

# Detail Environmental Report



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# Promotion of Environmental Management

## Establishment of 2020 Environmental Vision (What Kawasaki Should Be in the Year 2020)

Manufacturing that makes the Earth smile



Under our Group Mission “Kawasaki, working as one for the good of the planet,” the KHI Group has established “Kawasaki Business Vision 2020” as well as the “2020 Environmental Vision,” which seeks to optimize our relationship to the environment in 2020 in terms of integrating environmental and business considerations. Following the Environmental Philosophy of our Environmental Charter, the 2020 Environmental Vision seeks to achieve three things: a low-carbon society, a sound material-cycle society and a society that coexists with

nature. As a foundation for these, a fourth item, “Establishment of Environmental Management Systems,” is set as basic policy with the goal of helping to build a sustainable society.

To achieve that vision, we have set out an Environmental Management Activities Plan every three years. We have set targets for the three years beginning in 2010 as our seventh Environmental Management Activities Plan period.

## Flow of Environmental Management



## Environmental Charter Established in 1999, rev. 2010

### Environmental Philosophy

Seeking to contribute to the development of society through the art of manufacturing, the Kawasaki Heavy Industries Group conducts its business activities globally as a company in key industries of the land, sea and air. We seek to achieve a low-carbon society, a sound material-cycle society and a society that coexists with nature in order to help solve global environmental problems. We contribute to the sustainable development of society through business activities attuned to the natural environment and through environmentally conscious products and services.

### 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 impact.
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 impact.
4. Kawasaki will minimize the impact of its business activities on ecosystems and proactively protect those ecosystems.
5. 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.
6. 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.
7. 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.
8. 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.

## 2020 Environmental Vision

Our products and manufacturing that use energy without waste

Manufacturing that uses resources without waste

Manufacturing that is in harmony with the global environment

Establishment of environmental management systems (EMS)



## Three Points of Entry onto the Path Toward Realization of a Sustainable Society

### Realization of a low-carbon society

Contribute to the prevention of global warming **by means of our products and manufacturing that use energy without waste.**

#### ■ Perspective on our activities

In many areas of the world, global warming appears to be driving wide-scale climate change. To address problems like these that affect our planet's sustainability, Kawasaki is working to reduce the greenhouse gas emissions associated with our business activities and providing products and services that help reduce those same emissions, thereby contributing to building a low-carbon society.

#### ■ Ideal in 2020

- (1) Reduce 2020 greenhouse gas emissions in line with national targets.
- (2) Offer customers energy-efficient products and services and reduce emissions of greenhouse gases on a planetary scale.
- (3) Promote energy conservation in production and logistics processes and reduce emissions of greenhouse gases.

### Realization of a sound material-cycle society

We **engage in manufacturing that uses resources without waste** in order to recycle and fully utilize limited resources.

#### ■ Perspective on our activities

Planetary resources to support human life are now being consumed faster than the earth can naturally replace them. Kawasaki endeavors to conduct business and develop products in order to fully use, reuse and recycle limited resources as the precious quantities they are and thereby help achieve a sound material-cycle society.

#### ■ Ideal in 2020

- (1) Practice design that uses resources effectively and work to make products lighter, more durable and more recyclable.
- (2) Practice the 3R's (reduce, reuse and recycle of waste) in production activities and achieve zero emissions at all plants.
- (3) Completely and appropriately process all PCB waste and PCB-containing devices.

### Realization of a society coexisting with nature

**Through manufacturing that is in harmony with the global environment,** we are contributing to minimization of environmental impact and conservation of the ecosystem.

#### ■ Perspective on our activities

Biological diversity sustains the ecosystems that make up our global environment. Biodiversity provides us with food and natural resources, regulates our climate, cycles materials and cleans the environment.

We will conduct business activities that lessen our burden on the environment and we will help prevent pollution and protect ecosystems through our products and technologies.

#### ■ Ideal in 2020

- (1) Offer customers products and services that prevent air and water pollution, and advance environmental improvements and ecosystem protection.
- (2) Reduce the use of chemical substances in products and production activities.
- (3) Cooperate in regional forest conservation and other activities to protect the environment of ecosystems.

## Environmental Management Activities

### Establishment of environmental management systems

Building a foundation for environmental management that will realize the 2020 Environmental Vision

#### ■ Perspective on our activities

We aim to achieve a sustainable society and to contribute to more prosperous lifestyles for the people of the world and a brighter future for the global environment through environmentally conscious business activities and Kawasaki products and services.

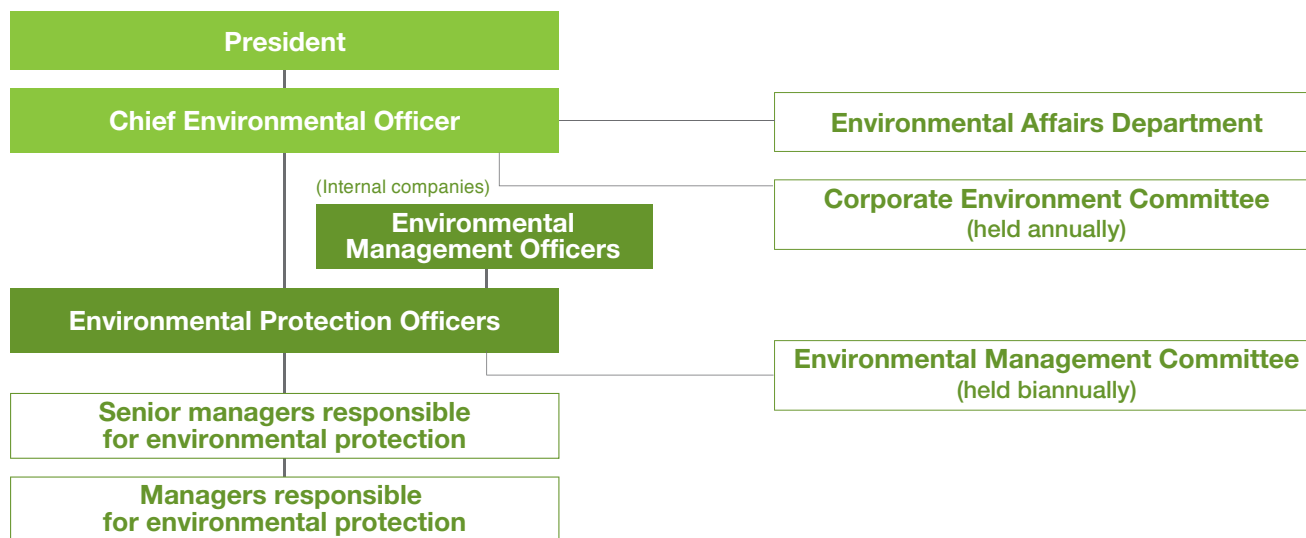
#### ■ Ideal in 2020

- (1) Have an environmental management system (EMS) in place at every consolidated subsidiary in Japan and abroad and practice environmental management throughout the Group.
- (2) Comply with environmental laws and regulations and regularly follow up on compliance status.
- (3) Communicate environmental data within and beyond the Group and maintain two-way dialogue while protecting the environment.

## Environmental Management Organization

The KHI Group appoints a Chief Environmental Officer (the director for environmental issues) and deliberates and makes decisions on a variety of important matters in its Corporate Environment Committee, which the Chief Environmental Officer chairs. We additionally appoint Environmental Management Officers, Environmental Protection Officers, senior managers responsible for

environmental protection and managers responsible for environmental protection for the organization of each internal company to allow each division to voluntarily carry out the Environmental Management Activities Plan decided on, and we establish an organizational system under which members can work together to advance environmental activities.



