



# Environmental Report

# 2002

# CONTENTS

Corporate Profile	2
Message from the President	3
Message from the Chief Environmental Officer	4
<b>Medium and Long Term Environmental Vision</b>	
Progress of Environmental Protection Activities	5
Medium and Long Term Environmental Vision	6
Environmental Charter / Organization for Environmental Management / Environmental Management Level Evaluation	7
<b>Greetings from Each of Internal Six (6) Companies</b>	
Shipbuilding / Rolling Stock, Construction Machinery & Crushing Plant	8
Aerospace / Gas Turbines & Machinery	9
Plant & Infrastructure Engineering / Consumer Products & Machinery	10
<b>Development of Environment-conscious &amp; Environmental Protection Products</b>	
Basic Thoughts and Our Challenges	11
Application of Product Assessment / LCA (Life Cycle Assessment) / Green Procurement	12
Environment-conscious Products and Technologies Chart	13
Examples of Environment-conscious Products and Technologies	14
Environmental Protection Products and Technologies Chart	15
Examples of Environmental Protection Products and Technologies	16
<b>Feature Report: Environmental Business</b>	17&18
<b>Environment-conscious Production Activities</b>	
Basic Thoughts and Our Challenges / Energy Saving / Global Warming Prevention	19
Waste Reduction / Dioxin and PCB Measures	20
Ground Water / Chemical Substance Reduction / Compliance with Laws and Regulations	21
<b>Social Contribution Activities</b>	
Major Activities	22
<b>Information Disclosure</b>	
Providing Information / Environmental Accounting	23
<b>Environmental Management System (EMS)</b>	
Activities for Acquiring ISO14001 Certification / Environmental Auditing / Environmental Education	24
<b>Environmental Performance</b>	
Environmental Data by Each Internal Company	25&26

## ■ Editorial Policy

To substantially strengthen our operational structure, in April 2001 we took our previous divisional system of organization a major step forward with the introduction of an internal company system. This 2002 edition of our Environmental Report is the first of this new corporate structure. With this added responsibility, it introduces the "medium and long term environmental vision" that is guiding us towards the "environmentally conscious management" being targeted by Kawasaki, and it reports the environment-related undertakings of each company to show how all of our newly formed entities are consciously aware of that very important theme. Furthermore, it provides set targets, topics and outlooks for each item within our "medium and long term environmental vision".

In regard to environmental performance data, information is prepared at the end of this publication for each internal company, under performance items conforming to the 2000 Environmental Reporting Guidelines of the Ministry of the Environment.

We hope this report will help you understand our position on the environment as well as make clear the environmental protection activities that we are implementing as part of our "environmentally conscious management" concept.

## ■ About This Report

### ● Reporting Scope

This report covers information on environmental aspects of head offices, technical institutes, branch offices, and works of Kawasaki in Japan but does not cover the overseas offices, subsidiaries and affiliates.

### ● Reporting Period

The information contained herein is strictly reported for the period of April 1, 2001 to March 31, 2002, which is our fiscal 2001. We will continue reporting our environmental activities annually.

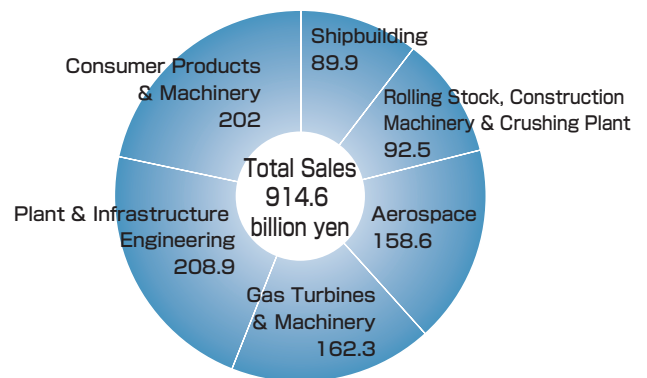
# Corporate Profile

**Name:** Kawasaki Heavy Industries, Ltd.  
**Incorporated:** October 15, 1896 (Founded: April, 1878)  
**Capital:** 81.4 billion yen  
**Location of Head Offices:** Kobe Head Office: 1-3, Higashikawasaki-cho 1-chome, Chuo-ku, Kobe, Hyogo 650-8680, Japan  
 Tokyo Head Office: 4-1, Hamamatsu-cho 2-chome, Minato-ku, Tokyo 105-6116, Japan  
**Representative:** Masamoto Tazaki, President and CEO  
**Kawasaki Network:** Domestic Offices 25 (including 13 Works) Overseas Offices 7  
 Subsidiaries and affiliates 137 (As of March 31, 2002)

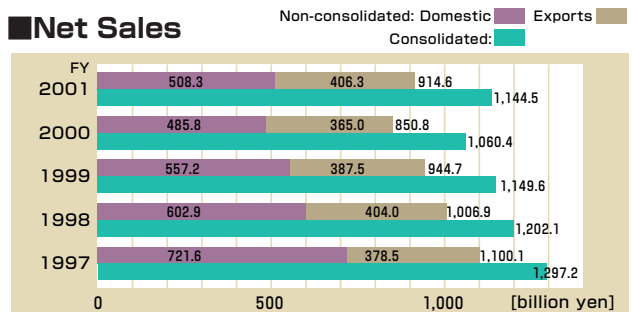
## Business Fields, Major Products and Works

Company	Shipbuilding	Rolling Stock, Construction Machinery & Crushing Plant
Major Products	Shipbuilding, Marine Engineering 	Rolling Stock, Construction Machinery, Crushing Plants, Grinding Plants, Cast Steel Products 
Works	Kobe Works Sakaide Works	Hyogo Works Banshu Works Yachiyo Works
Company	Aerospace	Gas Turbines & Machinery
Major Products	Aircraft, Space Development Equipment 	Gas Turbines, Jet Engines, Prime Movers, Hydraulic Machinery 
Works	Gifu Works Nagoya Works 1 Nagoya Works 2	Akashi Works Seishin Works Kobe Works Nishi-Kobe Works
Company	Plant & Infrastructure Engineering	Consumer Products & Machinery
Major Products	Industrial Plants, Environmental Protection Facilities, Steel Structures 	Motorcycles, ATVs, Jet Ski Watercraft, Industrial Robots 
Works	Noda Works Kobe Works Harima Works	Akashi Works

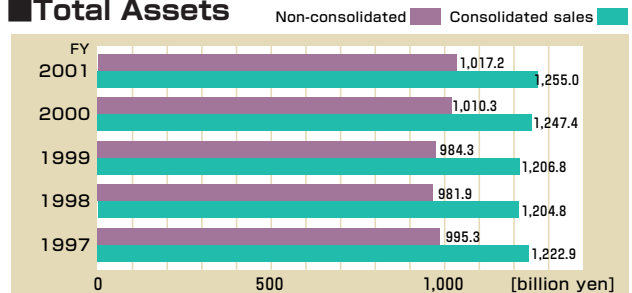
## Sales by Company (FY2001) (Non-consolidated)



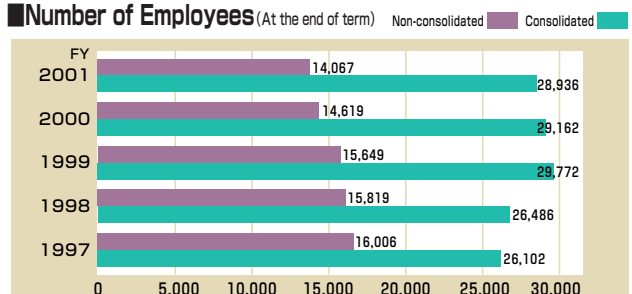
## Net Sales



## Total Assets



## Number of Employees (At the end of term)



# Message from the President

## Responding to a Diversity of Needs With the Minimum Required Resources – Striving for True "Affluence"



**Masamoto Tazaki**  
President and CEO

A handwritten signature in black ink that reads "Masamoto Tazaki". The signature is written in a cursive, flowing style.

### ■Do Not Make Unneeded Products

Economic growth has transformed Japan into a materialistically wealthy society. With technological progress, mankind has increased the material richness today but has never succeeded in finding a way to increase time. Simply having things without the time to use them does not result in people's happiness. I believe that it is now the duty of manufacturers to "not make unneeded products".

Since becoming CEO, I have strongly emphasized the concept of *Quality followed by Quantity* wherein you can image the development of business activities as the area plotted on a graph between a "quality" vertical axis and a "quantity" horizontal axis, and I want to expand that area by increasing the "quality" axis with much greater focus than the "quantity" axis. The manufacturing industry must consequently make high quality products replete with energy saving and recycling always in mind. Can we make ourselves happy without wasting our natural resources? I think we can. My motto, "*think globally, act locally*", can show the way in all of our business decisions.

### ■Always Conscious of the Global Environment in Product Development

In regard to environmental conservation issues, the current problems that must be urgently resolved are air pollution and global warming. As the conversion of energy sources continues from oil and coal to natural gas, a source which emits less CO<sub>2</sub>, Kawasaki's products and technologies have been used increasingly in diverse fields. With existing electric power supply systems, losses occur in various ways when attempting to transmit power from a large power station over high voltage lines, making it difficult to properly balance supply and demand. However, with a "distributed power source" that consists of small gas turbine power plants closer to the areas of demand, electric power can be generated in direct response to local demand and the heat generated in the process can be utilized efficiently and effectively. In terms of applications of natural energy resources, great attention is falling towards wind and solar power, and Kawasaki is developing its business in these fields in cooperation with companies overseas.

Kawasaki offers a wide variety of products that relate to energy efficiency, and our task is to promote high energy-efficient products as little energy as possible taking into consideration of the overall product lifecycle; What is important in the manufacturing process is how little energy is required for the corresponding production activities and a balance among "the energy needed to make a product", "the energy consumed during lifecycle of the product", "the energy needed to recycle the product", etc. An increase in technological capabilities that will improve environmental efficiency is now an extremely important issue.

The world's population has multiplied by six times in the past 200 years from the roughly 1 billion to more than 6 billion today. Since the Earth's mass has been unchanged, something else has undoubtedly decreased over this time. So what has that been? The major declines have been in water and vegetation. True, Japan itself is still blessed with plenty of water and sunshine. But, at the rate that the world's population is growing, the world will inevitably face lack in water resources. Taking care of the water and air, and using solar energy are critical prerequisites to developing new products and technologies. The most important issue in this context is how to balance economic and business vitality with environmental conservation.

Society's needs are diversifying and progress is being made by the day in environmental technology. Therefore, Kawasaki is always making every effort to develop its technologies collecting information from all over the world.

### ■Creating More Fans to Kawasaki by Listening to a Diversity of Wishes

To increase the brand value of Kawasaki, it is very important to release information about a company's environmental efforts and social contributions to the general public. Take our motorcy-



## Message from the Chief Environmental Officer

cles for example: we have very environment-conscious production activities as our motorcycles are designed for easy recycling and use standardized parts that can be replaced with any number of products made by our business partner. We have also implemented a great number of measures in response to specific issues that customers do not readily see, such as the special packaging material made from recycled newspapers and cardboard that we use for our shipping containers, and a reusable outer frame made of steel.

We hope that our customers appreciate our high level of concern for the environmental conservation and contribution to sustainable society. This is the emotion that turns a customer into a true fan. In working toward getting customers to want to repeatedly use Kawasaki products throughout their life, we are thoroughly committed to incorporating "Design for Environment" and we start it right away from the product planning stage.

By pursuing environmental efficiency, you can automatically save energy. Take clothes for example: for efficiency's sake alone, one pair of pajamas and three suits may be sufficient for your daily life, but is your heart truly satisfied with such clothing? In order to protect the environment and provide a richness of heart at the same time, it is mandatory to be efficient from the production stage all the way through to recycling while still meeting the diverse needs of customers, rather than to use unlimited amounts of energy to satisfy our needs. Kawasaki is proceeding with technological development and production activities with the principle of "responding to a diversity of customer's needs with the minimum required resources".

### ■ Making Every Kawasaki Worker Aware of the Environment at Work and at Home—"Act Locally"

After promoting environmental activities in line with long-term plans, I think Kawasaki's efforts are well understood from a "thinking globally" perspective. Now, we are getting even more actively involved in "acting locally" efforts in order to meet society's needs and enhance our corporate value. I believe education is very important in everything we do. What seems to be missing, for example, in Japan today are such important customs as parents teaching their children how to coexist with the nature through outdoor activities. Together with children, we should realize that a variety of efforts are needed to protect our environment and enable us all to live happily.

By caring for the nature both at work and at home, we can contribute greatly to society. We must remember that "Making Every Kawasaki Worker Aware of the Environment at Work and at Home—"Act Locally". With this belief, we want to fully commit ourselves in helping create a society where every citizen acts according to the "act locally" principle in order to realize a bright future and sustainable society.

Kawasaki publishes this report to promote an understanding of our stance about and what we are specifically doing in regard to the environment. It is also intended to create a channel of two-way communication so that we can hear your thoughts and ideas. We welcome your frank opinions and suggestions.



## Building the Foundations for "Environmentally Conscious Management"



**Shiroh Ikeda**  
Chief Environmental Officer  
Senior Executive Officer

Our Fiscal 2001 fell right in the middle of the 3rd Stage (2000 - 2002) of our Environmental Protection Activities Plan. Amidst several major changes in corporate structure, noting in particular the "internal company" system, we are now confident that all the Kawasaki works will be soon awarded the ISO14001 certification and that a basis for environmental management system of all Kawasaki has been established. Furthermore, our Harima Works, Banshu Works and Nishi-Kobe Works successfully attained their "Zero Emission" target and further efforts to reduce environmental impact in our production activities are steadfastly producing results as planned.

We are planning a "medium and long term environmental vision" with concrete targets as we aim to establish a system of "environmentally conscious management" that combines environmental protection efforts with our corporate management policy. In order to raise the overall level of environmental management, we are promoting activities with both a medium and long range outlook, such as developing environment-conscious products, reducing the environmental impact of our production activities, contributing constructively to society and positively disclosing information. We are also developing an environmental management system for the entire Kawasaki group as well as considering the introduction of environmental management evaluations for internal six (6) companies to help them strengthen their individual environmental management systems.

Kawasaki contributed to social development in the 20th century by building infrastructure such as ships, rolling stocks, steel structures, industrial plants and more. We feel it is our duty to now apply those technologies to the creation of a "sustainable society" and so we will continue to develop technologies and products to meet society's diverse needs. As a manufacturer, we will aggressively develop product assessments, increase the procurement of green products, implement environmental accounting and focus many other aspects of our business on an axis of environment-conscious products, along with continuing to build the foundations for "environmentally conscious management".

