

Environment-Conscious Products and Environmental-Solution Products

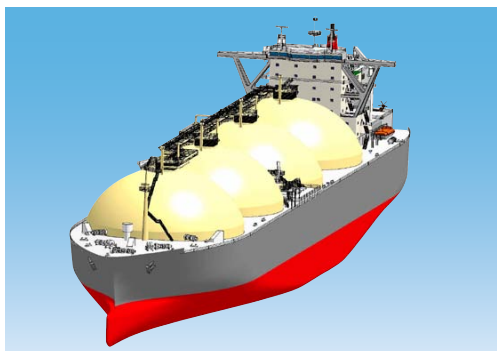
Among KHI's major business fields are transportation systems, energy and environmental engineering, and industrial equipment. Through these business fields, we deliver products endowed with high energy efficiency and environmental performance to the Japanese and overseas markets. In addition to environmentally conscious products that emphasize energy-saving, resource-saving, noise control, and similar issues, here we present examples of environmental-solution products, which are high-performance products related to various forms of energy supply, waste treatment, and prevention of environmental pollution.

Order received for newly developed LNG carrier: an improvement of more than 25% in transport efficiency with vessels able to navigate the New Panama Canal

The LNG* carrier for which the order was received is the largest-size Moss tank LNG* carrier, which has a flexible range of applicability, can pass through the New Panama Canal (due for completion in 2015), and can also berth at the world's major LNG terminals.

The vessel has expanded its cargo tank capacity to approximately 164,700m³, while the main engine, an improved version of the energy-saving reheat steam turbine plant taken into service in 2011, offers an improvement in transport efficiency of 25% or more. The tank's thermal insulation performance has also been improved to achieve the world's lowest rate of boil-off (natural vaporization of LNG) at 0.08% per day. This means that gas generated naturally during marine navigation can be used with no wastage as fuel to provide propulsion power to the ship, making this a vessel with excellent levels of energy-saving and economy.

*LNG: Liquefied natural gas



Newly developed LNG carrier

Energy saving

Fuel efficiency

Launch of Series E6 Shinkansen rolling stock with a bold new color design

On March 16, 2013, the new Series E6 of high-speed rolling stock was launched on JR East's Tohoku and Akita Shinkansen (bullet train) lines. KHI was involved from the initial stage in the development project for this rolling stock, which is used mainly on Super Komachi services. In addition to the design and manufacture, KHI was placed in charge of the interior and exterior finish design, taking on the role of a design company for the first time. Like the earlier launched Series E5, the Series E6 model can operate at a maximum speed of 320 km/h. Its long-nosed front shaping reduces "micropressure waves," while the adoption of Inter-car fairings, sound-absorbing panels, a bogie shroud, and other features reduces noise and achieves additional improvements in environmental performance. Efforts were also devoted to realize lighter weight, which also contributes to improved energy-saving characteristics.



Shinkansen rolling stock Series E6

Energy saving

Environmental load reduction

Railway battery power system delivered to Tokyo Monorail Co., Ltd.

The GIGACELL high-capacity nickel-metal hydride battery developed by KHI is capable of high-speed charging and discharging and swift control response, and is distinguished by its high electric power storage capacity. By developing a battery power system (BPS) for rail networks that make the most of GIGACELL's characteristics, KHI has contributed significantly to promoting energy saving and CO₂ reduction in the railway sector. By accumulating and storing the electric power generated when the train brakes, and recycling it, this energy storage system maximizes energy-saving benefit. In fiscal 2013, the system was delivered to Tokyo Monorail Co., Ltd., which, among other features, evaluated highly the system's ability to operate trains during power outages. Tokyo Monorail plans additional BPS installation in fiscal 2014, and the system is gradually building an operational track record.