## Achievements and Evaluation of the Sixth Environmental Management Activities Plan

Evaluation: ◎ : Achieved ○ : Greater than 70% achieved △ : Less than 70% achieved

The Sixth Environmental Management Activities Plan (2008-09)	Activity results	Evaluation
<b>Environmental Management</b> Promotion of environmental management to increase the social trust of the Kawasaki Group		
<b>1. Follow up on environmental management plan incorporated into short-term business plan</b> ① Initiatives to reduce greenhouse gas emissions ・ Activities to reduce total amount ・ Reduce CO <sub>2</sub> basic unit (=CO <sub>2</sub> emissions per net sales) Reduce average basic unit in FY2008-2012 10% compared to FY2007 benchmark	① Activities to reduce greenhouse gas emissions ・ Activities to reduce total amount FY2009 total emissions reduced 19.3% compared to FY2008 ・ Reduced basic unit FY2009 basic unit reduced 7.7% compared to FY2008 ・ Reduced emissions by participating in domestic emissions trading system	○
② Capital investment in environmental measures to reduce environmental risk	② Capital investment in environmental measures to reduce environmental risk ・ Followed up on capital investment plans for reducing CO <sub>2</sub> , protecting the environment and reducing chemical substances	◎
③ Establish and follow through on PCB processing plan	③ Followed up on PCB processing plan execution status	○
<b>2. Environmental risk management</b>		
① Build an EMS at Kawasaki Group	① Built an EMS at Kawasaki Group ・ Built EMS at subsidiaries in Japan and major production bases overseas ・ Studied ways to increase precision of environmental data and expand range of data collected ・ Began survey of CO <sub>2</sub> emissions results at subsidiaries	○
② Manage risks by performing risk reviews of production and environmental facilities	② Identified latent risk of production and environmental facilities as based on environmental risk review	○
③ Establish environmental crisis management system	③ Established environmental crisis management system ・ Created stronger link with Group-wide crisis management system as based on our CSR framework	◎
④ Comply thoroughly with environmental laws, agreements and regulations on reporting, etc.	④ Followed up on environmental laws ・ Activities of Environmental Law and Regulation Compliance Status Review Committee	◎
<b>Environmentally Conscious Products</b> Contribute to the sustainable development of society through technologies and products conducive to environmental impact alleviation		
<b>1. Activities to reduce environmental burdens over product life cycle</b>		
① Evaluate environmental burden reductions over product life cycle (CO <sub>2</sub> , SOx, NOx, etc., at usage stage)	① Examined internal techniques for evaluating environmental burden reductions over the life cycle of major products	△
② Expand offerings of green products to reduce chemical substances ・ Establish design and procurement policies for a greener product lineup	② Publicized green products and deployed same improvements to similar products ・ Responded conscientiously to laws and regulations and promoted voluntary initiatives (RoHS, REACH, etc.)	△
<b>Environmentally Conscious Production</b> Efforts to reduce environmental burdens with production activities designed for production efficiency		
<b>1. Reduce environmental burdens in our production activities</b>		
① Activities to reduce waste emissions per unit of net sales	① Reduced emissions per net sales ・ FY2009 total emissions reduced 17% compared to FY2008	○
② Activities to reduce chemical substances ・ Reduce VOC emissions, amounts of hexavalent chromium and lead handled, etc.	② Activities to reduce chemical substances ・ FY2009 emissions of major VOCs (toluene, xylene, ethylbenzene) reduced approximately 3% compared to FY2008 ・ FY2009 amount of lead handled reduced approximately 33% compared to FY2008	△
<b>Environmental Communication</b> Efforts to improve mutual trust with stakeholders		
<b>1. Internal environmental education and awareness-raising efforts</b>		
① Operate and develop environmental education system with IT	① Expanded Group environmental education ・ Expanded environmental e-learning to subsidiaries ・ Gave training for persons without PCs	○
② Continue environmental awareness-raising initiatives for Kawasaki Group employees	② Environmental awareness-raising initiatives for Kawasaki Group employees ・ Published environmental news ・ Participated in company forest restoration program in Hyogo Prefecture	◎
<b>2. Disclose information to stakeholders</b>		
・ Fuller disclosures of environmental data ・ Active cooperation in environmental initiatives of national and local governments	・ Published Environmental and Social Report ・ Made social contributions through company's business and community activities	◎

# The Seventh Environmental Management Activities Plan and Priority Initiatives for FY2010

We have set the seventh Environmental Management Activities Plan (FY2010-2012), which starts off our 2020 Environmental Vision, and Priority Initiatives for FY2010, and are working toward realizing our vision.

## Priority Initiatives of the Seventh Environmental Management Activities Plan

### ■ Global Warming Countermeasures

We endeavor to achieve targets that are fundamentally about reducing total greenhouse gas emissions from our production activities, along with emissions per net sales to indicate our progress toward greater productivity.

### ■ Waste Reduction Initiatives

Each works pursues activities suited to its own characteristics, while the Group in total endeavors to reduce our top three waste types (metal scrap, waste oil and wood scrap), conserve resources and practice the 3R's.

### ■ Chemical Substance Reduction Initiatives

We set reduction targets at each business site for the chemical substances we are working to reduce Group-wide, namely major VOCs, dichloromethane and harmful heavy metals, and we strive to reduce these from both design and production angles.

### ■ A Foundation for Environmental Management

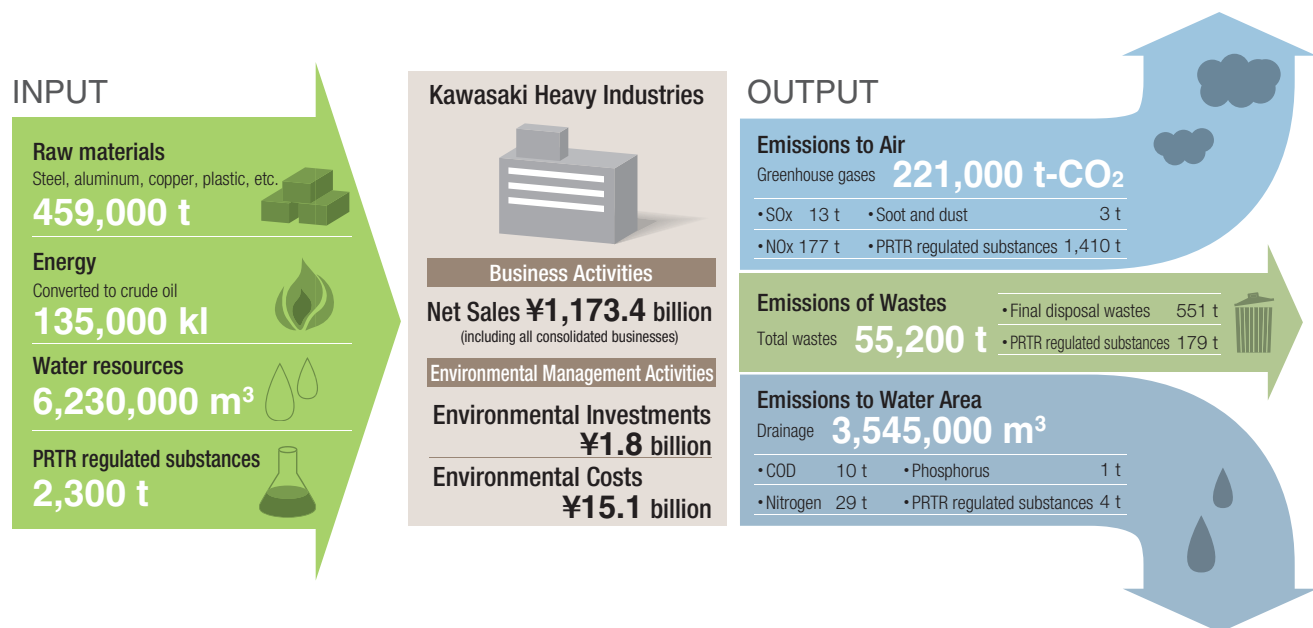
- We seek to build an environmental management system at the all-Group level.
- We practice environmental risk management and provide employee training to prevent environmental problems.

