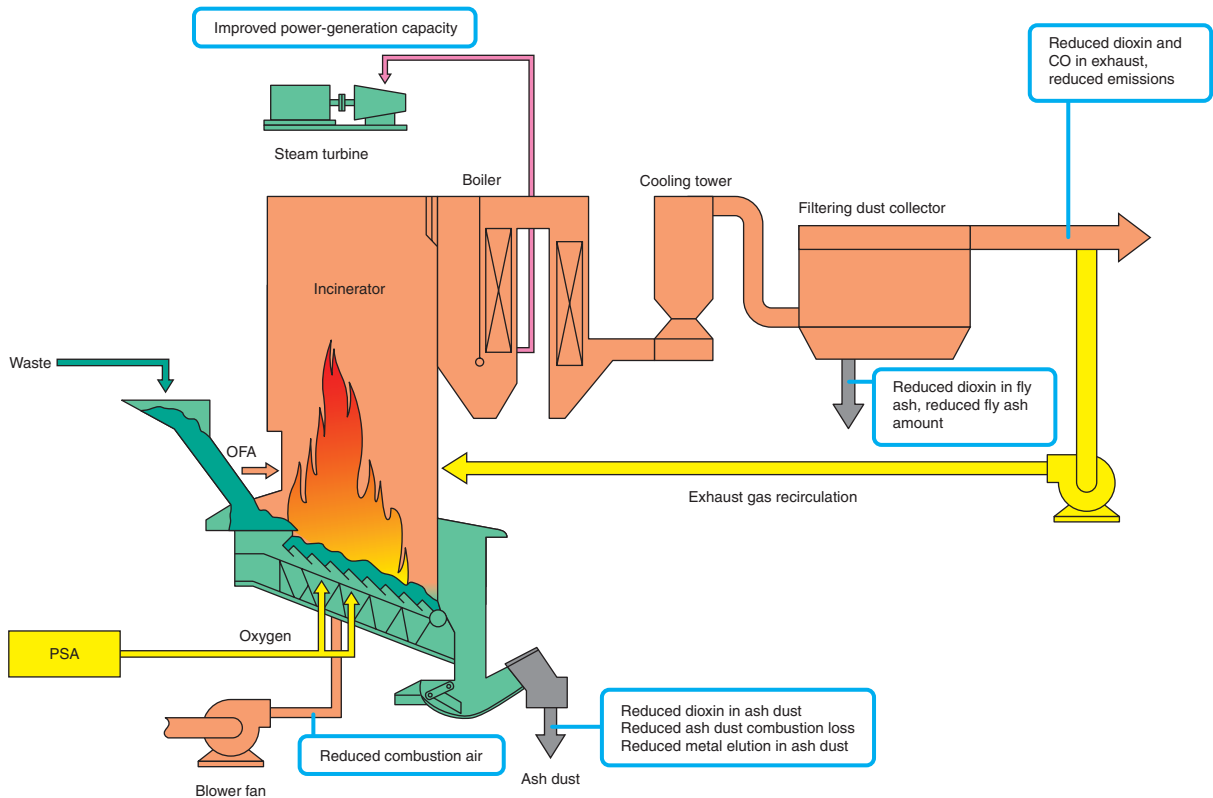
### Oxygen-rich Combustion System

The oxygen-rich combustion system, delivering a high-temperature combustion solution, has received strong confidence from the users as a next generation waste processing system that achieves both reduced environmental burden and exhaust emission reduction at the same time. The combination of MHI's proved and proprietary stoker furnace and the oxygen condensation system (PSA: Pressure Swing Absorption) supplies the primary combustion chamber with oxygen-rich air containing about 27% oxygen. This raises the combustion temperature by 100 to 20°C and thus significantly reduces dioxin sources. It also offers about 50% reduction in CO emissions, ash dust, and heavy metal elution. Furthermore, the additional exhaust gas recirculation system reduces the chimney gas emissions to 65% (reduced by 35%) of the conventional level.

### Effect of Oxygen-rich Combustion



### System Configuration



## Forklift trucks

Forklift trucks are an essential component in the logistic industry that contributes to the modern life and society. MHI is developing forklift trucks utilizing compressed natural gas.

### CNG Forklift trucks

Environmentally-friendly forklift trucks, that utilize compressed natural gas (CNG) as fuel for the purpose of prevention of air pollution from engine exhaust emissions, as well as utilizing alternative energies and further fuel saving. Natural gas, with methane as the major component, does not generate SOx and soot when combusted. In the CNG engine, the emissions of other pollutants such as CO<sub>2</sub>, a global warming gas, and NOx, cause of oxidase smog, are also reduced in comparison to gasoline engines. The fuel consumption per working hour may be as low as 44% of that for gasoline engines, and 56% of that for LPG engines, depending on the conditions. We have been introducing CNG Forklift trucks as an option for working environment improvement, in our Sagami-hara plant as part of the model project for CNG utilization since September 2001.

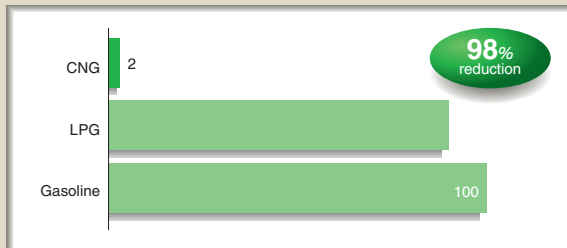
CNG forklift trucks



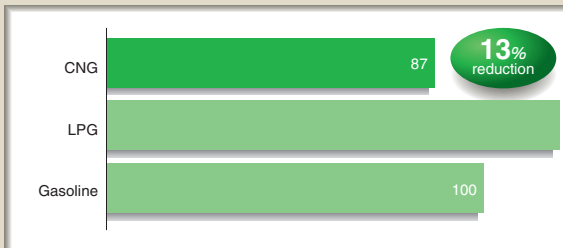
CNG supply stand

### Emission Level of Each Exhaust Component

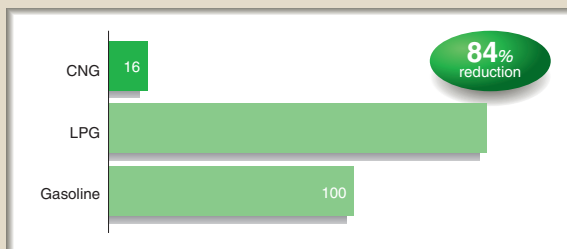
#### Hydrocarbon (HC)