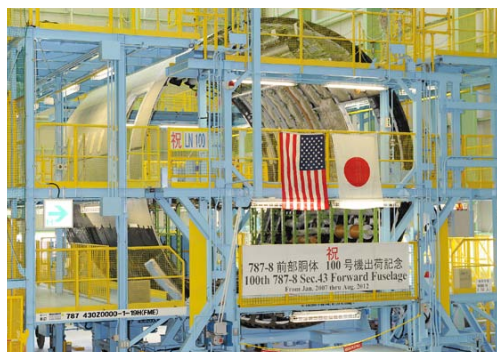
Railway battery power system

Energy saving

Environmental load reduction

100th forward fuselage delivered for the Boeing 787 Dreamliner

KHI is responsible for manufacturing the forward fuselage section of the 787 Dreamliner. In August 2012, we delivered to Boeing the milestone 100th unit. Extensive use of composite materials allows the 787 to achieve reduced weight. Combined synergistically with improvements to the engine and other modifications, this gives the aircraft its characteristic high level of fuel efficiency, with a reduction of approximately 20% in fuel costs compared to previous models. A contributory factor in this was our development of composite one-piece barrel molding technology for the forward fuselage. Although the forward fuselage manufacturing process uses large amounts of electric power, installing a large solar power generation panel on the factory roof has given access to renewable energy.



Forward fuselages for the Boeing 787

Fuel efficiency Environmental load reduction

KAWASAKI ECO SERVO used in hydraulic presses

In the hydraulic equipment and systems sector, in addition to promoting high levels of efficiency in equipment, we are promoting the use of system products characterized by compact dimensions and low noise levels along with driving energy-saving in control systems. These characteristics are being emphasized in the rollout to usage of KAWASAKI ECO SERVO in industrial equipment, including hydraulic presses and others. In combination with an electric motor for which it is possible to control rotation, the system allows optimal control of the hydraulic pump flow rate as well as reduction of the volume of hydraulic oil and more compact dimensions for peripheral devices. In hydraulic presses, these features contribute not only to energy-saving characteristics but also to preventing overheating of the hydraulic oil, boosting the reproducibility of press molding, and other performance improvements.



KAWASAKI ECO SERVO

Energy saving Low noise

BX series for spot welding achieves a major reduction in cycle time

The BX series is a vertically articulated robot that optimizes the spot welding of automobile bodies and components by employing the Z series of existing large, general-purpose robots. With their lightweight arms, small and high-output, high-revolution motors, and the latest in anti-vibration control technology, BX series robots achieve a cycle time about 25% shorter than equivalent models already on the market. In addition, creation of a hollow section in the arm to accommodate the cable harnesses of the welding gun realizes a compact body, reducing by approximately 50% the footprint compared to equivalent models already on the market and making it possible to install robots in high-density space.



Spot-welding robots BX200L

Energy saving Resource saving

Trent 1000/XWB jet engines: realizing outstanding energy-saving and environmental performance

The Trent 1000 and Trent XWB are high bypass-ratio engines jointly designed and developed by KHI and Rolls Royce plc. for the new Boeing 787 and Airbus 350 aircraft models. The engines realized outstanding energy-saving performance (20-25% improvement in fuel economy compared to existing models of the same class, reducing fuel costs) and outstanding environmental performance (20-25% reduction in CO₂ emissions compared to existing models of the same class; low NOx and noise levels that meet and surpass regulation values set by the International Civil Aviation Organization).

We acquired engine-type certification for the Trent XWB in February 2013, while for the Trent 1000, already in operation, we aim to achieve improved performance through design changes. For the intermediate-pressure compressor (IPC) modules that form the core of these engines, we are responsible for operations from design and manufacture through to assembly, while for the Trent 1000 we also carry out engine testing.



Trent 1000 jet engine IPC module

Energy saving Environmental load reduction

Japan's first 110MW gas engine power plant delivered

In August 2012, KHI delivered a 110MW gas engine power plant to Nihon Techno Co., LTD., a producer and supplier of power equipment. The 110 MW power plant constructed at Sodegaura, Chiba Prefecture, consists of 14 Kawasaki Green Gas Engines with an electrical output of 7,800 kW and the world's highest generating efficiency of 49.0%.

To ensure a stable power supply, there is increasing demand for distributed power systems including small and medium-scale utility and captive power plants. Kawasaki is constantly advancing to meet these needs with its innovative gas engines and other power systems.



Kawasaki Green Gas Engine

High efficiency Environmental load reduction

Market launch of world's first compact centrifugal chiller using water as refrigerant

KHI has commercialized and begun sale of the world's first compact centrifugal chiller that uses water as refrigerant and is therefore CFC-free. The chiller is an environment-friendly model that uses water as refrigerant, thus contributing potentially to the protection of the ozone layer and the prevention of global warming. Water, a natural refrigerant, has the advantages of causing zero depletion of the ozone layer and containing no greenhouse gases or combustible or toxic substances.