The Seventh Environmental Management Activities Plan (FY2010-2012)		Priority Initiatives for FY2010	
<b>Realization of a low-carbon society</b> Contribute to the prevention of global warming by means of our products and manufacturing that use energy without waste.		<b>Realization of a low-carbon society</b> Contribute to the prevention of global warming by means of our products and manufacturing that use energy without waste.	
Global warming prevention measures ① Reduce CO <sub>2</sub> emissions from our own production activities · Make CO <sub>2</sub> more tangible to promote energy-saving activities Group-wide · Create a verification system · Take Group-wide CO <sub>2</sub> reduction measures (energy-saving capital investment) · Promote energy savings from logistics as a specified consignor ② Acquire emissions credits with KHI Group products and technologies · Create a system to acquire emissions credits with KHI Group products and technologies in Japan and abroad (e.g., CDM) ③ Purchase emissions credits from trading market · Take measures in case we do not meet CO <sub>2</sub> reduction targets ④ Acquire emissions credits by endowment or donation <b>Group-wide target</b> By FY2012, reduce our average amount of CO <sub>2</sub> basic unit (=CO <sub>2</sub> emissions per net sales) for FY2008-2012 by 10% compared to FY2007		Global warming prevention measures ① Reduce CO <sub>2</sub> emissions from our own production activities · Make CO <sub>2</sub> emissions tangible and verifiable (inc. responding to Revised Energy Saving Law) · Take Group-wide CO <sub>2</sub> reduction measures (energy-saving capital investment) · Strengthen voluntary reduction initiatives of each department and follow through with plans ② Acquire emissions credits with KHI Group products and technologies · Give indirect support for activities of each department for reducing CO <sub>2</sub> with UN CDM program, etc. ③ Purchase emissions credits from trading market · Examine cost burden of purchasing portion of reduction targets not achieved ④ Acquire emissions credits by endowment or donation · Study forest conservation activities, use of green electric power, etc.	
<b>Realization of a sound material-cycle society</b> We engage in manufacturing that uses resources without waste in order to recycle and fully utilize limited resources.		<b>Realization of a sound material-cycle society</b> We engage in manufacturing that uses resources without waste in order to recycle and fully utilize limited resources.	
Activities to reduce total waste emissions ① Promote resource savings and 3R (reduce, reuse, recycle) ② Zero emissions activities, increasing recycling rate <b>Group-wide target</b> By FY2012, reduce waste basic unit (=waste emissions per net sales) by 12% compared to FY2002, maintain zero emissions Decide on proper treatment plan for PCB wastes and follow through		Activities to reduce total waste emissions ① Activities to reduce three substances with greatest waste emissions (metal scrap, waste oil, wood scrap) ② Promote resource savings and 3R ③ Maintain and enhance zero emissions ④ Promote implementation of electronic manifests Decide on proper treatment plan for PCB wastes and follow through ① Follow through on JESCO commissioned processing ② Follow through on processing trends and number of processed units of equipment containing low-density PCBs	
<b>Realization of a society coexisting with nature</b> Through manufacturing that is in harmony with the global environment, we are contributing to minimization of environmental impact and conservation of the ecosystem.		<b>Realization of a society coexisting with nature</b> Through manufacturing that is in harmony with the global environment, we are contributing to minimization of environmental impact and conservation of the ecosystem.	
Activities to reduce chemical substances · Set reduction targets and promote activities (both design and production initiatives) <b>Group-wide target</b> Set controlled chemical substances reduction target for FY2010-2012 compared to average for FY2003-2005 Environmental contributions through products and technologies ① Activities to reduce environmental impacts over product life cycle · Prepare foundation for performing product life cycle assessment ② Make products greener, promote environmental consciousness in products Reduce impact on and conserve biodiversity · Decide on biodiversity action guidelines and promote conservation		Activities to reduce chemical substances ① Perform critical point follow-through in departments stepping up reduction measures in seventh plan · Learn and organize usage status, clarify issues and set targets Environmental contributions through products and technologies ① Activities to reduce environmental impacts over product life cycle · Select model products and examine evaluation techniques · Report environmental contributions from products and technologies ② Make products greener · Respond thoroughly to laws and regulations (RoHS Directive, REACH Regulations, etc.) · Promote green procurement (set a green purchasing rate and take measures to achieve it) Activities to protect biodiversity ① Promote initiatives within works	
<b>Establishment of environmental management systems</b> Building a foundation for environmental management that will realize the 2020 Environmental Vision		<b>Establishment of environmental management systems</b> Building a foundation for environmental management that will realize the 2020 Environmental Vision	
Build an EMS at KHI Group <b>Group-wide target</b> Finish building EMS at consolidated subsidiaries in Japan and abroad that are key production bases by FY2012 Thoroughly comply with environmental laws and regulations · Prevent recurrence of environmental accidents, etc. Practice environmental communication · Promote environmental dialog with all stakeholders		Build an EMS at KHI Group ① Decide on and promote plan for building EMS at consolidated subsidiaries in Japan and abroad ② Collect major environmental data for entire Group (energy, waste, chemical substances, etc.) Thoroughly comply with environmental laws and regulations ① Activities of Environmental Law and Regulation Compliance Status Review Committee ② Follow up on environmental law revisions, etc., and expand Group-wide Practice environmental communication ① Awareness-raising activities for KHI Group employees (environmental education) ② Disclose environmental data within and beyond Group (issue environmental news, CSR report, etc.) ③ Company forest restoration program	

# Material Balance of Business Activities and Environmental Accounting

A summary of environmental impacts and environmental accounting in our business activities for FY2009 is as follows. In the manufacture of various products, we are making efforts to reduce the input amounts of the raw materials, energy and water that we use, as well as reduce the emissions of substances that are harmful to the environment.

## Material Balance of Business Activities for FY2009 (Summary of Environmental Impact)



## Environmental Accounting Calculations for FY2009

- These data were compiled in accordance to the Environmental Accounting Guideline released by the Ministry of the Environment.
- Coverage: Kawasaki Heavy Industries, Ltd.
- Period: April 1, 2009 to March 31, 2010

Item		Environmental Investments	Environmental Costs	Economic Effects	
Business area costs	Global warming prevention	553	1,423	Reduction of energy costs 240	
	Efficient use of resources	153	199	Reduction of materials costs 50	
	Resource recycling activities	Resource recycling activities	61	783	Income from recycling 1,004
		Waste disposal costs	9	178	Reduction of waste disposal costs 54
	Environmental risk control	747	1,134	—	
	Subtotal	1,523	3,717	1,348	
Comparisons w/ previous FY		94%	83%	61%	
Upstream/downstream costs		90	2,777	0	
Management activity costs		0	2,853	—	
R&D costs		47	5,497	—	
Social activity costs		29	199	—	
Environmental damage compensation costs		115	80	—	
Total		1,804	15,123	1,348	
Comparisons w/ previous FY		80%	107%	61%	

Item		Total
Total investments in FY2009		57,964
Total R&D costs in FY2009		36,076

Item	Proportion
Percentage of investments (Environmental investments 1,804/ Total investments 57,964)	3%
Percentage of R&D costs (Environmental R&D costs 5,497/ Total R&D costs 36,076)	15%

# Environmental Management Activities

We are striving to build an environmental management system (EMS) for the entire Kawasaki Group. In order to prevent environmental trouble from occurring, we are also making efforts to implement environmental risk management and employee education on the environment.

## Further Development of EMS

All the production bases of Kawasaki Heavy Industries in Japan have acquired ISO14001 certification. Currently, we are promoting the development of EMS at our subsidiaries in Japan and abroad, and continuing activities with the aim of establishing an EMS, including compliance with environmental laws and regulations.

