Environmental Contribution Through Products

Product Assessment

For newly developed and designed products, as well as for particularly important products, Kawasaki assesses products according to such criteria as resource and energy savings and recycling potential, with the goal of reducing the environmental impact of our products during their life cycles. Because specific evaluation techniques vary depending on the type of product, each business segment draws up product assessment rules appropriate to the characteristics of the respective product. The main evaluation items of product assessment are shown below.

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

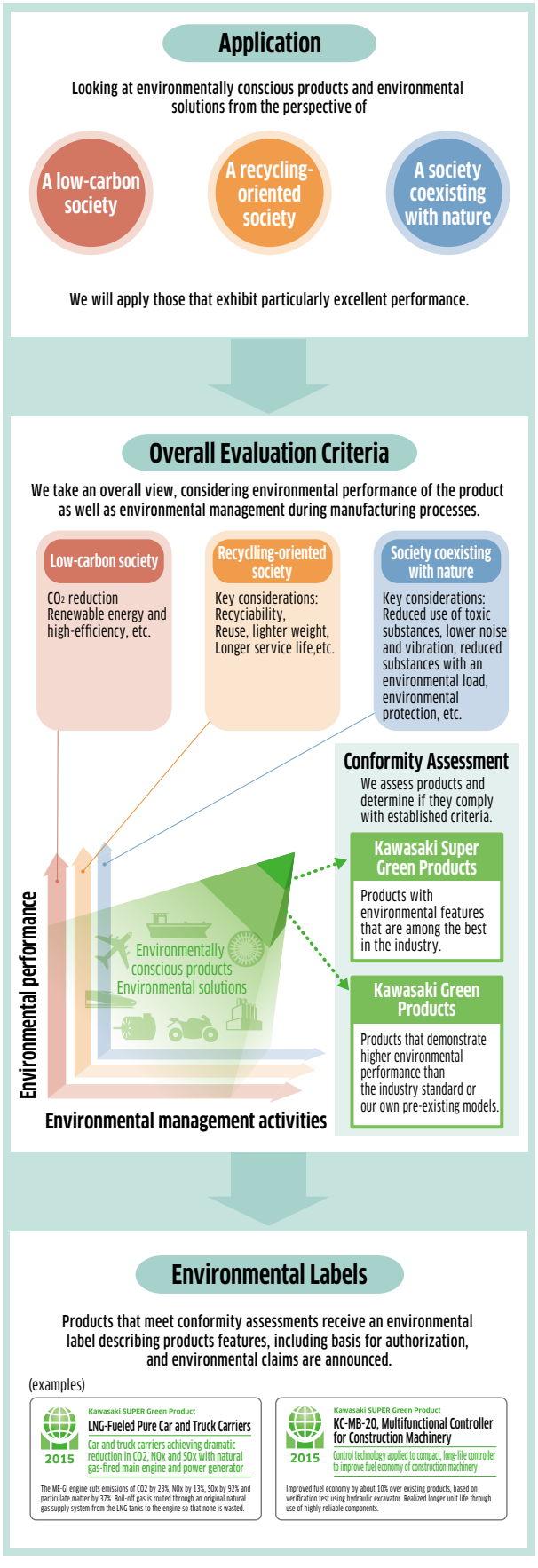
Kawasaki Green Product Promotion Activity

To realize our Group Mission: "Kawasaki, working as one for the good of the planet," we will draw on high-level, comprehensive technological capabilities over the Kawasaki Group's extensive range of business pursuits to create new value for coexisting with nature and building a brighter, more comfortable future for generations to come. Just recently, we launched Kawasaki-brand Green Products, a program in support of the Group Mission objective and through which we will boost the environmental performance of products and accelerate the reduction of environmental impact caused by associated manufacturing processes. The products selected for this program must meet self-established criteria and are categorized as either Kawasaki Green Products or Kawasaki Super Green Products. The products are then labeled compliant with ISO 14021, and the list is made public.

Kawasaki Green Product Promotion Activity Program logo

The program logo embodies Kawasaki's commitment to environmental sustainability through products and manufacturing. The three pillars in the logo represent our primary business areas—land, sea and air transport systems, energy and environmental engineering, and industrial equipment—and the innovative and advanced technological capabilities in these respective areas form a firm foundation for these pillars, which together support the global environment.

