

## Environmental Solution Products -Energy-Related Products-

KHI Group has 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. KHI Group is also working on renewable energy technologies (solar cooling/heating system, bio-ethanol production, photovoltaic power generation, etc.) and clean energy technologies (hydrogen and LNG facilities, etc.)

### 1 Sales Begin for “L30A”, a Japan-made 30 MW-Class High-Efficiency Gas Turbine

The “L30A” combines KHI’s many years of expertise in developing small- and medium-sized industrial gas turbines with its highly sophisticated component technologies in the area of state-of-the-art jet engines and industrial gas turbines. With generating efficiency that exceeds 40%, this new gas turbine has the highest rating in the world in the industrial-use 30 MW class. A cogeneration system using this gas turbine is able to achieve total efficiency above 83%, and a combined-cycle generating plant that utilizes the gas turbine with a steam turbine realizes a power generation rate in excess of 50%. The new gas turbine is equally noteworthy for its environmental

performance. Through a proprietary Dry Low Emission (DLE) combustion system, NOx emissions are held below 15 ppm—the lowest level in the world.

Demand for the “L30A” is sure to grow in Japan and worldwide, especially in light of rising interest in on-site power generation and tougher environmental standards.



Gas Turbine “L30A”

High efficiency energy utilization

NOx reduction below 15ppm

### 2 KHI Wins Order for Japan’s First 110 MW Gas Engine Power Plant

KHI was sourced by Nihon Techno Co., Ltd., to construct a power plant for its Sodegaura Green Power Project. The plant, with 110 MW generating capacity, will comprise 14 units of the high-efficiency “Kawasaki Green Gas Engine” with unit capacity of 7,800 kW and power-generating efficiency of 49.0%. This will be the first gas engine power plant in Japan to have capacity exceeding 60 MW.

The “Kawasaki Green Gas Engine” provides superior environmental performance. It requires no additional denitrification devices in most areas of Japan since NOx emissions are below 200 ppm (O<sub>2</sub> = 0%), and it cuts fuel costs by more than 5% over conventional gas engines in the same class.

Demand for distributed power supply systems is expanding. In Japan, the technology is attracting interest as a way to deal with power shortages since the Great East Japan Earthquake, and overseas, it will provide power needed to support industrialization and economic development. To meet heightened expectations, KHI is working to reinforce its production structure for the “Green Gas Engine.”



“Kawasaki Green Gas Engine”

High efficiency energy generation

High efficiency energy utilization

NOx reduction below 200ppm

### 3 Solar Absorption Chiller-Heater Optimized for Solar Thermal Energy Utilization

Technology for utilizing solar thermal energy is expected to become widely popular because it achieves annual energy transfer efficiency four times that of photovoltaic power generation. KHI Group offers a solar absorption chiller–heater optimized for solar thermal energy utilization. To promote greater interest in this unit, the Company installed a model plant at its Shiga Works. Test calculations indicate that the plant could realize energy savings of 14% over conventional equipment and cut CO<sub>2</sub> emissions by 18.3 tons per year.

The absorption chiller–heater uses water—not CFCs, HFCs or HCFCs—as the refrigerant and presents excellent environmental

performance since it utilizes solar thermal energy and natural gas combustion for both cooling and heating applications.

In addition, the unit has been specially designed to maximize the potential afforded by solar thermal energy, with an emphasis on preferential use and control system of hot water heated by solar thermal energy.



Kawasaki Thermal Engineering

Solar Absorption Chiller-Heater

Renewable energy

Unutilized energy use

## Environmental Solution Products -Waste Treatment and Environmental Pollution Prevention Products-

KHI Group 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. KHI Group has delivered leading-edge waste treatment systems all over Japan.

To prevent pollution, KHI Group has worked with a number of technologies to protect and improve air and water quality. KHI Group has addressed boiler and other combustion gases since the 1970s by developing flue-gas desulfurization systems, and have delivered a number of these in Japan and abroad, where they are improving air quality.

### 4 Cement Plant Waste Heat Recovery Power Generation Contributes to Lower CO<sub>2</sub> Emissions

A cement plant waste heat recovery power generation is a facility that generates power by recovering heat from the waste gas discharged during production of cement and therefore exemplifies clean power generation technology that does not release CO<sub>2</sub>. The power that is generated is sufficient to cover about 30% of a cement plant's overall power consumption. KHI has earned a solid reputation for reliability, underpinned by expertise in waste heat boilers, which can tolerate high-temperature gas above 1,000°C and exhaust gas containing large amounts of dust. Since delivering its first waste heat power generation facility for a cement plant in 1980, the Company has built more than 180 systems for cement

plants in Japan and overseas. Some of these projects are still under construction. Many orders have been received, mainly from China and other parts of Asia, including South Korea, but also from Europe, including Germany and Turkey. Aggregate power generation by systems in use exceeds 2,100 MW, which has contributed to a reduction of more than 14 million tons of CO<sub>2</sub> emissions per year.



Cement plant waste heat recovery power generation

Waste heat utilization

### 5 KHI Wins Order to Build and Maintain Municipal Waste Incineration Plant

KHI was selected by the city of Miyakonojo in Miyazaki Prefecture to build and maintain the city's Clean Center. This design-build-maintain project bundles construction of a waste incineration plant and its maintenance over a 20-year period. The facility will be able to incinerate 230 tons of waste per day, and it will have a reduced impact on the environment thanks to an all-out effort to minimize air pollution. Specifically, the facility will be equipped with parallel flow stoker-type incinerators capable of high-temperature combustion at a low excess air ratio, and flue gas exiting the furnace will go through filter-type dust collectors, selective catalytic reduction system and

exhaust gas recirculation system. The facility will achieve superior environmental and energy-saving performance, with maximum power generation capacity of 4,990 kW and power generation efficiency of about 20% during normal waste-burning operation.



Waste Incineration Plant

High efficiency power generation from waste products

#### CO<sub>2</sub> Emissions Reduction through Products for Major Products Delivered in Fiscal 2012

Field	CO <sub>2</sub> Emissions Reduction	Major Products	Technologies, Remarks
Energy-related products	215,000t-CO <sub>2</sub> /year	• Gas turbine cogeneration system	1,2
		• Gas engine power generation system	1
		• Binary turbine power generation system	3
		• Waste heat recovery power generation in cement plant	3
		• High-efficiency boiler system	2
		• Absorption Chiller/Heater	2
Transportation-related products	102,000t-CO <sub>2</sub> /year	• 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
		• intermediate-pressure compressor for the "Trent" engine	4
Industrial equipment and other products	4,000t-CO <sub>2</sub> /year	• Sewage aeration blowers ("Kawasaki MAG Turbo series")	5
		• Electro-hydraulic hybrid system ("Kawasaki Eco Servo")	5
		• Large General-purpose Robot	5
Total	312,000t-CO <sub>2</sub> /year	-	-

**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

**CO<sub>2</sub> 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) CO<sub>2</sub> emissions 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 CO<sub>2</sub> reduction effect.