The chiller has a cooling capacity of 100 US refrigerating tons (352 kW), suitable for the air-conditioning of a small commercial building, factory, or office. Despite being CFC-free, oil-free, and compact in design, it achieves a coefficient of performance (COP) of 5.1.*



Compact centrifugal chiller using water as refrigerant

Environmental load reduction

*COP (Coefficient of Performance): index of cooling efficiency calculated by dividing cooling output (kW) by electric power consumption (kW).

Orders received from the city of Kobe for construction of waste-treatment facility and outsourced facility maintenance

KHI received an order from the City of Kobe for a project to build and maintain the city's 11th Clean Center jointly with Obayashi Corporation and Daiken Sekkei Inc. The incineration plant will feature parallel-flow stoker incinerators capable of high-performance combustion with a minimum air ratio as well as bag filters and a flue gas recirculation system to completely protect against atmospheric pollution. Meanwhile, the facility will also combine high-temperature, high-pressure boilers and extraction condensing turbines to realize a highly efficient electric power generation system capable of producing up to 15,200 kW. In addition, the entire facility will be designed to minimize the use of electric power to help reduce greenhouse gas emissions.



Projected appearance of the Kobe waste-treatment facility when completed

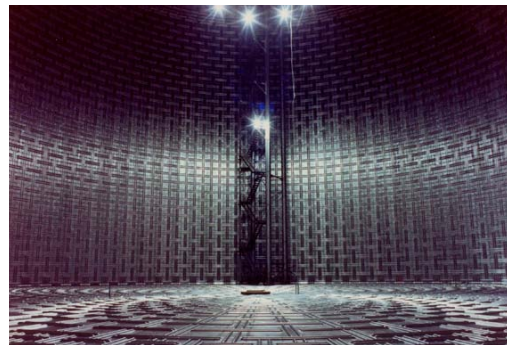
High efficiency

Environmental load reduction

Order received for in-ground LNG tank from Toho Gas Co., Ltd.

Liquefied natural gas (LNG), which consists mostly of methane cooled to a temperature of around -160°C, is a clean and environment-friendly energy source.

KHI has won an order from Toho Gas Co., Ltd., for one in-ground LNG storage tank for the company's Chita-Midorihamama Works. The tank will have a capacity of 220,000 kl and can hold an amount equivalent to the annual gas consumption of around 350,000 households. As well as the in-ground type, LNG tanks are made in a wide variety of other formats, including PC tanks, completely buried tanks, in-pit and single/double/full containment tanks. Able to handle all tank types, KHI has a track record of delivery covering more than 30 tanks in Japan and overseas. By constructing LNG tanks, KHI contributes to protecting the global environment.



LNG tank interior

Environmental load reduction

CO₂ Emissions Reduction through Products for Major Products Delivered in Fiscal 2013

Field	CO ₂ emissions reduction (t-CO ₂ /year)	Major products	Technologies, remarks
Energy-related products	369,000	Gas turbine cogeneration system	①, ②
		Gas engine power generation system	①
		Binary turbine power generation system	③
		High-efficiency boiler system	②
		Absorption chiller / heater	②
Transportation-related products	123,000	Next-generation mid-sized "Boeing 787" (reduced weight)	④ Shared production
		LNG carriers, LPG carriers, bulk carriers (improved propulsion capabilities)	④
		Battery power system (BPS) for railways	③
		Vehicles fitted with fuel efficiency technology	④
Industrial equipment and other products	12,000	Sewage aeration blowers (Kawasaki MAG Turbo series)	⑤
		Natural gas compressed transport facilities (KC compressor)	⑤
		Electro-hydraulic hybrid system (KAWASAKI ECO SERVO)	⑤
		Large general-purpose robot	⑤
Total	504,000	-	-

Technologies:

1. High-efficiency power generation;
2. High-efficiency energy use;
3. Waste heat/exhaust energy use;
4. Reduced fuel costs;
5. Energy-saving equipment and other systems

CO₂ emissions reduction effect calculation reference points:

1. Emission factors for electricity, heat, fuel and other types of energy were set to comply with the manual for the Law Concerning the Promotion of Measures to Cope with Global Warming.
2. CO₂ emission reduction effect through improved efficiency is based on a comparison with products before replacement or with standard products on the market.
3. All energy derived from the use of waste energy and energy produced from waste products is counted toward the CO₂ reduction effect.