Conformity Assessment Process



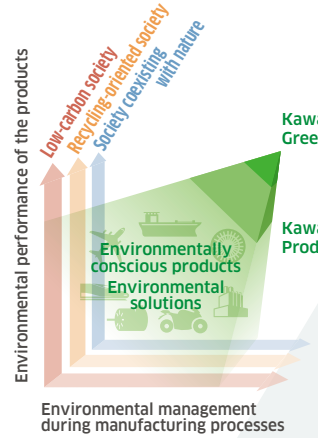
Kawasaki-brand Green Products Lessen Environmental Impact

Kawasaki Green Product Promotion Activity

Kawasaki's approach to environmental issues, such as global warming and energy use and availability, is to lessen environmental impact through its products, and toward this end, the Company has supported a program, Kawasaki Green Product Promotion Activity, to address these issues, since 2014. Registered products receive an ISO 14021-compliant environmental label certifying that they are environment-friendly.

The Select "Second Set" of Kawasaki-brand Green Products

Kawasaki selected 11 products in 2015 to be in the second set of Kawasaki-brand Green Products. Kawasaki-brand Green Products are assessed for their contribution to the realization of a low-carbon society, a recycling-oriented society, and a society that coexists with nature, as well as conforming to established criteria, from two perspectives—environmental performance of the product and environmental management during manufacturing processes. We will continue to provide customers with Kawasaki-brand Green Products, boasting superior environmental performance.



■**Kawasaki Super Green Products:** Products with some of the most outstanding environmental features in the industry.

■**Kawasaki Green Products:** Products with environmental features that exceed either the industry standard for environmental performance or the level reached by pre-existing models of our products.


LNG Fueled Pure Car and Truck Carriers


efWING


Straight Tube LED Lamps for Rail Cars


KC-MB-20, Multifunctional Controller for Construction Machinery

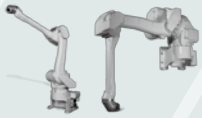

Ninja H2


Versys 650
Versys 1000

Pick Up!

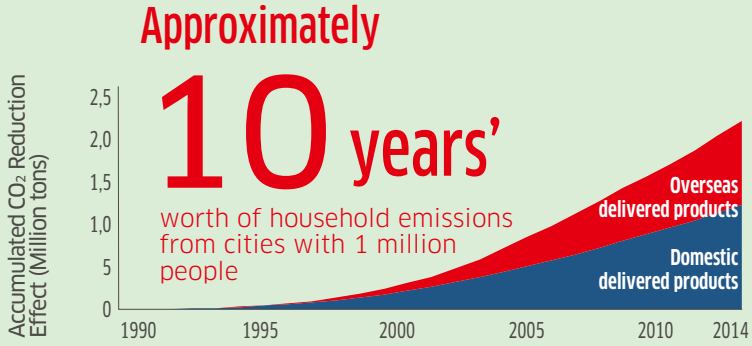

M7A-03D Gas Turbine


KAWASAKI ECO SERVO


Painting Robot KJ264/314

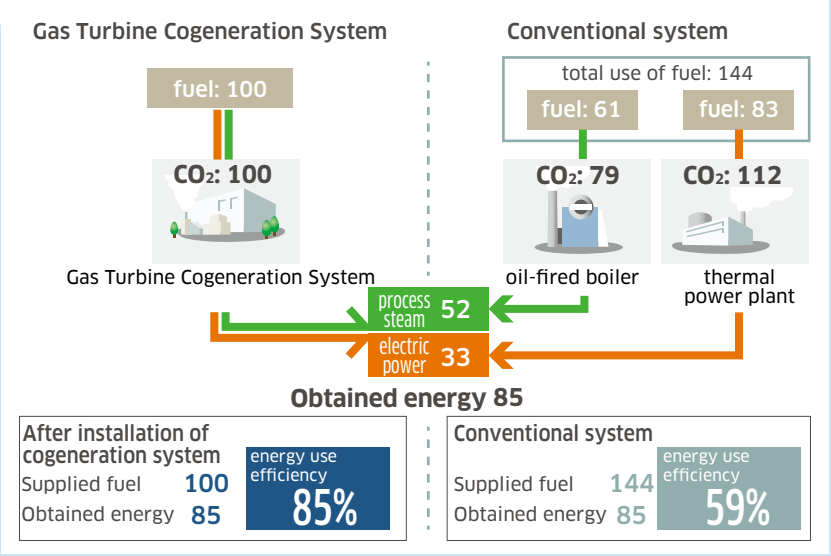

Clean Robot NT420

CO_2 Reduction Effect Using Gas Turbine Cogeneration System



The use of Kawasaki gas turbine cogeneration systems significantly reduces the amount of CO_2 released into the atmosphere, and the CO_2 reduction effect based on actual deliveries of gas turbine cogeneration systems since 1989 is about 23 million tons—equivalent to approximately 10 years of CO_2 emitted in Japan from households in cities with one million people.