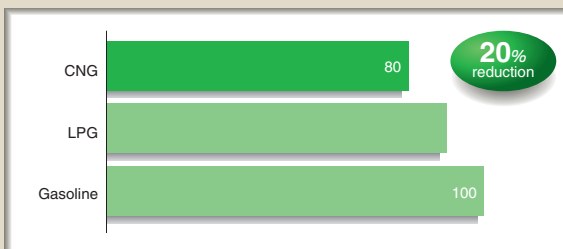
#### Nitrogen oxide (NOx)



#### Carbon monoxide (CO)



#### Carbon dioxide (CO<sub>2</sub>)



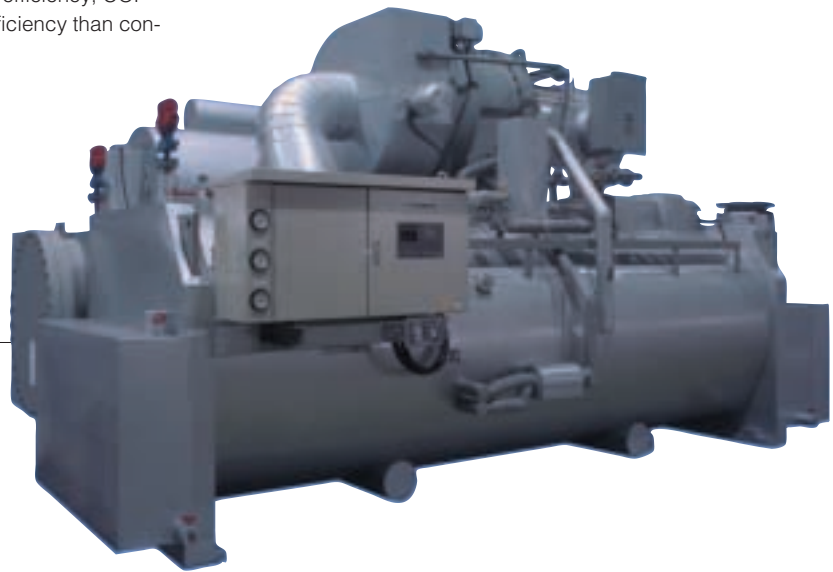
## Air-Conditioning System

Environmental protection is the biggest challenge for air-conditioning technologies. MHI has delivered significant effects for energy-saving and ozone layer protection in this technology domain.

### Centrifugal Liquid Chiller

This chiller is an environmentally-friendly design that adopts HFC-134a for the refrigerant, which achieves zero level in the ozone depletion potential (ODP). HFC-134a is one of the alternative refrigerants that is widely used in other industrial products and therefore easily available. The chiller utilizes refrigeration cycle with 2-stage compressor, economizer and sub cooler to achieve best-in-the-world level energy efficiency, COP 6.1. This amounts to 20% greater energy efficiency than conventional chiller.

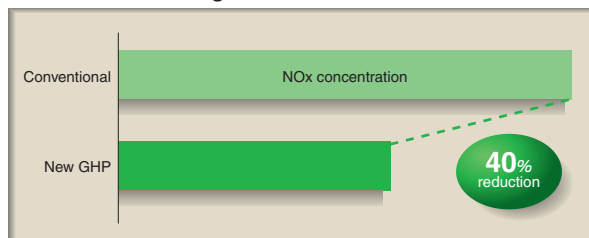
Centrifugal liquid chiller NART series



### Gas-Heat Pump Air-Conditioner

This machine delivers 20% greater energy efficiency, COP 1.34, by improving the engine heat efficiency, adopting an electronic control system and optimizing the refrigeration cycle. It also has reduced the NOx emissions by 40% from that of conventional machines by adopting an improved EGR valve (exhaust gas recirculation valve), and electronic control. The refrigerant in use is HFC (R407C) which does not destruct the ozone layer.

#### ECO Model Achieving 40% NOx Reduction



Adoption of an improved EGR (\*1) that recirculates part of exhaust gas, as well as electronic control has achieved 40% reduction in NOx emissions compared to conventional models. This is further progress in reducing the burden on the environment.

\*1 : Exhaust Gas Recirculation



Gas heat pump air conditioner GHCP560

## Injection Molding Machine

MHI's energy-saving injection molding machines are contributing a great deal to manufacturing of various products with sophisticated electronics technology.



Electric injection molding machine "em" series

### Electric Injection Molding Machine

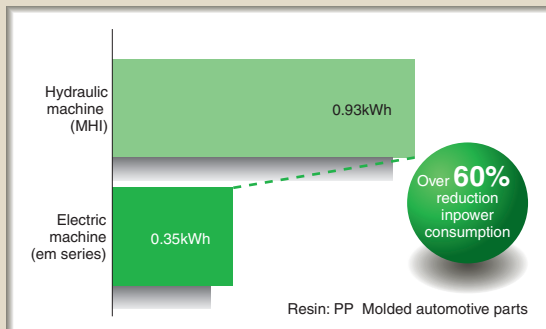
The large-size electric injection molding machine "em" series achieves remarkable energy saving and space efficiency. The overall length is 15% shorter than our competitor's in the same class. This achieves the smallest size for a machine of this type in the world. Furthermore, the compact size of each unit of this machine has reduced the necessary materials and the area of the foundation work.