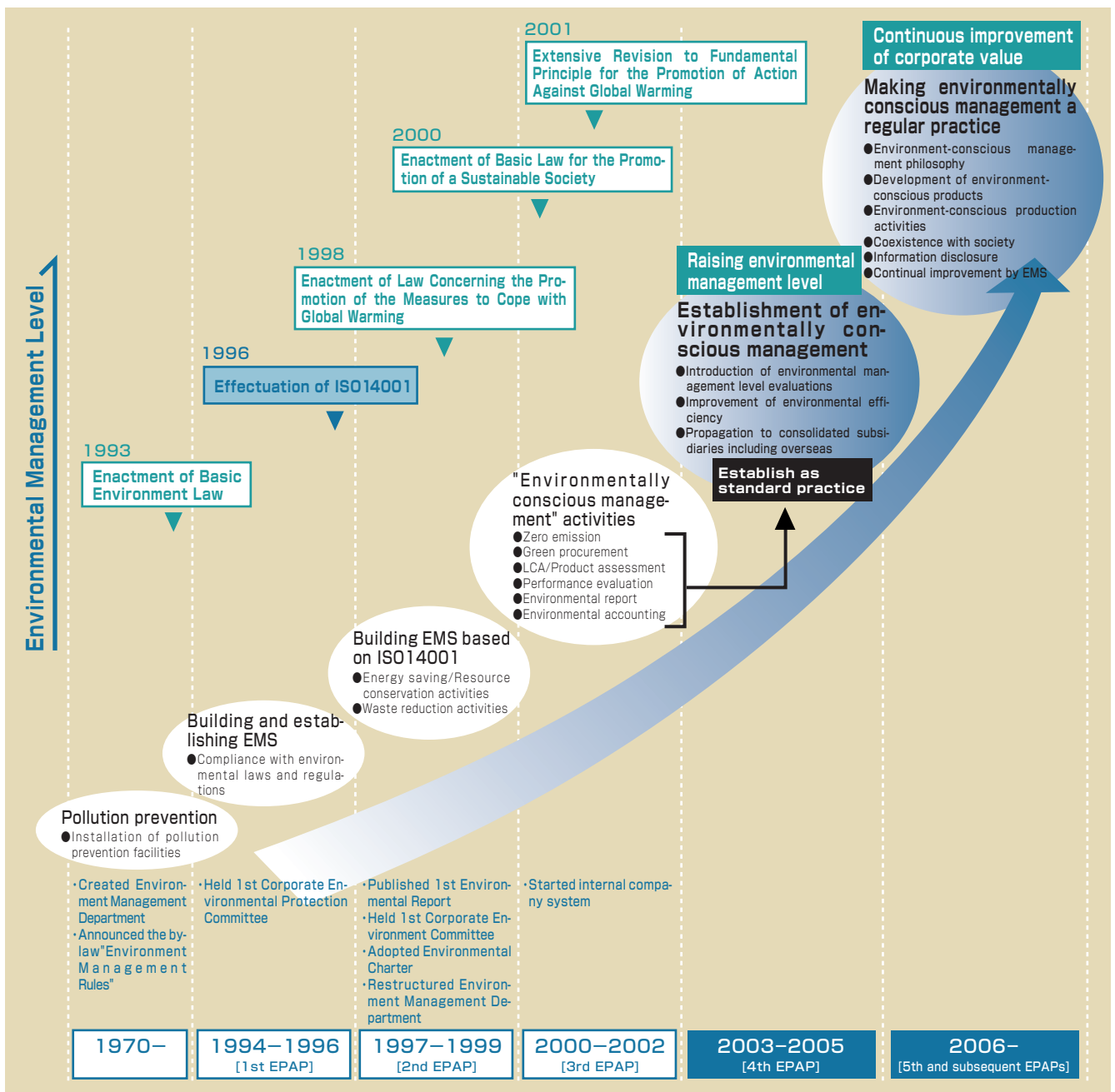
In order to achieve our goals, every Kawasaki employee has to not only care for the environment but also possess a firm belief that environmental issues are closely associated with our business activities and environmental conservation is our duty. Society will recognize it when the company and the individual both play an active role in building a "sustainable society" and, as a result, the corporate value of Kawasaki will be increased. At Kawasaki, we will be dedicating our time and efforts to providing information through this report, our web site and other media so that people far and wide will know what we are thinking and doing in regard to the environment.

# Medium and Long Term Environmental Vision

## Establishing Targets and Activities to Raise Kawasaki Environmental Management Level

In 1994, Kawasaki launched the first 3-year Environmental Protection Activities Plan (EPAP) and began implementing activities in line with targets to establish an Environmental Management System (EMS) and acquire ISO14001 certification. Fiscal 2001 came right in the middle of the third EPAP and brought with it, as of April, transition to an internal company system. However, just the same we started activities aimed at building an "environmentally conscious management" that unifies business activities and environmental protection in one. To promote activities with both a medium and long range outlook, we are planning a "medium and long term environmental vision" that announces attainment targets and brings into scope environmental protection activities of the upcoming 4th and 5th EPAPs. This "medium and long term environmental vision" expounds the objective of establishing an "environmentally conscious management" amongst our internal company system and, by doing so, continually enhancing our corporate value. Our plan is to turn ideas for achieving these goals into specific activities.

### Progress of Environmental Protection Activities



# Medium and Long Term Environmental Vision

We are planning a "medium and long term environmental vision" to guide our development of an "environmentally conscious management". We plan to materialize this vision by de-

veloping environmental protection activities around a core of the six items indicated below.

Item	-2nd EPAP [-FY1999]	3rd EPAP [FY2000-2002]	For the Materialization of Our Medium and Long Term Environmental Vision	
			4th-5th EPAP [FY2003-2009]	
<b>Management Philosophy</b>	<ul style="list-style-type: none"> <li>● Adopted Environmental Charter</li> <li>● Announced Corporate Code of Ethics</li> </ul>	<ul style="list-style-type: none"> <li>● Develop activities in line with Environmental Charter and Corporate Code of Ethics (includes environmental responsibilities)</li> </ul>	<ul style="list-style-type: none"> <li>● Have employees think and act in line with management philosophy, Environmental Charter and Corporate Code of Ethics</li> </ul>	<ul style="list-style-type: none"> <li>● Have all employees think and act, as the single entity of the Kawasaki Group, in line with management philosophy, for the creation of a sustainable society.</li> </ul>
<b>Environment-conscious Products/Environmental Protection Products*</b>	<ul style="list-style-type: none"> <li>● Created LCA Subcommittee and tested samples</li> <li>● Created Product Assessment Subcommittee</li> <li>● Developed environmental protection products</li> </ul>	<ul style="list-style-type: none"> <li>● Expand LCA testing to other samples</li> <li>● Standardize product assessments</li> <li>● Create Green Procurement Subcommittee</li> <li>● Develop environmental protection products and business</li> </ul>	<ul style="list-style-type: none"> <li>● Diffuse LCA</li> <li>● Upgrade product assessments. Apply design for environment (DFE) to all products</li> <li>● Make procurement of green products a regular practice</li> <li>● Establish environmental efficiency index and improve environmental efficiency of products</li> <li>● Expand into new environmental protection products and business, and increase sales</li> </ul>	<ul style="list-style-type: none"> <li>● Apply DFE to all products</li> <li>● Greatly improve environmental efficiency of products</li> <li>● Greatly increase share of environmental protection products and business in total sales</li> </ul>
<b>Environment-conscious Production Activities</b>	<ul style="list-style-type: none"> <li>● Created Energy Saving Subcommittee</li> <li>● Created Waste Management Subcommittee</li> </ul>	<ul style="list-style-type: none"> <li>● Promote energy saving activities</li> <li>● Promote waste reduction activities</li> <li>● Create zero emission working group</li> </ul>	<ul style="list-style-type: none"> <li>● Promote energy saving activities</li> <li>● Attain zero emission target at all factories</li> <li>● Establish environmental efficiency index and improve environmental efficiency of production processes</li> </ul>	<ul style="list-style-type: none"> <li>● Switch all production activities to environment-conscious production</li> <li>● Greatly improve environmental efficiency of production activities</li> </ul>
<b>Coexistence with Society (Social Contribution)</b>	<ul style="list-style-type: none"> <li>● Organized cleanup around business sites/factories</li> <li>● Participated in local environmental events</li> </ul>	<ul style="list-style-type: none"> <li>● Organize cleanup around business sites/factories</li> <li>● Participate in local environmental events</li> </ul>	<ul style="list-style-type: none"> <li>● Participate more constructively in local environmental events and plan our own events</li> <li>● Systematize social contributions</li> <li>● Cooperate with NPOs and NGOs</li> </ul>	<ul style="list-style-type: none"> <li>● Have company and employees contribute more towards building sustainable society</li> </ul>
<b>Information Disclosure</b>	<ul style="list-style-type: none"> <li>● Published Environmental Report</li> </ul>	<ul style="list-style-type: none"> <li>● Publish Environmental Report</li> <li>● Introduce environmental accounting and create Environmental Accounting Subcommittee</li> </ul>	<ul style="list-style-type: none"> <li>● Build foundations for sustainable report from publication of Environmental Report</li> <li>● Establish environmental accounting system and coordinate operations with financial accounting operations</li> </ul>	<ul style="list-style-type: none"> <li>● Publish sustainable report</li> </ul>
<b>Continual Improvement Under EMS</b>	<ul style="list-style-type: none"> <li>● Acquired ISO14001 certification for factories and business locations</li> <li>● Held environmental hearings</li> </ul>	<ul style="list-style-type: none"> <li>● Build EMS throughout all companies</li> <li>● Implement company-wide internal audit</li> </ul>	<ul style="list-style-type: none"> <li>● Have each company develop its own EMS</li> <li>● Build EMS for consolidated subsidiaries and overseas business locations</li> <li>● Build environmental training program</li> <li>● Evaluate company environmental management level</li> </ul>	<ul style="list-style-type: none"> <li>● Develop EMS for entire Kawasaki Group</li> <li>● Evaluate company environmental management level</li> </ul>

\*Environment-conscious Product: Any product that reduces its impact on the environment in all stages of the product lifecycle (e.g. low energy consuming machinery, low pollution vehicle, etc.)  
 Environmental Protection Product: Any product designed and built to prevent, clean or improve environmental pollution; treat, recycle or clean waste; provide high efficiency energy, etc. (e.g. waste incinerator plant, solar power generating equipment, etc.)

# Medium and Long Term Environmental Vision

## Environmental Charter

### ■ Environmental Philosophy

As a company in key industries related to land, sea and air, Kawasaki is deploying its business activities globally in pursuit of reducing environmental impact and creating a sustainable society. This makes us to commit ourselves to contribute to the sustainable development of society through our environmentally conscious business activities, technologies and products that preserve the global environment.

### ■ Conduct Guidelines

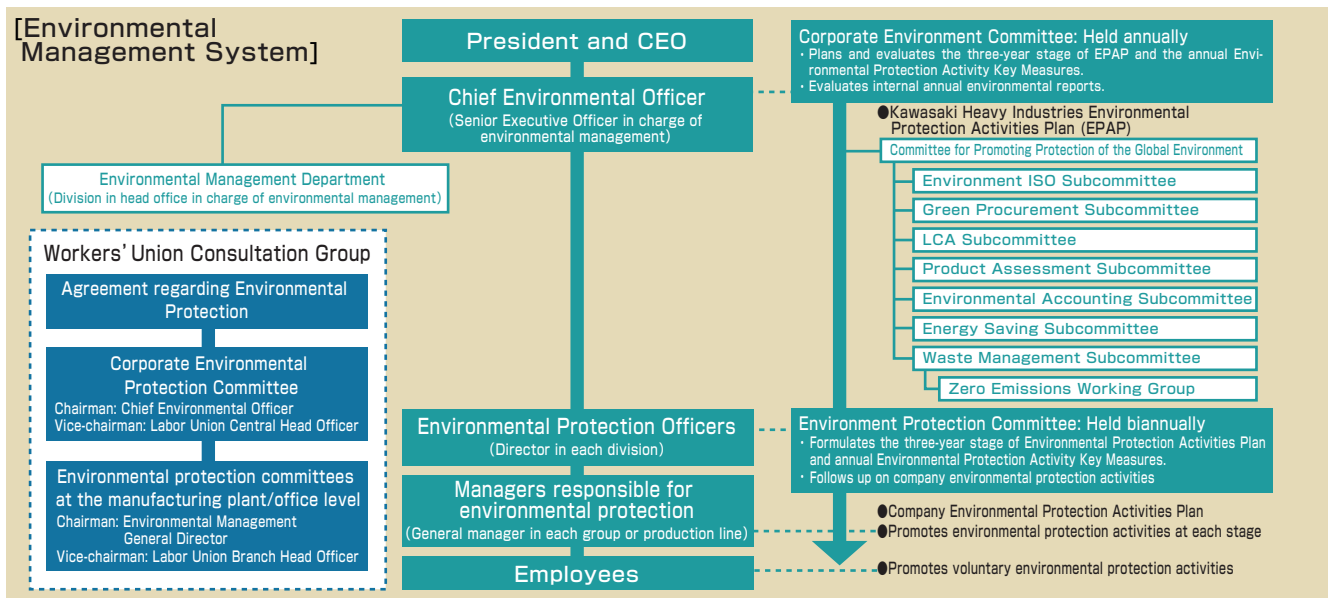
1. Recognizing that global environmental protection is a common and serious issue for humankind, Kawasaki will positively volunteer to engage itself in harmonizing with the environment globally. We shall regard this as one of the most important strategies when we deploy our business activities.
2. During its production stages, Kawasaki will endeavor to conserve resources, to save energy, to recycle resources and to reduce industrial waste and will promote the reduction of environmental impacts.
3. In the new product planning (i.e. research and development) and designing stages, Kawasaki will render careful attention throughout the procurement, production, distribution, utilization and material disposal stages in order to minimize the environmental impacts.
4. In seeking solutions to global environmental issues, Kawasaki will do its best to develop and provide new technologies and new products that contribute to environmental protection, energy saving and resource conservation.
5. Notwithstanding its compliance with environmentally related institutional laws, regulations and agreements and voluntary action plans of each industry concerned, Kawasaki will voluntarily institute its own environmental control standards as an appropriate and necessary action in order to strive to improve environmental control levels.
6. Through environmental training and public awareness activities, Kawasaki will strive to enlighten all its employees on global environmental issues and will support individual views, lifestyles and will encourage their participation in the social activities and services.
7. Kawasaki will implement an environmental management system to promote environmental preservation and conservation, and hold regular conferences to review management systems and maintain continual improvement.

## Organization for Environmental Management

The Chief Environmental Officer is in charge of Kawasaki's overall environmental protection activities. Under his leadership, the Corporate Environment Committee is held each year to plan and evaluate the three-year EPAP\* and the annual Environmental Protection Activity Key Measures.

In each company, Environmental Protection Officers formulate three-year activities plan and its annual key measures. Environment Protection Committees are gathered twice a year to follow-up on their activities.