What is a Gas Turbine Cogeneration System?



A gas turbine cogeneration system produces electricity with a generator using a gas turbine as its main driver and utiliged the heat for additional applications, such as air conditioning, hot water, and factory heating, which derives the most efficient use of supplied energy. Cogeneration systems have also been designated by the government, which will lead to wider use of these systems as distributed energy systems using natural gas.

Photo provided by:
Toray Industries, Inc., Okazaki Plant

M7A-03D Gas Turbine Domestic Delivery (Customer Comment)

Electricity and steam obtained from the gas turbine cogeneration system that was installed at the factory are used on the production floor. Since the system was installed, we have achieved an annual reduction effect of about 12,000kl, on a crude oil equivalent basis, compared with the use of existing boiler (gas- and heavy oil-fired) facilities. Converted to CO_2, that works out to about 30,000 tons per year, equivalent to emissions from around 5,600 typical households in Japan. In addition, the system has contributed to overall plant energy savings of about 22%.

Utility Section, Engineering Department, Okazaki Plant, Toray Industries, Inc.

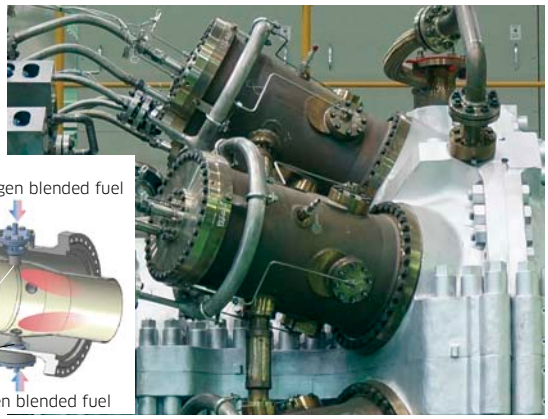
* Estimated annual CO_2 emissions from a single-family household are 5,270kg-CO_2. Source: Greenhouse Gas Inventory Office of Japan

Development of Hydrogen Gas Turbine Technology to Further Reduce CO_2 Emissions

Hydrogen-fired gas turbine combustion technology

Hydrogen is characterized by its fast rate of combustion and because of this, when used with conventional gas turbines, it is problematic, generating higher NOx, exhibiting unstable combustion, and causing burner scaling. Seeking to solve these issues, Kawasaki has been working on the development of hydrogen combustion technology, which would make it possible to burn hydrogen-enriched natural gas in volumes from 0% to up to 100% (hydrogen only). Repeated combustion simulations and verification tests have been made at RWTH Aachen University in Germany with Kawasaki gas turbines, on the road to establishing proprietary hydrogen-fired gas turbine technology.

(Kawasaki welcomed the start of demonstration testing for a low-NOx, mixed hydrogen and gas-driven gas turbine system, commencing at its Akashi Works in May 2015.)



Combustor facilitating hydrogen-blend combustion

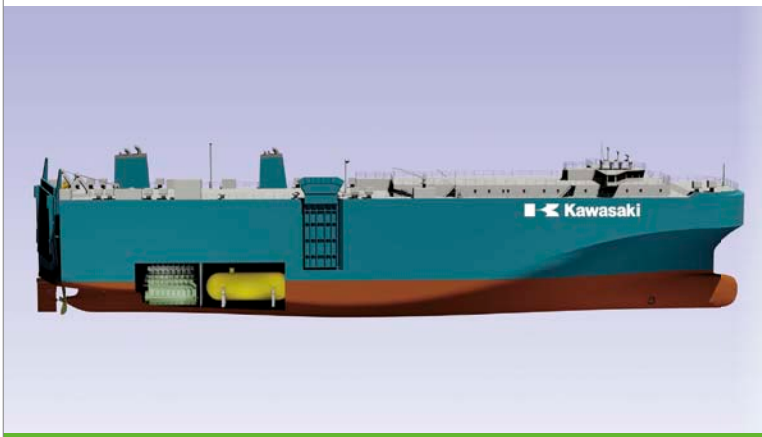
The second set of Kawasaki-brand Green Products