### Remarkable Energy-Saving Effect

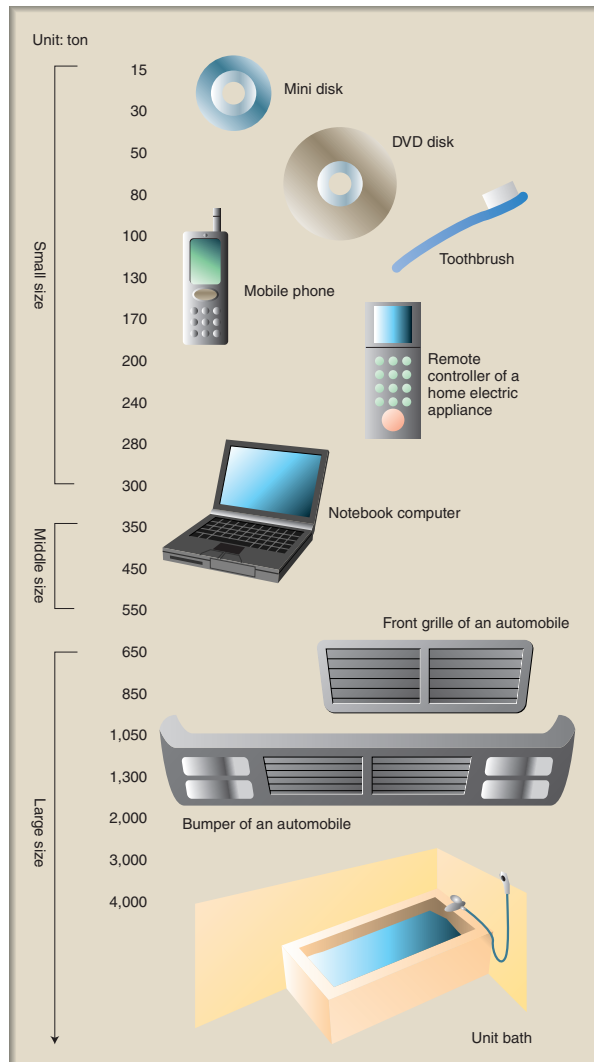
Adoption of high-performance servo motors and Eco-servo pump has reduced the power consumption by 60% or more compared to conventional hydraulic machines.

The regeneration type servo amplifiers that recover energy from the decelerating motors contribute to energy saving.

### Power Consumption



### Examples of Molded Products





## Machine Tool

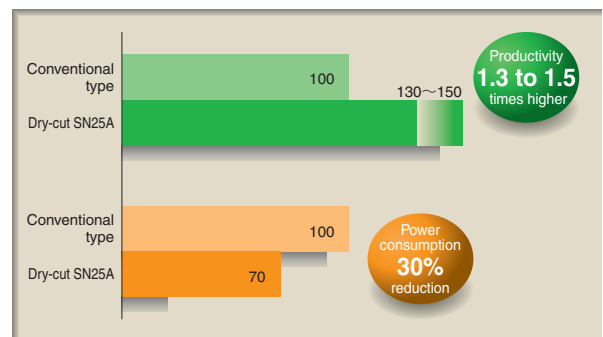
The machine tool business is the origin of MHI's artisan mind that has been inherited since its establishment. We have been developing various technologies that achieve both higher productivity and lower energy consumption.



Dry-cut gear shaping machine SN25A

### Dry-cut gear shaping machine

The dry-cut gear shaping machine offers a clean and safe working environment. It uses no cutting oil, and thus makes the working environment cleaner, eliminates the need for waste fluid disposal and contributes to waste reduction, as well as eliminating the risk of fire due to cutting oil. Furthermore, the oil-free operation saves a significant amount of electric power that may be otherwise consumed for cutting oil related systems such as lubrication pump, mist collector, and oil cooler. The energy-saving effect amounts to 37% of the conventional type in case of a typical automotive gear shaping machine, as shown in the figure.



## Topic

## Our Awarded Products

### Dry hob cutting system

In February 1999, our gear manufacturing machinery, as exemplified by our dry hob cutting system, received a Minister of International Trade and Industry commendation, the highest award given at the 1998, 19th annual Excellent Energy Saving Machinery Awards, hosted by the Japan Machinery Federation.

#### Background

When gears are machined and cut from metal stock, a large amount of oil is required to protect the tool surface and to flush away scrap material. The inevitable spreading and misting of the oil degrades the work space, making it dirty and dangerous. Hobbing machines generally use water insoluble oil that represents a fire hazard. Thus a dry-cutting system is desirable from the standpoint of safety, environmental friendliness, and waste oil management.

#### Features

##### <Clean and safe work environment>

Because our dry-cutting system uses no oil, the workspace is greatly improved compared with that of conventional systems. As well, waste-oil treatment is unnecessary and the risk of fire eliminated.

##### <Productivity>

Compared to the conventional speed of 100 m/min., a high cutting speed of 200 m/min. is achieved, thus doubling productivity.

##### <Economical>

Owing to a special coating, tool life has been extended five-fold. As well, power consumption is reduced, cutting-oil cost eliminated, and labor costs reduced due to the improved working environment. Finally, operating costs are reduced by 45% through the elimination of oil-related components such as a circulation pump, mist collector, and cutting oil cooler.

##### <Energy-saving effect>

The energy saved by eliminating oil-related components results in a cost reduction of 37% in case of typical automotive gear parts in comparison to conventional type.



H.S.S. material hob cutter "Super Dry"



Super Dry Hob Cutting System GN10A

# Achievements in Technology Development with a Look Ahead to the Future

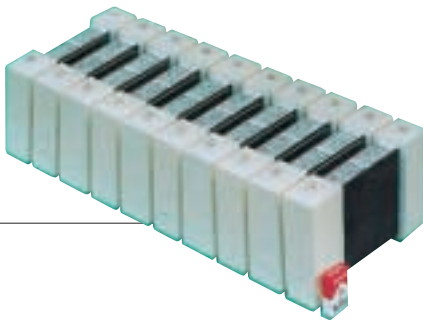
MHI has been tackling various technology challenges for the future ecology-oriented economy and society: Creation of clean and low environmental burden electric energy, solution of global warming, CO<sub>2</sub> emission reduction/restriction.

## Fuel cell

MHI for years has delivered a significant number of thermal power plants ranging from the large type for power plant projects to the medium/small types for factory use. Their advanced technology features, reliability, and high efficiency have been given favorable reputations from the customers. Now, based on these technological achievements and experiences, MHI is developing some fuel cell technologies as a new-generation high-efficiency power-generation solution. Of all fuel cell technologies currently available, MHI's selections are the polymer electrolyte fuel cell (PEFC) and the solid oxide fuel cell (SOFC).

## Solid oxide fuel cell (SOFC)

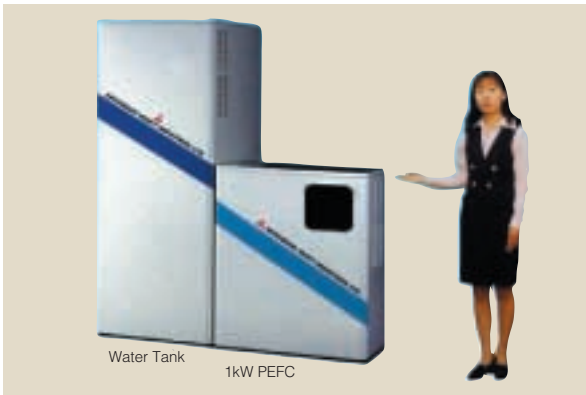
SOFC, with a high operating temperature, allows high-efficiency power generation when combined with a gas turbine. They offer potential for wide application from distributed power networks to thermal power plants.