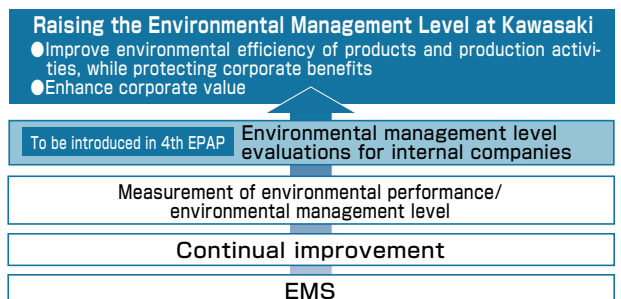
\*EPAP: Environmental Protection Activities Plan



## Environmental Management Level Evaluation

Corporate value is no longer based entirely on business performance, as a company's "level of environmental management" –which includes the environmental efficiency of production processes and products– is gradually becoming an important evaluation criteria. Now that Kawasaki exists as a group of companies, activities in our 4th Environmental Protection Activities Plan (EPAP) will be developed to evaluate the environmental management level of internal six (6) companies. By evaluating the environmental performance and environmental management level of internal companies, we aim to establish a system of "environmentally conscious

management". In FY2001, we evaluated company environmental management levels on a trial basis.





# Greeting from Each of Internal Six (6) Companies

## Shipbuilding Company



**Shuichi Tadokoro**  
President,  
Shipbuilding Company

### ■Reducing the Environmental Impact with High Efficiency, Resource Conservation and Energy Saving

I consider that there are two main issues regarding the harmony with the global environment: "reducing environmental impact of products (ships)" and "reducing environmental impact in production stages".

Ships are superior to any other means of transportation in the transportation efficiency (fuel consumption / transportation volume x distance). Large ships that carry a large amount of cargo are typical examples. Speaking of our design improvements achieved after the 1970's, the fuel consumption was reduced to 1/2 per ton of crude oil in VLCCs and to 1/3 or less per container in container ships due to the improvement of hull forms, development of energy saving appendages, adoption of fuel-efficient means for main engines, etc. And we Shipbuilding Company are strong in LNG ships and LPG ships which are to carry clean energy. In the aspect of "reducing environmental impact of products", therefore, I am proud that we contribute not a little to the reduction of environmental impact.

As regards "reducing environmental impact in production stages", all of our sections and departments are challenging to the environment-conscious shipbuilding with resources and energy saved. One particular effort worth mentioning is the about 7% reduction of high voltage electric power consumption in the Sakaide Works, from 10.95 MWH/1000 h three years ago to 10.21 MWH/1000 h last year. This is the result of our consistent endeavors towards the reduction of environmental impact. Also I give high marks to "shortening the shipbuilding period in a single dock" from the standpoint of concentrated resource management.

For the air pollution by CO<sub>2</sub>, NO<sub>x</sub> and SO<sub>x</sub>, we understand the terms and phenomena of ozone layer depletion, global warming, acid rain, etc., but generally speaking, we are inclined to think, "So what? That's not my concern." Continuing to emit CO<sub>2</sub> without a second thought is just the same as leaving scenic spots with waste plastics and cans to future generations. Ships are a unique means of transport that has paralleled the history of mankind. Any means could not so reduce the environmental impact as a "dugout made of a fallen tree and moved simply by hoisting a sail", but keeping such an ideal in mind, we at Kawasaki's Shipbuilding Company will continue to innovate each individual's attitude so as to protect the global environment and pass a beautiful world truly free of waste down to future generations.

## Rolling Stock, Construction Machinery & Crushing Plant Company



**Takehiko Saeki**  
President, Rolling Stock,  
Construction Machinery &  
Crushing Plant Company

### ■Building a Production System for Rolling Stock That Meets Today's Demands

Rolling stocks emit very small quantity of CO<sub>2</sub> in terms of unit amount being transported, approximately 1/8 to 1/10 that of automobiles. In addition, because they regularly carry large numbers of people and a large amount of freight at high speeds, they are an effective means of transportation from an environmental perspective. Kawasaki's Rolling Stock, Construction Machinery & Crushing Plant Company is one of the foremost rolling stock manufacturers in the world and this gives us the responsibility to faithfully meet the needs by modern society—control of CO<sub>2</sub> emission and prevention of global warming—through production of rolling stocks.

We are happy to report that our Banshu Works (Construction Machinery Division) obtained ISO14001 certification in May 2000, our Yachiyo Works (Crushing Plant Division) in September 2000 and our Hyogo Works (Rolling Stock Division) in February 2002. However, we continue to promote additional environmental protection activities and are aggressively working for the creation of a sustainable society. In fact, these efforts have paid off further as the Banshu Works attained a zero emission target in December 2001. The Yachiyo Works and Hyogo Works are currently implementing activities to attain this target as well. In this way, we will execute a series of activities in order to achieve a zero generation level of hazardous waste and will promote a variety of other activities to ensure our operations do not adversely affect the global environment.

In order to further reduce the impact that our operations and products exerts onto the environment, we are applying LCA (Life Cycle Assessment) program and attempting to make products with a minimum of resources. Such products are designed to consume less energy during operation and decommissioned or disposed products to be recycled to create materials useful in the society. In other words, we are pursuing products that are even more environment-conscious and less expensive to produce, through energy saving and resource conservation across the entire product lifecycle. We will continue to develop and produce rolling stock and construction machinery of even lower total lifecycle costs and which present a lower impact on the environment, and will dedicate more and more of our efforts to developing and expanding business for promoting resource recycling. Furthermore, we will continue to consolidate the wisdom of Kawasaki towards the worldwide development of our business as an environment-conscious company.

## Greeting from Each of Internal Six (6) Companies

### Aerospace Company



**Takashi Sugoh**  
President,  
Aerospace Company

#### ■Enhancing Environmental Activities in Japan and Overseas to Become a Top Class Company

Aiming for leading aerospace manufacturer worldwide, we are consolidating an effort in achieving a number of projects, including development of a next-generation maritime patrol aircraft (P-X) and a next generation cargo aircraft (C-X), both of which we have been designated as a prime contractor by Japan Defense Agency last year. Together with such effort, we are making an effort to prevent and mitigate pollution of natural environment.

For example, we are trying to change surface treatment solutions used for corrosion resistance from the one which contains heavy metals to other harmless material. We are also preparing to change a paint remover used in repair work to the less environmentally affecting one. This is already being applied with some of our machines and expected to be applied with even more by 2003.

In design work, by optimizing the blade and tip form of a rotor blade and introducing variable rotor speed control of BK117 C-2 helicopter, which is jointly developed with ECD of Germany, we have attained an outside-craft noise emission level far below the international standard. Regarding plant equipment, we will begin operation of a gas co-generation system made in-house in 2003 which will enable us to save about 6% more energy and reduce 13% CO<sub>2</sub> emission compared with current condition.

In February this year, we have obtained ISO14001 certification. From now on, we will continuously improve our environmental management system while improving each process and review to minimize environmental impact of our production processes. Also, due to the geographic situation of our Gifu Works being surrounded by urban areas, there remain some problems associated with noise during test flights and electromagnetic interference from plant buildings. However, as I consider our co-existence and co-prosperity with the local community are essential foundation of our business, we will therefore continue to extend every possible effort toward bringing complaints from nearby residents down to zero.

Through the wisdom of our workforce, we are striving to become an environment-conscious manufacturer with worldwide business.

### Gas Turbines & Machinery Company



**Kengo Yamashita**  
President,  
Gas Turbines &  
Machinery Company

#### ■Contributing to Society by Making Environment-conscious Gas Co-generation Systems

Throughout the 20th century, people sought for greater convenience and affluence, but the outcome was the accelerated deterioration of our global environment. A warning has now been issued to mankind's pursuit of pleasure. The 21st century is a time to exercise constraint and control with regard to one's desires. It is imperative that we establish a dialog with our planet.

Kawasaki's Gas Turbines & Machinery Company is contributing to the global environment with its many products and services. All of our factories, typically the Kobe Works which borders the sea, have made environmental measures high priority. One example is our Precision Machinery Division's Nishi-Kobe Works which fully attained their target of zero emission. This success was even highlighted in the newspapers.

In terms of products, it is increasingly clear in the energy supply field that power plants are switching from the large centralized power plant to distributed power source from an energy efficiency perspective. Gas turbines are increasingly in the limelight as the prime mover. We have developed small to medium size gas turbines in-house and, in doing so, have built a solid position in the industry. These gas turbines exhaust clean gas and, when applied in a co-generation system, they boost total heat efficiency over 80% and help reduce CO<sub>2</sub> emissions. We have also marketed a gas turbine with a catalytic combustor that clears environmental regulations in California, USA, the toughest standards of anywhere in the world. For better understanding of our unique gas turbine technology, please refer to the article given in this report later about our L20A 20 MW-class gas turbine that we successfully developed last year.

We are also involved in the production of many other products that contribute to environmental protection: an ultrasonic air filter cleaning system, an electrostatic precipitator for road tunnels, an aeration blower for sewage treatment, an absorption chiller-heater with the highest class efficiency in the world, and much more.

I firmly believe in "developing business to supply products that are useful to society", and that the best contribution to society as a company is to be truly "environment-conscious". To this end, it is my pledge that we will continue to contribute to the protection of the global environment.

## Plant & Infrastructure Engineering Company



**Takuya Maeda**  
President,  
Plant & Infrastructure  
Engineering Company

### ■Strengthening Technology and Products to Solve Environmental Problems

I would like to briefly describe my view on the relationship between industrialization and environmental problems.

It is an undeniable fact that, during the less industrialized days, the merits of industrialization outweighed the demerits. Increased production and power supply capacity brought the materials and machines that make life more comfortable, though environmental problems were a byproduct. In the years of advancing industrialization, the necessities are already at hand within the general process of life, people began to seek greater pleasure, demanding quality over quantity. As the flow of the times would have it, it eventually became a top priority to address environmental issues.

In looking at our line of business, most of our products are actually originated in the 1960s. Those early products targeted quantitative expansion in technical development and increased production capacity, but nowadays consideration and efforts for environmental consideration play an important role in adding another value to products. In the future, this trend will further accelerate, and, as a result, increasing numbers of products targeted at environmental conservation will be released.

Our Environmental Division deals in "equipment and systems needed for environmental protection", centering on waste incinerators, industrial waste recycling systems, and sewerage treatment systems. In other words, the act of alleviating or solving environmental problems is a major line of our business. In other sectors, our Plant Division, for example, makes a truly key product: a waste heat recovery boiler. This unit recovers wastefully released heat, in the form of effective value steam or electricity, from a variety of processes that use heat energy such as paper manufacturing, steel manufacturing, and cement mixing. The technology greatly helps reduce CO<sub>2</sub> emissions. We also have our hands on many other products necessary for taking environmental measures such as desulfurization-denitration systems. And we will continue to combine the technologies and products we have to further develop ways to resolve global environmental problems.

## Consumer Products & Machinery Company



**Shinichi Morita**  
President,  
Consumer Products &  
Machinery Company

### ■Helping to Build a Sustainable Society through Recycling Technology

We have a very wide range of business activities at Kawasaki's Consumer Products & Machinery Company. We handle everything from consumer products such as motorcycles and general purpose gasoline engines to industrial products such as robots. And the network created by these business activities spreads throughout most of the world.

Because of the nature of our business activities, the Consumer Products & Machinery Company has been seriously dealing with environmental problems for some time. More specifically, we have long been deeply committed ourselves to realizing "environmentally conscious management" that balances economic efficiency with environmental protection activities. Some specific results that we have produced are as follows:

In design work, we have introduced schemes to evaluate overall environmental impact, including energy savings and resource recycling, and are continually checking each product we make. For example, beyond the expected fuel consumption, exhaust gas regulations and noise reduction, we check the ability to disassemble used parts for recycling, labeling for used plastic and more. At overseas operation plants, we collect returnable pallets used for shipping knockdown parts and products. Used corrugated cartons and newspapers at our plants are dissolved and reformed as product and packaging spacers. This additionally makes waste processing easier at the recipient end. (Conventional materials were hard to process because of their properties.) In addition to such actions as the reuse of casting sand for shell molds at our moulding plant, the Consumer Products & Machinery Company at Kawasaki is always looking for new ways to reuse and recycle resources at all stages of the product flow.

In meeting the today's environmental requirements, we will promote product recycling in each individual field and will work constructively to build a sustainable society by improving the "environmentally conscious management" system that has been raised as Environmental Philosophy.

# Development of Environment-conscious & Environmental Protection Products

Products and technologies that use resources most efficiently and lessen the environmental impact are truly needed in the 21st century. Kawasaki has products for land, sea and air and, with our medium and long term environmental vision targets at application of the design for environment (DFE) to all of our products and improvement in environmental efficiency in order to be able to reduce environmental impacts by strenuously researching into resource conservation, energy saving, improved recyclability and longer service life.

## Basic Thoughts and Our Challenges

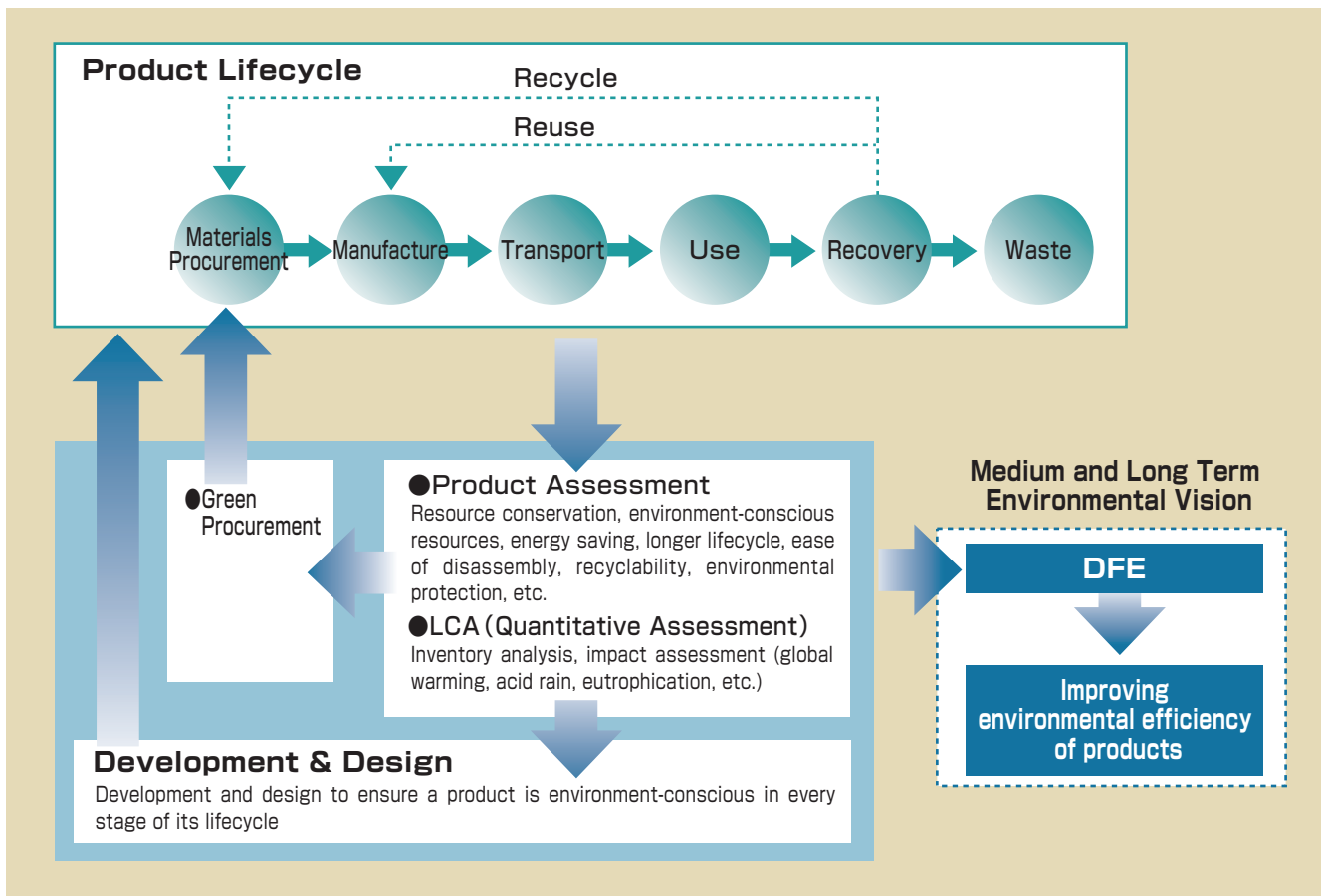
We feel it is our corporate duty to supply society with environment-conscious and environmental protection products and technologies. Our medium and long term environmental vision targets at application of the design for environment (DFE) to all of our products and improvement in environmental efficiency in order to be able to reduce environmental impacts by strenuously researching into resource conservation, energy saving, improved recyclability and longer service life.