2015

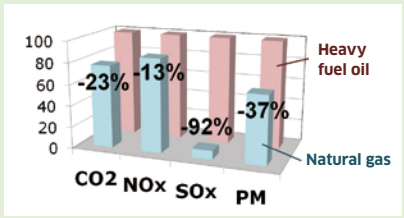
Kawasaki SUPER Green Product

LNG-Fueled Pure Car and Truck Carriers

Pure car and truck carriers achieving dramatic reduction in CO_2, NOx and SOx with natural gas-fueled main engine and power generator



The ME-GI engine cuts emissions of CO_2 by 23%, NOx by 13%, SOx by 92% and particulate matter by 37%. Boil-off gas is fully utilized through newly developed fuel gas supply system.



Product Description

A 3,800-vehicle pure car and truck carrier equipped with dual-fuel 2-stroke diesel engine (ME-GI), dual-fuel diesel generator (DFD) and dual-fuel auxiliary boiler—a world first for a pure car and truck carrier.

Special Features

- ME-GI engine cuts emissions of CO_2 by 23%, NOx by 13%, SOx by 92% and particulate matter by 37%, compared with conventional oil-fired main engines
- Optimizes propulsion performance at low speeds and cuts propulsion power at low speeds by about 3%
- LNG fuel system that effectively utilizes boil-off gas, reducing overall weight of system, including tanks, by about 15%

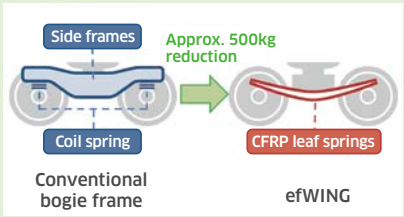
2015

Kawasaki SUPER Green Product

efWING

Reduced power consumption and improved ride stability with world's first use of lightweight CFRP leaf springs in a bogie

Weight reduction of about one ton per car lowers running costs, such as electricity and maintenance expenses, and cuts CO_2 emissions. Noise and vibration are also minimized.



Product Description

A next-generation rolling stock bogie, the efWING features the world's first application of CFRP (carbon fiber reinforced plastic) in a bogie frame and also integrates the function of coil spring suspension into the enhanced frame design

Special Features

- Dramatic reduction in weight (about 500kg per bogie compared with existing bogies), which leads to lower running costs
- Enhanced safety and ride comfort
  (Running test performed at Transportation Technology Center, Inc., in the United States, with confirmed improvement in safety)
- Lighter weight reduces load on tracks, which then minimizes incidence of track irregularity, vibration and noise

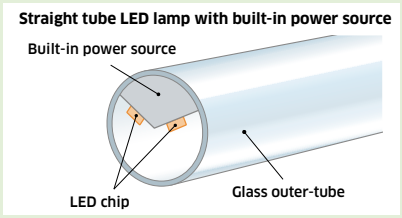
2015

Kawasaki SUPER Green Product

Straight Tube LED Lamps for Rail Cars

LED lamp with built-in power source for rail cars curbs power consumption and equipment weight

Compared with fluorescent lamps, including ballast, these lamps cut power consumption by 55% and weigh 75% less. Conversion to LED limits waste since LED lamps are suitable for existing fluorescent lamp fixtures.



Product Description

Designed specifically for rail cars, these straight LED lamps feature a built-in power source, making it particularly easy to switch from existing rail car fluorescent lamps

Special Features

- Weigh about 49% less, compared with LED lamps that have a separately attached power device
- Switch to LED lamps using existing fluorescent lamp fixtures is possible during remodeling of existing rail cars, and installation of LED lamp will not necessitate removal/disposal of the existing lamp fixtures
- Emergency lamps (DC power source) will go out in a two-stage process (fully illuminated → semi-lit → off), accompanying the voltage drop that occurs when a rail car cannot operate normally (on battery power), and lighting time will be extended * Patented

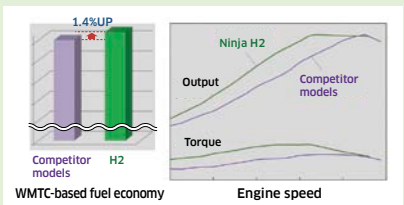
2015

Kawasaki SUPER Green Product

Ninja H2

World's ultimate performance motorcycle, delivering outstanding power capabilities with low fuel consumption

Boasting a supercharged mass-produced motorcycle engine designed, in-house—a world first for a motorcycle—the Ninja H2 delivers outstanding power. But its fuel economy, based on the Worldwide Motorcycle Test Cycle (WMTC), is still one of the best among competitor models. In addition, emissions contain reduced levels of CO, total hydrocarbons (THC) and NOx.