Among our subsidiaries in Japan, K-TEC Corporation, Kawasaki Engineering Co., Ltd. and Fukae Powtec Co., Ltd. newly completed to develop EMS. Forty-four of 51 of these

companies completed the EMS establishment by FY2009. Of the 13 overseas companies where we are seeking to develop EMS, Wuhan Kawasaki Marine Machinery Co., Ltd. completed in FY2009. For the remaining seven companies that do not yet develop, based on local laws and regulations, we will clarify objectives according to business conditions and scale and set timeframes and otherwise implement incremental efforts for EMS development by the end of FY2009.

## Current Situations for Acquiring ISO 14001 (JIS Q 14001) Certification

### ● Kawasaki Heavy Industries

Internal Company	Date acquired	Registration
Ship & Offshore Structure Company	Kobe Works Aug. 2002	DNV
	Sakaide Works Aug. 2000	DNV
Rolling Stock CompanyA	Feb. 2002	LRQA
Aerospace Company	Feb. 2002	BSK
Gas Turbine & Machinery Company	Gas Turbine Division Mar. 2000	LRQA
	Machinery Division Dec. 2000	NK
Plant & Infrastructure Company	Nov. 1999	JICQA
Motorcycle & Engine Company (including Robot Div.*)	Feb. 2000	DNV
Precision Machinery Company	Feb. 1998	DNV

◆ LRQA: Lloyd's Register Quality Assurance, JICQA: JIC Quality Assurance, NK: Nippon Kaiji Kyokai (ClassNK), BSK: Bouei Choutatsu Kiban Seibi Kyoukai (Defense Procurement Framework Establishment Association of Japan), DNV: Det Norske Veritas

\* The Robot Division was included in the ISO 14001 certification of the Motorcycle and Engine Company but will undergo inspection for its own certification in December 2010.

### ● Subsidiaries Overseas

Oversight organization	Company	Date acquired	Registration
Ship & Offshore Structure Company	Wuhan Kawasaki Marine Machinery Co., Ltd.	Jul. 2009	DNV
	Motorcycle & Engine Company	Kawasaki Motors Manufacturing Corp. Lincoln Plant (U.S.A.) Apr. 2003	DNV
Precision Machinery Company	Kawasaki Motors Manufacturing Corp. Maryville Plant (U.S.A.) Feb. 2006	DNV	
	Kawasaki Precision Machinery (UK) Ltd. (U.K.) Nov. 2001	LRQA	
Robot	Flutek, Ltd. (South Korea) Nov. 2005	KMA	
	Kawasaki Precision Machinery (Suzhou) Ltd. (China) Dec. 2007	BSI	
	Kawasaki Robotics, Inc. (U.S.A.) Aug. 2003	DNV	

◆ DNV: Det Norske Veritas, LRQA: Lloyd's Register Quality Assurance, KMA: KMA R&A Inc., BSI: British Standards Institution

### ● Subsidiaries in Japan

Oversight organization	Company	Establishment level	Date of establishment
Head office	Kawaju Tokyo Service Corp.	3	Mar. 2009
	Kawasaki Trading Co., Ltd.	1	Dec. 2004
	Kawaju Service Co., Ltd.	1	Feb. 2000
	Kawaju Techno Service Corp.	3	Mar. 2005
	Kawasaki Life Corporation	2	Jul. 2006
	Kawasaki Hydromechanics Corp.	1	Jun. 2007
	K Career Partners Corp.	2	Mar. 2007
	Benic Solution Corp.	2	Feb. 2006
	Kawasaki Machine Systems, Ltd.	1	Mar. 2000
	KCM Corporation	1	May 2000
Ship & Offshore Structure	Akashi Ship Model Basin Co., Ltd.	3	Mar. 2008
	Kawasaki Techno Wave Co., Ltd.	1	Aug. 2000
	Kawaju Kobe Support Co., Ltd.	2	Dec. 2005
	Kawaju Marine Engineering Co., Ltd.	1	Mar. 2008
	KHI JPS Co., Ltd.	3	Mar. 2008
	Kawasaki Shipbuilding Inspection Co., Ltd.	2	Apr. 2008
Rolling Stock	Alna Yusoki-Yohin Co., Ltd.	1	Nov. 2008
	EarthTechnica M&S Co., Ltd.	1	Sep. 2000
	Kawasaki Rolling Stock Component Co., Ltd.	1	Aug. 2002
	Kawasaki Rolling Stock Technology Co., Ltd.	1	Aug. 2002
	Kansai Engineering Co., Ltd.	3	Aug. 2002
	Kawaju Hyogo Service Co., Ltd.	3	Aug. 2002

Level 1 Acquire ISO14001 certification or its equivalent

Level 2 Acquire simplified EMS certification

Level 3 Self-declaration of EMS establishment

Oversight organization	Company	Establishment level	Date of establishment
Rolling Stock	EarthTechnica Co., Ltd.	1	Sep. 2000
	Nichijo Manufacturing Co., Ltd.	3	Oct. 2005
	Fukae Powtec Co., Ltd.	3	Mar. 2010
	Nisseki Service Consultant Co., Ltd.	2	Oct. 2005
Aerospace	Kawaju Gifu Engineering Co., Ltd.	1	Feb. 2002
	Kawaju Gifu Service Co., Ltd.	1	Feb. 2002
	KGM (Kawaju Gifu Manufacturing) Co., Ltd.	1	Feb. 2002
Gas Turbine	NIPPI Corporation	1	Dec. 2006
	Kawaju Akashi Engineering Co., Ltd.	1	Mar. 2000
Machinery	Kawasaki Thermal Engineering Co., Ltd.	1	Apr. 2002
	Kawasaki Prime Mover Engineering Co., Ltd.	1	Dec. 2002
Plant & Infrastructure	Kawasaki Naval Engine Service, Ltd.	1	Dec. 2002
	Kawasaki Engineering Co., Ltd.	3	Oct. 2009
	K-GEES Co., Ltd.	1	Dec. 2003
	KEE Environmental Service, Ltd.	1	Jun. 2002
	Kawaju Steel Work & Engineering Co., Ltd.	3	Jun. 2006
	Kawaju Facilitatech Co., Ltd.	2	Jul. 2007
Motorcycle & Engine	K-GES Co., Ltd.	1	Jan. 2006
	Kawasaki Oita Manufacturing Co., Ltd.	3	Apr. 2008
	Kawasaki Motors Corporation Japan	1	Feb. 2008
	K-TEC Corporation	3	Dec. 2009
	Union Precision Die Co., Ltd.	1	Jul. 2006



## Compliance with Laws & Regulations

In FY2009, there were no violations (Judicial/Administrative Penalties [1](#), Administrative Measures [2](#) or Administrative Warnings [3](#)), accidents or citizen complaints at any KHI works.

- [1](#) Judicial/Administrative Penalties: Punishment by judicial or administrative authorities
- [2](#) Administrative Measures: Receiving instructions for improvements, etc., in written form
- [3](#) Administrative Warnings: Receiving verbal directives concerning business practices

### ● Violations and Accidents during the Past 5 Years

FY	2005	2006	2007	2008	2009
Judicial/Administrative Penalties	1	0	0	0	0
Administrative Measures	1	0	0	1	0
Administrative Warnings	0	6	4	3	0
Complaints from residents	3	1	2	4	0

## Risk Management

### Responding to the administrative measures for exceeding nitrogen oxide emission standards

Our Akashi Works received a written remonstrance from Hyogo Prefecture for exceeding the nitrogen oxide emission standards of the Air Pollution Control Law and environmental conservation agreements.

We exceeded standards even as we were seeking to further advance our efforts for pollution prevention. In order to assure that it never occurs again, we established an investigation committee that included outside experts and other third-party members. This committee examined the

### Activities of Environmental Law and Regulation Compliance Status Review Committee

Prompted by an environmental violation at the Akashi Works in February 2009, we set up an Environmental Law and Regulation Compliance Status Review Committee, which did on-site studies of compliance with environmental laws and regulations at all 11 works of Kawasaki Heavy Industries in FY2009.