In order to achieve our goals, we think it is important at the design stage to consider the environment across the entire product lifecycle, using techniques such as product assessment, LCA (Life Cycle Assessment) and green procurement. At present, these techniques are being applied individually, but our goal is to systematize them under the DFE that will add E (Environment) to existing elements Q (Quality), C (Cost), and D (Delivery). At the same time, we

feel another task of ours is to create logical environmental efficiency indicators in order to evaluate the environmental efficiency improvement of our products and technologies. That effort will definitely be undertaken in the future.

As for environmental protection products and technologies, we are aggressively developing business in the environmental protection field with products and technologies for cleaning and restoring polluted environments, treating and recycling waste, efficiently supplying clean energy, and more. Our medium and long term environmental vision sets expanded business and increased sales of these products and technologies as a target, hence development is underway in a variety of areas. As a part of this effort, we believe it is duly necessary to accurately tune into society's needs and swiftly adapt to fast changes in the market situation.

[Development Scope for Environment-conscious Products]





## Application of Product Assessment

A product assessment is used as a means for reducing the potential environmental impact of a product. It estimates and evaluates the effect that a product has on the environment in every stage of its overall lifecycle. A wide range of items are included in this assessment, such as environmental impact in materials procurement, manufacture and use, and recyclability after waste. At present, each of internal companies are improving product assessment regulations so as to apply DFE standard to all products as specified in our medium and long term environmental vision. We want to increase the application of product assessment in production development and improvement.

The Product Assessment Subcommittee is providing support with regard to evaluation items and methods in order to help internal companies improve their regulation.

### [Application of Product Assessments in Past Years]

FY	1998	1999	2000	2001
Divisions with regulation (Total divisions: 14)	1	7	10	11
Cases of product assessment	10	47	69	138

### [Example of Product Assessment Evaluation Sheet]

Product Assessment Report		Date revised: yr month day	
		Date prepared: yr month day	
		Dept: Gr	
		Approved by	Checked by
		Prepared by	
Order No.	Project Name	Delivery	yr month
Ref. Order No.	Ref. Project Name	Final deadline	yr month
Overall Evaluation <input type="checkbox"/> Pass <input type="checkbox"/> Pass with conditions <input type="checkbox"/> Rejection			
Evaluate item		Result	Remarks
1	Product weight reduction		
2	Resource conservation/Energy saving		
3	Product long lifecycle		
4	Environmental impact of packaging and transporting		
5	Safety and environmental protection in field setup		
6	Safety and environmental protection in field operation		
7	Environmental impact in emergency situation		
8	Waste, recovery & recycling		
9	Information provided		
10	Conformity to regulations		
Handling for products passed with conditions		<input type="checkbox"/> Discuss with this report <input type="checkbox"/> Discuss with design review (Deadline: yr month day)	
		<input type="checkbox"/> Significant environmental impact identified	
Handling for rejected product (Instruction for concerned design dept.)			

## LCA (Life Cycle Assessment)

LCA (Life Cycle Assessment) is used as a means for quantitatively analyzing and identifying the environmental impact of a product across its entire lifecycle from resource mining and material manufacture to waste and recycling. This program is being developed throughout each internal company. In its application, we understand the problem for manufacturers, such as ourselves, who design a variety of products is how to efficiently apply that technique.

The LCA Subcommittee is helping to diffuse the application of LCA throughout internal companies by providing ex-

planations using specific examples of application. One example of LCA research carried out by the Consumer Products & Machinery Company was to participate in LCA research with the Japan Automobile Manufacturers' Association in a joint project to establish LCA techniques for motorcycles. The Gas Turbines & Machinery Company is testing ways to collect inventory data\* on power generating facilities.

\*Inventory Data: Data for a single product manufacturing process with invested energy and resources as inputs, and product, waste and emissions as outputs.

## Green Procurement

Green procurement is one element of product assessment that constructively uses environment-conscious materials and parts. With the objective of improving the environmental consciousness in designing and manufacturing our products, we have been spreading green procurement practices since 1999, in line with the basic policy established by the Head Office Procurement Department. The Green Procurement Subcommittee launched in FY2000 is promoting activities into 2 stages. Stage 1, which has been completed, was to procure green office supplies. Stage 2, which is currently underway, is developing the procurement of green supplies for

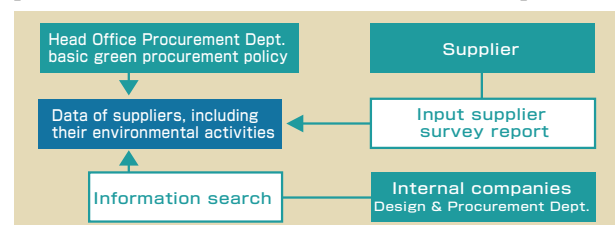
### [Basic Policy of Green Procurement]

- 1 Environmental impact must be considered across the entire lifecycle of all products from resource mining to waste.
- 2 In the selection of a supplier, if multiple suppliers are equal in terms of quality, price and delivery, a supplier who is most seriously committed in environmental conservation is given priority over other suppliers.
- 3 Environmental product information must be obtained from suppliers.

products and production activities.

More specifically, we are studying the expanded application of product assessments and LCA through links to environmental evaluation and the green procurement activities of our suppliers. We are also adding information on green procurement to the suppliers database and are currently building a system that will enable the procurement departments in each of our internal companies to access environmental information on their suppliers.

### [Green Procurement Database (Model)]



# Development of Environment-conscious & Environmental Protection Products

## Environment-conscious Products and Technologies Chart

To promote environmental consciousness in developing products and technologies, our medium and long term environmental vision targets at application of "Design for Environment (DFE)" to all of our products. In attempting to apply DFE to the wide diversity of products, we have various chal-

lenging tasks including creating of relevant standards.

At present, we are determining the specific areas in our products and technologies that need improvements from the environmental consciousness viewpoint and implementing improvements whenever possible.

\*Example indicated with ① through ⑧ are introduced on page 14.

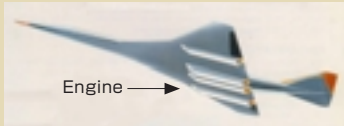
Item	*	Example of Improvement Effort
Energy Consumption Efficiency	① ②	<ul style="list-style-type: none"> <li>Improved bow shape to reduce necessary propulsion thrust</li> <li>Currently reviewing the feasibility for a Super Eco-ship demonstrator</li> <li>Changed rolling stock body material from steel to aluminum alloy to reduce power consumption through light-weight body</li> <li>Adopted a system for decreasing tire slippage during the operation with wheel loaders, thereby improving fuel consumption</li> <li>Reduced weight, improved aerodynamics and adopted low power-consumption equipment on aircraft, thereby improving fuel consumption</li> <li>Reduced fuel consumption and noise emissions, and cleaner exhaust from the engines for supersonic transport (SST)</li> <li>Adopted "electro-hydraulic hybrid system" in hydraulic equipment to control the speed of hydraulic pump in order to decrease electric power consumption</li> <li>Reduced energy demand and NOx emissions by regeneration burner in hot strip mill</li> <li>Added convection part to the cooling boiler for a converter exhaust gas treatment system, thereby lowering gas temperature and reducing blower power demand</li> <li>Recovered uncombusted CO gas and sensible heat from a converter exhaust gas treatment system in order to reduce fuel consumption</li> <li>Incorporated fluidized bed for cement kilns, thereby reducing energy consumption below that of rotary kilns</li> <li>Installed waste heat boiler (exhaust gas driven) at a cement plant to generate power, thereby reducing system power consumption</li> <li>Evaluated fuel consumption improvement rate of newly developed motorcycles against reference year in product assessment phase</li> </ul>
Greenhouse Gas Emissions		<ul style="list-style-type: none"> <li>Reduced emissions of greenhouse gases based on the energy consumption improvements noted above</li> <li>Reduced use of air conditioner refrigerant (CFC) in wheel loaders</li> </ul>
Product Weight	③	<ul style="list-style-type: none"> <li>Designed ships with less material used, thereby reducing weight below that of ships with similar transport capability</li> <li>Downsized 19 models of back-up gas turbine generators, thereby greatly reducing weight</li> <li>Reviewed machining allowance and blank layout for the components in the reducer to reduce material weight</li> <li>Developed high output density (increased discharge per unit weight) hydraulic motor</li> <li>Adopted fluidized bed for cement kilns, thereby reducing equipment weight below that of rotary kilns</li> <li>Set targets for newly developed motorcycles and evaluated weight reduction ratio in product assessment phase</li> </ul>
Hazardous Substances/ Pollutants	④ ⑤	<ul style="list-style-type: none"> <li>Changed rolling stock body material from steel to stainless steel to reduce paint consumption through a paint-free design</li> <li>Currently switching the paint remover used in aircraft maintenance to dichloromethane-free agent</li> <li>Currently developing low NOx diesel engine for marine power generator</li> <li>Greatly reduced pollutants in engine exhaust gas of wheel loaders</li> <li>Changed from tufftriding process (uses cyanide) to a less hazardous surface treatment technique for mechanical parts</li> <li>Currently researching use of biodegradable hydraulic liquid for hydraulic pump</li> <li>Used atmospheric corrosion resisting steel members for bridge girders, thereby eliminating the need for painting or repainting</li> <li>Evaluated reduction of lead use in newly developed motorcycles against reference year in product assessment phase</li> <li>Confirmed compliance of motorcycles with exhaust gas reduction regulations and gained approval from countries around the world</li> </ul>
Containers & Packaging		<ul style="list-style-type: none"> <li>Changed crating of spare parts and tools for main diesel engines from wood to returnable boxes, avoiding overuse of wood</li> <li>Changed packaging for hydraulic equipment knockdown parts for overseas from steel container to basket-type returnable container</li> <li>Introduced returnable boxes to package pumps, motors, valves and other parts of hydraulic equipment</li> <li>Changed packaging for Jet Ski watercraft engines for overseas from wood and cardboard to returnable steel pallet-type</li> </ul>
Product Service-life		<ul style="list-style-type: none"> <li>Changed rolling stock bodies from steel to highly corrosion resistant aluminum alloy or stainless steel, thereby increasing the effective service life of rolling stock</li> <li>Implemented a maintenance following maintenance inspection schedule for gas turbines, thereby extending the service life</li> <li>Began development of long-life burner grates for waste incinerators</li> <li>Evaluated model change interval for newly developed motorcycles in product assessment phase</li> </ul>
Ratio of Use for Re-usable & Recyclable Parts	⑥	<ul style="list-style-type: none"> <li>Developed a system for reusing internal parts of shield machine</li> <li>Evaluated recycle rate of newly developed motorcycles in product assessments (90% or higher recyclable)</li> </ul>
Product Disassembly Time		<ul style="list-style-type: none"> <li>Stopped using FRP components with overlaid metallic parts in wheel loaders and road rollers</li> <li>Reduced number of parts used in motorcycles</li> </ul>
Recovery of Used Products, Containers & Packaging		<ul style="list-style-type: none"> <li>Labeled plastic parts used in wheel loaders and road rollers by material description</li> <li>Currently promoting standardization of plastic materials used in back-up gas turbine generator</li> <li>Currently promoting labeling of plastic parts used in back-up gas turbine generator by material description</li> <li>Labeled plastic parts used in hydraulic equipment by material description</li> <li>Labeled plastic parts used on motorcycles by material description</li> </ul>
Vibrations & Noise	⑦ ⑧	<ul style="list-style-type: none"> <li>Adopted low noise-emitting nose shape and optimally smooth profile of cars on rolling stock, thereby reducing noise</li> <li>Reduced number of pantographs in rolling stock and adopted streamlined, low noise-generating pantograph design</li> <li>Optimized the shape of the blade section and blade tip in helicopters to reduce noise in flight</li> <li>Enveloped back-up gas turbine generator in package to reduce machine side noise emission to 55 dB</li> <li>Greatly reduced noise of jet fan for tunnel ventilation</li> <li>Currently studying into noise reduction in hydraulic pumps by optimizing valves and enhancing casing rigidity</li> <li>Proposed effective noise reducing construction for subways using noise evaluation technology</li> <li>Estimated and reduced noise of steel viaduct for railway</li> <li>Confirmed compliance of motorcycles with noise reduction regulations and gained approval from countries around the world</li> </ul>

## Examples of Environment-conscious Products and Technologies

### Environment-conscious Supersonic Transport (SST) Engine ①

#### ● Successfully developed technology to reduce fuel consumption, noise and NOx emissions

Kawasaki is one of several companies including Ishikawajima-Harima Heavy Industries, Mitsubishi Heavy Industries, and 4 foreign companies involved in a major project for the Ministry of Economy, Trade and Industry towards the research and development of a SST jet engine. We have successfully tested low fuel consumption and low noise technology as well as combustion technology that reduces emissions of NOx, an ozone depleting substance, to 1/10 of the current level. The project targets a combined cycle engine never seen before anywhere in the world which combines turbo jet and ram jet engines. The project was given a special award by the Japan Industrial Technology Examination Committee.



### Energy-saving Hot Strip Mill ②

#### ● Greatly reduces necessary resources for construction, as well as energy consumption

We shortened the usual 400 meter line used to hot strip mill to just 192 meters, greatly reducing resources for construction. Also, by using a low NOx regeneration burner (heat-accumulating type), energy demand has been reduced by about 20% compared to conventional systems. With little NOx and SOx emitted, the system does not adversely affect the environment.