A supercharged engine that delivers both power and fuel economy

Product Description

The biggest feature of the Ninja H2, developed through combined expertise in engine and body technologies within the KHI Group to offer riders an unprecedented sensory experience, is its supercharged mass-produced motorcycle engine using a highly efficient supercharger designed in-house

Special Features

Compared with competitor models in the same output class

- Excellent WMTC-based fuel economy
- Supercharged engine delivers intense acceleration and response
- New style of frame offers lightweight solution that transfers the power of the high-performance engine to the road with nothing lost
- Excellent aerodynamically designed body for riding stability

2015

Kawasaki Green Product

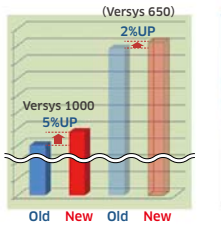
Versys 1000/(650)

Touring performance and comfort with improved fuel economy and reduction in regulated exhaust emission substances

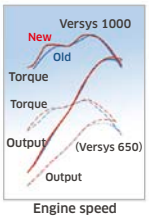
Versys 1000

(Versys 650)

Output is 2% higher than the 2012 model (up 9% for the 650), and WMTC-based fuel economy is 5% better (up 2% for the 650). Levels of CO, THC and NOx emissions are dramatically lower.



WMTC-based fuel economy



Engine speed
Output characteristics

Product Description

Sharing similar features, the Versys 1000 and 650 are ideal motorcycles for touring, delivering better fuel economy through a model change along with dramatic reduction in regulated exhaust emission substances, and showcasing a sporty design with excellent performance and comfort

Special Features

Compared with Kawasaki predecessor model

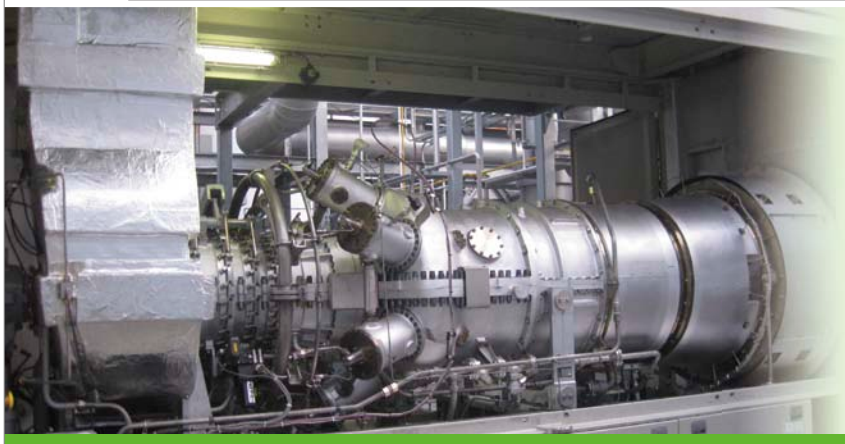
- WMTC-based fuel economy is 5% better (up 2% for the 650)
- CO_2 emissions down 5% (down 2% for the 650)
- Levels of CO, THC and NOx emissions are nearly 50% less
- Output is 2% higher (up 9% for the 650)

2015

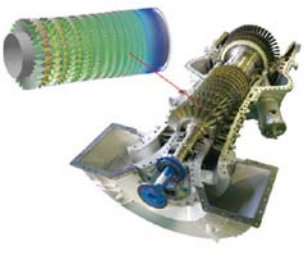
Kawasaki SUPER Green Product

M7A-03D Gas Turbine

Delivers world's highest total efficiency level in its class, and low-NOx performance



Optimized compressor, turbine and combustor design yield top-class total thermal efficiency of 85.2% and a guaranteed NOx value of 15ppm (O_2 = 15%).