SOFC

## Polymer electrolyte fuel cell (PEFC)

PEFC, with a low operating temperature, has several excellent properties such as "quick start" "allows compact size and light-weight" and "low cost materials". They are expected to be used widely, especially for home co-generation systems.



PEFC

## Wind power-generation system

MHI contributes to the stable supply of electric power worldwide, through systems that utilize various sources of renewable energy.

Recently wind power generation has attracted much attention, even in Japan, but we have been developing and producing such systems for over twenty years now.

Domestically, we have constructed more than 50 plants, starting from Muroran's 1,000 kW plant. Overseas, we have constructed more than 1,300 plants primarily in the U.S. and Europe. By harnessing the wind, an unlimited natural source of energy, we are able to supply clean electric power all over the world.



250 kW × 660 units/system  
Mojave Desert, California, U.S.A.  
The world's largest area (1.4 km × 1.1 km)



Muroran city, 1,000 kW system

**Amorphous solar battery**

MHI is working to advance the development of power systems that use renewable energy such as solar generation and solar cells. Our solar cell uses amorphous silicon, requiring much less than 1% of the amount of silicon required by crystalline type cells. Moreover, the energy required for its production is also only a fraction of that required for the crystalline type. Thus, it is a solar cell that considers the future of the earth and is gentle to the environment.



2kW field test system for residential use



10kW field test system for factory use

**Biomass gasification methanol production system**

MHI has been developing a system to convert biomass material (biological resources) at high efficiency into new liquid fuel such as methanol, which is easy to store and transport. Biomass is produced when plants utilize solar energy to incorporate atmospheric CO<sub>2</sub> and grow. Because biomass is abundant in supply and causes no increase in CO<sub>2</sub> when used as fuel on a sustainable basis, biomass conversion is considered an ideal solution from the viewpoint of energy self-sufficiency and CO<sub>2</sub> problems.



Plants, the source of biomass

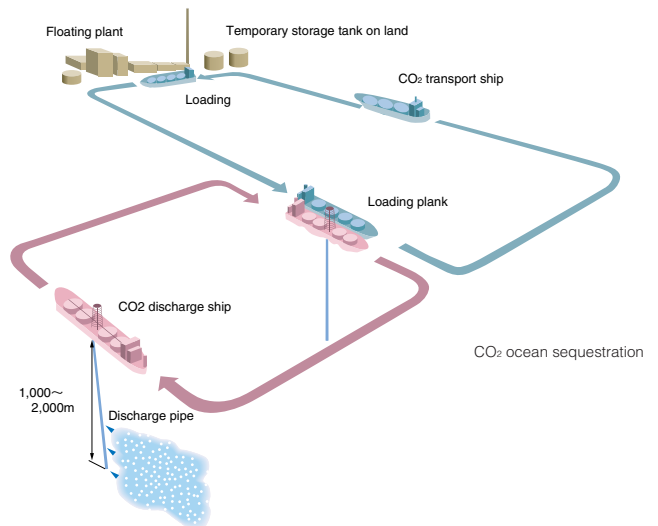


Pilot plant for production of biomass gasification methanol

**CO<sub>2</sub> ocean sequestration**

This system is based on the concept of recovering CO<sub>2</sub> generated by burning of fossil fuels and using the ocean to absorb it. This approach has many advantages such as compatibility with existing energy supply systems, freedom of site location selection, direct processing of a large amount of CO<sub>2</sub>, and relatively low cost. However, to materialize this concept, it is necessary to identify the time until CO<sub>2</sub> in the sea is rereleased into the air, and evaluate what impact is expected on the oceanic environment. In addition, a reliable methodology to predict the behavior of CO<sub>2</sub> in the sea must be established.

MHI has participated in the Study on Environmental Assessment for CO<sub>2</sub> Ocean Sequestration to Mitigate Climate Change, a Ministry of Economy, Trade and Industries project begun in 1997, and has continued studying the fundamental concept for a feasible CO<sub>2</sub> Ocean Sequestration system.



**CO<sub>2</sub> recovery/underground retention system**

This system is to recover CO<sub>2</sub> emitted from power plants at low cost by means of our unique technology, new absorptive fluid (with more than 20% greater energy efficiency), and permanently retain the CO<sub>2</sub> in aquifers located deep under the ground.

In EOR (CO<sub>2</sub> Enhanced Oil Recovery), another type of underground retention system which will also contribute to heavy oil production, the recovered CO<sub>2</sub> is injected into the underground oil layer and readily absorbed in the crude oil. Because the absorbed CO<sub>2</sub> remarkably improves the fluidity of the heavy oil, much more crude oil can be extracted from under the ground.

The CO<sub>2</sub> absorbed in the extracted crude oil is separated from the oil and injected again into the underground oil layer. The result is that the oil layer under the ground is finally replaced by CO<sub>2</sub>. Thus, significant amount of CO<sub>2</sub> will be retained underground without being released in the air.

MHI is working to develop necessary technologies to enlarge the capacity of these systems, improve the crude oil extraction efficiency, and dispose of CO<sub>2</sub> emissions on a reliable basis.



Underground retention system

**Motor for electric vehicles**

In August 2001, an electric vehicle developed by Mitsubishi Motors Corporation, named "Eclipse EV" achieved a round trip in the Shikoku island (about 780 km mileage in total) in 25 hours. The electric vehicle was equipped with an electric motor and motor control unit (MCU) developed by MHI. These units, with light weight and high efficiency, significantly helped the vehicle to achieve a long mileage per full charge exceeding 400 km.

Recently some electric motor-based vehicles such as EV, hybrid, and fuel cell EV have attracted more attention as next generation automobiles. The motors used in these vehicles must be compact, highly efficient, and very powerful. To meet these requirements, MHI has developed a compact, light-weight, and high-efficiency motor with higher power than our competition's by adopting an interior permanent magnet motor (IPM motor) and optimizing the layout of magnets and sole-noids.