This has helped to eliminate the causes of environmental accidents and citizen complaints and there were no violations in our workplaces in FY2009.

causes and deliberated countermeasures to prevent recurrence. In addition, we established a companywide committee to investigate the status of compliance with environmental laws and regulations. They conducted on-site inspections of every company plant and promoted recurrence prevention countermeasures simultaneously throughout the company.

We will continue to strive to make our compliance with laws and regulations even more certain by implementing these countermeasures to prevent recurrence of such an incident.

## Education

### E-learning/Education for persons without PCs

We completed our PC-based environmental education (Environmental E-learning) for affiliated companies in April 2010 (attended by about 5,500 persons, an attendance rate of 92%). For the KHI Group as a whole in Japan domestic area, about 17,000 persons have taken the training (final attendance rate of 95%), and we have finished training in the Group over a period of two years.

Over the two years since FY2008, we have also given environmental education to about 3,700 production workers, such as site workers who cannot easily take PC-based E-learning, with an attendance rate of 49%.

### Raising Awareness about the Environment

We are conducting publicity activities with the goal of raising the environmental awareness of every individual employee.

We are conducting these awareness-raising activities continuously to promote conduct that is considerate of the environment not only in the workplace, but also in local communities and households.



"Message from the President" about environmental management



Environmental News (released 4 times a year)



"Eco Mind" in our Group magazine "Kawasaki"

### Cultivating Qualified Managers

In order to enhance our environmental management efforts, we are also focusing on the cultivation of individuals who have legal qualifications required by laws and regulations related to the environment.

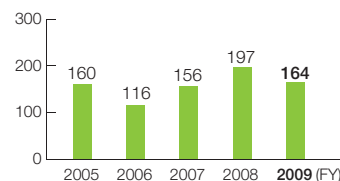
#### ● Number of Qualified Pollution Control Managers

Air	71
Water	73
Noise, Vibration	44
Others	22
Total	210

#### ● Number of Qualified Energy Managers

Energy Managers	52
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#### ● Number of Newly Registered ISO 14001 Auditors



# Achieving a Sustainable Society


Due to changes in the forms of our business, the results of our efforts for energy saving, global warming prevention, waste reduction and chemical substances reduction have become difficult to evaluate. From this year, we will analyze the effects of our activities using a basic unit (e.g. environmental aspect per net sales) as a typical index in order to promote effective measures based on these results.

## Measures to Prevent Global Warming

We “contribute to the prevention of global warming by means of our products and manufacturing that use energy without waste” as we work to achieve a low-carbon society.

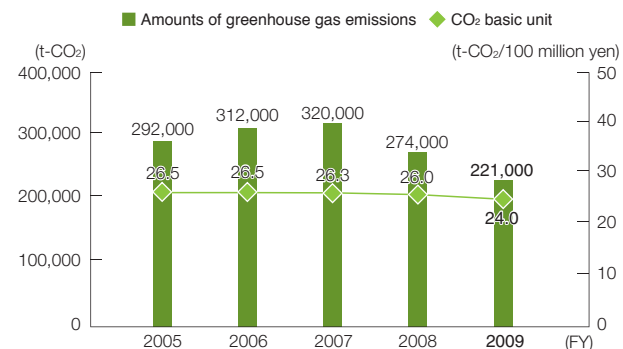
### ① Reduce 2020 greenhouse gas emissions in line with national targets.

One of our basic goals is to reduce total emissions of greenhouse gases that occur from our own production activities, but to make sure our improvements also increase productivity, we have established a basic unit target as well, and use these two indicators to reduce emissions.

We are pursuing activities with a target of reducing average CO<sub>2</sub> basic unit  in FY2008-2012 10% compared to FY2007 as the reference year. Our target for FY2020 is still under consideration, but we plan to make it coincide with the Japanese government's target level.

 A value found by dividing CO<sub>2</sub> emissions by net sales

### ● Amounts of Greenhouse Gas Emissions (CO<sub>2</sub> equivalent)

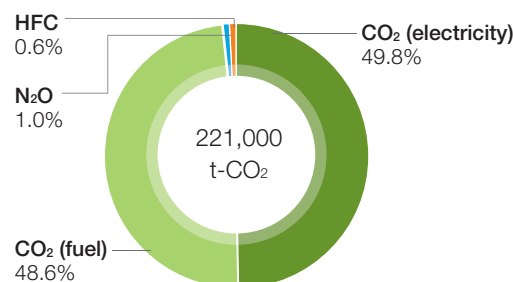


· Electricity conversion factors used herein were specified by power utility companies. (Electricity conversion factor for FY2008 was used to compute those of FY2009.)  
 · CO<sub>2</sub> emissions from ship testing on the water have been separately managed from CO<sub>2</sub> emissions at our works since FY2009.

#### Emissions Results

- Our greenhouse gas emissions in FY2009 declined in both total emissions and emissions per net sales compared to reference year FY2007, but we need to make further reductions to reach our target of 10% lower basic unit.
- The large-scale reduction in total emissions in FY2009 occurred partly because of CO<sub>2</sub> savings that resulted from energy conservation capital investment and operating improvements, but also because of changes in the scope of data collection after a company split and a review of CO<sub>2</sub> emissions sources at production bases.

### ● Breakdown of Greenhouse Gas Emissions (FY2009)



### ② Offer customers energy-efficient products and services and reduce emissions of greenhouse gases on a planetary scale.

As a manufacturer of energy and environmental products and transportation systems that help reduce CO<sub>2</sub>, we seek to boost global warming countermeasures through our products and services.

#### Topic

We work to reduce our own CO<sub>2</sub> through capital investment and productivity increases, and are examining the use of credits for CO<sub>2</sub> reductions from our products and technologies to make up for any shortfalls toward our targets. Specifically, we participate in the domestic credit program as a joint reductions business, seeking to acquire domestic credits involving KHI Group products and technologies.

### ③ Promote energy conservation in production and logistics processes and reduce emissions of greenhouse gases.

We adhere closely to the Law Concerning the Rational Use of Energy and other relevant laws and aim to reduce greenhouse gas emissions throughout our products' life cycles.

We are undertaking global warming countermeasures that combine reductions of greenhouse gases from our production activities with reductions through products and services, as mentioned above, and also the use of CO<sub>2</sub> credits yielded by our products and technologies.

## Waste Reduction Activities

Among our efforts for waste reduction, we are promoting the reuse and recycling of waste oil. We are also continuing to advance our “zero emissions” efforts in which we seek to recycle 100% of the waste emitted from our works without simple incineration or disposal as landfill. In addition to efforts that suit the characteristics of each works, we are also undertaking the “zero emissions” efforts as shared measures at every plant.

### Common activities at all works

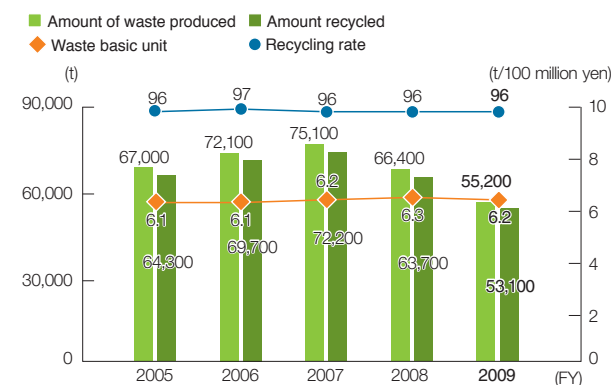
- Activities to reduce three substances with greatest waste emissions (metal scrap, waste oil, wood scrap)
- Promote resource savings, 3Rs
- Maintain and enhance zero emissions
- Promote implementation of electronic manifests

As a result of these efforts, our recycling rate in FY2009 reached 96%, which was the same as in FY2008. Due to the decrease in production volume because of the changing economic conditions and other factors, the total amount of waste that we produced declined, resulting in a reduction of

about 17% from the record of the previous fiscal year to about 55,200 tons.