### High Output Density Hydraulic Motor ③

#### ● Employs a new mechanism that conserves resources and boosts output density

We applied a simple, new mechanism to the M5X Series hydraulic motor which is used for the swivel motion on construction machinery. It greatly reduces the number of parts over conventional motors and greatly reduces the number of areas on the casing to be machined, etc. We also reduced chip generation in milling operation by 32% compared to conventional motors by adopting a forging process and improving a casting technique. At the same time, we reduced weight and increased capacity to boost output density by 10% over earlier motors.



### Clean Technology for Wheel Loader Exhaust Gas ④

#### ● Greatly reduces hazardous emissions thanks to electronic engine control

We incorporated an engine that electronically controls fuel injection according to the operating status into a new model of wheel loaders that are used to load crushed rock onto trucks at construction sites. The electronic control greatly reduces emissions of NOx and suspended particulate matter. It has already cleared emission standards for construction machinery that will go into effect in 2003 and improved fuel efficiency 10–15% over earlier products.



### Paintless Steel Bridge Girder ⑤

#### ● Does not require painting because of the atmospheric corrosion-resisting steel used

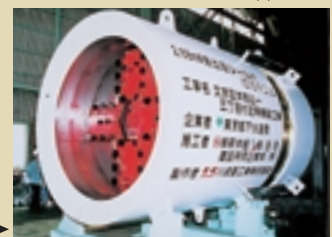
The bridge girders are increasingly constructed with atmospheric corrosion-resisting steel members since they do not require painting or repainting. Because no paint (which normally contains chemical substances) is used at all, the bridge is environmentally conscious. One example is the Chidori-no-sawa River Bridge in Hokkaido, on the Hokkaido-Odan National Expressway.



### Draw a Shield for Recycle System (DSR) ⑥

#### ● 90% of parts reusable

After digging a tunnel underground for sewerage system, etc., most portion of the shield machine is buried in place. But, in a joint development project with Arai-Gumi in 2001, we applied a DSR technique that enabled us to extract and reuse the internal shell of shield machine. This greatly reduces construction costs and reduces the impact on the environment by using resources more effectively and efficiently.



Shield machine being extracted ▶

### Low Noise Technology of Helicopter Rotor ⑦

#### ● Research into rotor and speed control law in order to reduce external noise

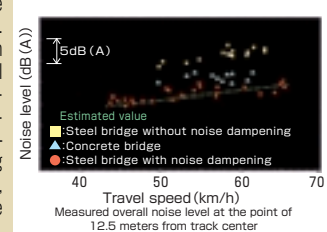
External noise is one of the key factors for public acceptance of helicopter, which flies relatively low altitude and speeds. With the BK117 C-2, jointly developed with ECD of Germany, we resolved this by optimizing the shape of the blade section and blade tip, and by introducing a newly redefined variable rotor speed control law in helicopter to reduce noise in flight. As a result, external noise achieved significant margin to international regulations.



### Low Noise Technology for Steel Viaduct for Railway ⑧

#### ● Estimated noise level and applied technology in order to counter noise

Steel bridges make more noise than concrete bridges. So, we analyzed noise level in the design stage of a steel bridge and took noise reduction measures such as covering steel plates with a vibration-dampening material and laying rubber mats in key points, effectively reducing the noise that is generated.



# Development of Environment-conscious & Environmental Protection Products

## Environmental Protection Products and Technologies Chart

Kawasaki is working on a number of products that protect the environment in diverse ways such as effective energy use, prevention of air, water and soil pollution, as well as waste treatment and recycling. Some of these are introduced below. We will continue developing environmental

protection products and look for new business opportunities at the same time. In our medium and long term environmental vision, we recognize that aggressive product development will lead to future business development.

\*Example indicated with ① through ⑨ are introduced on page 16.

Technological Field	*	Product	*	Research & Development	
Energy		<ul style="list-style-type: none"> <li>Combined cycle power plant</li> <li>Gas turbine co-generation system</li> <li>Waste heat recovery boiler</li> <li>Cement waste heat power generation system</li> <li>Top-pressure recovery plant for blast furnace</li> <li>High efficiency Low-NOx coal fired boiler</li> <li>Ice storage cooling system</li> <li>District heating and cooling system</li> <li>Optimization and diagnosis of industrial energy system</li> </ul>	①	<ul style="list-style-type: none"> <li>High performance coal gasified generation technology</li> <li>High performance gas turbine</li> <li>Ceramic gas turbine</li> <li>High efficiency combustion technology (Various combustion system/Engine)</li> <li>Fuel cell power system</li> </ul>	
	Renewable Energy System	② ③	<ul style="list-style-type: none"> <li>Photovoltaic system</li> <li>Wind turbine generation system</li> <li>Geothermal generation system</li> </ul>		<ul style="list-style-type: none"> <li>Black liquor gasification technology</li> <li>Wood-based biomass energy utilization technology</li> </ul>
	New Energy System				<ul style="list-style-type: none"> <li>Liquid-H<sub>2</sub> carrier ship (World Energy Network)</li> </ul>
Air Pollution Control	SOx/NOx Reduction, Dust Collection	④ ⑤	<ul style="list-style-type: none"> <li>De-SOx/De-NOx plant and dust collector for flue gas</li> <li>Low-NOx gas turbine generation system</li> <li>Low-NOx slag-tap firing boiler</li> <li>Low-NOx combustion system for heavy oil fired boiler</li> <li>De-NOx system for road tunnel</li> <li>Ventilation filter for road tunnel</li> <li>Electrostatic precipitator for road tunnel</li> </ul>		<ul style="list-style-type: none"> <li>Low-NOx combustion technology (Gas turbine, Boiler, Diesel, Jet engine)</li> <li>De-NOx catalyst for lower temperature flue gas</li> <li>De-NOx technology for marine diesel engine</li> <li>Clean-up technology for diesel engine exhaust (Suspended particulate matter)</li> </ul>
	Air Pollution Control		<ul style="list-style-type: none"> <li>Photocatalytic coating business (For environmental protection)</li> </ul>		
Water Pollution Control	Sewage/Sludge Treatment		<ul style="list-style-type: none"> <li>Sewage/Sludge treatment system</li> <li>Reverse-osmosis membrane water treatment system (Recycled water etc.)</li> <li>Sludge recycling system (Into activated carbonized material)</li> <li>On vehicle sludge drying system</li> </ul>		<ul style="list-style-type: none"> <li>Dehydration technology for sludge</li> <li>Membrane water treatment technology (Leachate etc.)</li> </ul>
	Water Pollution Control				<ul style="list-style-type: none"> <li>Purifying technology for closed water basin</li> </ul>
Soil Pollution Control	Dioxin Reduction				<ul style="list-style-type: none"> <li>Cleaning technology for dioxin polluted soil</li> </ul>
Waste Treatment/ Recycling	Waste Incineration	⑥	<ul style="list-style-type: none"> <li>High performance waste incineration system (Stoker-type, Fluidized bed-type, Gasifying-melting type)</li> <li>High performance waste power generation system (Super waste power generation etc.)</li> <li>Waste-burning power generation system (RDF, Soda recovery boiler etc.)</li> <li>Waste incineration system for pollution control</li> <li>Flue gas treatment system (Dioxin, HCl, SOx, NOx)</li> </ul>		<ul style="list-style-type: none"> <li>Advanced stoker-type incinerator</li> <li>Advanced dioxin reduction technology</li> </ul>
	Crushing, Sorting	⑦	<ul style="list-style-type: none"> <li>Bulky waste crushing and recycling system</li> <li>Waste automobile/electrical appliance crushing and recycling system</li> <li>Construction waste crushing and recycling system</li> <li>Waste tire freeze-crushing system</li> <li>Waste glass bottle/plastic sorting system</li> </ul>		
	Recycling, Pollution Control	⑧	<ul style="list-style-type: none"> <li>Incineration and fly ash treatment system (Melting, Volume reduction, Pollution control, Recycling)</li> <li>Refuse derived fuel (RDF) production system (Domestic/Industrial waste)</li> <li>Refuse paper and plastic fuel (RPF) production system</li> <li>Treatment system for slag from incineration ash</li> <li>Food waste treatment system (Compost, Feed etc.)</li> <li>Livestock waste treatment system (Fuel, compost etc.)</li> <li>Sewage sludge utilization system (Fuel, compost etc.)</li> <li>Coal fired boiler's ash recycling system (Paving material etc.)</li> <li>Ultrasonic air filter cleaning system (Reusing air filter)</li> </ul>	⑨	<ul style="list-style-type: none"> <li>Stabilization technology of incineration ash</li> <li>Organic waste treatment technology (Methane fermentation etc.)</li> <li>Waste plastic gasification technology</li> <li>Waste polyvinyl chloride treatment technology</li> <li>Dredged mud recycling technology</li> <li>PCB decomposition technology</li> </ul>
	Radioactive Waste Treatment		<ul style="list-style-type: none"> <li>Radioactive waste treatment system</li> </ul>		<ul style="list-style-type: none"> <li>Nuclear reactor decommissioning technology</li> </ul>
Others	Monitoring & Measuring				<ul style="list-style-type: none"> <li>Offshore monitoring platform on greenhouse gases</li> </ul>

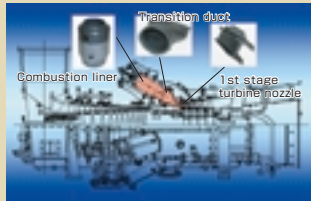


## Examples of Environmental Protection Products and Technologies

### Ceramic Gas Turbine ①

#### ●More efficient than earlier models

As part of the NEDO (New Energy And Industrial Technology Development Organization) project, we applied ceramics to high temperature parts of a gas turbine for co-generation. As a result, we boosted turbine inlet temperature from 1,100°C to 1,250°C and resultantly improved thermal efficiency by 34% or more. In addition, we reduced CO<sub>2</sub> emissions and energy demand. A pilot 8,000 kW class gas turbine has started to run at our plant and will reach a total of 4,000 running hours by the end of FY2003.



### Photovoltaic System & Wind Turbine Generation System ②③

#### ●Promoting the use of power generation systems that do not emit CO<sub>2</sub>

As one solution for the worsening situation surrounding global warming, we are dedicating our efforts to diffusing power generation systems that utilize natural energy. In 2001, we delivered large photovoltaic systems to a water treatment plant in Isobe, Mie Prefecture, and to Yachiyo Shoin High School, Chiba Prefecture. We also delivered a 14,850 kW total output wind turbine generator system to Marubeni Group's Sarakitomanai Wind Farm in Hokkaido.



### Low-NOx Gas Turbine Generation System (Catalytic Combustion Gas Turbine) ④

#### ●Aiming for zero emission of air polluting substances

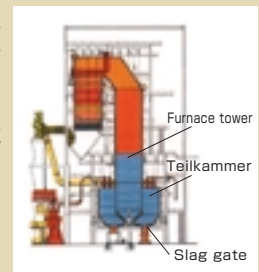
Gas turbine co-generation emits little hazardous substances such as NO<sub>x</sub>, CO and HC, but we are developing technology to reduce these substances even more to the "zero emission" level. Our Catalytic Combustion Gas Turbine uses a combustion catalysis that reduces NO<sub>x</sub> emission to 2.5 ppm and less, which is less than 1/10 of conventional (lean pre-mixed burn) systems. It clears the gas emission standards of California, USA, which are the toughest in the world.



### Low-NOx (U-type) Slag-tap Firing Boiler ⑤

#### ●Developing coal ash recycling technology

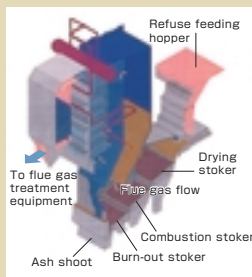
To properly treat and effectively utilize the coal ash generated by Japan's thermal power plants, we developed a Low-NO<sub>x</sub> Slag-tap Firing Boiler that recovers coal ash as slag that can be used as road bed material, etc., in civil engineering work. This type of boiler had problems with NO<sub>x</sub> emissions, but we developed a low NO<sub>x</sub> emission burner for high temperature burning under reducing atmosphere that greatly reduces NO<sub>x</sub> emission and turns coal ash into melt slag.



### High Performance Waste Incineration System (Parallel Flow Stoker-type Incineration System) ⑥

#### ●Prevents dioxin formation through complete combustion and a long residence time at a high temperature

With a Parallel Flow Stoker-type Incineration System, waste feed and gas flow are performed in the same direction, so waste can be positioned to optimize combustion. Also, unburned gas occurring in the drier section and carbonization section is force-burned at a high temperature using secondary air supplied from the ceiling. Compared to conventional intermediate flow incinerators, prevents dioxin formation through complete combustion and a long residence time at a high temperature.



### Waste Glass Bottle/Plastic Sorting System (Auto Glass Bottle Sorter) ⑦

#### ●Greatly improves operational efficiency through imaging process

This system automatically sorts and selects waste glass bottles by color and shape using imaging technology. It can identify maximum 8 kinds of colors including brown, white and green, as well as various shapes that the user can program in advance. Moreover, using Kawasaki proprietary technology, image recognition is quite stable and is not fooled by dirt or labels. Compared to hand-sorting, operational efficiency is greatly improved and the system contributes to resource recycling.



### Livestock Waste Treatment System ⑧

#### ●Resource recycling plant that generates power from animal excrement

A pilot biogas plant in Yubetsu, Hokkaido, collects animal excrement and uses the biogas obtained from methane fermentation to generate electric power and hot water. The digested liquid left over after methane fermentation is a good quality fertilizer, too. Because it recycles animal excrement for other uses, this form of recycling is expected to spread in the future.



### Waste Plastic Gasification Technology ⑨

#### ●Recovers energy and recyclable resources from waste plastic

We are moving forward with technological development to convert all kinds of plastic waste into clean gas and recyclable melt slag, using a rotating gasification furnace. In combination with a highly efficient generator such as a gas turbine, gas engine or fuel cell, this technology can be used to build a decentralized power generation system.



# Feature Report

## Environmental Business

We produce environmental protection products and develop environmental protection technologies for a wide range of fields including energy, waste treatment, and pollution prevention. With industrial gas turbines—one of our strong products—we expect to see increasing demand for plant use and power generation, because of its high energy conversion efficiency and environmental protection features. In 2001, we successfully developed a 20 MW-class gas turbine, which is the highest output of all our industrial gas turbines, and started operation at a plant in our Akashi Works. We call that unit the "L20A" and consider it a business solution that will greatly contribute to environmental protection. Here following, our environmental technology is briefly introduced.



L20A pilot plant at the Akashi Works

### Product Introduction: Newly Developed Gas Turbine—L20A

## High Efficiency Gas Turbine for Decentralized Power Generation and Reduced Environmental Impact

■ **Low cost, high efficiency and low NOx.**  
**World's highest level of thermal efficiency.**

Gas turbines act continuously a cycle of: air intake→air compression→combustion→exhaust. Fuel is injected into the compressed air and ignited. The resulting high temperature, high pressure gas then turns a turbine at high speed. When the gas turbine is combined with a waste heat boiler, it becomes a co-generation system and can utilize 80% or more use out of the invested energy, making many people interested in its use as a high efficiency energy plant.