The EV technology competition in the automotive industry is increasingly heating up. These low-pollution vehicles are expected to spread gradually in the market as a solution for the problems of environmental destruction and fossil fuel resource exhaustion. We intend to make further progress in our R&D activities for smaller, lighter and more reliable electric motors to satisfy the automotive industry needs.



Eclipse EV



**Specifications of MHI's new motor and our competition's**

	MHI	D Co.	X Co.
Displacement	2,000 cc equivalent	-	Generic motor (Reference)
Vehicle drive system	Motor-driven	-	-
Sequential max. output	40 kW	15 kW	37 kW
Max. output	100 kW	40 kW	55 kW
Max. rpm	5,750 rpm	5,750 rpm	1,950 rpm
Stator diameter	240 mm	280 mm	300 mm
Stator length	80 mm	90 mm	215 mm
Stator weight	24 kg	25 kg	120 kg



Round trip in Shikoku Island (780 km)  
 Vehicle performance (Eclipse)  
 1. Max. speed: 180 km/h  
 2. Range (mileage per full charge): 450 km

## Harmonization with Local Communities

MHI believes that a company must build its business based in the local community. To achieve this objective, in other words harmonization with local communities, we are constantly committing ourselves in various local volunteer activities such as cleaning of public areas, preservation of natural life and other environmental protection activities.

### Collaboration with local communities

To increase employee awareness of the importance of environmental protection, in the 'Environmental Week' of each June since 1970, we have conducted company-wide activities, such as environmental patrols by the heads of the Works or by environmental protection managers, hosting sightseeing tours of environment protection facilities, collecting garbage around factory during lunch time, and other activities which allow employees to gain firsthand experience.

These activities were highly evaluated by the relevant ministries and agencies, and cited as a valuable precedent in Japan.

Each Works participates aggressively in the campaign to eliminate unlawful littering, and tries to improve the cleanliness of the local community.

### Preservation of natural life

The Hiroshima Machinery Works is promoting preservation of killifish (called medaka in Japan) and fabrication of birdhouses utilizing scrap wood from the factory.

The killifish live in the approximately 4,000 m drainage canals that ring the compound. Every year, the Works donates part of the increasing killifish to local kindergartens and elementary schools for use in lessons.

As for the birdhouses, the Hiroshima Works regularly hosts a competition of birdhouse fabrication through which employees have strengthened their awareness for waste reduction and preservation of natural life. The fabricated birdhouses are posted on trees in the premises. The facility intends to continuously maintain these natural environments in the premises, which allows them to see killifish and birds.



Volunteer cleaning activity  
(Local public areas)



Birdhouses  
(Hiroshima Machinery Works)



Volunteer cleaning activity (Around factory)



Kindergartners observing medaka  
(Hiroshima Machinery Works)

### Actual volunteers cleaning around factory

Year	Number of operations	Number of employees involved	Dust recovered
1999	206	4,422	4,411kg
2000	306	4,756	4,911kg
2001	397	5,909	4,288kg

Source: MHI

## Contribution and Confidence Developed through Communication

MHI discloses and publishes valuable information in addition to providing excellent products. We believe that we must first listen to our customers and have friendly communication with them to enjoy customer confidence in our business activities.

### Public Communication Activities

MHI discloses environmental information in environmental reports and on our Internet site, and responds to every inquiry via communication means such as e-mail received from our customers. We are also aggressive in having discussions with autonomous bodies and industrial associations to review our environmental policies from an objective viewpoint. These activities as well as our products released to the public were evaluated and rewarded for their environment-oriented technologies.

### MHI participation in local and municipal environmental events in 2001

Seminar/learning tour	20 events
Public area cleaning/tree planting	40 events
Lecture/briefing	30 events
Discussion/conference	36 events

Source: local and autonomy

### Product commendation case

Date (year/month/day)	Host	Description
1997. 1. 29	Ministry of International Trade and Industry, Natural Resources and Energy Agency, Director General, Tadashi Ezaki	Our room air-conditioner series "BEAVER air-con new double scroll" received the "Director General of Natural Resources and Energy Agency commendation" in the 7th 21st-Century Energy Saving Equipment/System Awards.
1997. 2. 28	Japan Machinery Federation, Chairman, Shoichi Saba	"Re-powering power plant," jointly developed with Chubu Electric Power Company and three other companies, was awarded as excellent energy-saving equipment in 1996.
1997. 2. 28	Japan Machinery Federation, Chairman, Shoichi Saba	"Peak cut & shift thermal ice storage package air conditioner," jointly developed with Tokyo Electric Power and five other companies, was awarded as excellent energy-saving equipment in 1996.
1998. 2. 4	Ministry of International Trade and Industry, Natural Resources and Energy Agency, Director General, Yasuhiro Inagawa	Our room air-conditioner series "BEAVER air-con DANGAN (warm shot) warp SRK320RZX" received the "Director General of Natural Resources and Energy Agency commendation" in the 8th 21st -Century Energy Saving Equipment/System Awards.
1998. 2. 4	Energy Conservation Center, Japan, Chairman, Sho Nasu	The gas direct-fired absorption chiller-heater with auxiliary waste heat recovery "GENELINK," joint development with Tokyo Gas and three other companies, received the "Energy Conservation Center Chairman commendation" in the 8th 21st-Century Energy-Saving Equipment/System Awards.
1999. 6. 14	Ministry of International Trade and Industry, Natural Resources and Energy Agency, Director General, Yasuhiro Inagawa	The compact, thermal ice-storage package air conditioner "ECO ICE mini," jointly developed with Daikin Industries and two other companies, received the "Director General of Natural Resources and Energy Agency commendation" in the 1st Electric Load Equalization Equipment/System Awards.
2000. 4. 19	Prime minister, Yoshiro Mori	"Development & Implementation of Combined-Cycle Power Plant utilizing high-efficiency large-capacity gas-turbine," jointly developed with Tohoku Electric, Mitsubishi Electric, received the "Prime Minister's award" in the 29th Japan Industrial Technology Grand Prize.
2001. 3. 14	Ministry of Economy, Trade and Industry, Natural Resources and Energy Agency, Director General, Hirofumi Kono	The Mitsubishi Minatomirai Industrial Museum received the "Director General of Natural Resources and Energy Agency commendation" in the Japan Productivity Center for Socio-Economic Development, Energy Education/Enlightenment and Facility/Activity Awards.
2001. 6. 27	Ministry of Economy, Trade and Industry, Minister, Takeo Hiranuma	Our "PCB detoxification plant" received the Minister of Economy, Trade and Industry commendation in the Japan Society of Industrial Machinery Manufacturers Excellent Environmental System Awards.