Moreover, our basic unit (i.e. waste emissions per net sales) was 6.2 points, which is 0.1 point improvement from FY2008. We set FY2002 as reference year for the basic unit, and are striving to achieve our target, 20% improvement in FY2020 from FY2002.

### Amount of Waste Produced and Recycling Rate



## Efforts for Reducing Chemical Substances

As part of our efforts for reducing chemical substances, we are working to realize reduction targets set at every division for major VOC, dichloromethane and heavy metals. Nearly every division is working to reduce major VOC, hexavalent chromium and lead. The status of those efforts is outlined below.

### [Major VOC]

Concerning major VOC, while it is important to reduce VOC from painting processes, there are few low-VOC paints that perform adequately, some users designate specific paints to use, and paint requirements change according to international standards, making it difficult to reduce usage. Our efforts in FY2009 included closely controlling paint thickness and expanding the use of water-based or high-solid paints, but our VOC emissions were about the same as the previous year.

### [Hexavalent Chromium]

Through efforts to use chrome-free paint, some divisions were able to eliminate the use of hexavalent chromium, or plan to do so. However, hexavalent chromium is often used in special surfacing processes, and while we are trying to implement technologies that do not use hexavalent chromium and are making progress at replacing it, the amount handled actually increased over the previous year.

### [Lead]

Lead is often found in paint, so our efforts have focused on switching to lead-free paint. Some divisions have eliminated lead use, or plan to, and the amount handled decreased from the previous year.

The seventh plan, which began in FY2010, contains the basic policy of driving down the use of chemical substances under control to the absolute minimum (as a rule, totally eliminating heavy metals) by FY2020. This policy will guide our further reduction activities.

### Amounts of Chemicals Subject to Reduction Handled and Emitted (t/year)

Substance		FY2009	Increase or decrease from FY2008
Major VOC	Toluene	305	-7.0%
	Xylene	719	-5.4%
	Ethylbenzene	324	+7.6%
	Total	1,348	-3.0%
Heavy metals	Dichloromethane	51	+2.0%
	Hexavalent chromium	22	+10.0%
	Lead	2.4	-33.3%
	Cadmium	0.12	0%

· Amount of major VOC and dichloromethane is the amount emitted, while that of heavy metals is the amount handled.

# Consideration for the Environment in Our Products

## Main Efforts of the KHI Group

The KHI Group believes that one of the pillars of our Group Mission is to contribute to the environment through our products. We will make thorough efforts in implementing product assessments and complying to overseas laws and regulations and voluntary regulations in industry, and will continue to promote consideration for the environment in our products in the entire KHI Group.

### Implementing Product Assessment

For newly developed and designed products, as well as for particularly important products, we implement product assessment for resources conservation, energy saving, and recycling with the goal of reducing the environmental impacts of products during their lifecycles.

Because specific evaluation techniques vary depending on the type of product, each division draws up "Product Assessment Rules," enabling responses suitable for the characteristics of its products.

Main evaluation items of product assessment are as shown right.

- 1 Product weight reduction
- 2 Product energy saving
- 3 Longer product life
- 4 Product safety and environmental conservation effectiveness
- 5 Measures for product disposal and recycling
- 6 Environmental impacts when problems or other extraordinary circumstances occur
- 7 Provision of information for use and maintenance
- 8 Compliance with regulations

### Responding to the ELV Directive <sup>1</sup>, the RoHS Directive <sup>2</sup> and the REACH Regulation <sup>3</sup>

Since 2000, the ELV Directive, the RoHS Directive and the REACH Regulation have strengthened laws and regulations related to chemical substances in the EU. The RoHS Directive covers electrical and electronic equipment, so some of the products made by our Precision Machinery Company has met the directive. The ELV Directive covers automobiles, but excludes motorcycles. The Motorcycle & Engine Company, however, is participating in the voluntary efforts of JAMA <sup>4</sup>, and Precision Machinery Company is also applying the directive to some of its products.

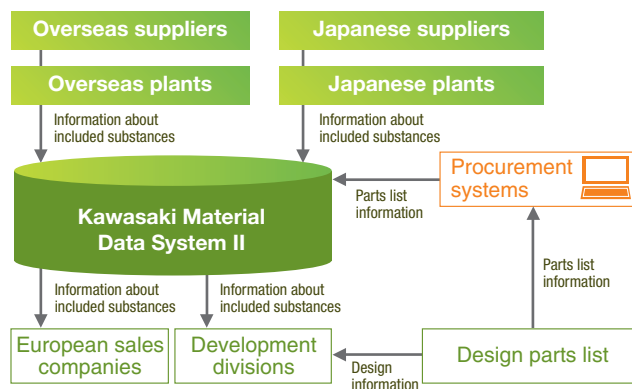
The REACH Regulation came into force in June 2007, and it applies to all chemical substances manufactured in or imported into the EU. Businesses that manufacture or import chemical substances in quantities of one ton or more are required to register and report those substances.

Our products are mainly articles and only a limited number of them are need to be registered. However, substances that are emitted intentionally or those of very high concern that may cause cancer must be registered and filed. In addition, there are regulations related to evaluation, authorization, restriction and communication of information, so it is necessary to have a system to determine information about the chemical substances included in our products throughout our entire supply chain.

The Rolling Stock Company, Motorcycle & Engine Company and Precision Machinery Company practice "green

procurement" (see p. 26 of booklet version) and respond to requests to determine chemical substance information, and the Motorcycle & Engine Company has created the KMDS II system <sup>5</sup> to collect data about chemical substances and respond to REACH and other chemical substance regulations.

#### ● Response to REACH in the Motorcycle & Engine Company



<sup>1</sup> ELV Directive: End of Life Vehicles Directive

<sup>2</sup> RoHS Directive: Directive on Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment

<sup>3</sup> REACH Regulation: Regulation on Registration, Evaluation, Authorisation and Restriction of Chemicals

<sup>4</sup> JAMA: Japan Automobile Manufacturers Association

<sup>5</sup> KMDS II: Kawasaki Material Data System II

## Efforts of the Motorcycle & Engine Company

### Cleaning Exhaust Gas

As in the year before, in FY2009 we continued to clean the exhaust from motorcycles sold in Japan, making exhaust system improvements to conform with 2007 domestic emissions regulations. During the year, we launched the VULCAN 900 Classic, a large-displacement cruiser model with exceptional environmental performance.

In addition to an electronically controlled fuel injection system, the model has an O<sub>2</sub> sensor, which detects the density of oxygen in emissions to precisely control how much fuel is injected. The result is the optimal air/fuel ratio for the catalyst to function efficiently. The honeycomb catalyst also has a larger capacity, which enhances cleaning of harmful substances contained in emissions.



VULCAN 900 Classic

We also launched sales of the KLX125 and D-TRACKER 125 for beginning riders and riders of larger motorcycles looking for a second bike. These air-cooled, single-cylinder bikes bring fuel injection to the 125 cc and below class, achieving strong fuel economy and high enough environmental performance to meet domestic emissions regulations in effect since FY2007.

### Promotion of 3Rs

Since October 2004, we have been steadily operating an autonomous motorcycle recycling system in cooperation with three other motorcycle manufacturers and 12 importers in Japan. Using this system, we have achieved a recycling rate of 87.6% in its sixth fiscal year (weight basis; calculated based on the treatment results at 14 recycling facilities).