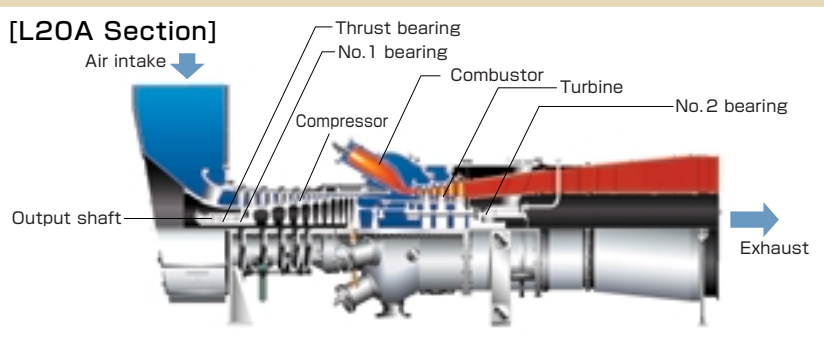
The L20A was developed targeting a low lifecycle costs, high effi-

ciency and low NOx. We pursued a more compact and durable machine, and an easy-maintenance construction, which resulted in lower total costs including manufacture and maintenance costs. It also employs a "dry low-emission combustor" to keep exhaust gas clean. Since the dry low-emission technology uses no water, no steam and no chemicals at all to lower NOx, it saves on water resources. Thermal efficiency in the L20A is 35%, the highest in the world amongst same-class turbines.

■ **Promoting sale on results from pilot plant**

The L20A started operation in November 2001 as a co-generation system at a power generation plant built in our Akashi Works. By effectively using waste heat, this co-generation system is boosting energy efficiency to the max. At the Akashi Works, we are planning to introduce a steam turbine (combined power generation) to increase the amount of in-house generated power and, by centrally controlling electricity and steam, retire the existing boiler. With the start of the L20A, overall NOx emissions at the Akashi Works have been reduced 8% on the average.

With the successful results of the Akashi Works, we will promote sale of the L20A as an environment-conscious and highly efficient gas turbine.



### [Major Systems (Gas-fired, ISO conditions)]

Power generation system		Generated power (MW)	Generation efficiency (%LHV base)	Blown steam rate (ton/h)
Simple cycle		17	34	—
Co-generation		17	82 (Total heat efficiency)	36
Combined co-generation	1) 1 gas turbine system + 1 steam turbine system	25	48	—
	2) 2 gas turbine systems + 1 steam turbine system	51	49	—

### Point

#### ● Merits of decentralized power

In a system that transmits power great distances over power lines from a large power plant, it is difficult to utilize the waste heat from that plant and much more is lost in the actual transmission. A decentralized system, such as co-generation with a gas turbine, easily uses the resulting waste heat and has almost no transmission loss. Energy efficiency is 80% or more, and environmental efficiency can be considered high as well.

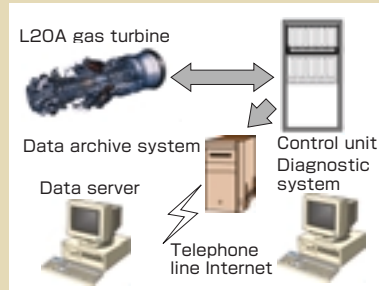
## ■Optimized operation using advanced control systems

Operation and functional diagnoses of the L20A pilot plant are handled by an electronic control system. Technology has been applied to optimize control so as to reduce NOx emissions and for stable operation at a high heat efficiency across a wide output range.

Also, instabilities are forecast and diagnosed from past data to prevent unexpected troubles from occurring. The system is also Internet-ready and can be monitored and diag-

nosed from remote systems, even overseas.

### [L20A Diagnostic System]



Diagnostic system

## Voice Thoughts from L20A Development Staff

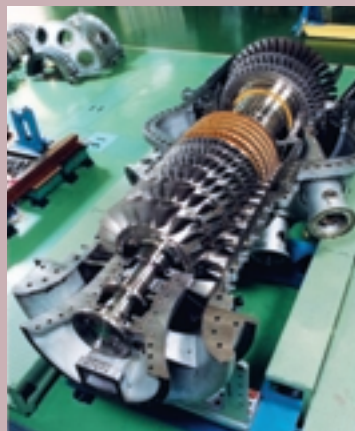


**Takashi Nagatomo**  
Industrial Gas Turbine Center,  
Gas Turbine Division, Gas Turbines  
& Machinery Company

### ■Dealing with the global environment through gas turbines

Since joining the company, I have been involved entirely with gas turbines, but the L20A project was bigger than any other project ever seen before. The engine and system were being developed at the same time as the plant was being constructed at our Akashi Works, and this required the services of many persons from not only the Akashi works, but also the Kobe Works, technical research institute, and more. As the project manager overseeing the entire project, it was necessary to verify regulatory compliance and complete all of the formalities for Akashi City and Hyogo Prefecture. Schedule management and coordinating the various sections of development were important tasks. Needless to say, there were many difficult moments.

As for environmental problems, presently China and the countries of Southeast Asia, in their strive for economic development, are seeing problems of pollution that occurred for similar reason several decades ago in Japan, the USA, and Europe. It is the duty of industrially advanced nations of the world to spread the know-how for preventing pollution to developing nations. Unless efforts are made in various areas, environmental problems are only going to get worse and worse. This is one of the outstanding reasons for our development efforts in energy systems and want to continue to further improve our systems.



L20A with top casing removed



**Katsushi Nagai**  
Large Engine Development Section  
Engine Research & Development  
Department, Gas Turbine Research  
& Development Center, Gas Turbines  
& Machinery Company

### ■Energy-saving and zero NOx emissions are never-ending themes

In the limited amount of time allotted us, it was a tremendous task to develop the engine of the L20A to be efficient, low cost and compact in size. While referring to reliable design techniques used in the past, we presented a challenge to several new techniques in order to reduce NOx and improve performance. A huge amount of time was required for analyses alone. There was a mountain of issues to overcome in making the engine both compact and highly efficient, and it was a tough battle everyday. From start to completion and on to the start of operation, there were about two and a half years of research and development under extreme pressure, but we owe the successful result, in addition to the years of experience and know-how of the company, to the hard work of everyone involved.

For me personally, protecting the global environment is very important. Knowing that the technological development I am involved with as a job, and this particular gas turbine as well, will contribute to resolving environmental problems leaves me feeling euphoric. For us, energy-saving and zero NOx emissions are never-ending themes. We want to develop even higher performance technology in the future.



# Environment-conscious Production Activities

Product manufacturing processes use various materials, and energies in the form of heat and electricity, as well as water resources. They then discharge the exhaust gas and waste. To raise our environmental management level, it is necessary to utilize that energy effectively, minimize the environmental impact of production by reducing CO<sub>2</sub> and through other methods, and make production activities more efficient.

## Basic Thoughts and Our Challenges

Our medium and long term environmental vision sets as its targets the conversion of all production activities to "eco-production" which shows due consideration for the environment, as well as improving environmental efficiency. As to resources consumed, such as energy and water, we have been gathering numerical data in an attempt to evolve currently used management indicators\* into environmental efficiency indicators. However, owing to a diversity of our products, calculation of relevant indicators poses a challenging task. We are planning to establish a reference year and intend to raise the environmental efficiency to the tar-

get value by FY2009. Also, it is our challenge to propagate this practice to all of our companies and affiliates.

This plan will serve as the basis for promoting a reduction in environmental impact and correctly evaluating environmental protection efforts within our production activities. We have focused on the three pillars of protection in energy saving, the prevention of global warming, and waste reduction. Those pillars are individually described below for FY2001.

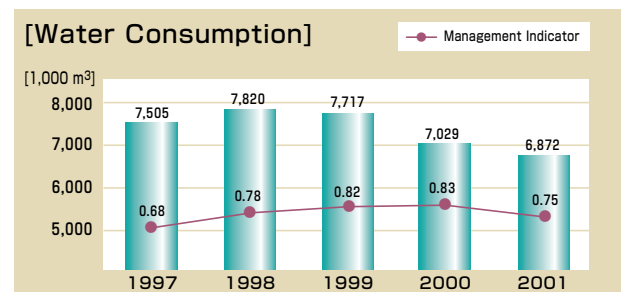
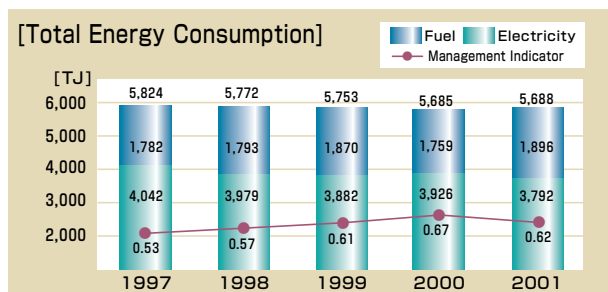
\*Management Indicators: These indicators are obtained by dividing total energy use, water use and CO<sub>2</sub> emissions by the total sales.

## Energy Saving

Effective energy use is a major prerequisite to improving environmental efficiency. We have been monitoring the trend in our energy and water consumption, and have set management indicators for our business activities so as to compare energy and water consumption against sales. Also, through our environmental management program (EMP), we are carrying out energy-saving PR, promoting

energy-saving operations, improving production lines and innovating our production system. We will continue to undertake energy saving to raise our level of environmental management from now on.

In FY2001, the combined management indicator for electricity and fuel improved by 0.05 point over the previous year. Water use improved by 0.08 point.

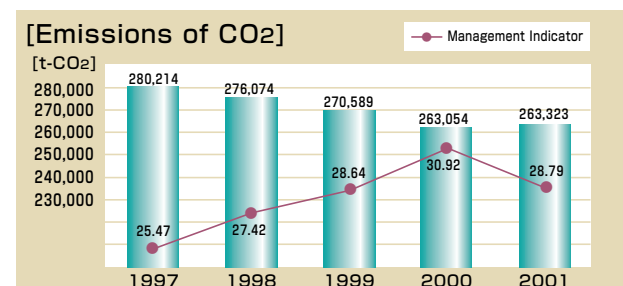


## Global Warming Prevention

CO<sub>2</sub> is the primary cause of global warming. To reduce CO<sub>2</sub> emissions, we are promoting activities in line with our Greenhouse Gas Reduction Plan that was adopted in 2001 based on the Kyoto Protocol\*. Through this plan, we are trying to reduce CO<sub>2</sub> emissions by using natural gas, which exhausts less hazardous substances, as an energy source for plants. The management indicator for FY2001 improved by 2.13 points, although total emissions did increase to 263,323 t-CO<sub>2</sub>.

As for the reduction of ozone depleting substances, we introduced alternative washers over a three-year period from 1993 to 1995, and completely abolished the use of ozone depleting substances on production lines in 1996.

\*Kyoto Protocol: A treaty signed at the 3rd Conference of the Parties (COP3) for the Prevention of Global Warming held in Kyoto in December 1997. It targets a 5% total reduction or more of six types of greenhouse gases against 1990 levels, in industrially advanced nations between 2008 and 2012. Japan's reduction target is 6%. At COP7 held in Marrakech, Morocco, in 2001, management rules were adopted and negotiations are currently underway to put these rules into effect in 2002.





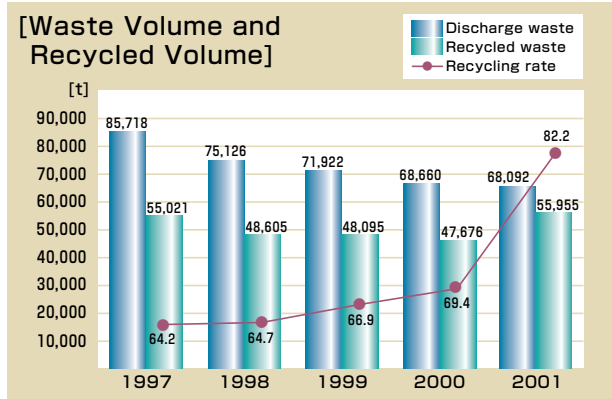
## Waste Reduction

### Improved Recycle Rate

Since Kawasaki produces a wide range of products, we also generate a broad diversity of waste at our plants and, consequently, seeking an optimal method for waste disposal and recycling poses a challenge for us. We manage waste volume for paper, wood, other burnt waste, used oil, rubber, scrap metal and other types of waste, and are applying the 3Rs – Reduce, Reuse and Recycle. We have focused our efforts on prevention of waste generation as well as promotion of waste recycling in particular with wastes that have a large volume but a low recycling rate. In FY2001, we generated 68,092 tons of waste, of which 55,955 tons were recycled. We will continue to boost our recycling rate and ultimately achieve our goal of zero emissions.

We also are appropriately treating specially controlled industrial wastes such as used oil, spent acids and alkalis, infectious waste, asbestos and dust, while working in an

effort for prevention of waste generation and reduction in waste discharge.



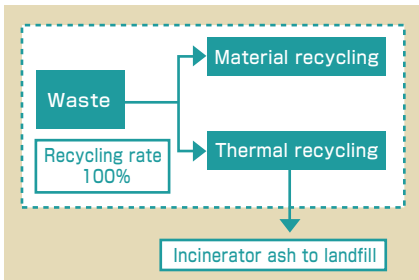
### 3 Factories Attained Zero Emission Target

As a concrete means for improving environmental efficiency, we set zero emission by FY2004 as a target for all our factories. In 2000, we started "Zero Emission Working Group". Since then, the group investigated into the situations that led to waste generation as well as associated recycling methods in our Harima Works in Hyogo (a factory selected as a model plant) and defined the problems and developed relevant solutions. As a result, Harima Works became a zero-emission factory by the end of September

2001. The same target was attained in December that year at our Banshu Works and then in March 2002 at the Nishi-Kobe Works. In all three cases, the factories attained their targets ahead of original schedule.

Zero waste discharge also means less expenses related to waste treatment. In the future, we will continue to search for ways to prevent waste generation at the source as well as to promote recycling and make those activities more efficient.

#### [Our Definition of Zero Emission]



Waste sorting area (Harima Works)



After attaining the zero emission target, trash cans have been unnecessary. (Nishi-Kobe Works)

## Dioxin and PCB Measures

### Storage in accordance with PCB waste regulations

We are properly storing condensers and transformers that contain PCB in line with standards in the Waste Disposal Law. In July 2001, the Law for the Treatment of PCB\* was enacted, so we are watching the trends of PCB treatment facilities and will properly dispose of these substances.

\*Law for the Treatment of PCB (Special Measures Law for the Promotion of Proper Treatment of Polychlorinated Biphenyl): Law that requires companies to report the amount of PCB waste they store and treat every year to prefectural authorities. PCBs must be rendered innocuous within 15 years.

### Shutting down incinerator plants to comply with dioxin regulations

In January 2000, the Law Concerning Special Measures Against Dioxins\* was enacted. So, during FY 2001, we shut down incinerator plants at three factories and began outsourcing waste disposal to governments and recycling contractors. We plan to shut down incinerators at all our factories by November 2002.

\*Law Concerning Special Measures Against Dioxins: Law that regulates dioxins from waste incinerators and other sources in terms of emission level, daily intake, environmental permitted quantity, landfill, etc.