Product Description

With high reliability and excellent economic and environmental efficiency, the M7A-03D is a power-generating gas turbine for world cogeneration systems in the 8MW class

Special Features

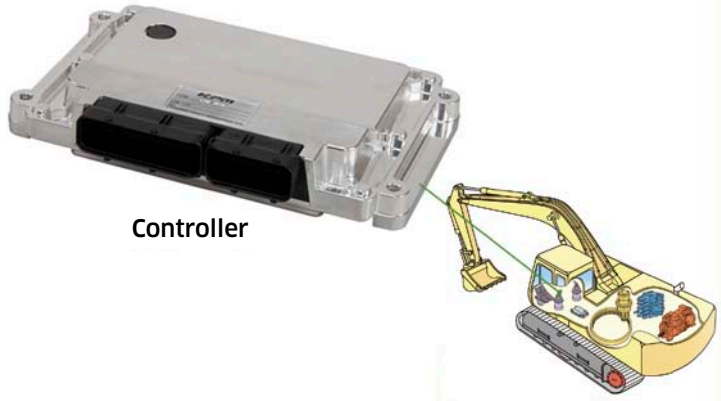
- Improved efficiency, through aerodynamically optimized design for compressor and turbine, underpins top efficiency level in its class
- Boasts world's highest total thermal efficiency level in its power class, thanks to higher exhaust gas energy
- Improved combustion burner and flow chamber geometry push NOx level down, contributing to its environmental performance as one of the industry's leaders

Kawasaki Green Product

2015

KC-MB-20, Multifunctional Controller for Construction Machinery

Compact & long-life controller that applies control technology to reduce fuel consumption in construction machinery.



Improved fuel economy by about 10% over existing products, based on verification test using hydraulic excavator. Realized longer unit life through use of highly reliable components

Item	KC-MB-20	Existing product
Operating temperature range	-40 to 85 degrees C	-30 to 75 degrees C
Lightning surge	2000V	1000V
Transient voltage (power surge)	173V 350ms x 10 pulses	173V 350ms x 1 pulse
Control program	Newest logic (upgrade) + Customizable functions	Newest logic
Size	169 x 245mm	196 x 250mm

Product Description

Controls hydraulic equipment to prevent engine from being overworked and maximizes system capabilities, thereby contributing significantly to enhanced features and performance of construction machinery, including hydraulic excavators

Special Features

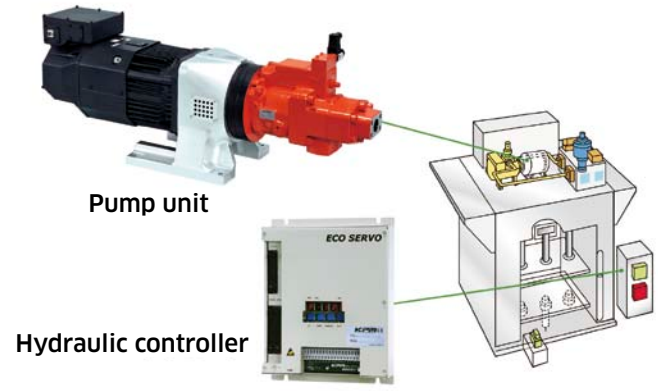
- Improved fuel economy of excavator achieved with application of new engine, pump and valve control logic
- 15% smaller than existing products
- Longer life: Durable, highly reliable design suited to environments where construction machinery is used

Kawasaki SUPER Green Product

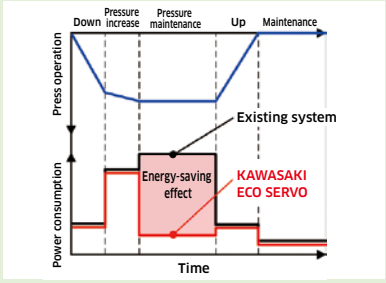
2015

KAWASAKI ECO SERVO

Electro-hydraulic hybrid system realizing industry's top energy saving and reduced noise.



Speed control by K3VL high-efficiency pump, achieving 40% energy savings as compared with the existing system.
System is made more compact by reduction in heat value.



Product Description

Electro-hydraulic hybrid system delivering energy savings and reduced noise by controlling speed of hydraulic pump, the pressure source of the hydraulic-drive system, in response to required power.

Special Features

- Industry leader in energy savings: Speed controlled by K3VL high-efficiency pump
- Reduced noise: Introduced the housing to restrain the propagation of pump vibration.
- Simple configuration contributes to improved maintainability.
- System is made more compact and lighter by reduction in heat value.