Furthermore, for our new models of motorcycles, we are endeavoring to consider design for environment, including reducing materials and recycling, from the development phase. We conduct preliminary evaluations of our efforts related to reducing, recycling and reusing (3Rs) at the beginning of each of the design, prototyping and mass-production stages. In particular, through the use of materials that are easy to recycle, we are seeking to increase recyclability, and have achieved a potential recycling rate of over 90% for every model, with the majority of models scoring over 95%. This potential recycling rate was calculated based on The Guidelines for Definition and Calculation Method on the Recyclability Rate for New Vehicles (1998 JAMA).

### Elimination and Reduction of Environmental Substances of Concern

For new motorcycles sold in Japan, we have already been achieving the voluntary reduction targets established by JAMA. In addition, we have also achieved the voluntary reduction targets for older motorcycle models that we have continued selling.

#### ● Japan Automobile Manufacturers Association "Reduction targets for environmental substances of concern" for new vehicles

Substance	Reduction target
Lead <sup>1)</sup>	Use 60 g or less in and after January 2006 (for 210 kg weight vehicle)
Mercury	Use prohibited in and after October 2004 (Exception for the use of minute quantities in parts that are necessary for traffic safety <sup>2)</sup> )
Hexavalent chromium	Use prohibited in and after January 2008
Cadmium	Use prohibited in and after January 2007

<sup>1)</sup> Used batteries are already recycled and excluded from the target values

<sup>2)</sup> Combination lamps, discharge headlamps, etc.

For general purpose engines, JET SKI® watercraft, there are no Japanese regulations like the JAMA voluntary reduction targets, but we are making elimination and reduction efforts that follow those applied for motorcycles, and we had achieved voluntary reduction targets for lead, mercury and cadmium by FY2007. Hexavalent chromium had been contained in a very small amount of parts, but we completed its elimination in FY2008.

# Environmentally Conscious Products

## Transportation-Related Products

In the rolling stock field, we manufacture a wide range of products, including Shinkansen bullet trains, express trains, commuter trains, subway trains, freight trains and locomotives. Among our environmental measures, we are enhancing energy efficiency during operation and reducing the noise of high-speed rolling stock through technological cooperation with our clients and proprietary Kawasaki's own technologies.

We also contribute to the advancement of the world's aircraft by jointly developing and manufacturing fuselages and jet engines with leading European and American enterprises.

In our shipbuilding business, starting with LNG carriers and LPG carriers, we are developing and building a variety of products, including container ships, bulk carriers and crude oil tankers. In response to the demand for increased fuel efficiency, we are working to develop technologies for optimizing hull forms and increasing the efficiency of propulsion systems.

## 1 Environmental Measures for Shinkansen Series E5, Japan's Fastest Train

In December 2010, Tohoku Shinkansen will extend service to Shin-Aomori, with the new series E5 high-speed Shinkansen debuting in March 2011. Kawasaki participated in the E5 development project led by East Japan Railway Company. We last year manufactured and delivered five of the 10 cars of the prototype train, including the driving car, and are currently manufacturing production cars. To accommodate the nation's fastest revenue service speed of 320 km/h, the driving car has a long, 15-m nose to reduce noise while going through tunnels (tunnel boom). The train also reduces body aerodynamic sound, lowers bogie noise and uses low-noise pantographs among other leading-edge noise countermeasures. We also improved energy efficiency through electricity regeneration, lighter bodies and diminished air resistance.



E5 driving car

Energy saving

Low noise

## 2 Boeing 787 Dreamliner, next-generation mid-sized airliner, had successful maiden flight

### Fuel efficiency boosted 20%

Boeing's next-generation mid-sized airliner, the Boeing 787 Dreamliner, had a successful maiden flight in December 2009. Kawasaki took part in developing and manufacturing the plane as a partner in the international collaborative development, taking charge of the forward fuselage (which uses advanced composite materials), the main landing gear wheel well and main wing fixed trailing edges. Moreover, we have been involved in the development and manufacture of the Rolls-Royce Trent 1000 fuel-efficient low-noise engine used on the aircraft. The Boeing 787 has 20% greater fuel efficiency than existing aircraft of the same class, thanks to the use of the Trent 1000 fuel-efficient engine and a significantly lighter body owing to a single-piece molded fuselage made of advanced composite materials, a first for a large aircraft.



Maiden flight of Boeing 787 Dreamliner

High fuel efficiency  
(20% improvement)

Low noise

## 3 Energy-Saving Technology for Large Bulk Carrier

We have developed a 180,000-DWT type bulk carrier with one of the largest capacities in a vessel allowed to enter the Port of Dunkirk in France. Fuel consumption has been reduced by improving propulsion with a two-stroke fuel-efficient main diesel engine, a high-efficiency propeller, and the latest technologies like a semi-duct system with contra fins and Kawasaki's rudder bulb with fins developed by Kawasaki to control flow around the propeller. The carrier has double-hull fuel tanks and electrical deck machinery to prevent marine pollution. As of June 2010, four such vessels have been delivered to customers since the delivery of the first, the *Cape Canary*, in November 2009.



Semi-duct system with contra fins



Large bulk carrier *Cape Canary*

High fuel efficiency

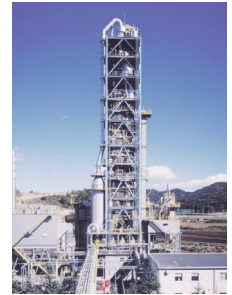
Marine pollution prevention

## Industrial Plant and Equipment

We are offering around the world a variety of products that support the foundations of industry, including, large-scale plants for cement, chemicals and nonferrous metals, and industrial equipment such as steam turbines, aerodynamic machinery and other prime movers, as well as industrial robots, hydraulic equipment, and other civil engineering machinery. The field of plant and industrial equipment constantly requires not only high performance but also lesser environmental impact, such as energy and resource conservation and more compact sizing. We continue to develop new products with advanced technologies to meet these needs.

## 4 Compact, Energy-Saving Fluidized Bed Cement Kiln System

We have developed a fluidized bed cement kiln system that is completely different from the conventional rotary kiln system used in cement production processes. The excellent combustion efficiency, high heat transfer coefficient and low radiation area are among the characteristics of a fluidized bed process, resulting in 10-25% lower heat consumption rate than conventional systems. Combustion takes place at low temperatures, reducing NOx emissions by 40% or more. And since the equipment can be set vertically, it has a footprint about 70% smaller, allowing for compact installations and lower facility costs. With no moving parts, the machinery and refractory last longer, saving resources and cutting operating and maintenance costs.



Fluidized bed cement kiln system

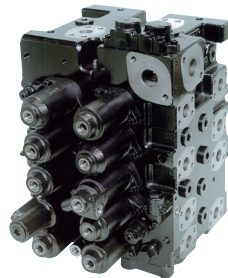
**Energy saving**  
(10-25% improvement)

**Resource saving**  
(compact, long life)

**Low NOx**  
(40% reduction)

## 5 Energy-Saving Control Valve/ Realizing Fuel-Efficient Excavator

We develop and manufacture pumps, motors and miscellaneous pilot valves and control valves to control actuators for excavators. Control valves comprehensively control the action of each actuator in an excavator, and the hydraulic oil main conduit and pilot conduit have a complex configuration. We successfully developed an energy-saving control valve by revising the conduit configuration and optimizing conduit form through fluid analysis, which resulted in a 20-60% decrease in pressure loss in each conduit. Cutting pressure loss in hydraulic systems like this helps excavators to run more fuel-efficiently.



Energy-saving control valve KMX15

**Energy saving**

**Resource saving**  
(compact)

## 6 KEEP-D5000 Hydraulic Press Acquires MF Eco Machine Certification

We have announced the KEEP-D5000 hydraulic press as an environmentally conscious product. This product is the first hydraulic press to earn certification under the MF Eco Machine Certification System established by the Japan Forming Machinery Association. It conserves energy by using servo valve control, which optimally controls the flow rate of hydraulic oil, cutting energy consumption by 43% when under load. Resources are also conserved, as the press itself is more compact and 26% lighter, and 50% less hydraulic oil is used. We will continue to mitigate environmental impacts and improve work environments by developing environmentally conscious products like this.