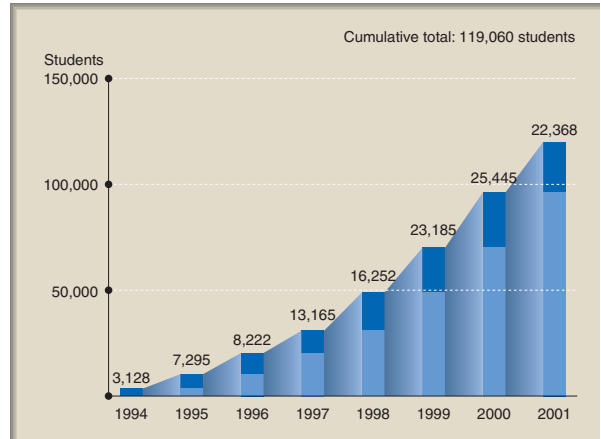
### Mitsubishi Minatomirai Industrial Museum

This facility that exhibits MHI's various activities received the top award, the "Director General of Natural Resources and Energy Agency at the Ministry of Economy, Trade and Industry commendation" in the 10th Energy Education/Enlightenment Facility/Activity Awards hosted by Japan Productivity Center for Socio-Economic Development/Energy Environment Education and Information Center.

This commendation event is intended to commend institutions, corporations, business places or private organizations that are aggressively deploying energy/environment education and enlightenment activities to the younger generations and local communities, aiming for further promotion of people's attention to energy/environment issues. The above "Director General of Natural Resources and Energy Agency commendation" is the grand prix of the commendation event. It is given only to the one facility that is considered the most excellent from a comprehensive viewpoint including student education, consideration of local communities, exhibition contents, and planning/administration/management.

In this commendation, the Mitsubishi Minatomirai Industrial Museum was evaluated highly for its exhibitions that plainly present various state-of-the-art technologies in the energy/environment fields, as well as for its willingness to receive school students for field learning, and implementation of a variety of open events including handicraft workshops using usual materials and scientific experiment seminars. Taking this opportunity, we will make further effort to enrich the exhibition contents and draw more interest in science technologies.

### Yearly reception of field learning by elementary and junior high schools



Plaque

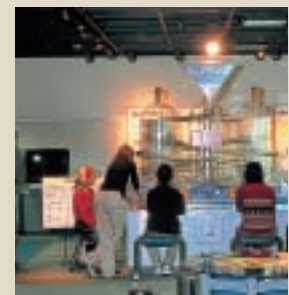
Snap shot of commendation event

### Mitsubishi Minatomirai Industrial Museum

Address: Mitsubishi Heavy Industry Yokohama Building, 3-3-1, Minatomirai, Nishi-ku, Yokohama-shi  
 ZIP: 220-8401  
 Phone: 81-45-224-9031  
 Fax: 81-45-224-9902  
 Home page address: <http://www.mhi.co.jp/museum>  
 Getting there: JR Negishi Line / Tokyu Toyoko Line / Yokohama Subway Line to Sakuragi-cho station  
 Opening: 10:00 am to 5:30 pm (Entry allowed until 4:30 pm)  
 Closed: Every Monday (or Tuesday if Monday is a holiday)  
 Admission: Adults 500 yen, junior and senior high school students 300 yen, elementary school students 200 yen  
 \*No charge for field learning by elementary and junior high schools (Reservation required)



Thermal plant boiler



Atomic power exhibition



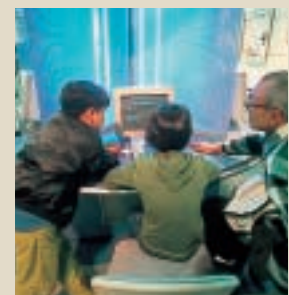
Minatomirai Industrial Museum



Atomic plant shell



Energy exhibition



Q&A on PC

## To Fulfill Responsibilities as a Comprehensive Heavy Industry Company

MHI has always been prompt in responding to any domestic or overseas environmental trends since the establishment of our Environmental Management Office in 1973. We are also deploying company-wide environmental activities, for example, ISO14001 certification acquisition by all works.

Year	MHI	Events domestic/foreign (Japan / Worldwide)
1967		Enactment of the Basic Law for Environment Pollution Control
1970	Completed the first domestic PWR power plant	
1971		Establishment of the Environment Agency The United Nation's Environment Conference held in Stockholm <Adoption of the United Nations Human Environment Declaration> <Establishment of the United Nation's Environment Program (UNEP)>
1973	Established an Environmental Management office	
1978	Began conference for managers in charge of environmental management	
1987		Adoption for the Montreal Protocol
1988		Enactment of the Ozone Layer Protection Law
1989	First internal company CO <sub>2</sub> counter measures conference First internal company fluorocarbon counter measures conference	
1991		Enactment of the Keidanren (Japan Federation of Economic Organizations) Global Environment Charter
1992		United Nation's Conference for the Environment and Development (Earth Summit) held in Rio de Janeiro <Adoption of the Rio Declaration on Environment and Development> <Adoption of Agenda 21> Ministry of International Trade and Industry requested companies to formulate the Voluntary Plan for Environment
1993	MHI voluntary plan formulated Company guideline towards environmental problems	Enactment of the "Basic Law for Environmental Pollution Control"
1995		The 1st Conference of the Parties to the United Nations Framework Convention on Climate Change (COP1) held in Berlin
1996	Established policy on environmental matters Established an Environment Committee	The 2nd Conference of the Parties to the United Nations Framework Convention on Climate Change (COP2) held in Geneva Issued ISO14001
1997	Yokohama Dockyard & Machinery Works received an ISO14001 certification, the first one given in Japan's heavy industry Commercialized air-conditioner with the new coolant R410A	The 3rd Conference of the Parties to the United Nations Framework Convention on Climate Change (COP3) held in Kyoto Guidelines of the Keidanren (Japan Federation of Economic Organization) Voluntary Action Plan on the Environment
1998	Developed a hydrothermal PCB decomposition system	The 4th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP4) held in Buenos Aires Amendment of the "Energy-Saving Law" Enactment of the "Climate Change Law"
1999	Delivered a combined-cycle power plant using the latest model gas-turbine "M701G" with the world's highest efficiency	The 5th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP5) held in Bonn Enactment of the "Pollutant Release Register or Management Promotion Law" Enactment of the "Law concerning Special Measures against Dioxins"
2000	All 13 of our production sites received an ISO14001 certification	Enactment of the "Basic Law for the Promotion of the Formation of a Ecologically-Oriented Society" Enactment of the "Waste Management and Public Cleaning Law" Amendment of the "Law for Promotion of Utilization of Recyclable Resources" Enactment of the "Law for Promotion of Recycling of Construction Waste" Enactment of the "Law for Promotion of Recycling of Food Residue" Enactment of the "Law concerning the Promotion of Environmentally Friendly Goods Procurement by the State" The 6th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP6) held in Hague
2001	Our engineering activity received an ISO14001 certification.	The 7th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP7) held in Morocco Enactment of the "Law concerning Special Measures against PCB Wastes" Enactment of the "Law concerning the Promotion of Freon Recovery and Depletion"