2015

Kawasaki SUPER Green Product

Painting Robot KJ264/314

The most lightweight, streamlined and compact robots in their class

Realizing a 54% reduction in body mass compared with existing models, these lighter robots achieve a decrease of more than 20% in power consumption. The arms, with high-density placement capability, contribute to smaller paint booth dimensions. The robots reduce the consumption of energy used for air intake and exhaust in the paint booth.

Product Description

With industry-leading lightweight and slim profile features, these explosion-proof robots are used across many manufacturing sectors, including the automotive industry

Special Features

- Industry's most lightweight body mass per payload capability
- Reduced arm weight cuts power consumption by more than 20% compared with existing models
- Offers space-saving advantages, thanks to integrated treatment of painting cables inside the structure and arm body with slim profile
- Can be placed on the factory floor or shelf- or wall-mounted
- KJ314 has seven axes for greater degree of movement (interference avoidance)

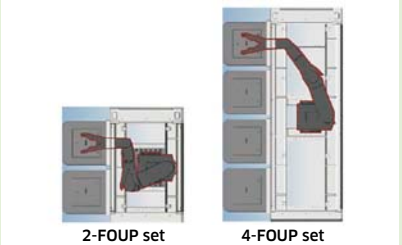
2015

Kawasaki SUPER Green Product

Clean Robot NT420

Industry-leading compact, lightweight clean robot for high-speed, high-precision wafer-handling operations

With wide motion range eliminating the need for a traverse unit, this robot is one of the most compact, lightweight units in the industry and cuts energy consumption by about 40% over existing models. It also reduces shipping and packaging volume by 75% over existing models.



Product Description

Featuring a highly rigid gear train developed in-house, this robot delivers high-speed, high-precision wafer handling, with ability to access two to four Front Opening Unified Pods

Special Features

- Boasts exceptional reach and eliminates the need for a traverse unit, taking the top spot in the industry in terms of compact size and light weight
- Thanks to a gear train that delivers high power transmission efficiency and a design that does not require a traverse unit, power consumption per transfer length is about 40% less than that of existing models

Topics

Approach by the Motorcycle & Engine Company

Cleaner Exhaust Gas

In fiscal 2015, we continued to tackle technologies that make exhaust from motorcycles cleaner, from a world standard perspective, and launched sales of the VERSYS 1000, matching the appeal of a multipurpose model with high environmental performance and practical features. The VERSYS 1000 conforms to European emission standards, thanks to improvements in the air intake and exhaust systems. Within the air intake system, the electronic fuel injection system is equipped with dual throttle valves[*1] for precise fuel control, accommodating all types of riding conditions. This ensures superior engine performance while producing cleaner exhaust gas.

VERSYS 1000 (overseas model)

*1 Dual throttle valve: a device that achieves optimal control of air intake volume through coordination between an electronically operated throttle and a manually operated throttle.

Promoting the 3Rs

Since October 2004, we have operated an independent motorcycle recycling system in cooperation with three other motorcycle manufacturers and 12 importers in Japan. In fiscal 2015, we achieved a recycling rate of 97.3%. Since October 2011, the user burden of recycling costs has become completely free of charge.

For new-model motorcycles, we emphasize environmentally conscious designs highlighting reduced materials and more recycling, right from the development phase. We conduct preliminary evaluations of efforts related to the 3Rs—reduce, reuse and recycle—before commencing design, prototyping and mass production phases. In particular, we seek to increase recyclability through greater use of materials that are easy to recycle and we have achieved a potential recycling rate exceeding 90% on every model, with most models exceeding 95%. This potential recycling rate was calculated based on the Guidelines for Definition and Calculation Method on the Recyclability Rate for New Vehicles (1998 Japan Automobile Manufacturers Association).

Reducing and Eliminating Environmental Substances of Concern

For new-model motorcycles sold in Japan, we already meet the voluntary targets of reduced environmental substances of concern (lead, mercury, hexavalent chromium and cadmium) set by the Japan Automobile Manufacturers Association, and we have also achieved voluntary targets for older models still being sold.

For general-purpose engines and JET SKI watercraft, there are no Japanese regulations such as the JAMA voluntary reduction targets, but we are making elimination and reduction efforts that follow those applied to motorcycles, and we had achieved voluntary reduction targets for lead, mercury and cadmium by fiscal 2008. Hexavalent chromium had been contained to a very small amount, but we completed its elimination in fiscal 2009.