KEEP-D5000 hydraulic press

Kawasaki Hydromechanics Corporation

**Energy saving**  
(43% improvement)

**Resource saving**  
(compact, reduced hydraulic oil)

# Environmental Solution Products

## Energy-Related Products

We have numerous high-performance products, including gas turbines, gas engines and various types of boilers, and we are providing a range of energy systems that incorporate these products to locations around the world. We are also working on renewable energy technologies (woody biomass power generation, photovoltaic power generation, small-scale hydraulic power generation, etc.) and clean energy technologies (hydrogen and LNG facilities, etc.).

### CO<sub>2</sub> emissions reduction effect from major energy-related products (products delivered in FY2009)

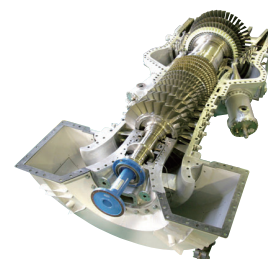
[1,000 t-CO<sub>2</sub>/year]

Field	CO <sub>2</sub> emissions reduction effect	Major products
High-efficiency power generation/effective use of energy	120	Gas turbine cogeneration system, etc.
Use of exhaust heat and exhaust energy	203	Waste heat recovery power generation (WHRPG) in cement plant, top pressure recovery turbine (TRT) system, etc.
Total	323	—

- ① The manual of the Law Concerning the Promotion of Measures to Cope with Global Warming was consulted to set CO<sub>2</sub> emission factor for electricity, heat, fuel, etc.
- ② All energy derived from the use of disposed energy was counted as part of the CO<sub>2</sub> reduction effect.

## 1 M7A-03 Gas Turbine for Highest Level of Energy Efficiency in the World

Development of the M7 gas turbine began in 1992 with the M7A-01, followed in 2007 by the 7,000 kW-class M7A-03, which provides world-leading efficiency of 33% on the generating end (and overall efficiency of 82% using heat exhaust). To clean up the turbine's gas emissions, we equipped it with a newly developed DLE combustors in 2009. The combustors mix fuel with air to thin it before combustion, helping to achieve the world's lowest NO<sub>x</sub> emissions of 15 ppm (O<sub>2</sub> = 15%). With this performance, the M7A-03 gas turbine can deeply reduce emissions of CO<sub>2</sub> and NO<sub>x</sub>. As of June 2010, we have taken orders for or delivered more than ten units.



The new DLE combustor won a Technology Award from the Gas Turbine Society of Japan.

High-efficiency energy use  
(82% efficiency)

Low NO<sub>x</sub>  
(15 ppm)

Interior of M7A-03 gas turbine

## 2 Binary Power Generation System Begins Proving Tests at Kobe Works

### Uses heat exhaust from independent power generation facility running on Kawasaki Green Gas Engine

A small binary power generation system (250 kW) developed by Kawasaki began proving operation in May 2010, using heat exhaust from an independent power generation facility utilizing a 5,000 kW-class Kawasaki Green Gas Engine installed at the Kobe Works. A binary power generation system is an energy conserving system that recovers energy from previously unused lower-temperature heat sources, such as heated effluent and exhaust gas, to run turbine generators and create electric power. Because it uses substitute fluorocarbons with low global warming potential and ensures that heat exchangers work at high performance, the compact system is eco-friendly and efficient.



Kawasaki Green Gas Engine



Binary power generation system

High-efficiency energy use

Use of unutilized energy

## 3 Delivery of Sakaide LNG\* Terminal with One of World's Largest Above-ground Tanks

### Shikoku Electric Power cuts CO<sub>2</sub> annual emissions by 500,000 tons

In March 2010, we completed the Sakaide LNG Terminal, the first terminal in Shikoku to accommodate large LNG carriers. It has since begun operating to supply Shikoku Electric Power. We took the order and built the entire facility on a full turnkey basis. With a capacity of 180,000 m<sup>3</sup>, the terminal's LNG tank is one of the largest above-ground LNG tanks in the world. LNG is stored at about -160°C, and its natural daily boil-off rate of no more than about 0.05% is a particularly excellent property. It is also a clean fuel, causing low CO<sub>2</sub> emissions. Shikoku Electric Power is introducing the use of LNG in two of its four power generation facilities and expects to cut CO<sub>2</sub> emissions by about 500,000 tons, about 5% of its annual total.

\* LNG: Liquefied natural gas



Sakaide LNG Terminal

Clean energy technology



## 4 High-Efficiency Ifrit-Beat Drumless Water Tube Boiler

### Development of World's First 10:1 Turndown\* Control System

We have developed the world's first Drumless Water Tube Boiler with a 10:1 turndown control system that greatly increases the range of adjustable load with continuous combustion in the Ifrit-Beat lineup of gas-fired Drumless Water Tube Boiler. The system controls burner combustion to one-tenth of the maximum firing rate to enable the boiler to keep firing without turning off, resulting in up to 13% lower fuel consumption and CO<sub>2</sub> emissions than boilers currently in use. An optional exhaust O<sub>2</sub> concentration control system makes further boiler efficiency improvements possible by ensuring that combustion is always at the optimal air-fuel ratio.

Kawasaki Thermal Engineering Co., Ltd.

High-efficiency energy use  
13% improvement

The Ifrit series won a Technology Award from the Japan Gas Association in FY2009.

\* Turndown: A ratio between a burner's maximum and minimum firing rates that can be controlled



Ifrit-Beat Drumless Water Tube Boiler

## Waste Treatment and Environmental Pollution Prevention Products

We began developing waste treatment technologies early on, and we currently have various such technologies for treating urban refuse, including stoker-type furnaces, fluidized bed gasification and melting furnaces and direct gasification and melting furnaces. We have delivered leading-edge waste treatment systems all over Japan, and are also providing various types of industrial waste incineration systems (for power generation).

To prevent pollution, we have worked with a number of technologies to protect and improve air and water quality. We have addressed boiler and other combustion gases since the 1970s by developing flue gas de-SO<sub>x</sub> systems, and have delivered a number of these in Japan and abroad, where they are improving air quality.

## 5 Advanced Refuse Incineration Plant Delivered to Hirakata City, Osaka Prefecture

We delivered a state-of-the-art refuse incineration plant with capacity of 240 t/day to Hirakata City, Osaka Prefecture. Aiming to achieve the world's highest standards for mitigating environmental impact, this facility consists of refuse incineration system using the advanced stoker-type furnace, together with a fuel-type ash melting system and other equipment. The plant is also equipped with a steam turbine with output of 4,500 kW that utilizes heat from incineration to generate power, which is then used to operate plant facilities or sold to the power company. The plant furthermore reduces environmental impacts by meeting strict standards for dioxins, exhaust gas, effluent emissions and leachate from fly ash and other sources.

Waste power generation

Reduced environmental impacts



Refuse incineration plant (Hirakata City, Osaka Prefecture)

## 6 Flue Gas De-SO<sub>x</sub> Systems Utilized in Japan and Abroad

Flue Gas De-SO<sub>x</sub> Systems remove sulfur oxides from the exhaust gas emitted by power generation boilers and various types of industrial boilers for the purpose of preventing air pollution. We have accumulated over 30 years of research and improvements to complete the development of technologies that offer high performance, outstanding energy-saving and reliability. Kawasaki has delivered 37 flue gas de-SO<sub>x</sub> plants to various industries and electric power companies in Japan and 56 plants abroad, including China, Southeast Asia and Europe. We also supply technologies abroad. In recent years, we have developed compact absorption towers for industrial boilers and otherwise created plants that save energy and resources while ensuring excellent reliability and easy maintenance.

Air quality improvement



Flue gas de-SO<sub>x</sub> system (Saudi Arabia)