## CNG

P22

### Compressed Natural Gas (Fuel to automobiles)

Its emissions of CO<sub>2</sub>, the cause of global warming, are minimal, and since almost no SO<sub>x</sub> is exhausted, use as a replacement for gasoline and diesel fuel is expanding, primarily for buses and taxis.

## CO<sub>2</sub>

P11

### Carbon Dioxide

The main cause of the "greenhouse effect," which keeps the earth's surface warm by confining the sun's heat. As the amount of trapped heat has increased due to increases in CO<sub>2</sub> emissions, global warming is becoming a serious threat.

## COP3

P32

### The 3rd Conference of the Parties to the United Nations Framework Convention on Climate Change

A convention held in Kyoto in 1997 under the theme of prevention of global warming. It is usually called the Kyoto Conference on Climate Change. At this convention, Japan agreed to reduce its CO<sub>2</sub> emissions by 6% from its level of 1990 before 2012.

## DXN

P21

### Dioxin

Pollutant generated from chloride-containing materials when they are burnt or during chlorine bleaching processes. Decomposes extremely slowly in the natural environment. It poses significant risk to the human body, such as carcinogenicity and immunotoxicity.

## ERP

P18

### Electronic Road Pricing

A system that enables charging of usage fees without cars stopping. Data communications between mounted equipment in cars and antennas make this possible. Already under operation in Singapore from 1998.

## ETC

P18

### Electronic Toll Collection System

A system that enables smooth charging usage fees through data communications between equipment mounted on cars and antennas at tollgates. Merits include reduction of CO<sub>2</sub> emissions, etc due to reduced traffic jams. Introduction is underway in Japan.

## HFC

P15

### Hydrofluorocarbon

A category of substitute for fluorocarbon, which causes destruction of the ozone layer and global warming. Recently, however, these compounds have also proved to be a cause of environmental destruction due to global warming.

## ISO

P 9

### International Organization for Standardization

A private organization that establishes international standards. In particular, the standard for corporate environmental management is called ISO14001, which is being promoted in Japan.

## ITS

P17

### Intelligent Transportation Systems

A system intended for safe and traffic jam-free road environment that utilizes the latest information and communication technologies. Expected merits include significant relaxation of traffic jam and reduction of CO<sub>2</sub> emissions in urban areas.

## LPG

P22

### Liquefied Petroleum Gas

Fuel primarily produced by gas generated during oil refining. This is a comprehensive term that includes propane and butane for household use. LPG is also used as an automobile fuel.

## MSDS

P14

### Material Safety Data Sheet

A data sheet that contains information such as the name of chemical substances, the supplier's name, classification, whether the substances are harmful and dangerous, safety measures, and the measures to be taken in an emergency. It is an important information source for the management of chemical substances.

## NO<sub>x</sub>

P19

### Nitrogen Oxides

Oxidized compounds that cause respiratory problems and photochemical smog, and are linked to exhaust from diesel engines.

## PCB

P13

### Polychlorinated Biphenyls

Chemical compounds that because of their superior heat resistance and non-conductivity were, in the past, used in many products. Their production has been stopped because of their high toxicity. Because safe treatment is difficult, strict storage regulations have been effect for years, but only recently have chemical decomposing methods such as the hydrothermal decomposition system been developed.

## PRTR

P14

### Pollutant Release Transfer Register

A system by which companies report to government administrations their release and transfer volume of chemical substances in order to clarify the status of harmful materials such as endocrine disrupters. Its introduction was advanced in Europe and the U.S. while in Japan the law was enforced in 2001.

## PWR

P32

### Pressurized Water Reactor

A type of nuclear-power reactor called a pressurized water reactor that heats pressurized water (first coolant) with the nuclear fuel inside the reactor, and then transfers heat energy to the other water (secondary coolant) by a steam generator, producing steam for power generation.

## RDF

P13

### Refuse Derived Fuel

A bar shaped fuel made by separating flammable substances from waste and making them into a solid. RDF power systems using this fuel have attracted attention as sources of environmentally friendly power that use recycled energy.

## SO<sub>x</sub>

P22

### Sulfur Oxides

Produced primarily by the combustion of fossil fuels such as petroleum and coal, these compounds can cause respiratory problems and acid rain.

## UNEP

P32

### United Nations Environment Program

An organization in the United Nations that conducts comprehensive arrangements for environment-related activities, in corporation with other organizations of the United Nations. Since its establishment in 1972, Japan has served on the UNEP management committee.