# Environment-conscious Production Activities

## Ground Water

The use of tri-chloroethylene, an organic chlorine compound, is limited due to its toxicity and carcinogenic properties. At one of our manufacturing plants in Kagamigahara, Gifu, the substance was detected in the ground water at 0.057 mg/l, which is twice the level of environmental regulation standards and was immediately reported to the authorities.

In this manufacturing site, the use of tri-chloroethylene

in the cleaning process of components was eliminated 25 years ago. Moreover, ground water has only been used for industrial purposes. Further inspections in surrounding wells produced results that were well below the level of regulation standards.

From now on, we will conduct stringent management by continuous monitoring and improvement efforts under administrative instructions.

## Chemical Substance Reduction

To reduce the environmental impact of chemical substances, our policy is to reduce the use of environment polluting substances by improving the environmental efficiency in production stages. The prime topic is to reduce the chemical substances contained in paint, which we are attempting to do by, for example, using water-based paints that place less impact on the environment.

Since the start of the PRTR survey in 1997, we have

kept continuous records on the amount of specified substances we have handled and we have our records keeping amount of procurement, emissions and transfers. In this Environmental Report, we have tabulated the amount of chemical substances discharged at all business locations in line with the PRTR Law\* that was enacted in April 2001.

\*PRTR Law (Pollutant Release and Transfer Register): Law that requires businesses to keep records of the amount of hazardous chemical substances they discharge and transfer as waste, and report these records to authorities.

### [Total of Chemical Substances Handled in Fiscal 2001]

(Unit: kg)

Gov't No.	Substance	Release into air	Release into public water area	Release into ground	Release subtotal	Transfer to public sewerage	Transfer as waste
<b>Type 1 Designated Chemical Substances: 5,000 kg or more handled annually</b>							
30	Bis phenol A	0.0	0.0	0.0	0.0	0.0	4,397.0
40	Ethyl benzene	118,280.0	0.0	0.0	118,280.0	0.0	10,526.1
43	Ethylene glycol	0.0	0.0	0.0	0.0	0.0	0.0
63	Xylene	665,421.1	29.0	0.0	665,450.1	0.0	60,257.4
68	Chromium and its trivalent compounds	45.9	39.0	0.0	84.9	0.0	49,487.9
100	Cobalt and its compounds	1.3	0.0	0.0	1.3	0.0	593.9
145	Dichloromethane (Also known methylene chloride)	103,893.3	30.0	0.0	103,923.3	0.0	4,000.5
177	Styrene	5,450.0	0.0	0.0	5,450.0	0.0	1,789.0
198	Hexamethylenetetramine	0.0	860.0	0.0	860.0	0.0	7,700.0
207	Water-soluble copper salt (Excluding complex salt)	0.0	15.0	0.0	15.0	0.0	490.0
227	Toluene	294,741.7	0.0	0.0	294,741.7	0.0	44,605.9
230	Lead and its compounds	0.0	5.3	0.0	5.3	0.0	690.0
231	Nickel	2.5	750.0	0.0	752.5	0.0	3,028.7
266	Phenol	0.0	4.0	0.0	4.0	0.0	11,654.0
283	Hydrogen fluoride and its water-soluble salts	0.0	1,500.0	0.0	1,500.0	0.0	7,900.0
311	Manganese and its compounds	103.7	0.0	0.0	103.7	0.0	31,125.8
<b>Special Type 1 Designated Chemical Substances: 500kg or more handled annually</b>							
69	Hexavalent chromium compounds	0.0	15.3	0.0	15.3	0.0	2363.0
179	Dioxins (mg-TEQ)	18.0	0.5	0.0	18.5	0.0	0.0
232	Nickel compounds	0.0	0.0	0.0	0.0	0.0	1,600.0
299	Benzene	2.3	0.0	0.0	2.3	0.0	0.0

## Compliance with Laws and Regulations

In FY2001, there was one accident at the Kobe Works in which equipment broke down and spilled oil into the sea. As to this incident, an administrative warning was issued to us. Immediately after the accident occurrence, we promptly removed the floating oil and neutralized residual oil. We duly investigated the cause and made countermeasures to all the equipment concerned. The Yachiyo Works as well received 4 complaints from residents about noise and promptly worked out countermeasures.

In order to minimize and eventually eliminate such problems, we will continue to expend every effort to improve

our environmental management system and strengthen our environmental activities.

### [Violations, Accidents and Complaints]

FY	1997	1998	1999	2000	2001
Judicial or administrative penalty	0	0	0	0	0
Administrative provision	2	1	4	0	0
Administrative warning	0	0	0	1	1
Residents complaint	1	3	2	0	4

\*●Judicial or administrative penalty: Punishment by judicial or administrative authorities ●Administrative provision: Instructions imparted in writing (e.g. improvement order, etc.) ●Administrative warning: Verbal warning

# Social Contribution Activities

We are working towards helping to protect the environment not only through our business activities but in cooperation with local communities and with international contributions as well. As these activities are important towards the creation of a sustainable society, we will further expand our involvement in cooperating with NGOs and NPOs, promote environmental protection plans of our own, and systematize our social contributions.

## Major Activities

### ■ Donating Used PCs to Schools and Welfare Centers

When our Aerospace Company, Gifu Works, upgraded their PC network, they donated some 810 used computers to the lower and middle schools and social welfare associations of Kagamigahara City. Though older models, they still have the functions and computing power for creating documents and spreadsheets as well as using the Internet. Prior to this, we also donated 30 laptop PCs to the Gifu Friendship Society for the Blind. These PCs would be useful of networking schools and classrooms by LAN, and education via Internet.



Computers donated by the Aerospace Company being carried into a school

### ■ Park Development & Natural Environment Protection

Located in the center of Hyogo Prefecture, Yashiro-no-Mori Park is where local citizens are voluntarily working on creating and protecting a new kind of forest. Our employees who reside in Hyogo have been volunteering for these activities every year. In FY2001, they removed weeds from a wetland area, thinned forests, and built trails. Every time a work event is held at Yashiro-no-Mori Park, some 20 to 30 Kawasaki people participate in it. These are extraordinary activities as participants get to enjoy the great outdoors while returning the favor and protecting it.



Volunteers building a trail (chip road)

### ■ Welcoming trainees under the JICA program

We have been welcoming trainees from developing nations to our facilities under a program organized by the Japan International Cooperation Agency (JICA). In August 2001, our Rolling Stock Company, Hyogo Works, imparted a course on the "Chemical Analysis of Trace Hazardous Substances" for trainees from Indonesia. In November, the Consumer Products & Machinery Company, Akashi Works, hosted a course on "Technical Training in Water Environment Management of Enclosed Coastal Seas" for trainees from developing nations. In the future as well, we will continue to use our technology to support international environmental protection activities.



Trainees studying at the Hyogo Works

### ■ Volunteer Cleanups

We stage volunteer cleanups primarily around our business locations, both the head office and plant. Each of the factories has a set day for a periodic cleanup along perimeter roads, such as the Hyogo Works performing this activity every second Friday of the month. The Kobe Works cleans up the beachfront in Suma, Kobe, every autumn. (There was no cleanup, however, in 1995, the year of the Great Hanshin-Awaji Earthquake.) In June, which is Environment Month, we clean up around our head office and we will continue to do so in the future as well.



Employees of the Kobe Head Office outside cleaning up

# Information Disclosure

To make more people aware of what we are doing for the environment and inform them of the latest corresponding events, we are making an aggressive effort to provide information through various types of media. We are also promoting efforts to establish an environmental accounting system to help build a system of "environmentally conscious management" as well as activities that will enable us to report on our environmental management, such as environmental investments and other information. We are intending to publish a "sustainable report" that details all corporate activities, including our environmental protection efforts.

## Providing Information

To help people of all sorts of backgrounds understand what we think about the environment and what we are doing for it, we are providing information through this report and over the Internet. We began publishing this report in 1999 and studies are underway to have each internal company publish its own environmental report in line with our medium and long term environmental vision. Also, various information on environmental aspects related to Kawasaki is released through our website under the item "Environmental Protection Activities", and you can also read past issues of this Environmental Report at that same site.

Other than releasing information over the Internet and electronic bulletin boards, we periodically publish the magazines Kawasaki (quarterly) and Environmental News (biannually) for in-house circulation.

In our efforts to establish a system of "environmentally conscious management", we have our sights set on broader goals that will turn this Environmental Report into a "sustainable report" that covers the sustainability of the entire the Kawasaki Group.

- Homepage address <http://www.khi.co.jp/earth/english/index.html>
- E-mail address [webecocenter@khi.co.jp](mailto:webecocenter@khi.co.jp)



Environmental Report

Kawasaki in-house magazine

Environmental News

## Environmental Accounting

In the same way that a financial accounting serves to put management in financial order, we are building an environmental accounting system that will enable us to make accurate investment decisions with regard to the environment. At present, we have compiled guidelines in conformity with the Environmental Accounting Guidebook released by the Ministry of the Environment, and are testing them in our internal companies. Results will be published in FY2002 and beyond.

For FY2001, we are listing "Environmental Facility Investments" and "Environmental Protection Costs". Environmental Protection Costs entails expenses for maintenance and management of environmental facilities, treatment and recycling of industrial and general waste, and research and development of products and technologies having to do with environmental protection.

### [Environmental Accounting]

(unit: million yen)

FY	1997	1998	1999	2000	2001	
A: Environmental Facility Investments	450	790	562	751	673	
B: Environmental Protection Costs	Wastewater Treatment	633	625	591	579	566
	Waste Disposal	1,112	1,043	988	928	900
	Analysis	92	74	93	194	96
	Subtotal	1,837	1,742	1,672	1,701	1,562
R&D	4,100	6,000	6,100	5,900	5,700	
Total	5,937	7,742	7,772	7,601	7,262	
C: Net Sales (billion yen)	11,001	10,069	9,447	8,508	9,146	
B/C (%)	0.54	0.77	0.82	0.89	0.79	

\*Note: The environmental protection cost includes the costs of employment, facility depreciation, consumable supplies, electricity, and contracts. Until fiscal 1997, the R&D cost was calculated based on depreciation. However, since fiscal 1998, it is calculated based on accruals.



# Environmental Management System (EMS)

Our medium and long term environmental vision targets at the building of a group-wide EMS and for internal companies to raise their level of environmental management in order for Kawasaki to establish a system of environmentally conscious management. Our next steps are to work on ISO14001 certification for subsidiaries and affiliates, and to promote the evaluation of environmental management levels at internal companies. Moreover, we will continue to upgrade environmental education activities in order to improve the awareness and knowledge of our employees in regard to environmental protection.

## Activities for Acquiring ISO14001 Certification

In FY2001, our Rolling Stock Company (Hyogo Works) and Aerospace Company (Gifu Works) obtained ISO14001 certification. This accomplished our goal of certifying all of our factories and helped us build the foundations of a group-wide EMS.

We now want to expand EMS establishment into the head office, branch offices, sales offices and affiliates and, in the future, we will broaden the scope to include overseas business locations and companies\*.

\*Kawasaki Precision Machinery (UK) Ltd. obtained ISO14001 certification in November 2001.

## Environmental Auditing

In our medium and long term environmental vision, we are aiming to develop an EMS for the entire Kawasaki group. Internal companies are also working to continually improve their own EMS, in order to raise the level of their environmental management.

Environmental auditing is necessary for improving an EMS. There are three types of audits at Kawasaki: the Environmental Management Department holds an "environmental management hearing" with each of the internal companies, each of the companies conducts its own internal environmental audit, and ISO14001 inspections are conducted by a third party organization. In an internal audit, the auditor appointed by the company makes an objective assessment based on plans of the EMS.

Environmental management hearings were first implemented in FY2001, a year the internal company system was implemented, to replace the conventional internal environmental auditing system. At these hear-

ings, the level of environmental management is assessed from progress made on the Environmental Protection Activities Plan of the internal company and on objective environmental performance data. If necessary, site inspections are made. By introducing environmental audits on these 3 levels, we are objectively evaluating our efforts and identifying areas that need improvement.



Environmental management hearing



Site inspection

## Environmental Education

We will upgrade our environmental education programs in order to enhance the environmental awareness of each individual employee and make sure that all employees correctly and thoroughly understand the environmentally conscious management system that we target in our medium and long term environmental vision.

At present, a systematic program is being imparted in the EMS of each internal company. The program imparts both general and special environmental education and training to all employees in line with our "Annual Education Plan". We also encourage employees to acquire special knowledge and licenses on environmental protection fields.

"Internal Audit Training" is provided periodically in an effort to train auditors. In FY2001, 137 persons were

certified as internal auditors after 6 training sessions. In the years from 1996 to 2001, the total has reached 933. Eventually, we will arrange persons from affiliate companies to take part in our Internal Audit Training.

[Number of Qualified Pollution Control Manager]

Air	100
Water	98
Noise	44
Vibration	29
Dioxins	3
Others (Dust, Senior Manager)	23
<b>Total</b>	<b>297</b>

[Number of Qualified Energy Manager]

Heat	22
Electricity	24
<b>Total</b>	<b>46</b>

# Environmental Performance

To improve environmental efficiency, we are promoting energy saving, the prevention of global warming, and waste reduction as the three pillars of our environmental improvement efforts. The table below indicates energy and resource input and output of our business activities by internal company. Because we are in the test stage of collecting data under the various items, some information is still lacking or not detailed. We will strive to improve our environmental data collecting and evaluating techniques and work continuously to reduce the overall environmental impact.