**Headquarters & Divisions**

**I . Head Office**

5-1, Marunouchi 2-chome, Chiyoda-ku, Tokyo  
 ZIP: 100-8315  
 Phone: 81-3-3212-3111  
 Fax: 81-3-3212-9800

**II. General Machinery & Special Vehicle Headquarters**

3000, Tana, Sagamihara-shi, Kanagawa  
 ZIP: 229-1193  
 Phone: 81-42-761-1101 (General Affairs Dept.)  
 Fax: 81-42-763-0800

**III. Air-Conditioning & Refrigeration Systems Headquarters**

3-1, Asahi-cho, Nishi-Biwajima-machi, Nishi-Kasugai-gun, Aichi  
 ZIP: 452-8561  
 Phone: 81-52-503-9200 (Front desk)  
 Fax: 81-52-503-3533

**IV. Industrial Machinery Division**

1, Aza Takamichi, Iwatsuka-cho, Nakamura-ku, Nagoya-shi  
 ZIP: 453-8515  
 Phone: 81-52-412-1110 (General Affairs Dept.)  
 Fax: 81-52-412-1399

**V. Paper & Printing Machinery Division**

5007, Itozaki-cho, Mihara-shi, Hiroshima  
 ZIP: 729-0393  
 Phone: 81-848-67-2054 (General Affairs Dept.)  
 Fax: 81-848-63-4463

**VI. Machine Tool Division**

130, Roku-jizo, Ritto-shi, Shiga  
 ZIP: 520-3080  
 Phone: 81-77-553-3300 (General Affairs Dept.)  
 Fax: 81-77-552-3745

**Works**

**① Nagasaki Shipyard & Machinery Works**

1-1, Akunoura-machi, Nagasaki-shi  
 ZIP: 850-8610  
 Phone: 81-95-828-4121 (General Affairs Dept.)  
 Fax: 81-95-828-4105

**② Kobe Shipyard & Machinery Works**

1-1, Wadasaki-cho 1-chome, Hyogo-ku, Kobe-shi  
 ZIP: 652-8585  
 Phone: 81-78-672-2220 (General Affairs Dept.)  
 Fax: 81-78-672-2245

**③ Shimonoseki Shipyard & Machinery Works**

16-1, Hikoshima Enoura-cho 6-chome, Shimonoseki-shi, Yamaguchi  
 ZIP: 750-8505  
 Phone: 81-832-66-5978 (General Affairs Dept.)  
 Fax: 81-832-67-7010

**④ Yokohama Dockyard & Machinery Works**

12, Nishiki-cho, Naka-ku, Yokohama-shi  
 ZIP: 231-8715  
 Phone: 81-45-629-1201 (General Affairs Dept.)  
 Fax: 81-45-629-1202

**⑤ Hiroshima Machinery Works**

6-22, Kan-on-shin-machi 4-chome, Nishi-ku, Hiroshima-shi  
 ZIP: 733-8553  
 Phone: 81-82-291-2112 (General Affairs Dept.)  
 Fax: 81-82-294-0260

**⑥ Takasago Machinery Works**

2-1-1, Arai-cho Shinhama, Takasago-shi, Hyogo  
 ZIP: 676-8686  
 Phone: 81-794-45-6125 (General Affairs Dept.)  
 Fax: 81-794-45-6900

**⑦ Nagoya Aerospace Systems Works**

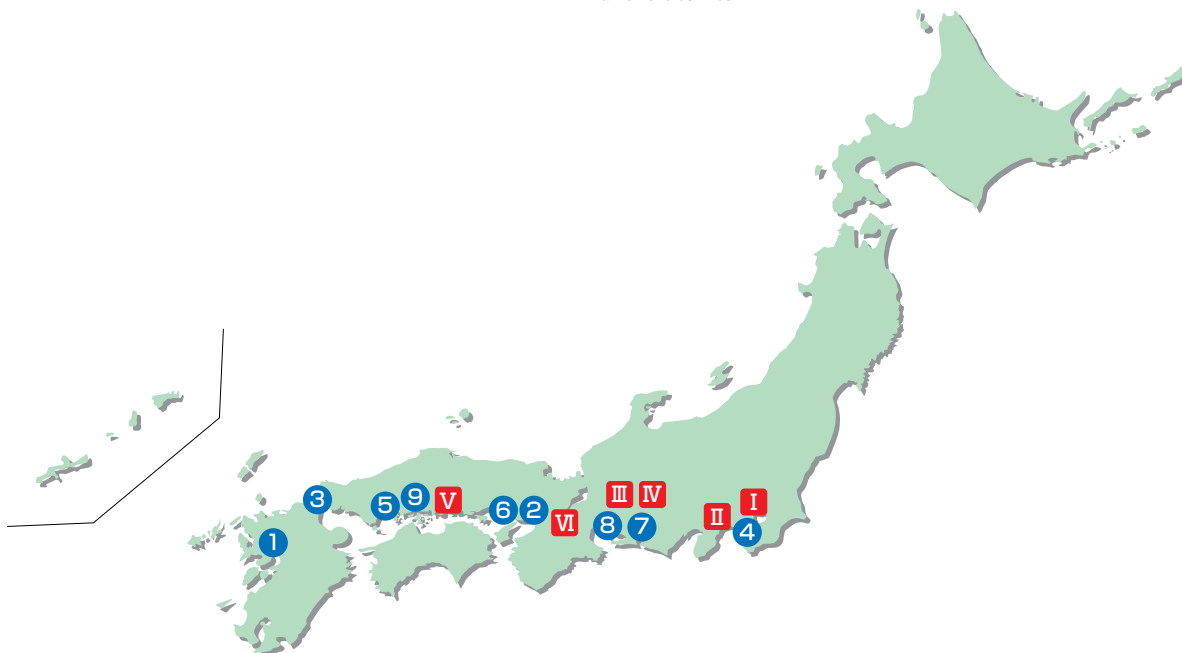
10, Oe-cho, Minato-ku, Nagoya-shi  
 ZIP: 455-8515  
 Phone: 81-52-611-2121 (General Affairs Dept.)  
 Fax: 81-52-611-9360

**⑧ Nagoya Guidance & Propulsion System Works**

1200, O-aza Higashi Tanaka, Komaki-shi, Aichi  
 ZIP: 485-8561  
 Phone: 81-568-79-2113 (General Affairs Dept.)  
 Fax: 81-568-78-2552

**⑨ Mihara Machinery & Transportation Systems Works**

5007, Itozaki-cho, Mihara-shi, Hiroshima  
 ZIP: 729-0393  
 Phone: 81-848-67-2054 (General Affairs Dept.)  
 Fax: 81-848-63-4463





●Inquiry regarding this report

**Mitsubishi Heavy Industries, Ltd.**  
**General Affairs Dept.**

5-1, Marunouchi 2-chome, Chiyoda-ku, Tokyo

ZIP: 100-8315

Phone: 81-3-3212-9718

Fax: 81-3-3212-9811

Home page address: <http://www.mhi.co.jp>



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