## ■ Environmental Data by Each Internal Company

		Performance Items*1	Units	Shipbuilding Company		Rolling Stock, Construction Machinery & Crushing Plant Company		Aerospace Company		
Environmental impact caused by input of material, energy, etc.	Material input		ton	191,981		51,519		5,855		
	Material recycle amount		ton	551		0		0		
	Electricity consumption		TJ	592	[+5%]	480	[-4%]	848	[+4%]	
	Fuel consumption		TJ	187	[+1%]	144	[-14%]	361	[-2%]	
	Total			779	[+4%]	624	[-6%]	1,209	[+2%]	
	Recycled energy consumption		TJ	0		0		0		
	Water consumption		1,000 m <sup>3</sup>	961	[0%]	594	[-10%]	3,387	[-4%]	
	Water recycle amount		1,000 m <sup>3</sup>	0		0		174		
	Recycled resource and recycled parts input		ton	0		0		0		
	Hazardous substance input		kg	777,164		1,086,938		175,341		
Rain forest wood and genetically manipulated plant input		kg	0		0		0			
Environmental impact upstream of business area	Green procurement (Stationary and office supplies)		1 mil yen	58		16		—	*3	
	Purchase of eco-labeled products		1 mil yen	58		20		—	*3	
Environmental impact caused by output of unnecessary things	Air	Greenhouse gas emission	t-CO <sub>2</sub>	38,080	[+5%]	28,053	[-11%]	60,878	[0%]	
		Ozone depleting substance emission	ODP ton	0		0		0		
		SOx emission	kg	1,776		1,513		23,358		
		NOx emission	kg	3,463		2,000		17,875		
		Dust emission	kg	601		560		2,053		
		VOCs emission	kg	147,204		59,370		176,000		
		PRTR substance emission	kg	642,751		143,202		118,927		
		SOx concentration when emitted	K value	Compliant*2		Compliant*2		Compliant*2		
		NOx concentration when emitted	K value	Compliant*2		Compliant*2		Compliant*2		
		Dust concentration when emitted	g/m <sup>3</sup> N	Compliant*2		Compliant*2		Compliant*2		
	Dioxins concentration when emitted	ng/m <sup>3</sup> N	Not applicable*4		Not applicable*4		Compliant*2			
	Concentration of emission-controlled substances when emitted (Benzene)	mg/m <sup>3</sup> N	Not applicable*4		Not applicable*4		Not applicable*4			
	Noise and vibration generation	dB	Compliant*2		Compliant*2		Compliant*2			
	Odor generation	m <sup>3</sup> /min	Compliant*2		Compliant*2		Compliant*2			
	Water quality	Total discharge		1,000 m <sup>3</sup>	562		337		2,536	
		PRTR substance discharge		kg	0		0		68	
		COD discharge		kg	Compliant*2		Compliant*2		Compliant*2	
		Nitrogen discharge		kg	12		1,911		21,230	
		Phosphorus discharge		kg	0		72		658	
	Concentration of discharge-controlled substances when discharged		mg/L	Compliant*2		Compliant*2		Compliant*2		
Waste	Total discharge of waste, etc.		ton	23,760	[+12%]	13,320	[-5%]	3,768	[+1%]	
	Reused resources		ton	566	[+25%]	0	[+6%]	0	[+15%]	
	Recycled resources		ton	19,428		11,547		1,734		
	Resources subject to thermal energy recovery		ton	570		556		772		
	Amount of waste		ton	1,938		173		561		
	Final disposal waste		ton	1,691		1,207		605		
	Specially controlled industrial waste		ton	88		88		173		
PRTR substance transfer		kg	70,119		93,226		42,248			
Environmental impact downstream of business area	Environmental impact caused by product characteristics			See p.13-14.		See p.13-14.		See p.13-14.		
	Production and sale of environmental impact-reducing products			—	*3	—	*3	—	*3	
Environmental impact caused by transport	Total transport		ton×1,000 km	920		41,157		—	*3	
	CO <sub>2</sub> emission during transport		t-CO <sub>2</sub>	73		4,157		—	*3	
	NOx emission during transport		kg	405		28,817		—	*3	
	Number of eco-vehicle introduced		unit	0		0		0		

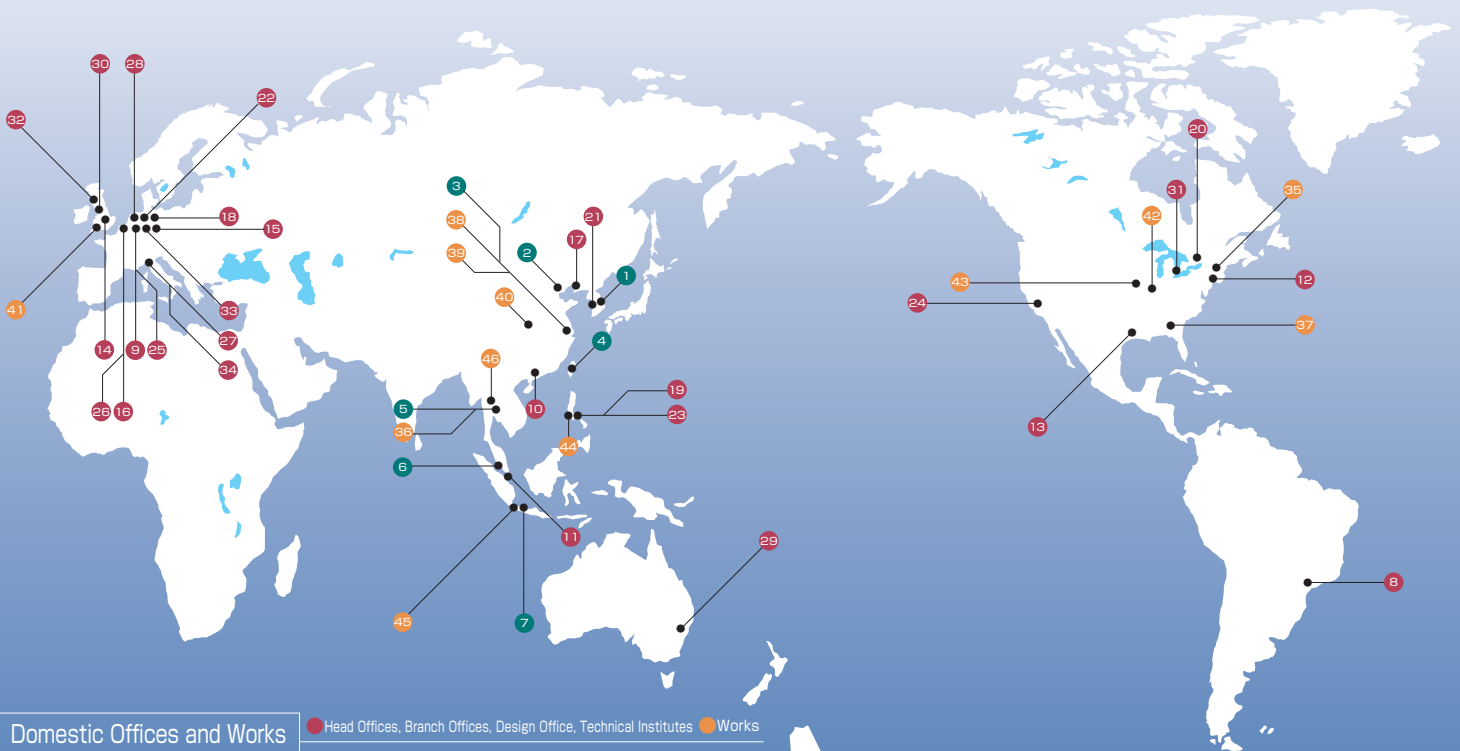
- \*1. Performance items in the table above were taken from "State of Activities for Reduction of Environmental Burden" contained in the 2000 Environmental Reporting Guidelines of the Ministry of the Environment. Environmental data is given in the horizontal direction for internal companies as well as for a single group consisting of the head office, branch offices and technical institutes.
- \*2. The discharge concentration of regulated substances and the generation of noise, vibrations and odors are listed as "Compliant" or "Not Compliant".
- \*3. "—" is used when data was unavailable. "0" means the measured data was zero.
- \*4. "Not applicable" means there were no regulated facilities that create environmental impact.
- \*5. Data in [ ] is the percentage of increase/decrease from performance data of the previous year. Provided only where last year's data was available.

Gas Turbines & Machinery Company		Plant & Infrastructure Engineering Company		Consumer Products & Machinery Company		Head Office, Branch Offices & Technical Institutes		Total	
45,527		64,031		149,990		102		509,005	
0		76		2,187		0		2,814	
644	[-8%]	203	[-1%]	912	[-11%]	113	[-7%]	3,792	[-3%]
549	[+30%]	29	[+12%]	586	[+2%]	39	[+217%]	1,896	[+8%]
1,193	[+7%]	232	[0%]	1,498	[-6%]	152	[+13%]	5,688	[0%]
0		0		0		0		0	
656	[-11%]	176	[-8%]	1,014	[-8%]	84	[-32%]	6,872	[-2%]
0		30		264		0		468	
0		40		0		28		68	
50,691		94,797		573,900		—*3		2,758,800	
0		0		0		0		0	
5		5		170		1		255	
6		5		160		6		255	
57,599	[+2%]	9,301	[0%]	62,446	[-7%]	6,966	[+30%]	263,323	[0%]
0		0		0		0		0	
10,245		0		1,192		—*3		38,084	
135,598		160		19,200		—*3		178,296	
1,493		5		501		—*3		5,213	
5,146		28,149		0		—*3		415,869	
46,722		83,337		153,002		—*3		1,187,900	
Compliant*2		Compliant*2		Compliant*2		Not applicable*4		Compliant*2	
Compliant*2		Compliant*2		Compliant*2		Not applicable*4		Compliant*2	
Compliant*2		Compliant*2		Compliant*2		Not applicable*4		Compliant*2	
Not applicable*4		Not applicable*4		Compliant*2		Not applicable*4		Compliant*2	
Not applicable*4		Not applicable*4		Not applicable*4		Not applicable*4		Not applicable*4	
Compliant*2		Compliant*2		Compliant*2		Not applicable*4		Compliant*2	
Compliant*2		Compliant*2		Compliant*2		Not applicable*4		Compliant*2	
41		106		528		—*3		4,110	
0		0		3,180		—*3		3,250	
Compliant*2		Compliant*2		Compliant*2		Compliant*2		Compliant*2	
671		277		13,603		—*3		37,704	
57		48		326		—*3		1,161	
Compliant*2		Compliant*2		Compliant*2		Compliant*2		Compliant*2	
6,717	[+9%]	5,298	[-6%]	15,084	[-12%]	145	[-30%]	68,092	[-1%]
5		0		0		0		571	
4,691	[-+31%]	4,837	[-+1%]	8,129	[-+29%]	20	[-+64%]	50,386	[-+17%]
1,112		328		1,544		115		4,998	
957		16		2,787		10		6,442	
107		63		2,062		0		5,735	
32		0		470		0		851	
3,421		7,240		25,949		0		242,200	
See p.13-14.		See p.13-14.		See p.13-14.		See p.13-14.		See p.13-14.	
—*3		—*3		—*3		—*3		—*3	
37,400,000		—*3		12,610		—*3		37,454,687	
911		174		6,487		2		11,805	
6,314		948		44,961		8		81,453	
0		0		0		0		0	

## Global Network

● Overseas office ● Overseas affiliate (sales) ● Overseas affiliate (production)

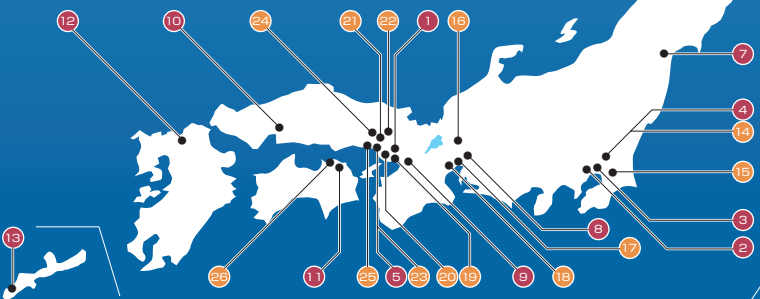
- |  |   |   |
|--|---|---|
| 1 Seoul Office   | 17 KHI (Dalian) Computer Technology Co., Ltd. | 35 Kawasaki Robotics G.m.b.H.   |
| 2 Beijing Office   | 18 Kawasaki Gas Turbine Europe G.m.b.H.       | 34 Tiesse Robot S.p.A.  |
| 3 Shanghai Office  | 19 KHI Design & Technical Service Inc.        | 35 Kawasaki Rail Car, Inc.  |
| 4 Taipei Office  | 20 Canadian Kawasaki Motors Inc.              | 36 Khitkan Co., Ltd.  |
| 5 Bangkok Office   | 21 Kawasaki Machine Systems Korea, Ltd.       | 37 Kawasaki Construction Machinery Corp. of America                   |
| 6 Kuala Lumpur Office  | 22 Kawasaki Motoren G.m.b.H.                  | 38 Nantong Cosco KHI Ship Engineering Co., Ltd.                       |
| 7 Jakarta Office   | 23 Kawasaki Motors (Phils.) Corporation       | 39 Shanghai Cosco Kawasaki Heavy Industries Steel Structure Co., Ltd. |
| 8 Kawasaki do Brasil Industria e Comércio Ltda.              | 24 Kawasaki Motors Corp., U.S.A.              | 40 Wuhan Kawasaki Marine Machinery Co., Ltd.                          |
| 9 Kawasaki Heavy Industries (Europe) B.V.                    | 25 Kawasaki Motors Europe N.V.                | 41 Kawasaki Precision Machinery (UK) Ltd.                             |
| 10 Kawasaki Heavy Industries (H.K.) Ltd.                     | 26 Kawasaki Motors France S.A.                | 42 Kawasaki Motors Manufacturing Corp., U.S.A. (Maryville Plant)      |
| 11 Kawasaki Heavy Industries (Singapore) Pte. Ltd.           | 27 Kawasaki Motors ITALY S.p.A.               | 43 Kawasaki Motors Manufacturing Corp., U.S.A. (Lincoln Plant)        |
| 12 Kawasaki Heavy Industries (U.S.A.), Inc.                  | 28 Kawasaki Motors N.V.                       | 44 Kawasaki Motors (Phils.) Corporation                               |
| 13 Kawasaki Heavy Industries (U.S.A.), Inc. (Houston Branch) | 29 Kawasaki Motors Pty. Ltd.                  | 45 P.T. Kawasaki Motor Indonesia                                      |
| 14 Kawasaki Heavy Industries (UK) Ltd.                       | 30 Kawasaki Motors (UK) Ltd.                  | 46 Kawasaki Motors Enterprise (Thailand) Co., Ltd.                    |
| 15 Kawasaki Heavy Industries G.m.b.H.                        | 31 Kawasaki Robotics (U.S.A.), Inc.           |   |
| 16 KHI Europe Finance B.V.                                   | 32 Kawasaki Robotics (UK) Ltd.                |   |



## Domestic Offices and Works

● Head Offices, Branch Offices, Design Office, Technical Institutes ● Works

- |                              |                   |                     |
|------------------------------|-------------------|---------------------|
| 1 Kobe Head Office           | 11 Shikoku Office | 21 Nishi-Kobe Works |
| 2 Tokyo Head Office          | 12 Kyushu Office  | 22 Seishin Works    |
| 3 Tokyo Design Office        | 13 Okinawa Office | 23 Akashi Works     |
| 4 Noda Technical Institute   | 14 Noda Works     | 24 Banshu Works     |
| 5 Akashi Technical Institute | 15 Yachiyo Works  | 25 Harima Works     |
| 6 Hokkaido Office            | 16 Gifu Works     | 26 Sakaide Works    |
| 7 Tohoku Office              | 17 Nagoya Works 1 |                     |
| 8 Chubu Office               | 18 Nagoya Works 2 |                     |
| 9 Kansai Office              | 19 Kobe Works     |                     |
| 10 Chugoku Office            | 20 Hyogo Works    |                     |



Contacts:

## KAWASAKI HEAVY INDUSTRIES, LTD.

Environmental Management Dept., Kobe Head Office  
 Kobe Crystal Tower, 1-3, Higashikawasaki-cho 1-chome,  
 Chuo-ku, Kobe 650-8680, Japan  
 Phone: 81-78-371-9542 Fax: 81-78-360-8700  
 Kawasaki Web Site  
<http://www.khi.co.jp/earth/english/index.html>



Printed on 100% recycled paper



Printed with aroma-free soy ink.